NOTE FROM THE EDITOR

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We just recently closed issue 32 and start into the new year and a new issue with this first editorial in 2016 and issue 33. As in all last years there is a continuous flow of submissions and the first manuscripts can be expected to be uploaded to issue 33 soon. I can only encourage you to keep following the development on our website.

The IUCN OSG Bulletin is indexed in the Directory of Open Access Journals (DOAJ) allowing more visibility for your manuscripts. Lesley is currently developing a new layout for the IUCN OSG Bulletin and I have seen first ideas and can promise that the new design will clearly improve the functionality of the website. We also change the design based on some requirements to show more information on ethics, copyrights, etc. coming from COPE and DOAJ, to which I have signed up the IUCN OSG Bulletin to comply in order to get in the future a status in the highest class of open access journals.

As you can see on the website the date and the venue for the next International Otter Colloquium has been decided and communicated. I hope that many of you will be able to participate in Singapore in 2016 in order to exchange scientific and conservation ideas for all otter species.

I would be very happy if those of you that have high quality pictures of otters could send them to me and Lesley as we are always in need of good pictures for the title pages of future issues! Your help is greatly appreciated.

With my last sentence I want to send the deserved flowers and thanks to Lesley for all her work and hours spend with the IUCN OSG Bulletin.

R E P O R T

A FIRST RECORD OF TICKS IN FREE-RANGING GIANT OTTER (*Pteronura brasiliensis*) IN THE BRAZILIAN AMAZON

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Abstract: Studies of the biology and ecology of the giant otter (*Pteronura brasiliensis*) have increased considerably during the past few years. However, information on epidemiologic aspects of this species is still scarce in the literature. A series of helminthes were recorded parasitizing giant otters, but they were all endoparasites. To date, there is no record of ectoparasites reported for this species. In the present study, we report for the first time the occurrence of a tick nymph of the morphospecies *Amblyomma cajennense* sensu stricto (s.s.) attached to the lower right lip of a free-ranging giant otter. The location where the tick was attached suggests that other areas of the giant otter body far from the head would preclude hematophagy due to the amount of time otters spend in the water while swimming and feeding. Increased records of *A. cajennense* s.s. parasitizing different hosts in the Amazon basin will contribute to future molecular analysis and to a better taxonomic and geographic knowledge of this species of the Brazilian Amazon, as well as to a better knowledge of the epidemiologic aspects of the endangered giant otter.

Keywords: Amazon, ectoparasite, endangered species, Giant otter, *Pteronura brasiliensis*, tick

The giant otter (*Pteronura brasiliensis*) is a diurnal and social semi-aquatic mammal endemic to the South American continent. The species feeds primarily on fish, and it is therefore morphologically well adapted for swimming (Carter and Rosas, 1997; Rosas et al., 1999; Cabral et al., 2010). However, giant otters also have strong liaisons with terrestrial habitats. They use the banks of water bodies to dig dens, which are used for sleeping and cub rearing. Irregularly shaped patches of land, known as campsites, are also used for defecating (communal latrines), drying out, scent marking, grooming, resting during the day and sometimes for denning activities

(Groenendijk et al., 2005; Rosas et al., 2015). All these interactions with terrestrial habitats put giant otters potentially in close contact with ectoparasites, which live in forest areas.

A series of helminthes have been recorded in the stomach, intestines, heart, lungs, lung artery and under the skin of giant otters. Parasite species previously identified in giant otters include *Alaria clathrata*, *Alaria pseudoclathrata*, *Ancylostoma* sp., *Baschkirovitrema incrassatum*, *Cryptocotyle thapari*, *Cryptosporidium* sp., *Diphyllobothrium* sp., *Diplostomum alarioides*, *Dirofilaria* sp., *Dirofilaria spectans*, *Galeiceps longispiculum*, *Molineus major*, *Paragonimus rudis*, *Strongyloides* sp., *Subulura amazonica* and *Subulura interrogans* (Flügger, 1997; Hagenbeck and Wünnemann, 1992; Wünnemann, 1995; Muniz-Pereira et al., 2009). However, all of the parasite species mentioned are endoparasites and, according to Labruna et al. (2005a), although tick species (*Amblyomma ovale*) have been found infesting the Neotropical otter (*Lontra longicaudis*), tick infestation remains unreported for five of the Brazilian Carnivora species, of which the giant otter (*Pteronura brasiliensis*) is one.

On February 6th, 2014, we caught a free-ranging giant otter at Balbina hydroelectric reservoir (01º 55'00''S, 59º 29'00''W) with the aim to implant a radio-transmitter intraperitoneally for a radio-telemetry study (License Nº 27396-6, Ministério do Meio Ambiente, SISBIO/Instituto Chico Mendes de Biodiversidade (ICMBio) and License Nº 006/2013 Comissão de Ética em Pesquisa no Uso de Animais (Ethics Committee in the Use of Animals) of the National Institute of Amazonian Research/Ministério da Ciência, Tecnologia e Inovação. The methodology used to catch the otter and to implant the transmitter followed that described by Silveira et al. (2011).

The otter caught was an adult female of 162 cm long and 21 kg. During physical examination of this animal, we found a tick attached to its right inferior lip. The tick was hand removed, fixed with alcohol 92% and according to Martins et al. (2015) as well as the comparisons with the tick collection of the Laboratory of Zoology of the Universidade Federal do Amazonas (UFAM) it was positively identified as a nymph of *Amblyomma cajennense* sensu stricto (s.s.) (Acari: Ixodidade) (Fabricius, 1787). The nymph was deposited at the Paulo Bhürheim Zoological Collection (CZPB) of the Universidade Federal do Amazonas under the accession number CZPB-IX-00388.

Recent studies on the genetics (Beati et al., 2013), morphology (Nava et al., 2014), ecology (Estrada-Peña et al., 2014) and biology (Labruna et al., 2011; Mastropaolo et al., 2011) carried out in the Americas have shown that *A. cajennense* is a complex of at least six different species, each one associated to its biogeographical area. Currently, *A. cajennense* s.s. is the only species of this complex present in the Brazilian Amazon (Nava et al., 2014; Estrada-Peña et al., 2014).

Amblyomma cajennense s.s. was originally described in French Guiana, and it is distributed in the northwest region of the Amazon basin and found in a series of domestic and wild mammals as well as in human beings (Nava et al., 2014). Labruna et al. (2005b) recorded adults of this tick species in Brazilian tapir (*Tapirus terrestris*), collared peccary (*Tayassu tajacu = Pecari tajacu*), horse (*Equus caballus*) and in humans, and nymphs of this species were recorded in domestic dogs (*Canis familiaris*), while free-ranging adults and nymphs were collected in the vegetation of Rondonia State, northern Brazil.

This is the first record of a tick in giant otters and, consequently, it is also the first time *A. cajennense* s.s. has been reported on this host species. It is well known that ticks usually choose areas of difficult access of their hosts for hematophagy.

However, the site of infection (lower lip) of the tick in the giant otter is an important fact to observe, as semi-aquatic mammals like giant otters carry out most of their activities in the water and therefore, the head is the body part which is least present under water. However, even been attached to the otter's lip, and in this way less subjected to hypoxia, the presence of this tick on a giant otter reveals the high adaptability of *A. cajennense* s.s. to perform hematophagy in semi-aquatic mammals and its capacity to withstand periods of oxygen deprivation.

The increased number of individuals and records of *A. cajennense* s.s. from different locations along its distribution and its occurrence in different host species will help to establish the actual range of this ixodid and to elucidate its adaptation to the environment and to the lifestyle of its hosts. Notwithstanding, the occurrence of a tick on a free-ranging giant otter may also contribute to the health aspects of this endangered mammalian species.

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RÉSUMÉ

UN PREMIER CAS DE PRÉSENCE DE TIQUES SUR DES LOUTRES GÉANTES (*Pteronura brasiliensis*) EN AMAZONIE BRÉSILIENNE

Les études sur la biologie et l'écologie de la loutre géante du Brésil (*Pteronura brasiliensis*) se sont beaucoup enrichies ces dernières années. Cependant, les informations sur les aspects épidémiologiques de cette espèce restent rares. Seules des espèces d'helminthes endoparasites ont été signalées dans cette espèce. Jusqu'à présent, aucune espèce d'ectoparasite n'a été signalée dans cette espèce. Dans cette étude, nous rapportons pour la première fois, la présence d'une nymphe de tique de l'espèce *Amblyomma cajennense* sensu stricto (s.s.) attachée à la lèvre inférieure droite d'une loutre géante sauvage. La localisation où la tique était fixée, c'est-à-dire sur la tête, suggère que les autres parties du corps d'une loutre géante n'autoriseraient pas l'hématophagie du fait du temps passé dans l'eau pour nager et se nourrir. De nouveaux signalements de *A. cajennense* s.s. parasitant différents hôtes dans le Bassin Amazonien contribueront à une future analyse moléculaire, une meilleure approche taxonomique et à une meilleure connaissance de la répartition de cette espèce dans l'Amazone Brésilienne, tout autant qu'à une meilleure connaissance des aspects épidémiologiques des loutres géantes.

RESUMEN

PRIMER REGISTRO DE GARRAPATAS EN NUTRIAS GIGANTES (*Pteronura brasiliensis) EN* ESTADO SILVESTRE, EN LA AMAZONÍA BRASILERA

En los últimos años se han incrementado considerablemente los estudios sobre la biología y la ecología de la nutria gigante (*Pteronura brasiliensis*). Sin embargo, la información sobre aspectos epidemiológicos de esta especie es aún escasa en la literatura. Han sido registrados una serie de helmintos parasitando nutrias gigantes,

pero han sido todos endoparásitos. Hasta hoy, no se han informado ectoparásitos para esta especie. En el presente estudio, informamos por primera vez la ocurrencia de una ninfa de garrapata de la morfoespecie *Amblyomma cajennense* sensu stricto (s.s.), sujeta al labio inferior de una nutria gigante en estado silvestre. La localización en la cual la garrapata estaba sujeta sugiere que otras áreas del cuerpo de la nutria gigante alejadas de la cabeza, precluirían la hematofagia debido a la cantidad de tiempo que las nutrias están en el agua, nadando y alimentándose. Registros adicionales de *A. cajennense* s.s. parasitando distintos huéspedes en la cuenca amazónica, contribuirían a un futuro análisis molecular y a un mejor conocimiento taxonómico y geográfico de esta especie de la Amazonía Brasilera, así como a un mejor conocimiento de los aspectos epidemiológicos de la amenazada nutria gigante.

RESUMO

PRIMEIRO REGISTRO DE CARRAPATO EM ARIRANHA DE VIDA LIVRE (*Pteronura brasiliensis*) NA AMAZÔNIA BRASILEIRA

Nos últimos anos os estudos da biologia e ecologia da ariranha (*Pteronura brasiliensis*) têm sido intensificados. No entanto, embora ameaçada de extinção, ainda são escassas as informações acerca dos aspectos epidemiológicos desta espécie. Do ponto de vista parasitológico, uma série de helmintos foi registrada na ariranha. Todos, porém, endoparasitas e nenhum registro de ectoparasita havia sido reportado para esta espécie. No presente estudo registramos pela primeira vez a ocorrência de uma ninfa de carrapato pertencente à morfoespécie *Amblyomma cajennense* sensu stricto (s.s.) aderida ao lábio inferior direito de uma ariranha de vida livre revelando que *P. brasiliensis* também é suscetível à infestação por carrapatos. O local de fixação do carrapato sugere que outras áreas do corpo da ariranha distantes da cabeça tornariam a hematofagia impossível dado ao tempo que a ariranha permanece com o corpo submerso durante atividades de pesca e deslocamentos na água. O aumento de registros de exemplares de *A. cajennense* s.s. na bacia Amazônica parasitando diferentes espécies contribuirá para futuras análises moleculares e para o melhor conhecimento taxonômico e geográfico desta espécie na Amazônia brasileira, bem como contribuem para um melhor entendimento dos aspectos epidemiológicos na ariranha.

R E P O R T

OTTER (*Lontra longicaudis*) SPRAINT AND MUCUS DEPOSITIONS: EARLY ECOLOGICAL INSIGHTS INTO THE DIFFERENCES IN MARKING SITE SELECTION AND IMPLICATIONS FOR MONITORING PREY AVAILABILITY

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Abstract: Otters are not territorial in the classical sense of marking territory boundaries. Instead they mark key resource areas within the territory with faeces, or *spraint*, for olfactory communication. There is a high level of site fidelity in otter marking behaviour and the function of scent marks may explain their spatial distribution. Typically marking sites are in proximity to deep water which provides key resource areas for energy-efficient foraging. Occasionally spraint is laden with mucus, which may also be deposited in isolation without any faecal material. Any difference in the microhabitat variables predisposing site selection by otters with mucus present and absent in depositions has not yet been quantitatively investigated. This study serves as a primary exploration of these selective processes. Here we show that habitat selection by the Neotropical otter (*Lontra longicaudis*) is different when mucus is deposited at a site compared to when it is absent. The cause of mucus deposition has been suggested in other otter species to indicate reduced prey availability or reproductive state. Depositions here were associated with deep water as in other studies, and temporally, the relative abundance of those with mucus present was highest toward the end of the dry season when prey availability is assumed relatively low. Here we infer how the monitoring of mucus prevalence may be used as a valuable efficient indirect index of the status of otters and their prey. For species whose primary threats include reduced prey availability, such as the Neotropical otter, research attention to these aspects of behavioural ecology are particularly significant in applied conservation. Furthermore, research to validate indirect indices of prey availability and species-habitat interactions may extend to benefit recreational interests and broader human-wildlife conflict mitigation strategies.

Keywords
Lontra longicaudis, scent marking, Costa Rica, freshwater, habitat selection, ecological indicators

INTRODUCTION

Olfactory communication is the predominant form of broadcasting information amongst carnivores (Gorman, 1990; Clapham et al., 2014), varying in form and function between species (Smith, 2009). Otters fulfill this communication via scent marks, which are usually deposited in small amounts at selected, repeatedly-used sites

rather than simple eliminations of waste as faeces, or *spraints* (Kleiman, 1966; Hutchings and White, 2000). Though very little is known about the exact messages conveyed in scent marks (Kean et al., 2011), their function may influence their spatial distribution (Ben-David et al., 2005).

Prior to deposition, mucus is added to the spraint (Kruuk, 2006). This mucus is known to also occur in isolation without faecal material suggesting a more complex cause and function than simply as a faeces-binding substance (Erlinge et al., 1982; Davies et al., 1988).

The study of sprainting activity has recently been advocated to give rise to better understanding of behavioural ecology and implications for research design (Rheingantz et al., 2011; Santos and Reis 2012). Further, attention to species-habitat interactions has become increasingly popular in recent years, likely reflecting its pivotal role in applied conservation (Boitani and Powell, 2012).

Our aim here is to quantitatively explore the micro-habitat selective processes acting on the deposition of mucus compared to those for typical spraint marking behaviour by the Neotropical otter (*Lontra longicaudis*). Our secondary aims are to investigate the level of marking site fidelity and the seasonal variation in detection probability of spraint and mucus depositions.

METHODS

This study was conducted within the Osa Wildlife Refuge on the Osa Peninsula, Costa Rica (83°19'–83°21' W, 8°23'–8°26' N; Figure 1). The northern half of the refuge is bordered by the Golfo Dulce Forest Reserve, an area of almost 58,000 ha connecting the neighbouring biodiversity-rich Corcovado National Park with mainland counterparts of the Osa Conservation Area (ACOSA). The average temperature is 26 – 28 °C and annual rainfall is 3,500 – 5,000 mm yr^{-1}, heaviest between late August and early November; the dry season extends from late November through April.

The intensive study area was within the Rio Piro River Basin (~ 1,500 ha) on the Southern Pacific Coast. The two rivers which form the main drainage of the area, the Rio Piro (5.6 km) and Quebrada Coyunda (6.6 km) reach a confluence less than one kilometre from the ocean, are mostly surrounded by dense forest and have a maximum elevation within the studied area of 160 m above sea level.

We established two linear transects of 5.2 km and 2.8 km on the Rio Piro and Quebrada Coyunda respectively, because of their heterogeneous river profiles within and between the two rivers, and the study area was sufficiently large to encompass temporal changes in distribution. We conducted weekly surveys on foot between November 2013 and June 2014 to encompass periods of variable water levels in response to rainfall; due to these replicates, a total length of 220 km was sampled within the survey period. We surveyed continuously on each sampled morning, scanning for spraints and mucus depositions.

Only spraints less than 48 hrs old were considered, identified by moisture content, colour and stage of decomposition: dry and/or crumbling fading grey-white spraints were disregarded owing to the greater chance of environmental changes occurring between the time of deposition and the time of recording. Secondly, this exclusion of old spraints enabled us to carry out more reliable analyses of temporal variation in sprainting activity, reporting changes in activity rather than frequency of weather-tolerant spraints. Further, we recorded the presence of mucus within spraint or as a separate deposition, and thereby studying only fresh depositions reduced the chance of recording false absences as mucus became dry and undetectable over time.

We recorded each site of deposited spraint and/or mucus as *new* on its first encounter and as *reutilised* for every recorded use thereafter. This status was determined by author memory verified with GPS data recorded at every observation and photographs of the sites taken for increased verification power. When a deposition occurred within one metre of another of the same age, we pooled it as one record.

For each record we measured the following variables at the point of deposition, perpendicular to river flow: river width; escape cover distance (ECD) on both sides of the river (distance from the water edge to vegetation line, Anoop and Hussain 2004), and; water depths at 1-m intervals along the river cross section. We determined these variables to be potential factors influencing marking site selection following consultation with published literature and a four-month preliminary study.

We analysed the spatial distribution of data by *average nearest neighbour* on ArcGIS 10 using an input area value of 1 km^2 to account for river width and a buffer width representing GPS accuracy. Following Anoop and Hussain (2004), principal component analysis (PCA) extracted nine habitat variables from descriptive statistics of ECD and water depth, plus river width (Table 1) which we plotted in a three-dimensional scatterplot for further exploration; we used magnitude and direction (+ or -) of PCA scores to interpret results. We analysed the correlation of variables with Spearman's rank. We compared measured variables and the Bartlett factor analysis scores computed by PCA with Mann-Whitney *U*-tests. We performed logistic regression with habitat variables as the covariates and either mucus presence/absence or new/reutilised site status as the dependent variable. We tested data for normality using Shapiro-Wilk test and ANOVA or Kruskal-Wallis tests to infer differences. We performed statistical tests using SPSS 20.

RESULTS

In total, 356 fresh depositions were recorded within the sampled 220 km (Figure 1). Fifty one of these contained mucus and 283 occurred at a reutilised site. Spatial distribution of depositions (mucus and non-mucus pooled) was highly clustered ($P<0.01$) suggesting the prevalence of micro-habitat selection processes.

Principal component analysis extracted four components with eigen values > 1.0, summarising 89.8% of the variation (Table 1; Figure 2). PC1 (35.6 % of the variance) was related to water depth characteristics favouring sites with deeper water within the cross section: maximum depth and depth range were highly correlated ($r = 0.924$, $P<0.01$).

A difference between the selective pressures of mucus present/absent records was statistically validated for PC1 ($U=6388$, $Z=-2.011$, $P=0.044$); other components were not different ($U=6436$, $Z=-1.941$, $P=0.052$ for PC2; $U=7651$, $Z=-0.149$, $P=0.882$ for PC3). Records of mucus deposition carried a higher loading for escape cover distance than river depth for PC1, and *vice versa* where mucus was absent.

Further statistical analyses revealed that habitat characteristics were not different between sites with mucus present and absent ($P>0.2$ for all measured variables).

A logistic regression model was developed to predict the presence of mucus and deposition at reutilised sites (Table 2). Of the 51 records found positive with mucus, none were classified with higher probability of presence. Further, none of the mucus-absent records were predicted positive for presence. Only 4.7 % of depositions at new sites were correctly classified; all others were given a higher probability of occurring at reutilised sites.

Table 1. Summary of the first three principal components influencing site selection by otters in the Rio Piro River Basin, presenting all records, and sites with mucus present or absent within depositions. Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalisation. Rotation converged in 11 iterations (all, and mucus absent) and seven iterations (mucus present).

	Principal components								
	I			II			III		
Variables	All	Present	Absent	All	Present	Absent	All	Present	Absent
River width	0.462	-0.031	0.477	0.053	0.182	0.042	0.549	0.491	0.579
Escape cover distance									
Maximum	-0.016	0.988	-0.015	0.995	-0.007	0.995	-0.004	-0.033	0.000
Minimum	0.068	0.001	0.058	0.042	0.066	0.030	0.058	-0.974	0.035
Median	-0.001	0.882	-0.003	0.941	0.019	0.941	0.009	-0.415	0.007
Range	-0.032	0.925	-0.027	1.004	-0.034	1.012	-0.017	0.375	-0.008
Water depth									
Maximum	0.915	0.015	0.927	0.013	0.833	0.014	-0.334	-0.016	-0.306
Minimum	0.048	0.084	0.081	0.079	-0.082	0.065	-0.867	0.114	-0.856
Median	0.514	0.039	0.556	0.061	0.250	0.062	-0.730	-0.130	-0.696
Range	0.976	-0.021	0.976	-0.015	0.975	-0.008	-0.050	-0.070	-0.030
Interquartile range	0.930	-0.018	0.927	-0.038	0.944	-0.036	0.175	0.111	0.175
Percentage of variance	35.6	34.8	35.9	28.8	29.5	28.9	15.0	15.3	14.9

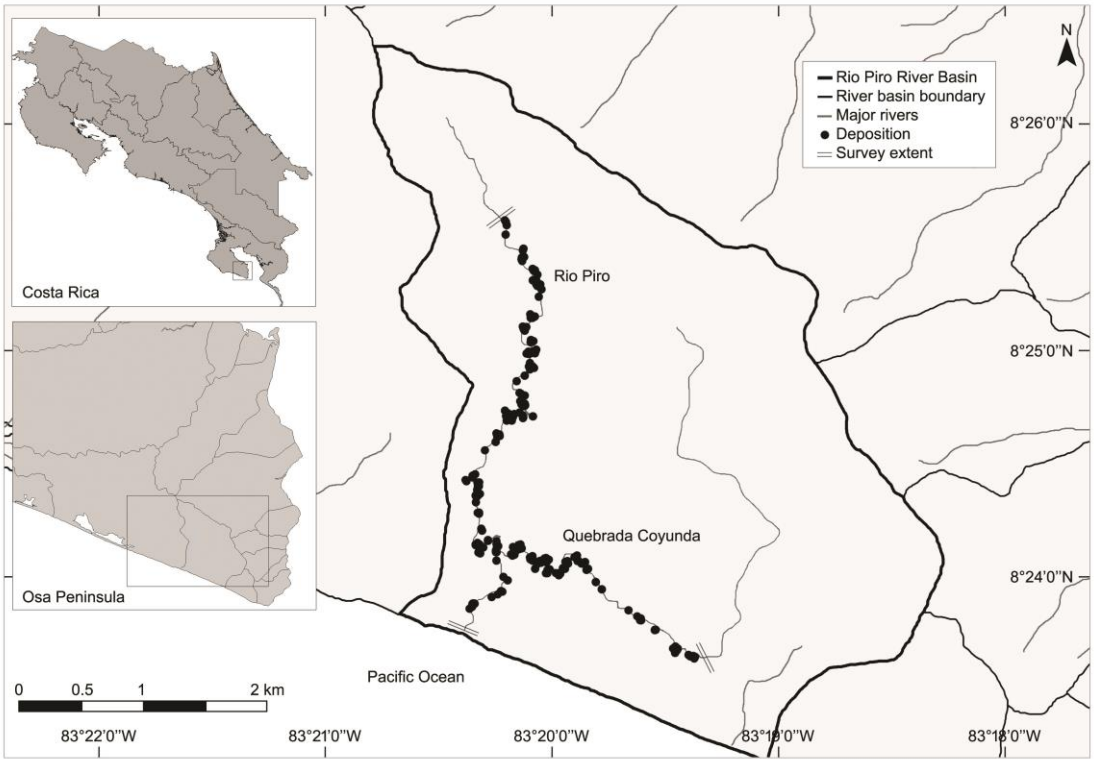

Figure 1. Study site of the Rio Piro River Basin, Osa Peninsula, Costa Rica, presenting all records of depositions including those with mucus present.

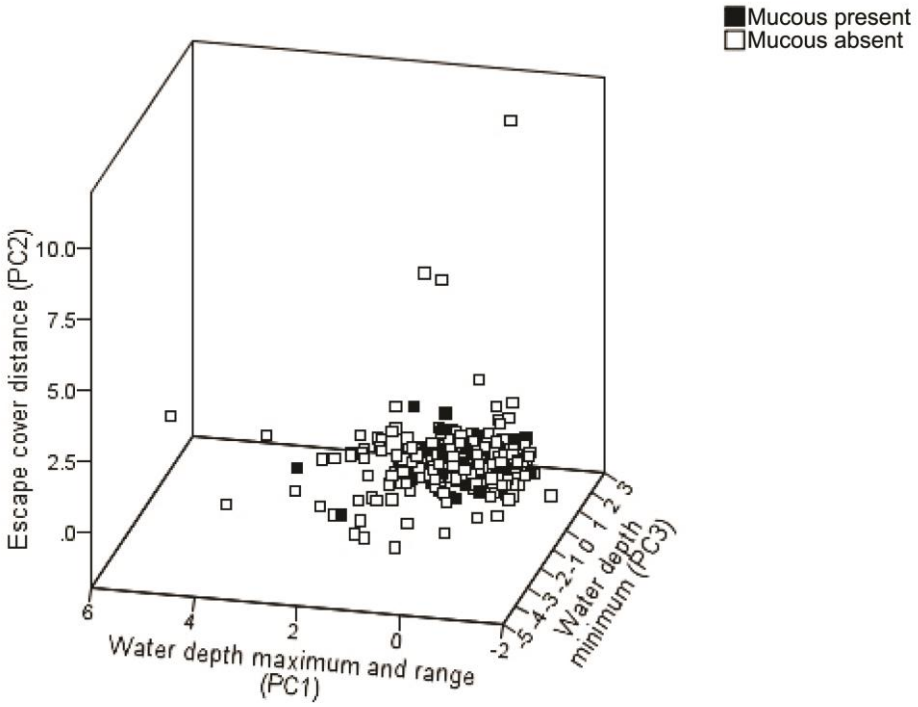

Figure 2. Locations of sites marked by Neotropical river otters (*Lontra longicaudis*) with mucus present and absent within a spatial matrix plotting the first three principal components (PC1 – 3) of habitat variables in the Rio Piro River Basin**.**

Table 2. Summary of logistic regression model for predicting deposition at reutilised sites in the Rio Piro River Basin.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
River width	0.024	0.049	0.232	1	0.630	1.024
Escape cover distance						
Maximum	-0.001	0.030	0.001	1	0.978	0.999
Minimum	0.141	0.159	0.778	1	0.378	1.151
Water depth						
Maximum	-0.027	0.011	6.493	1	0.011	0.974
Minimum	-0.003	0.031	0.008	1	0.928	0.997
Median	0.043	0.023	3.354	1	0.067	1.044
Constant	1.850	0.581	10.150	1	0.001	6.358

Frequency of spraint depositions per kilometre varied within the study period ($F(7, 49) = 3.28$, $P<0.01$) with the greatest frequencies observed in November (2.43 km^{-1}), January (1.81 km^{-1}), and June (2.43 km^{-1}; Figure 3). The relative occurrence of mucus was highest in March (23%), May (33%) and June (53%); mucus deposition per kilometre however, was not statistically different between months ($\chi^2=10.96$, df=7, $P>0.1$). On average, 88 % of depositions occurred at reutilised sites each month.

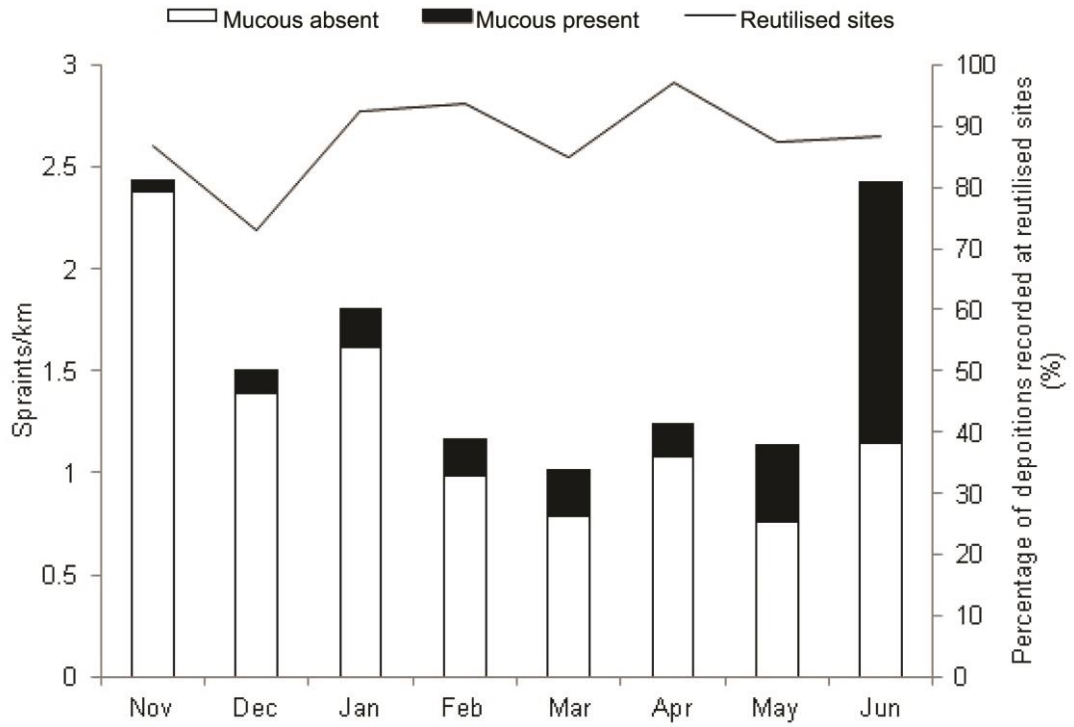

Figure 3. Temporal variation in Neotropical river otter (*Lontra longicaudis*) sprainting activity, site fidelity and relative occurrence of mucus within depositions found in the Rio Piro River Basin between November 2013 and June 2014.

DISCUSSION

Interpreted as the most important factor influencing marking site selection, water depth likely explains the clustered spatial distribution observed. This association of spraint with deep water concurs with previous studies of *L. longicaudis* and other otter species (Carrillo-Rubio and Lafón, 2004; Ottino and Giller, 2004; DePue and Ben-David 2010). Extracting whether maximum depth or depth range was more significant was not performed as the two factors were duly correlated owing to cross sections often having at least one depth close to zero centimeters at the measured intervals.

While some aspects of the environment are consistently reported to influence marking site selection, such as water depth, vegetation and conspicuous substrata such as rocky outcrops and fallen trees (Carrillo-Rubio and Lafón, 2004; Kruuk, 2014), it is likely that numerous other interacting factors are at work (Quadros and Montiero-Filho 2002; Depue and Ben-David, 2010). Despite the widespread distribution of the Neotropical otter, the species' scent marking behaviour has received little research attention (e.g., Carrillo-Rubio and Lafón, 2004; Kasper et al., 2008). A greater understanding of these factors was beyond the scope of this study. Instead the limited number of variables measured here were intended to enable a primary exploration of sites marked with mucus compared with those where mucus was absent, using those factors most consistently reported to be of significant influence.

Indeed this study has revealed different processes acting on the deposition of mucus compared with typical spraint depositions in this case. To our knowledge, this is the first published study to report so distinctly on the occurrence of mucus depositions by Neotropical otters.

For the Eurasian otter (*Lutra lutra*), these mucus depositions have been associated with food shortages (Kruuk et al., 1993) and for the closely-related North American river otter (*Lontra canadensis*), it is suggested to signal reproductive state

(Rostain et al., 2004). Here, the relative occurrence of mucus was greatest around the period of the end of the dry season when river levels were generally lowest. As fish abundance is expected to be higher in deeper water (Cuplin, 1986), it may follow that the mucus observed here may be a response to reduced prey availability. This interpretation is reinforced by acceptance that food availability likely affects seasonal variation in sprainting behaviour (Melquist and Hornocker, 1983; Ruiz-Olmo et al., 2000; Almeida et al., 2012). Naturally the principal recommendation of this study is to explore relationships between prey availability, river depth and relative occurrence of mucus within a complete annual cycle.

We propose that if mucus occurrence is indeed related to prey availability here as with Eurasian otters (Kruuk et al., 1993), monitoring mucus prevalence may serve as a valuable indirect indicator of the status of otters and their prey. The high level of site fidelity observed here, as reported across other otter species (Erlinge, 1967; Kruuk et al., 1986; Macdonald and Mason, 1986), suggests that such a monitoring program can be highly efficient in terms of deposition detection. Moreover, during periods of heavy rain and when the river mouth became closed to form a lagoon (March – May), some sites became submerged but were marked again once the water level lowered, as also reported by Anoop and Hussain (2004).

Detecting unfavourable changes in prey availability is of particular advantage in the case of the Neotropical otter which is exposed to threats of reduced prey availability (Rheingantz and Trinca 2015). This significance is exacerbated as the dependence on healthy aquatic environments paired with the low reproductive potential of the otter mean the species cannot respond quickly to any ensuing population decline (Cezare et al., 2002; Rheingantz and Trinca, 2015).

Though otters may exploit sub-optimal prey items during periods of reduced prey availability (Kruuk et al., 1993), the reduced abundance of preferred prey is a known causal factor of increased stress and mortality, and reduced immunity and reproductive fitness (Ruiz-Olmo et al., 2001; Nelson et al., 2002; Kitaysky et al., 2010). Further, under conditions of prey stresses, competition between otters and fishing interests can result in harassment and occasional otter mortality (Carrillo-Rubio and Lafón, 2004). Monitoring the status of prey indirectly via mucus, or howsoever else determined, is therefore here attested, yielding both conservation and recreation benefits.

This study represents an early quantitative exploration of the deposition of mucus. It is highly recommended that physiological analyses of mucus are performed to complement field data. Otter spraint is a key resource in itself, increasing heterogeneity and biological productivity at the landscape level such as on the Osa Peninsula (Ben-David et al., 2005; Leuchtenberger et al., 2012; Maslo and Lockwood, 2014). Understanding the cause of mucus depositions and the respective broader implications for conservation and research are encouraged in this and other otter species.

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RÉSUMÉ

EPREINTES DE LOUTRE (*Lontra longicaudis*) ET DÉPÔT DE MUCUS: PREMIÈRES CONSIDÉRATIONS ÉCOLOGIQUES DES CHOIX POUR LA SÉLECTION DES SITES DE MARQUAGE ET LES IMPLICATIONS POUR SUIVRE LA DISPONIBILITÉ DES PROIES

Les loutres ne sont pas territoriales au sens classique du marquage des limites de leur territoire. Mais elles marquent plutôt les zones de ressources dans leur domaine vital avec des fèces ou épreintes, pour la communication olfactive. Le comportement de marquage des loutres montre une grande fidélité à des sites, et la fonction des marques olfactives peut expliquer leur distribution spatiale. Les sites de marquage typiques se trouvent à proximité de zones d'eau profonde qui sont riches en ressources, et rentables en terme d'énergie dépensée pour les récupérer. Occasionnellement des épreintes sont recouvertes de mucus qui peut aussi être déposé isolé, sans matériel fécal. Aucune recherche quantitative dans les différences de l'habitat pouvant prédisposer les loutres à déposer ou non du mucus n'a été effectuée. Le but de cette étude est de fournir une première exploration de ce processus de sélection. Nous montrons ici que la sélection de l'habitat par la loutre à longue queue est différent quand le mucus est déposé ou non. Des suggestions pour expliquer le dépôt de mucus chez les autres espèces de loutres comprenaient une baisse des proies ou un statut reproducteur. Les dépôts ici sont associés avec une eau profonde comme dans les autres études, et temporairement l'abondance relative des épreintes avec du mucus était plus importante vers la fin de la saison sèche quand la disponibilité des proies est moins bonne.

Nous en déduisons que le suivi de la prévalence du mucus peut être utilisé comme un index indirect mais valable du statut des loutres et de leurs proies. Pour les espèces dont les principales menaces sont une baisse de la disponibilité de leurs proies, comme la loutre à loutre queue, les recherches sur ces aspects de comportement peuvent être importantes dans des stratégies de conservation appliquée. De plus, la recherche pour valider ces indices indirects de disponibilité des proies et d'interaction des espèces dans leur habitat peut être utile à des fins d'activités de loisirs, ou plus largement pour gérer les conflits faune sauvage/humains.

RESUMEN

FECAS Y DEPOSICIONES MUCOSAS DE LA NUTRIA NEOTROPICAL (*Lontra longicaudis)*: PRIMEROS ANÁLISIS ECOLÓGICOS DE LAS DIFERENCIAS EN LA SELECCIÓN DE SITIOS DE MARCACIÓN E IMPLICANCIAS PARA EL MONITOREO DE LA DISPONIBILIDAD DE PRESAS

Las nutrias no son territoriales en el sentido clásico de "marcar los límites del territorio". En cambio, marcan áreas de recursos clave dentro de su territorio, con fecas, para comunicación olfatoria. Hay un alto nivel de fidelidad de sitio en el comportamiento de marcación de las nutrias, y la función de las marcas de olor puede explicar su distribución espacial. Típicamente, los sitios de marcación están en proximidad a aguas profundas que proveen áreas de recursos clave para una alimentación energéticamente eficiente. Ocasionalmente las fecas están cargadas de mucus, que también puede ser depositado solo, sin material fecal. Aún no se ha investigado cuantitativamente la diferencia en variables de microhabitat que predisponen la selección por parte de las nutrias, de sitios para dejar deposiciones con o sin mucus.

Este estudio es una primera exploración de estos procesos selectivos. Aquí mostramos que la selección de hábitat por parte de la nutria Neotropical (*Lontra longicaudis*) es diferente cuando se deposita mucus respecto a cuando éste está ausente. Para otras especies de nutria, se ha sugerido que la deposición de mucus indica reducida disponibilidad de presas, ó estado reproductivo. Aquí, las deposiciones estuvieron asociadas con aguas profundas como en otros estudios, y en el aspecto temporal, la abundancia relativa de las deposiciones con mucus fue mayor hacia el final de la estación seca, cuando se supone que la disponibilidad de presas es relativamente baja. En este trabajo inferimos cómo el monitoreo de la prevalencia de mucus puede ser utilizado como un eficiente índice indirecto del estado de las nutrias y sus presas. Para especies entre cuyas principales amenazas se incluye la reducción de la disponibilidad de presas, como la nutria Neotropical, la atención investigativa sobre estos aspectos de la ecología del comportamiento es particularmente significativa para la conservación aplicada. Más aún, la investigación para validar índices indirectos de disponibilidad de presas y de interacciones especie-hábitat, puede extenderse para beneficiar estrategias de manejo de actividades recreativas ó de mitigación de conflictos hombre-fauna.

R E P O R T

THE CONSERVATION STATUS OF OTTERS IN PREK TOAL CORE AREA, TONLE SAP LAKE, CAMBODIA

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Abstract: The conservation status of otters in South-east Asia remains poorly known, because of a paucity of records for which certain identification can be confirmed. Otter populations in South-east Asia face a multitude of threats and are in decline; the identification and then protection of sites that support sizeable populations is a priority for their conservation. A rapid camera-trap survey targeted otter populations along one stream in Prek Toal Core Area, an area of flooded forest in the Tonle Sap Great Lake Cambodia. 172 camera-trap days over May to July 2014 produced a total of 34 notionally independent photographs of otters, of which 24 could be identified as Smooth-coated Otter and 4 as Hairy-nosed Otter. Although few other otter records exist for Cambodia, these data indicate that Prek Toal is at least a regionally important site for these species and of probable global significance for Hairy-nosed Otter. Protection of fish-breeding habitat and a large waterbird colony has perhaps benefitted the otter population at Prek Toal.

Keywords: camera-trap, Prek Toal, conservation priority, wetlands, fish

INTRODUCTION

Four otter (Lutrinae) species are known to inhabit South-east Asia (Corbet and Hill, 1992; CEPF, 2012; IUCN, 2015), although the difficulties in identifying otters to species in the wild and even in many cases as specimens, mean that exact distributions for all species remain uncertain. Three species are confirmed for Cambodia: Hairy-nosed Otter *Lutra sumatrana*, Smooth-coated Otter *Lutrogale perspicillata* (Poole 2003) and Asian Small-clawed Otter *Aonyx cinereus* (Hon and Dong 2008 in Hon et al., 2010). There are no Eurasian Otter *Lutra lutra* records for the country, although this species has been reliably recorded in the surrounding countries of Thailand (Kruuk et al., 1994), and, historically, northern Lao PDR (Duckworth et al., 1999) and Vietnam (Roberton 2007).

Otter populations in Asia face a multitude of threats and are in decline (IUCN, 2015). Major threats include wildlife hunting to meet demand for the skin, traditional medicine and exotic pet trade and targeted hunting for perceived/proven damage to fish ponds/fishing gear. Other locally relevant at least potential threats include opportunistic hunting using dogs, large-scale habitat conversion for agro-industries, agricultural encroachment, overharvesting of prey animals, accidental/secondary

poisoning, and hydro-dam development (in that it leads to a rise in hunting) (Timmins and Sechrest 2010; CEPF, 2012; IUCN, 2015; WWF, 2013). Hairy-nosed Otter is listed as Endangered on the *IUCN Red List of Threatened Species* (Aadrean et al., 2015), and both Smooth-coated Otter and Asian Small-clawed Otter are listed as 'Vulnerable' (de Silva et al., 2015; Wright et al., 2015). All three species are considered high regional priorities for conservation investment and for species-focused conservation action (CEPF, 2012).

Hairy-nosed Otter was first confirmed for Cambodia in the late 1990s (Poole, 2003) and there have since been a few confirmed records, centred around the Tonle Sap Lake and the coastal wetlands in the south-west of the country. Records collated in Poole (2003) were based on live captive/market animals or museum specimens and exact provenance was difficult to determine, though at least two records were very likely to have come from flooded forest habitat in the Tonle Sap Lake (Poole, 2003). A camera-trap record from the Tonle Sap Lake is in Olsson et al., (2007) and repeated in Wright et al., (2008) but no other details are given. Another camera-trap record is in Wright et al., (2008) but no further details are given in the text other than "a tributary to the Tonle Sap River at about 300m". A captive animal was recorded at Preaek [Prek] (stream/river) Roung, near Botum-Sakor National Park, Koh Khong Province (Royan, 2010). A captive animal and two skins were recorded during wildlife surveys in the coastal lowlands of South-west Cambodia, all in Koh Khong province (Timmins and Sechrest, 2010). The first published wild records of the species with more exact locality data for Cambodia were from Peam Krasaop Wildlife Sanctuary (Hon and Dong 2008 in Dong et al., 2010) and Central Cardamom Protected Forest, Pursat province (Wright et al., 2008; provisionally identified earlier in Holden and Neang Thy, 2009).

Smooth-coated Otter is one of the more widespread otter species in Cambodia with reliable field records from the following sites: Western Siem Pang, Stung Treng Province (Birdlife International unpublished, 2013); Seima Protection Forest, Mondulkiri Province (WCS Cambodia 2010); Tatai Krom commune (Heng and Hon, 2007 in Dong et al., 2010), Botum-Sakor NP (Royan, 2009); Stoeng Koh Pao (A. Starr pers. comm. 2008 in Timmins and Sechrest, 2010) and Prek Ta Ok Valley (Timmins and Sechrest, 2010) all in Koh Khong Province; Mondulkiri Protected Forest (Gray et al., 2012) in Mondulkiri Province; and Prey Long [Prey Lang] in Kratie, Preah Vihear, Kampong Thom and Stung Treng provinces (Theilade and Schmidt, 2011). There is also a record of a captive animal in Kbal Tol village near Prek Toal Core Area, Battambang Province (Poole, 2003).

No field records of Asian Small-clawed Otter were traced by Poole (2003) but the species has since been confirmed at Chhlong, Kratie Province (Gray et al., 2012); Seima Protected Forest, Mondulkiri Province (WCS Cambodia unpublished, 2015), and along the Prek Kasap in Stung Treng and Ratanakiri provinces (Hon et al., 2010).

In Cambodia, it is thought that otters are primarily hunted for the skin and traditional medicine trade (e.g. Wright et al., 2008, Dong et al., 2010, WCS Cambodia, 2010). Some of this trade is assumed to be international (e.g. Wright et al., 2008), for which China (especially Tibet) is a major demand country (Yoxon and Yoxon, 2007, 2014). However, as with other countries in the region there exists, relative to South Asia, very little documented international trade in otter skins or their parts in Cambodia (DW pers. obs.). There is some evidence of the use of otter parts in

local traditional medicine in Cambodia; skins steeped in alcohol are given to women during pregnancy/childbirth (Poole, 2003), and dried penes are perceived to be aphrodisiacs (Dong et al., 2010). Wright et al. (2008) mention "massive hunting" of otters around the Tonle Sap Lake based on incidental observations of skins and traps in villages at this site and some anecdotal reports of trade to China, however it is largely unknown how significant a threat the international wildlife trade is to Cambodia's otter populations. Despite these uncertainties on the dynamics of current trade, otters are thought to have undergone significant hunting-driven declines in Cambodia (Poole, 2003).

Prek Toal was one of the first sites in the region that had some proof of the probable co-existence of Hairy-nosed Otter and Smooth-coated Otter (Poole, 2003). However, despite years of large waterbird conservation there since then (Sun Visal and Mahood, 2015), there has been little otter-focused conservation activity at the site and the status of these two globally threatened species at Prek Toal is now uncertain. Following a relatively recent spate of unconfirmed field sightings of both Hairy-nosed Otter and Smooth-coated Otter, and a captive record of the former in 2011 (Sun Visal and Mahood, 2011), a rapid survey was undertaken to clarify the likely conservation status of both species at Prek Toal. The results of this survey are presented here, as well as recommended follow up.

STUDY SITE

The Prek Toal Core Area [Prek Toal] (13°07'N, 103°39'E) lies on the north-western edge of the Tonle Sap Lake (map 1). It is one of three core areas in the Tonle Sap Biosphere Reserve. It has the largest waterbird colony remaining in South-east Asia and is a site of global importance for biodiversity conservation (CEPF, 2012). The waterbird colony includes breeding populations of several of the region's most threatened bird species including Greater Adjutant *Leptoptilos dubius*, Spot-billed Pelican *Pelecanus philippensis* and Milky Stork *Mycteria cinerea* (Sun Visal and Mahood, 2011).

Prek Toal (21,342 hectares) is one of the closest to intact areas of seasonally inundated forest around the Tonle Sap Lake (Seng Kim Hout et al., 2003), and probably the region; similar habitats have now been mostly converted into agriculture e.g. the Mekong Delta. The site contains a mixture of scrub and gallery forest dominated by *Barringtonia acutangula* and *Diospyros cambodiana* (Seng Kim Hout et al., 2003). During the peak of the wet season (July – October) the entire site is flooded, with only the tops of the larger (7 – 15 m high) trees remaining visible. In the dry season, the water levels drop dramatically, with only three permanent streams and a few small pools retaining water, little of which is more than 1 m in depth.

Prek Toal and its biodiversity, together with the rest of the Tonle Sap Great lake and its inundation zone, face a multitude of threats including unsustainable fishing practices, wildlife hunting, agricultural development, clearance of the flooded forest, and changes to hydrological flows caused by the development of hydro-electric power dams along the Mekong River and its tributaries (CEPF, 2012; Arias et al., 2012; WWF, 2013).

METHODS

Four LED-flash camera-traps (Bushnell Trophy Cam) were used for the survey. Locations for the camera-traps were selected based on the presence of otter signs (latrines and/or tracks). Otter signs were found following rapid searches of exposed banks of soft mud. It became apparent during the survey that gently sloping banks with little Water Hyacinth *Eichhornia crassipes* obstructing access to/from the water were ideal locations; this microhabitat would often produce multiple sets of *Lutra*/*Lutrogale* tracks and well-used latrines.

Camera-trap survey effort focused on the Prek [stream] Da (Map 1), where a relatively large number of unconfirmed Smooth-coated Otter and Hairy-nosed Otter sightings had been reported by permanently-based conservation patrol staff during 2011 – 2014, and where otter signs were found to be relatively abundant. A patrol station is located at the mouth of the Prek Da stream to prevent illegal activity during the dry season in the Prek Toal Core Area; it was thought this would also have the benefit of reducing the risk of theft of the camera-traps.

As there were few suitable trees along the banks of the streams, the camera-traps were attached to wooden poles that were staked into the ground. To avoid 'trap shyness' freshly cut branches were used to mask the shape of the camera-traps. To maximise the possibilities of photographing the entire animal, and to ensure that cameras were low enough to photograph the distinguishing neck, chin and cheek pelage patterns of otter species, cameras were positioned 20 – 30 cm from the ground. During the first survey period there was little risk of a sudden rise in water levels, however, during the survey effort that ran from June to July, the cameras were checked every few days and moved if necessary. The sensitivity of the infra-red trigger beam on all camera-traps was set to 'high', and the delay between photographs was set to one second. All cameras were pointed on an approximate North/South bearing to avoid overexposure of the photograph (which can reduce the ability to identify a photographed animal). No baits or lures were used at any of the camera-trap locations. All notionally independent encounters with otters, defined when successive photographs of the same species at the same camera-trap station were separated by at least 30 minutes, were extracted from the camera-trap data and recorded.

RESULTS

Camera trapping ran over two survey periods: 25 May to 17 June 2014 and 19 June to 9 July 2014. Four camera-traps were used at nine separate stations and this resulted in a total of 172 effective camera-trap nights (Table 1). A total of 34 notionally independent photographs of otters were produced, of which 24 were Smooth-coated Otter and 4 Hairy-nosed Otter. The remaining six could not be identified to a species. Both species were recorded at two camera-trap locations (camera-trap stations 2 and 3; Table 1). Other photographed small carnivore species were Leopard Cat *Prionailurus bengalensis*, Small Asian Mongoose *Herpestes javanicus* and Common Palm Civet *Paradoxurus hermaphroditus*.

Smooth-coated Otter

Five of the nine camera-trap stations recorded Smooth-coated Otter (Figure 1 and Table 1). The largest minimum group size photographed was five individuals (Figure 2), which was recorded on two separate dates: 7 June 2014 and 2 July 2014.

The majority of photographs (70%) were taken during the day (05h30 – 18h00), with half of these in the early hours of the morning (05h30 – 7h30).

Hairy-nosed Otter

Two of the nine camera-trap stations recorded Hairy-nosed Otter (Figure 3, 4, Table 1). The species was recorded too infrequently to look into activity patterns in any meaningful detail but Hairy-nosed Otter was recorded at 07h35, 09h46, 12h06 and 17h46. This would suggest a diurnal activity pattern however this species has been recorded at night elsewhere (U Minh Ha NP, Vietnam in 2008; Save Vietnam's Wildlife unpublished data).

Figure 1. Smooth-coated Otter *Lutrogale perspicillata*, Prek Toal, May 2014.

Figure 2. Group of five Smooth-coated Otters *Lutrogale perspicillata*, Prek Toal, July 2014.

Figure 3. Hairy-nosed Otter *Lutra sumatrana*, Prek Toal, May 2014.

Figure 4. Hairy-nosed Otter *Lutra sumatrana*, Prek Toal, May 2014.

Map 1. Prek Toal Core Area in the Tonle Sap Biosphere Reserve, with otter sighting records and camera-trap locations

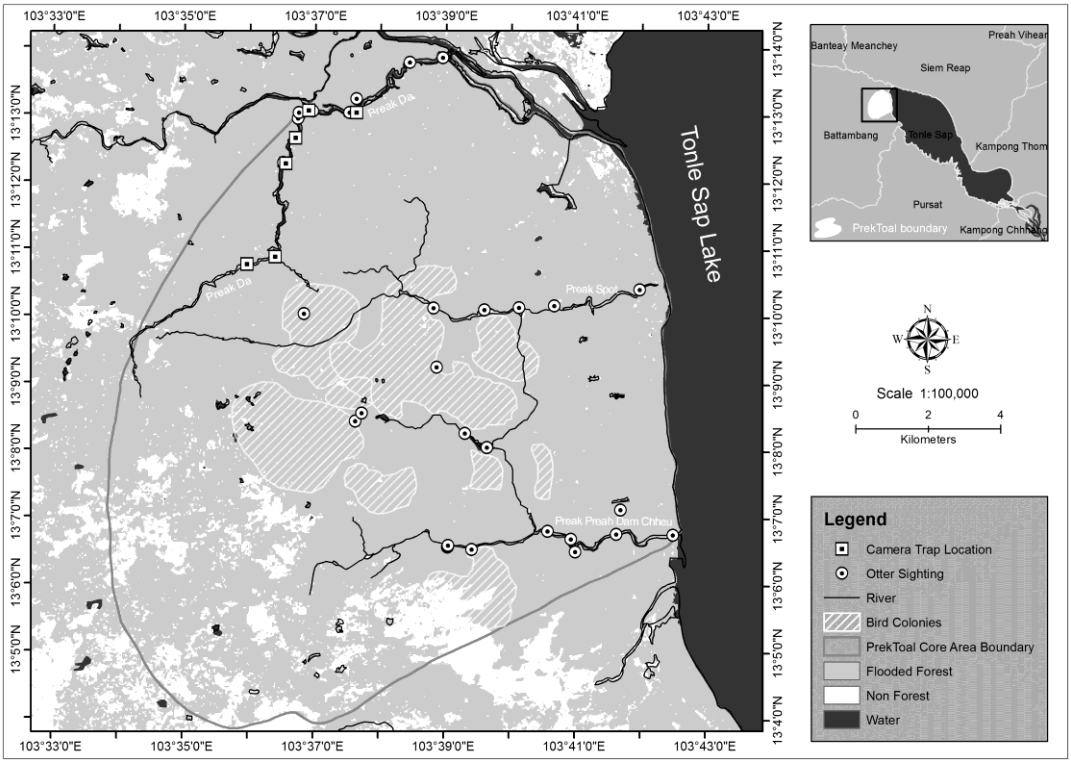

Table 1. Camera trap station details, survey effort and otter species recorded

Camera-trap station No.	Latitude (DD MM SS.SS)	Longitude (DD MM SS.SS)	Microhabitat	Otter signs recorded	Date set	Date of last photo	No. trap nights[1]	SCO[2]	HNO[2]	Otter sp.[2]	Other small carnivore species
1	13° 10' 42.13"	103° 35' 58.68"	Gentle slope with exposed dry soil and 20cm high grasses, beyond that it was dense scrub	Otter latrine; dried out spraint found on the ground.	25-May	15-Jun	22	3(2)	0	4(1)	Leopard Cat *Prionailurus bengalensis*
2	13° 10' 49.01"	103° 36' 24.68"	Flat exposed bank, bordered by dense scrub	Otter latrine; dried out spraint found on the ground. Fresh *Lutra*/*Lutrogale* tracks in soft mud	25-May	17-Jun	24	47(7)	1(1)	0	Small Asian Mongoose *Herpestes javanicus*, Common Palm Civet *Paradoxurus hermaphroditus*
3	13° 12' 12.31"	103° 36' 33.81"	Relatively steep slope from the water's edge leading to an enclave in some dense scrub	Otter latrine; reported by rangers to be Hairy-nosed Otter. Relatively fresh spraint found on a low-lying horizontal branch of a tree.	25-May	15-Jun	22	14(2)	6(3)	6(5)	Small Asian Mongoose
4	13° 12' 35.36"	103° 36' 42.65"	Flat exposed bank, bordered by dense scrub	Set of relatively old *Lutra*/*Lutrogale* tracks	25-May	17-Jun	24	0	0	0	Small Asian Mongoose, Leopard Cat
5	13° 10' 49.11"	103° 36' 54.81"	Flat exposed bank	Otter latrine; dried out spraint found on the ground.	20-Jun	09-Jul	20	39(10)	0	0	Small Asian Mongoose

6	13° 12’ 36.45”	103° 36’ 51.72”	Small open area on the bank in dense scrub. Dense matts of water hyacinth later blocked the entrance to this site	Otter latrine; dried out spraint found on the ground.	20-Jun	09-Jul	20	0	0	0	
7	13° 12’ 59.81”	103° 36’ 54.64”	Small open area on the bank in dense scrub	Otter latrine; dried out spraint found on the ground.	20-Jun	09-Jul	20	16(3)	0	0	Leopard Cat
8	13° 10’ 49.01”	103° 36’ 24.68”	Same location as 'No.2': Flat exposed bank, bordered by dense scrub	Otter latrine; dried out spraint found on the ground. Fresh *Lutra*/*Lutrogale* tracks in soft mud	19-Jun	23-Jun	4	0	0	0	
9	13° 12’ 58.28”	103° 37’ 38.62”	Small open area on the bank in dense scrub	Otter latrine; dried out spraint found on the ground.	23-Jul	08-Jul	16	0	0	0	Small Asian Mongoose, Common Palm Civet
							172	**119(24)**	**7(4)**	**10(6)**	

All dates given are from 2014

1 Number of effective trap nights is the number of 24 hour periods that the camera was in operation for, calculated by the difference between the date set and the last photograph taken.

[2] Species recorded: SCO is Smooth-coated Otter *Lutrogale perspicillata*, HNO is Hairy-nosed Otter *Lutra sumatrana*. If the identity of the otter could not be confirmed it was recorded as ‘Otter sp.’ Numbers recorded in each column include the total number of photographs followed by the number of notionally independent photographs in parentheses ( )

DISCUSSION

These are the first confirmed wild records for Hairy-nosed Otter and Smooth-coated Otter for Prek Toal. Site records for both species had previously been limited to unconfirmed field observations (Sun Visal and Mahood, 2011) and captive animals seen in Prek Toal and Kbal Tol villages (Poole, 2003; Sun Visal and Mahood, 2011). Hairy-nosed Otter has not been reliably recorded in the wild in Cambodia since Holden and Neang Thy (2009). The most recent confirmed Smooth-coated Otter record for Cambodia is a camera-trap photograph from Western Siem Pang, Stung Treng province in 2013 (BirdLife International, unpublished data).

Camera-trapping at otter latrines proved to be a relatively successful method for producing verifiable otter records in Prek Toal. This method generated a total of 34 notionally independent records, 82% of which could be identified to a species level. There were a total of 172 effective camera-trap nights during this rapid targeted survey, which is a relatively low survey effort; typically most surveys that use this method generate approximately 1,000 effective camera-trap nights (e.g. Willcox et al., 2014), or even greater (e.g. Gray et al., 2014, Coudrat et al., 2014), though none of these surveys were targeting otter species. Camera-traps were concentrated in a relatively small area of the site. The low survey effort produced a relatively large number of verifiable otter records, indicating the suitability of this survey method when the objective is to confirm presence/non-detection of otter species in seasonally flooded forest during the dry-season.

The confirmation of Hairy-nosed Otter, considered to be one of the rarest and most threatened otter species in the world, arguably places Prek Toal as one of the most important sites for otter conservation globally. The site is also likely to be regionally significant for Smooth-coated Otter; the species is probably extinct in Vietnam (DW pers. obs.) and is in decline in other range countries, including Cambodia.

Prek Toal is widely considered to be one of the conservation success stories in Asia, where active management and an approach that has effectively mixed community outreach, community-based eco-tourism, enforcement and direct species-based interventions, has led population increases in multiple threatened and near-threatened waterbird species (Sun Visal and Mahood, 2011; 2015). Several of these long-term site-based activities are likely to be benefitting the site's otter species. These include enforcement activities aimed at minimising wildlife hunting, and monitored bans on dry-season fishing along the main streams that lead into Prek Toal Core Area. The latter activity is enforced through a strict no-use/no-entrance policy and there is anecdotal evidence that this has helped to limit the impacts of wildlife hunting on mammal species; Indochinese Silvered Leaf Monkey *Trachypithecus germaini* and Long-tailed Macaque *Macaca fasciculata* are both recorded along these streams and are thought to be recovering from severe hunting-induced declines. It therefore seems likely that these activities are also benefiting otter species, both by limiting hunting during the dry season when most wildlife is vulnerable to this threat, and by aiding the population recovery of prey animals. This is however speculative and further research on the impacts these activities are having on the site's otter species is warranted; similar actions could then be justified at other sites in Cambodia and in the region.

CONCLUSIONS

Otters across South-east Asia are in decline and no populations should be considered secure. Whilst there might seem to have been a relatively large number of recent records (i.e. within the last 10 years) for all three of Cambodia's known otter species, populations at most of these sites are probably low, and are facing an array of direct and indirect threats. Moreover, given the amount of general survey effort in potentially suitable otter habitat by people likely to notice and report otters, the overall number of records is extremely low, relative to areas such as southern India; the average motivated general bird and mammal surveyor is lucky to have seen otters at all in Cambodia since the resurgence of survey activity around 1999, whereas in similar habitat in southern India (and at Kaziranga in north-east India), sightings are so frequent as to be daily in some areas (Will Duckworth *pers. comm.* 2015). Without targeted interventions, most or all of the Cambodian otter populations are likely to go extinct in the near future.

Prek Toal has a relatively large amount of natural habitat remaining, a seasonally flooded-forest ecosystem that by regional standards is close to intact, and there are several long-term site-based activities already underway that are likely to be benefiting otter populations there. Prek Toal represents one of the best opportunities to conserve Hairy-nosed Otter and should be considered a priority site for otter conservation in Asia.

Conservation Recommendations

The diurnal Giant Otter *Pteronura brasiliensis* can be individually identified by photographing their throat patterns when they "periscope" out of the water, allowing for some assessment of population numbers (e.g. see Groenendijk et al., 2014). Although Hairy-nosed Otter also has individual throat and neck markings, it is unlikely that this technique would work for this species; there is no evidence that the species "periscopes" and it is at least partly nocturnal. High-resolution camera-traps placed low enough on the ground at known/suspected Hairy-nosed Otter latrines may allow for individuals to be identified, but the chances of photographing enough of the throat pattern to be allow confident identification of individuals are slight. In Asia therefore, camera-trapping is only likely to produce relatively limited, though important, information on otter presence/non-detection at a site, and allow some broad inferences as to likely conservation status. To better assess the conservation status of otters at this globally important site and to measure the impacts of site-based activities, efforts should be made to produce a rigorous population estimate for both species, with Hairy-nosed Otter the priority. This should involve the collection of otter spraints and the DNA analysed for species and individual identification; visual identification to species should be considered unreliable (even if using experienced surveyors) unless suitable blind-testing with genetic confirmation is used to validate it. Specifically, on this survey, it was not possible to distinguish two sorts of spraint that would correspond to the two sorts of otters in the area. This indicates either that spraints are difficult for people of the surveyors' experience to identify to species, or that one species was sprainting in spots that meant the surveyors were not detecting it. Scat detection dogs could be used to help find otter spraints, but given the prohibitively high-costs involved with this technique this should be considered carefully, as it may not be very economically effective compared to using well-trained

human observers. There was some evidence from this survey to suggest that the distribution of otter latrines in this habitat were fairly predictable suggesting that the latter, less-expensive option, could be more cost-effective.

Although the evidence of their effects on mammal populations are common-sense observations and therefore unconfirmed, the enforcement activities aimed at minimising the impacts of wildlife hunting and unsustainable fishing at Prek Toal should continue to be supported and strengthened. Similar actions could be piloted at other sites likely to be important for otter conservation in Cambodia and in the region.

There is little reliable information on the scale of trade in otter skins or parts in Cambodia, and certainly no evidence that it approaches the levels seen in South Asia (e.g. Yoxon and Yoxon, 2014). To better understand the motivating factors behind otter killing in Cambodia, a wildlife trade survey focusing on key sites across the country (with Prek Toal a priority) needs to be conducted.

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RÉSUMÉ

LE STATUT DE CONSERVATION DES LOUTRES DANS LA ZONE CENTRALE DE PREK TOAL, LAC DE TONLE SAP, CAMBODGE

Le statut de conservation des loutres en Asie du sud-est reste peu documenté, essentiellement à cause du manque de données fiables et validées. Les populations de loutre d'Asie du sud-est subissent une multitude de menaces et sont en déclin. L'identification et la protection de sites accueillant des populations de loutres de taille suffisante est donc une priorité pour leur conservation. Un monitoring rapide à l'aide de pièges photos a été effectué sur les populations de loutre le long d'un cours d'eau

situé dans la zone de Prek Toal, une région de forêt alluviale autour du grand lac de Tonle Sap au Cambodge. L'utilisation de pièges photos durant 172 jours a permis de récolter 34 photos différentes de loutres entre mai et juillet 2014. Parmi celles-ci, 24 concernent la loutre de Sumatra et 4 la loutre cendrée. Bien qu'il existe peu d'enregistrements de ce type au Cambodge, ces données indiquent que la région de Prek Toal est en tous cas un site d'intérêt régional pour ces deux espèces et d'une importance globale significative pour la loutre de Sumatra. La protection des frayères à poissons et d'une importante colonie d'oiseaux aquatiques a sans doute été bénéfique à la population de loutres de Prek Toal.

RESUMEN

ESTADO DE CONSERVACIÓN DE LAS NUTRIAS EN EL ÁREA NÚCLEO PREK TOAL, LAGO TONLE SAP, CAMBOYA

El estado de conservación de las nutrias en el Sudeste de Asia sigue siendo poco conocido, a causa de una escasa cantidad de registros con confirmación cierta de identificación. Las poblaciones de nutrias en el Sudeste de Asia enfrentan una multiplicidad de amenazas, y están en declinación; la identificación y consecuente protección de los sitios que albergan poblaciones significativas, es una prioridad para su conservación. Realizamos una prospección rápida de nutrias con cámaras-trampa, a lo largo de un arroyo en el Área Núcleo Prek Toal, un área con bosque inundado en el Gran Lago Tonle Sap, Camboya. 172 días-cámara-trampa de Mayo a Julio de 2014, produjeron un total de 34 fotografías nocionalmente independientes de nutrias, de las cuales 24 pudieron ser identificadas como Nutria Lisa, y 4 como Nutria de Sumatra. Aunque hay pocos registros de nutrias para Camboya, estos datos indican que Prek Toal es un sitio regionalmente importante para estas especies, y de probable significación global para la Nutria de Sumatra. La protección de hábitat para reproducción de peces, y de una gran colonia de aves acuáticas, posiblemente haya beneficiado a las poblaciones de nutrias en Prek Toal.

KHMER ABSTRACT

ពត៌មានស្តីអំពីស្ថានភាពអភិរក្សសត្វឈរនៅតំបន់អាស៊ីអាគ្នេយ៍ ត្រូវបានគេដឹងតិចតួចនៅឡើយ ដោយសារ
មានការកត់ត្រាតិចតួចប៉ុណ្ណោះតាមរយៈការផ្ញើអត្តសញ្ញាណកម្មដើម្បីបញ្ជាក់អំពីប្រភេទ។
ចំនួនសត្វឈរនៅក្នុងតំបន់អាស៊ីអាគ្នេយ៍ កំពុងប្រឈមមុខនឹងការគំរាមកំហែងដោយសកម្មភាពមនុស្ស និងកំពុង
មានការថយចុះ ហើយការកំណត់តំបន់រស់នៅរបស់សត្វឈរ ជាកត្តាអទិភាពបំផុតសម្រាប់ការអភិរក្សពួកវាទាំងនោះ។ យើងនឹងផ្តល់ពត៌មានស្តីអំពីការសិ
ក្សាស្រាវជ្រាវចំនួនសត្វឈរដោយម៉ាស៊ីនថតស្វ័យប្រវត្តិនៅតាមអូរព្រៃកមួយ នៃតំបន់ស្នូលព្រៃកទាល់ដែលជាតំបន់អូរលិចទឹកបឹងទន្លេសាបនៃប្រទេស
កម្ពុជា។ ម៉ាស៊ីនថតស្វ័យប្រវត្តិត្រូវបានដាក់ចំនួន ១៧២ថ្ងៃ ពីខែមេសា ដល់ ខែឧសភា ឆ្នាំ២០១៤ ដែលថតបាន
រូបភាពសត្វឈរផ្សេងៗគ្នាសរុបចំនួន ៣៤រូប ដែលក្នុងនោះមាន២៤រូប ជាប្រភេទ ឈ្លូនរលោង និង ៤រូប ផ្សេងទៀតជាប្រភេទ ឈរាមច្រមុះ។
ទោះជាមានការកត់ត្រាអោមួយចំនួនផ្សេងទៀតនៅប្រទេសកម្ពុជាក៏ដោយ ក៏ទិន្នន័យនេះបានបង្ហាញថា តំបន់ស្នូលព្រៃកទាល់
ហ៊ាងហោចណាស់ ជាទឹកន្លែងដែលមានសារៈសំខាន់
ក្នុងតំបន់សម្រាប់ប្រភេទទាំងនេះ ហើយប្រហែលអាចជាតំបន់ដែលមានសារៈសំខាន់ជាសាកល សម្រាប់ប្រភេទឈរាមច្រមុះផងដែរ។ វាត្រូវបានគេសន្និ
ដ្ឋានថា ការការពារជម្រកត្រីមេពូជ និងបន្ទាយពងកូនសត្វស្លាប
ទឹកនៅតំបន់ស្នូលព្រៃកទាល់ បានជួយការពារដល់ចំនួនសត្វឈរនៅក្នុងតំបន់នេះផងដែរ។

REPORT

THE PERILOUS VOYAGE OF INDIAN HIMALAYAN 'AMBASSADORS' AMIDST ANTHROPOGENIC PRESSURES AND CHANGING CLIMATIC VARIABLES

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Abstract: Otters, the ambassadors of aquatic bodies play a vital ecological role by indicating the health of these threatened ecosystems. Three species of otters, (i.e. Smooth-coated, Oriental small-clawed, and the Eurasian) were historically widely distributed in the Indian Himalayan region. However, otters here are under severe anthropogenic pressures. Additionally, the changing climatic variables in the region could potentially affect these species. Despite the growing threats, few studies on the current status, population and distribution of Indian Himalayan otters have been previously conducted. This article highlights the urgent need for novel scientific and policy-oriented strategies to protect and conserve the otters in the region.

Keywords: otters, rivers, anthropogenic stressors, climate change

The Indian Himalayan region is a biodiversity hotspot and contains multiple endemic floral and faunal species (Singh et al., 2011) including otters. These mammalian carnivores belonging to the Family Mustelidae exist at the top of the aquatic food chain, and are indicators of healthy aquatic ecosystems. Globally, 13 species of otters are present however, only three, i.e. Smooth-coated (*Lutrogale perspicillata*), Oriental small-clawed (*Aonyx cinereus*) (Hussain and de Silva, 2008; Hussain et al., 2008), and the Eurasian (*Lutra lutra*) (Ruiz-Olmo et al., 2008) are found in the Indian Himalayan region (Hussain, 1999).

Historically, the Smooth-coated and the Eurasian otters occurred throughout the Indian Himalaya (Hussain et al., 2008; Ruiz-Olmo et al., 2008), whereas the Oriental small-clawed otter was found in the Himalayan foothills and in some protected areas of the Northeast regions (Hussain and de Silva, 2008). However, serious concerns are now being raised by scientists regarding the present status, population and distribution of otters in the region. Very few confirmed sightings have been reported by researchers during field surveys in the past few years. This is not surprising as the

ever-increasing anthropogenic stressors coupled with changing climatic variables are affecting the region's aquatic bodies – home to these otter species.

The Himalayan aquatic bodies despite providing both ecological and socio-economic benefits (Gupta et al., 2014a; Gupta et al., 2015a,b), are facing increasing anthropogenic pressures, e.g. point and non-point sources of pollution, destruction of riverine habitats, and the introduction of invasive species (Gupta et al., 2014a,b,c; Gupta et al., 2015b). Numerous hydro-power projects and associated road networks along rivers have damaged otter habitats due to submergence and altering the flow of rivers (Rajvanshi et al., 2012). The changing climatic variables in the Indian Himalaya too could have an effect on the aquatic bodies and their biodiversity (Gupta et al., 2015c), indirectly affecting the otter population.

There have been reports of conflict between fishermen and otters over fish as the common prey, resulting in killing of otters in the region (N. Gupta, pers. comm. with village communities). The otters are also hunted for food in the north-eastern states and for the fur trade in other areas (Ruiz-Olmo et al., 2008; Hussain et al., 2011; Nawab and Hussain, 2012).

Despite the numerous threats being faced by otters throughout the Indian Himalaya, published texts on otters (Hussain, 1999; Mishra et al., 2006; Datta et al., 2008; Nawab and Gautam, 2008; Aiyadurai et al., 2010; Chutia, 2010; Nawab and Hussain, 2012; Naniwadekar et al., 2013; Nautiyal, 2013; Selvan et al., 2013; Velho and Laurance, 2013; Ghose et al., 2014; Khan et al., 2014; Medhi et al., 2014) focus mostly on presence/absence data. Very few detailed investigations have been conducted until now to assess the status, distribution patterns, or the breeding behaviour of Himalayan otters. Threats such as hunting for trade and conflict with fishing communities have seldom been addressed and investigated.

The authors firmly believe that there is an urgent need for novel scientific and policy-oriented strategies to protect and conserve the remaining population of Himalayan otters. The mere inclusion of these species under various Acts has not helped achieve the conservation targets previously envisioned by scientists. For example, the Smooth-coated and the Oriental small-clawed otter are listed as Vulnerable, and the Eurasian otter as Near Threatened in the IUCN Red List of Threatened Species, 2014. These three species are protected under the Indian Wildlife (Protection) Act, 1972, and listed in the Appendices of the Convention on International Trade in Endangered Species (CITES).

A 'thinking outside the box' approach needs to now be applied for the protection and conservation of Indian Himalayan otters. For instance, otters are common in England living in an anthropogenic landscape despite years of hunting, in Jakarta otters are found in storm-drains, and in artificial environments in Singapore, and in Periyar, South India otters can be spotted in rivers with altered flow.

However, there is a need to first and foremost address the knowledge gaps in order to respond to the existing/emerging challenges facing the otters in the Indian Himalaya. The understanding of various threats to otters in the region, and acquiring the knowledge regarding their current status, population and distribution is vital for the applicability and success of any novel conservation actions in the future.

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RÉSUMÉ

Le Voyage Périlleux Des « Ambassadeurs » De L'himalaya Indien À Travers Les Pressions Anthropiques Et Le Changement Climatique

Les loutres, ambassadeurs des milieux aquatiques, jouent un rôle écologique majeur en étant le témoin de la santé de ces zones menacées. Trois espèces de loutres (i.e. la loutre d'Asie, la loutre naine cendrée, et la loutre européenne) étaient historiquement présentes sur toute la partie Himalayenne de l'Inde. Cependant, les loutres sont dans cette région sous une pression anthropique importante. De plus le changement climatique dans la région peut aussi affecter ces espèces. En dépit de ces menaces, peu d'études sur le statut actuel, les populations et la distribution des loutres de la partie Indienne de l'Himalaya ont été effectuées. Cet article souligne l'urgence de réaliser des études, et de mettre en place des stratégies de protection pour conserver les loutres de cette régio

RESUMEN

EL PELIGROSO VIAJE DE LOS "EMBAJADORES" DEL HIMALAYA, EN MEDIO DE PRESIONES ANTROPOGÉNICAS Y VARIABLES CLIMÁTICAS CAMBIANTES

Las nutrias, embajadoras de los cuerpos de agua, juegan un rol ecológico vital, al indicar la salud de estos ecosistemas amenazados. En la región India del Himalaya, tres especies de nutrias (nutria lisa, nutria de uñas pequeñas asiática, y nutria eurasiática) estuvieron ampliamente distribuidas históricamente. Sin embargo, las nutrias están aquí bajo severas presiones antropogénicas. Adicionalmente, las variables climáticas cambiantes en la región podrían potencialmente afectar a estas especies. A pesar de las amenazas crecientes, se han conducido pocos estudios sobre el status actual, la población y la distribución de las nutrias del Himalaya Indio. Este artículo destaca la urgente necesidad de estrategias renovadas, con orientación científica y de políticas, para proteger y conservar las nutrias en la región.

R E P O R T

THE SMOOTH-COATED OTTER *Lutrogale perspicillata* (MAMMALIA: MUSTELIDAE) IN SINGAPORE: ESTABLISHMENT AND EXPANSION IN NATURAL AND SEMI-URBAN ENVIRONMENTS

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ABSTRACT – The smooth-coated otter *Lutrogale perspicillata* reappeared in Singapore in the mid-1990s after an apparent absence of three decades. No assessment of their status has been reported since. We compiled 370 sighting records from the literature and verified online reports and submissions between 1998 and 2014. The records revealed increasing numbers of individuals since the 1990's with breeding populations in the western and eastern Johor Straits on the north shore, and in South of Singapore. About half the records were from three localities: Sungei Buloh Wetland Reserve (16%), Pulau Ubin (14%) and Serangoon Reservoir (14%). In areas of frequent reports of otter presence, camera trapping and sign surveys were conducted to determine the status (transient, infrequent, newly resident, established resident). Thirteen spraint sites and three den sites were identified at four localities, two of which were along rivers dammed to form freshwater reservoirs. The smooth-coated otter is using partially disturbed environments along the Singapore coastline, and in increasingly human-disturbed sites. As the interface with humans continue to increase, the importance of habitat preservation and public communication is highlighted.

KEYWORDS – Conservation, *Lutrogale perspicillata*, status, Singapore, Smooth-coated otter

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INTRODUCTION

Otters have been used as a symbol for promoting the conservation of wetlands, because of their widespread public appeal, worldwide distribution and indication of healthy aquatic habitats (Foster-Turley, 1991; Kruuk, 2006). As human populations continue to grow, wetlands become increasingly polluted or are lost to development (Moser et al., 1996; Prigent et al., 2012). As a result, otters have become increasingly

vulnerable throughout their original range (de Silva et al., 2015; Wright et al., 2015). Of the diversity of natural habitats suitable for otters in South-east Asia (Foster-Turley, 1992), mangrove forests and estuaries are available to otters in Singapore. However, less than 1% of original mangrove cover remains in Singapore (Yee et al., 2010) owing to decades of intensive coastal development and activity (Hilton and Manning, 1995).

Four species of otters occur in Asia (Foster-Turley, 1992; Sivasothi and Nor, 1994), of which two have been known to occur in Singapore, namely the smooth-coated otter *Lutrogale perspicillata* and the small-clawed otter *Aonyx cinereus* (Sivasothi and Nor, 1994). Prior to the 1960's, *A. cinereus* appeared to be the common otter species compared to *L. perspicillata* of which few records were available (Sivasothi, 1995). No verified records of either species are available in the 1970s and 1980s; although this not an indication of absence. In the early to mid-1990s, sightings of individual *L. perspicillata* re-emerged (Lim, 1990; Sivasothi, 1995). In 1998, a pair of smooth-coated otters re-established themselves at the Sungei Buloh Wetland Reserve and raised pups (Sivasothi, 1999; Baker, 2000).

Since then, sightings of *L. perspicillata* have increased on blogs, photo sites and personal reports from the community of naturalists and photographers, especially since 2008. These records have suggested the establishment of more than one population. This is exciting news as *Lutrogale perspicillata* is listed internationally as 'Vulnerable' in the IUCN Red List of Threatened species (de Silva et al., 2015) and nationally as 'critically endangered' in the Singapore Red Data Book (Lim et al., 2008). In areas where they are extant, a grasp of their distribution is vital. With the use of collated records and field surveys, we: (1) summarise sighting records between 1998 and 2014 to describe the distribution and status of *L. perspicillata* in Singapore; and (2) determine the residency status of *L. perspicillata* in various sites in Singapore.

STUDY AREA

The Republic of Singapore (103°500'E, 1°200'N) is an island 719 km^2 in area, located off the southern tip of Peninsular Malaysia (Fig. 1). The Johor Straits is a sea channel of varying width of 500-1,000 m, separating Peninsular Malaysia and Singapore giving rise to sheltered coastlines. The Johor-Singapore causeway links the two countries and separates the straits into eastern and western halves. The eastern Straits of Johor contain two islands belonging to Singapore, Pulau Ubin (10.2 km^2) and Pulau Tekong (24.4 km^2). This area has suffered an impact by coastal development by both countries and high vessel traffic from the Malaysian port of Pasir Gudang, which began operations in the 1970s (Johor Port, 2012). Singapore's coastline is highly developed and reclaimed (Tan et al., 2010), and major river mouths are sealed to form reservoirs but short stretches of relatively intact habitats such as mangrove, beaches and estuaries are still present or recovering (Fig. 1).

METHODS

Verified otter sighting records were compiled and then plotted on a map to reveal the distribution of *L. perspicillata* in Singapore. The records were supplemented with data from sign foot surveys and camera trap surveys, which are among the methods suggested by the IUCN Otter Specialist Group Standard to monitor otter distribution (Reuther et al., 2000). Nine sites with a high incidence of sighting reports between 2010 and 2011 were selected for these surveys and included estuarine mangroves, estuarine reservoirs, mangrove, beaches, coastal park and ponds (Table 2).

Compilation and analysis of records: Records of otter sightings between 1996 and 2014 were compiled from the following sources: records from the Raffles Museum of Biodiversity Research, National University of Singapore (RMBR, now Lee Kong Chian Natural History Museum); the Vertebrate Study Group (VSG), Nature Society (Singapore); National Parks Board (NParks); submissions (both unsolicited and invited) by the naturalist community and the public through Mammal Sightings in Singapore (an online records submission form at http://mammal.sivasothi.com); Google searching for internet sources (online photography forums, YouTube and blogs) with photographic and/or video evidence; and soliciting records through a FaceBook page (https://www.facebook.com/OtterWatch). Records were verified before inclusion. The compiled records were grouped by year and location and plotted on Google Maps.

Sign Surveys: Sign surveys were conducted on foot between July 2011 and April 2012 at all locations where otters had been reported in 2011, to detect otter signs (spraint and footprints), spraint sites and den sites. Sites with a high incidence of sightings and signs of otters were selected as study sites - Sungei Buloh Wetland Reserve, Woodlands Waterfront, Coney Island, Sungei Tampines, Serangoon Reservoir, Punggol Reservoir and Pulau Ubin (Fig. 1). These were regularly surveyed for new otter signs to evaluate the status of otter presence there.

Defining Status. Based on the available data, otter occurrence in a survey site was classified into one of four categories: 1) transient, 2) infrequent, 3) newly resident, and 4) resident. The criteria for each category are listed in Table 1.

Table 1. Criteria for the classification of *L. perspicillata* presence at survey sites in Singapore as of December 2014

Category	No. of consecutive years of sighting records	Activity of spraint sites, July 2011 - April 2012	Presence of juveniles or subadults in past three years
Transient	Less than three	Inactive	No
Infrequent	Three	May not be active	No
Newly resident	Less than three	Active	Yes
Resident	More than three	Active	Yes

Camera Trapping: Ten Reconyx™ PC900 Hyperfire™ camera traps were opportunistically deployed in eight active sites to monitor otter activity and group structure between September 2011 and March 2012. Each trap was fixed to a tree or fence railing at a height between 0.5 and 1.5 m. Traps were set to be active 24 hours per day and triggered by an infra-red motion sensor with the following setup: high sensitivity, three pictures per trigger, one second picture interval, no quiet period delay, 3.1 MP resolution, balanced night mode.

RESULTS

A total of 370 verified records were collated from January 1998 to December 2014 (records are archived at http://mammal.sivasothi.com) and plotted on a map to describe *L. perspicillata* distribution in Singapore (Fig. 1). More than two-thirds of these records were submitted through the Mammal Sightings in Singapore online form since mid-2009 (258 records; 70%) while the rest were obtained from records

maintained by the natural history community (RMBR, VSG, NParks) (46 records; 12%) and the rest were harvested from the public mainly from photos shared online, blogs and webpages (51 records; 14%).

Lutrogale perspicillata were first exclusively observed in mangrove, estuaries and along the coast mainly along the northern shores of Singapore along the western and eastern Straits of Johor. From 2008, however, the otters have been exploring the coastal reservoirs of Punggol and Serangoon and more recently (in 2014), a six-fold increase (2013: 11 records; 2014: 65) in occurrences in the south with some rare records of otters observed inland. Records are poor for coastal areas with restricted public access (mostly military areas).

Clusters of sightings are reflected at Sungei Buloh Wetland Reserve (81 records; 22%) and Pulau Ubin, (53 records; 14%), particularly Chek Jawa. From 2008 there have been numerous records from recently dammed Punggol and Serangoon Reservoirs (63 records; 17%), where barrage works ended in October 2010 and December 2009 respectively (Ng and Tan, 2013). Reports from inland and southern areas of Singapore were few and episodic (16 records; 4%) until 2014, when southern records comprised 48% of the records submission that year.

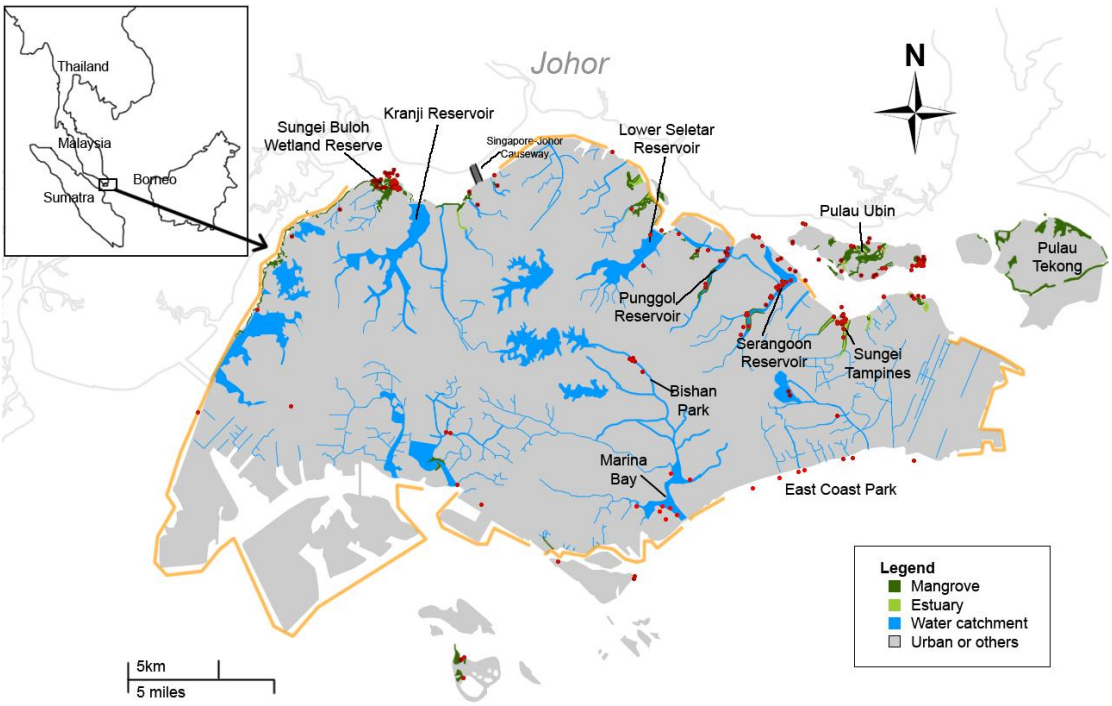

Figure 1. Map of the distribution of *Lutrogale perspicillata* (red dots) in Singapore based on verified otter sighting records from January 1998 to December 2014, overlaid onto a map of the current mangrove, estuary (Yee et al., 2010) and water catchment areas in Singapore. Orange lines indicate restricted areas for which mostly no records were available.

An increasing number of otter sightings have been recorded annually since the appearance of a pair of otters in 1998, except for the period 2004–2006 when there were few records. Sightings records peaked slightly in 2000–2003 and thereafter a much larger number of records were obtained between 2007 to 2014. The greatest number of otter sighting records obtained so far was in 2014 (Fig. 2).

The early sighting records obtained from 1998–2006 were mostly of the first resident population at Sungei Buloh Wetland Reserve in western Johor Straits (24 records; 80%). During this time, other records of *L. perspicillata* were mostly of a

single individual or a pair of otters at Pulau Ubin in eastern Johor Straits. Otters had not yet been detected in southern Singapore.

From 2007 to 2014, otter records in western Johor Straits had increased in number but no longer constituted the majority of records (64 records; 17%). Reports of otters were now mostly originating from eastern Johor Straits (191 records; 52%) and a fifth of the records were from Pulau Ubin. For the first time since 1938 (Sivasothi and Nor, 1994), *L. perspicillata* was recorded in the southern islands in 2010 (Fig. 3).

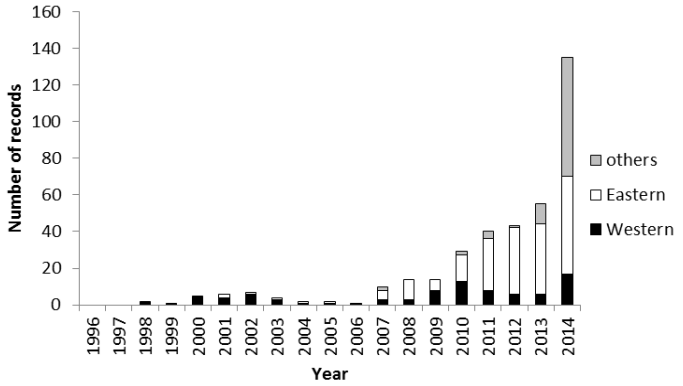

Figure 2. The annual number of verified *Lutrogale perspicillata* records, with an indication of their source from eastern and western Johor Straits, and other (southern and inland Singapore) areas.

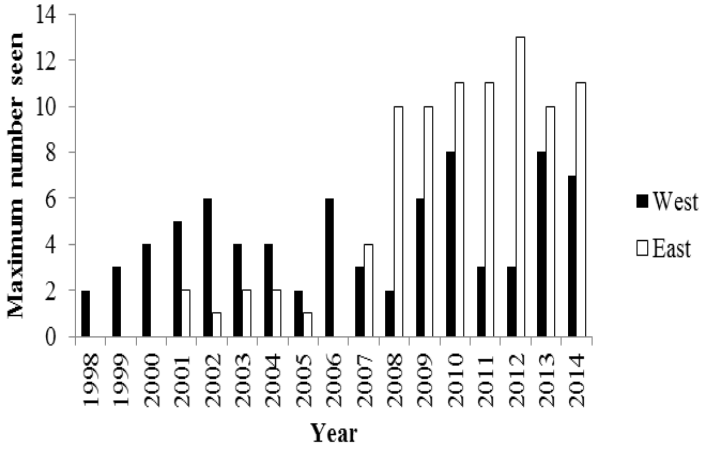

Figure 3. Maximum number of otters reported in Western and eastern Johor Straits annually.

In Singapore, records of groups of four or more otters were common (118 records) and have increased over time (see the appendix of records in http://mammal.sivasothi.com). Group sizes larger than seven individuals have been reported 25 times between 2008 and July 2014, almost entirely from eastern Johor Straits populations. The largest, a group of 13, was reported by officers of the Public Utilities Board at Punggol Reservoir in 2012.

Reports of pups and/or subadults of *L. perspicillata* were few but are a useful indication of residency (Table 2). Every year from 1999 to 2003, pups or subadults were reported at Sungei Buloh Wetland Reserve, and also in 2009 to 2014. In Pulau Ubin, subadults were reported in 2007–2008, 2010, 2012 and 2014. Pups and/or subadults were first reported at Punggol and Serangoon reservoirs in 2011 and 2012 respectively, and in Marina Bay in 2014.

Thirteen spraint sites and three dens were found in four study sites. Activity recorded by camera traps was high in two of six sites (more than 0.5 visits/trap night;

Table 3). Otters were determined to be resident in Sungei Buloh Wetlands Reserve and Chek Jawa on Pulau Ubin, and newly resident in Punggol and Serangoon Reservoirs, and Marina Bay. Permanent otter presence was not detected in other sites despite reports of otter presence.

Table 2. Residency status of *Lutrogale perspicillata* at nine sites in Singapore, based on the activity of spraint and/or den sites between Jul 2011 – Apr 2012, presence of subadults and/or juveniles and the number of years otters have been detected in the area. BP: Brackish water pond; EM: Estuarine mangrove; ER: Estuarine reservoir; SB: Sandy Beach; UB: Urban.

No.	Site	Residency status	Spraint/den site activity in Jul 2011 – Apr 2012	No. of years juv/subadults present	No. of consecutive years with sightings
1	Sungei Buloh Wetland Reserve (EM)	Resident	Active	11 (1999-2003; 2009 - 2014)	17 (1998-2014)
2	Chek Jawa, Pulau Ubin (SB)	Resident	Active	1 (2007, 2008, 2010, 2012)	7 (2001; 2007-2013)
3	Punggol Reservoir, west bank (ER)	Resident	Active	2 (camera trap 2011, 2012, 2013, 2014)	4 (2008; 2010 - 2013)
4	Serangoon Reservoir, Lorong Halus (ER)	Resident	Active	3 (2012-2014)	3 (2008; 2011-2014)
5	Pulau Ubin – Various locations apart from Chek Jawa (BP, EM, SB)	Transient/absent	None detected	1 (2008, 2012, 2014)	7 (2001-2004; 2007-2014)
6	Sungei Tampines, Api-api (EM)	Infrequent	None detected	1 (2011, 2014)	4 (2008; 2010-2014)
7	Coney Island (SB)	Transient	Old	1 (2010)	1 (2010)
8	Woodlands Waterfront (UB)	Transient	None detected	1 (2011)	1 (2011)
9	Serangoon Reservoir, upstream (ER)	Transient	None detected	None observed	1 (2011)
10	East Coast Park (SB)	Transient	-	None observed	2 (2013, 2014)
11	Marina Bay (ER)	Newly resident	-	1 (2014)	1 (2014)
12	Bishan Park		-	None observed	1 (2014)

Table 3. Camera trap results of *Lutrogale perspicillata* activity and group numbers.

Site	Trap nights	No. of days with visits	No. of visits	No. of otters	Group structure
Sungei Buloh Wetland Reserve Visitor Centre Pond	66	32	40	2	Adult male &female
Chek Jawa, Pulau Ubin	73	50	122	2	Adult male & female
Punggol Reservoir (west bank, inlet)	71	17	27	2–9	Adults & subadults
Punggol Reservoir (west bank, breakwater)	44	7	8	4–9	Adults & subadults
Serangoon Reservoir (east bank, Tampines Expressway Bridge)	31	1	1	At least 4	Adults
Serangoon Reservoir (east bank, junction with Sg Blukar)	11	1	1	At least 2	Adults

DISCUSSION

Records submission peaks: It is unclear why there was a lack of records in the 2004-2007 period. Some familiarity with the otters could have led to a reduction in official records. Also, public encounters, are often unrecorded. The large increase in records (from 2007 to 2014) can be partly attributed to the growing trend of naturalist blogging (nine blog records between 2007 to 2013), greater online communication through social media (pers. obs.), and as a result, the growing awareness of the online submission form, Mammal Sightings. Annex C in The Singapore Blue Plan 2009 (2008) contains a list of blogs that feature marine content, reflecting a surge of new blogs from 2006. Photography forums and platforms have contributed records and sites such as ClubSNAP and Flickr sourced a further 14 records which were either posted publicly at these sites or derived after communication with the photographers. The bulk of recent records (2011: 38 of 40; 2012: 42 of 43; 2013: 49 of 55; 2014: 122 of 135) were from Mammal Sightings, which has seen an increase of submissions (from 2010: 3; 2009: 2) since its creation in 2009. This may have been attributed to the active promotion and solicitation of otter record submissions through a FaceBook page (www.facebook.com/OtterWatch) created by the first author in September 2011.

Three zones of residency: The rise in the number of records also implies that the population has continued to increase and spread island-wide after the first recorded colonisation event in the Sungei Buloh Wetland Reserve (Fig. 2). These numerous records have indicated an established presence throughout the coastlines of Singapore with evidence of residency. There appears to be three zones of residency in Singapore: the northwest, northeast and the south.

Of the groups recorded in the study, the pair of *L. perspicillata* in Sungei Buloh Wetland Reserve (northwest) appeared to be the longest established residents with a fixed home range encompassing the reserve. However, it is not clear if all records were due to the same individuals, as group size varied. The fluctuating group numbers may be an indication of dispersals, with the pair being the parental subpopulation of a metapopulation in southwestern Johor and southern Singapore.

Three study locations to the northeast (Serangoon Reservoir, Punggol Reservoir, and Pulau Ubin) were classified as areas newly resident to otters. This was concluded by the presence of active spraint sites, presence of juveniles/subadults and at least three consecutive years of records in each of these locations. The first signs of residence in the east were from records in Pulau Ubin that indicated an established group since (at least) 2007. Sightings of 1-10 individuals have been observed for seven consecutive years (Table 2) with one active den site known from the area (in Chek Jawa). A third and fourth group appear to be newly resident in Punggol and Serangoon Reservoirs since 2010 and 2011 respectively. However, as individuals and groups could not be identified, individuals in these three areas may not all be from separate groups.

Although recorded for consecutive years, the infrequency of records within a year in each of these eastern locations could be an effect of a larger home range that encompassed more than one of these locations and parts of southern Johor (i.e. the estuarine mangroves of Sungei Kim-Kim and Sungei Johor in the east). This is likely given the proximity of the sites that are approximately 2 km from each other. A similar distance was reported in a radio-tracking study of the species in Indian freshwater rivers that found small-scale foraging in the environs of dens and extensive journeys between dens and foraging sites of up to 1.5 km (Hussain, 1993).

Transient otters numbering two to three individuals have been recently (2013-2014) recorded in the southern locations of East Coast Park, Marina Bay and Bishan Park. Although Marina Bay recorded a very recent presence (since January 2014), the birth of five pups in the location was recorded shortly after, indicating new residence. This began with the sighting of a pair earlier in the year (Feb 2014) and subsequent sightings of a lone male, until the appearance of the entire family group of two adults and five juveniles in June 2014. The short absence of the female likely indicated its confinement to a natal den for the birth and nursing of the pups until they were old enough to emerge.

New habitats, population growth and dispersal: There appears to be a move southwards from the Johor Straits that led to an increase in the number of locations *L. perspicillata* was present in, suggested by the shifts in the composition of record locality from 1998–2014, with the stream of records in previous locations persisting. Initial records (1998–2004) were exclusively in mangroves and estuaries (indicated by western Johor Straits records, mostly from Sungei Buloh Wetland Reserve), which were considered suitable otter habitats in Southeast Asia (Foster-Turley, 1992). This was followed by records in the newly dammed rivers (Serangoon and Punggol Reservoirs), largely modified sites where entire banks have been concretized and developed, with patches of wasteland vegetation. The species has been reported to inhabit reservoirs in India and Pakistan that were once natural estuaries or lakes (Anoop and Hussain, 2004; Khan et al., 2010). This may be a sign of pressure to adapt to these unoccupied, suboptimal habitats, evidenced by diets of almost exclusively non-native cichlids in the areas (Theng *et al.*, *in press*). Moreover, the recent emergence of southern and inland records (with a record peak in 2014) could be an indication of attempts to migrate and disperse from the Johor Straits populations, a possible result of the maturation of offspring from breeding groups (Table 3: subadults in eastern sites).

Origins and barriers to movement: It appears that populations of *L. perspicillata* on the western and eastern Johor Straits are separated by the Johor-Singapore Causeway (Fig. 1). Built all the way down to the seafloor, the causeway is a likely physical barrier to animal crossing. This obstruction is coupled with the highly urbanised surroundings could be a barrier hindering or preventing exchange between populations.

If the two populations on either side of the causeway are indeed isolated, it is possible they represent migrants from distinct populations residing in mangroves and rivers in southwestern and southeastern Johor. These possible source sites presently include mangrove areas of Pulau Kukup, Tanjung Piai and Sungei Pulai (RAMSAR sites) in southwest Johor and Sungei Johor and Kim-Kim, all of which have reported the presence of this species (Iskandar Malaysia, 2009).

Push and pull factors for establishment in Singapore: The eventual establishment of *L. perspicillata* suggests three possibilities: a pull factor in the recovering natural environment receiving migrants from Malaysia, a push factor from development and loss of habitat in Malaysia, or a combination of both.

Coastal development in northern Singapore has significantly slowed (Tan *et al.*, 2010: 79) since a 40-year period (1953–1993) of intensive coastal development, resulting in significant mangrove loss (Hilton and Manning, 1995). This may have encouraged the migration of *L. perspicillata*, following the disturbances from land

reclamation during the 1960s for farming, housing and industrial activity (Hilton and Manning, 1995), when the environs of pockets of natural waterways stabilised. This phenomenon was also reflected in the northeast, where the increased presence of groups of *L. perspicillata* (from 2008 onwards) in the Serangoon and Punggol Reservoir followed years of activity from fishing and farming villages, reclamation work and eventual dam construction, which was completed in 2009 (Cornelius, 2005).

Meanwhile, massive development plans of a similar scale have been underway in Southern Johor, threatening the continued existence of extensive mangrove patches (e.g., Iskandar Malaysia, 2011; Pengerang Integrated Petroleum Complex in southwest Johor). This may have caused a pressure for *L. perspicillata* to migrate southwards to escape habitat loss and disturbance. Thus it may no longer be just transient males dispersing to seek new territory, by relocating to Singapore, but family groups as well. This may have helped establish populations here.

Implications: The rising occurrence of *L. perspicillata* throughout Singapore was not a result of targeted efforts to encourage otter presence but one that was mostly natural dispersal. The population spread has seen the increase in the heterogeneity of habitat use throughout the years as the species continues to surprise us with the amount of modification and disturbance it is able to tolerate. Though *L. perspicillata* appeared to be fairly adaptable to severely degraded and disturbed habitats, actual use of spaces within these areas appeared more specific. What is often seen are individuals traversing expanses of unfavourable habitat to move between these spaces, evident by the transience in areas such as Woodlands Waterfront and East Coast Park (Table 2), sites with banks that are completely bare or vertically walled.

Habitat: The spaces that otters require in their home range are foraging sites and suitable spraint and den sites to defecate, groom and rest. Spraint and den sites are sites used with regularity and fidelity (Kruuk, 1995; Anoop and Hussain, 2004; Shenoy et al., 2006) and tend to have preferred characteristics like elevated ground, presence of grooming substrate (e.g. sand), surrounding vegetation and a refuge from disturbance (Kruuk, 2006: 82). The latter is especially required when raising young (Kruuk, 2006: 90). Similarly, spraint and den sites were recorded on more vegetated, elevated but gently sloping banks that were less human disturbed, in the coastal reservoirs of this study (Theng, 2012). Bankside vegetation is known to serve as a refuge (Mason and Macdonald, 1986) and a screen from disturbance (pers. obs.). It usually has a positive correlation with otter presence in species such as *Lutra lutra* (Macdonald and Mason, 1983; Prenda and Granado-Lorencio, 1995; Ottino and Giller, 2000; Madsen and Prang, 2001), *Lontra canadensis* (Melquist and Hornocker, 1983), *Lontra provocax* (Medina-Vogel et al., 2003), *Aonyx cinereus* (Prakash et al., 2012), *Aonyx capensis* (Carugarti et al., 1995) and *Hydrictis maculicollis* (Carugarti et al., 1995). Thus rehabilitating bankside vegetation in heavily modified sites could improve habitat for the local population, evident in 'otter haven' projects in Europe, which have successfully enhanced *L. lutra* populations (Fox, 1999). In fact, a recent initiative of the government body in charge of water resources (Public Utilities Board) has introduced a similar concept of greening waterways in its Active, Beautiful, Clean Waters programme, which has seen the engineering of otherwise concrete canals into 'naturalised' rivers in Bishan Park and Sungei Ulu Pandan (Public Utilities Board, 2010, 2014). This may have enriched the habitat for otters that may result in an increased presence in such areas in future.

Attitudes and actions: As otter presence continues to increase throughout the country, an increasing interface with humans is inevitable and this raises the probability of potential disturbance and conflict. Raising awareness and spreading a consistent message to encourage responsible behaviour when faced with wildlife such as otters is thus vital. Working with local government agencies and management to spread this message has been key in achieving this in Singapore. An example was set by collaboration with the management of Gardens by the Bay where a message of "Please do not approach but view from a distance" was adopted by staff and printed on pedestrian sign boards (Fig. 4). This has since been actively communicated by the lead government agency on biodiversity conservation in Singapore (National Parks Board), news media (Ee, 2014; Boh, 2015) and even echoed by our then-National Development Minister (Goy, 2014).

Figure 4. Signs have been erected in areas with otter presence to encourage appropriate behaviour when encountering otters. *Left*: Gardens by the Bay; *Right*: Coney Island, Serangoon Reservoir (Photo by: Jeffrey Teo).

Encouraging public involvement: Apart from encouraging good wildlife ethic, encouraging public involvement in the research and monitoring of the species has proven to be invaluable. The use of public records has been a critical element in understanding *L. perspicillata*'s distribution in Singapore. Of late, public involvement has been taken a step further with a constant engagement with enthusiastic members of the public who report otter sightings real-time through the use of smartphones and capture high-resolution media that provides a vital source of documentation for this species. This contribution has also enabled updated and effective feedback to various development projects and advice about public encounters for the ongoing conservation management of otters in Singapore. Public involvement has proven to be big part of local otter research in highly connected Singapore and will continue to provide the information required for population monitoring, conservation management and future studies.

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RÉSUMÉ

LA LOUTRE D'ASIE (*Lutrogale perspicillata* (MAMMALIA: MUSTELIDAE) À SINGAPOUR : ÉTABLISSEMENT ET RECOLONISATION DANS UN ENVIRONNEMENT NATUREL ET SEMI URBAIN

La loutre d'Asie *Lutrogale perspicillata* est réapparue à Singapour dans le milieu des années 90 après une absence apparente de trois décennies.

Aucun établissement de leur statut n'avait été établi. Nous avons compilé 370 observations visuelles dans la littérature, et vérifié les données rapportées sur Internet entre 1998 et 2014. Les observations révèlent un nombre d'individus en augmentation depuis les années 1990 avec une population se reproduisant dans les détroits de Johor ouest et est sur les plages du nord et dans le sud de Singapour. Presque la moitié des observations proviennent de 3 sites : Sungei Buloh Wetland Reserve (16%), Pulau Ubin (14%) et Serangoon Reservoir (14%).

Dans les zones d'observations fréquentes de loutre, des pièges photos et des prospections à la recherche d'indices de présence ont été utilisés pour déterminer le statut (de passage, non fréquent, nouveau résident, résident établi). 13 places de marquage et 3 catiches ont été identifiées dans 4 sites, deux d'entre elles, le long de rivières possédant des barrages en vue de créer des réservoirs d'eau douce. La loutre d'Asie utilise un environnement partiellement dégradé le long des côtes de Singapour. Alors que l'interface avec les humains ne cesse de s'accroitre, l'importance de la préservation de l'habitat et de la communication auprès du public est de plus en plus capitale.

RESUMEN

LA NUTRIA LISA *Lutrogale perspicillata* (MAMMALIA: MUSTELIDAE) EN SINGAPUR: ESTABLECIMIENTO Y EXPANSIÓN EN AMBIENTES NATURALES Y SEMI-URBANOS

La nutria lisa *Lutrogale perspicillata* reapareció en Singapur a mediados de los 90s, después de una aparente ausencia de tres décadas. Desde entonces no se ha reportado ningúna evaluación de su estatus. Hemos compilado 370 registros de avistaje de la bibliografía y de reportes online o enviados, verificados, entre 1998 y 2014. Los registros revelaron un creciente número de individuos desde los 90s, con poblaciones reproductivas en los Estrechos Johor occidentales y orientales sobre la costa norte, y en el sur de Singapur. Alrededor de la mitad de los registros fueron de tres localidades: Reserva del Humedal Sungei Buloh (16 %), Pulau Ubin (14 %) y el embalse Serangoon (14%). En áreas con reportes frecuentes de presencia de nutrias, condujimos relevamientos con cámaras-trampa y en base a signos, para determinar el estatus (transeúntes, infrecuentes, residentes recientes, residentes establecidos). Identificamos trece sitios con fecas y tres sitios con cuevas en cuatro localidades, dos de las cuales estaban a lo largo de ríos represados para formar embalses de agua dulce. La nutria lisa está usando ambientes parcialmente disturbados a lo largo de la costa de Singapur, y sitios con disturbio humano creciente. Como la interfase con los humanos continúa creciendo, destacamos la importancia de la preservación de hábitats y la comunicación pública.

R E V I E W

THE EURASIAN OTTER *Lutra lutra* IN AFGHANISTAN: A REVIEW OF THE SPARSE AVAILABLE INFORMATION

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ABSTRACT: The status of the Eurasian Otter in Afghanistan is particularly poorly documented, reflecting in part the effects of the country's turbulent history of recent decades on mammal survey. In the 1970's the species was reported in all major rivers and streambeds in Afghanistan between 400 and 2,900 m asl. Because of the poor security conditions that render most of the species's historical habitat inaccessible, surveys carried out by the Wildlife Conservation Society (WCS) could only confirm since 2007 its presence in the Wakhan district of Badakhshan province, in the northeastern corner of the country. Surveys of Kabul fur market carried out by WCS in 2006 confirmed the continued trading of the species and a decline in market supply compared to survey results from the 1960's, possibly as a result of a decrease in population size. Since 2010, the Eurasian Otter is on the list of protected wildlife species in Afghanistan. Clarification of the species's current natural distribution, population trend and threats is necessary before appropriate conservation measures, if needed, can be proposed.

The Eurasian Otter *Lutra lutra* has a wide range across the Palaearctic from Ireland to Asia's Pacific coast (congeneric populations in Japan are sometimes considered a separate species, Japanese Otter *L. nippon*) and across much of tropical Asia (e.g. Corbet and Hill, 1992). It remains widespread and locally common in much of its Palaearctic range, but the current status of the tropical Asian populations is much less well known (e.g. Conroy et al., 1998). Its status in Afghanistan is particularly poorly documented, reflecting in part the effects of the country's turbulent history of recent decades on mammal survey (e.g. Smallwood et al., 2011; Stevens et al., 2011). The Eurasian Otter is the only species of otter ever recorded from the country, and to find any other species of otter in the country would be a major extension of known range. Thus, all information about otters ('*sang abi*' in the Dari language) in Afghanistan is assumed here to relate to the Eurasian Otter.

In his benchmark review of the mammals of Afghanistan, Hassinger (1973) traced many records of the species from the country and considered that it lived below 2,500 m a.s.l. along perennial streams from a wide range of localities. He cited various statements indicating a high trade in pelts within the country.

Melisch and Rietschel (1996) published 22 distribution records from Afghanistan and showed that the species was once widely distributed. Nauroz (1974), cited in Melisch and Rietschel (1996), stated that otters occurred in almost all river systems of Afghanistan, except for the seasonally flooded Hari-Rud Valley, and ranged in altitude from 400 to 2,900 meters. Habibi (2003) reviewed information collected until the late 1970s and noted that the species is present in all major rivers and streambeds in Afghanistan between 500 and 2,000 m a.s.l. (probably misreading the value for upper altitude proposed by Hassinger 1973).

In summer 2007, the Wildlife Conservation Society (WCS) confirmed the presence of otters in the Wakhan district of Badakhshan province (in the far northeastern part of the country), in the Wakhan River near the villages of Sargez and Goz Khun (Habib, 2008). According to local information presented by Naumann and Niethammer (1973), in Melisch and Rietschel (1996), it also occurred in the early 1970s further eastward in the Wakhan corridor where it reached Baba Tangi at 3,000 m a.s.l. On 22 June 2013, one otter, possibly a transient individual visiting the area because of the high water level in this season, was observed in Wakhan in a tributary glacial stream of the Panj River (36°57′N, 72°34′E) at an altitude of 3,120 m, which constitutes the highest record for the species in Afghanistan (S. Ostrowski pers. obs.). In Wakhan the species seems to reside in a few localized populations, along approximately 45 km of the Panj and Wakhan rivers, approximately between 72°34′E and 72°55′E, but the lower reaches of the Panj river in Wakhan still need to be thoroughly examined for otter presence. Between 2006 and 2015 WCS has carried out numerous wildlife surveys, including along river courses and in wetlands in Badakhshan, Bamyan, Ghazni, Nuristan and Takhar provinces (Karlstetter, 2008; Ostrowski et al., 2008a,b; Shank, 2010; Stevens et al., 2011), with no positive results but in Badakhshan (i.e. Wakhan) (Habib, 2008). However, direct searches for otters were only attempted in Badakhshan and Takhar provinces.

Afghanistan population estimate and trends are unknown. Before the Soviet invasion in 1979, otters were hunted in Afghanistan and the skins were highly prized (Niethammer, 1967; Nauroz, 1974 cited in Melisch and Rietschel, 1996). Historically, the otter was a major staple in the Kabul fur markets. Niethammer (1967) reported easily finding up to 40 otter furs in Kabul's fur market with the biggest proportion reportedly coming from Maidan Valley, Wardak province. Rodenburg (1977) also found 94 complete skins in his survey of the Kabul fur markets in autumn 1976 and estimated that another 34 animal pelts had been used in a variety of manufactured products put up for sale, including hats, gloves and occasionally coats. Although otter pelts were relatively common in Kabul fur markets in the 1960s, Niethammer (1967), quoting shopkeepers, stated that they were becoming rare and more expensive. In support of such a trend, surveys of Kabul's fur markets carried out by the Wildlife Conservation Society (WCS) in 2006 confirmed the continued trading of the species, yet it was only the ninth most common fur species with only seven observations (Johnson and Wingard, 2010). The survey also confirmed that foreign buyers from Russia, Tajikistan, Turkey and the EU prized otter pelts. Roberts (1977) indicated that Eurasian Otter was rare in the Pakistan/Afghanistan border regions (river valleys of Swat, Chitral and Kaghan). It is possible that the decline in Kabul's market supply mirrors a decline in harvest as a result of a decrease in population size.

One of the main threats to wildlife in Afghanistan is hunting (Formoli, 1995; Kanderian et al., 2011). While the Eurasian Otter is still hunted for its pelts, WCS, during a continuous presence in the country since 2006, has collected no evidence that the species is hunted as food, sport, or as a pest species. In Wakhan the species does not compete with humans for fish resources: the latter are scarcely harvested and traditionally not valued as food by local people (S. Ostrowski pers. obs.). Habibi (2003) noted that hunting has reduced numbers and the species is now only seen in isolated areas, those where trapping and other forms of hunting are limited.

Since 2010, the Eurasian Otter is on the list of protected wildlife species in Afghanistan, and off-take from the wild, transportation, export or re-export are strictly forbidden without prior authorisation from the National Environmental Protection Agency. In spite of this formal protection, people continue to hunt otters and dealers

to buy and sell their furs with relatively limited law enforcement, although there are no hard data available indicating the magnitude of this contravention. Afghanistan is also a party of CITES and CBD since 1985 and 2002, respectively.

Clarification of the species's current national distribution, population trend and threats is necessary before appropriate conservation measures, if needed, can confidently be proposed. However, given this otter species' wide global distribution and, in some areas, buoyant populations, and the various other mammal species of high global concern which inhabit Afghanistan, Eurasian Otter cannot be regarded as one the country's mammal species conservation priorities from a global perspective.

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RÉSUMÉ

La Loutre Commune *Lutra Lutra* En Afghanistan: Résumé Des Rares Information Disponibles

Le statut de la loutre commune en Afghanistan est très mal connu, du fait notamment de la difficulté à organiser des missions d'étude dans un pays en guerre depuis des décennies. On sait cependant que dans les années 1970 l'espèce était présente dans toutes les rivières et torrents majeurs d'Afghanistan entre 400 et 2900 m d'altitude et qu'elle était chassée pour sa fourrure. Les problèmes de sécurité récurrents rendant toujours la majeure partie de son aire historique de distribution inaccessible, les informations récentes sont malheureusement très parcellaires. La Wildlife Conservation Society (WCS) a cependant pu montrer à partir de 2007 que l'espèce était toujours présente dans le district du Wakhan, dans la province nord-orientale du Badakhshan, et qu'en 2006 on trouvait encore des peaux de loutre sur le marché aux fourrures de Kaboul, bien qu'en moins grand nombre que ce qui était observé dans les années 1960, ce qui pourrait traduire une diminution de la population. Depuis 2010 la loutre commune est protégée en Afghanistan. Il reste nécessaire de clarifier sa répartition et sa situation démographique actuelles, ainsi que les menaces qui pèsent sur sa survie, avant de proposer, s'il y a lieu, des mesures conservatoires.

RESUMEN

LA NUTRIA *Lutra lutra* EN AFGANISTÁN: UNA REVISIÓN DE LA ESCASA INFORMACIÓN DISPONIBLE

La condición de la nutria en Afganistán está particularmente mal documentada, lo cual refleja los efectos de la turbulenta historia del país sobre los estudios de mamíferos en las últimas décadas. En los años 70, se registró la presencia de la especie en los principales ríos y corrientes de agua en Afganistán entre los 400 y 2.900 metros sobre el nivel del mar. Puesto que las malas condiciones de seguridad han imposibilitado el acceso a la mayor parte del hábitat histórico de la especie, los estudios llevados a cabo por la Wildlife Conservation Society (WCS) a partir del año 2007 sólo pudieron confirmar su presencia en el distrito de Wakhan de la provincia de Badakhshan, en la esquina noreste del país. Las investigaciones sobre el mercado de pieles en Kabul llevadas a cabo por WCS en 2006 confirmaron el tráfico continuado de la especie y una disminución de la oferta de mercado con respecto a los resultados de los estudios realizados en la década de 1960, posiblemente a causa de una disminución en el tamaño de la población. Desde 2010, la nutria figura en la lista de especies silvestres protegidas en Afganistán. Será preciso aclarar la distribución actual, la tendencia poblacional y las amenazas a las que se enfrenta la especie antes de proponer medidas pertinentes de conservación, en caso de que sean necesarias.

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

NEW MEMBERS OF OSG

Since the last issue, we have welcomed 30 new members to the OSG.

Sharmin Akhtar, Bangladesh: Field biologist working on otter conservation in Bangladesh. I have also been trained in the IUCN Red List Assessment Process.

CR Aneesh, India: I am currently working as a conservation biologist in Silent Valley National Park in the state of Kerala, India. I have been involved in the research on otters since my under graduation project, primarily focusing on Smooth-coated otter (*Lutrogale perspicillata*) and Asian small-clawed otter (*Aonyx cinerea*). The reason I am working on otters is simply because I enjoy seeing these animals in the wild. My own research gave me several insights into their secretive life and I want to continue my work on otters.

Sajeda Begum, Bangladesh: I would like to enhance research in Academic Institutions on otter ecology, the importance of breeding sites, and captive propagation program with habitat improvement. Development of methods and materials for public awareness and education activities (photographs, movies, videos, etc.).

Jamie Bouhuys, Malaysia: Dwindling otter numbers in Southeast Asia are largely caused by hunting for fur, purported medicinal benefits, meat, threat to fisheries and lately even for pets. As a wildlife trade researcher I survey both online and physical markets for otters and their products to identify the magnitude of this threat and find solutions to counter it.

Camille Coudrat, Laos: Founder and director of Project Anoulak (www.conservationlaos.com) based in Lao PDR. Project Anoulak is dedicated to wildlife conservation in Lao PDR and more precisely in Nakai-Nam Theun National Protected Area, at four main levels: scientific research; law enforcement/forest patrols; capacity building; and conservation education.

Alana Dewar, United Kingdom: Alongside continuing to develop the husbandry of the group of Asian Small-Clawed Otters at the Scottish Deer Centre, I encourage peers and visitors to adopt otter-friendly practices and support conservation initiatives locally and around the world, highlighting the work of other otter conservation groups.

Mayukh Dey, India: I have recently completed my graduation in Environmental Science from Fergusson College, in Pune, India. My research interests are in Freshwater biology, Hydrology and in the ecology of Otters, and Crocodilians. I am currently studying the behaviour of smooth-coated otters (*Lutrogale perspicillata*) in the Gangetic floodplains of Bihar, which is a highly dynamic and human dominated landscape.

Abhishek Gopal, India: A former computer science engineer, I now work in conservation. I am a member of Wild Otters and Conservation Leadership Program (CLP) in Goa, surveying, camera trapping and using digital methods to document their activity and behaviour.

Md Kamrul Hasan, Bangladesh: I have been working on conservation and management of various wild animals including primates, small cats, bats, otters and Gharials in Bangladesh. I am particularly interested to see the present status and distribution of three species of otters in Bangladesh. I would like to expand my molecular research on smooth-coated otters to see their population trends both in wild and traditionally conserved captive otters used in otter fishing.

Sungwon Hong, South Korea: I have performed research on the distribution of the Eurasian otter in South Korea. Currently I am in the process of assessing fluctuations in population as a response to environmental change within the Nakdong River basin.

Maxine Jenkins, New Zealand: I am currently the Head of Exotics at Brooklands Zoo in New Zealand. I have been working with Asian Small-Clawed Otters for 7 years now, primarily with post reproductive and aged individuals.I have a strong interest in environmental and behavioural enrichment and how it effects the mental and physical health of otters in captivity. I run an enrichment group on facebook called Exotic and Domestic Animal Enrichment (https://www.facebook.com/groups/442062329252407/)

Rajesh Jha, Nepal: I am working on population status and distribution of otters in Shuklaphanta Wildlife Reserve, and an otter awareness program for the community in the Buffer Zone of the reserve.

Rowan Jordaan, South Africa: I am interested in how, and ultimately why, behaviour and trophic ecology varies between and within populations occupying different habitats with varying climatic variables as well as other factors such as land use, human disturbance. I aim to use my results to aid management strategies and conservation efforts of areas where humans and otters are in close contact and often in conflict, including unprotected areas and trout farms, both of which are vital habitats needed to preserve genetic diversity and population numbers of these extremely charismatic animals.

Murthy Kantimahanti, India: Founder and lead conservation biologist for the Eastern Ghats Wildlife Society (EGWS). Murthy works closely with communities throughout the Eastern Ghats, especially outside the protected areas where human-wildlife conflict occurs, monitoring wildlife and providing education and intervention strategies

Vivien Kent, United Kingdom: I am Conservation Officer at Durham Wildlife Trust in the UK. Among other things I run our Annual Spring Otter Survey, train volunteers in survey methods, organise collection of otter spraint for analysis of dietary preferences and am the Events Organiser for the North East Otter Network.

Astrid Kiendl, Germany: I've been working at the OTTER-ZENTRUM for 4 years as a geographer, GIS and geodata expert. I lead the Information System Otter Surveys (ISOS) Project, in which I organize the data about the spread of the Eurasian otter in Germany and Europe. I also coordinate a network of more than 150 volunteer trackers across Germany. I´m very interested in the wildlife conservation of otters.

Sunita Khatiwara, India: My area of interest is on Himalayan ecosystem and its remarkable biodiversity. In particular, my research focuses on small carnivores, small mammals along the elevation gradient and human-wildlife conflict in the Eastern Himalayan region.

Hannah Krupa, India: I am a member of Wild Otters in Goa, working on Smooth-coated and Asian Small-Clawed Otters in the Western Ghats. I work on educational

modules and presentations for children, and recently co-authored a children's book: "Nuno and Mingel, The Adventures of a young Fisherman and an Otter"

Rahul Kumar, India: I am an undergraduate Zoology student in Mumbai. I have worked on several otter-related projects including a Rapid Action Project to protect 3 newly born pups of *Lutrogale perspicillata* in a highly human dominated disturbance zone on an island in the Gangetic flood plain, and a rehabilitation & radio-telemtry project on a rescued *Amblonyx cinereus*, both funded by Wildlife Trust of India.

Shawn Larson, USA: I have been working at the Seattle Aquarium since 1995 as Curator of Conservation research. I have been studying marine mammal physiology, genetics, population biology and ecology for over 20 years and have published over 10 scientific papers on various aspects of sea otter biology and conservation including acting as lead editor on a book published by Elsevier scientific titled "Sea Otter Conservation".

Benaya Leles, Brazil: I am a giant otter researcher and conservationist from Brazil. I have researched the population dynamics and behavior of giant otters in Cantão Park, on the Araguaia river in Central Brazil, for three years. I am currently beginning a PhD thesis which will hopefully lead to the reintroduction of giant otters in the Paraná River basin.

Brian Long, USA: I have been involved with river otter work since I received a grant to survey neotropical river otters on the Rio Bavispe/ Rio Negro in Northern Sonora and Chihuahua, Mexico, in 2001-2. After another survey river otters survey in New Mexico, I joined the otter reintroduction project to reintroduce otters to the upper Rio Grande watershed in New Mexico. I am also interested in otters in Mongolia, where I have worked.

Katarina Loso, Sweden: I work on otter necropsies together with Anna Roos, collection care and data recording of otter material. I administrate a web page where the public can report otter sightings, and I also work on public engagement concerning otters

Jessica Luis, India: Research associate at Wild Otters, Goa, camera trapping and carrying out otter sign surveys. Also working on a project interacting with fishing communities, aiming to understand which fish species are important to both otters and fishermen, extent of overlap, otter diet analysis, how otters interact with fishing activities, and how to involve fishermen in otter monitoring activities.

Kannadasan Narasimmarajan, India: I am part of a team investigating otter presence, diet, distribution and threats on the River Moyar in Tamil Nadu, this being the first survey ever done there. We are involving local people and other stakeholders, and conducting outreach campaigns to raise awareness of the otters and generate support for their conservation.

Eswar Narayana, India: I work on the conservation of smooth-coated otters, fishing cats, tigers, Great Indian Bustards and Mouse Deer with local villagers, NGOs, Forest departments and other stakeholders in Andhra Pradesh. I have also surveyed for otters on the Rivers Krishna and Godavari, and am now documenting otter distribution, population status and threats in Coringa Wildlife Sanctuary.

Kelsie Oldfield, UK: I am a Senior Keeper & Chair of the Training committee at Longleat, UK, and currently manage a pair of Asian Small-Clawed otters sharing an exhibit with binturong.

Laura Rink, USA: I have recently become the lead North American River otter trainer at the Calvert Marine Museum in Southern Maryland. As lead, it is my goal to truly utilize our otters as ambassadors to inspire the public, create awareness, and promote conservation. In my opinion, our otters are on display for public learning and we would be doing them a disservice if we do not do all that we can to convey their importance to the public.

Shamia Shoma, Bangladesh: I am a lecturer in Zoology at Jahangirnagar University. I work with the fishermen who have been using trained otters to lure fish into their nets for centuries.

Tammy Schmidt, USA: I have been a part of the zoological community for numerous years and have a keen interest and focus with otters, working with North American River Otters, Giant Otters and Asian small-clawed Otters. I am particularly interested in otter welfare, environmental enrichment and Giant Otters.

Clio Smeeton, Canada: Clio Smeeton is President of the Registered Charity, the Cochrane Ecological Institute (www.ceinst.org) which works in association with the Cochrane Research Institute (www.cochraneresearchinstitute.org) undertaking the breeding and reintroduction of endangered species, the rehabilitation and release of orphaned wildlife, environmental research and education. Clio is a member of the OS and the international wild otter rehabilitation and care group and has decades of hands-on experience with wild and captive *Lontra canadensis*.

Leona Wai, Malaysia: I'm a master student working on the ecology of otters in the Lower Kinabatangan Wildlife Sanctuary (LKWS), Sabah, Malaysia. I'm also involved in the project of assessing the Bornean otters.

Daisuke Waku, Japan: I have been working on the genetic relationships between the now-extinct Japanese otter and *Lutra lutra* populations in nearby countries. I discovered that the Japanese otter may have two lineages - one Eurasian Otter, and the other distinctly different but still in the *Lutra* clade. I am also keen on raising otter awareness, and educating students who are the otter persons of the future.