NOTE FROM THE EDITOR

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This is the second editorial note written for the online version of the IUCN OSG Bulletin. During the last months Lesley and I were quite busy. Lesley did a tremendous job to get the new articles online once they final version came back from the authors. I cannot say whether it is the new form but since autumn there was a steady stream of manuscripts coming in and while the 2006 issue consisted of 46 pages we will soon have some articles in the 2007 issue online as there are several interesting in the pipeline! Altogether I have the idea that the new form is meanwhile well accepted. Lesley sends me once a month an update on number and locations of hits to the website and the Bulletin and from these data we can conclude that the website is well visited.

Thanks to those who sent us manuscripts and those that took the task to review the manuscripts and assist with the editing of the English! We appreciate also the references that were sent to us either physically or as a link to the webpage improving the usefulness of the website.

It is only a bit more than 6 months left until we have the next meeting in South Korea and I hope to see many of you again. Oxford University Press provided me with two free copies of Hans Kruuk's new book on otters that I thought may be given away as a price but details have to be discussed. Another point I thought could be mentioned already at this stage is the question whether we should have an art auction again, similar to what Tom organised at the last meeting. Personally I am in favour of such an idea! Anyhow please have a look on the website of the conference (http://www.otter2007.org) for new announcements.

I want to take the chance to congratulate two of our colleagues who recently finished their PhD on otters – namely Johanna Arendal, Sweden and Risto Sulkava, Finland. I hope that the two of you keep related to otters and the "otter family" in the future.

With regards,

Arno

There was an additional delay in the printing of the Proceedings of the conference held on Skye in 2003 but they should be printed soon and copies may be ordered from Grace. Please contact her for details (Grace M. Yoxon, E-mail: iosf2@aol.com, www.otter.org).

IUCN/SSC OSG GROUP

FROM THE CHAIRMAN'S DESK

As the current Bulletin nears completion, it is time once again for me to give a short report on 2007.

To many the most important event was the Xth Otter Colloquium in Hwacheon, South Korea. This took place in October and was attended by over 160 delegates from more than 30 countries. It was the first time the event was held in Asia and congratulations must firstly go to the organisers, in particular Professor Sung-Yong Han and Miss Kwon Kyeonja of the Korean Otter Research Centre. The success was also due, in no small part, to the support given by the mayor of the city and his staff. There was a good cross section of delegates, from the old and grey haired to the young and enthusiastic – an opportunity to share ideas, meet old friends and make new.

The standard of presentation was by and large very good and the topics covered extremely varied – an ideal combination. To many, however, the memory of the event will be more than 'just the conference' – it was the whole experience: a visit to a new part of the world, a new culture etc. The title of the conference was *Otter, Peace Ambassador of Korea.* The excursions to the Peace Dam, the Peace Bell Park and the Demiliterised Zone gave us an opportunity to understand why this was chosen as the title. The colloquium had to be seen in the wider context of the movement for peace and reconciliation with neighbouring North Korea, a movement that has been led by the people of Kwacheon. To commemorate the colloquium and all the efforts of the organisers and the local council, a set of five chimes, the otter peace chimes were designed and cast by a sculptress in Scotland and presented to the mayor on the first day of the meeting. These were very well received and eventually will be exhibited in the Peace Bell Park.

Much was achieved at the meeting, with the various sections, task forces etc having the opportunity to get together and discuss ideas and issues. Recommendations were made and targets set. As a major theme for the immediate future, Nicole Duplaix highlighted the importance of the role climate change will/might affect all the otter species. I would also like to express my sincere thanks to Nicole, who, at the colloquium, has agreed to act as vice-chair of the OSG. As the original Chair of the OSG, we are indeed lucky to have her in this role.
So with our memory of Hwacheon, with its otter banners and fountain we now look forward to our next colloquium which will be held in Italy in 2010.

In addition to the Colloquium, 2007 saw the OSG progress and develop further. The success of the Web Page has been recognised, not only by members, but also by others – in this the members have an easy accessible tool.. To this we are indebted to Lesley Wright It is you, the members' web page, so make use of it. If you have any ideas, queries etc, contact Lesley and she will try and accommodate your requests.

Some changes in the organisation have been that, as Chair, I felt that I needed a management team who could advise on the running of the Group and to comment on issues etc. This is now oin place and has, and will have, an important role to play in the future organisation of the Group.

Membership has been reorganised, with the establishment of a membership team. This is chaired by Lesley Wright. Potential new members are proposed and Lesley circulates these to a small team who decide on whether or not the person is suitable.

After much discussion, the Bulletin has gone 'electronic' and is now available on the web. Thanks to the efforts of Arno Gutleb (who in Korea agreed to continue as editor) and Lesley, almost all the back issues are now available on the OSG web page. The Bulletin goes from strength to strength and is seen by many as an important means of disseminating information on otter research. On the subject of the Bulletin, there is a section on new publications. This is an important way of telling the wider membership of what has been published. We are now considering an e-library for members – an ability to readily access papers. Could I ask all the members of the Group if, in addition to telling us of your work, that you also forward an electronic copy of your paper for inclusion? This is particularly true of unpublished reports and thesis.

An important part of any of our colloquium is that the proceedings are published – an action that the Group has failed to do in the past. It is gratifying to know that steps have been taken to resolve this situation. For the Chile meeting (VIIIth IOC): a special issue of the Bulletin has been assigned for this – abstracts of the papers presented there will be continuously made available as these "lost" files show up. The proceedings of the Frostburg meeting(IXth IOC) are now on stream to be published later this year. Tom Serfass, the principal editor, is now cracking the whip to get it finished. Already a number of papers have been received for the Hwacheon meeting so hopefully these too will be produced within the next 12 months.

The success of the OSG is dependant on its members, please remember this.

As Chair, I find that I am dependant on the support of a number of individuals who are willing to help and readily give up their time. These people know who they are, so once again my thanks to you and the other members for all support. The last year has seen the OSG develop, perhaps slowly, but develop it has, 2008, no doubt, will see other changes.

Jim Conroy

Celtic Environment Ltd.,
Old Mart Road
Torphins
Aberdeenshire, AB31 4JG
UNITED KINGDOM
e-mail: jim@celticenvironment.wanadoo.co.uk

V I E W P O I N T

SPECIES-WISE DISPARITY IN SCIENTIFIC KNOWLEDGE ABOUT OTTERS: AN OBSTACLE TO OPTIMAL MANAGEMENT AND CONSERVATION ACTIONS?

Daniel GALLANT

105-B Connolly Street, Moncton, New Brunswick, E1A 3K9, Canada
e-mail: beru9664@hotmail.com

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Abstract: Some species of otters have been much more studied than others. A particular challenge in the management and conservation of otters worldwide is that some of the lesser-known species are also among those being the object of conservation concerns. In this paper, I argue about the importance of producing more scientific knowledge about lesser-known otter species and discuss the importance of integrating more species- and region-specific knowledge in survey practices. By comparing literature, I present examples showing how species-wise differences in behaviour and ecology can affect sign-based survey outcomes.
Keywords: *otter behaviour, otter ecology, sign-based survey techniques, monitoring, scientific knowledge, inter-specific differences, knowledge disparities*

INTRODUCTION

The most studied species of otter is without doubt the Eurasian otter (*Lutra lutra*). This is due to the fact that a considerable part of its range is on the European continent, spanning several heavily industrialized countries. The dramatic population declines of this species in Europe, due to pollution and habitat loss, sparked great interest from scientists and conservationists (see references in MASON and MACDONALD, 1987; ROBITAILLE and LAURENCE, 2002), reflecting the abundant and diverse scientific knowledge having been produced for this species up to now. Another well-studied species is the sea otter

(*Enhydra lutris*). I cite here as examples, some of the famous ecological studies on near-shore community structure and dynamics (ESTES and PALMISANO, 1974; ESTES et al., 1978; SIMENSTAD et al., 1978). A growing body of scientific literature is also available for other species such as the giant otter (*Pteronura brasiliensis*) (CARTER and ROSAS, 1997; DUPLAIX et al., 2003). This is also the case for the river otter (*Lontra canadensis*), especially in the United States, with conservation concerns in various parts of that country and many reintroduction projects (reviewed in RAESLY, 2001) and distribution surveys (e.g., SHACKELFORD and WHITAKER, 1997; SERFASS et al., 1999; PITT et al., 2003) having been conducted.

In many parts of the world where urgent need to monitor otters followed, researchers and conservationists often adopted the survey methods developed in Europe, for monitoring the Eurasian otter populations. Indeed, during the 1980’s and 1990’s, the waves of studies and surveys that followed for other freshwater otter species in various parts of the world were usually characterized by a short reference section, or loaded with citations of studies focused on species (mostly Eurasian otter) other than the one of interest (e.g., CHEHÉBAR et al., 1986; CLARK et al., 1987; VERWOERD, 1987; ROWE-ROWE, 1992). This situation attested the disparity in knowledge that existed about other otter species compared with the Eurasian otter. This disparity still exists because there is often no alternative to citing works on Eurasian otters to support specific arguments when explaining and discussing results of studies (e.g., GALLANT et al., 2007; GALLANT et al., in press). This reality credits European scientists, who have produced a large and diverse wealth of scientific literature about Eurasian otter ecology and conservation (see KRUUK, 1995). It also highlights the need to gain more knowledge about many of the other otter species.

With conservation issues comes the interest and resources to do ecological research for a better understanding of the species’ needs. Yet for some species, reliable scientific information on basic ecology and population status remains scarce. Rareness and elusiveness of the animals, as well as lack of resources or difficult field conditions, can make data acquisition arduous and dangerous. Such examples are the Congo clawless otter (*Aonyx congicus*) (ALARY et al., 2002; JACQUES et al., 2002), the hairy-nosed otter (*Lutra sumatrana*) (LONG, 2000; LUBIS, 2005) and the neotropical otter (*Lontra longicaudis*) (WALDEMARIN, 2004; SILVA et al., 2005). This is a complex challenge because some species with data-deficient status might also be those that need pressing attention with regard to conservation issues (HUSSAIN, 2004; NEL and REUTHER, 2004).

The goal of this paper is to discuss the importance of evaluating the performance of survey methods, as well as producing and integrating regional ecological knowledge about otters of interest in survey design and data interpretation. Based on my own experiences of research on river otters in New Brunswick (Canada) and other examples from the literature, I further assert that producing more ecological knowledge, especially about the lesser-known species, is one of the keys for improving management and conservation of otters worldwide.

ON SURVEYS AND OTTER SPECIES

Sophisticated survey methods have been proposed for elusive carnivores such as otters in the past (KRUUK et al., 1980; TESTA et al., 1994) and are still being developed (e.g., BEHELER et al., 2004; BEHELER et al., 2005). However, limited resources, coupled with the need to conduct large scale and long term monitoring, mean that cost-effective survey methods based on documentation of activity signs (i.e., scats and tracks) will remain the norm. Europe undoubtedly has the longest and most active history in development and implementation of otter monitoring programs through sign-based surveys. Much debate about these methods has taken place (KRUUK et al., 1986; CONROY and FRENCH, 1987; KRUUK and CONROY, 1987; MACDONALD and MASON, 1987; MASON and MACDONALD, 1987) and today, standardized sign-based survey techniques are proposed (e.g., REUTHER et al., 2000).

From 2003 to 2006, along with colleagues, I evaluated different aspects of the performance of sign-based survey methods (GALLANT et al., 2007; GALLANT et al., in press) because we were interested in developing a long-term monitoring program for a resident river otter population in Kouchibouguac National Park of Canada. One particular technique we evaluated (GALLANT et al., in press) was the popular standard sign-based survey method. Ideally, the sites of standardized shore-lengths, where searches are undertaken for signs of otter activity, should be chosen randomly. Because of accessibility and logistical constraints however, this procedure is often amended and sites are chosen non-randomly so that ease of access is guaranteed. Road bridges are often selected as starting points to conduct searches for signs of otter activity. This permits easy and quick access to riparian habitats and enables surveyors to maximize the number of locations that can be visited. This compromise has often been made in European surveys (e.g., MACDONALD, 1983; REUTHER and ROY, 2001; GEORGIEV, 2005). Bridges have also been used as sampling locations in North America (e.g., CLARK et al., 1987; SHACKELFORD and WHITAKER, 1997; BISCHOF, 2003).

Because we did not know if and how river otters in North America reacted to roads and bridges, we set out to investigate this bridge survey method in a North American setting. We found that for a given length of shoreline searched per site, results of bridge sites were very similar to randomly chosen sites (GALLANT et al., in press). This indicated that river otters did not actively avoid bridges and that these structures with associated human activity (i.e., traffic) would not affect chances of detecting river otter presence in a region of interest.

Interestingly, comparing our results with studies on the Eurasian otter showed that longer searches were necessary for us to reach high detection rates. This was caused by what seems to be a subtle, but nonetheless, important behavioural difference between the two species. A particularity of Eurasian otters is that they often use road bridges as marking sites by depositing scats (i.e., spraints or faeces) under them or in their vicinity (ROMANOWSKI et al. 1996; REUTHER and ROY, 2001). During our research on river otters, involving winter (GALLANT et al., 2007; GALLANT et al., in press) and summer (GALLANT, 2006) fieldwork along rivers and streams, river otter scats were never found under bridges. They did not use road bridges as latrine sites and I was unable to find any indication that river otters in North America actively select bridges as latrine sites. SHACKELFORD and WHITAKER (1997) suggested that searching beyond 100 m of bridges would probably result in more river otter signs being discovered and was confirmed in GALLANT et al. (in press). This apparently benign behavioural difference between the species has important implications in the way we should view and interpret such sign surveys, depending on the species being monitored.

With the Eurasian otter in Europe, because most scats tend to be found under or near bridges (ROMANOWSKI et al., 1996; REUTHER and ROY, 2001), deliberately selecting bridges as search sites is very much akin to using a targeted sampling approach. As a matter of fact, surveyors are choosing to search locations where there are increased chances of detecting otter activity signs, if otters are present. For river otters in North America, because they apparently neither actively avoid nor use bridges as marking sites (GALLANT et al., in press), this is more akin to a random survey because bridges do not appear to influence river otters and they were not built at locations with river otter habitat needs in mind (i.e., availability of prey and shelter). This is a situation where the same method does not produce the same type of data. Different species of otters manifest different behaviour with regard to bridges. This has implications for interpreting survey data. For example, it is foreseeable that for targeted sampling designs, saturation of the response variable (e.g., presence-absence of activity signs at searched sites) would occur at much lower abundance of otters because we are sampling locations that are most likely to have activity signs deposited by the species of interest.

A second example of species-specific behavioural differences that potentially affects otter survey data can be found in the practice of collecting scats of otters from one region for use as foreign scats to stimulate otter marking in another. OGADA (2004), working with African clawless otters (*Aonyx capensis*), found such techniques to be useful for mapping otter territories in Kenya. However, BRZEZIŃSKI and ROMANOWSKI (2006), working on the Eurasian otter in Poland, found that using scats from unfamiliar individuals did not stimulate defecation any more than the practice of removing old scats. Information is generally lacking for inter-specific comparisons regarding this topic and the scarcity of available literature on this subject for Eurasian otters give contrasting results (discussed in BRZEZIŃSKI and ROMANOWSKI, 2006). Some species are probably more territorial than others. Therefore, such techniques would not be suitable for all otter species.

These examples confirm the need to give further consideration to behavioural and ecological differences between otter species. They show the need to integrate region- and species-specific knowledge into monitoring and management practices as they become available. This is a challenge because of the relative paucity of information for some species compared to others.

ON ADAPTATIONS AND VALIDATIONS OF SURVEY METHODS

Truly, it is an advantage to be able to implement standardized survey methods over large areas (REUTHER et al., 2000; GROENENDIJK et al., 2005). If researchers and conservationists do not all use the same standardized survey method, we cannot hope to accurately make direct comparisons of survey results between regions and throughout time. However, accurate assessments of a given population's state is paramount and this justifies adaptations or innovations in survey methods, in as much as new scientific knowledge about the species and eco-region of interest shows that it is necessary and beneficial to do so. For example, regarding a specific otter species, it is possible that the behaviour of animals varies across regions. It will therefore be necessary to determine if differences, yet to be found, will have implications for the performance and accuracy of existing survey techniques applied on a large geographical scale. Moreover, species spanning different ecosystem-types exacerbate the difficulty that different shoreline substrates and vegetation can alter detection rates (CONROY and FRENCH, 1987; ROMANOWSKI et al., 1996). These issues are especially relevant to species that have large distribution ranges, such as the Eurasian and river otters (LARIVIÈRE and WALTON, 1998; ROBITAILLE and LAURENCE, 2002). This is also an issue at smaller geographical scales. For example, GEORGIEV and STOYCHEVA (2006) documented no less than twelve different types of riparian habitat used by Eurasian otters in southern Bulgaria. As more information on these issues become available, adaptations, modifications and innovations in survey methods are warranted. If standard methods are to change as little as possible for comparison purposes, at least some measure of adaptation in interpretation of survey data will become essential when we will have more detailed information regarding these issues.

One recent example of species- and region-oriented integration of ecological information relevant to management activities is found in HUBBARD and SERFASS (2004), who determined seasonal fluctuations in river otter marking activities in their region of western Pennsylvania. They then adapted their survey methods so that timing of sampling in the field coincided with river otter marking activity peaks, spring and fall, so maximizing detection rates. These spring and fall activity peaks are different from the results of MACDONALD and MASON (1987), who found that marking peaks for Eurasian otters in Wales (United Kingdom) consistently occurred in winter and early spring. ROBSON and HUMPHREY (1985), working on river otters in Florida, found that the scent-marking activity peak was in winter.

Giant otter monitoring practices constitute another example of species- and region-specific adaptations in survey techniques. In South America, timing of the sampling for monitoring of the giant otter coincides with the dry season, when water level is low and otters are restricted to permanent watercourses (GROENENDIJK et al., 2005). This limitation of movements by otters possibly increases the chances of detection. This species is also monitored using sign-based survey techniques (GROENENDIJK et al., 2005) but because it is a large and diurnal species that typically occupies open habitats, opportunities for detection of their presence via direct observations are frequent (DUPLAIX, 1980; GROENENDIJK et al., 2000; GROENENDIJK et al., 2005). Another advantage that is capitalized upon when doing surveys for this species is the possibility of identifying individual animals by observing the distinct spot patterns on their throat (UTRERAS and PINOS, 2003; GROENENDIJK et al., 2005). Researchers and conservationists, when in the field, can easily keep records of the whereabouts of individuals by direct observations and identification of these spot patterns (e.g., DUPLAIX, 1980; GROENENDIJK et al., 2000).

Finally, another consideration is that if a particular survey method is deemed inefficient, ineffective or inadequate for monitoring one otter species, this does not necessarily mean that it cannot be of use in monitoring other otter species. For example, even if freshwater otter species, as semi-aquatic mammalian predators, are very similar to each other, it does not mean that they will all behave or react in the same way in a given context. Even if ROBSON and HUMPHREY (1985) convincingly demonstrated the inefficacy of scent stations as a monitoring method for the river otter, scent stations remain a potential method for monitoring other species of otters, until we have scientific data that motivate us to drop that technique altogether when otters in general are concerned. The fact that river otters quickly loose interest in lures of scent stations (ROBSON and HUMPHREY, 1985) does not mean that other species of the same family or genus will respond in the same way. Our finding of different defecation behaviours in relation to bridges for river otters compared with Eurasian otters (GALLANT et al., in press) serves as a case example of this.

CONCLUSION

The examples mentioned above show that not only is it important to encourage the development of cost-effective survey methods based on signs of otter activity (e.g., OGADA, 2004; HUBBARD and SERFASS, 2004; MERCIER and FRIED, 2004; SULKAVA, in press), it is also important to conduct studies to investigate existing methods to see if, and how, they can be validly used in different ecosystems to survey different species of otters. We need to constantly investigate and evaluate various aspects of the performance of methods we use (ROBSON and HUMPHREY, 1985; ELMEROS and BUSSENIUS, 2002; GALLANT et al., 2007) and ask how they might be improved or adapted to new environments and other otter species (e.g., HUBBARD and SERFASS, 2004; SILVA et al., 2005; GALLANT et al., in press). Corroboration of the adequacy of survey methods for other species and eco-regions is far from being useless redundancy; it is required information that is often lacking. We need to validate methods in different contexts and adapt or develop alternative methods when it is justified by new scientific results to do so.

The fact that so many of the studies I cited in this paper are from the IUCN Otter Specialist Group Bulletin is in itself a demonstration that the Otter Specialist Group is successful in its goal of guiding and promoting research on all otter species, to improve our knowledge about otter ecology, conservation, and monitoring practices. For the lesser-known species especially, there is still a lot to do in the way of eliminating the disparity in scientific knowledge. As researchers and conservationists with interests without borders, we must feel compelled to encourage, assist, and help those who are, with meagre resources more often than not, attempting to bring to all of us precious knowledge about the lesser known (and often threatened) otter species.

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Résumé :La Disparité au Niveau des Connaissances Scientifiques sur les Différentes Espèces de Loutres : Une Entrave à leur Gestion et Conservation Optimale?

Certaines espèces de loutres ont été beaucoup plus étudiées que d'autres. Un défi particulier au sujet de la gestion et la conservation des loutres à l'échelle mondiale, c'est que certaines des espèces les moins connues comptent aussi parmi celles faisant l'objet d'inquiétudes quant à leur conservation. Dans cet article, je discute à propos de l'importance de produire plus de connaissances scientifiques à propos des espèces les moins connues et j'argumente au sujet de l'importance d'intégrer plus de connaissances particulières à l'espèce et la région d'intérêt dans les méthodes de suivi. En comparant la littérature disponible pour différentes espèces, je propose des exemples démontrant comment des différences entre les espèces, au niveau comportemental et écologique, peuvent influencer les résultats de suivis indiciaires.

Resumen: Disparidad en el Conocimiento Científico entre las Especies de Nutria de Río: ¿Un Obstáculo para el Manejo Óptimo y las Acciones de Conservación?

Algunas especies de nutria de río han sido más estudiadas que otras. Un desafío particular en el manejo y conservación de nutrias de río en el mundo es que algunas de las especies menos conocidas son aquellas sobre las que existe preocupación en cuanto a su conservación. En este artículo yo discuto la posibilidad de producir más conocimiento científico sobre especies menos conocidas y discuto la importancia de integrar conocimiento sobre ciertas regiones y especies durante relevamientos de campo. Mediante la comparación de literatura, presento ejemplos que muestran cómo diferencias en el comportamiento y ecología de diferentes especies pueden afectar los resultados de relevamientos de campo.

A R T I C L E

WHAT IS THE PROXIMATE CAUSE OF BEGGING BEHAVIOUR IN A GROUP OF CAPTIVE ASIAN SHORT-CLAWED OTTERS?

Nicola GOTHARD

24 Sovereign Close, Didcot, Oxon, England 0X11 8TR
n.j.gothard@sms.ed.ac.uk

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Abstract: The study aimed to ascertain the proximate cause of 'begging' behaviour in a group of captive Asian short-clawed otters (*Aonyx cinereus*). Two alternative hypotheses were tested by manipulating aspects of husbandry in three experimental conditions. Condition 1 served as a baseline for comparison. In Condition 2 meal worms and crickets were provided every hour to stimulate natural foraging and hunting behaviour and alleviate boredom. During Condition 3 the food allowance was increased by 7.5% of the otters' body weight and they were fed every hour to more accurately represent their natural foraging ecology. The results show that both Condition 2 and Condition 3 reduced 'begging' behaviour, however the reduction was significantly greater in Condition 3. Thus indicating that the main cause of 'begging' behaviour was hunger, however lack of stimulation is also likely to be a contributing factor. Inconsistency in feeding times might have contributed to the 'begging' problem as well, although a further long-term study is needed to determine the extent to which this is a factor. Some recommendations for changing aspects of husbandry and diet are provided

INTRODUCTION

Research Question

The study zoo had noticed that their Asian otters constantly displayed 'begging' behaviour towards staff and members of the public, even during and immediately after feeding. This was felt to be a welfare issue and the zoo staff was interested in elucidating the cause behind this behaviour.

Previous research on begging in Asian short-clawed otters

Asian otters have been observed 'begging' in a variety of captive environments (Maslanka and Crissey, 2002). However despite the widespread occurrence of this problem, there has been little published research into the underlying cause. In 1982 Markowitz and Foster-Turley used environmental enrichment in the form of live prey to reduce abnormal behaviour in Asian otters. They suggested that otters 'begged' because they were bored and the behaviour induced a response from visitors. Steen et al. (1995) reduced 'stereotypical begging' in Asian otters by randomly distributing food in time and place with the use of a catapult. This reduced dependence on keepers for food and added an element of unpredictability and control over their environment. Owen (2004) observed that the otters 'begged' from visitors when they were hungry and that visitors threw food into the enclosure reinforcing the behaviour. However this was an ad libitum observation as part of another study and the statement was not statistically tested. Although the previous research was successful at reducing the 'begging' through environmental enrichment, none of the previous studies looked into elucidating the cause at the root of the behaviour. Therefore the purpose of this research was to determine the proximate cause of 'begging' behaviour in a group of captive Asian short-clawed otters.

Hypotheses

H1: Boredom is the proximate cause of 'begging' behaviour as a result of lack of stimulation and opportunity to engage in the appetitive component of feeding behaviour.

H2: Hunger is the proximate cause of 'begging' behaviour as a result of inadequate nutrition and a feeding regime that doesn't take into account the natural foraging ecology of Asian otters.

Boredom induced 'begging'

Inglis et al. (1997) found that animals prefer to work for food in a phenomenon called 'contrafreeloading'. It is possible to meet an animal's entire physiological requirement and yet often they often will develop abnormal behaviour because of stress and boredom (Poole, 1992). A study into the behaviour of young rhesus macaques found that they exhibited less self-directed behaviour and were more exploratory when they were allowed to work for food (Chamove, 1989). In nature, working for food provides information about resource availability and through evolution it has become a rewarding activity in itself (Poole, 1992). Mammals rely for their survival on collecting and analyzing data and acting intelligently. Their psychological well-being depends upon having an environment that offers facilities to search for information to establish and monitor their concept of the world. Opportunists suffer more in captivity because they are adapted to highly variable environments and captivity does not provide enough stimulation. Social animals have higher cognitive abilities, which, also increases the need for constant sources of stimulation (Mench, 1998; Robinson, 1998). The Asian short-clawed otter is an opportunist and highly sociable and therefore it is possible that the captive environment is not stimulating enough for them (Kruuk et al., 1994). Behavioural problems associated with feeding may develop because foraging constitutes the main form of information gathering for otters, which spend 41 - 60% of their time in the wild involved in feeding or foraging activities (Davis et al., 1992; Spelman et al., 1999; Kruuk 1995, Hoover and Tyler, 1986).

Hughes and Duncan (1988) and Jensen and Toates (1993) argue that animals will suffer if they are unable to perform behaviour that they are motivated to do, even if it is not necessary to meet their immediate physiological requirements. For any behaviour that is largely governed by internal factors, motivation levels will sooner or later increase above threshold. This will trigger appetitive behaviour but in some environments it will be impossible to reach the consummatory phase so the appetitive behaviour will continue, sometimes in an abbreviated form. It can result in boredom, redirected behaviours, vacuum activities, stereotypes and reduced health (Veasey, 1996). Carnivores devote a large amount of time and energy to hunting behaviour in the wild. In captivity there is little opportunity to express hunting behaviour while a strong motivation remains (Lyons et al., 1997). Shephardson (1993) found that providing small felids with hidden food satisfied the need to express foraging behaviour as well as information gathering. If the lack of stimulation and opportunity to engage in the appetitive phase of feeding behaviour hypothesis is correct, stimulating the otters hunting/foraging behaviour with live prey should reduce begging because it provides them with an outlet for foraging motivation and a more stimulating environment for information gathering thus negating the motivation to seek stimulation from outside the enclosure and allowing the appetitive component of feeding behaviour to progress to the consummatory phase.

Hunger induced 'begging'

The second hypothesis suggests that poor nutrition or a feeding regime that does not take into account the natural foraging ecology and the physical adaptation of the species could result in hunger. It has been well documented that animals fed restricted amounts of food will develop behavioural stereotypes (Lyons et al., 1997). The stereotypes are built upon elements of redirected activities consecutive to thwarted attempts to reach food and may have been an expression of foraging motivation (Terlouw et al., 1993). Broiler hens have been found to excessively drink, preen and peck non food objects when food was restricted (Savoury et al., 1992). Pregnant sows living in food restricted environments developed pre-feeding stereotypes (Terlouw et al., 1993).

Wild Otters eat roughly 20% of their body weight per day (Duplaix-Hall, 1975). However the study group ate 384g per day each, which is only 12.5% of their estimated body weight. This is 36% less than they would eat per day in the wild. The dominant female was also lactating during the study period but no extra food was provided to minimize the weight loss and metabolic stress associated with milk production, despite recommendations to do so by Tumarov and Sorina (1997).

Asian otters have high metabolic rates (Borgwardt and Culik, 1999). Food is digested and defecated within one hour of ingestion and they eat frequently throughout the day

(Lekagul and McNeely, 1988). Therefore Lombardi (2002) recommends that Asian otters are fed three times a day or more due to their natural feeding style of frequent small amounts, fast metabolism and generally high activity levels. The study group were fed roughly four times per day, however the difference between zoo feeding regimes and the natural foraging ecology and morphological adaptations of the Asian otter may mean that even four feeds per day are not frequent enough to prevent ‘begging’. If the hunger hypothesis is correct then increasing the quantity of food to 20% of the body weight and feeding more frequently throughout the day will reduce hunger and negate the need to ‘beg’ because it more naturally represents their foraging ecology and morphology.

METHOD

Study area

The outside enclosure is approximately 20m x 10m. There is an underground burrow, where the otters can not be seen by the public (area 8) and have open access to throughout the day. There are two sandy areas (1) and (2,10,12,13) and 2 pebbled banks (3 and 4). A waterfall runs from the top of the enclosure into the pool (11). These areas are separated by a large pool of water that flows through the enclosure (5, 6 and 7). There is also a bridge which they can go underneath (9). The otters can be viewed by the public from all sides although the viewing areas are set approximately 1m back on three sides, with only close proximity at the top end.

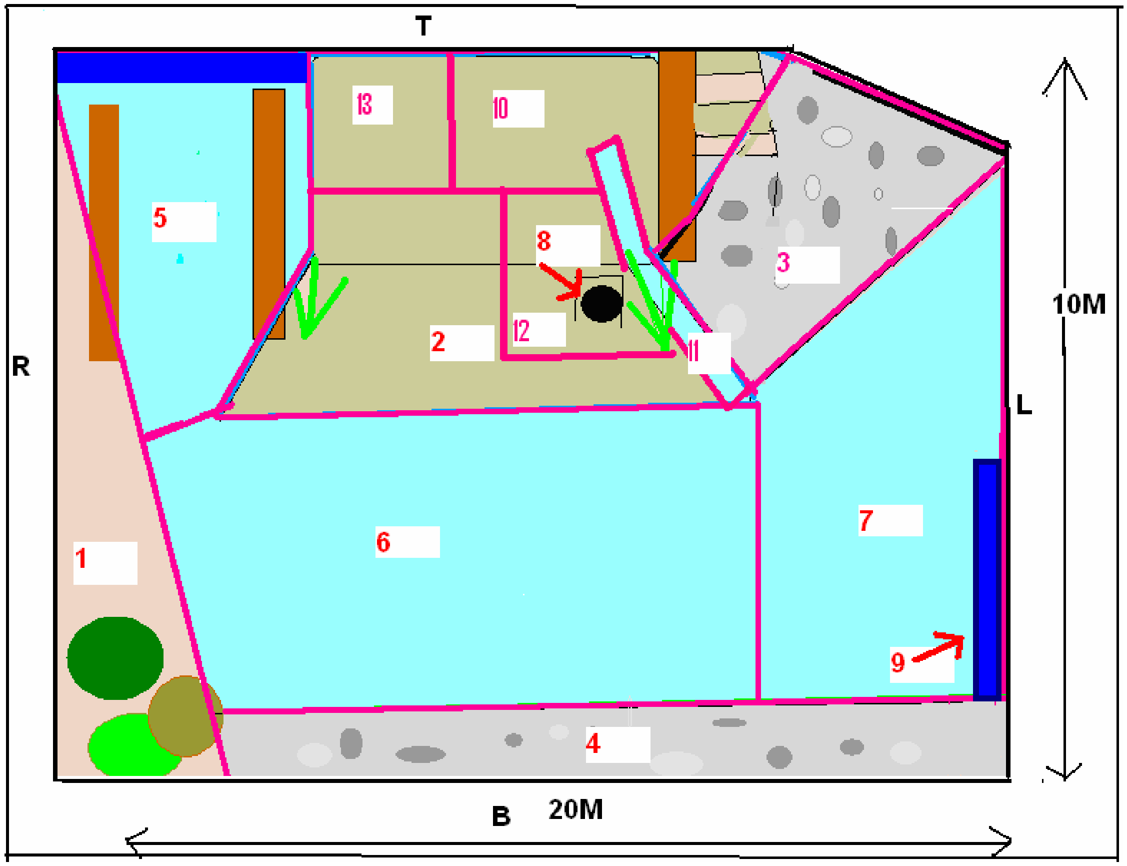

Figure 1: Map of enclosure

Study subjects

There were three adult Asian short-claws, five juveniles and five pups. The pups were five weeks old when the study began and therefore were not included in the study because they spent most of their time in the burrow and were not independent of their mother Mia, who was lactating during the study. The eight remaining otters were observed.

Table 1: Details of the group of otters used in the study

ID	Sex	ID code	Age (years)	Distinguishing marks	Relationship to group members
Mike	Male	1	13	Darker pelage	Father of Ollie and 5 juveniles
Mia	Female	2	6	More white on throat and pink spot above mouth (lactating)	Mother of Ollie and 5 juveniles
Ollie	Male	3	3	Larger and appeared slightly overweight in comparison to the other otters	Son of Mike and Mia, older brother of juveniles
Juvenile 1	Male	4	1	Lighter pelage	Offspring of Mike and Mia
Juvenile 2	Male	51	1		Offspring of Mike and Mia
Juvenile 3	Male	52	1		Offspring of Mike and Mia
Juvenile 4	Male	53	1		Offspring of Mike and Mia
Juvenile 5	Female	54	1		Offspring of Mike and Mia

Begging' definitions

Steen et al. (1995) referred to begging as a stereotypical movement. However the 'begging' observed in this study group was not an invariant functionless behaviour and it was not strictly repetitive. Therefore for the purpose of clarification, in this study the broad term 'begging' has been replaced with the term 'feeding anticipation behaviour', which has then been graded on 3 levels: scan, FA1 and FA2 (refer to table 2 for operational definitions).

Research design

The method is based on a study by Repp et al. (1988) in which stereotypic and self injurious behaviour in humans were treated based on hypotheses about their cause. A baseline was used to formulate hypotheses and two groups were treated based on alternative hypotheses. The cause could then be determined by the response of the groups to treatment. For the purposes of this study both treatments were applied to the same group of otters due to lack of availability of two comparable groups. To reduce the confounding effect of applying one treatment after another, two days were left between treatments to allow behaviour to return to baseline. The experiment was split into three experimental conditions. In Condition 1 the normal husbandry regime was observed to provide baseline data. In Conditions 2 and 3 the feeding regime was manipulated based on two alternative hypotheses; Details of experimental conditions in table 3. Lombardi (2002) argues that it is important to look at how other zoos manage the husbandry. Therefore questionnaires were sent out to zoos housing Asian otters requesting information regarding feeding regime

Table 2: Operational definitions of behaviour

Behaviour	Description
Begging behaviour	Behaviour concerned with looking for food
Scan	Sitting or standing scanning the perimeter of the enclosure in the direction from which food arrives. The lowest intensity begging behaviour
FA1	1m or less from the enclosure wall looking in the direction from which food arrives. The otter may be vocalising at intensity level 1 or 2
FA2	1m or less from the enclosure wall standing in an upright posture straining to see outside the enclosure in the direction from which food arrives. The otter may also be vocalising at intensity 1 or 2
Other behaviour	
Feed	Consumption of food item
Pebble roll	Rolling a pebble between paws or down a slope
Pebble roll hand to mouth	Standing in an upright posture, extending front paw with pebble in, then bringing the paw back towards the body and placing the pebble in the mouth, then repeating the sequence .
Vocalisation 1	A short high pitched tone
Vocalisation2	A high pitched screech that lasts more than 5 seconds
Vocalisation3	A grunt or snort

Data collection and analysis

Group scans were conducted every fifteen minutes on the instant between 8am and 5pm. For each experimental condition 180 scans were taken over 45 hours of observations. The ID, nearest neighbour, nearest neighbour distance, body orientation, behaviour and vocalisation were noted down for every otter. Visitor numbers and weather conditions were also taken in every scan, as well as any other relevant details such as keeper presence or disturbances.

SPSS was used to analyze the data; non-parametric statistics were used because of the relatively small sample size and because the data were not normally distributed. Friedman and Wilcoxon matched pairs tests were used to determine significant differences between conditions for the group because the data was related. Appropriate graphs were then produced to demonstrate significant trends using SPSS and Excel (Hawkins, 2005). A critical significance level of P=0.05 was used.

Table 3: Experimental Conditions implemented in the study

Condition	Description
(1) Baseline	The otters were observed under normal feeding conditions 08:00-17:00 for five days as a control for subsequent conditions. Baseline feeding conditions (per otter per day): Approx 8am : 4 x day old chicks Approx 12pm: 3 x day old chicks Approx 2 pm: 2 x day old chicks Approx: 4.30pm: 4 x day old chicks The chicks were occasionally substituted for mice and the feeds were thrown around the enclosure for the otters to find. The otters were fed boiled eggs in addition to their daily meals, once per week. Food (g) per otter per day: 384 % estimated body weight: 12.5%
(2) Stimulation	Baseline feeding condition (see above) +15g of meal worms (*tenebrio molitor)* and crickets (*acheta domestica)* thrown into different areas of the enclosure on a random basis every hour to stimulate appetitive foraging behaviour between 08:00-17:00 for five days. The crickets and mealworms were chosen to stimulate foraging behaviour. They additional nutrients and energy were negligible and therefore wont confound the results of condition 2 Food (g) per otter per day: 399 % estimated body weight: 12.8%
(3) Feeding regime manipulation	The otters were fed once an hour between 08.00-17.00 for five days and the mass of food provided was increased to 20% of their body weight. 08.30 & 16.30: 3 x chicks per otter 9.30,10.30, 11.30, 13.30, 15.30:1x chick per otter 12.30 & 14.30 2 x chick per otter Food (g) per otter per day: 600 % estimated body weight: 20%

RESULTS

Activity Budgets

The group data was collated for each stage and the mean percentage of group scans between 8am and 5pm calculated for each behaviour for the group. The results indicate that there were significant differences in time budget between experimental conditions.

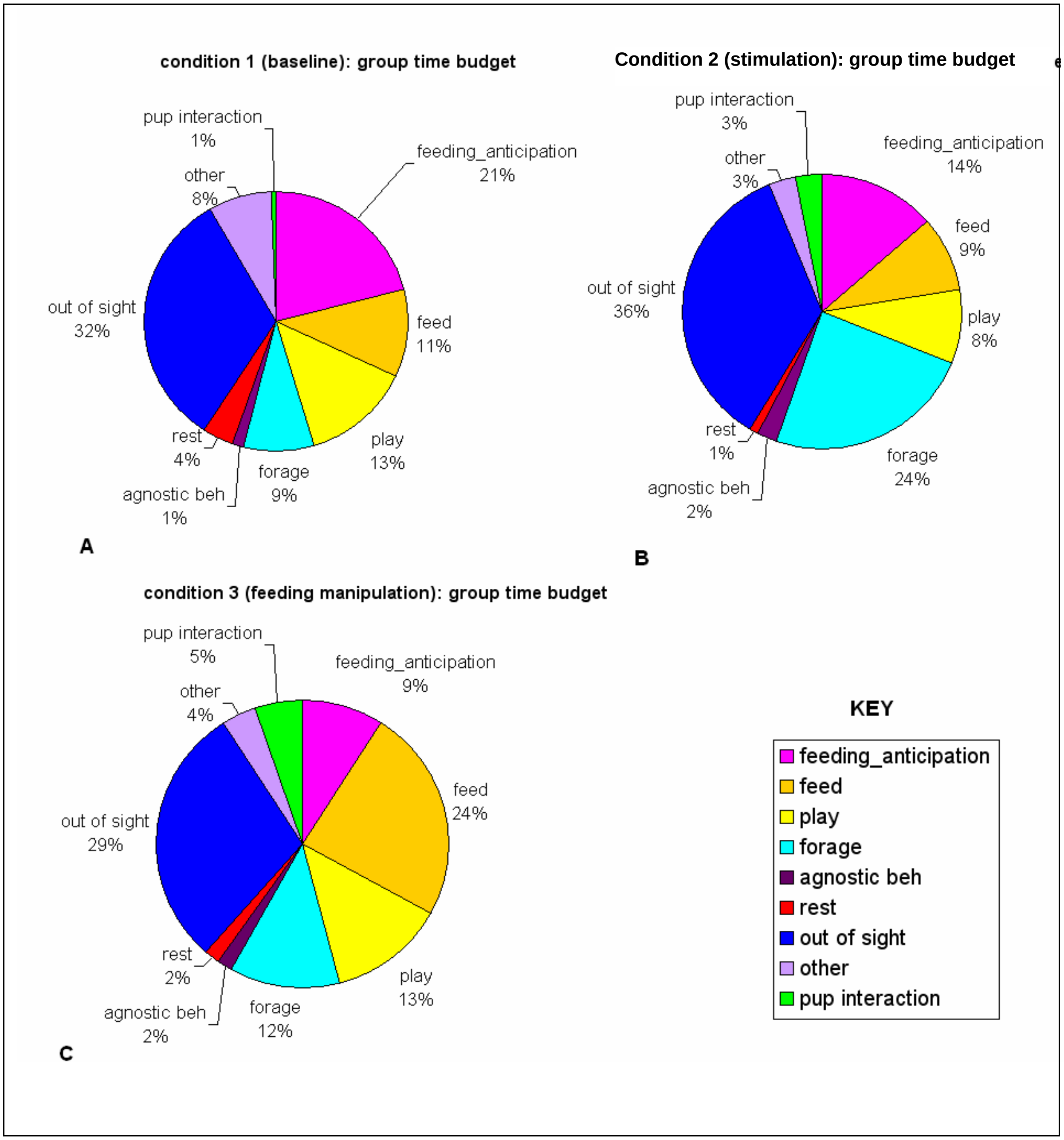

Figure 2. A) Percentage of group scans in Condition 1 in which each behaviour was observed B) Percentage of group scans in Condition 2 in which each behaviour was observed C) Percentage of group scans in Condition 2 in which each behaviour was observed

The percentage of group scans in which any feeding anticipation was recorded declined significantly from 21% in Condition 1 (baseline) to 14% in Condition 2 (Wilcoxon, Z=2.366, N=8, *P*=0.016) (Figure 2). Feeding anticipation declined further to 9% in Condition 3, this was significantly less than that in both Conditions1 and 2 (FA: con 1 and 3, Wilcoxon, Z=2.383, N=8, *P*=0.017) (FA: con 2 and 3, Wilcoxon, Z=2.383, N=8, *P*=0.035).

The mean percentage of group scans in which foraging behaviour was recorded increased significantly from 9% in Condition 1 to 24% in Condition 2 (Foraging Con1 and 2: Wilcoxon Z=2.524, N=8, *P*=0.012) (Figure 2). Foraging behaviour then decreased to 12% in Condition 3, which was significantly less than in Condition 2 (Foraging Con2 &3: Wilcoxon, Z=2.521, N=8, *P*=0.012). However there was significantly more foraging in Condition 3 than in Condition 1(Foraging Con1 and 3: Wilcoxon, Z=2.521, N =8, *P*=0.012).

Effect of experimental condition on feeding anticipation behaviour

The mean percentage of group scans in which the group was displaying scanning behaviour was significantly less in both Conditions 2 and 3 compared to Condition 1 (Scanning Con 1 and 2: Wilcoxon, Z=2.383, N=8, *P*=0.03)(Scanning Con 1 and 3: Wilcoxon, Z=2.243, N=8, *P*=0.025) (Figure 3). There was not a significant difference between Conditions 2 and 3 (Scanning Con2 and 3: Wilcoxon, Z=0.690, N=8, *P*=0.490).
Mean FA1 increased slightly from Condition 1 to Condition 2 but this was not statistically significant (FA1 Con1 and 2: Wilcoxon, Z=1.778, N=8, *P*=0.075) (Figure 3). FA1 was significantly lower in Condition 3 than both Condition 1 and 2 (FA1 Con 1 and 3: Wilcoxon Z=2.380, N=8, *P*=0.017) (FA1 Con 2 and 3: Wilcoxon, Z=2.103, N=8, *P*=0.035).
Mean FA2 decreased from 7.5% of scans in Condition 1 to 4.4% in Condition 2 and decreased further to 2.7% in Condition 3 (Figure 3). These differences were statistically significant between all conditions (FA2 Con 1 and 2: Wilcoxon, Z=2.527, N=8, *P*=0.012) (FA2 Con 1 and 3: Wilcoxon, Z= 2.524, N=8, *P*=0.012) (FA2 Con 2 and 3: Wilcoxon, Z=2.226, N=8, *P*=0.026).

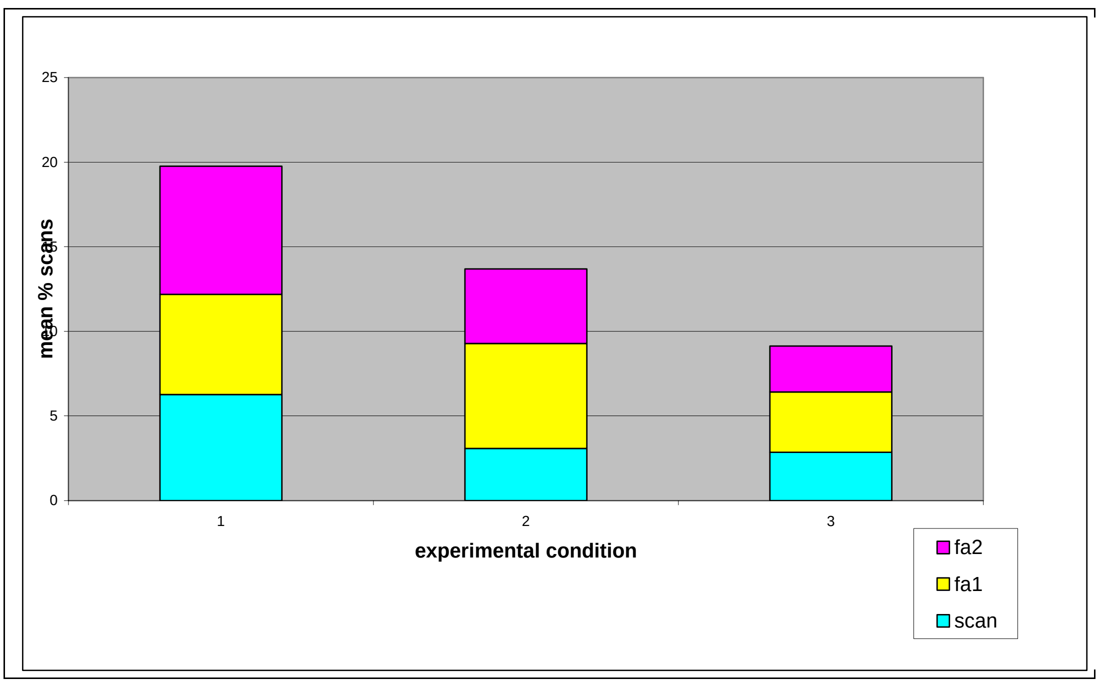

Figure 3. A graph to show the trend in each feeding anticipation intensity and the overall trend for feeding anticipation behaviour as a whole for the group. Standard deviation values in Table 4.

Table 4. Feeding anticipation (STD)

	Standard deviation		
	condition1	condition2	condition3
scan	3.02	4.44	5.04
fa1	3.04	1.54	4.15
fa2	2.03	2.8	1.55

Effect of visitor density on feeding anticipation

Feeding anticipation behaviour differed slightly between different numbers of visitors, the highest density visitor group does have the highest feeding anticipation, and however the second largest group had the lowest mean % scans in which the otters were displaying feeding anticipation (Figure 4). There was no significant difference between visitor numbers and the mean % scans in which feeding anticipation was present (Friedman: χ^2=5.438, df=4, *P*=0.245).

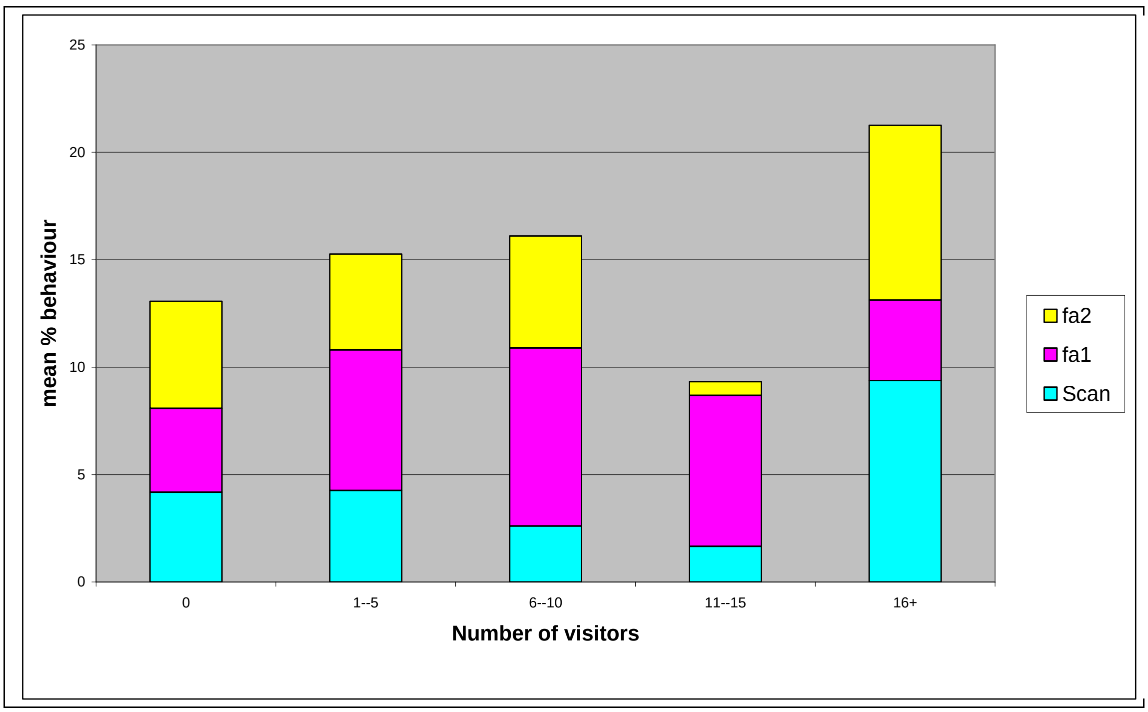

Figure 4. Mean % feeding anticipation behaviour in relation to the number of visitors

Effect of the presence of a keeper on feeding anticipation behaviour

Feeding anticipation behaviour was slightly greater when no keepers were in sight (Figure 5). However this was not statistically significant (Wilcoxon signed ranks, Z=-0.140, N=8, *P*=0.889).

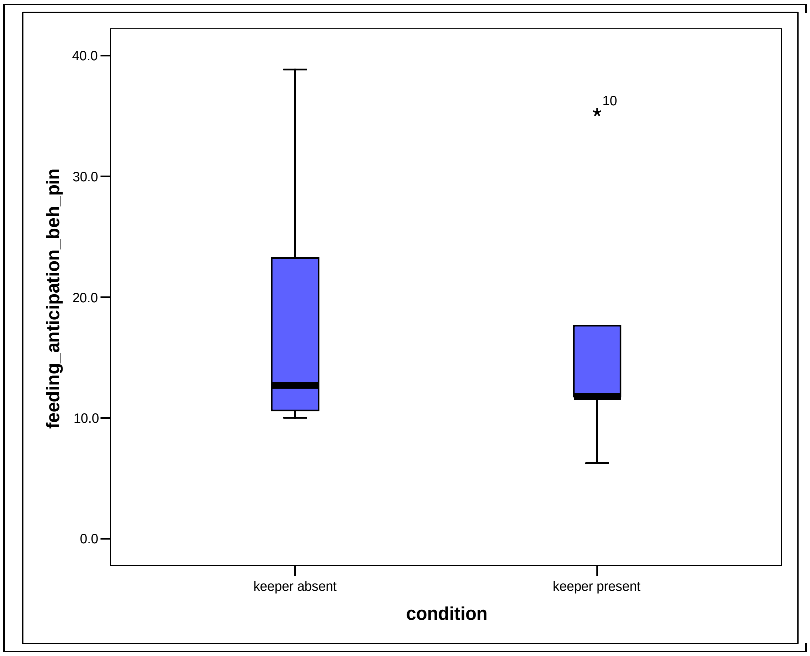

Figure 5*. Effect of the presence of keepers on mean % of scans in which feeding anticipation behaviour was present

* The data used for keeper present excluded scans when the keeper was feeding the otters as it confounded the results because they were always feeding during feeding time and therefore would not be showing feeding anticipation.

Differences in feeding anticipation behaviour within the group

Feeding anticipation changed with experimental condition for each individual and highlight differences within the group (Fig. 6-8). There is variation within the group in Condition 1 (Figure 6). The adults (1-3) show significantly greater feeding anticipation behaviour than the juveniles (4-54) (FA Con1 Adults–Juveniles: Mann-Whitney, U=0.000, n 1:5 n 2:5, *P*=0.009). Mia (2) showed the greatest feeding anticipation behaviour. However there was not a significant difference within the adults or within the juveniles (FA Con1 ID 1-3**:** Kruskal-Wallis, χ^2 = 3.933, df = 2, P=0.140) (FA Con1, ID 4 -54**:** Kruskal- Wallis, χ^2 = 0.962, df = 4, *P*=0.916).

All individuals were anticipating food less in Condition 2 than Condition 1 (Figure 7) except for Mia (2) who still exhibited high feeding anticipation behaviour, which was significantly higher than the other adults (1 and 3) (Con2: ID: 2and 3:. Kruskall Wallis, χ^2=4.870, df = 1, *P*=0.027) (Con2: ID: 1 and 2: Kruskal-Wallis, χ^2=6.400, df=1, *P*=0.011). There was no significant difference between the two adult males (Con2: ID 1 and 3: Mann-Whitney U, U=6.500, n 1: 5 n 2: 5, *P*=0.202). The adults (1-3) showed significantly greater feeding anticipation behaviour than the juveniles (4-54) (Con2: adults – juv: Mann- Whitney U, U=0.000, n1.5 n1.5, *P*=0.009) There was no significant difference between juveniles (Con2: ID: 4 – 54**:** Kruskal-Wallis, χ^2=2.609, df=4, *P*=0.625).

Feeding anticipation behaviour was further reduced in condition 3 from conditions 1 and 2 for all individuals except Mia (2) (Figure 8). The juveniles showed the greatest overall reduction in feeding anticipation behaviour. The adults showed significantly greater feeding anticipation than the Juveniles (Con3: ID: adults and juv**:**. Mann- Whitney U, U=

0.000, n 1: 5 n 2: 5, *P*=0.009). There was a significant difference in feeding anticipation behaviour between all the adults in Condition 3 with Mia (2) demonstrating the greatest feeding anticipation followed by Ollie (3) and Mike (1) (Con3: ID: 1 and 2: Mann-Whitney U, U=0.0005, n 1: 5 n 2: 5, *P*=0.008) (Con3: ID: 1 and 3: Mann- Whitney U, U=3.000, n 1: 5 n 2: 5. *P*=0.04) (Con3: ID: 2 and 3: Mann- Whitney U, U=0.000, n 1: 5 n 2: 5, *P*=0.008). There was no significant difference between the juveniles (Con3: ID: 4 – 54: Kruskal- Wallis, χ^2=2.935, df=4, *P*=0.56).

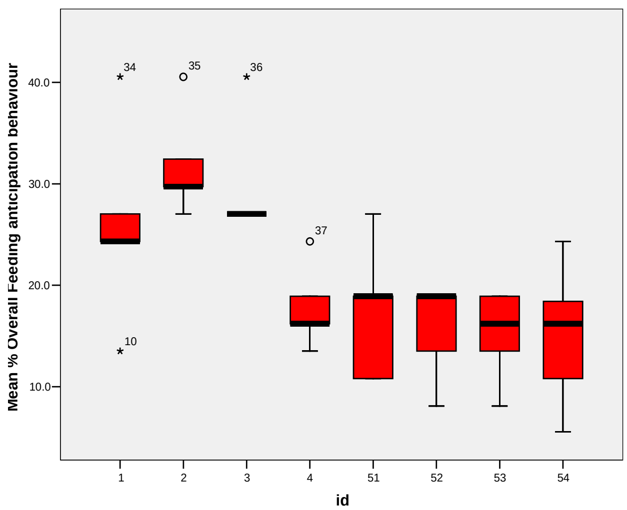

Figure 6. Condition 1 – Difference between the otters in the % of scans in which feeding anticipation behaviour was observed

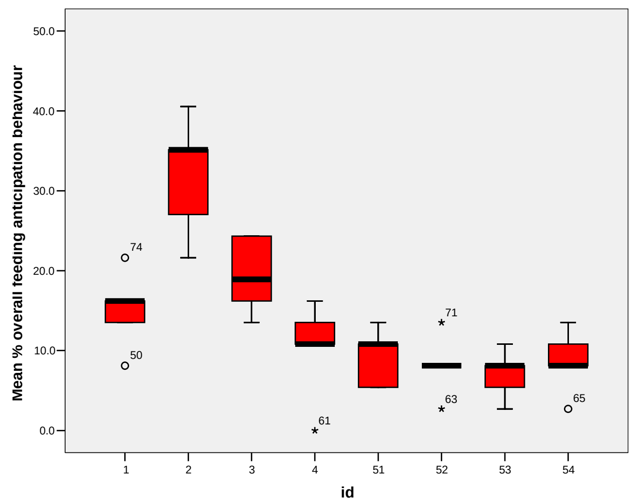

Figure 7. Condition 2 – Difference between the otters in the % of scans in which feeding anticipation behaviour was observed

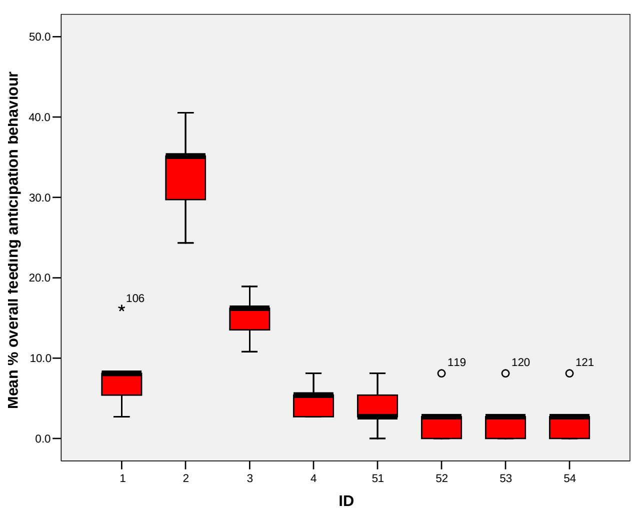

Figure 8. Condition 3 – Difference between the otters in the % of scans in which feeding anticipation behaviour was observed

Vocalisations

Effect of experimental condition on vocalisation 1

The mean percentage of group scans in which the group were vocalising at intensity 1 in all three conditions. Vocalisation 1 decreased in Conditions 2 further in Condition 3. There was a significant difference between Condition 1 and 2 but not between Condition 1 and 3 and Conditions 2 and 3 (V1: Con 1 and 2: Wilcoxon, *Z*=2.383, N=8, *P*=0.017) (V1: Con 1 and 3: Wilcoxon, Z=1.183, N = 8, P= 0.237) (V1: Con 2 and 3: Wilcoxon, Z=1.402, N=8, *P*=0.161).

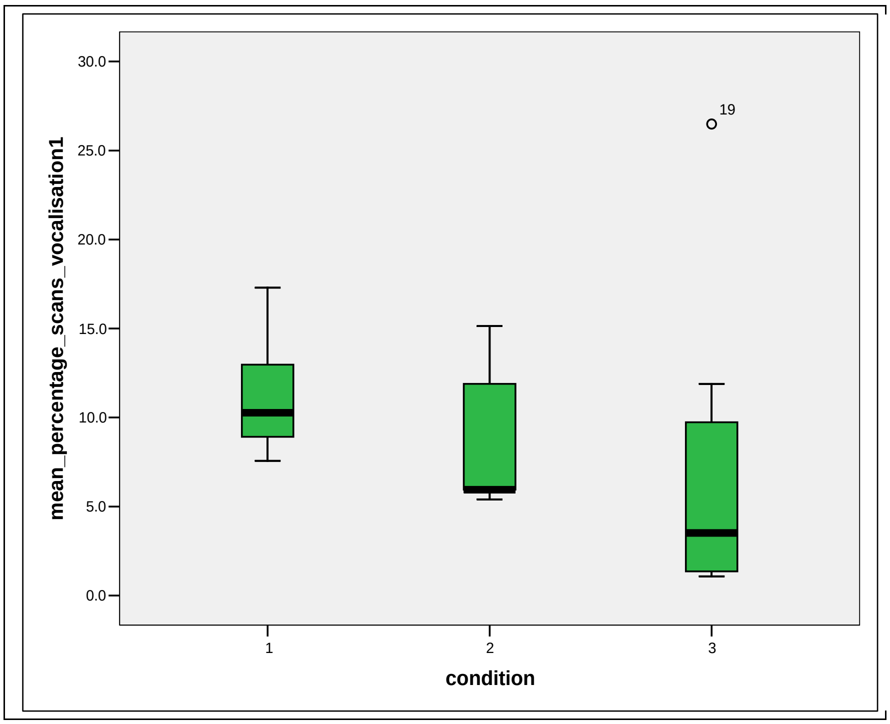

Figure 9. Mean % of scans in which the group was vocalising at intensity 1 during each experimental condition

Effect of experimental condition on vocalisation 2

The mean percentage of group scans in which the group were vocalising at intensity 2 in the three conditions. The mean percentage of group scans in which vocalisation 2 was recorded decreased in Conditions 2 and 3 from Condition 1. There was a significant difference between Condition 1 and 2 and Condition 1 and 3 but not between Conditions 2 and 3 (V2: Con 1 and 2: Wilcoxon, Z=2.383, N=8, *P*=0.017) (V2: Con 1 and 3: Wilcoxon, *Z*=2.243, N=8, *P*=0.025) (V2: Con 2 and 3: Wilcoxon, Z=0.690, N=8, *P*=0.490).

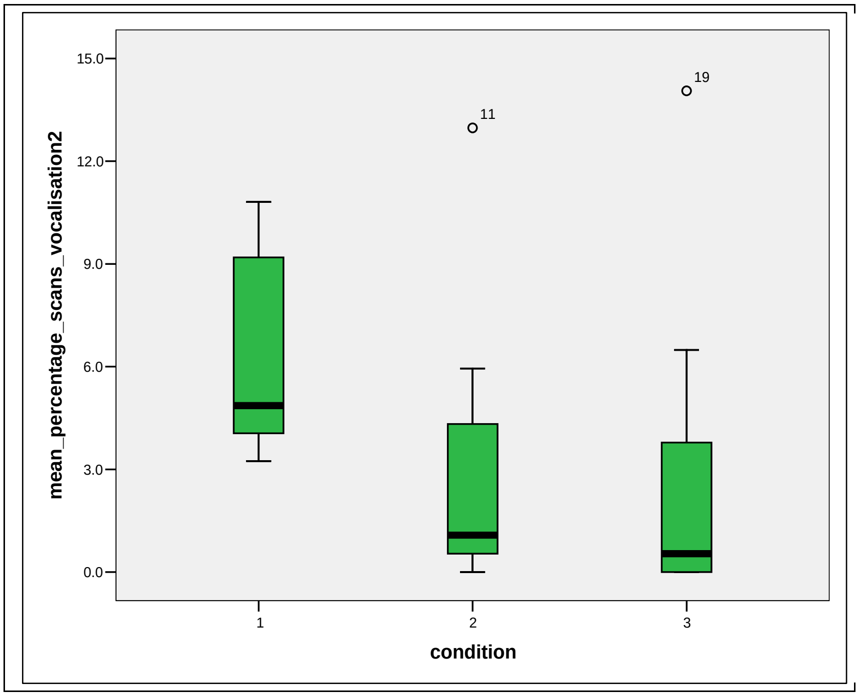

Figure 10. Mean % of scans in which the group was vocalising at intensity 2 during each experimental condition

Zoo Questionnaire

Out of seven zoos the quantity and type of food provided was similar across all institutions, although 'begging' was observed to some extent in all of them (Table 5). The nutritional content of the 3 main foods eaten by the study otters was adequate according to guidelines by Lombardi (2002) (Table 6).

DISCUSSION

Feeding anticipation behaviour 'begging'

Experimental condition

From the results in Figures 2 and 3; Condition 3 had the greatest effect on reducing feeding anticipation behaviour. This supports hypothesis two (hunger is the proximate cause of 'begging' behaviour). However Condition 2, although less than Condition 3 also reduced feeding anticipation behaviour significantly from the baseline. Therefore hypothesis one (lack of stimulation and opportunities to carry out the appetitive part of feeding behaviour) cannot be ruled out as a contributing factor towards the motivation behind 'begging' behaviour. This may have been further confounded by the fact that Condition 3 was implemented after Condition 2 and the possibility exists that Condition 2 had an overall motivating effect on the otters behaviour and therefore will have contributed to the reduction in 'begging' in Condition 3.

Table 5. Quantities of food fed to Asian otters and 'begging' information for zoos

Zoo	Average daily feeding regime (per otter)	Food mass (g) Per otter	# Feeds per day	Beg 30 mins before feed?	Beg at other times of day?	Types of food
1	Morning: 4 chicks Noon: 2 chicks 2pm: 2 chicks Evening:4 chicks	384g	4	YES	YES up to 2 hours before a feed	day old chicks; mice horse meat; egg
2	Morning: 2 chicks Late morning: fruit Afternoon: 400g fish	464g	3	YES	When they see keeper	day old chicks; sprats herring ;egg ; fruit
3	Morning: 4 sprats or 2 chicks Afternoon:4 sprats or 2 chicks Evening: Alternate between chicken leg, rabbit leg and hamsters	300g	3	YES	YES up to two hours before a feed	Sprats:Day old chicks Rabbit:Hamster: Chicken
4	Morning: 1 chick Evening: 1 chick + pieces of meat	100g	2 + Occasional treats	YES	YES up to two hours before a feed (especially when they see a keeper	day old chicks: Trout Minced heart:, liver, carrot : cod liver oil peanuts:
5	Morning: 1 mackeral or trout Evening: 1 mackeral or trout Scatter feeds of rats, mice, peanuts, insects, egg, crab claws	460g	2 feeds + 1-4 scatter feeds	YES	YES	mackerel trout mice rats crab claw egg
6	Various protein inc 3 chicks given morning and evening	453g	2 feeds winter 3 summer	YES	NO	egg; lobster crayfish; day old chicks
7	Early morning 11.30 public feed Evening feed (morning and evening no set time) 4 chicks ¼ chicken carcass per day	300g	3 feeds	YES for the public feed	Only when the keeper is seen	horsemeat sprat chicken day old chicks

Table 6. Recommended nutrients for otters compared with three common foods

Item	Target nutrient ranges*	Day old chick**	1 mouse**	Horsemeat**
Crude Protein %	24- 32.5	67.9	58.3	71
Fat %	15- 30	16.8	23.9	20.9
Calcium %	0.6-0.8	1.7	3.4	0.07
Phosphorus%	0.6	0.9	1.8	0.5
Mass (g)	NA	34.3	27.6	NA

* Maslanka et al. (2002)
** Allen et al. (1997)

Visitor density

Visitor density and intensity have been found to affect the behaviour of zoo animals (Foster-Turley, 1982; Marguilis et al., 2003; Sellinger; 2005; Hosey and Druck, 1987; Chamove, 1988). Therefore the number of visitors was recorded during every scan to measure the effect of this possible confounding variable. The results showed that there was no significant difference in feeding anticipation between visitor densities ranging from 0 to 16+ (Figure 4). This suggests that visitors had no effect on feeding anticipation behaviour therefore they were not a confounding variable. From ad libitum observations I noticed that the otters largely ignored the visitors, often trying to see past them to the path where food arrived from. The only visitors that they 'begged' directly from were wearing blue shirts in the same shade as that worn by the keepers. This contradicts findings by Owen (2004) who found that Asian otters only 'begged' in the presence of people. Research into the intensity of visitor interactions on Asian otter 'begging' behaviour may be an avenue of further study.

Keeper presence

It was felt that keeper presence may confound the results of the study. Therefore when the keepers were present during a group scan it was recorded along with the nature of their visit. The results showed that there was no significant difference in feeding anticipation behaviour between scans when the keeper was present and absent (Figure 5). This result was initially surprising as it appeared that the otters would nearly always 'beg' from keepers. The result may have been because the majority of instants where the keepers were present, they were carrying out maintenance on the enclosure and the otters were more curious as to what the keeper was doing rather than begging for food. They may have also picked up on the cue that when the keeper is in the enclosure they are not going to be fed, as they were always fed from the outside, therefore they could relax knowing that they would not be fed. This provides tentative support for the proposal by Waitt et al. (2001) that reliable cues as to when feeding will and will not occur allows animals to relax and engage in non anticipatory activities.

Difference in feeding anticipation behaviour within the group

The results of differences within the group showed that in every condition the adults showed significantly higher levels of feeding anticipation behaviour than the juveniles. This lends support to hypothesis one (lack of stimulation). Abnormal behaviour caused by captive environment is often more difficult to reduce in adults even when the environment becomes enriched because the behaviour pattern is more fixed (Wemelsfelder, 1993). However Mia (2) consistently 'begged' more than all the other otters and showed the least reduction in feeding anticipation behaviour. She was lactating to provide milk for a litter of five during the study and therefore her energy requirements would have been the greatest. Even in Condition 3 when the otters were fed 20% of their body weight based on the amount they eat in the wild, this did not account for Mia's lactation needs and therefore it is plausible that she was still hungry. The fact that Mia did not improve and ‘begged’ significantly more than the other adults in Conditions 2 and 3 supports hypothesis two (hunger).

Vocalisations

Vocalisations often accompanied feeding anticipation, particularly vocalisations 1 and 2. Vocalisation 1 was less shrill and lasted for a shorted duration than vocalisation 2 and was more often associated with less intense feeding anticipation behaviours. There was a significant reduction between Condition 1 (baseline) and the two experimental conditions for both vocalisations but not between Conditions 2 and 3. The fact that there is not a significant difference between Conditions 2 and 3 in vocalising did not lend support to either hypothesis over the other. The fact that there was a significant difference between baseline and both experimental conditions suggests that feeding anticipation may be due to both hunger and lack of stimulation.

Time budget

The group data was collated for each stage to produce graphs on time budgets to help to determine if behavioural diversity increased and if abnormal behaviour and inactive behaviours were reduced (Figure 2). The results show that abnormal behaviour and rest declined significantly and foraging significantly increased in Condition 2 when stimulation in the form of foraging for live insects was introduced. This supports hypothesis one (lack of stimulation and of opportunity to engage in appetitive behaviour; result: ‘begging’ behaviour). However, play behaviour decreased and instances of ‘out of sights’, where the animals were in the burrow, usually resting, increased. This provides evidence in favour of hypothesis two because the increase in out of sights suggests a greater need to rest possibly due to the energetic demands of the extra foraging opportunity. The decline in play behaviour adds extra weight to this argument because play behaviour can be an indicator of nutritional status. For example, studies by Barrett et al. (1992) and Sommer and Mendoza Granados (1995) found that play behaviour was strongly correlated with habitat quality in monkeys. Good habitat quality leads to better nutritional status because the food is more plentiful and nutrient rich. Animals with better nutritional status play more because they can afford to engage in this luxury behaviour.

In Condition 3, play behaviour increased significantly from Condition 2 back to baseline levels. Foraging behaviour declined in Condition 3 although it was still significantly greater than in Condition 1. The fact that foraging behaviour did not decline to baseline levels in condition three might have been due to a residual motivating effect from Condition 2 or it could be interpreted as an increase in activity due to more energy from a more appropriate husbandry routine, therefore supporting both hypotheses. However percentage time resting and ‘out of sight’ (behaviours characterized by inactivity) were both significantly lower in Condition 3 than the other two Conditions, which supports hypothesis two (hunger) because they were engaged in more active behaviour as a result of receiving more energy in their diet despite the fact that there was little stimulation in their environment.

Feeding time

I was unable to analyze the correlation between feeding time and feeding anticipation behaviour because the feeding times were too varied in Conditions 1 and 2 for a particular time of day to be positively correlated with feeding anticipation. This inadvertently led to a possible explanation as to why they 'begged' so frequently and for such long periods of time. They were routinely fed four meals a day, however on two out of ten occasions the afternoon feed was recorded as missed. Furthermore on five out of twenty feeds the keeper had presumably fed the otters before observations began in the morning or after they finished in the evening creating the possibility of other missed feeds. The morning feed was recorded to occur at times between 8.00-10.00, the lunchtime feed between 10.00 -12.30, the afternoon 12.30-14.30 and the evening 16.15 - 16.45. This meant that there was the possibility that the otters might be fed in 7 out of 9 hours of observation during the day. The schedule might have been too unpredictable for Asian otters to rely on cues informing them when feeding would definitely not occur and therefore they were in a constant state of alert, unable to relax. This theory is supported by Waitt (2001) who argues that animals pick up on external cues to reliably predict feeding time and these cues cause the change in behaviour prior to feeding. The safety-signal hypothesis suggests that reliably signalling to an animal prior to delivering food allows the animal to predict when not to anticipate the event allowing the animal to relax during times that it knows it will not be fed. Unreliable signals and unpredictable feeding times result in the animal anticipating the delivery of the stimuli which may or may not be forthcoming causing frustration. Waitt (2001) concludes that if animals had a clear distinct and reliable signal that informed them about the event, then pre-feeding behaviours might not occur. This is an interesting area for a long-term study; It would be interesting to determine how feeding the otters on a truly predictable schedule with reliable pre-feeding cues over a long period of time would affect their feeding anticipation behaviour.

Mia: Adult female

Mia the alpha female in the group was lactating during the study and unique in much of her behaviour. She typically 'begged' for longer periods and more intensely than the other otters and her play was characterized entirely by pebble rolling. She also performed a type of pebble rolling behaviour that was unique to her in the group. She would pick up pebbles and extend her paw towards the perimeter of the enclosure and then pull it back placing the pebble in her mouth repeating the sequence often for prolonged periods of time. The behaviour looked very analogous to human 'begging' and may have been reinforced by the public who thought she was 'begging' for food creating an association between the behaviour and acquiring food. However, no visitors were observed feeding the otters during the study. The correlation between feeding time and frequency of pebble rolling could not be analyzed because of the great variation in feeding time. However from ad libitum observations the behaviour increased in intensity the longer the period without food has been. The behaviour may be a form of coping with the stress or an expression of frustration about lack of control over feeding opportunities and therefore a welfare concern. Further study is required to establish the cause of this behaviour and if indeed it is a form of oral stereotypy.

Zoo Questionnaire

In seven zoos the quantity and type of food provided was similar across all institutions, although begging was observed to some extent in all of them indicating that it's possible that they all underfeed their otters (Table 5). The nutritional content of the 3 main foods eaten by the study otters was adequate according to guidelines by Lombardi (2002) (Table 6). However there are no formal guidelines on the quantity of food to feed otters, therefore they may not be receiving enough to provide the quantity of nutrients needed, which may in turn lead them to beg for food.

Limitations of the study

The adult female was lactating during the study which may mean that feeding anticipation levels were higher than in times of less physiological stress. All three conditions were studied on the same group of otters, possibly making the results dependent on each other. However it is very difficult to find groups that are similar in enough respects to do a comparative study without further factors confounding the results. The relatively small sample size of eight otters makes it difficult to generalize about all Asian otters in captive environments, therefore reducing the application of the findings to the study zoo. The study is also limited by its short-term nature. Ideally it would run over several months to determine the long term effect of each condition and prior to the study an investigation into the efficiency of digestion of the different food items fed to the otters would have occurred. It may be that they digest certain food items badly and therefore are hungrier on the days they are fed them. However this was not possible because of time constraint.

CONCLUSIONS

In conclusion, I get the impression from the results that Hypothesis 2, hunger, is the major proximate cause of 'begging' behaviour. However boredom as a result of lack of stimulation and opportunity to perform the appetitive components of feeding was also a major factor. Foraging enrichment could help alleviate 'begging' behaviour by providing a distraction and giving the animal a sense of control over the environment. Thus reducing the frustration associated with captive feeding. This will only be effective if hunger levels are not too high. In the case of Mia hunger levels definitely have been too high. The inconsistency in feeding times may have also contributed to the extent of the feeding anticipation behaviour although this needs further study.

RECOMMENDATIONS

1. Feed otters on a highly predictable schedule with reliable pre-feeding cues. This will allow the otters to relax and engage in non feeding activities when they are not being fed and reduce the frustration associated with captive feeding.
2. Provide otters with enrichment that stimulates natural foraging/hunting behaviour. This will allow them to exert control over the environment and satisfy their behavioural need to forage.
3. There is an increased need for energy during lactation and this should be taken into account when feeding lactating females.
4. Asian otters should be fed 20% of their body weight per day. Preferably in small frequent amounts to more closely match their natural foraging ecology and the functional anatomy of their digestive tracts, which digest and defecate food within one hour of ingestion.

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Résumé: Quelle Est La Cause Proximale Du Comportement De Mendicite Observe Chez Un Groupe De Loutres Cendrees Captives ?
Le but de cette étude fut d'établir la cause proximale du comportement de "mendicité" observé chez un groupe de Loutres cendrées (*Aonyx cinereus*). Deux hypothèses alternatives furent testées par des modifications des conditions de vie en captivité, au cours de trois situations expérimentales. La première situation servit de témoin. La situation 2 consista à fournir des repas à base de vers de farine et de crickets toute les heures, afin de stimuler un comportement naturel de chasse et de recherche de nourriture et d'atténuer l'ennui. Dans la situation 3, l'apport de nourriture fut augmenté d'une quantité égale à 7,5 % du poids des loutres et elles furent nourries toutes les heures afin de davantage simuler leur écologie alimentaire naturelle. Les résultats montrent que les situations 2 et 3 toutes deux réduisirent le

comportement de "mendicité", cependant la diminution la plus importante fut observée pour la situation 3. Ceci montra que la principale cause du comportement de mendicité fut la faim, cependant, un manque de stimulation a aussi tendance à jouer un rôle. Une irrégularité dans les heures de nourrissage, semble également avoir contribué au problème de mendicité, mais une étude à long terme est nécessaire afin de déterminer l'importance de ce facteur. Certaines modifications des conditions de maintien en captivité et de l'alimentation furent recommandées.

Resumen: ¿Cual Es La Causa Inmediata Del Comportamiento De Mendigueo En Un Grupo En Cautiverio De Nutrias De Río Asiáticas De Garras Cortas?
Este estudio se orientó a la identificación de las causas inmediatas del comportamiento de 'mendigueo' en un grupo en cautiverio de nutrias de río asiáticas de garras cortas (Aonyx cinereus). Dos hipótesis alternativas fueron testeadas mediante la manipulación de aspectos de la producción en tres condiciones experimentales. La condición 1 sirvió como control. En la condición 2 gusanos y grillos se ofrecieron cada una hora para estimular el comportamiento de forrajeo y caza, y disminuir el aburrimiento. En condición 3 la ración de alimento se aumentó a un 7,5% de la masa corporal de las nutrias, las que fueron alimentadas cada una hora para representar con más exactitud su ecología natural de forrajeo. Los resultados muestran que Condiciones 2 y 3 redujeron el comportamiento de 'mendigueo', con la reducción más significativa en la Condición 3. Esto indica que la mayor causa de comportamiento de 'mendigueo' fue el estado alimentario; sin embargo la falta de estímulo es otro factor que probablemente contribuye. Inconsistencia en los momentos de alimentación puede haber contribuido también a este comportamiento; sin embargo un estudio de mayor duración es necesario para determinar si la falta de estímulo es otro factor. Algunas recomendaciones para cambiar las características de la producción son mencionadas.

A R T I C L E

Dilian G. GEORGIEV

Department of Ecology and Environmental conservation,
University of Plovdiv,
Tzar Asen Str. 24, BG-4000 Plovdiv, Bulgaria
e-mail: diliangeorgiev@abv.bg

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ABSTRACT: Otter mortalities (n = 50) from Southern Bulgaria were analyzed. Among the mortality types, poaching was the most common cause of death recorded in this study (52% of all mortalities recorded), followed by road kill (10%) and drowning (8%). Killing of otters by dogs had the lowest impact (6%).
Most of the otter mortalities (40%) came from areas with fish-farming activities – micro-dams and fishponds. In the second place were the regions of the large dams with 18% of all otter mortalities. The other locations provided lesser numbers of otter deaths.

INTRODUCTION

The Eurasian otter (*Lutra lutra* L.) has been protected in Bulgaria by law since 1962. It has a relatively stable population and is widely distributed in the plains, but is scarce in the high mountains and in the steppe regions of the north-eastern part of the country (Spiridinov and Spassov, 1989; Georgiev, 2005). After a change of political regime in 1989, the number of otters increased from 800 - 1200 adult and subadult individuals in the period 1977-1989 (Spiridinov and Spassov, 1989) and 1000 – 1400 in 1989-1994 (Spiridinov and Mileva, 1994) to 2300 – 2400 calculated in 2006 (Georgiev and Koshev, 2006, unpublished). Spiridinov and Spassov (1989) recommend a study on the threats to otters in Bulgaria, and accordingly in this paper we represent some data on some otter mortalities, gathered in the south of the country.

MATERIALS AND METHODS

Data were gathered mainly during 2005 and 2006 from 34 locations in Southern Bulgaria (Figure 1). Otter mortalities were investigated by questioning various people: biologists, fish-farmers, hunters and others. When it was possible carcasses were collected and pictures were taken. Otter mortalities (n = 50) were divided into the following types: poaching (killed by guns or various traps), drowning (nets, fyke nets), road kill, killed by dogs, collection of specimens (possession of otters or their derivatives, e.g. pelts, with unknown cause of death), and unknown cause. Mortality locations were described as either: large river, medium sized river, lake, micro dams/fishponds, large dams, Black Sea, or unknown, as defined by Georgiev (2005).

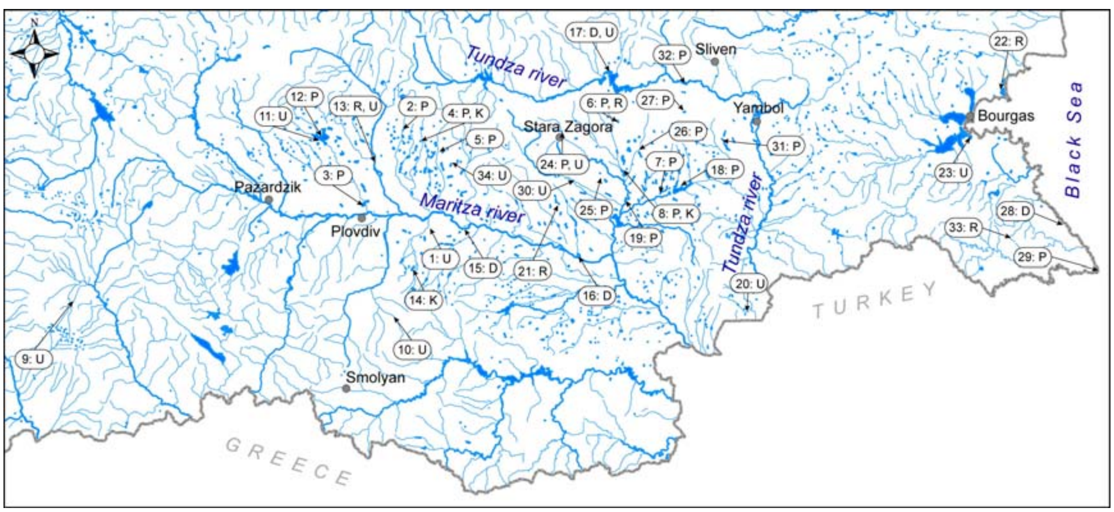

Figure 1. Location of the study site

Legend: **P-poaching, R-road kill, D-drowning, K-killing by dogs, U-unknown cause**

1. Pub in Popovitza village
2. Microdam near Otetz Paisievo village
3. Fish-farms in Plovdiv Town
4. Microdam near Zlatosel village
5. Medium sized river near Brezovo village
6. Microdam near Podslon village
7. Microdam near Kovachevo village
8. Microdam nearmi Daskal Atanasovo village
9. Pub in Bansko Town
10. Village of Belitza
11. Pub at Piasachnik Dam
12. Pyasachnik Dam
13. On the road and near a river, Rajevo Konare village,
14. Microdam near Konush village
15. Maritza River near Parvomay Town
16. Maritza River near Zlato Pole village
17. Jrebchevo Dam
18. Ovcharitza Dam
19. Microdam near Risimanovo village
20. River near Sladun village
21. On the road near Trakia village
22. Pomoriisko Lake
23. Poda Lake
24. Microdam and a pet shop in Stara Zagora Town
25. Two microdams near Trankovo village
26. River near Bogdanovo village
27. Microdam near Konyovo village
28. Black Sea near Tzarevo Town
29. Black Sea near Rezovo village
30. Pub in Streletz village
31. Microdam near Roza village
32. Tundza River near Zlati Voivoda village
33. On the road to Malko Tarnovo Town
34. Near village of Choba.

RESULTS

Types of otter mortalities

Poaching (Figure 2, 4) was the most common cause of death recorded in this study (n = 26; 52% of all mortalities recorded). The same problem exists in neighbouring Romania (Csaba and Attila, 2005), in contrast with data from western countries like Germany (Hauer et al., 2002) where the impact of poaching is very low.
Road kill (Figure2, 5) had a relatively low impact (n = 5; 10% of all mortalities), compared with western countries where it is the major cause of death, such as in Germany (Hauer et al., 2002), France (Lafontaine, 1993) and Great Britain (Kruuk and Conroy, 1991; Simpson, 1997; Chanin, 2003).
Drowning in fish-nets also had a low impact (n = 4; 8% of all mortalities) which is similar to data for Germany (Hauer et al., 2002) while in some regions of France it is a critical factor (Lode, 1993).

Killing by dogs had the lowest impact recorded (n = 3; 6% of all mortalities). A low percent of this mortality type was also reported for England (Simpson, 2002). 12% (n = 6) of the cases were of illegal possession of taxidermic specimens (Figure 7) or otter pelts; illegal killing can be assumed but is not proven. For an additional 12% (n = 6) the cause of death was entirely unknown (Figure 6).

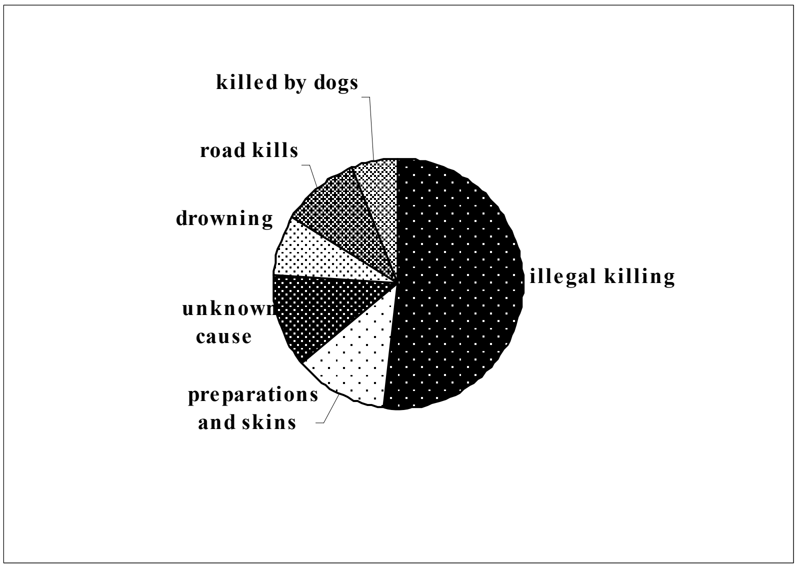

Figure 2. Causes of otter mortality recorded in southern Bulgaria, represented as a percent of occurrence.

Distribution of otter deaths by habitat type

See Figure 3
Micro-dams and fishponds: Most of the otter mortalities (n = 20; 40%) came from areas with fish-farming activities, where poaching is a constant non-controllable factor. Most of the otters killed were from the micro-dams used for fish-farming (38% of all mortalities, n = 19 and 57.7% of all illegal killings, n = 15). The mortalities recorded were: 16 individuals killed by poachers (32%), three killed by dogs (6%) and one road casualty (2%).
Large Dams came in second place with 18% (n = 9) of all otter mortalities. The cause of death of the individuals recorded were: one taxidermic specimen (2%), two from unknown causes (4%), one from drowning (2%), and five from poaching (10%).

Large Rivers: Two otters (4%) were killed by poachers and two were drowned in a fyke net, adding up to four dead otters (8%).
Medium-Sized Rivers: Two otters (4%) were killed illegally and two of the mortalities were from unknown causes. Total mortalities = 4 (8%).
Lakes: One road kill (2%) and one unknown cause of death. Total mortalities = 2 (4%).
Black Sea: One drowning (2%) and one illegally killed individual. Total mortalities = 2 (4%).
Unknown location: Five taxidermic specimens (10%), three road casualties (6%), one unknown cause of death (2%). Total mortalities = 9 (18%).

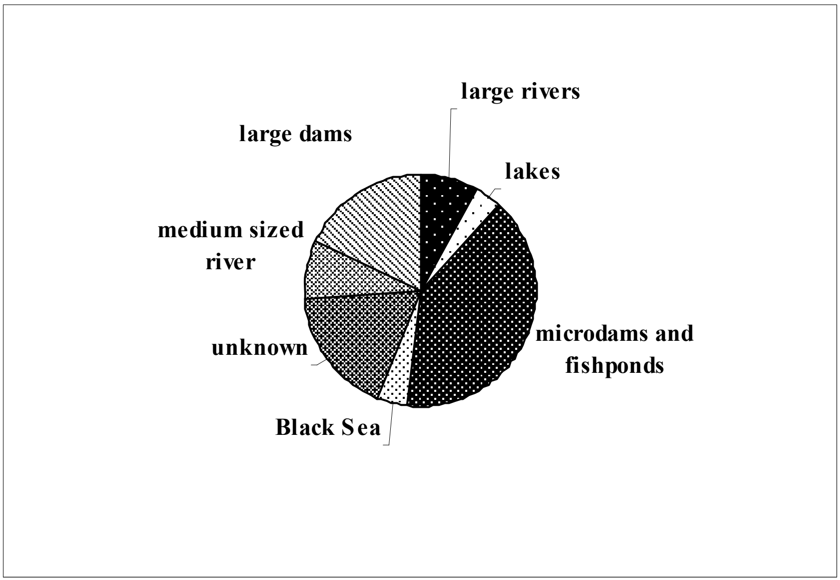

Figure 3. Distribution of otter mortalities between various habitats of southern Bulgaria.

Figure 4. An otter shot by poachers at a micro dam at Podslon village. Photo: D. Georgiev.

Figure 5. A road kill near Trakia village Photo: A. Mechev

Figure 6. Unknown cause of death: otter bones found near Ovcharitza Dam. Foto: D. Georgiev.

Figure 7. An otter preparation confiscated by the Regional Environmental Inspection in a pub in Popovitza village. Foto: D. Georgiev.

CONCLUSIONS AND RECOMMENDATIONS

The most significant cause of death recorded for the otter in southern Bulgaria was poaching as a consequence from present gaps in the national conservation policy. Accordingly, we recommend a control on the micro dam fish-farms by the Regional Environmental Inspections and a control of the illegal possession or sale of otters and their derivatives (e.g. pelts).

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RÉSUMÉ : MORTALITE DE LA LOUTRE D'EUROPE (LUTRA LUTRA L.) DANS LE SUD DE LA BULGARIE : UNE ETUDE DE CAS

La mortalité de la loutre (n=50) dans le sud de la Bulgarie fut analysée. Dans cette étude, le braconnage fut la cause principale de mortalité (52% des cas), suivi par les collisions routières (10%) et la noyade (8%). Les attaques par des chiens n'eurent qu'un impact mineur (6%).

La plupart des carcasses provinrent de secteurs à activité piscicole – micro barrages et étangs de pisciculture. En seconde position, vinrent les régions où se trouvent de grands barrages, avec 18 % des carcasses. Peu de carcasses provinrent des autres régions.

RESUMEN: ESTUDIO SOBRE LA MORTALIDAD DE LA NUTRIA DE RIO (LUTRA LUTRA L.) EN EL SUR DE BULGARIA

La mortalidad de la nutria de río (n=50) fue analizada en el sur de Bulgaria. Entre los diferentes tipos de mortalidad, las muertes debidas a cazadores furtivos fue la causa más común en este estudio (52%), seguida por muertes debidas a atropellamientos por vehículos (10%) y ahogadas (8%). Nutrias muertas como consecuencia de ataques de perros tuvo el impacto más bajo (6%).

La mayoría de las nutrias de río muertas provinieron de áreas con producción piscícola, pequeñas represas y estanques con peces. Áreas con estanques grandes tuvieron menos mortalidad con sólo un 18%. Otras áreas tuvieron menor número de nutrias de río muertas.

R E P O R T

SIGHTING OF AN INTERACTION BETWEEN A NEOTROPICAL OTTER, *Lontra longicaudis* AND A TEJU LIZARD, *Tupinambis merianae* IN A LAGOON ECOSYSTEM OF SOUTHERN BRAZIL

Marcos R. ROSSI-SANTOS

Instituto Baleia Jubarte. Avenida do Farol, s/n, CP 92, Praia do Forte, Mata de São João, Bahia, Brazil, CEP 48280-000. Phone/fax: 55 71 3676 1463. e-mail:marcos.rossi@baleiajubarte.com.br

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Abstract - Otters are opportunistic feeders in that they feed upon whatever available prey. Sightings of live otters in their natural environment are uncommon, mainly because otters are known to have shy habits, avoiding human presence. Despite the fact that reptiles are listed in the neotropical otter´s diet, they just constitute a small part of it. This paper aims to report an unusual sighting of interaction between a neotropical otter, *Lontra longicaudis*, and a Teju lizard, *Tupinambis merianae*, in a lagoon environment of southern Brazil, characterized as predation.

Keywords: ecology, neotropical otter, *Lontra longicaudis*, Lagoon ecosystem, Southern Brazil.

The neotropical otter, *Lontra longicaudis*, (Olfers, 1818) has a large distribution in Latin America, occurring in Central and South America and has its austral limit in northern Argentina (Chehebar, 1990). In Brazil, although there are records of the species' occurrence in coastal marine areas (Blacher, 1987; Alarcon and Simões-Lopes, 2003, 2004), it is a general belief that the sea is a transit area for the neotropical otter, which concentrates its feeding habits mostly in fresh water environments.

Otters are opportunistic feeders in that they feed upon whatever available prey, mostly reported on slower moving fish (Mason and Macdonald 1987; Taastrøm and Jacobsen, 1999) because of their vulnerability to predation.

Sightings of live otters in their natural environment are uncommon mainly because otters are known to have shy habits, avoiding human presence, hence the majority of ecological studies relying on indirect observation methods (Blacher, 1987; Passamani and Camargo, 1995, Quadros and Monteiro-Filho, 2001, Kasper et al., 2004), mainly by documenting their typical behavior of defecating at prominent places within their home ranges (eg. Beja 1991, Passamani and Camargo, 1995; Quadros and Monteiro-Filho, 2001). This paper aims to report an unusual sighting of interaction between a neotropical otter and a teju lizard in a lagoon environment of southern Brazil.

The Hydrographic Basin of Lagoa da Conceição is located on the east coast of Santa Catarina Island (27º27S, 48º22'W), covering an area of 116.78 Km² (IPUF, 1998) (Figure 1). It extends in a north-south orientation, ranging 13.5km in length, varying in width from 200m to 2.5km. The lagoon is linked to the sea by a shallow 2.5km long channel, which reduces the tide effects inside the lagoon (Odebrech and Caruso Junior, 1987). The freshwater contribution to the Lagoa da Conceição comes from regular rain precipitation, from small watercourses on the western border and from Capivaras River, which reaches the northern point of the lagoon (Dutra, 1990). The study area has a subtropical climate, characterized by a yearly average temperature of 20.4°C and a relative air humidity of 80%.

The once abundant Atlantic Rain Forest is limited to the Protected Areas, such as the granite hills surrounding the lagoon (CECCA, 1997). During the last 15 years the human population in Lagoa da Conceição has increased three-fold and the local development for tourism and national migration is bringing serious environmental concerns, such as lagoon pollution and occupation of protected areas (Hauff, 1996; CECCA, 1997, 2001).

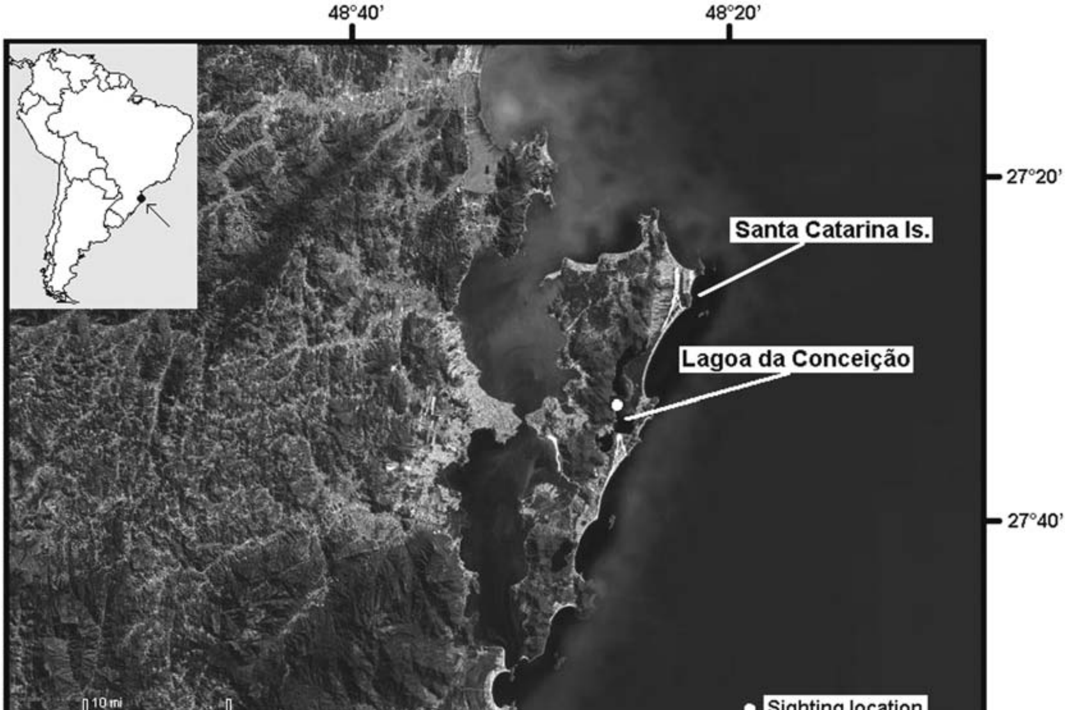

Figure 1. Study area localization in the Lagoa da Conceição, Santa Catarina Island, southern Brazil. White dot indicate the approximate sighting location.

During a trekking in Costa da Lagoa (27°S, 48°W), on October 22nd, 2005, I opportunistically sighted a neotropical otter, which I have estimated to be no more than one meter long, at a site approximately 40m away from the lagoon. That location was a typical otter habitat, covered by rocks and vegetation, and near water with good shelter opportunities (Chehebar, 1990; Waldemarin et al., 1998). The animal crossed about 15m from me, at an elevated position in relation to my eyes, because it was on the rocks. The sighting comprised of two quick observations. First, the otter was identified from behind, by its characteristic conic bulky tail and brown pelage, moving fast and going northwards along the trail (Figure 2A). I heard what sounded like steps (breaking branches), and when looking in the direction of the sound, I saw a teju lizard (*Tupinambis merianae*) (Linnaeus, 1758) of about 40 centimeters running away from another larger animal among the vegetation and rocks (Figure 2B). Less than one minute later, I could identify the animal as being the otter, which remained pointed toward me and looking in my direction, clearly showing its face. At this time I could see that the otter had a piece of a reptile tail coming out of its mouth (Figure 2C), linking this event to the previously observed teju lizard.

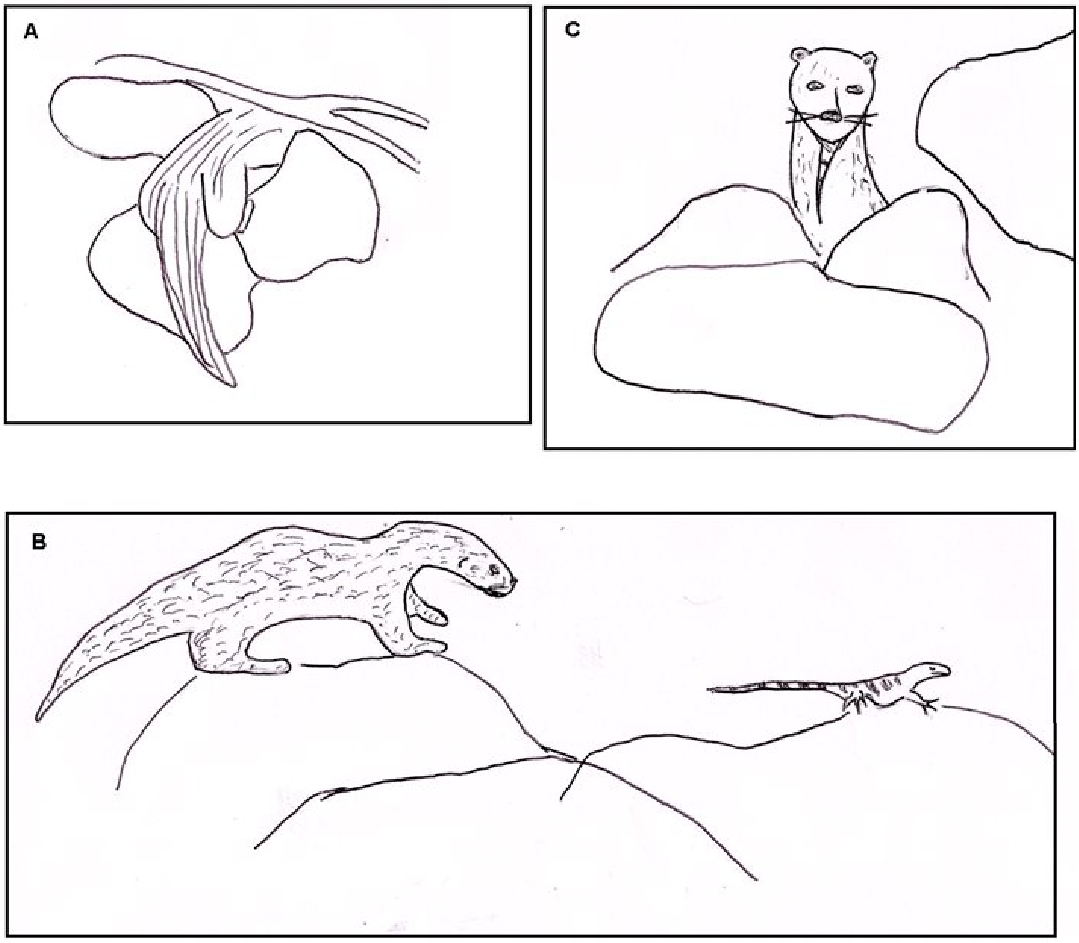

Figure 2. Illustrations of the sighting of a neotropical otter (*Lutra longicaudis*) and a teju lizard (*Tupinambis merianae*). (A) Shows the otter sighted from its backside, showing its characteristic conic bulky tail and brown pelage; (B) shows the teju lizard running away from the otter among the rocks; (C) shows that the otter had a piece of a reptile tail coming out of its mouth.

The literature contains innumerable items of information regarding the otter's diet and while reptiles are listed as potential prey, few works report on this (see also Beja, 1991; Helder and Andrade, 1997; Alarcon and Simões-Lopes, 2004).

Clavero et al. (2005) are one of the few who report more detailed information about amphibian and reptile consumption by otters (*Lutra lutra*) in the Iberian Peninsula, describing prey species and seasonality of predation by the otters. Despite the feeding habits of the otters being well documented, they fail to report on any other report of

predation on land. In fact, even if otters are known to feed on reptiles, these are usually aquatic species (Clavero et al., 2005).
Some studies in Brazil have shown that the feeding habits of *L. longicaudis* in coastal marine environments presented similar patterns compared with the species' diet in freshwater ecosystems. In the Environmental Protected Area (EPA) of Anhatomirim, Alarcon and Simões-Lopes (2004) identified that fish constitute the dominant prey group, as similarly reported in other studies carried out on the same species in rivers and lagoons of South America (Carvalho, 1990; Blacher and Soldatelli, 1996; Helder and Andrade, 1997; Pardini, 1998; Quadros and Monteiro-Filho, 2001; Gori et al., 2003).

Crustaceans are commonly cited as the second main prey group for *L. longicaudis* (Helder and Andrade, 1997; Pardini, 1998; Quadros and Monteiro-Filho, 2001), with some exceptions, where it can appear as the dominant group (Spinola and Vaughan, 1998) or be absent (Kasper et al., 2004).

Other prey groups such as amphibians, clams, mammals, and insects appeared in low frequency in southern Brazil, whether in coastal marine environments (Alarcon and Simões-Lopes, 2003) or in freshwater environments (Helder and Andrade, 1997; Pardini, 1998; Quadros and Monteiro-Filho, 2001).

A richness of species in *L. longicaudis* diets going up to 7 suggests that escaping ability is the main factor influencing the selection of the otters' preys (Pardini, 1998; Gori et al., 2003; Kasper et al., 2004). In another area of Southern Brazil, Vale do Taquari, six prey groups, fish (89%), mammals (8,8%), insects (5,6%), birds (1,6%), amphibians (0,8%) and mollusks (0,8%) were found in 263 samples (Kasper et al., 2004). No evidences of feeding on reptiles were found.

The described observation brings important new information about the opportunistic otter foraging behavior, of predation on a teju lizard in a coastal lagoon of Southern Brazil, mainly to the fact that the lizard was not captured in the water but on land.

The patterns of coastal habitat use by *L. longicaudis* are still not well understood. For a better understanding of the diverse potential preys taken by foraging otters, we need more information about prey availability and anthropogenic impacts such as over-fishing and intensive exploration of the coastal zones for tourism activities. Such information should also be useful to implement local conservation strategies for neotropical otters and their environment.

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Resumé: REGARD SUR L'INTERACTION ENTRE UNE LOUTRE NÉOTROPICALE (*Lontra longicaudis*) ET UN LÉZARD TÉJU (*Tupinambis merinae*)DANS UN ÉCOSYSTÈME LAGUNAIRE DU SUD DU BRÉSIL

Les loutres sont des prédateurs opportunistes qui chassent les proies là où ils les trouvent. Les observations de loutres dans leur biotope naturel sont rares, les loutres étant bien connues pour leur timidité, et elles évitent tout contact humain. Quoique les reptiles figurent parmi les proies de la loutre sud-americaine, *Lontra longicaudis*, ils sont une catégorie de proie minimale. Cet article décrit l’observation inhabituelle d’une rencontre entre une loutre sud-americaine, *Lontra longicaudis,* et d’un gros lezard Tegu, *Tupinambis merianae*, dans un marécage au sud du Brésil, que nous avons classée comme un acte avec intention de prédation éventuel.

Resumen: **AVISTAJE DE UNA INTERACCIÓN ENTRE UNA NUTRIA DE RÍO NEOTROPICAL, *Lontra longicaudis*, Y UN LAGARTO BLANCO, *Tupinambis merianae*, EN UN AMBIENTE LACUSTRE DEL SUR DE BRASIL**

Nutrias de río son predadores oportunistas que se alimentan de cualquier presa disponible. Avistajes de nutrias en la naturaleza son poco comunes, principalmente debido a su comportamiento elusivo y a que evitan la presencia del hombre. A pesar de que reptiles han sido listados como parte de la dieta de la nutria, éstos solo constituyen una pequeña fracción. Este artículo reporta un avistaje poco usual de depredación entre una nutria de río neotropical, *Lontra longicaudis*, y un lagarto blanco, *Tupinambis merianae*, en un ambiente lacustre del sur de Brasil.

R E P O R T

VETERINARY CARE OF EURASIAN OTTERS (*Lutra lutra*) AT THE OTTER BREEDING CENTRE OF HUNAWIHR (FRANCE)

Fabrice CAPBER

4 avenue de la Liberté, 68000 Colmar, France,
fabrice.capber@tiscali.fr
Otter Breeding Centre of Hunawihr, route des vins, Hunawihr 68150, France http://www.cigogne-loutre.com/

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Abstract - More than 16 years of veterinary care in the EUROPEAN OTTER (*Lutra lutra*) BREEDING CENTRE of Hunawihr (France), reveals many aspects of diseases and health problems. It emerges from this review that infections caused 62.5% of all deaths and that the prevalence of urolithiasis is high. Uroliths were found in 61.9% of all autopsied otters. *Salmonella* and *Pasteurella* sp. were isolated from several otters. Other health considerations such as traumas, neoplastic diseases and breeding problems are described. Cases of paraphimosis and aerophagia are described for the first time in Eurasian otters to our knowledge. Everyday veterinary care is also emphasized. Finally, pathological occurrences in both captive and wild otters are discussed.

Keywords: Eurasian otter, captive otter, *Lutra lutra*, diseases, health problems

INTRODUCTION

Worldwide many zoos and otter centres house Eurasian otters (*Lutra lutra*). In the wilderness, territorial expansion has been observed throughout Europe and many reports on the distribution or the status of this species are published every year. Less information is available on veterinary care in captive otters.

The Otter Breeding Centre of Hunawihr was created in 1991. The original seven otters came from zoos and parks across Europe: Krefeld Zoo (Germany), Norfolk Park (Great Britain), Zurich Zoo (Switzerland) and Torbiera Park (Italy). Since 1991, 49 pups were born in 25 litters with a mean litter size of 1.96. In 16 years, we cared for 59 otters, 4 pups and 24 adult otters died in the Centre, two escaped and six were released. The youngest died at the age of 22 days whereas the oldest died at the age of 14 years and 9 months. 21 adult otters were autopsied.

INFECTIOUS DISEASES

1. BACTERIAL INFECTIONS

Infections caused 62.5% (15 otters) of all deaths (24 otters) making them the most common cause of death in Hunawihr. Most infections resulted from injuries of enclosure structures or bite wounds from other otters (Fig. 1a, b). Bites generally occurred on the face, the feet, the tail and the genital area. Fights between otters can be extremely violent and can cause severe injuries. Although injuries are often not immediately apparent, they often lead to a systemic infection (septicaemia). As infections which are not treated may result in death, animal keepers should pay special attention to any fight or wound and start a treatment with antibiotics as soon as possible (Tab. 1). Drugs can be administrated orally with food. The use of palatable tablets once daily makes treatments easier. In Hunawihr, we can also easily give long acting injectable antibiotics to otters that do not eat. Otters are used to rest and sleep in artificial wooden holts in each enclosure. The holts can be locked and removed. The trapped otter is simply strongly squeezed with a wire net down the holt and injections can be given. An antiseptic spray may sometimes be applied to wounds of cooperative otters.

Figure 1a. Infected and necrotic wound of a tail

Figure 1b. Wounded forefoot

Table 1. Antibiotics used in Hunawihr

Antibiotic	Dose	Route
Amoxicillin (trihydrate)	15mg/kg twice in 48h	sc, im
Amoxicillin-clavulanic acid	12.5mg/kg/12h 5 days	oral
Cefalexin	30mg/kg/24h 5 days	oral
Cefovecin	8mg/kg once	sc
Colistin	25000UI/kg/12h 3 days	oral
Doxycyclin	10mg/kg/24h 5 days	oral
Gentamicin	4mg/kg/12h 5 days	oral
Lincomycin	20mg/kg/12h 5 days	oral
Marbofloxacin	2-5mg/kg/24h 5 days	oral, iv
Metronidazole	25-50mg/kg/24h 5 days	oral
Penicillin (procaine)	30mg/kg once	im
Trimethoprim-sulfamethoxypyridazin	5mg and 25mg/kg/24h 5 days	oral

Our experience with treatment of infections showed, that every time antibiotics were administered within 24h after visible injuries occurred, the otters recovered. Most mild injuries certainly healed unnoticed. But all severe injuries detected too late (purulent or necrotic wounds) did not heal properly and usually led to septicaemia with lethal complications. Thus several otters died from abscesses, fibrinopurulent pleuritis, pleuropneumonia, hepatitis, peritonitis and pyelonephritis (Tab.2). The two otters that died from pyelonephritis presented numerous and voluminous uroliths in both kidneys (see below). One otter died from peritonitis due to a leak from the intraperitoneal transmitter implanted 4 years before (Fig. 2).

Figure 2. Leak in a transmitter

Pasteurella multocida was isolated from two otters that died from pleuropneumonia and fibrinopurulent pleuritis. *Pasteurella multocida* was also suspected in three other otters that died of a fibrinopurulent pleuritis. Bacteriology showed gram-negative bacteria but they could not be cultured. Infections with *Pasteurella* species generally often occur due to bite wounds or the intake of contaminated food. This can lead to respiratory infection, septicaemia and endocarditis with a very high mortality rate.
Salmonella species were isolated from an otter that died from hepatitis. Faecal analyses were carried out in all otters but *Salmonella spp* were only found in a few of them (*S. hadar, S. virchow* or *S. indiana*). All otters were treated with antibiotics (Colistin) in accordance with the pattern of sensitivity. Foot baths were installed and strict hygienic rules established. The faeces were thereafter regularly analysed until they all proved negative. Treatments and hygienic strategies turned out to be very effective as no other otter died or suffered from salmonellosis. The bacteria could have been transmitted from contaminated food. The otters in the Centre are fed with fish and poultry. Raw poultry is a frequent source of *Salmonella*.

Table 2. Casualties due to infections in Hunawihr

Condition	Number
Abscess (head)	2
Fibrinopurulent pleuritis	4
Pleuropneumonia	1
Peritonitis	2
Hepatitis	1
Pyelonephritis	2
Septicaemia	3
Total	*15*

2. VIRAL INFECTIONS

Viral infections have never been diagnosed in otters from Hunawihr, no animal have never been tested for viruses. In the early 1990's some otters were vaccinated against distemper and rabies but vaccinations were stopped, estimating it was not really necessary in captivity. Dogs are not allowed in the Centre since housing of otters started. Canine distemper virus (morbillivirus) is pathogenic for many mustelid species but only very few cases have been described in otters. The status of terrestrial rabies in France is considered to be free since 2001 and vaccination is no longer obligatory (Beuret, pers. comm.). Finally, the immune responses of otters towards the vaccines for dogs have not been evaluated yet. These are the main reasons why the routine vaccination of otters stopped.

TRAUMAS

Otters often hurt themselves in the enclosures. Regular traumas come from running after one another, fighting, mating, and climbing rocks or trees and escape attempts. They usually show haematomas, contusions or lameness. In these cases anti-inflammatory drugs are administrated orally over three to five days (Tab. 3). Antibiotics are also given if necessary. The otters recover generally quickly, but sometimes traumas can be much more severe. A young female was suffering for at least 24 hours from a traumatic amputation of the tail (Fig. 3). We suspected a sharp-edged steel sheet in the enclosure. She was in a critical state and presented extensive bleeding. We tried to immobilize her with a low dose of anaesthesia (ketamine hydrochloride 5mg/kg) to first treat the haemorrhage and the shock before attempting an operation. Unfortunately she died a few minutes later. The cause of death was most likely a hypovolaemic shock.

Table 3. Anti-inflammatory drugs used in Hunawihr

Anti-inflammatory	Dose	Route
Tolfenamic acid	4mg/kg/24h 3-5 days	oral, sc
Nimesulid	5mg/kg/24h 3-5 days	oral
Ketoprofen	1mg/kg/24h 3-5 days	oral
Ibuprofen	20mg/kg/24h 3-5 days	oral
Meloxicam	0.2mg/kg once	sc, iv

UROLITHIASIS

The prevalence of urolithiasis seems high in captive otters. Uroliths were found in the urinary tract or in the kidneys in 61.9% (13 otters) of the autopsied animals (21 otters) in Hunawihr. Most of the time only one kidney was affected; three otters had calculi in both kidneys whereas two other otters had smaller concrements or sand in the bladder and the ureters causing no tract obstructions. Proteus species were isolated from the latter. Renal calculi were generally voluminous and led to atrophy and fibrosis of the renal tissue (Fig. 4). Seven calculi were analyzed using infrared spectrophotometry and all of them were composed of ammonium urate. Bilateral urolithiasis could be found in two otters, together with pyelonephritis and septicaemia.

Figure 3. Severe tail trauma

An interesting case was a female otter which drowned a few hours after presenting posterior paralysis. The necropsy revealed nothing but unilateral renal calculi which could have caused great pain, paraplegia and consecutive death. Several other otters have shown sudden posterior paralysis. They have recovered spontaneously. We treated them preventively with acidifying drugs such as ethylene diamine dichlorydrate (300mg/24h) over several weeks. The causes for ammonium urate calculi formation in otters are quite complicated and complex and still not analyzed in all details yet (Weber et al., 1998).

Figure 4. Renal calculi

MALE GENITAL SYSTEM AFFECTIONS

1. NEOPLASTIC DISEASES

Two male otters were suffering from genital tumours. They were both older animals (8.5 and 12.5-year-old), cachectic and anorectic. Both were euthanized and autopsied. One had a testis tumour and the other one had a voluminous tumour outside the inguinal canal including the vas deferens with global tissue adhesion in the area (Figs. 5a, b). The testis tumour‘s histological result revealed a Sertoli-cell tumour. The other tumour was not investigated histologically. The testis tumour had been noticed several months before. It was probably not the cause of the health problems from this animal. Sertoli-cell tumours are generally not aggressive. On the contrary, the health of the other otter (8.5 years old) certainly was influenced by the tumour. Its course of illness took only a few weeks and the otter showed much abdominal pain in the end.

2. PARAPHIMOSIS

Paraphimosis is an affliction where the prepuce no longer covers the penis. In our case, the problem occured probably due to a bite by the female which shared the enclosure of the 7-year-old male. The pair was observed mating repeatedly for several days. The pain must have caused permanent erection which resulted in the necrosis of the glans penis (Fig. 6). In order to avoid additional complications such as gangrene for example, the otter was captured and treated immediately. The animal was anesthetized (ketamine hydrochloride (10mg/kg) and xylazine (1mg/kg)) and the necrotic parts of tissue were delicately removed. The paraphimosis was reduced by gentle manipulation. Intravenous injections with marbofloxacin (5mg/kg), butorphanol (0.2mg/kg) and meloxicam (0.2mg/kg) were given. Considering his age, and in order to prevent any deleterious consequences of erection or potential urogenital tumours, we castrated him as well. A long acting antibiotic subcutaneous injection with cefovecin (8mg/kg) was given and he was transported to a small enclosure located on the other side of the Breeding Center, away from the females' enclosures in order to avoid any sexual excitement. Two days after the surgery, the animal showed obvious fever and pain, and the scrotum was oedematous. Anti-inflammatory (prednisolon 1mg/kg) and diuretic drugs (furosemid 8mg/kg) were administrated orally over five days. Three weeks later the otter had completely recovered.

Figure 5a. Testis tumour

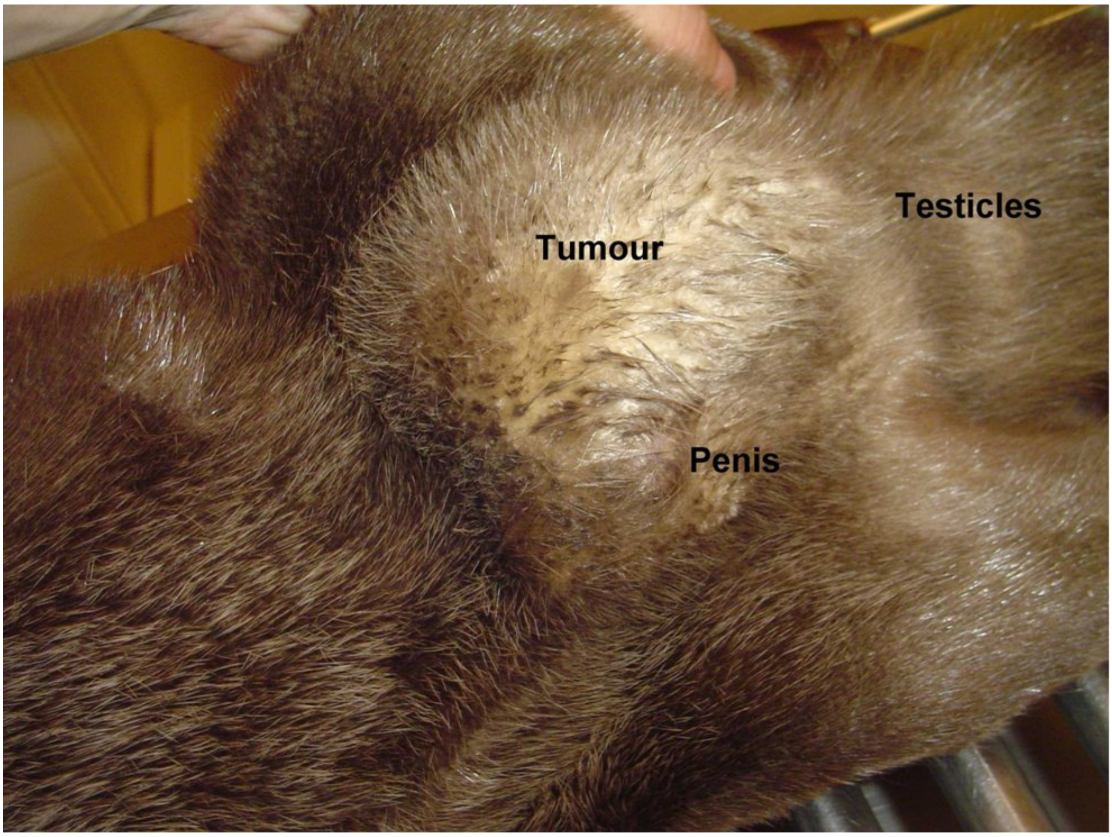

Figure 5b. Inguinal tumour

Figure 6. Aquired paraphimosis

3. MASTURBATION

Three male otters regularly masturbated with both front paws and their mouths. While masturbating they either leaned on their back or their side (Mercier, pers. comm.). Masturbation is often observed among animals, both male and female. It is considered to be a normal behaviour. In our case, boredom or separation from females may have exacerbated sexual stimulation in these captive animals.

HEALTH PROBLEMS ARISING DURING BREEDING TIME

1. DEFICIENT MOTHERS

Mothers never had trouble in giving birth but some of them rejected their pups or suffered from agalactia (Capber, 2006). A female rejected her pups despite their incessant cries. Such behaviour is also observed in other carnivores but we do not know precisely why and many hypotheses are possible. Another female showed agalactia in three mammary glands. Only one mammary gland was functional. She could only feed and raise one pup; the others had to be hand-reared.

2. MORTALITY IN PUPS

Stillbirths and neonatal mortality occurred in 11 pups (22.4%). Four other pups died between the age of 22 and 43 days. One died of starvation because its mother suffered from agalactia (see before) which we did not noticed in time. Another one died of exposure because its mother carried it into the water too early. Finally, two pups were found dead having been crushed by their mothers.

3. INFERTILITY

One female is thought to be infertile. We put her together with all possible partners over a period of 5 years but she never got pregnant although matings and copulations were very often observed. There are many causes of female infertility (genetic, anatomic, hormonal, disease, etc.).

OTHER HEALTH PROBLEMS

5. PARASITES

Anthelmintic drugs are administrated prophylactic every spring and fall to all otters (Tab. 4). In numerous faeces analyses from otters in captivity, helminths or eggs of helminths have never been found. However, helminths have been recorded in many spraints of released otters during the post-release surveys. Most of them were nematodes. One cestode and one acanthocephalo specimen was also found, but no further species identifications were realised (Mercier, 2005). No infestation with ticks or fleas has ever been seen in captive otters from the Centre. However, ticks were found on a wild otter captured by hunters near Hunawihr (Manson, pers. comm.).

Table 4. Antihelminthic drugs used in Hunawihr (twice a year)

Anthelmintic drug	Dose	Route
Oxibendazol/Niclosamide	15mg/kg/120mg/kg	oral
Nitroscanate	50mg/kg	oral
Milbemycin/Praziquantel	0.5mg/kg/5mg/kg	oral
Praziquantel/Pyrentel/Febentel	15mg/kg/5mg/kg/5mg/kg	oral

2. ORGANOCHLORINE PESTICIDES AND FIPRONIL

Blood samples of two young male otters (2 and 2.5-year-old) anaesthetized for microchip implantation were analyzed for organochlorine pesticides (Tab. 5). PCBs (polychlorinated biphenyls) could not be detected in the samples. However, traces of other contaminants like fipronil (agricultural insecticide) were found in very low concentrations. These negative results are not a surprise because captive otters fed a less contaminated diet than wild ones. Otters in Hunawihr are fed with fish (herrings, eels, trouts), chicken (hearts, chicks) and minced meat. Mason (1993) came to the same conclusion after the analysis of contaminants in the spraints of two female captive otters and a pup.

Table 5. Results of blood analysis for contaminants in two otters ($\mu g\ g^{-1}$ blood)

Contaminants	Otter 1	Otter 2
Lindane	0.033473025	0
Endosulfan	0	0
DDE	0.00676042	0.003606662
DDD	0.01331566	0.00312377
DDT	0	0
Heptachlor	0.00326819	0
Heptachlor epox	0	0.001263126
Aldrin	0.002078483	0.000995814
Metoxychlor	0	0

3. AEROPHAGIA

A 5-year-old male otter developed chronic aerophagia (Fig. 7) after we moved him to a smaller enclosure. He was presented with significant abdominal bloating, belching and flatulence after he suddenly started to swallow air over up to ten minutes while swimming in circles rapidly. This would happen several times each day and most of the time he recovered spontaneously. Aerophagia did not seem to bother him at all; he just faced difficulty swimming underwater. We treated him with activated charcoal when the abdomen was extremely swollen. First we thought that the cause could have been psychogenic. So we tried anxiolytic treatment using clomipramine (1.5mg/kg/24h) and replaced him in a larger enclosure with a female. The treatment did not prove effective. His state improved temporarily after we gave him daily supplements with lactic fermentative bacteria (*Lactobacillus acidophilus*). These symptoms were not further investigated; the animal is still presenting aerophagia from time to time but seems very well otherwise.


Figure 7. Aerophagia

4. OLD AGE

In captivity, otter can live very old. A female otter died at the age of 11 years and 6 months whereas a male otter died at the age of 14 years and 9 months. They presented no particular health problems except for age-related sclerosis of the crystalline lens observed in all old otters. The necropsies failed to show any particular cause-of death.

5. UNKNOWN CAUSES OF HEALTH PROBLEMS OR DEATHS

Other minor health problems such as sporadic vomiting, diarrhoea, anorexia, rhinitis, conjunctivitis and alopecia were managed using symptomatic treatments. The causes of these problems were unknown and the animals generally recovered rapidly. 12.5% (3 otters) of all deaths could not be related to precise causes. Either the animals were not autopsied (1 otter) or the necropsies and bacterial cultures failed to show any cause of death (2 otters).

ANAESTHESIA

Otters are generally anaesthetized for two purposes: surgeries and subcutaneous microchip or intra-peritoneal transmitter implantations. The otters are trapped in an artificial wooden holt (Fig. 8) and strongly squeezed with a wire net down the box in order to be immobilized. They are anaesthetized with an intramuscular injection in the thigh with ketamine hydrochloride (10mg/kg) and xylazine (1mg/kg) or acepromazine (0.25mg/kg). If a surgery is undertaken, a tube is inserted in the trachea and anaesthesia is prolonged using isoflurane (2-4%). Breath and heart frequencies as well as rectal temperature are monitored. Antibiotic and anti-inflammatory drugs are injected intravenously. If the surgery turns out to be painful we also use opiate analgesic such as butorphanol (0.2mg/kg). This procedure works well, only one otter died under anaesthesia (out of 12 procedures). Death occurred because of the poor condition of the animal before anaesthesia. One otter in good condition died several hours after anaestensia with no obvious reason. After anaesthesia the otters are put back into the holt and kept warm until they are fully awake. They are generally transported to their enclosures at the same day.

Figure 8. Artificial holts used in Hunawihr

DISCUSSION

This paper presents an overview about diseases and health problems we had to deal with in an otter breeding centre. It is interesting to point out that much of the diseases are also reported in wild otters whereas specific problems arise from captivity. Bite wounds are also common in wild otters (Simpson, 2006, 2007; Green and Green, 2002). Eurasian otters are solitary and competition for territory often results in violent intraspecific aggression between male otters. Some heavy infections may even lead to septicaemia and death. In captivity, otters sharing the same enclosure are females, a pair or a pair with pups. In Hunawihr, every time we tried to put two males together they became aggressive and had to be separated again. Therefore most aggressions occur between female otters. Females with pups were seen trying to bite the male when getting too close towards the pups. Bites can also happen in otters of both sexes during mating. However, in the wild, road traffic accidents have been identified to be the major cause of death (Lanszki, 2007; Simpson, 2006; Green and Green, 2002; Madsen et al., 1999) whereas the most common cause of death in captivity is a bacterial infection. We isolated *Pasteurella multocida* from the lung of an otter that died from pleuropneumonia.

Specific infectious diseases are rare in both captive and wild otters. In Hunawihr we had to cope once with Salmonellosis. Borg (1964) described human tuberculosis in a captive otter. Distemper virus was found in two captive otters (Geisel, 1979). Loupal et al. (1998) found two wild otters that died from canine distemper and Madsen et al. (1999) recorded distemper virus in six wild dead otters but they seemed not to have suffered from the disease. Mañas (2007) revealed the possible role of wild otters in the dissemination of Aleutian disease on other riparian species. Fournier et al. (2004) found antibodies to ADV (Aleutian disease parvovirus) in many wild mustelid species from south-western France, but no otter is recorded. Rabies and toxoplasmosis may also threaten wild otter populations (Jacques, 2007). Park et al. (2007) described for the first time a canine adenovirus type 1 (CAV-1) in a 10-year-old captive otter.

Ammonium urate urolithiasis is commonly found in captive and wild otters (Madsen et al., 1999; Weber et al., 1998). It may be due to a specific purine metabolism in otters (Weber et al., 1998). Kidney calculi may cause severe back pain. In our study most of the otters showed calculi in only one kidney and no death could be directly attributed to renal failure in these cases. Urolithiasis is also common in captive Asian small-clawed otters *Aonyx cinereous* (Petrini et al., 1999; Féjan and Hue pers. comm.), but the main component in this species is calcium oxalate.

Parasites have often been described in wild otters (Torres et al., 2004; Madsen et al., 1999; Torres et al., 1999; Vismanis and Ozolins, 1998; Fons and Feliu, 1996). Matsuda et al. (2003) found *Dirofilaria immitis* in the heart of a young otter and suspected the otter to be a definitive host for this worm. Simpson et al. (2005) found flukes (*Pseudamphistomum truncatum*) in the gall bladders of a few otters. As we mentioned, ectoparasites are uncommon in captive otters as well as in wild ones (Madsen et al., 1999; Green and Green, 2002). However, we did find ticks on a wild otter captured near Hunawihr.

Neoplastic diseases were not often described in Eurasian otters. Weber and Mecklenburg (2000) reported a malignant melanoma in a 11-year-old female otter and Bae et al. (2007) reported a hepatocellular adenoma in a 7-year-old captive female otter. The two otters that developed neoplastic diseases in Hunawihr were both over 8 years old. Life expectancy in captive otters is two to three times longer than in wild ones. Wild otters usually do not live more than 5 years whereas captive animals can live up to 19 years (Sidorovich, 1991; Pechlaner and Thaler, 1983). As prevalence of neoplastic diseases is higher in older animal and human populations, tumours must certainly occur more frequent in captivity.

Finally ocular problems such as blindness and retinal dysplasia were also described in Eurasian otters (Williams et al., 2004; Williams, 1988) as well as neurological problems such as hydrocephalus and meningitis (Green and Green, 2002).

CONCLUSION

Veterinary care of captive otter is challenging. Dealing with unhabituated animals that cannot be handled for diagnosis and treatments is not easy. The lack of medical information about the species and the necessary control of the zoological facilities' spending are additional obstacles for veterinarians. We certainly do need more investigations on many diseases and health problems. The haematology and biochemical reference intervals determination for the Eurasian otter by Moran *et al.*

(2001) is a good example of what can be done to improve our knowledge about this discipline for instance. Information gained from captive otters may be of importance for all otters and for all veterinarians dealing with these animals.

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Résumé:

Plus de 16 années de soins vétérinaires au CENTRE DE REPRODUCTION DE LA LOUTRE EUROPÉENNE (*Lutra lutra*) d'Hunawihr (France), permettent de présenter les différentes pathologies rencontrées. Les infections sont responsables de 62.5% de la mortalité totale et la prévalence des urolithiases est élevée. Des lithiases urinaires ont été découvertes chez 61.9% des individus autopsiés. Des bactéries du genre *Salmonella* sp. et *Pasteurella* sp. ont été isolées sur plusieurs loutres. D'autres pathologies comme les traumatismes, les maladies néoplasiques et les problèmes liés à la reproduction sont décrites. Un cas de paraphimosis ainsi qu'un cas d'aérophagie sont décrits pour la première fois à notre connaissance chez cette espèce. Les soins vétérinaires courants sont également présentés. Enfin, les différentes pathologies de la faune captive sont discutées en regard de celles de la faune sauvage.

Resumen:

Más de 16 años de cuidado veterinario en THE EUROPEAN OTTER (*Lutra lutra*) BREEDING CENTRE of Hunawihr (France), revela varios aspectos sobre enfermedades y otros problemas de salud. Esta revicion muestra que las infecciones causan el 62.5% de las muertes, donde la prebalencia de urolithiasis es alta. Uroliths fue encontrada en el 61.9% de las nutrias que se les hizo autopsia. Se aislaron muestras de *Salmonella sp* and *Pasteurella sp* en varias de las nutrias. Otros aspectos de salud que se tuvieron en cuenta y son descritos fueron traumas, enfermedades neoplasticas y problemas de reproducción. Casos de parafimosis y aerofagia son descritos por primera ves en la nutria europea. Cada dia se enfatizo en cuidado veterinario. Finalmente patologias encontradas en cautiverio y en vida silvestre son discutidas.

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[Johanna Arrendal, Department of Ecology and Evolution, Department of Animal Ecology, Norbyv 18 D, Uppsala University, SE-75236 Uppsala, Sweden]

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P R O C E E D I N G S

PROCEEDINGS OF THE EUROPEAN OTTER WORKSHOP, SKYE, 2003

The Proceedings of the conference held on Skye in 2003 are available on CD and copies may be ordered from Grace Yoxon.

Please contact her for details (Grace M. Yoxon, E-mail: iosf2@aol.com, www.otter.org).

PROCEEDINGS OF THE VIITH INTERNATIONAL OTTER COLLOQUIUM

These are now available online via the Bulletin:

IUCN/SSC Otter Specialist Group Bulletin Volume 19A

CONGRESS ANNOUNCEMENTS

GEWÄSSERENTWICKLUNG UND LEBENSRAUMKORRIDORE FÜR UND MIT DER LEITTIERART FISCHOTTER

March 6-7 2008

Mauth, Germany

The "Wildland - Stiftung Bayern" and the "Ökologische Bildungsstätte Oberfranken" invite you to the Workshop "Gewässerentwicklung und Lebensraumkorridore für und mit der Leittierart Fischotter" (Wetland Development and Corridors with and for Otters as the Key Species) into the Bavarian Forest. The workshop will take place from 6th to 7th of March 2008 at the "Otterhaus" in Mauth.

Please contact the organisation if you want to participate, as the number of participants is limited due to available space.

Dr. Katrin Ruff
Projektbearbeitung OttERFRANKEN
Ökologische Bildungsstätte Oberfranken
Naturschutzzentrum Wasserschloß Mitwitz e.V.
Unteres Schloß
96268 Mitwitz
Tel. ++49-(0)9266-6286
mobil ++49-(0)1520-1827256
Fax ++49-(0)9266-6442
Katrin.Ruff@oekologische-bildungsstaette.de
www.oekologische-bildungsstaette.de

ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION (ATBC) SYMPOSIUM

June 9-13, 2008

Paramaribo, Suriname, South America

Dear colleagues,

The next congress of the Association for Tropical Biology and Conservation (ATBC) will be held in Paramaribo-Suriname-South America in June 9-13, 2008. Registrations are open at www.atbc2008.org/register/ or http://www.bayceer.uni-bayreuth.de/atbc2008/
.

We (Pia Parolin and Florian Wittmann) are organizing a symposium on "Tropical wetlands: Diversity, ecophysiological processes and conservation"

Hoping to see you soon in our symposium in Suriname.

Pia

Title: Tropical wetlands: Diversity, ecophysiological processes and conservation

Organizers:

- PIA PAROLIN, University of Hamburg, Biozentrum Klein Flottbek, Dept. Plant Systematics, Germany; pparolin@botanik.uni-hamburg.de
- FLORIAN WITTMANN, Max Planck Institute of Chemistry, Biogeochemistry, Mainz, Germany; F-Wittmann@web.de

Abstract and goals

Tropical wetlands cover huge areas and belong to the most diverse ecosystems worldwide. They are the habitat for many partially endemic plant and animal species and they are indispensable for hydrological cycles, water resources management, etc. Whether fringed by grasslands or forests, wetlands are the source of many valuable timber and non-timber products and represent the main food source for many fish and mammal species, which in turn are the main protein base for large part of the rural population.

In spite of their ecological importance, wetlands belong to the most threatened ecosystems worldwide as they underlie a severe use conflict by human demands on water supply, timber, agriculture and pasture area, fish and wildlife, wastewater disposal and leisure activities. Biodiversity is especially affected in wetlands, among other reasons because of the recently drastic reduced area of undisturbed sites.

Wetlands are characterized by a high organismic and functional diversity. The occurring gradients (e.g. flood duration and amplitude, sedimentation and erosion, etc.) cause the need for a series of morphological, physiological and anatomical adaptations of the biota inhabiting them. Inundation dynamics create a mosaic of environmental conditions, which are closely linked to the diversity and distribution patterns of wetland species at different spatial and temporal scales. In past and recent scientific research, efforts dealt with the basic understanding of functioning and processes in wetland ecosystems.

The present symposium aims at highlighting the status quo of organistic and functional diversity research, understanding traits of species composition and diversity, ecophysiological processes and adaptation strategies of plant and animal species, and discuss the possibilities of implementation of scientific results into sustainable management and conservation schemes in wetlands.

Some potential topics of the proposed symposium are:

- Organistic, functional and structural diversity: Which databases can be used or created?
- How do wetlands create favourable or adverse conditions for biodiversity?
- Which species traits make organisms successful in wetlands?
- Plant life in oxygen-deficient environments: ecological, physiological and molecular perspectives
- Does biodiversity influence organic matter exchange between aquatic and terrestrial systems?
- Modelling of wetland dynamics
- Interactions between plants and geochemical processes
- Interaction between nitrogen enrichment and global change in wetland ecosystems
- Palaeoecology and long-term wetland function dynamics
- Wetlands for Wastewater Treatment and Pollution Control
- Which are the most important threats to biodiversity and wetland ecosystem services?
- Which conception approaches aid prediction of diversity changes?
- Science-based conservation and social needs: How to combine them in practice?

Dr. Pia Parolin
Universität Hamburg - Fachbereich Biologie
Biozentrum Klein Flottbek, Abteilung Systematik der Pflanzen
Ohnhorststr. 18, D-22609 Hamburg
pparolin@botanik.uni-hamburg.de

THE OTTER – AMBASSADOR OF PEACE

The Xth International Otter Colloquium

Hwacheon, Korea

10-16th October 2007

For further information: http://www.otter2007.org

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Sung-Yong Han
Wildlife Institute of Korea, Kyungnam University
Dept. Of Biology
449-Wolyoung
631-701 Masan City
Kyungnam
South Korea
Phone: ++82 55 222-5901
Fax: ++82 55 222-5903
e-mail: hansy@wildlife.re.kr

25TH MUSTELID COLLOQUIUM

Dear colleagues, dear friends,

We would like to invite you to attend the 25th Mustelid Colloquium. The meeting will be held at Trebon in South Bohemia (Czech Republic) from October 4th - 7th 2007 and it is co-organised by the Czech Otter Foundation Fund and the Agency for Nature Conservation and Landscape Protection of the Czech Republic.

The conference is open to everyone with an interest in Mustelids and this year for the first time also for those interested in the Raccoon Dog. Scientists, students, conservationists, both professionals or volunteers,
are welcomed. Plenary and poster sessions will cover various aspects of ecology, behaviour, biogeography, genetics, physiology, population and habitat management and conservation biology related to the above mammals.

For more information, please see the 1st circular and our web site
www.mustelid2007.org

Yours sincerely,

Behalf of the organising committee
Petra Hajkova
Institute of Vertebrate Biology, v.v.i.
Academy of Sciences of the Czech Republic
Kvetna 8
603 65 Brno
Czech Republic
Tel.: +420-543422522
Fax: +420-543211346
www.ivb.cz

CALL FOR INFORMATION

- Is anyone currently working on Lutrine Phylogenetics?
- Otters in the Falklands Islands
- Use of Green Bridges by Otters
- Otters using Badger Gates

Lutrine Phylogenetics

Is anyone currently working on the phylogenetics of the Lutrinae? I'm curious what the present state of knowledge is.

I also wonder if there's anyone who might be looking at the evolution of lutromorphy in general.

Thanks in advance for any citations that could be provided.

-Scott

J Scott Shannon
Email: admin@riverotters.net

Otters in the Falklands Islands

Dear Colleagues,

Does anyone have any information, especially anything recent, about the status of otters in the Falkland Islands (Los Malvinas)?

Otters were introduced to the Falkland Islands in the 1930s when there was an unsuccessful attempt to raise them for fur. Although rare, there have been several sightings of them and their spraint (notably by the ornithologist Ian Strange), most recently by Edwards (1999).

We believe that these are Marine Otters, Lontra felina, and if they are still extant, we need to press for their protection.

Grateful for any help,

Lesley Wright and Jim Conroy
Email L.Wright@rl.ac.uk

Use of Green Bridges by Otters

We have a large dual carriageway trunk road scheme being built in Surrey that is in an area likely to be an important watershed crossing area connecting the head waters of six or seven streams/rivers. For technical engineering reasons a tunnel under the road is not feasable but the engineers are creating a green bridge at a critical crossing point. Has anyone any experience of otters using green bridges please? The bridge will be used as a bridleway and will be about 7 metres wide at its narrowest point.

IOSF on behalf of Chris Matcham, Surrey
Email: iosf2@aol.com

Otters using Badger Gates

Also has anyone come across otters using badger gates? Otters are probably strong enough to use them but as far as we are aware no-one has come across this.

Any guidance or information on these two issues will be gratefully received.

IOSF on behalf of Chris Matcham, Surrey
Email: iosf2@aol.com