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

NOTE FROM THE EDITOR

Dear Friends, Colleagues and Otter Enthusiasts!

It is with great sadness that I have to mention that we lost a friend and enthusiastic otter researcher during the recent earthquake. Paula was on a research on an island off the Chilean coast that was hit by the tsunami. All other of our Chilean friends were frightened but are in good health.

Lesley and I closed issue 26/2 as the page number for 2009 had reached already almost 130 pages. Therefore issue 27/1 does not start in April as it was usual in the past but is open already in January. We have meanwhile received several manuscripts that are in different stages in the review and revision process and we will have soon some very interesting articles online. If the positive trend will continue in 2010 we may have three issues in this year.
At this stage I would also like to express my sincere gratitude to Hermann Ansorge, Robert Brooks, Eduardo Carillo-Rubio, Claudio Chehebar, Pablo Garcia Diaz, Nicole Duplaix, Dilian Georgiev, Syed Ainul Hussain, Hans Kruuk, Chris Matcham, Laurent Mercier, Mauricio Montano-Garces, Darren Norris, Zachary Olsen, Nuno Pedroso, Rob Pickles, Fernando Rosas, Marcus Rowcliffe, Andy Sheldon, J. Scott Shannon, Vic Simpson, Grace Yoxon, who contributed a lot by either serving as reviewers, assisting some authors with the improvement of the English or by translating abstracts into French and Spanish. You may have noticed that we had some articles in 2009 with abstracts in additional languages. If this is of interest for you because of local reasons please feel free to submit the respective abstract together with the final revised version.

Many of you may have realized how much work Lesley puts into the Bulletin and the homepage of OSG. She is not only updating regularly the website, is uploading articles on short term once the final versions become available, but finds in addition the time to digitalize the old issues and right now only six issues are not online and available for searches. Thanks a lot Lesley! For all the time and efforts!

We all regret not to be able to have the XIth Otter Colloquium later this year in Italy, to discuss otters and meet old friends again. However I am also sure that we all understand the reasons for the organizers to postpone the meeting and I hope to see you all in Italy in 2011. Good luck to the team in Italy as there is a lot of work ahead.

OBITUARY

Paula Ayerdi (1981 - 2010)

It is with great sadness that we have to announce the death of Paula Ayerdi as a result of the recent earthquake in Chile. Paula was only 28 years old, a Chilean marine biologist who loved nature and the ocean more than anybody. However, it was the ocean, which Paula admired and respected so much, that took her from us. She passed away on Saturday, 27th February 2010 a victim of the Tsunami, which followed the earthquake. At that time she was on Juan Fernandez/Robinson Crusoe Island, Chile, where she was doing research on the Juan Fernandez lobster together with her fiancé. Since 2006 she had been working on the genetics of marine otters, as a result, she travelled most of the Chilean coast collecting samples for the marine otter genetics research.

She was a member of Chinchimen (NGO), working for marine otter and coastal marine conservation. Furthermore, she was a key person in the collection of valuable samples for a Wildlife DNA Bank in Chile. Last year Paulav began working on kelp ecology and genetics, in charge of the fieldwork. Not only was she a great scientist, she was also a mentor to many students who learned about science and life in general from her. Paula also dedicated her time to make people change their attitude and do small daily things to save our environment, such as recycling. She loved scuba diving but also taking care of her cactii and other plants. She left behind her fiancé who is also a marine biologist, family, many friends who loved her so much and a Chilean fauna who needed her enthusiasm, dedication, intelligence, and passion.

Paula (Poli), there are no words to express how much we will miss you…

Juliana Vianna and Gonzalo Medina

I am sure that I speak for the whole OSG family in passing the Group's condolences to Paula's fiancée, family and colleagues.
(Jim Conroy – Chair IUCN/SSC Otter Specialist Group


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CHUNGUNGO - NUTRIA MARINA
Conoce los aspectos más importantes de esta maravillosa especie
LINKS DE INTERES
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SITIOS DE ALTO VALOR ECOLÓGICO
Acantilados de la Quirilluca / Humedal Campiche, zonas de alta biodiversidad
HISTORIA DE UN CHUNGUNGO
Relato de Ricardo Correa sobre su experiencia con la nutria marina, que dio origen a la organización
GALERÍA DE IMÁGENES
Aportes y Donaciones
DONACIONES
Chinchimén
Protejamos a la Nutria marina
Paula Ayerdi Retamales
1981 - 2010
Consientes que la fauna costera enriquece y embellece el paisaje, el Grupo de Acción Ecológica Chicnchimén ha creado una serie de actividades cuyos principales objetivos son educar y articular a los voluntarios para la conservación de la biodiversidad.
Nuestro ecosistema costero, hogar de los chungungos, piqueros y muchas otras especies necesitan de nuestro compromiso. Ayúdanos a mantener el equilibrio del ecosistema, PARTICIPA EN NUESTRAS ACTIVIDADES.
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SHORT NOTE

TRACKS AND OTHER SIGNS OF OTTERS IN RICE FIELDS IN PADANG PARIAMAN, WEST SUMATRA: A PRELIMINARY STUDY

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(received 14th July 2009, accepted 30th October 2009)

Abstract: We identified otters based on tracks and other signs in a West Sumatran rice field. Field surveys were conducted from July to December 2008 at Padang Pariaman, West Sumatra, Indonesia. We identified one species, *Aonyx cinereus* (Illiger, 1815) based on the size and form of 8 fore and 17 hind footprints. Further, we describe three types of spraint site, sliding sites and other evidence of otter existence in this area.

Keywords: Species identification, footprint, rice field, sprainting site

INTRODUCTION

There are four species of otter in Sumatra, *Lutra lutra, L. sumatrana*, *Lutrogale perspicillata,* and *Aonyx cinerea* (Corbet and Hill, 1992). The first two species are protected by Indonesian law (Noerdjito and Maryanto, 2001). However, heavy use of pesticides in agriculture, the dumping of toxic wastes from factories, and domestic wastes and detergents from human settlements are contaminating many rivers and water systems in Indonesia, causing a severe threat to the entire aquatic food chain, including otters. In addition, the draining of wetlands in Sumatra and Kalimantan for agriculture and human settlement destroys important otter habitats and results in a decline in prey species (Foster-Turley and Santiapillai, 1990)

Rice fields, together with their contiguous aquatic habitats and dry land comprise a mosaic of rapidly changing ecotones that harbor a rich biological diversity. A variety of small mammal and fish species utilize rice fields, mainly as feeding sites. The concentration of prey species attracts medium-sized carnivorous mammals including otter (Bambaradeniya and Amerasinghe, 2003).

In Malaysia, Kerian rice fields are an important habitat for small-clawed and smooth otters. The brushy cover along the dikes and between separate rice fields serves as denning grounds for both otter species. Their survival in these areas depends on the availability of suitable prey and islands of brushy cover where they can den and raise cubs without human intervention (Foster-Turley, 1992).

In Indonesia, however, there is little information about the occurrence of otters in rice fields. Melisch, Asmoro, and. Kusumawardhami (1994) reported small-clawed otter existence in rice fields of West Java, however there is a of lack data from Sumatra. Otter existence is known from reports by local rice farmers and fishermen, with uncorroborated reports of otter species as pests. The objective of this study was to collect preliminary data on otter occurrence through tracks and other indirect signs. These data will be used as the basis for further investigation.

STUDY SITES AND METHODS

This study was located in the Lubuk Alung rice fields (between latitudes 0°38'27" and 0°40'34"S and longitudes 100°19'43" and 100°17'17"E), district of Padang Pariaman, West Sumatra from July to December 2008. We conducted direct observation along rice field dikes and water canals. Lubuk Alung contains 3,804 Ha (hectares) of rice fields. Most fields (2,432 Ha) use technical irrigation with three harvests a year. Irrigation canals are also used for fish cultivation. We searched for otters' track and other signs for a total of 21 days with three repeated surveys of 11.2Km along rice field dikes and water canals. We took pictures and measurements when encountering otter sign. Tracks were studied by collecting plaster casts, and were identified subsequently with reference to published literature on the basis of form and size (van Strien, 1983; Kruuk et al., 1994; Larivière 2003). Otter spraints were collected and stored for further research. Spraint sites, damage to paddy clumps, and sliding sites were recorded and described.

Figure 1. The study site in West Sumatra

RESULTS

Tracks

Footprints were found in mud bed near an irrigation line. A trail of parallel tracks from two individuals and randomized tracks were recorded. We found a total of 25 tracks from a single otter species, the small-clawed otter *Aonyx cinereus* (Illiger, 1985). Footprints of small-clawed otter are small with long fingers and incomplete webbing (Fig. 2). Most tracks showed no indication of a claw mark. We found that fore feet were smaller than hind feet. Measurements (in mm) of 8 fore feet and 17 hind feet averaged (range in parentheses): length of fore feet, 56.06 (51.30-63.60); width of fore feet, 37.81 (29.55-47.95); length of hind feet, 67.47 (61.60-71.15); and width of hind feet, 51.63 (45.55-58.00). Measurements of 7 track trails (in mm) averaged: step, 159.14 (128-208); stride 380.85 (346-428), and straddle 115.71 (104-132). In addition to small-clawed otter tracks, tracks of Leopard cat (*Felis bengalensis*), domestic dog (*Canis domesticus*), domestic cattle (*Bos indicus*), water monitor (*Varanus salvato*r) and some bird species were also found.

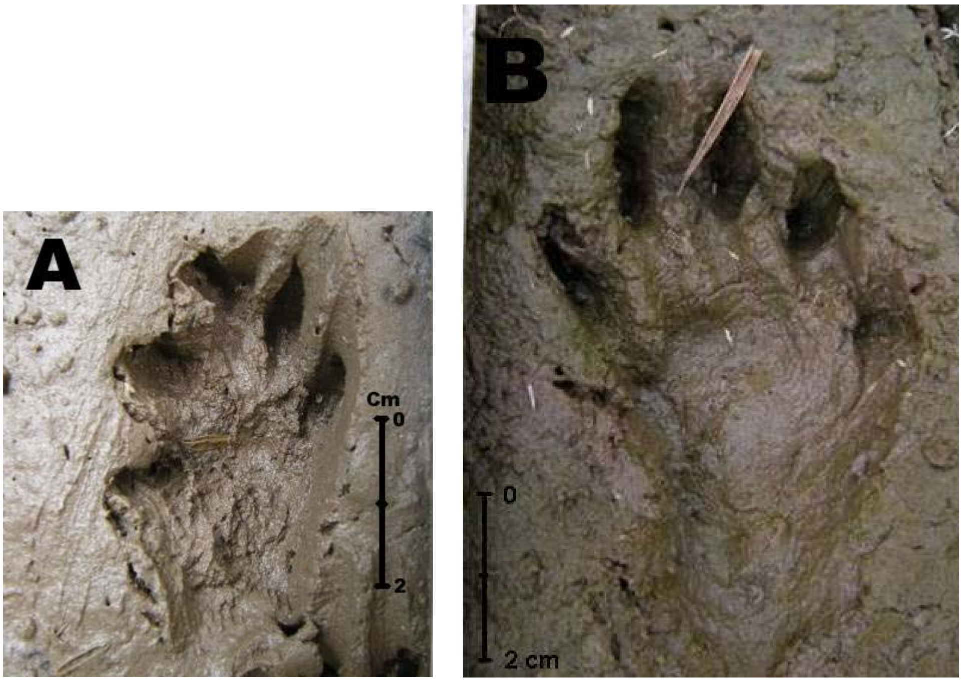

Figure 2. Tracks of small-clawed otter A: Right Fore Foot, B: Left Hind Foot

Sprains and sprainting sites

All spraints were found on a clearing path near a small irrigation line. Three sprainting sites were observed: near a rice field hut (69.23%), tree trunk (23.08%), and at a division of an irrigation canal (15.38%) (n=13) (Fig. 3). Spraints were scattered black mass when fresh. The size of 6 spraints averaged 249.68 mm (range: 73.1-450) in smearing diameter. Spraints contained undigested material such as scales, bone and skin (Fig. 4), all this material remains unidentified. Three spraints were collected for further study.

Figure 3. Sprainting site. A: near rice field hut, B: near tree trunk, C: at a division of an irrigation canal

Figure 4. Fresh spraint of small-clawed otter contained undigested material

Other signs

Other signs included sliding sites and damage to paddy clumps (Fig. 6). The sliding site was found near a small canal. Otters seem to slide from a higher dike to the waters surface. During surveys we found that otters broke paddy clumps in the corner of a rice field and at the side of a dike near a small canal. All damage to paddy clumps was found near sprainting sites. Based on local information, otters often break paddy clumps before depositing spraints, but further study is needed to confirm this information.

Figure 6. Other signs, A: sliding site (show by arrow), B: damage to paddy clumps

DISCUSSION

This study shows that small-clawed otter appear to be feeding in the area and supports the findings of Foster-Turley (1994) who described rice fields in Kerian Perak (Malaysia) as a habitat used by small-clawed otter. Based on the tracks (including a parallel set from 2 individuals) we suggest that at least one family of small-clawed otters is present. Only one species was found in this area, suggesting that other otter species may not be as tolerant of human activities, which may account for their rarity throughout Southeast Asia.

We found that tracks of small-clawed otter were larger than those recorded from populations in Thailand, but smaller than *Lutra sumatrana* (Kanchanasaka, 1998), *Lutra lutra* and *Lutrogale perspicillata* (Kruuk et al., 1993; Kruuk et al., 1994). Although sizes varied, the form of small-clawed otter tracks enables unambiguous identification. Larivière (2003) summarized that tracks from *A. cinereus* can be differentiated from tracks of other otters by smaller size, absence of claw marks, incomplete webbing between fingers and toes, longer middle digit compared with other digits, and relatively long fingers. The difference in sizes we found could be partially explained by the variation in size in different substrates, for example Mercier and Fried (2004) analyzed the tracks of captive otters and found a significant difference in measurements between substrates.

Previous studies about diet of small-clawed otter have demonstrated the preferred diet of this animal was crabs (Kruuk et al., 1994). But in general, no crab remains were found in spraints of small-clawed otter in this study. This can be explained by the absence / low densities of crabs in the study area (Aadrean pers. observ.). But additional research is required to provide a thorough analysis of diet and prey availability. According to Foster-Turley (1992), about half of the small-clawed otter toilet sites show signs of scat-smearing, a behavior often seen in captivity. The result of this study supported these findings where all spraints showed sign of scat-smearing.

Damage and destruction of paddy clumps indicate places where otters have been body-rubbing (rolling, or pressing their sides against the ground or vegetation), which also occurs in other otter species and is often associated with sprainting sites (Kruuk et al., 1993). It is one of the ways of scent marking, but also, many carnivores bite off and eat grass every so often, to 'scour' their stomach (Kruuk, pers. comm.). In our study area, the damage to paddy clumps caused by otters occurs at a low level that has no impact on rice production, but does generate a bad image for local farmers who may sub- sequentially regard otters as pests.

To ensure the conservation of small-clawed otter in rice fields, further information on their ecology, feeding habits and social dynamics in this habitat is still needed. Research priorities include: revealing diet compositions by scat analysis, and exploring prey availability in this area.

ACKNOWLEDGEMENTS - We would like to thank Wilson Novarino, Ardinis Arbain and Padma de Silva for their contribution by constructive comments. We also acknowledge valuable support from zoological museum of Andalas University and Idea Wild. IUCN Otter Specialist Group has given first author a great support by access to valuable literatures and papers as student member. The following individuals for their contribution of papers and their explanations: Hans Kruuk, Budsabong Kanchanasaka and Irwansyah Reza Lubis. The manuscript was improved by the constructive comments and grammatical revision from Darren Norris, and other people who cannot be mentioned personally.

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RÉSUMÉ

PISTES ET AUTRES INDICES DE PRESENCE DE LA LOUTRE DANS LES RIZIERES DE PADIANG PARIAMAN, OUEST DE SUMATRA : ETUDE PRELIMINAIRE

Nous avons identifié la présence de loutres dans les rizières à l'ouest de l'île de Sumatra à partir de pistes et d'autres indices. Les enquêtes de terrain se sont déroulées entre juillet et décembre 2008 dans le district de Padang Pariaman (Indonésie). Nous avons détecté une espèce, *Aonyx cinereus* (Illiger, 1815) grâce à la taille et à la forme de 8 empreintes antérieures et 17 postérieures. Enfin, nous avons décrit trois types de sites de marquage, des sites de glissades et d'autres preuves de l'existence de la loutre sur cette zone.

RESUMEN

RASTRO Y OTROS SIGNOS SOBRE LA PRESENCIA DE NUTRIAS EN CAMPOS DE ARROZ EN PADANG PARIAMAN AL ESTE DE SUMATRA : ESTUDIO PRELIMINAR

Basados en rastros y otros signos se identificaron nutrias en un campo de arroz al este de Sumatra. Estudios de campo se condujeron desde Julio hasta Diciembre de 2008 en Padang Pariaman al este de Sumatra, Indonesia. Una especie de nutria (*Aonyx cinereus*) fue identificada (Illiger, 1815) con base en el tamaño y la forma de 8 huellas delanteras y 17 traseras. Adicionalmente, se describieron tres tipos de sitios de deposición, sitos de deslizamiento y otras evidencias de la existencia de nutrias en el area.

SHORT NOTE

FOOD AND HABITAT OF ASIAN SMALL-CLAWED OTTERS IN NORTHEASTERN CAMBODIA

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(received 3rd September 2009, accepted 14h October 2009)

ABSTRACT: We established the existence of Asian small-clawed otters, *Aonyx cinereus, in* northeastern Cambodia. The study was conducted between May to June 2009, at two fresh water streams located on the border between Stung Treng and Ratanakiri province, northeastern Cambodia. Asian small-clawed otters' main habitat appears to be small fresh streams surrounded by evergreen-forest, secondary-forest or abandoned farmland, with shoreline vegetation (grass 20%, rock 20%, sand 20%, and soil 40%), where it is rich in food sources, especially crabs. Asian small-clawed otters prefer to produce their sprainting sites under canopy cover rather than the open sky, and situated their spraint an average of 1.78 m from water. This species seems to produce their sprainting sites in large piles (33.11 cm average in width and 43.52 cm in length), which consisted of crabs 85%, and fish 10%, unidentifiable debris 5%. Hunting for meat, traditional medicine, and skins for trade as well as habitat disturbance and over fishing are the main threats to the population of Asian small-clawed otter in the study area.

Key-words: *cinereus,* threat, skin trade, hunting, ecology, diets

INTRODUCTION

Four species of otters historically occurred in Cambodia: the hairy-nosed otter *Lutra sumatrana*, the smooth-coated otter *Lutrogale perspicillata*, the Asian small-clawed otter *Aonyx cinereus*, and the Eurasian otter *Lutra lutra* (Poole, 2003). Recently, hairy-nosed otters have been found in a few locations in Cambodia: Tonle Sap Great Lake (Olsson *et al*., 2007), the Cardamom Mountains (Wright *et al*., 2008), and coastal areas of Koh Kong province (Hon and Dong, 2008). The smooth-coated otter is found in nearly all parts of Cambodia. There are no current reliable reports of Eurasian otters in Cambodia.

The Asian small-clawed otter is listed as a Vulnerable Species by the IUCN Otter Specialist Group Red List Authority because of an inferred future population decline due to habitat loss and exploitation (Hussain and de Silva, 2008). This species was historically found in many countries such as the Philippines, Indonesia, southern India, Sri Lanka, Peninsular Malaysia, Thailand (Harris, 1968), Bangladesh, Bhutan, Brunei, South China, Hong Kong, Lao PDR, Nepal, Singapore, and Vietnam (Lekagul and McNeely, 1977; Medway, 1969). There have been no reports or reliable information on the Asian small-clawed otter in Cambodia for long time, and there is a great deal of concern about the decline of populations of this species, but recent unpublished work found evidence of their existence in northeastern Cambodia (Hon, 2008).

Asian small-clawed otters are the smallest otters in the world (Kanchanasaka *et al.*, 1998). They usually live in small family groups of about 4-12 members. Their food includes shrimps, crabs, some molluscs, and fish and mostly inhabits streams, lakes, swamps and various other wetlands (Kruuk, 1995; Kanchanasaka, 1997).

In this study we focuses on two streams, Kasap and Tankin, located on the border between Stung Treng and Ratanakiri provinces in northeastern Cambodia. Our aim was to identify their main habitat, diet, and the threats they face. We hope that this work will be useful for Asian small-clawed otter conservation in general, and specifically for the Conservation International Otter Conservation Project in Cambodia.

STUDY AREA

This study was conducted along the borders of Stung Treng and Ratanakiri Provinces. Interviews were conducted in three villages: I-Tub, Pakea, and Kang Nouk. The Veun Sai district is well known as having a rich variety of flora and fauna and religious cultural heritage, and is populated by Khmer and many ethnic minorities including Kreng, Lao, and Chinese. The town of Veun Sai is located in the district, approximately 38 km north by road of Banlung town, and is on the Sesan River. It is contiguous with Virachey National Park: one of the priority areas for both fauna and flora conservation in Southeast Asia. The major vegetation types in this area (Veun Sai District) are: grassland (36%), non forest (34%), semi-evergreen forest (24%), evergreen-forest (4%) and deciduous forest (2%) (Forestry Administration, 2006). The study started where the Kasap and Tankin streams merged with each other (Figure 1).

Kasap (693197/1558670) stream is a long watercourse which flows from the mountains of Virachey National Park through to the Sekong River, Stung Treng Province. The stream is rich in fisheries resources and most parts are surrounded by evergreen-forest.

Tankin (690622/1556384) is a small seasonal stream which only flows continuously in the wet season (April to October). Most parts of this stream are surrounded by old farms (shifting cultivation) of indigenous people who live near/in those forested areas.

During the survey we found considerable evidence of crab holes and some crabs and fish were seen directly along the stream. There are two small fresh water streams connected with the Kasap stream, Kasin and Kapin, located downstream from Pakea village. These streams were not surveyed during the study, but were mentioned in the interviews with local people.

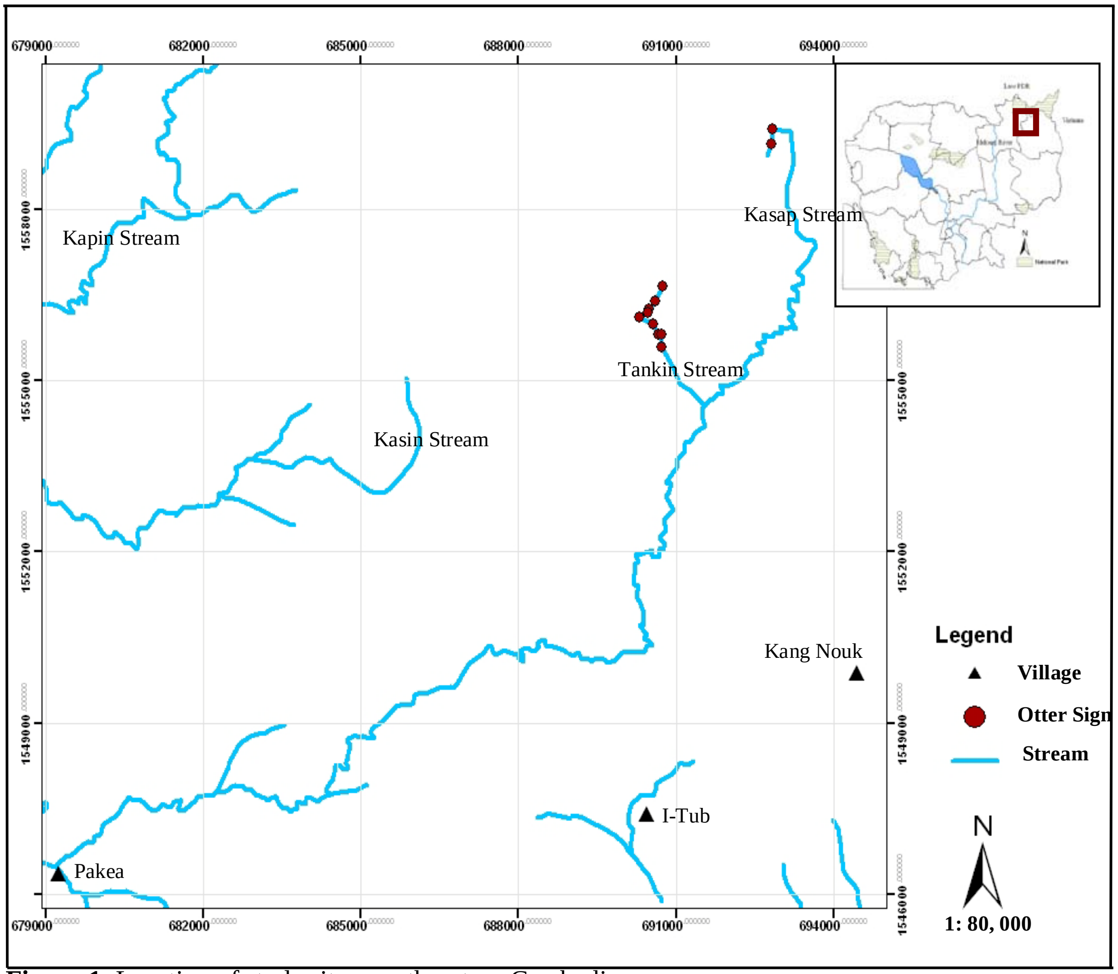

Figure 1: Location of study sites, northeastern Cambodia.

METHOD

Interviews

Interviews were conducted in three villages: I-Tub, Pakea, and Kang Nak (Figure 1). Sixty families were chosen interview. People were selected based on their experience: fishermen, hunters, wildlife middlemen, rangers and/or people who spend most time in the forest. These people were interviewed by using a pre-designed structured questionnaire. The interviews aimed to assess which otter species were present, their past and present distribution and the abundance of these species. Interviews also assessed any changes that maybe impacted on the otter's habitat, local threats to otters, demand for the trade of otters and otter's parts and other information as needed.

Transect Surveys

The unmistakable Asian small-clawed otter footprints are small, rounded, with long fingers very clearly visible, and without any claw marks; spraints are large and full with crabs (Kruuk *et al*., 1993; Kruuk, 2006). Two lines transect, to search for otter signs such as spraints, footprints, grooming sites, and sprainting sites, were walked along the two streams, one of 3,092 meters on Kasap stream and other of 1,495 meters on Tankin stream (Figure 1). These lengths were determined depending on the local conditions. The water levels can be very deep and there is thick forest that cannot be walked across. Whenever, otter signs were found, the spraints were measured and collected for prey analysis by putting them into small plastic boxes, grooming sites were measured and a plaster cast of footprint were made for species identification. After the surveys, habitat assessments were conducted. Plot sizes of 5 x 5 m (25m^2) were laid around the otter signs. These plots were intensively searched for additional otter signs, and the following habitat assessment data were collected: water depth, river width, tree diameter by using measure tape. Water current and habitat types were recorded by using direct observation. Forest canopy was evaluated using a finger hole in A4 paper to evaluate the percentage between canopy cover and open sky. Ground cover was recorded step by step around the habitat assessment area, one step being recorded as one item (e.g. step one might be grass and step two could be sand, soil or litter. Ten steps were done per plot. Tree species around the habitat assessment areas were identified by using local guides. Tree height was measured using Suunto height meters.

Various methods such as direct observation (Kanchanasaka, 2001) and taking notes were used for recording data on otter threats in the study areas such snares, traps, and illegal fishing activities, human and dog footprints were found at the study sites. And other evidence such wildlife-shops were observed and recorded as indicating potential threats to otters.

Camera trapping

Camera traps were set in those areas where otter signs were found. Four camera traps were set in front of sprainting sites and one was set in front of a grooming site. The results from camera traps were intended to be used for species identification and document human disturbance to otters in those areas. Two Cam Trakkers were set for day and night time photography, set for 24 hours actively with a camera delay of 10 seconds, producing one photo every 10 seconds. Three Reconyx cameras were used also set for 24 hours actively (Nguyen *et al*, 2002), and with a camera delay of 10 seconds, producing three photos every 10 seconds.

Five camera traps were set up at five difference sites representing approximately nearly the same habitats, and those camera traps had been setting for the whole 20 days period. Because the study period was during the heavy rainy season, (Cambodian rainy season is in April to October) and these streams water levels can rise very quickly, we set the cameras high above water level in order to avoid water damage (Figure 2).

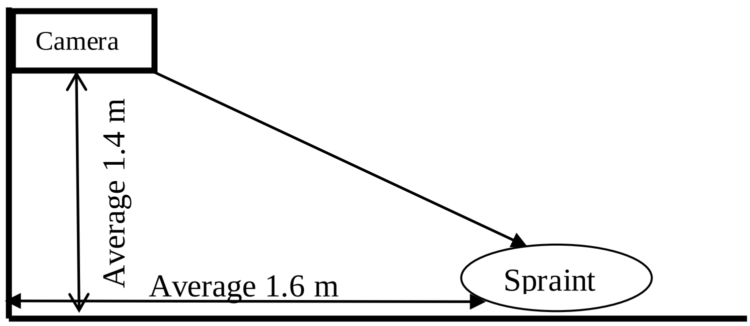

Figure 2. Diagram showing the height from the ground and distance from otter signs that camera traps were placed in the rainy season in the study areas.

Procedure for Spraint Analysis

Spraint analyses have been used to determine the diet of wild otters (e.g. Webb, 1975; Clavero et al 2004). Spraint composition was analyzed in order to find out the main diet of Asian small-clawed otter in the study sites. All spraints were cleaned with water in a box (length 47 cm and width 36cm) using a Petri dish to separate the litter from the spraint items (Anoop and Hussain, 2004). After this, they were placed on clean paper and dried out of direct light, then transferred to labeled small boxes. Spraints were separated by prey species (crap, fish, and unidentified debris) and each species were weighed in order to calculate as a percentage of composition.

RESULTS

Interviews

Sixty households were interviewed in three villages: I-Tub, Pakea, and Kang Nak. Each household chose one person for interview. Their main livelihoods are shown in Table 1. Nearly all interviewees usually see otters directly both in the rainy season and dry season. Eighty seven percent claimed that they used to see otters, especially when they go fishing and collecting non-timber forest products in areas where otters live. Moreover, the results showed that 52% have seen otters in the morning, 17% in the afternoon, 8% in the evening, and 8% at night. Otters were most frequently seen in Kasap stream, with 68% of interviewees having sighted otters there, compared with 13% in the Kasin stream.

Table 1. The local People: livelihood categories

Livelihood	Percentage (%)
Farmer and Fishing	53
Farmer and Hunter	42
Mainly Farmer	5

Habitat Types

Records from tracks (hind-foot 4 cm and fore-foot 3cm), spraints, and direct observations have shown that Asian small-clawed otters occur in the surveyed areas both at Kasap and Tankin streams. Asian small-clawed otters were found in small fresh water streams in the study sites, with an average stream width of 5.72 m, slow water current, water depth of 51.18 cm, and shoreline composition of grass 20%, rock 20%, sand 20%, and soil 40%. There were 30 tree species found around the sprainting sites of Asian small-clawed otter, dominant species are shown in Table 2.

Table 2. Percentage tree species found at the spraint sites of small clawed otter

Tree Species	Percentage (%)
Bridelia ovata	16
Homonoia riparia	10
Barringtonia acuiangula	8
Other 27 species	66

Spraint and Sprainting sites

Twelve sprainting sites were collected over the 14 days between May to June 2009: this period is completely within the wet season in northeastern Cambodia .Most spraints were found on the rock, sand, and soil (Figure 3), with a strong preference for sand. Sixty seven percent of spraints were found under the canopy cover and 33% were found under the open sky. Most of the sprainting sites were situated in an average of 1.78 m from the water edge (standard deviation 0.88, n=11). The large piles of sprainting sites of Asian small-clawed otter were found in the study sites (width in an average 33.11 cm and length in an average 43.52 cm). Spraints were easily damaged by rain, but were grey white in color when fresh (Figure 4), did not have a strong smell, and where dominated by crab remains. In the study sites, relative densities of sprainting sites were 386.56 m/sprainting site at Kasap stream and 166.16m/sprainting site at Tankin stream.

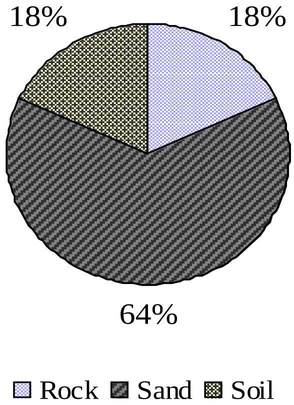

Figure 3. Substrate of Asian small-clawed otter deposit their spraintting site in the study areas

Figure 4. The grey white color of fresh spraints of Asian small-clawed otter

Spraint composition

The result from spraint analysis has shown that crab was the main prey for Asian-small-clawed otter in the study sites (Figure 5). However, crab and fish species could not identify.

Threats

The overall otter numbers in Veun Sai district appear to have been reduced significantly when compared to the past population, according to 70% of the interviewees. For example, from 1990 to 2009 there were 21 otters killed in this area alone (Figure 6). Forty five percent of local people claimed that the Chinese people who live in the Chinese village at Veun Sia town and wildlife middlemen came to tell indigenous people in villages to hunt wildlife including otters for them. Local wildlife traders bought otter skins at a very high price; small skins for 10,000-40,000 Riel[1]/skin and large skins at 60,000-150,000 Riel/skin.

[1] 1USD=4100 Riel

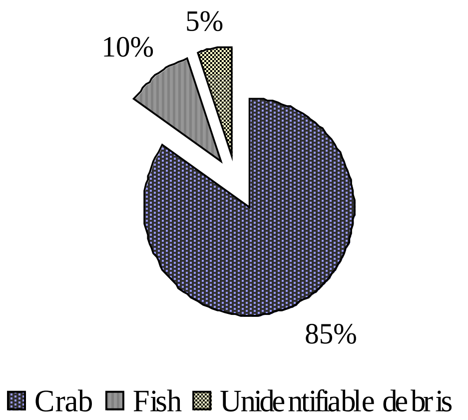

Figure 5. Composition of Asian small-clawed otter diet

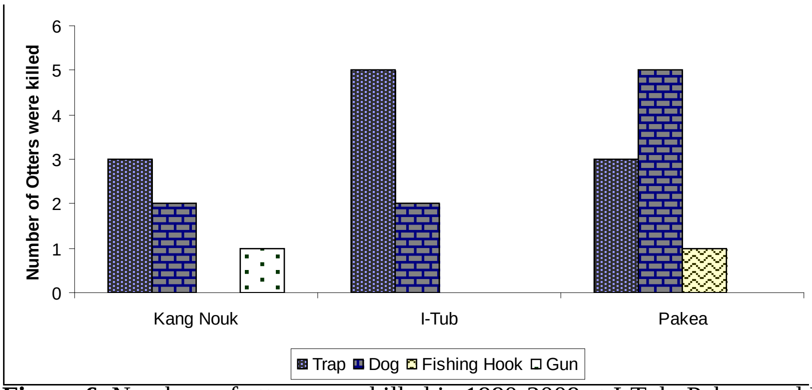

Figure 6. Numbers of otters were killed in 1990-2009 at I-Tub, Pakea, and Kang Nak village, Veun Sai district, Ratanakiri province.

Although there is direct hunting for otters, they are not usually the primary target for many hunters, but the risks of otters being taken are still high. Otters are usually killed when they meet the hunters by chance both at night and during day time. During surveys in Banlung market in Ratanakiri province, there were seven Asian small-clawed otter skins found. Skins were displayed for sale with a whole skin costing 120, 000 Riel and a small part of skin (about 10 cm x 10 cm) costing: 5000 Riel (Figure 7). Those people use otter as their traditional medicine for women who just delivered a baby or pregnant women, the middleman said.

Figure 7. The two Asian small-clawed otter skins and Pygmy loris samples were on sale for traditional medicine purposes at three different wildlife-shops in Banlung market

Camera Traps

None of Camera traps recorded any otters or other wildlife species. The two Cam Trakker films were damaged by water and the three Reconyx camera traps only recorded activity when we tested them. Moreover, one camera trap was disturbed by human activities, and became pointed away from the sprainting site. However, one photo of an Asian small-clawed otter was recorded in this area in 2008 by a camera trap set by another Conservation International team at Kasap stream (Figure 8).

Figure 8. A photo of a group of Asian small-clawed otter was recorded by Camera trap in 2008 by CI team at Kasap stream.

DISCUSSION

Tracks and spraints were found in the study areas and were identified as coming from Asian small-clawed otters. Moreover, this species was previously recorded by camera trap at Kasap stream, northeastern Cambodia (Hon, 2008) where the study was conducted. According to the result from line transect surveys, 73% of otter signs (sprainting sites and grooming sites) were found at Tankin stream and 27% found at Kasap stream. Kasin and Kapin stream was ignored during the study.

The habitat of Asian small-clawed otters was found to be small fresh water streams surrounded by evergreen-forest and secondary forest, or parts of those stream contained old indigenous farmland. Many studies have found that the typical habitats of Asian small-clawed otter are freshwater, swamps, forested rivers, and mangrove forest, stream, lake, rice paddies, and even high in the mountain (Shrestha, 1997; Muller, 1839 cited in Hussain and de Silva, 2008; Kanchanasaka *et al.*, 1998; Kruuk, 2006). The Asian small-clawed otter preferred to live under the canopy more than in the open areas, as the Asian small-clawed otter dislike the bare and open areas that do not offer any shelter (Melisch *et al.*, 1996, cited in Hussain and de Silva, 2008).

Analysis of spraint composition indicated that the diet of the Asian small-clawed otter in this region contained many more crabs remains than fish. Lekagul and

McNeely 1988 state that they eat less fish than other otters and rely more on molluscs and crabs. Many other studies comment on its reliance on non-fish aquatic organisms such as crabs and molluscs, insect and small fish such as gouranmis and catfish (Medway, 1983; Wayre, 1978). Moreover, Asian small-clawed otter also eats frogs, small birds and the occasional octopus (Heap *et al*., 2008) including invertebrates, fish, snakes, amphibians and snails (Maslanka and Crissey, 2002). This otter species was already known as mainly a crab-eater, (Foster-Turley, 1992), followed by snails, fish, and snakes (Kanchanasaka, 2004).

There is little documentation about threats to Asian small-clawed otters in Cambodia (Hon, 2008). However, based on interviews documenting changes in abundance, and apparent high hunting pressures, it seems very likely that populations of Asian small-clawed otters are declining in the region. Most of the Asian small-clawed otters reported were killed by traps and dogs in the study areas, because the otters seem to prefer to live in small streams, and rice paddies feeding on the many small crabs there (Kruuk, 2006), where those habitats are closely to the indigenous people farms and settlements. Through direct observation around the study sites, most parts of evergreen-forest were cleared for farming (shifting cultivation) and settlement, particularly the forests near the stream, which comprise Asian small-clawed otter habitats. The indigenous people's main livelihoods are as farmers, hunters, and fishermen, so they often go into forest by walking along the streams in order to catch fish, hunt wildlife (pangolin, turtle, dragon monitor, water monitor), and collect honey, and use poisonous leaves to kill fish resources along the streams. Many fresh tracks of both humans and dogs, and fishing nets were found during the survey. These activities suggest the Asian small-clawed otters were heavily threatened by human being activities. Other studies also found that the main threats to otters to be habitat destruction (Hussain and de Silva, 2008), skin demand for both traditional medicine and the wildlife trade (Nguyen *et al*., 2002), and over-fishing. Additionally, Asian small-clawed otters get killed when they were caught in fishing traps (Kanchanasaka, 2004). This species is currently considered to be Vulnerable by the IUCN Otter Specialist Group's Red List Authority because of an inferred future population decline due to habitat loss and exploitation (Hussain and da Silva, 2008).

No otters or other wildlife species were recorded by camera traps during the study period, although most camera traps were set up in front of the fresh spraints of Asian small-clawed otters. This period in northeastern Cambodia coincides with the heaviest rain, especially the period of our study from May to June. During the study period, we found that the water level at Kasap can increase by an average of 2 meters and at Tankin stream can increase by an average of 1 meter after rains of more than 2 hours. Consequently, all the camera traps had to be set up higher than one would typically use to trap otters in order to escape water damage. It is therefore probably impractical to set camera traps aiming to record otters in the wet season, especially on streams where the water level changes quickly like Kasap and Tankin streams.

CONCLUSION

In summary, we definitely established that Asian small-clawed otters are found in the study area located on the border between Stung Treng and Ratatanakiri provinces in northeastern Cambodia. This is the first recent, reliable record of this species' distribution in Cambodia.

We found that the habitat used was small fresh water streams surrounded by evergreen-forest, secondary forest and indigenous farmland, abandoned under the shifting cultivation system. Both streams surveyed have similar habitat, and the areas where otter spraint was found are dominated by three species of tree: B*ridelia ovata, Homonoia riparia, and Barringtonia acuiangula*. The streams averaged about 5.72 m in width, with slow water current, and depth averaging 51.18 cm. The streams where the Asian small-clawed otter signs were found are rich in food resources, especially crabs.

Typically, for sprainting sites, the otters seem to use substrates which are a mixture of soil, grass, rocks and sand, strongly preferring sand, under canopy cover rather in the open, and on average 1.78m from the water's edge. Large piles of sprainting are created as all group members use the same site. There are two main components in the spraint: 85% crab and the rest apparently fish or unidentifiable debris.

The main threats to Asian small-clawed otter in the study area are: hunting for skin trade, food, traditional medicine and habitat disturbance, especially by human activities. The indigenous people in the study area use many tools for hunting otter such as traps, domestic dogs, fishing hooks and guns. From 1990 to 2009, 21 otters were killed for skins in this area alone, and we found seven Asian small-clawed otter skins for sale in Banlung wildlife-shop, Ratanakiri province. These skins were bought by people who believe they can cure illness, especially in pregnant women. The local wildlife traders buy otter skins at a very high price compared to local incomes and as the main livelihoods of local people are farming, hunting and fishing, and since they often travel along streams when hunting, otters are readily met by chance and killed.

We believe that the population of Asian small-clawed otters in Cambodia is under threat and declining, and that further surveys should urgently be done to establish whether this is the only remaining population, in the country, the area populated, and an estimate made of the current population size, with a view to mobilizing conservation effort to protect these animals.

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RÉSUMÉ

LE RÉGIME ALIMENTAIRE ET L'HABITAT DES LOUTRES CENDRÉES DANS LE NORD-EST DU CAMBODGE

Nous avons établi la présence de la loutre cendrée, *Aonyx cinereus*, dans le nord-est du Cambodge. L'étude a été menée entre mai et juin, 2009 dans deux rivières d'eau douce entre les provinces de Stung Treng et Ratanakiri au nord-est du Cambodge. L'habitat principal des loutres cendrées semble être les ruisseaux d'eau douce cernés par des forêts de conifères tropicales, des forêts secondaires ou des endroits de déprise agricole avec végétation le long des berges (couvert d'herbe à 20%, de roche à 20%, de sable à 20% et de terre à 40%) où se trouve d'abondante sources d'alimentation, surtout de crabes. Les sites de dépôts des épreintes préfères des loutres cendrées sont sous canopée au lieu de ciel ouvert, en moyenne leurs épreintes se situent à 1.78 metres de l'eau. Cette espèce semble déposer ses épreintes en grand tas (en moyen 33.11cm en largeur et 43.52 cm en longueur), les épreintes comportent 85% de crabes, 10% de poissons, et 5% non identifié. Les menaces principales pesant sur les populations de loutre cendrée où nous avons mené nous recherches sont la chasse

pour la viande de brousse, la médecine traditionnelle, et les peaux pour fournir le commerce de faune ainsi que la perturbation de leur habitat et la surpêche.

RESUMEN

ALIMENTO Y HÁBITAT DE LA NUTRIA ASIÁTICA DE GARRA PEQUEÑA EN EL NORESTE DE CAMBODIA

Hemos establecido la existencia de nutrias asiáticas de garra pequeña (*Anois cinereus*) en el noreste de Cambodia. Este studio fué conducido entre Mayo y Junio de 2009 en dos corrientes de agua dulce de la frontera entre las provincias de Stung Tren y Ratanakiri al nordeste de Cambodia. El hábitat de las nutrias asiáticas de garra pequeña parece icluir pequeñas corrientes de agua dulce con vegetación rivereña (20% hierba, 20% roca, 20% arena y 40% suelo), rodeadas bósques perennifolios, bósques secundarios o tierras agrícolas abandonadas con amplios recursos en alimentos, especialmente cangrejos. Las nutrias asiáticas de garra pequeña prefieren depositar sus excrementos bajo el dosel del bosque y no a cielo abierto, en promedio a 1.78 m del agua. Esta especie parece producir en sus lugares de deposición grandes pilas de heces (33.11 cm de ancho y 43.52 cm de largo en promedio) que incluyen 85% de cangrejo, 10% de pescado y 5% de desechos no identificados. Los mayores riesgos para la población de las nutrias asiáticas de garra pequeña en el área de estudio son la caza para alimento y medicina tradicional, así como la piel para comercio; perturbación del hábitat natural y pesca excesiva.

សង្ខេប

ចំណីអាហារ និងទីជំរករបស់សត្វភេតូចនៅភាគឥសាននៃប្រទេសកម្ពុជា

ក្រុមស្រាវជ្រាវបានធ្វើការសិក្សាទៅលើការរស់នៅរបស់ភេតូចនៅភាគឥសាននៃប្រទេសកម្ពុជា។ ការសិក្សាទៅលើប្រភេទភេនេះបានចាប់ផ្តើមនៅក្នុងខែ ឧសភា ដល់ខែមិថុនា ឆ្នាំ២០០៩ នៅស្ទឹងចំនួន ពីរដែលស្ថិត នៅជាប់ព្រំប្រទល់ខេត្តស្ទឹងត្រែង និងខេត្តរតនគិរី។ ភេតូចមានទីជំរកនៅតាម ស្ទឹងតូចៗ ដែលព័ទ្ធជុំវិញដោយព្រៃស្រោង ព្រៃបន្ទាប់ និងជុំវិញចំការចាស់ៗ ដែល នៅតាមមាត់ច្រាំងស្ទឹងទាំងនោះមាន (ស្មៅ ២០% ដុំថ្ម ២០% ដីខ្សាច់ ២០% និងដី៤០%)។ ទីជំរករបស់សត្វភេតូចជាតំបន់ដែលសម្បូរចំណីជាពិសេសគឺសត្វក្តាម។ ភេតូចចូលចិត្តបន្ទោរបង់ទុកនូវទីតាំងលាមករបស់វានៅក្រោមគំរបព្រៃជាងនៅក្រោមពន្លឺថ្ងៃហើយមានចំងាយជាមធ្យម១,៧៨ម៉ែត្រពីមាត់ទឹក។ ប្រភេទភេនេះចូលចិត្តបន្ទោរបង់ទុកនូវទីតាំងលាមករបស់វាជាពំនូកធំៗដែលជាមធ្យមវាមានប្រវែងបណ្តោយ ៤៣,៥២ សង់ទីម៉ែត្រ និងទទឹង ចំនួន ៣៣,១១ សង់ទីម៉ែត្រដែលមានទៅដោយកាកសំបកក្តាមចំនួន ៨៥% និងសំណល់ ត្រីចំនួន ១០% កំទិចកំទីដែលមិនអាចកំណត់បាន ចំនួន៥% ។ ការប្រមាញ់សំរាប់ម្ហូបអាហារថ្នាំបូរាណ និងស្បែកសំរាប់លក់ជាពិសេសគឺការបំផ្លាញទីជំរក និងការនេសាទលើសកំណត់គឺជាកត្តាចំបងក្នុងការគំរាមកំហែង ដល់ប្រ ភេទសត្វភេតូចនៅក្នុងតំបន់ដែលបានធ្វើការសិក្សា។

SHORT NOTE

ANNUAL AND INTERANNUAL FOOD HABITS VARIABILITY OF A NEOTROPICAL OTTER (*Lontra longicaudis*) POPULATION IN CONCEIÇÃO LAGOON, SOUTH OF BRAZIL

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Abstract: This work studies the monthly and annual diet composition and variability of an otter population living at Conceição Lagoon, Santa Catarina Island, south of Brazil. Analysis of food item proportion through the years reveals that fish and crustacean are the main food items, followed by mollusks, birds and mammals. The results do not show interannual or monthly variability for the items that compose the otter's diet within the study area. However, interannual and monthly spatial variability is found throughout the area.

Keywords: diet, distribution, long term analysis, numeric analysis

INTRODUCTION

The river otter (*Lontra longicaudis*) is considered an endangered species by the Convention on International Trade in Endangered Species of Wild Fauna e Flora (CITES) and U.S. Endangered Species Act (USESA). In Brazil, the Fauna Protection Law that prohibits the commerce of products made from animals protects the otter. Reports indicate that these animals are not popular in some sectors of society. Fishermen and aquacultures, for example, claim that otters are prejudicial; damaging nets, eating cultivated fishes, and impacting mussel and oyster farms (Alarcon and Simões-Lopes, 2003; Trindade, 1991). At the same time, looking at the literature we don't find any substantial information that would clarify such problems, making clear the need for further studies about the species.

Though a number of studies on diet have been published, these are based on short periods of data collection (Kasper et al., 2008; Uchôa et al., 2004; Quadros and Monteiro-Filho, 2001; Quadros and Monteiro-Filho, 2000). The purpose of this work is to define the diet composition of the species in a coastal lagoon in the south of

Brazil, Conceição Lagoon, Santa Catarina Island (Figure 1), describing possible annual and interannual variability, as well as describing differences at the spatial distribution level.

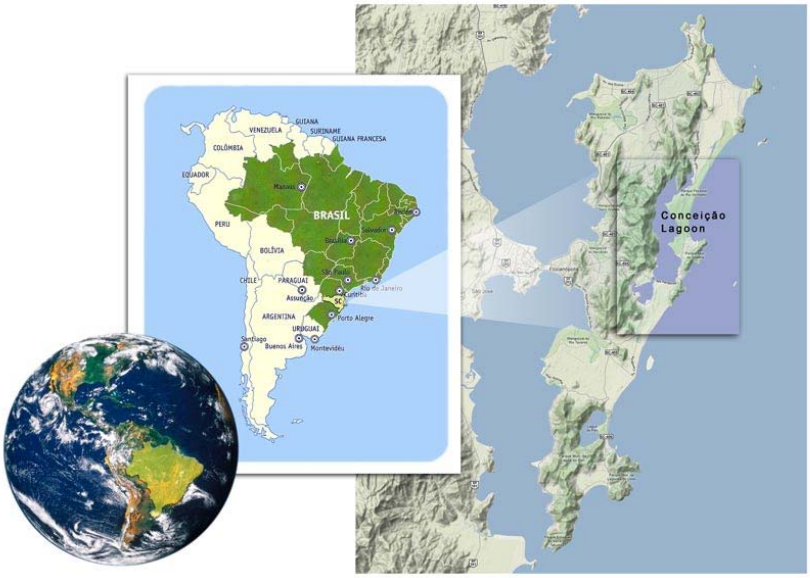

Figure 1. Location of the study area, South America, Brazil, Santa Catarina State, Santa Catarina Island with Conceição Lagoon.

The Conceição Lagoon is located on the eastern border of Santa Catarina Island, just below the Tropic of Capricorn, at latitude 27º34’S and longitude 48º27’W. It extends in a North-South direction, with a total length of 13.5km, a width between 2.5km and 0.15km, and a total area of approximately 20km^2. Different depths can be found in the study area: the average being roughly 1.7 m, and the maximum being approximately 8.8 m (Muehe and Gomes, 1989; Carvalho-Junior, 2008) (Figure 2). It is classified as a lagoon because it is made up of salt water and maintains a permanent communication with the ocean through the Barra da Lagoa channel. The salinity can vary from a minimum average of 6.70 to a maximum average of 18.50 (Martini et al, 2006; Fonseca et al, 2002).

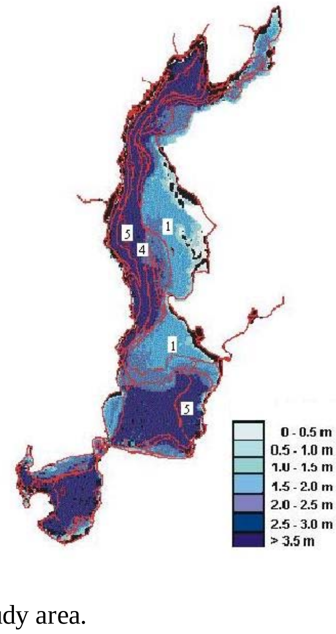

Figure 2. Bathymetry of the study area.

Three sections are defined to study the area, one in the south, one in the centre, and another in the north (Figure 3). The north portion of the lagoon is part of a State Park (Rio Vermelho Park) and well protected. The remaining portion of the lagoon is a popular area for tourism and nowadays is seen as a suburb of Florianópolis.

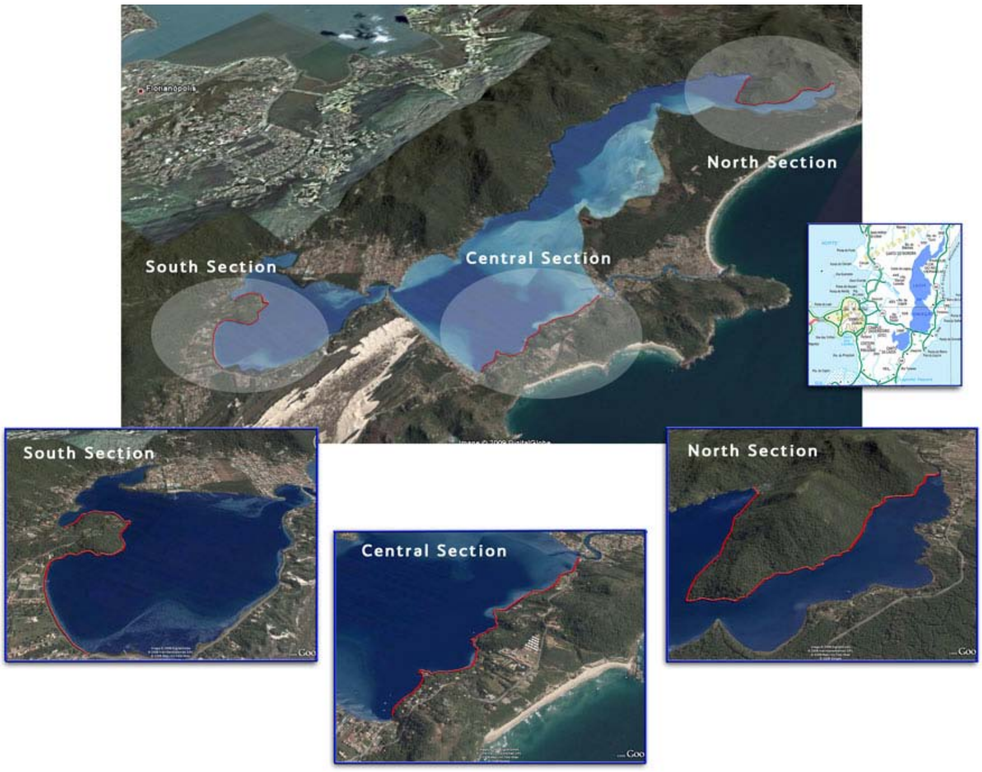

Figure 3. Sampled sections in the study area. Three sections are defined: South Section, Central Section and North Section.

The Conceição Lagoon represents an important scenic resource of great ecological, economic and scientific value. Its interior is comprised of different types of habitat that function as breeding grounds and protection for different species; it is a very fragile and complex ecosystem. Throughout the year it is a tourist destination and the site of recreational activities, water sports and fishing. Unfortunately, urban development, without proper planning, lead to a negative impact on water quality resulting in habitat destruction and sedimentation.

The impacts of urbanization on the otter's population, as well as the role that the species plays in the area, are not known. Knowing the food habits of *Lontra longicaudis* is important information in the conservation of the species in the region.

MATERIALS AND METHODS

Diet composition was determined from 2516 samples of feces collected and analyzed from 2004 to 2008, except in North Section in 2004, representing 60 months. The section areas were covered using canoes and kayaks and the material collected was placed in small plastic bags, and stored in a refrigerator (Figure 4). In the lab, each sample was washed through mesh and the contents described as fish, crustacean, mollusc, bird and mammal.

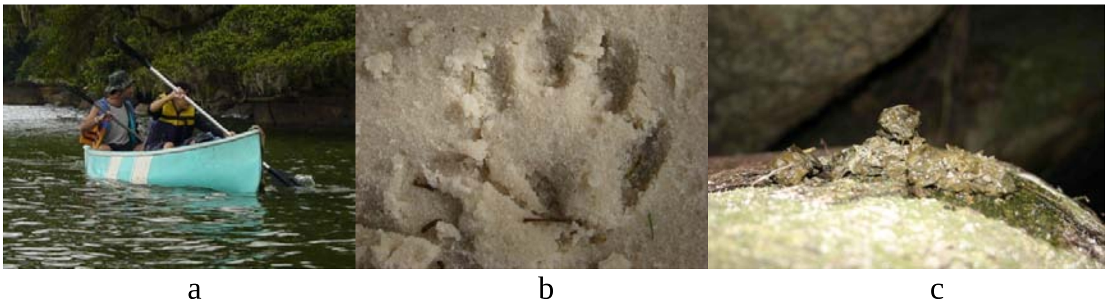

Figure 4. The section areas were covered using canoes and kayaks (a), searching for signs like footprints (b) and feces (c).

The food item proportion was used in order to measure the importance of each item in the otter's diet for years and months in each year. It was calculated for each food item using the total number for the food item in relation to the total of all food items. Unifactorial ANOVA was applied to determine whether there were any significant differences in abundance of the main food items and number of faeces for different years (2005 to 2008), months and sections. Bifactorial ANOVA was also applied to determine any interaction between years (2005 to 2007) and sections, and between months and sections. The Bartlett test was conducted to verify homogeneity of variances before each analysis and Tukey`s test was used to explain differences found on the ANOVA output. All count data were [$\log_{10}(x+1)$] transformed in order to stabilize the variance and fit the data to a normal distribution (Zar, 1996). The tests were performed on Statistica© 7.0 (Statsoft Inc., 1984-2004).

RESULTS

In 3889 food items found in the samples, food item proportion through the years reveals that fish and crustacean are the main ones, followed by mollusks, birds and mammals (Figure 5). As can be seen in Figure 5, diet composition does not change significantly through the years.

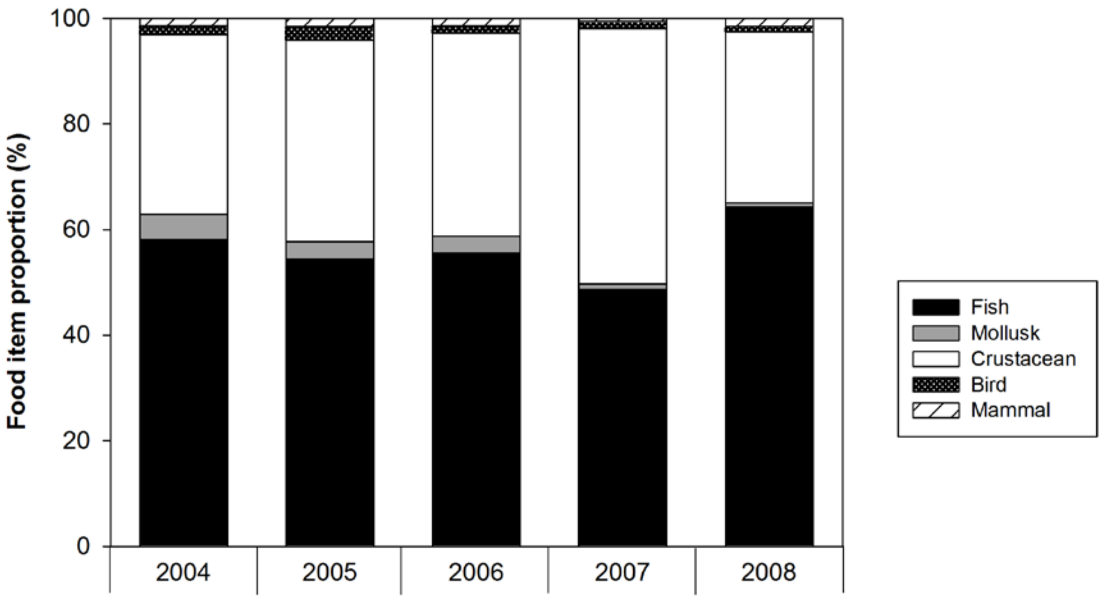

Figure 5. Food item proportion (%) of the otter's diet composition in the Conceição Lagoon from 2004 to 2008.

The monthly variability of the diet composition from 2004 to 2007 is shown in Figure 6. ANOVA indicates that the food item of fish did not show differences between months of the year (F=0.819, *P*=0.621). However, the diet composition showed differences among sections (F=53.96, *P*<0.001).

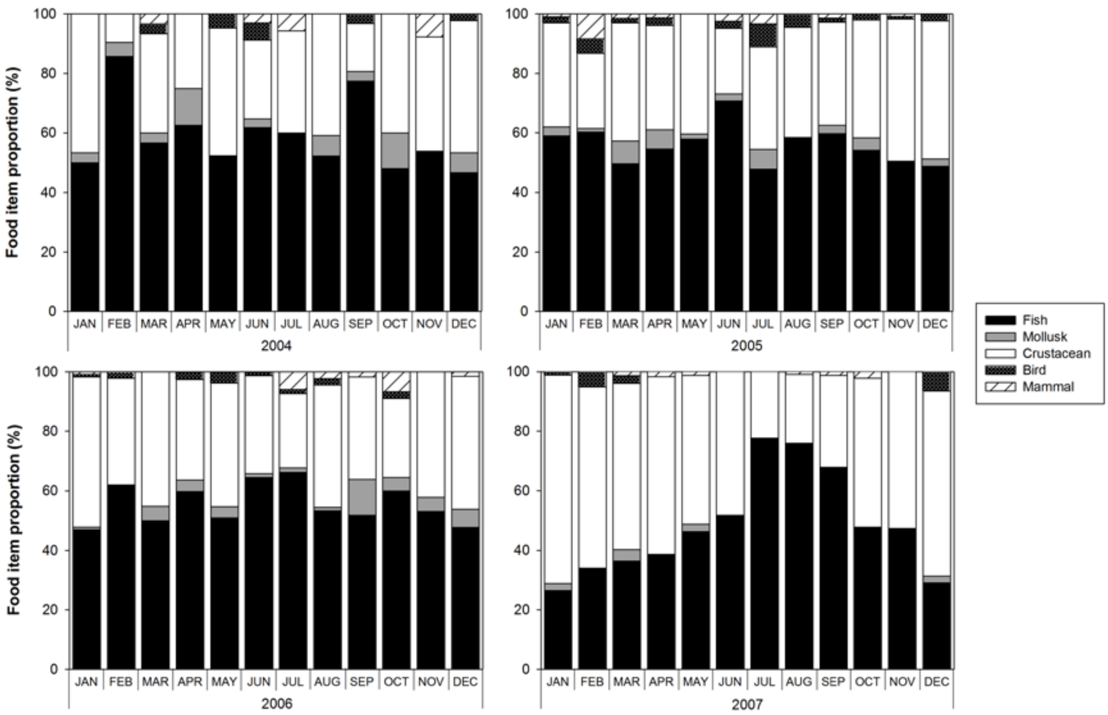

Figure 6. Monthly food item proportion (%) variation of the items found in the otter's feces in the Conceição Lagoon from 2004 to 2007.

Analysis from the Tukey`s test indicates that fish numbers were higher in the North Section (*P*=0.0002) as compared to Central and South sections (Figure 7A). The results did not indicate interannual differences between sections.

As with fish, ANOVA did not show significant differences for crustacean between years (F=0.70, *P*=0.552) and months (F=0.43, *P*=0.936). However, differences are again noticed comparing the sections (F=106.47, *P*<0.001). The Tukey`s test reveals that crustaceans were higher in the North Section (*P*=0.00002) (Figure 7A).

Bifactorial ANOVA detected no interaction for fish and crustacean considering year and section. These results indicate that in any year, the sampling should always result in predominance of these food items. The same analysis is applied for month and section, also showing no interaction between the two factors. For any month we should expect more fish and crustacean in the North Section.

Unifactorial ANOVA show no significant differences between years (F=3.16) and months (F=0.871) for number of feces. Considering the sections, the number of feces was higher in the North Section (F=128.338; *P*<0.001) (Figure 7B).

Bifactorial ANOVA applied in number of feces found significant differences between sections (F=96.082; *P*<0.001) for years versus sections. No significant differences were seen between years (F=0.554; *P*=0.577) or between the interaction of years and sections (F=0.694; *P*=0.598). The North Section presented higher number of feces with regard to the other two sections.

Significant differences are found between months (F=2.825; *P*=0.004) and sections (F=116.651; *P*<0.001). The interaction between these two shows no significant difference (F=0.996; *P*=0.480). When applying the Tukey`s test for months, it is found that August presents the highest average abundance of feces and October the lowest. The North Section shows the highest number of feces compared to Central and South sections.

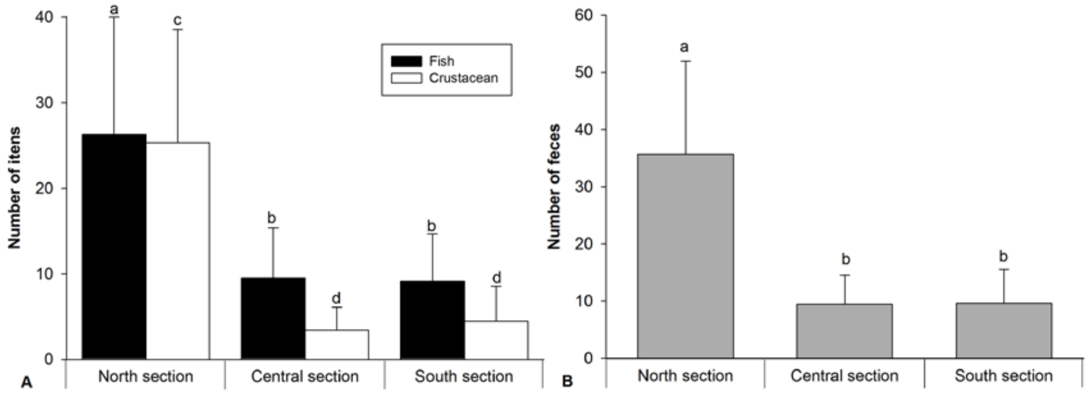

Figure 7. (A) Monthly average (± standard deviation) for fish and crustacean from otter feces, and (B) monthly average (± standard deviation) for number of feces, collected in Conceição Lagoon. Letters indicate significantly (p<0.05) different averages according to Tukey's test.

DISCUSSION

The results do not show interannual or monthly variability for the items that compose the otter's diet within the study area. These findings suggest a specific composition of the otter's diet, in which fish and crustaceans are the main source of food, followed by mollusks, birds and mammals. It can be said that the otter's diet does not change from year to year or month to month in the study area.

Crustaceans such as *Farfantepenaeus paulensis* (Pérez-Farfante, 1967), *Farfantepenaeus brasiliensis* (Latreille, 1817) (Decapoda, Penaeidae) (Lüchmann et al., 2008), and *Callinectes danae* (Smith, 1869) (Decapoda, Portunidae) (Branco and Masunari, 1992) are very common in the study area. Also, a common mollusk is the bivalve *Anomalocardia brasiliana* (Gmelin, 1791) (Mollusca, Bivalvia, Veneridae) (Pereira, 2003).

The Conceição Lagoon is particularly rich in fish with almost 40 families where Carangidae, Gerreidae, Gobiidae, Sciaenidae and Engraulidae are the most representatives (Ribeiro et al., 1999). Species associated with rocks and vegetation, such as those belonging to Gobiidae, Blenniidae and Cichlidae could be the most attractive in terms of availability to the otters. Previous studies in the Lagoa do Peri show the otter's preference on fish (*Tilapia* and *Geophagus*, Cichlidae) and crustacean (*Macrobrachium*, Palaemonidade) suggesting that these preferences could be associated to a hunting strategy related to cost-benefit energy (Carvalho-Junior, 2007).

Crustacean and fish represent potential otter species prey in the area. At the same time, many of these species are economically important for the local fishing community. From 1970 to 1981 the fishery production of Conceição Lagoon reached a total of 335.2 tons/year, in which *Mugil platanus* and *Mugil curema* were the main contributors (Sierra de Ledo et al., 1999). It would be interesting to evaluate if there are conflicts between otter and fishermen in the area.

At the moment we do not know which mollusks, gastropods or bivalves, the specific type of crustacean, or the dominant species of fish that were present in the feces. The continuity of the present research is taking into account these questions in order to improve the knowledge of the otter's ecology within the study area.

As in the present case, the diet of the neotropical otter is defined from fecal analysis. Lack of evidence of hard parts of some prey might happen in the scats. In the rivers of Pantanal, for example, catfish respond as an important part of the otter diet (Kruuk, 2006). This particular species would be difficult to identify from hard parts in the otter feces.

Without exception, all works on neotropical otters in Brazil reveal that fish is dominant in the diet, normally followed by crustaceans (Helder and Andrade, 1997; Pardini, 1998; Quadros and Monteiro-Filho, 2001; Quintela et al., 2008). Otter's preference of fish and crustacean in the Morato River and the Engenho River, Paraná State, was also reported by Uchôa et al. (2004). In this case, the authors also did not find monthly variation in diet composition.

Another study conducted on fresh water rivers in northern Santa Catarina State, shows the same otter's preference of fish and crustacean (Quadros and Monteiro-Filho, 2001). The same pattern is found in Taquary Valley, Rio Grande do Sul State, where fish were present in 97.5% of total samples (Kasper et al., 2008). Alarcon and Simoes-Lopes (2004) working in a marine environment, South of Brazil, also confirm that fish and various species of crustacean are the main items in the diet of the neotropical otter.

This work also attempts to address how the species is distributed within the study area. For example, interannual and monthly spatial variability are found in between sections. The north area appears to be an important food source region. The reason for this could be the fact that this region is part of a state park (State Park of Rio Vermelho), resulting in an area that still keeps its original vegetation and better water quality (Carvalho-Junior et al., 2004). The area is also the base of the State Environmental Police and a centre for recovering wild animals.

The higher number of feces in the North Section suggests a preference by otters for this area. It is quite clear that this area plays a key role in the local otter population. This may be due to the fact that there is a greater availability of food for the animals, together with less urbanization.

In fact, some authors recognize that variability in dispersion within species can be related to resource dispersion. Density of food, heterogeneity and patchiness of the prey could explain the dispersion of otters in a given environment (Macdonald, 1983; Kruuk, 2006). The North Section presents the highest average concentration of nutrient (De Souza-Sierra et al., 1999). Overall, the concentration and distribution of nutrients in the Conceição Lagoon is strongly affected by the ingression of seawater through the channel and just after rain, in areas close to discharge of river and domestic effluents (De Souza-Sierra et al., 1999). However, spatial distribution of fish and crustacean in the Conceição Lagoon is poorly known. Trying to understand how the environment affects the dispersion of otters in the study area is still a difficult task.

As the home range of the neotropical otter follows a linear shape, along the edge of the water body, the use of canoes and kayaks was considered appropriate to monitor and collect samples within the sections. The sampled areas are located in areas with depths ranging from 0.5 to 3 meters and mostly rocky coastline, reached only by water.

Apart from all efforts of research, to date we can affirm that *Lontra longicaudis* is poorly known, and we are still ignorant about its ecology and biology. This situation makes critical the need for conservation of the species.

ACKNOWLEDGEMENTS – We would like to acknowledge Marcelo Tosatti for helping with the fieldwork and Neno Brazil for making the location and sections maps. We also thank the staff of the State Protection Environmental Police “Dr. Fritz Muller” at the Rio Vermelho State Park for their assistance. We are most grateful to Tammy Snyder for the comments and review of the text and to Gaelle Moisand Lachenal who kindly translate the abstract to French. Finally we thank the comments and suggestions made by the anonymous reviewer, which improved significantly the quality of the paper.

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RÉSUMÉ

VARIABILITÉ ANNUELLE ET INTER-ANNUELLE DES HABITUDES ALIMENTAIRES D'UNE POPULATION DE LOUTRE (*Lontra longicaudis*) NÉO-TROPICALE DANS LE LAGON DE CONCEIÇÀO, AU SUD DU BRÉSIL

Ce travail s'intéresse à la composition et la variabilité du régime alimentaire mensuel et annuel d'une population de loutres vivant au lagon de Conceiçào, sur l'île de Santa Catarina, au sud du Brésil. La fréquence numérique à travers les années révèle que les poissons et les crustacés sont les principaux éléments, suivis par les mollusques, les oiseaux et les mammifères. Les résultats ne montrent pas de variabilité entre les mois ni les années pour les éléments qui composent le régime alimentaire des loutres dans l'écosystème étudié. Cependant, une variabilité spatiale inter-annuelle et mensuelle a été constatée dans cette zone.

RESUMEN

VARIABILIDAD ANNUAL AND INTER-ANNUAL EN HABITOS ALIMENTARIOS DE UNA POBLACIÓN DE NUTRIAS NEOTROPICALES (*Lontra longicaudis*) EN LA LAGUNA CONCEIÇÃO AL SUR DE BRASIL

Este trabajo estudia la composición y la variabilidad mensual y anual de una población de nutrias en la laguna Conceição, en la isla de santa Catarina al sur de Brazil. La frecuancia numérica a través de los años indica que peces y crustaceos son el alimento principal, seguidos por moluscos, aves y mamíferos. Los resultados no muestra variabilidad mensual o inter-annual en la composición alimentaria de las nutrias en el área de estudio. Sin embargo, se evidenció variabilidad espacial mensual e inter-annual a lo largo del área.

ARTICLE

PREGNANCY AMONG OTTERS (*Lutra lutra*) FOUND DEAD IN ENGLAND AND WALES: FOETAL DEVELOPMENT AND LACK OF SEASONALITY

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Abstract: In some parts of its range, the Eurasian otter (*Lutra lutra*) is reported to exhibit seasonal breeding, but in England and Wales breeding is thought to occur throughout the year. Here, we test that assumption using data from 206 female otters found dead in England or Wales between 1992 and 2008. Pregnant females were found in all months except June; no evidence for seasonality was found. The mean number of implantations (based on placental scarring) was 2.36. Information on foetal development of otters is limited; here we use foetal otters found *in utero* to describe development, and make a call for information from other researchers.

Keywords: Reproduction; Lactation; Foetus; Placental scarring; Road-traffic Casualty

INTRODUCTION

Seasonal breeding in the Eurasian otter *Lutra lutra* is recorded in some parts of its range, for example Kruuk et al. (1987) observed a breeding season for Shetland otters in June, whilst Heggberget and Christensen (1994) described a late summer-autumn breeding season for otters in Norway. In England and Wales however, it is suggested that breeding can occur throughout the year (e.g. Stephens, 1957; Mason and Macdonald, 1986). In captivity otters can come into oestrous at any time of year (Reuther, 1993), but it has been suggested that otters in the wild may exhibit seasonality in areas where either food availability or climate act as seasonally variable constraints (Liles, 2003). Often, records of seasonality are based on estimations of birth date from cubs seen in the wild, e.g. Harris (1968). Records of pregnancy in otters found dead have also been used to suggest seasonality (Heggberget and Christensen, 1994; Hauer et al., 2002).

Here, we present the results of reproductive assessment of 206 female otters found dead in England or Wales between 1992 and 2008. We look for evidence of seasonality, and describe foetal development.

ANIMALS, MATERIALS AND METHODS

Since 1992, otters found dead in Wales and much of England have been sent for post mortem examination to Cardiff University Otter Project (CUOP, www.otterproject.cf.ac.uk); since 2007, otters from the whole of England and Wales have been sent to CUOP. During examination, females are categorised as juvenile, sub-adult or adult, based on size and reproductive status (Chadwick, 2007). Adult (sexually mature) females are further described as pregnant, lactating or quiescent, where quiescent females are those that are not currently pregnant or lactating, but show evidence of previous reproduction (thickened uteri, placental scarring and / or protruding nipples). Chi-squared tests were used to test whether pregnancy occurred with equal frequency in four seasons (Dec-Feb, Mar-May, June-Aug, Sept-Nov).

Since changes in project management in 2004, post mortem procedures have been modified to include a record of the presence or absence of placental scarring, routine measurement of uteri and foetuses (uterus horn length and weight; foetus crown-rump length, total and tail length, and foetus weight), and a photographic record of all foetuses. Prior to this, records were inconsistent. Log_{10}-transformed uterus weights of pregnant, lactating and quiescent females were compared using a one-way ANOVA although the test had restricted sensitivity because of unequal group sizes. Although we found no published literature attempting to age foetal otters, the gestation period (61-63 days, Stephens, 1957) is the same as that for dogs (61 days, Pretzer, 2008). Descriptions of canine development (Pretzer, 2008) and a plot of crown-rump length by age (Kähn, 2004) were used to approximate days of gestation and thereby predict birth date.

RESULTS

Since 1992, reproductive status has been assessed for 206 adult females (Figure 1). Of these, 19 have been pregnant (9.2%), and 49 lactating (23.8%). Twelve females had convoluted uteri, these individuals were not lactating and were omitted from the analyses; convolutions may indicate early stage pregnancy (Simpson, 1998) but in these cases this was uncertain. If included in our totals, then the percentage pregnant increases to 15%. The number of foetuses present was recorded in 18 cases; of these, there were six single foetuses, nine pairs, and three triplets.

Pregnancy has been observed in every month apart from June, and lactation in all months apart from May, August and September (Figure 2). It should be noted that sample size is lowest in May, followed by June and September. There was no significant difference in the number of pregnancies per season (χ^2= 1.42105; df = 3; P=0.701). However this result is interpreted with caution due to the low sample number (n = 19 pregnant females for which month was also recorded). Prediction of birth month was possible in eleven cases, where an accurate date of death and foetal morphometry were both recorded. This suggested births in months February to May, and October to December, with no births predicted in June-September. Data were too few to perform statistical analyses.

Since 2004, the uteri from 82 lactating or quiescent females have been screened for placental scarring (for illustration see Figure 3.10). Placental scarring was observed in 15/20 (75%) lactating females, and 38/62 (61%) quiescent females. Placental scarring was found in every month of the year. The mean number of placental scars was 2.36 with a range of 1 - 4 (Figure 4).

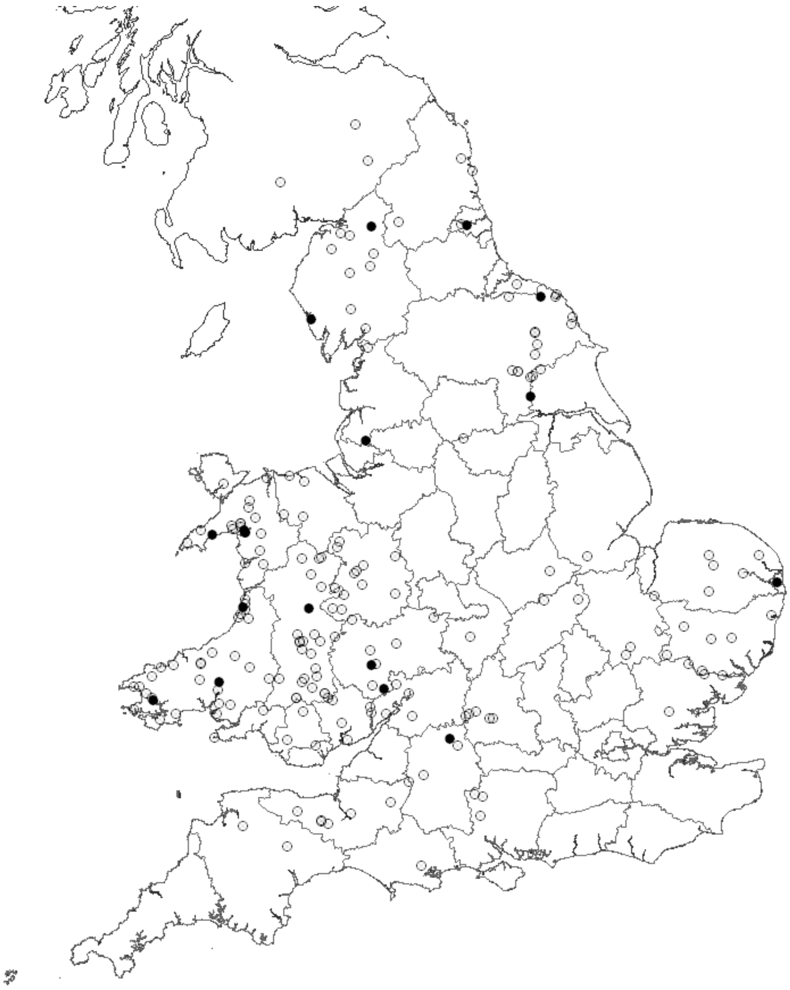

Figure 1. Distribution of females collected. Filled circles indicate pregnant females; all other females are shown with open circles.

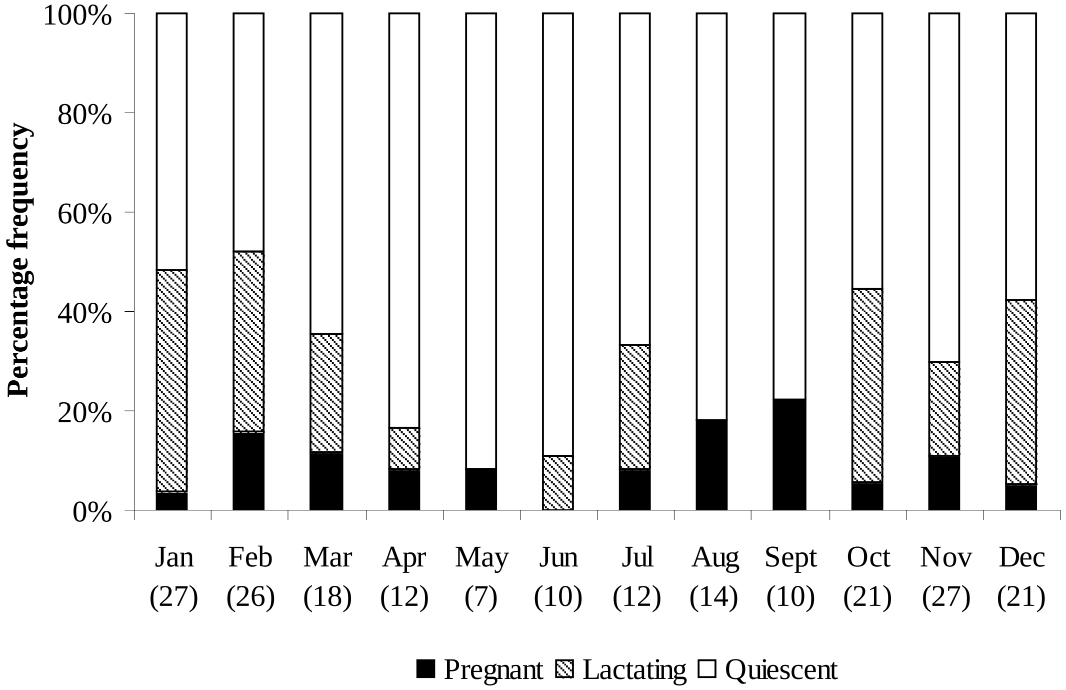

Figure 2. Percentage frequency of pregnant, lactating and quiescent adult females in each month (data pooled for 1994-2008). The number of individuals in each month is shown in brackets

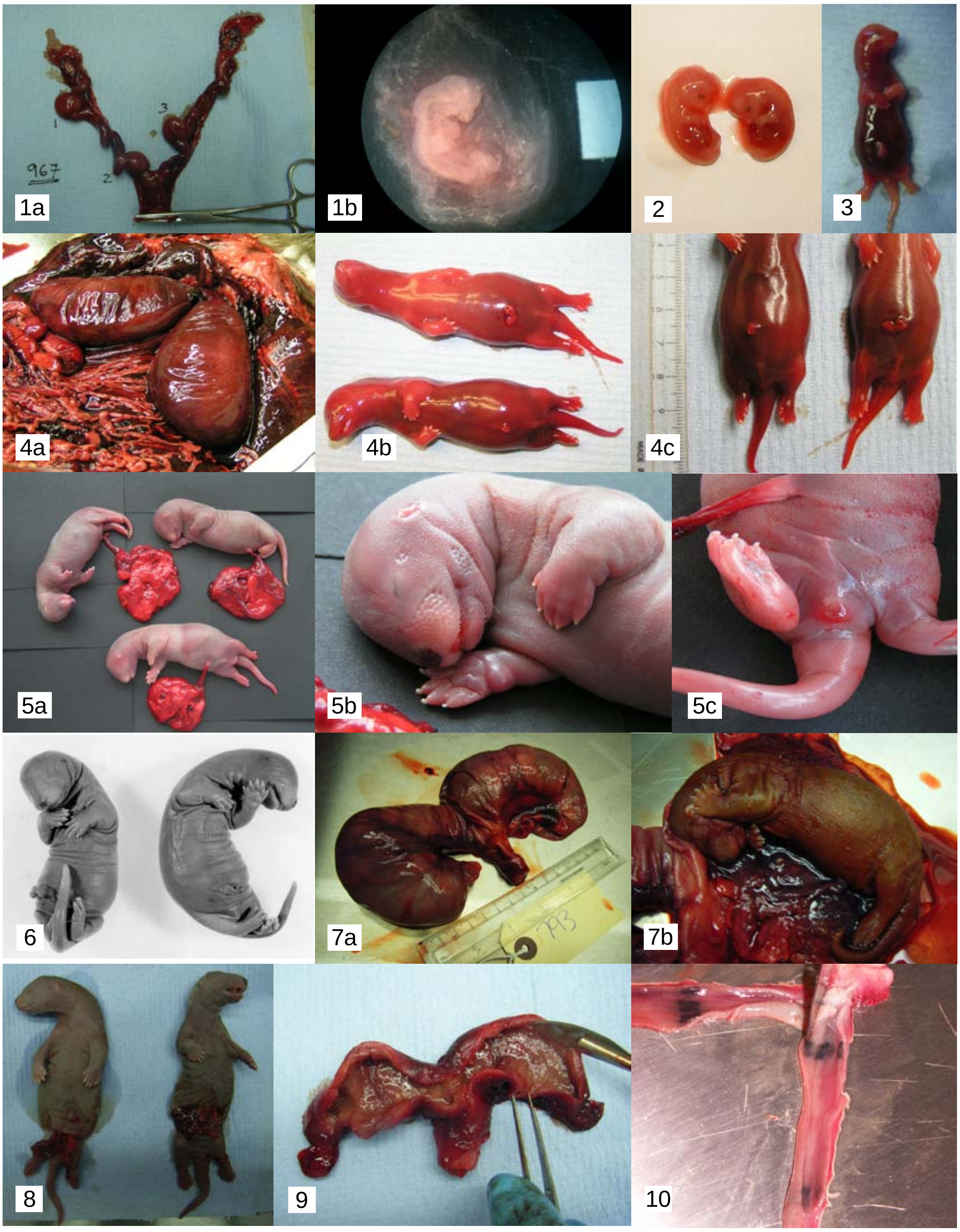

Figure 3. Foetal development and the appearance of the uterus (1) Female 967; (a) uterus at an early stage of pregnancy; distinct 'pockets' hold each of 3 foetuses; (b) miniscule (c. 5mm) foetus. (2) Female 557; fore-limbs have begun to form. (3) Female 902; fore- and hind-limbs apparent. (4) Female 763; (a) swollen uterus shown within body cavity; (b) claws formed but hairless; (c) close-up of the anogenital area, foetus appears to be male. (5) Female 1302; (a) 3 kits with placentas still attached; (b) close-up showing hair is present but not pigmented; (c) close-up of anogenital area, kit appears to be male. (6) Female 12; well developed foetuses. (7) Female 793; (a) uterus; (b) kit in uterus, hair and pigmentation apparent. (8) Female 906; hair present and pigmented. (9) Female 1104; swollen uterus but no kits; female was lactating – assumed post-parturition. (10) Female 735; placental scarring, evidence of 3 previous implantations. *For further details see Table 1.*

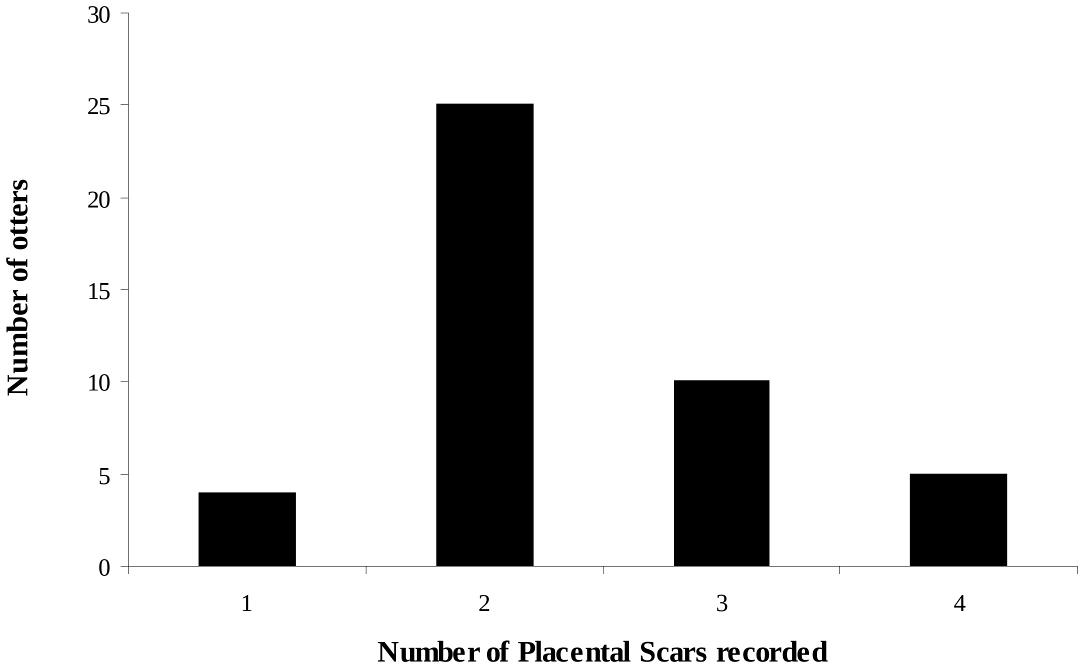

Figure 4. Frequency distribution of placental scar counts

Uterus weight was significantly greater in pregnant females (after removal of foetuses) compared to lactating and quiescent females (Mean uterus weight 36.59 ± 27.9g [pregnant], 7.71g ± 9.4g [lactating] and 5.11 ± 3.7g [quiescent]; F = 29.60, df = 2, $P < 0.001$). Lactating females had on average heavier uteri than those of quiescent females but differences were not statistically significant.

Stages of foetal development and other features of note are recorded photographically (Figure 3.1 to 3.10). Foetal crown-rump lengths measured to date range from <5mm to 125mm (Table 1). An attempt to fit a foetal growth curve has been made using data from 12 foetuses (from 7 pregnancies) for which weight and crown-rump and/or total foetal length have been recorded (Figure 5). Crown-rump lengths are commonly reported in the literature (possibly because most foetal measurements are taken using ultrasonography, thereby precluding straight lengths). Total (straight) lengths were additionally used because crown-rump length can vary depending on the curvature of the foetus, whereas straight lengths provide a consistent comparison. In fitting the curves, data from multiple foetuses taken from the same female were averaged.

The growth curves shown can be described using: foetus weight = $0.4845e^{0.045(\text{Crown-rump length})}$ ($R^2 = 0.8587$) and foetus weight = $2.2423e^{0.0183(\text{Total length})}$ ($R^2 = 0.9354$).

In most cases foetuses appeared to be male (based on the distance between the anus and the genital papilla). Male and female foetuses were recorded in two cases (UWC Ref 906 and 793); in both cases the female was the smaller of the pair. Both foetuses recovered from otter 906 were damaged across the posterior end; this may explain their lower than expected weight (Figure 5).

Table 1. Details of mother and foetuses shown in Figures 3 and 5. 'Photo' reference number refers to the numbered photograph in Figure 3. UWCref refers to the code number given to each otter examined, and is marked next to the relevant data points in Figure 5.

Photo	Details of mother		Details of foetus(es) (all weights in grams, lengths in mm's)					
	UWCref	Date found	n foetuses	Horn	Weight	Crown-rump length	Tail-length	Total length
6	12	1994	2	L	60		50	180
				R	56.8		48	160
none	221	May 1997	1	R	95.4	85	55	210
2	557	Feb 2003	2					
none	564	Feb 2003	2	L	0.93	26		
				R	0.93	24		
none	686	Oct 2004	1	R	70.5		55	
4	763	Sept 2005	2	L	22.17		28	113
				R	22.17		29	115
7	793	Nov 2005	2	L	91	120	60	195
				R	83.2	100	58	188
3	902	Feb 2007	1	L	93.45	60	20	83
8	906	Feb 2007	2	L	55.69	125	51	191
				R	43.7	115	49	181
1	967	Sept 2007	3	R		c.5		
				R		c.5		
				L		c.5		
5	1302	Mar 2009	3	R	76.998	116	49	176
				L	68.598	110	49	172
				L	74.201	103	50	176

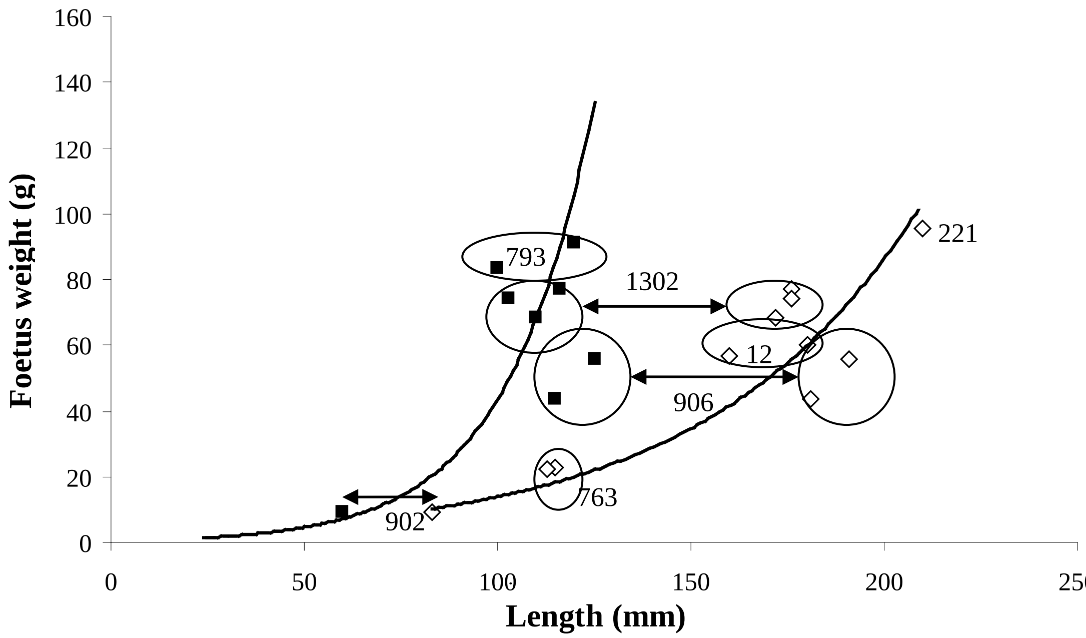

Figure 5. Growth curve for foetal development using crown-rump length (black squares) and/or total length (open diamonds). Exponential lines of best fit are based on mean values for each litter. Numbers correspond to the reference number for the mother.

DISCUSSION

Our data show no clear evidence of breeding seasonality in England and Wales, supporting previous studies (Stephens, 1957; Mason and Macdonald, 1986; Simpson, 2007). From estimates of birth month, it appeared that births were less common in the summer, but this should be treated with caution due to low sample size and potential inaccuracies introduced by basing estimates on canine foetal development curves. In a similar study (Simpson, 2007), also based in the UK, births were predicted in every month of the year except March. It seems likely that seasonality in locations such as Norway (Heggberget and Christensen, 1994), Denmark (Elmeros and Madsen, 1999) and Sweden (Erlinge, 1967) is due to a more marked seasonality in resources. It remains possible that seasonal breeding occurs in some parts of the UK, but given the small sample size it is not possible to separate data by region.

The young have been observed to begin leaving the mother at 10 months on the Shetland Isles, but may stay with her for longer (Kruuk, 2006); the young are weaned at around 15 weeks (Hancox, 1992). As pregnancies are observed in most months, it is unsurprising that lactation was observed throughout the year.

The maximum number of foetuses retained from a single female was 3, but most commonly (9/18 incidences) 2 foetuses were found. Mean litter size was 1.83. Similar litter size estimates have been reported in Belarus (Sidorovich, 1991), Germany (Ansorge et al., 1997) and Denmark (Elmeros and Madsen, 1999). Litters of up to six cubs have been observed (Harris, 1968) although this is rare. Broekhuizen et al. (2007) discuss the possibility that ovulation of six ova may not be uncommon but prenatal loss of foetuses limits litter size. Here however, the mean number of placental scars (2.36) was little higher than the mean number of foetuses (1.83).

Placental scars are thought to remain for at least 3 months post pregnancy (Elmeros and Madsen, 1999) but subsequently fade and disappear (Heggberget and Christensen, 1994). Occasionally otters were received showing multiple placental scars with pigmentation at various stages, possibly indicating a second pregnancy after a failed first one. The significant increase in weight of uteri in pregnant females is expected as oestrogen stimulates the growth of the uterine muscle mass required for foetal delivery.

Eurasian otters have a 61-63 day gestation period (Stephens, 1957). There is little information in the literature on foetal development in Eurasian otters. Reuther (1999) established Eurasian otter cubs have a mean birth weight of approximately 100g indicating that in a few cases (UWC Ref 221, 793 and 1302) females were close to delivery. From our observations, hair was first seen at foetal weights of 68g. Female foetuses were not recorded at weights less than c.44g (and in this case the foetus was damaged and the weight may therefore be underestimated). In dogs, gonadal appearance remains undifferentiated until after 30 days of gestation (Pretzer, 2008); it is not clear at what point male and female otters become distinct in appearance. We hope to use molecular analysis to accurately sex foetuses from our archive, so that we can establish whether those at earlier stages with male appearance are in fact female. We would also be keen to receive information or photographs of foetal development from other researchers.

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Cardiff University Otter Project: www.otterproject.cf.ac.uk

RÉSUMÉ

DES LOUTRES (*Lutra lutra*) PLEINES TROUVÉES MORTES EN ANGLETERRE ET AU PAYS DE GALLES: DÉVELOPPEMENT FŒTAL ET ABSENCE DE REPRODUCTION SAISONNIÈRE

Dans certaines régions, la loutre eurasienne (*Lutra lutra*) est connue pour avoir une période de reproduction saisonnière. Cependant, en Angleterre et au Pays de Galles, la période de reproduction semble s’étendre sur toute l’année. Dans cette étude, nous testons cette hypothèse en utilisant des données provenant de 206 femelles trouvées mortes en Angleterre et au Pays de Galles entre 1992 et 2008. Des femelles pleines ont été trouvées tout au long de l’année à l’exception du mois de juin. Les données ne montrent pas de reproduction saisonnière. Le nombre moyen d’implantations embryonnaires (basé sur les cicatrices placentaires) était de 2.36. Les données sur le développement fœtal de la loutre sont limitées. Des fœtus prélevés dans l'utérus sont utilisés ici pour décrire le développement fœtal, ce qui limite nos données d’observations - nous souhaitons donc lancer un appel aux autres chercheurs afin d’obtenir davantage d’informations.

RESUMEN

DESARROLLO FETAL Y AUSENCIA DE GESTACIÓN ESTACIONAL EN NUTRIAS (*Lutra lutra*) ENCONTRADAS MUERTAS EN INGLATERRA Y WALES

En algunas partes de su distribución, la nutria euroasiática (*Lutra lutra*) presenta una reproducción estacional, pero en Inglaterra y Gales se cree que su reproducción ocurre a lo largo de todo el año. En este estudio evaluamos esta suposición utilizando los datos de 206 hembras halladas muertas en Inglaterra y Gales entre 1992 y 2008. Se encontraron hembras preñadas en todos los meses excepto en el mes de junio, sin encontrar ninguna evidencia de estacionalidad. La media de implantaciones embrionarias, basado en las cicatrices de la placenta, fue de 2,36. La información sobre el desarrollo fetal de nutrias es limitada; nosotros utilizamos fetos de nutrias encontrados en los úteros para describir el desarrollo y hacer un llamamiento a la información de otros investigadores.

A R T I C L E

AGE STRUCTURE OF THE OTTER (*Lutra lutra*) POPULATION IN ENGLAND AND WALES, AND PROBLEMS WITH CEMENTUM AGEING

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Abstract: Age is an important parameter in understanding population structure and age-dependent processes such as accumulation of contaminants. In the current study, canines and incisors of sub-adult and mature wild otters (*Lutra lutra*) from England and Wales were sectioned and incremental cementum lines were used as an indication of age. The age structure of the sample population is much younger than some European populations (of 110 otters aged, only 10 were aged four or older). Cementum ageing is useful here in giving a broad indication of age structure, but is imprecise for species which do not exhibit seasonal breeding. Age is likely to be underestimated in most cases.

Keywords: Age structure; Cementum analysis; Road-traffic casualties; Otter, *Lutra lutra*

INTRODUCTION

Many conservation goals require an understanding of population age structure, age-specific reproduction, growth and survival (Bodkin et al., 1997, Harris et al., 1992, Stoneberg and Jonkel, 1966). A range of methods for ageing wild animals are described in the literature e.g. size frequencies (Tanaka, 1956), lens weight (Teska and Pinder, 1986), degree of tooth wear (Brothwell, 1989), and cementum banding (Castanet et al., 1990); here, we discuss the use of cementum banding in ageing Eurasian otters *Lutra lutra*.

Lieberman (1994) describes the biological basis for seasonal cementum banding. Cementum is a bone-like connective tissue that grows in incremental layers around the root of teeth. Banding patterns are caused by changes in mineralization and collagen orientation; these can be caused by nutritional or biomechanical factors that vary on a seasonal or annual basis. There have been a number of controlled studies indicating that cementum banding can be used to accurately age mammals including buffalo (Moffit, 1998), harbour seals (Norgaard and Larsen, 1991), stoat (King, 1991), and badger (Harris et al., 1992). In Eurasian otters taken from the wild in Denmark and Norway, a single dark line is produced annually (Heggberget, 1984).

Here, we present the results of cementum banding analysis of otters *Lutra lutra* found dead in England and Wales between 1992 and 2004. We discuss the age structure of the animals found, and potential errors implicit in using cementum analysis to age *Lutra lutra* from the UK.

ANIMALS, MATERIAL AND METHODS

Sample collection

Since 1992, otters found dead in England and Wales have been sent for post mortem examination to Cardiff University. During examination, data are collated following a standard protocol (www.otterproject.cf.ac.uk) including sex and age-class. Otters are classified as juvenile where body weight is <2.1kg (females) or < 3kg (males). Where these weights are exceeded, individuals are categorised as adult if reproductively mature (baculum length >60mm [males], signs of uterine thickening, placental scarring, previous or current lactation, or pregnancy [females]), or as sub-adults if reproductively immature.

Following post mortem examination, skulls are retained and cleaned. For this study, teeth were taken from 143 individuals (87 male, 56 female), for cementum analysis. Newly erupted teeth (those with a thin walled root and a large apical foramen) were counted, but omitted from cementum analysis. For carnivores, it is recommended to use lower canines for cementum analysis (Matson, 1981). Here, the lower left canine was taken where available (n = 131) or the lower right where the left was not available (n = 12). In order to assess reproducibility of results for left and right canines, and for different tooth types, groups of teeth from the same individual were taken as follows; upper left incisor, left canine, and right canine (n = 21), lower left canine and lower right canine (n = 3).

Cementum analysis

Tooth preparation and cementum analysis was undertaken by Matson's Laboratory, USA, following their standard procedure (http://www.matsonslab.com). A standardized analysis model specific to otters and the tooth type was then applied to count annuli. Matson's Laboratory based the age model for Eurasian otters on that of North American river otters (*Lontra canadensis*) so assume dark cementum rings are deposited in winter and assume a birth date of April. A reliability grading was given to each tooth, 'A' where histology was good, 'B' where it was reasonable. 'X' was given where ageing was not attempted due to cementum damage.

Data analysis

Preliminary analysis was carried out to test whether the subset of cementum aged animals was representative of the post mortem dataset as a whole (n = 515 [males], n = 348 [females] to June 2008). Otters are sexually dimorphic so sexes were analysed separately. Juveniles were eliminated from the comparison because newly erupted teeth were excluded from the aged data set. Analysis of Covariance using a General Linear Model was applied to test whether the aged animals differed from the non-aged animals in terms of animal size (weight, total length, tail length, femur, tibia and fibula length and weight) and condition (Wt/L), and showed no significant difference.

Analysis of Covariance using a General Linear Model was applied to test whether there were differences in the age structure of the male and female populations.

RESULTS

Age

Ageing was not possible for 45 teeth, representing 33 individuals (9 females and 29 males). This was due to poor histology, resulting from the use of detergents containing bleach to clean the teeth, prior to the decision to perform cementum analysis. Histological sections were good (graded A or B) for 62 male and 48 female otters (e.g. Figure 1); data from these were used in further analysis.

Reproducibility of cementum ageing for different canines from the same animals (n = 19 pairs) was 78.95% (fifteen aged the same, three cases with a one year difference, and one case with a two year difference). Matched pairs of incisors and canines (n = 14) showed a lower reproducibility of 57.1% (eight were aged the same, four aged one year different, and two aged two years different).

The age distribution was skewed towards younger animals, with the majority of otters aged between 0 and 2 years. Only 10 otters were 4 years or older, and the maximum age recorded was 8 yrs (Figure 2). There was no significant difference between the age structures of males and females (F ratio = 0.76, df = 1, $P = 0.398$).

DISCUSSION

Our data suggest a skewed age distribution, with most otters being less than three years of age, and the most frequent age being just one year old. There was no significant difference in age distribution between males and females. A similarly young age structure was found in Shetland, where otters were most commonly recorded in their first year (Kruuk, 2006). In Germany, the most frequent age class was again 1 year old, but otters aged 2-10 were also frequently found, and the maximum age was 16 years (from a sample size of 225) (Ansorge et al., 1997). Hauer et al. (2002a) also found many otters in age classes 3, 4-9 and >9 years (maximum age found is not given).

Interestingly, Hauer et al. (2002b) found the bulk of reproductively active females in Germany were 6-9 years of age. In our study we had only two females aged 6 or over. This suggests either that the age distribution presented here does not mirror that of the actual population, females breed at an earlier age in England and Wales than those in Germany, or that many otters are killed prior to peak reproductive age in England and Wales.

The majority of otters in this study were killed by traffic (94%). This is likely to be biased, because road kills are more detectable than natural deaths. However, this represents one of the highest proportions in Europe and can be compared to 36.1% in Norway (Heggberget, 1991); 69.9% in Germany (Hauer et al., 2002a); 64% in Upper Lusatia, Germany (Ansorge *et al.*, 1997) and 83% in south-west England (Simpson, 1997). It is possible that the age structure differs between our sampled population and the true population. Hauer (2002a) found that among otters sampled from road traffic mortalities, the most common age was 3 years, whereas among otters killed by disease or by hunting both young (<1) and old (>9) otters were more commonly found than intermediate ages. We have insufficient data for non road traffic mortalities to make a similar comparison.

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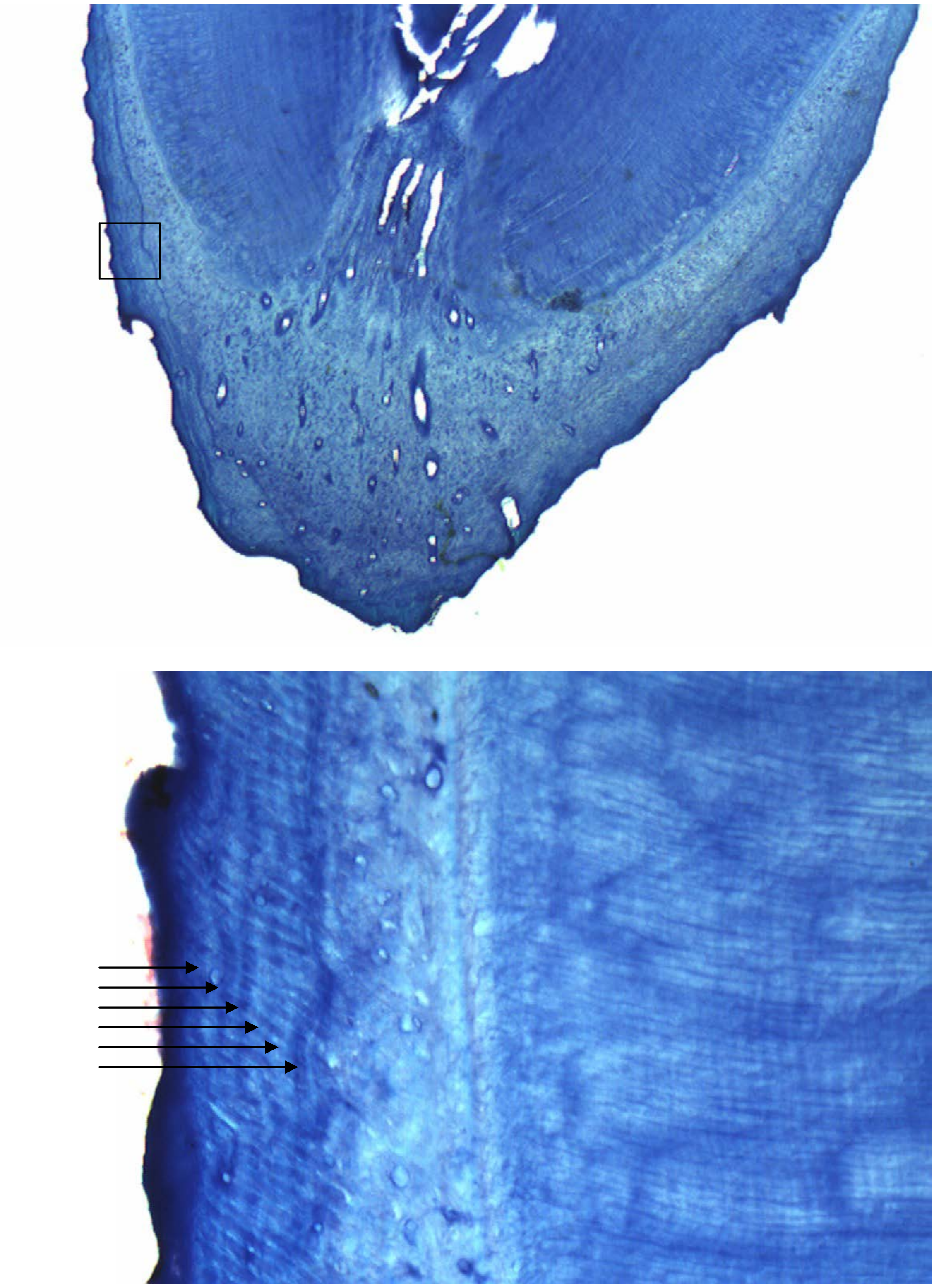

Figure 1. Cementum banding in Eurasian otter aged 6; A – root of otter tooth; B – enlarged version of cementum showing 6 annuli

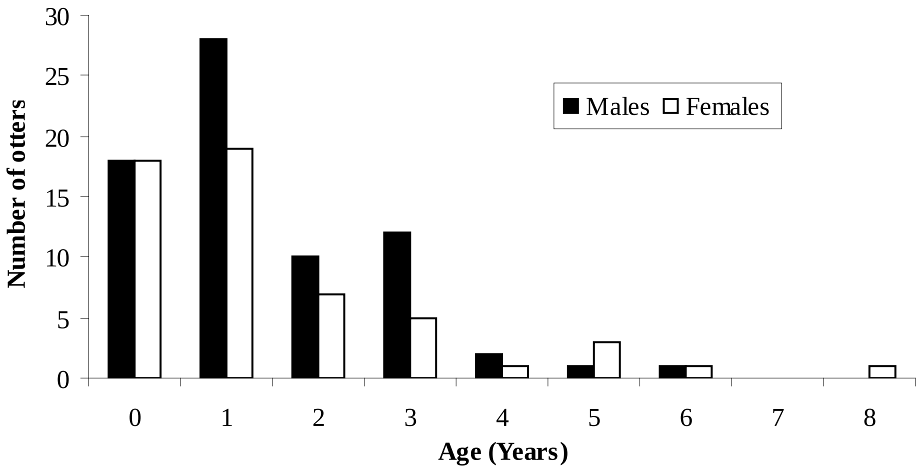

Figure 2. Age distribution of otters

In addition to potential bias associated with sample collection, it is also important to recognise problems associated with cementum analysis. In a study of 10 known-age captive otters, 1-11 years old, Yom-Tov et al. (2006) described the annuli as irregular and discontinuous, and maximum counts underestimated age by a year in half the animals examined. This may be because animals in captivity are less exposed to seasonal variation in climate and diet, but for wild North American river otters *Lontra canadensis* banding patterns are also described as indistinct, with peripheral compression of annual bands causing difficulty in ageing (Matson, 1981). In our study, ageing was not possible for 23% of individuals, but this failure rate was largely due to unsuitable cleaning protocols used at a time when cementum analysis was not planned.

Where histology is clear and counts can be made, interpretation to infer age remains subject to further error. Interpretation relies on two assumptions; an assumed season of band formation, and an assumed birth date. In most analyses it is assumed that a thin dark band of cementum forms in winter, and a broader, lighter band forms during the growth seasons of spring and summer (Matson, 1981). Grue and Jensen (1978) found that in Danish otters (*Lutra lutra*) incremental lines develop in winter-spring. In analyses of otter teeth from Norway, Heggberget (1984) found signs of dark-staining cementum in the process of deposition in all months from February to July, suggesting that band formation is variable. Here, we assume winter band formation, but known-age animals have not been used to test this in the UK, and error in this assumption could cause errors in ageing.

If we do assume winter band formation, the number of dark bands equates to the number of winters an otter has experienced since eruption of the adult teeth. To reach a more accurate assessment of age it is necessary to add the number of months survived prior to first band formation, and following the last band. The latter can be readily estimated using time elapsed between the most recent winter and the month of death (recorded when the animal was found). The former is a summation of two periods; (i) the period between birth and eruption of the adult teeth (in Eurasian otters, ca. 5 - 5.5 months (Heggberget, 1996)), and (ii) the period between eruption of the adult teeth and the first band-producing winter. Here, an assumed birth month must be used. In species or areas where reproduction is seasonal, the number of months between eruption of the adult teeth and the first winter can be readily estimated. For example, if an animal was found dead in April 2009, and one band was recorded, we would assume that it was born the previous April (2008), allowing adult teeth to develop by September-October 2008, and the first band to form in winter 2008-09. However, if birth date is unknown, the estimated age varies: it could have been born as late as June 2008 (adult teeth formed early winter 2008-09, band formation that same winter, at 6 months old, and died four months later), or as early as July 2007 (adult teeth not developed until mid-winter 2007-08 therefore not banded until its second winter, at 17 months old, and died four months later). Here, age would be recorded as one year, but the actual age might be anything from 10 to 21 months, i.e. the given age could be a 2 month overestimate or 9 month underestimate.

Seasonality of reproduction in Eurasian otters has been reported in some areas, for example Kruuk et al. (1987) observed a breeding season for Shetland otters in June, whilst Heggberget and Christensen (1994) described a late summer-autumn breeding season for otters in Norway. However in England and Wales it is generally stated that reproduction can occur in any month of the year, with no distinct seasonality (Mason and MacDonald, 1986). Stephens (1957) reports estimated dates of birth for 134 reliable instances on which cubs were sighted spread evenly throughout the year. Data collected by CUOP also shows no evidence of seasonality in reproduction, with pregnant females found throughout the year (Chadwick and Sherrard-Smith, 2010). Given the lack of reproductive seasonality among our sample population, the potential errors associated with using an assumed birth month may be considerable.

When calculating the potential errors associated with using an assumed April birth month, birth in January-March or July-December lead to an underestimate of age, while birth dates in May or June lead to an overestimate of age. Otter age is therefore more likely to be under- than over-estimated. Where, as in this study, the majority of animals are aged at <2 years old, a potential 9 month error in age may be problematic; using morphometry, reproductive status and observations such as tooth wear may give a more biologically relevant estimate of age than cementum ageing.

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RÉSUMÉ

TITLE

L'âge est un paramètre important pour comprendre la structure d'une population ainsi que les procédés dépendant de l'âge comme l'accumulation de contaminants.

Dans cette étude, les canines et incisives, prélevées chez des subadultes et adultes de loutres sauvage (*Lutra lutra*) de populations anglaises et galloises, ainsi que les céments dentaires, ont permis de déterminer l'âge des individus. La structure de l'âge de cet échantillon de population est beaucoup plus jeune que pour certaines populations européennes (sur 110 individus, seulement 10 étaient âgés de 4 ans ou plus).

Le cément dentaire donne une approximation de la strucutre de l'âge mais n'est pas assez précis pour des populations qui ne montrent pas de période de reproduction saisonnière.

RESUMEN

TITLE

La edad es un parámetro importante para entender la estructura de una población y los procesos dependientes de la edad como son la acumulación de contaminantes. Los caninos e incisivos de individuos subadultos y adultos de nutrias salvajes (Lutra lutra) de Inglaterra y Gales fueron examinados por las líneas de incremento del cemento, las cuales son utilizadas como un indicador de la edad en muchas especies de mamíferos. La estructura de edad de la población de muestra es mucho más joven que algunas poblaciones europeas (de 110 nutrias estudiadas, sólo 10 de ellas tenían 4 años o más). El envejecimiento del cemento dental aquí es útil para obtener una amplia visión de la estructura de edad, pero es imprecisa para especies que no exhiben una reproducción estacional. La edad es probable que sea subestimada en muchos casos.

SHORT NOTE

A RECORD OF INVASIVE BLACK CATFISH (*Trachelyopterus lucenai*) PREDATION BY THE NEOTROPICAL RIVER OTTER (*Lontra longicaudis*) IN RESTINGA OF RIO GRANDE, SOUTHERN BRAZIL

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Abstract: *Trachelyopterus lucenai* (Siluriformes: Auchenipteridae) is an invasive fish in *restinga* of Rio Grande, Rio Grande do Sul State, southern Brazil. In April 2007 remains of *T. lucenai* were found in the stomach of an individual of *Lontra longicaudis* which was run over near a pluvial channel in the *restinga* area. The present record contributes to the knowledge on otters predation on exotic/invasive species in aquatic environments.

Key-words: Auchenipteridae, predation, stomach content, *restinga*.

Since the year of 2001, individuals of the black catfish *Trachelyopteus lucenai* Bertoletti, Silva and Pereira, 1995 (Siluriformes: Auchenipteridae) have been captured during fish inventories conducted in Taim Hydrological System (Garcia et al., 2006), located in the *restinga* of Rio Grande, about 265 km away from its original area, in northern Patos Lagoon, Rio Grande do Sul State, southern Brazil. According to Garcia et al. (2006) the abundance of this species increased during samples realized in the period from 2001 to 2005, reaching the status of dominant species in pelagic deeper waters in lakes of the Taim Hydrological System. However, previous inventories conducted in the same area (Buckup and Malabarba, 1983; Grosser et al., 1994) did not record this species. Apparently, *T. lucenai* invaded the limnic systems of Taim in the decade of 1990 and the high abundance and diversity of food items and the habitat features favored its settlement and reproduction in the area (Garcial et al., 2006). Bertoletti et al. (1992) suggest that migration of this species could be associated with tributaries of Uruguay River, opening of irrigation channels and joining of limnic systems during floods.

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Trachelyopteus lucenai was described for the Patos Lagoon complex and the basin of the Uruguay River, Rio Grande do Sul State, southern Brazil (Bertoletti et al., 1995; Moresco and Bemvenuti, 2005). Data on habitat occupancy and feeding habits in Patos Lagoon complex reveal its occurrence near the margins of lowland tributaries with slow current water and muddy bottom (Bertoletti et al., 1995, Garcia et al., 2006), while diet is omnivorous with a tendency towards piscivory (Becker, 1998; Garcia et al., 2006).

On April 25th, 2007 remains of *T. lucenai* were found in the stomach of an individual of neotropical otter river *Lontra longicaudis* which was run over on the road BR 471 (32°12'541"S; 52°27'243") near a pluvial channel, about 42 km away from Taim Hydrological System, city of Rio Grande, southern Rio Grande do Sul State (Figure 1). The individual was an adult male presenting head-body length 79cm; tail length 52cm and body mass 12.5 kg. The stomach content was removed and preserved in formaldehyde 10%. The feeding remains were compared to specimens of *T. lucenai* stored in the ichthyologic collection of Ichthyology Lab of Universidade Federal do Rio Grande – FURG. The identification was confirmed by the similarities of pectoral spines morphology (Figure 2) and skin color patterns between feeding remains and stored specimens.

Although other siluriformes species have been found in scats and feeding remains of *L. longicaudis* in a stream in *restinga* of Rio Grande (Quintela et al., 2008), this is the first record of predation on *T. lucenai*. Once *T. lucenai* was the only item present in the analyzed stomach content, it could represent an important prey to *L. longicaudis* in the area. The black catfish quickly became the dominant species of pelagic waters in Taim Hydrological Station (Garcia et al., 2006), concerning artisanal fishermen of surrounding areas who attribute no commercial value for the species (Moresco and Bemvenuti, 2005; Bemvenuti and Moresco, 2005). Furthermore, the economic exploited characid *Oligosarcus jenynsii* was found in stomach contents of *T. lucenai* from Taim Hydrological System (Moresco and Bemvenuti, 2005).

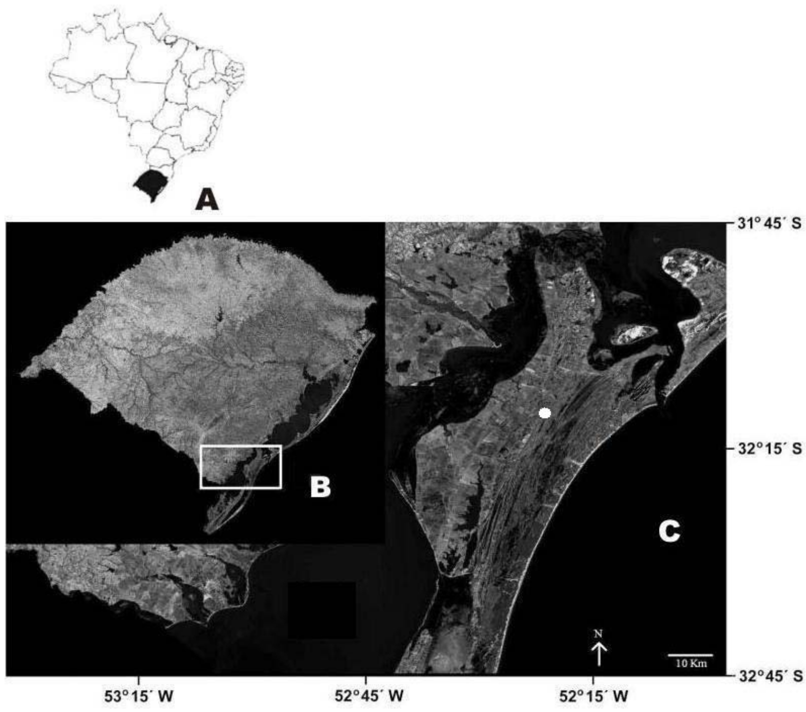

Figure 1. Location of Rio Grande do Sul State in Brazilian territory (A), part of southern Coastal Plain (B) and local of the encounter of *L. longicaudis* individual (C; white point).

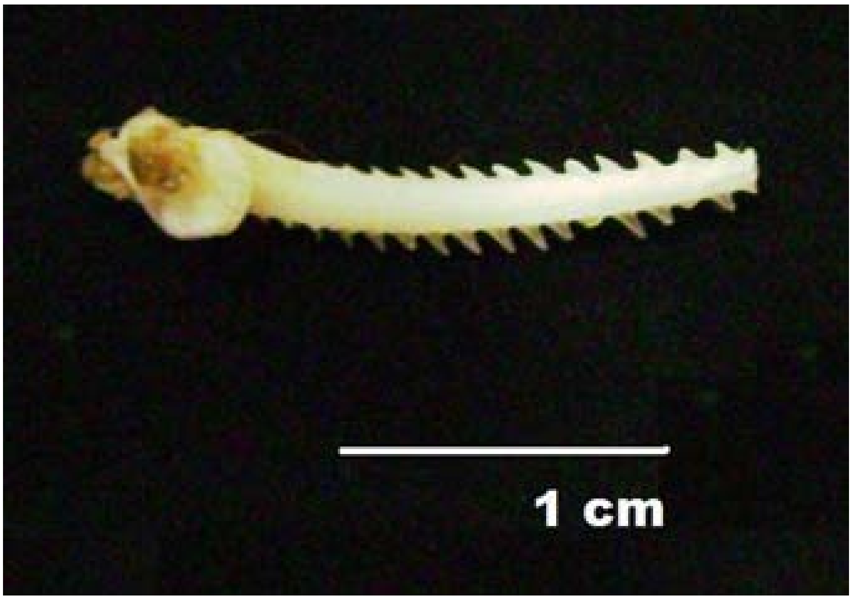

Figure 2. Pectoral spine of *Trachelyopterus lucenai* (Siluriformes: Auchenipteridae) found in stomach of *Lontra longicaudis* in restinga of Rio Grande, Rio Grande do Sul State, southern Brazil. Photo: Fernando M. Quintela.

Predation on exotic or invasive species by otters has been reported for crabs (Weber, 2008) and fishes (Passamani and Camargo, 2005; Helder-José and De Andrade, 1996; Kasper et al., 2004). The present record contributes to knowledge on otters predation on exotic/invasive species in aquatic environments.

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RÉSUMÉ

UN RECORD DE PRÉDATION DU SILURE NOIR INVAHISSEUR (*Trachelyopterus lucenai*) PAR LA LOUTRE NEOTROPICAL (*Lontra longicaudis*) DANS LA RESTINGA DU RIO GRANDE DO SUL, AU SUD DU BRÉSIL.

Le *Trachelyopterus lucenai* est une espèce de poisson envahisseur dans la Restinga de Rio Grande, l´État du Rio Grande do Sul, au sud du Brésil. Em avril 2007 des restes de *T. lucenai* ont été trouvés dans l’estomac d’une loutre morte écrasée par une voiture proche du canal pluvial dans la zone de Restinga. L’actuel rapport contribue à la connaissance de la prédation des loutres sur les espèces exotiques/invasives dans les écosystèmes aquatiques.

RESUMEN

UN REGISTRO DE LA DEPREDACIÓN DEL PEZ GATO INVASOR (*Trachelyopterus lucenai*) POR LA NUTRIA NEOTROPICAL (*Lontra longicaudis*) EN EL BAJÍO DE RIO GRANDE, SUR DE BRASIL.

Trachelyopterus lucenai (Siluriformes: Auchenipteridae) es una espécie de pez invasor en el bajío de Rio Grande, Estado de Rio Grande do Sul, sur de Brasil. En abril de 2007, restos de *T. lucenai* fueron encontrados en el estómago de un individuo de *Lontra longicaudis*, que ha muerto atropellado cerca a un canal pluvial en el área del bajío. El presente registro contribuye al conocimiento de la depredación de las nutrias en las especies exóticas / invasoras en los ecosistemas acuáticos.

RESUMO

UM REGISTRO DE PREDAÇÃO DO BAGRE NEGRO INVASOR (*Trachelyopterus lucenai*) PELA LONTRA NEOTROPICAL (*Lontra longicaudis*) NA RESTINGA DE RIO GRANDE, SUL DO BRASIL

Trachelyopterus lucenai (Siluriformes: Auchenipteridae) é uma espécie de peixe invasor na restinga de Rio Grande, Estado do Rio Grande do Sul, sul do Brasil. Em abril de 2007 restos de *T. lucenai* foram encontrados no estômago de um indivíduo de *Lontra longicaudis* morto por atropelamento próximo a um canal pluvial na área de restinga. O presente registro contribui para o conhecimento sobre a predação de lontras sobre espécies exóticas/invasoras em ecossistemas aquáticos.

CALL FOR INFORMATION

Otters and Railways

Dear colleagues,

I am looking for published data on otters and railways (i.e. otters killed by train). Little is known on this subject in Sweden, so any publications, notes, comments etc are welcome. It is also valuable if comparable data exist on roadkills (otters-traffic/cars). Even though my concern is *Lutra lutra*, information regarding any otter species is interesting.

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OSG Group Members News

New Members of OSG

Thus far this year, we have welcomed 8 new members to the OSG: you can read more about them on the Members-Only pages.

Daniel Allen, United Kingdom: My research interests lie within cultural and historical geography with a focus on cultures of hunting, human-animal relations, nature-society interactions, and, landscape and identity. I have written a book ("Otter") on how the otter's identity has been shaped by a variety of human interactions, which will be published in October 2010.

Johanna Arrendal, Sweden: My interest in otters led to studies at university level, which resulted in a PhD in conservation genetics of *L. lutra*. Today I work as a consultant with focus on otters (surveys, national action plan, national survey techniques, fauna passages, talks and field excursions at university level as well as for the public).

Emmelianna Bujak, United Kingdom: I am using non-invasive techniques to investigate the reproduction of Eurasian otters. Working with several zoological collections in Europe, I quantify the reproductive hormones in spraints in order to characterize the female oestous cycle. I am also working with Cardiff University Otter Project in a study investigating whether reproductive information is communicated in otter spraint via scent.

Jorge Cárdenas-Callirgos, Peru: My research is about wildlife parasitology and zoonotic diseases, in specific about marine otter health. My aim is to collect fecal samples and diet information about the marine otter population of Peruvian coast. Then I can compare different populations and find out if parasites could be a bioindicator of the diet and population tags.

Carol Heap, United Kingdom: I have been involved with otters over 35 years in a 'hands on" capacity with 4 species of otter (Asian short claw, Eurasian, North American river and Giant otter). Each year we care for wild born Eurasian otter cubs who have been abandoned or injured adult otters which are released back into the wild after rehabilitation.

Lorenzo Quaglietta, Italy: Following my innate passion and interest about otters, I've been studying them since 2004 for my undergraduate thesis in the Cilento and Vallo di Diano NationalPark (Southern Italy). Currently, I'm in the final phase of my PhD studies on the project "*OPA - Otter Project in Alentejo*" (Southern Portugal) of which I'm the author and coordinator. Here I've been interested to see if and how the variability in the resource availability during extreme Mediterranean droughts influence otters' space and habitat use. Following this issue, I'm currently interested on the potential impact of climate change on otters and considering to carry out a post-doc research on this topic

Lucy Spelman, USA: Otters have occupied a special place in my heart ever since I read *Ring of Bright Water* by Gavin Maxwell. There's something very endearing about these athletic, powerful, and playful animals. As a young child, I didn't understand that Maxwell's (Asian small clawed) otter was a product of the wildlife trade. Nor did I have any idea of the potential damage done to an ecosystem by allowing non-native species to run wild. I was probably also confused about freshwater versus marine otters and how many different kinds there were of each. Sadly, few people know these basic facts even today. Toward this end, I write a blog about otters, based on the ongoing conservation program at Karanambu in Guyana. It's called, "Helping Otters—Big and Small." Here's the link: http://savingotters.wildlifedirect.org/ For more about my background/bio, please see my website www.drlucyspelman.com

Jo Thompson, Democratic Republic of Congo: In 1995 I cared for a Congo Clawless Otter pup at my field site in the Democratic Republic of Congo and was happily thrust into the world of otter conservation. Since that experience, I have continued to survey and raise awareness about Africa's otters. In 2004 I produced and have widely distributed in the DR Congo an educational pamphlet about Africa's otters. I continue to work for their conservation and to gain information about their status.