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

NOTE FROM THE EDITOR

Dear Friends, Colleagues and Otter Enthusiasts!

We open this issue shortly after many of us came back from the XIth International Otter Colloquium in Pavia. The conference in Pavia had many good moments, starting from the unique lecture room with its centuries-old frescos, many very enthusiastic young researchers that tried to get out the best of the more experienced scientists, informal talks about future co-operations, the Italian hospitality, the unique food and excellent wine, and real Mediterranean early morning thunder and lightning.

As a result of ongoing discussions during and after the Colloquium some changes in the structure of the OSG will arise. To my opinion we all learned a lot from these discussions that will also influence the organisation of future IOCs. There is a need for more time for discussions devoted to species or topics, structural aspects could be presented at the start so that they can be discussed at the end in a plenary session etc. However, we also have to ensure that only scientific or conservatory lectures presenting new and state-of-the-art knowledge use time for oral presentations, while historic or previously published contents should be presented in the poster sessions. We all take the positive moments back home that will energize our work in the period until the next IOC.

For the future we plan to have the remaining manuscripts for the Proceedings from Frostburg (IOC IX) online and we are hard working to get the remaining articles for the Proceedings from Korea (IOCX) online. The abstracts from Pavia are already available via the website of *Hystrix* and full articles will go online as a special issue of the *IUCN OSG Bulletin* as soon as they become available and have passed the review process. In addition several high ranked scientists have agreed to serve as the editorial board for the *IUCN OSG Bulletin* further contributing to an increase in quality. You can find their names and affiliations on the website of the *IUCN OSG Bulletin*.

Many of you have either sent us pdfs of their publications or have scanned older publications. In the near future we will see an increase in available pdfs in the member-only library.

I am sure you all have meanwhile realized the unique role Lesley and all her efforts have not only for our website but also for the *IUCN OSG Bulletin*. Lesley, thanks a lot for all your efforts.

R E V I E W

BIOLOGY AND ECOLOGY OF ASIAN SMALL-CLAWED OTTER *Aonyx cinereus* (ILLIGER, 1815): A REVIEW

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Abstract: The Asian small-clawed otter is the smallest among the 13 extant species of otters. It has a large distribution range extending from India in South Asia through Southeast Asia up to Taiwan and Philippines in the east and Southern China in the north. It is considered 'Vulnerable' due to habitat loss and degradation, depletion of prey species and exploitation. Being adapted to live in shallow streams and water bodies, they are more vulnerable to modification of these habitats by anthropogenic as well as climate change impacts. This paper summarizes the state of knowledge on the biology and ecology of this little known species. Over the years, the IUCN SSC Otter Specialist Group has developed a cadre of biologist across Asia to conduct field surveys and has popularized otter conservation by promoting otter as the ambassador of wetlands. However, concerted effort is needed for its long-term survival. Policy based action, research on factors affecting survival, habitat-based actions on creation and where required expansion of protected areas and communication and awareness building among local communities are suggested.

Keywords**:** Asian small-clawed otter, species range, biology, ecology, habitat, genetics, conservation

INTRODUCTION

Otters belong to the mammalian order Carnivora and family Mustelidae. They are adapted for a semi-aquatic life with well-developed webs and a tapering tail, which helps in propulsion. Of the 13 extant species of otters distributed worldwide, five species; Eurasian otter (*Lutra lutra*), Smooth-coated otter (*Lutrogale perspicillata*), Hairy-nosed otter (*Lutra sumatrana*), Asian small-clawed otter (*Aonyx cinereus*) and Sea otter (*Enhydra lutris*) occur in various freshwater, coastal and marine ecosystems of Asia and Asia Pacific regions. The Asian small-clawed otter is the smallest otter in the world (Harris, 1968; Foster-Turley and Santiapillai, 1990) rarely weighing more than 5 kg. This species has unique hand-like front paws with reduced nails, which are well adapted for catching small vertebrate and invertebrate prey in shallow and murky water.

Based on canonical variate and Wagner analysis of morphological data from the 13 extant taxa, van Zyll de Jong (1987; 1991) identified two principal clades – the first group includes *Amblonyx*, *Aonyx*, *Enhydra* and *Lontra*, while the second group consists of *Lutra*, *Lutrogale* and *Pteroneura*. Phylogenetic relationships based on Willemsen's

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(1992) evaluation of morphological characters from extant and extinct otter taxa, identified three principal clades - *Lutrini*, *Aonychini* and *Enhydrini*, with *Lontra*, *Lutra* and *Lutrogale* in the first, *Aonyx* and *Amblonyx* in the second, and *Enhyra* in the third clades, respectively. The phylogenetic analysis of the complete nucleotide sequence of the mitochondrial cytochrome *b* gene by Koepfli and Wayne (1998) suggested that otters are divided into three primary clades: (i) the north American river otter (*Lutra canadensis*), neotropical otter (*Lutra provocax*) and marine otter (*Lutra feline*) (ii) the sea otter (*Enhydra lutris*), Eurasian otter (*Lutra lutra*), spotted necked otter (*Lutra maculicolis*), cape clawless otter (*Aonyx capensis*), Asian small-clawed otter and (iii) the giant otter (*Pteronura brasiliensis*). A recent genetic analysis based on maximum parsimony, maximum likelihood and Bayesian inference showed that hairy nosed otter (*Lutra sumatrana*) and Eurasian otter (*Lutra lutra*) are sister taxa, whereas Asian small-clawed otter (*Aonyx cinerea*) is sister to smooth-coated otter (*Lutrogale perspicillata*) (Koepfli et al., 2008).

The Asian small clawed otter has 2n=38 chromosomes. The X chromosome is metacentric, whereas the Y chromosome is acrocentric (van Zyll de Jong, 1987). The cytochrome-*b* sequences suggest that the Asian small-clawed otter and the Cape clawless otter (*Aonyx capensis*) are sister taxa with 10.4% sequence divergence and an estimated divergence time of 5 million years ago (Koepfli and Wayne, 1998). Thus, generic separation of *Aonyx* and *Amblonyx* may not be warranted. In view of this, the IUCN SSC Otter Specialist Group decided to use its generic name *Aonyx* in contrast to *Amblonyx* as proposed by Rafinesque (1832) and Pocock (1941).

Habitat loss and illegal trade for fur caused the rapid decline of the otter populations worldwide. Comparative genetic study conducted for assessment of variation in historical and present population indicates the loss of genetic variation among several species. For example; analysis of microsatellite allelic data revealed that the pre-fur trade (exploited population of 18th and 19th centuries) population of Sea otter (*Enhydra lutris*) had significantly more variation than all the extant sea otter populations (Larson et al., 2002). Analysis of microsatellite DNA variation in contemporary and historical samples, including the museum specimens covering a time-span from the 1880s to the 1960s provided indications of a recent bottleneck and loss of genetic variability in Eurasian otter (*Lutra lutra*) (Pertoldi et al., 2001). Mucci et al. (2010) conducted a genetic survey on the biological sample of otter collected from European countries and demonstrated that the genetic variation is low in mitochondrial DNA D-loop region and microsatellite markers.

Species range

The Asian small-clawed otter has a large distribution range from India in South Asia through Bangladesh, Myanmar, Thailand, and Indonesia in Southeast Asia to Philippines and Taiwan in the east and Southern China in the north. Its presence has been confirmed from India, Nepal, Bhutan, Bangladesh, Myanmar, South China and Hainan Islands, Thailand, Laos, Brunei, Malaysia, Vietnam, Indonesia, Taiwan and Philippines (Foster-Turley and Santiapillai, 1990; Hussain, 1999; Gonzalez, 2010) (Fig. 1). In Vietnam it appears to have a relatively widespread distribution with reports of its occurrence from the northern highlands limestone, Hoang Lien mountain range, northern and central Annamites, central Indochina limestone, Ke Go/Khe Net lowlands, the eastern plains dry forest, lowland Dong Nai watershed and the Mekong delta. It has been found in lower montane evergreen forests, peat swamp forests, freshwater wetlands, freshwater swamp forests and coastal wetlands (Roberton 2007). The records from Vietnam ranged from 50-600 m in elevation, although it has been found at up to 1500 m in other countries (Duckworth, 1997). The Asian small-clawed otter is believed to be extinct in Hong Kong (Foster-Turley and Santiapillai, 1990) and rediscovered in Singapore (Sivasothi, 1996).

The Asian small-clawed otters are nocturnal and crepuscular where they live near people in northern Malaysia. At night their chirps can be heard in rice fields. They are occasionally seen in the early morning or around dusk. In recent years, in England it has established itself in the wild after escaping from captivity (Jefferies, 1989, 1991).

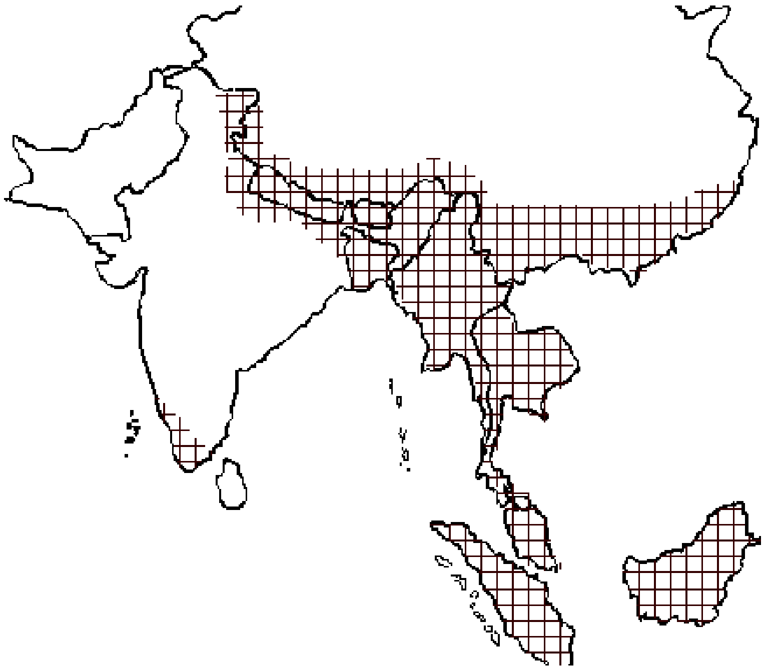

Figure 1. Distribution of Asian small-clawed otter in South and Southeast Asia

In India, the Asian small-clawed otter is reported to occur in north India from the Himalayan foothills of Himachal Pradesh (Kulu), West Bengal, Assam hill ranges as well as in South India, in the higher ranges of the hills in Coorg (Karnataka), Ashambu, Nilgiri and Palani hills (Tamil Nadu) and some places in Kerala (Pocock, 1941; Prater, 1948; Hussain, 1999). However, in recent years its occurrence has been confirmed from Western Ghats and from the northeast India (Hussain, 1999).

Three sub-species were recognized (Harris, 1968); *A. c. concolor* from the Himalayas from Kulu eastward to Assam, Meghalaya and upper Burma and *A. c. nirnai* from the Westen Ghats (Pocock, 1941); and *A. c. cinereus* from Southeast Asia. Corbet and Hill (1992) recognized two subspecies from Southeast Asia *Amblonyx* (*Aonyx*) *c. fulvus* from Lao Key, Tonkin, Vietnam (Pohle, 1920) and *Amblonyx* (*Aonyx*) *c. wurmbi* (Sody, 1933) from near Poeger, Watangan Mountains, on east Java.

Morphology

The Asian small-clawed otter has distinctive webbed feet, with the third and fourth digits markedly longer than second and fifth on each foot. All claws are reduced to small rudiments, which do not project beyond the tips of the digits. It is small in size as compared to other otter species, head and body measuring 406-635 mm, tail length 246-304 mm and the total length from snout to the tip of the tail is around 652-939 mm. Its weight ranges between 2.7-5.4 kg (Walker, 1975). The females are on an average, only a little smaller than the males (Harris, 1968).

The Asian small-clawed otter is principally distinguished from the Eurasian and the smooth-coated otter in external characters by the structure of the feet, which are considerably narrower with the digits tied closer together by shallower, narrower and more emarginated webs, which do not extend along the digital pads and are sparsely covered below with short hair. Also the claws, except in small cubs, are minute, erect spikes not projecting beyond the end of the digital pads. The planter pads are better developed, sub-symmetrical and four lobed, the inner main lobe being prolonged backwards by the pollical and hallucal elements. The rhinarium is inverted ‘V’ shaped similar to smooth-coated otter, its anterior surface is directed forwards and posterior margin is straight (Pocock, 1941). In the field, tracks of small-clawed otter can be differentiated from tracks of other otters by smaller size (width, 4.5 cm), absence of claw marks, incomplete webbing between fingers and toes, longer middle digit compared with other digits, and relatively long fingers (Lariviere, 2003).

Skull

The skull is shorter and broader, width of the cranium being over half the total length, and the dorsal profile not so depressed. The bulla is better developed, almost reaching the para-occipital process behind. The post-orbital area is short and only in well-developed skulls has an abrupt constriction a little distance behind the post-orbital process. The dentition is characterized by the absence of upper premolar, there being only four instead of five post-canine teeth above. The last two upper teeth (pm^4 and m^3) are larger in size than the Smooth-coated and the Eurasian otters.

Colour

The dorsal body colour is typically dark brown, sometimes with a tawny or rufous tinge. Often tips of the contour hairs are paler, but rarely white, giving the grey or ashy tint. The ventral side is generally paler brown than the upper, often showing a grey cast. The edge of the upper lip, chin, cheek, side of the neck and throat are grey or nearly white, sometimes sharply, sometimes comparatively weakly contrasted with the darker upper tint of the head and the neck (Pocock, 1941).

Physiology

Metabolic rates

During surface swimming the Asian small-clawed otter and their larger relatives propel their body using all four limbs, rowing with the forelimbs and paddling with the hind limbs (Fish, 1994). While swimming under water, propulsion is provided via dorso-ventral undulation of body and tail, similar to those of other truly aquatic mammals. Thus, the underwater swimming metabolism of Asian small-clawed otters is higher than that of fully aquatic mammals, but lower than those of paddling semi aquatic mammals (Borgwardt and Culik, 1999).

The metabolic rate of Asian small-clawed otter on land is similar to those of other otter species and about double than those of other terrestrial mammals of comparable size. The respiratory quotient of six small-clawed otters with a mean body mass of 3.1 kg $\pm$ 0.4 kg at rest on land at 16 ^{0}C had a respiratory quotient of 0.77 and a resting metabolic rate of 5.0 $\pm$ 0.8 Wkg^{-1} (SD). This increased to 9.1 $\pm$ 0.8 Wkg^{-1} SD during rest in water and 11-15 ^{0}C, 17.6 $\pm$ 1.4 Wkg^{-1} during foraging in water at 12 ^{0}C (Borgwardt and Culik, 1999).

Habitats

In most of their range the Asian small-clawed otters are sympatric with smooth-coated and Eurasian otters. In India all the three species occur in Southwest India, particularly in Western Ghats and possibly in the hills of Uttar Pradesh and Assam. In South India they are mostly found along hill streams. They were once common in the mangroves of east Calcutta and Sunderbans (Sanyal, 1988). In Malaysia and Indonesia including Java they occur in coastal wetlands, and along the banks of paddy fields. Comparable data from Java, Myanmar, and India revealed that the Asian small-clawed otters have a high climatic and trophic adaptability in South and Southeast Asian tropics, occurring from coastal wetlands up to mountain streams and in slow-flowing lowland streams to sub- montane streams dominated by rocks and boulders in forested areas. (Melisch et al., 1996). The typical natural habitats of small-clawed otter in west Java are wetland systems having pools and stagnant water, including shallow stretches with depth less than 1 m. These habitats are represented by freshwater swamps, meandering rivers, mangroves and tidal pools. Irrigated rice fields with many crab species (*Brachyura sp.*) are extensively used by small-clawed otters if proper shelter for them is available. These can act as suitable man made habitats (Melisch et al., 1996).

Habitat selection

Kruuk et al. (1994) found that although there were differences among Eurasian otter, smooth-coated otter and small-clawed otter in their macro-habitat, micro-habitat and food, there were overlaps between them. In Thailand, it occurs mostly in the middle sections and at the upper reaches of the rapid-flowing Huay Kha Khaeng River. When different otter species occurred in the same site there was evidence of a difference in use of the habitats. Signs of the small-clawed otter were found wandering further away from the river than the two other species, between patches of reeds and river debris where crabs were more likely to be found (Kruuk et al., 1994). In Eravikulum National Park its occupancy over smaller time scales indicated a strong time-dependant influence of altitude and habitat use intensity (Perinchery, 2008) and the intensity of its habitat use was influenced by altitude, followed by stream types, with pools preferred over cascades and riffles. Second and third order streams were used more intensively than first order streams (Perinchery et al., 2011).

In Annamalai hills the small-clawed otters occur in the Valparai plateau because the stream properties have not been fundamentally altered due to the presence of forest fragments, riparian vegetation. The human modified landscape is less used than the surrounding protected area because of human disturbance such as sand mining, fishing, and poaching (Prakash, 2010).

In west Java, the Asian small-clawed otters prefer pond areas and rice fields than the rivers, whereas they use mangroves and lakes in proportion to their availability. In riverine systems, they prefer moderate and low vegetation structure, though their presence was also observed from banks with poor vegetation cover (Melisch et al., 1996). Its presence is positively correlated with slow flowing and stagnant broad rivers and smaller streams, depicting a distinct preference decline from slow to deep-water bodies. On the other hand, they also use shallow fast-flowing mountain creeks narrower than 5 m, particularly when the course of the streams includes natural pools. In rice fields, they chose slow-flowing irrigation channels narrower than 2 m and with a varied, moderate or low vegetation structure. Like smooth-coated otter the Asian small-clawed otters dislike bare and open areas that do not offer any shelter (Melisch et al., 1996).

Diet/feeding

Otters have evolved two distinct foraging habits: piscivory and feeding on invertebrates. Piscivorous otters include *Lutra* species and the giant river otter *Pteroneura brasiliensis.* The invertebrate eaters include the clawless, small-clawed otters (*Aonyx* spp.) and the sea otter (*Enhydra lutris*) (Estes 1989). Like other *Aonyx* species such as Congo claw-less otter (*A. congica*) and Cape claw-less otter (*A. capensis*), the small-clawed otter is adapted to feed on invertebrates as evident from the last two upper teeth (pm^4 and m^3) which are larger in size for crushing the exoskeleton of crabs and other hard shelled prey. It feeds mainly on crabs, snails and other molluscs, insects and small fish such as gouramis and catfish (Pocock, 1941; Wayre, 1978). They supplement their diet with rodents, snakes and amphibians too. The quantitative information on the diet of small-clawed otter from different ecosystems is very scanty which has been reviewed in the subsequent sections.

Regional and seasonal variation in prey selection

During a study in Malaysia, Foster-Turley (1992) examined 328 spraints and found that around 80.8% of the diet of the small-clawed otter consisted of crabs, 77.8% fish, 12.5% insects and 4.0% snails. This is the first study in which quantitative information on the diet of wild Asian small-clawed otter was made. This study revealed that though it is adapted for an invertebrate diet it substantiates its diet with large quantities of fish. Apart from crabs, the major prey item for small-clawed otter was the mudskipper (*Gobioidei* sp.). The other important prey was *Trichogaster* sp. (20.7%), Anabantidae fish (27.4%), *Anabis testudineus* (5.2%), *Clarius* sp. (2.4%) and *Channa striatus* (1.5%). Apart from these they also consume snakes, frogs and insects in minor quantities.

In rice fields, the diet of the small-clawed otters was significantly different at different times of the year depending on water levels. Only the relatively rare dietary components of rodents, snails and snakehead fish (*Clarius* sp.) showed no significant difference among seasons. Crabs were always the most prevalent food items, but the frequency of occurrence in scats varied from 70.4% to 93.2%. Similarly, though the mudskippers were the second most important food items, they were consumed in significantly different amounts in different seasons from a low of 27.3% to 63.6%. The amount of *Trichogaster* sp., *Anabas* sp. and the entire family Anbantidae also varied considerably. This difference in the use of these prey items is most likely due to the difference in the life cycle and availability of these prey at different times of the year.

Preliminary analysis of the small-clawed otter spraints from west Java showed their preference for crabs in both natural and man-made habitats (Melisch et al., 1996). In 87% of all collected spraints, crabs formed the dominant prey. Remaining part of the spraints consisted of fish bones and scales, ribs and vertebrae, unidentified mammalian hair, shrimps, insects and snake scales.

In the Huay Kha Khaeng, Thailand almost 90% of the spraints of small-clawed otter contained remains of crabs *Potamon smithianus*, whereas 5% spraints contained each of Fish and Amphibians. Apart from this in few scats evidences of rodents and other arthropods were also found (Kruuk et al., 1994).

Size preference for major prey species

Kruuk et al. (1994) estimated the preference for various size classes of crabs eaten by small-clawed otter. Of the 92 spraints, 14 had crabs size 10-14 cm, 42 had 15-19 cm, 26 had 20-24 cm, 12 had 25-29 cm, four had 30-34 cm and one had 40-44 cm. The size distribution of crabs taken by small-clawed otter was similar to what was available, and there was not much evidence of selection for specific size. In west Java, a preliminary estimate of preferred size confirmed an average of 3-4 cm carapace width (Melisch et al., 1996).

Reproduction

The Asian small-clawed otter is amongst the least studied Asian otter species in wild. Information on its reproductive behaviour mostly comes from various zoos outside of its distribution range. Sexual behavior has been observed in pups as young as 6 months with breeding behavior having been noted in males and females as young as 18 months. Successful breeding has been reported for 2.1 year-old females and 2.8 year-old males. The youngest animal to reproduce was a 13 month-old female, captive born at Bronx Zoo, and the oldest was a male at the National Zoo, USA known to be more than 15 years old (Foster-Turley and Engfer, 1988).

Mating season

In the females oestrous cycle has duration of anywhere from 28 to 30 days, with breeding occurring the year round (Lancaster, 1975). Some facilities report this cycle extending to "every few months" with older animals. Oestrus lasts from one to thirteen days. Behavioral signs at the onset of oestrus may include increased rubbing and marking.

Mating behaviour

In captivity mating usually takes place in the water, but has also been observed on land on a few occasions. In most cases the exact gestation period could not be ascertained but it is believed to be around 60 days (Lancaster, 1975). Gestations of 62 to 86 days have been recorded in North American zoos. Sobel (1996) recorded a gestation length between 60 and 74 days from his study. Pregnancy is usually obvious by the increase in the females' girth. The females collect grass and other materials such as hay or straw and carry it into the breeding chamber a few days before parturition. The males frequently help in the task of collecting bedding and carrying it into the maternity chamber (Lancaster, 1975).

Pregnancy

In Santa Barbara Zoo, urinary hormone levels in the females from six pairs of Asian small-clawed otters were compared with the observed reproductive behaviour during six oestrous periods. The study showed that regular peaks in progesterone corresponded with observed mating activities, both male and female engaged in nest building and sometimes females even showed signs of pregnancy; however no offspring were ever produced. Such results illustrate one of the most frustrating aspects of attempts to breed small-clawed otter (Foster-Turley and Engfer, 1988). Two litters can be produced in one calendar year (Foster-Turley and Engfer, 1988). During a study an inter-birth interval as short as eight months was observed (Sobel, 1996).

Litter size

There is no published information on the litter size in the wild. In captivity the litter size varies from 1-7 (n=16, mean=4.4) (Lancaster, 1975). In a recent compilation Lombardy and O'Connor (1998) concluded that the mean litter size was 3.5. (n=28). The observed pup sex ratio was not statistically different from an expected 1:1 ratio. Like all other otter species, the cubs are born with eyes closed that remain so until the fifth week. When they are about ten weeks old they make tentative exploratory excursions outside the breeding den. When about three months old they first enter and paddle in shallow water under the guidance and watchful eye of the mother. The cub survival is low in captivity. For instance only 54% of the 70 cubs born in Adelaide Zoo survived to independence (4-5 months) (Lancaster, 1975). At birth the weight of the pups ranges between 45.60-62.50 g to 410-988 g after 60 days (Maslanka and Crissey, 1998). Several studies in captivity clearly indicated that the Asian small-clawed otter lives in pair and both the parents take part in nest building and rearing of families (Leslie, 1970,1971; Timmins, 1971; Lancaster, 1975).

Social structure

All that is known about the social behaviour of small-clawed otters is from studies in captivity. In captivity, they display a strong pair bond and both parents share the responsibilities of rearing the offspring. As many as seven cubs can be born in a litter. The inter-birth interval can be as short as ten months. Family groups can easily build up to 15 or more animals. In the wild groups up to 12 animals have been observed (Lekagul and McNeely 1977), which are mostly family groups.

Communication

The small-clawed otter is capable of a wide range of sounds. Timmins (1971) recognized 12 or more distinct calls. They utter a variety of yelps and whimpers and when disturbed high-pitched ululating screams (Medway, 1969; Lekagul and McNeely, 1977). The distress call of small-clawed otter serves to rally the help of other otters (Sivasothi and Nor, 1994).

Activity pattern

The small-clawed otters are nocturnal and crepuscular particularly where they live near human habitation in Malaysia. At night their chirps can be heard in rice fields. They are occasionally seen in the early morning or around dusk (Foster-Turley 1992). In Malaysia, Foster-Turley (1992) observed that only small-clawed otter smeared their scat at the toilet sites. Scat smearing was found in 28 of the 63 positively identified small-clawed otter toilet sites. The difference in the scat smearing was not significantly different at various seasons. The presence of smeared scat was related to the size of the otter group. Among the larger groups smearing was more prominent. Groups of three or fewer animals rarely displayed smearing. The frequency of sites with smeared scats varied in different locations, indicating choice for certain sites. This scat smearing is most likely associated with scent-marking displays. The observation of increased scat smearing with larger groups may indicate the social facilitation of this behaviour (Foster-Turley 1992). Scat smearing in the shared area may be a scent-marking display with interspecific territorial implications (Foster-Turley 1992). In captivity, small-clawed otters are often observed in scat smearing displays. Typically, scat is smeared with the hind feet and the tail and all otter in the group participate in the activity.

Relation with other species

In most of their range the small-clawed otters occur sympatrically with crab-eating mongoose (*Herpestes urva*) and directly compete with them for food. The foraging behaviour and diet of crab-eating mongoose and small-clawed otter overlaps greatly. Apart from sharing their habitat with Eurasian and smooth-coated otters, the small-clawed otters also share their habitats with crab-eating mongoose. Other aquatic species such as Indian marsh crocodile or mugger (*Crocodylus palustris*), saltwater crocodile (*Crocodylus porosus*), Siamese crocodile (*Crocodylus siamensis*), and several species of turtles also occur sympatrically with them and compete in one way or other for the same resources.

Threats

Throughout its range, the potential threat to the continued survival of the small-clawed otter is destruction of its habitats due to changing land use pattern in the form of developmental activities. In many parts of Asia, the habitats have been reduced due to reclamation of peat swamp forests and mangroves, aquaculture activities along the intertidal wetlands and loss of hill streams (Hussain et al., 2008). The primary threats to Asian small-clawed otter are loss of habitats due to tea and coffee plantations along the hills, siltation of smaller hill streams due to deforestation and in the coastal areas loss of mangroves due to aquaculture and increased human settlements (Sanyal, 1988) Increased influx of pesticides into the streams from the plantations reduces the quality of the habitats.

Other important threats to Asian small-clawed otter are reduction in prey biomass due to over-exploitation, which make its habitats unsustainable. Pollution is probably causing decline in the population of many fish species (Dehadrai and Ponniah, 1997). Reduction in prey biomass affects otter population, and organochloric and heavy metal contamination interferes with their normal physiology leading to a decline in population. The threat to small-clawed otter is prominent in its western range so much so that since last 60 years its range has shrunk considerably moving west to east from Himachal Pradesh to Assam. Once common in the mangroves of east Calcutta and Sunderbans (Sanyal, 1988), now it is believed to be locally extinct. It is likely that the present range boundary at the western limit is Assam and in the Western Ghats of South India. In many Southeast Asian countries it is regularly being killed, *e.g* rampant hunting and catching of these animals in Southern Palawan is persisting mainly because of curiosity and for food. Most of their habitats were already degraded with slash and burn farming that may cause the decline of their population. Because of their charismatic appeal they have a high public demand, leading to illegal trade in Palawan (Gonzalez, 2010).

Relation with humans

The Asian small-clawed otters are traditionally kept as pets not only in the Asian countries but also in many western countries. Besides being intricately woven with human culture the Asian small-clawed otters have significant economic value in terms of controlling crustacean populations in the rice fields which are otherwise destructive to rice culture in terms of destroying saplings and burrowing in the dykes leading to severe irrigation problems. At least eight species of crabs occur in rice fields of West Java. Some of these species also destroy mangrove saplings in the silviculture/plantation areas causing economic losses. Presence of small-clawed otters reduces such damages by controlling crustacean populations. On the other hand both the small-clawed and the smooth-coated otter damage paddy saplings because of their playful activities. They also prey upon rice field fish, which are otherwise an additional source of income for the farmers. They often raid fishponds and prawn farms causing large-scale damage, leading to human-animal conflicts.

Conservation status

It is considered "Vulnerable" under IUCN Red List due to an inferred future population decline because of habitat loss and exploitation (Hussain *et al.*, 2008). In the last few decades the range of Asian small-clawed otter has shrunk particularly in its western portion (Hussain et al., 2008). The vulnerable status of the species based on past population decline rates under criterion A2acd. Given the extent of habitat loss that is occurring in South and Southeast Asia (Schipper et al., 2008; Hoffman et al., 2010) and the intensity of poaching, the reduction in population has been observed in many parts of its range (Hussain, 1993; Melisch et al., 1996; Hussain, 1999).

Conservation action

Since 1977, The Asian small clawed otter is listed on Appendix II of CITES which indicates that the species is not necessarily threatened with extinction, but the trade on its pelt must be controlled in order to avoid utilization incompatible with their survival. However, most range countries are not able to control the clandestine trade leading to extensive poaching. Nevertheless, it is a protected species in almost all the range countries which prohibits its killing. The Asian small-clawed otter once common in the streams and wetlands of South and Southeast Asia is now restricted to a few protected areas. Creation of networks of protected areas, identification of sites as wetland of national and International importance under Ramsar Convention has to some extent halted the degradation of its habitat.

Over the years the IUCN Otter Specialist Group has developed a cadre of biologist across Asia to conduct field surveys and has popularized otter conservation by promoting otter as ambassador of the wetlands. However, concerted effort to conserve this species is needed. For the long-term survival of the species, policy based action, research on factors affecting its survival, habitat based actions on creation and where required expansion of protected areas and communication and awareness building actions are needed. Basic studies on the habitat use, feeding ecology, interspecific interaction and resource partitioning with other aquatic species and its conservation genetics from different parts of its range covering different ecosystems will contribute to the conservation of this species.

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RÉSUMÉ
ETAT DES LIEUX SUR LA BIOLOLGIE ET L'ECOLOGIE DE LA LOUTRE D'ASIE *Aonyx cinereus* (ILLIGER, 1815)

La Loutre d'Asie est la plus petite des 13 espèces de loutres présentes dans le monde. Elle présente une très grande distribution, de l'Inde à l'Asie du sud-est jusque Taiwan et les Philippines à l'est puis la Chine méridionale au nord. Elle est classée comme espèce «vulnérable» en raison de la perte et de la dégradation des habitats, la raréfaction des proies et son exploitation. Son adaptation à la vie dans des ruisseaux peu profonds et les plans d'eau la rend plus vulnérable aux modifications de ses habitats par l'Homme ainsi qu'aux conséquences du changement climatique. Ce document résume l'état des connaissances sur la biologie et l'écologie de cette espèce peu connue. Au fil des ans, le Groupe de spécialistes de la Loutre de l'UICN a soutenu des biologistes à travers l'Asie afin de mener des enquêtes de terrain et de populariser la conservation de la Loutre en l'utilisant comme ambassadrice des zones humides. Toutefois, des efforts concertés sont nécessaires pour sauvegarder cette espèce. Pour sa survie à long terme, des actions politiques, des recherches sur les facteurs affectant sa survie, des actions de conservation des habitats, la création et/où l'extension d'aires protégées, la communication et des actions de sensibilisation sont nécessaires.

RESUMEN
REVISION DE LA BIOLOGIA Y ECOLOGIA DE LA NUTRIA INERME ASIÁTICA *Aonyx cinereus* (ILLIGER,1815)

La Nutria Inerme Asiática es la más pequeña de las trece especies de nutrias existentes. Su rango de distribución se extiende desde India en el sur de Asia; Taiwán y Filipinas en el este y el sur de China en el norte. Su estado de conservación se considera "Vulnerable" debido a la pérdida y degradación de su hábitat, disminución de sus especies presa y explotación. La especie está adaptada a vivir en esteros y cuerpos de agua de baja profundidad por lo que son vulnerables a la modificación de éstos, principalmente por impactos antropogénicos o como consecuencia del cambio climático. El presente artículo resume el estado de conocimiento acerca de la biología y ecología de esta especie. En los últimos años el Grupo de Especialistas en Nutrias de la UCIN SSC ha formado un conjunto de biólogos a lo largo de Asia los cuales han implementado censos y han popularizado la conservación de las nutrias promoviéndolas como "embajadoras de los humedales". Sin embargo, mayores esfuerzos son necesarios para la sobrevivencia de la especie a largo plazo. Políticas de conservación y de investigación de las especies que se basen en estudios que identifiquen medidas para la sobrevivencia de esta nutria, protección del hábitat, expansión de áreas protegidas, así como la concientización de comunidades locales son necesarias

A R T I C L E

INVESTIGATION INTO THE DIETARY HABITS OF THE EURASIAN OTTER (*Lutra lutra*) IN THE COUNTY OF ESSEX

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Abstract: Monitoring throughout the county of Essex has shown annual widening of otter distribution. There is, however, room for expansion and some areas remain un-colonised. This paper reports a snapshot study of spraints collected from within the areas of known distribution, providing additional insight on a growing population.
Prey remains were identified to family level and data used to calculate trophic breadths over the range of stream orders. Investigative comparisons were used to detect changes in diet with stream order. Further consideration was given to the importance of crayfish predation(e.g. the signal crayfish *Pacifastacus leniusculus*).Within the sample (n= 54) from four stream orders (Strahler 2-5), fish occurred most frequently (67%). Other groups included; invertebrates 20%, birds 7% and mammals 6%. Crayfish comprised 4% of the sample. There were no significant differences between Trophic Niche Breadth and stream order (H^* =2.73, P>0.05), a finding strengthened by subsequent statistical analysis of the data. Dietary composition was consistent within the range and period studied. Extended research could determine seasonal variation and the extent to which available prey assemblage limits distribution against wider environmental and biological variables.

Key words; distribution, trophic niche breadth, Strahler classification, predation

INTRODUCTION

The Eurasian otter (*Lutra lutra*) population in the county of Essex and East Anglia is experiencing growth and becoming re-established after regional extinction (Mason and MacDonald 2003).

Historically, the otter was common throughout Britain (Stephens 1957). However, by the early 1960's hunt returns where showing a sharp reduction in numbers (Chanin and Jefferies 1978).In response to growing conservation concern a series of national surveys were instigated (Hewer 1974, Lenton et al., 1980).The second national survey reported an absence of otter signs in Essex (Strachan et al., 1990). The decline and eventual disappearance of otters was attributed to the effects of persistent toxic pollutants compounded by habitat destruction and direct persecution (Macdonald and Mason 1983; Mason and Macdonald, 1986; Mason, 1989; Strachan and Jefferies, 1996; Jefferies and Hanson, 2000). Environmental pollutants identified as harmful to otters included; organochlorine pesticides; heavy metals and polychlorinated biphenyls (PCBs).

Re-colonisation was facilitated by the efforts of multiple agencies combined within the Joint Otter Group and other agencies working to reverse environmental degradation. Habitat restoration and targeted re-introductions successfully re-established a small yet viable population (Jefferies et al., 1986, 2000). A survey in 1991 (Strachan and Jefferies, 1996), identified the presence of field signs indicating otter usage. Successive surveys have consistently shown increases in the extent to which the species uses local water courses (Tansley, 2008, 2009, 2011). Annual monitoring of the Essex population is tracking progress, which is essential, as the population has yet to reach carrying capacity and still has potential to expand (Crawford, 2010). This study aims to complement survey distribution data with additional information, through dietary analysis, on how a growing otter population uses available resources.

AIM AND OBJECTIVES

Aim

To determine the diet and feeding habits of *L. lutra* across the county of Essex

Specific Objectives

- To produce a map communicating the distribution of collected samples in relation to the known distribution of this species.
- To identify all prey species to family level.
- To determine the relative contributions of each family to otter diet in relation to distribution.
- To compare trophic breadth indices to identify geographical patterns in relation to stream order.
- To determine the importance of invasive crayfish species to otter diet.

METHODS AND MATERIALS

Essex is a low-lying county in eastern England. The largest of the counties rivers and tributaries included in this study are; the Stour, Colne, Chelmer and Roding. Spraint samples (n=54) were collected during the spring and summer of 2010from field locations known to have been previously used by otters (Figure 1, Tansley, 2009). Samples were wrapped in aluminium foil, sealed in plastic sample bags, tagged and stored frozen.

Stream order was allocated to each sample using the system described by Strahler (1952). Streams originating from source were allocated the first order. In this system an n^{th} order stream always flows downstream from the confluence of two $(n-1)^{th}$ order streams.

Samples were oven dried at 60 ^{o}C for 12-24 hours until completely desiccated, then carefully crumbled by hand to separate undigested prey remains. Once separated identification of prey remains to family level was aided by published keys (Conroy et al., 2005, Teerink 1991, Day 1966). Binocular Leica Zoom 2000 and Nikon 104 microscopes were used for analysis. The bulk percentage dry weight of prey items was estimated by eye (Wise et al., 1981). Data gathered were used to calculate the percentage (%) frequency occurrence of prey groups (P=number of spraints containing X / total number of spraints x 100).

The relative (R)percentage (%) frequency of occurrence for each prey group(R=occurrence of X / number of groups x 100). Trophic niche breadth (TNB) for each observation using TNB=1/RΣpi^2 Levins' index (Feinsinger et al., 1981). Where pi is the estimated proportion of prey type within each sample and R is the total number of prey types observed. Using descriptive statistics, homoscedasity was assessed for each group before and after various transformations. Despite transformation, neither normality nor homoscedasity were achieved. Therefore, analysis of data required the use of the Kruskal-Wallis (H) test between trophic niche breadth (TNB) and stream order. Additionally, the Spearman's test was used to look for correlation between ranked TNB and stream order.

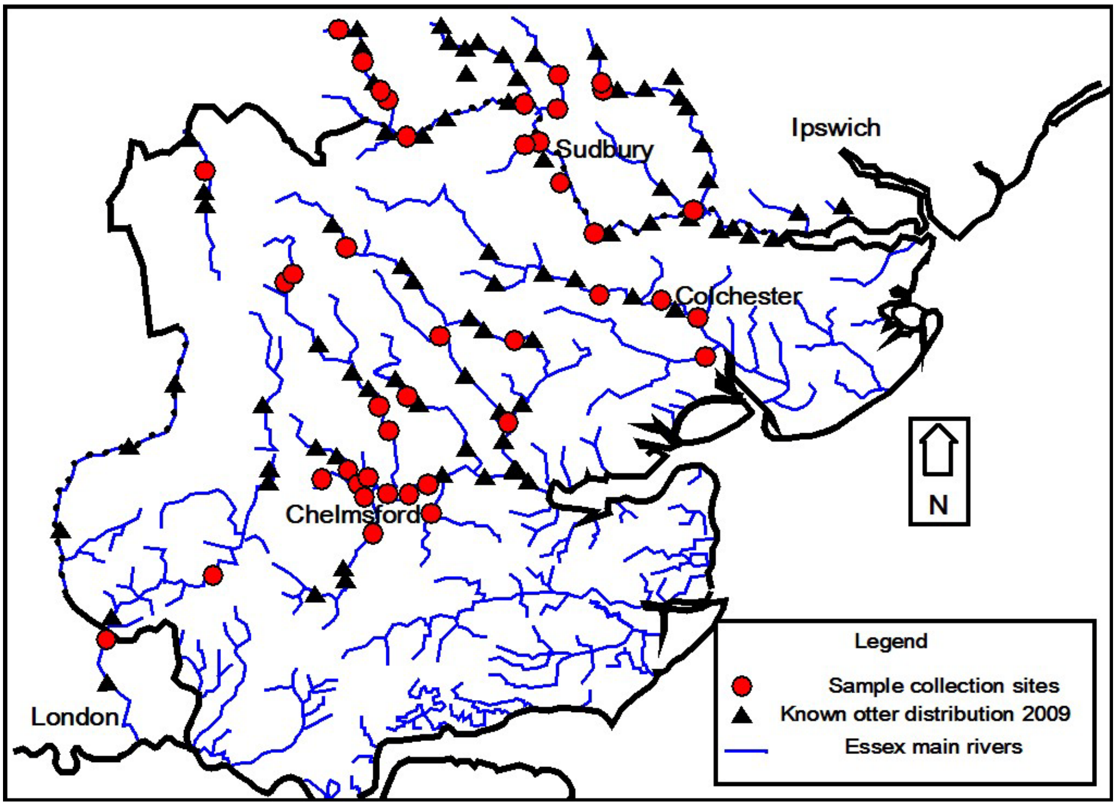

Figure 1: The county of Essex incorporating the known otter distribution as 2009 (triangles) and the sites where samples of spraints where collected in 2010 (circles). Figure produced as an overlay to Crown Copyright © Ordnance Survey Licence number 100025798

A contingency table was constructed to calculate expected values enabling a chi squared (χ^2) test of association between stream order and prey groups. Arcsine transformed frequencies of prey families were compared between stream orders using the paired t-test. The statistical analyses of data were performed using SPSS software.

RESULTS

Spraints (n=54) were collected from rivers of the orders; two to five (Figure 1). Six of the samples (11%) came from second order streams. Third order streams contributed the highest proportion of 20 samples (37%). Seventeen samples were taken from streams of the fourth order (31%). The remaining eleven samples (20%) where collected from fifth order streams. The dry weight of spraints ranged from 0.34g to 7.91g, mean 2.046g (SE 0.195).

Table 1. Families and Common names of prey items extracted from otter spraint (n=54) collected from the county of Essex 2010.

Prey Group	Family	Common name	Percentage (%) frequency
Fish	*Cyprinidae*	carp	35
	Percidae	perch	9
	Cottidae	stone loach	14
	Cobitdae	bullhead	15
	Gasterosteidae	stickleback	4
	Esocidae	pike	11
	Salmonidae	trout	2
	Anguillidae	eel	7
Invertebrate	*Odonata*	dragon fly	6
	Gammaridae	shrimp	5
	Astercidae	crayfish	6
	Tricoptera	caddis fly	1
Bird	*Ralliform*	moorhen	4
	Anseriform	duck	2
	Colombiform	pigeon	2
Mammal	*Leporidae*	rabbit	2

Otters predated animals from four groups comprised of eight families of fish, four families of invertebrate, three families of bird and one family of mammal (Table 1). Percent frequency occurrence values of prey families within each stream order (Figure 2) provided a description of predation within each stream order, these values were used to calculate related trophic niche breadths (Figure 3). The distribution of TNB values within each group was skewed. Second order streams had a median value of 0.1. The median TNB value of third order streams was 0.09. In the group of fourth order streams, the distribution was highly skewed and had a median of 0.07. Within the fifth order group of samples the TNB median was 0.08.

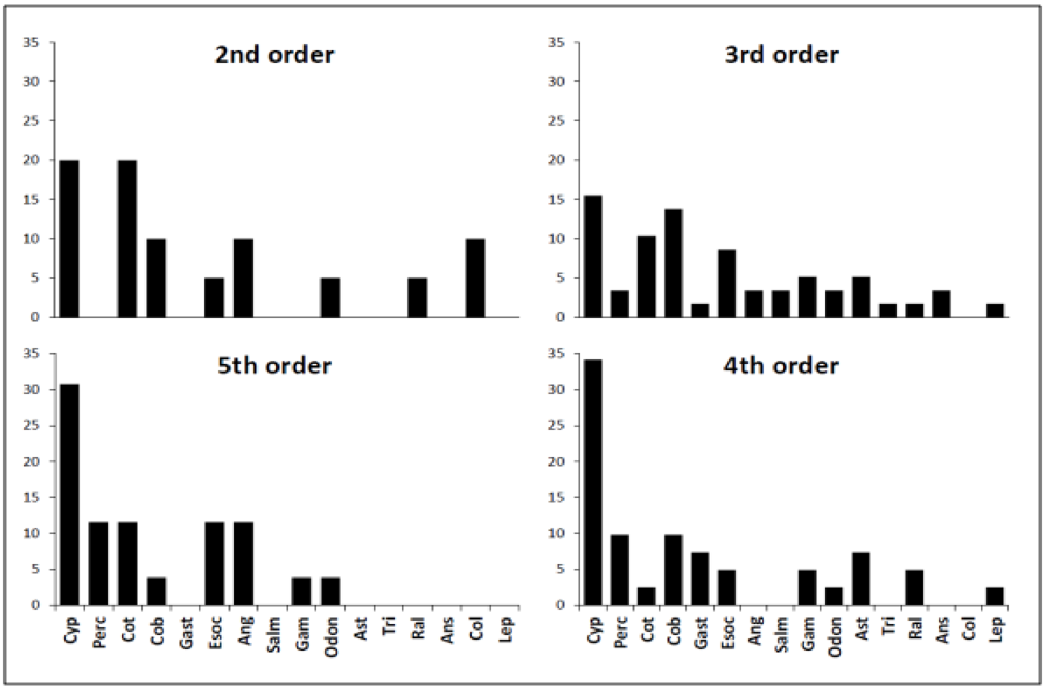

Figure 2. Relative percent (%) frequency of prey families within the diet of otters from four orders of stream. *Cyprinidae* (Cyp), *Percidae* (Perc), *Cottidae* (Cot), *Cobitidae* (Cob), *Gasterosteidae* (Gast), *Esocidae* (Esoc), *Salmonidae* (Salm), *Anguillidae* (Ang), *Odonata* (Odon), *Gammaridae* (Gam), *Astercidae* (Ast), *Tricoptera* (Tri), *Ralliform* (Ral), *Anseriform* (Ans), *Colombiform* (Col), *Leporidae* (Lep).

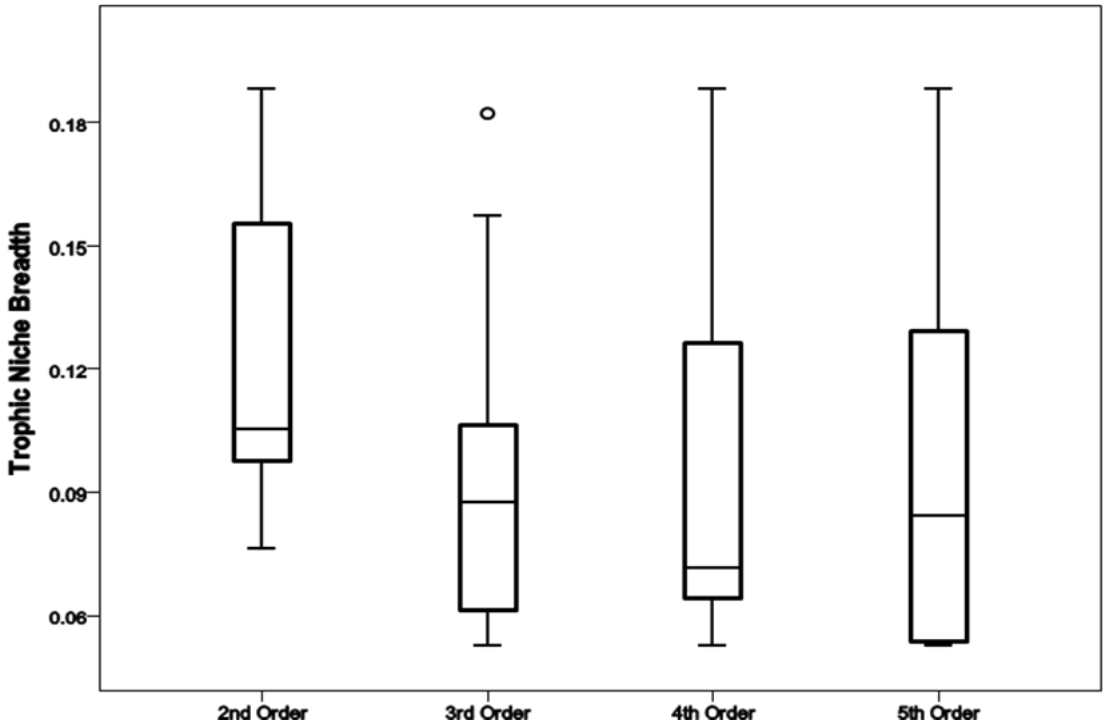

Figure 3. The Trophic Niche Breadth of otter diet as determined from spraints collected from four orders of stream within the county of Essex.

Comparison of these data could not separate populations, there being no significant difference between trophic niche breadths and stream order, H* =2.73, P>0.05. There was no correlation between ranked niche breadth data and stream order (r_S = -0.116, P>0.05). Prey occurrence data was tested for association with stream orders and none were found, e.g. the number of occurrences of Cyprinidae fish families within spraints were not significantly different between either of the stream orders investigated, χ^2_3= 5.41, P<0.05.

A comparison of the, arcsine transformed, proportion of each prey type found no significant differences (P>0.05) in distribution among stream orders (Table 2).

Table 2. Comparisons of the proportion of different prey types consumed in streams of increasing magnitude, n = 19.

Catagories	*t*- values			
	2nd Order	3rd Order	4th Order	5th Order
Whole Sample	0.721 (NS)	0.706 (NS)	0.823 (NS)	1.049 (NS)
2nd Order		0.535 (NS)	0.134 (NS)	0.092 (NS)
3rd Order			0.863 (NS)	0.652 (NS)
4th Order				0.116 (NS)

NS = not significant.

DISCUSSION

The frequency occurrence of prey within the diet of the Essex population was congruent with previous studies of eutrophic systems (e.g. Weir and Bannister, 1973, 1977; Jarman, 1979; Woodroffe, 1994), and consistent with evolutionary adaptation. In this study fish were the most frequently taken food items, 67%. In terms of volume, fish may contribute a larger proportion of diet than has been measured here. Due to problems associated with bulk estimations (Carss and Nelson, 1998) no attempt had been made to estimate the volume of fish eaten, whole or part.

Insects and crustaceans featured regularly in the diet (19.9%). Consistent occurrence across stream orders suggests invertebrates are an important dietary component to this population. Carss and Parkinson (1996) have described how well fed, captive otters actively pursue and consume aquatic insects. The benefit and importance of invertebrates to the diet of otters is considered by Taylor et al. (2010).

Otters are considered beneficial as a source of biological control of invasive crayfish species (Reeve, 2004). In this study crayfish occurred in 4% of the sample. Crayfish predation is identified by the presence of carapace or other cuticle fragments within spraints. This method is limited by providing only presence or likely absence of occurrence and not volumetric data. To fully understand habits, a longer study would be needed to identify spatial and seasonal variations in crayfish predation.

Birds and mammals were an infrequent, though regular, feature in the diet of the Essex population (bird 7.4%, mammal 5.5%). The families predated (e.g. Ralliform, Anserform and Leporidae) were those otters are most likely to encounter, and the infrequency suggests predation is opportunistic.

Amphibians area group of potential prey known to feature within the diet of otters (e.g. Clavero et al., 2003). The absence of amphibian prey from the sample could be due to the timing and habitat focus of sample collection. Observations have shown that otters feed on amphibians during the spawning season in early spring (Mason and Macdonald, 1986; Weber, 1990). This study focused on river habitats, excluding standing waters that are preferred breeding sites for frogs, toads and newts (Baker et al., 2011).

Comparison of TNB and one physical attribute of habitat variability (stream order) found no significant change in diet between rivers in terms of size and discharge. This study has detailed dietary norms of the local population. As range is a function of habitat quality (Jefferies and Woodroffe, 2008), these data could provide a baseline with which to gauge the prey assemblage of water courses yet to support otters.

An extended comparison of distribution, diet and broader habitat quality (eg. the standardised River Habitats Survey, Raven et al., 1997, 1998; Fox et al., 1998) of used and un-colonised rivers could provide informative results. Indices such as the RHS collect a range of physical and biological habitat attributes, not included in this study, which may have influence over the ecology and distribution of otters.

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RÉSUMÉ

ENQUÊTE SUR LES HABITUDES ALIMENTAIRES DE LA LOUTRE D’EUROPE (*Lutra lutra*) DANS LE COMTÉ D'ESSEX

Le suivi de la Loutre dans le Comté d'Essex a montré un élargissement annuel de sa répartition. Il existe effectivement des possibilités d'expansion mais certaines zones demeurent non colonisées. Cet article rapporte l’analyse rapide d’épreintes recueillies sur les zones de répartition connue, apportant des éléments supplémentaires sur une population croissante. Les restes de proies ont été identifiés jusque la famille et les données obtenues ont permis de calculer des valeurs trophiques sur l’ensemble des tronçons du continuum fluvial. Diverses enquêtes ont été comparées afin de détecter des variations alimentaires en fonction de la situation sur le continuum fluvial (classe de courant). Un examen plus approfondi a mis l’accent sur l'importance de la prédation des écrevisses (*Pacifastacus leniusculus*). Au sein de l'échantillon (n=54) regroupant quatre classes de courant (Strahler 2-5), les poissons sont les plus fréquents (67%). D'autres groupes sont aussi présents; les invertébrés 20%, les oiseaux 7% et les mammifères 6%. Les écrevisses composent 4% de l'échantillon. Il n'y avait pas de différences significatives entre l’ampleur de la niche trophique et la classe de courant (H * = 2,73, *P*>0,05). La composition alimentaire est restée stable durant l’étude et sur l’ensemble de la zone suivie. Des recherches plus poussées permettraient d’apprécier des variations saisonnières et évaluer dans quelle mesure la disponibilité des proies limite l’expansion de l’espèce en parallèle de variables environnementales et biologiques.

RESUMEN

ESTUDIO DE LOS HÁBITOS DIETARIOS DE LA NUTRIA EUROASIÁTICA (*Lutra lutra*) EN EL CONDADO DE ESSEX

Un monitoreo que abarca el condado de Essex ha mostrado una ampliación de la distribución de la nutria. Sin embargo, espacio para expansión y algunas áreas se mantienen sin colonizar. Este artículo es resultado de un estudio acotado de fecas colectadas dentro de las áreas de distribución conocida y aporta información adicional sobre una población en crecimiento. Los restos de presas fueron identificadas al nivel de familia y los datos usados para calcular la amplitud trófica en todo el rango de órdenes de los cursos fluviales. Se usó la comparación de investigaciones para detectar cambios en la dieta según el orden del curso fluvial. Se le dio otra importancia a la predación de cangrejos (por ej. el cangrejo señal *Pacifastacus leniusculus*). De la muestra (n=54) de cuatro órdenes de cursos fluviales (Strahler 2-5), los peces fueron más frecuentes (67%). Otros grupos presentes fueron: invertebrados 20%, aves 7% y mamíferos 6%. Los cangrejos comprendieron el 4% de la muestra. No se hallaron diferencias significativas entre las Amplitudes de Nicho Trófico según el orden del curso fluvial (*H** =2.73, *P*>0.05), este resultado está reforzado por posteriores análisis estadísticos de los datos. La composición dietaria fue estable dentro del área y período estudiados. Un estudio más amplio podría determinar variaciones estacionales y la medida en que el ensamble de presas disponibles limita la distribución frente a las más amplias variables ambientales y biológicas.

A R T I C L E

A STUDY ON EURASIAN OTTER (*Lutra lutra*) IN AMIRKELAYEH WILDLIFE REFUGE AND INTERNATIONAL WETLAND IN GUILAN PROVINCE, NORTHERN IRAN

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Abstract: There has not been any study on otters in the wetlands of Iran particularly in Amirkelayeh Wildlife Refuge and International Wetland (Amirkelayeh W.R&I.W). In this investigation, we surveyed the quality of Eurasian otter (*Lutra lutra*) sign distribution as a species presence index on the coast of Amirkelayeh (W.R&I.W). During a nine month period of monthly surveys, 673 signs were identified of which the majority were spraints. The number of spraints during different months differed significantly (χ^2 =408.732, P<0.05). The results indicated a close negative correlation between frequency of fish and frequency of spraints (r = -1, P<0.01). Shorelines of the wetland showed significant differences in the mean value of spraint number (K=19.628, P<0.05). There were two hot spots with values greater than 66% “Spraint Presence Intensity” (SPI) during the nine month period. The number of spraints and SPI were correlated significantly (r=0.793, P<0.01). In addition, significant differences among “Types Of Sprainting Places” (χ^2=130.723, P<0.05) and also in “Height of Sprainting places” (χ^2= 459.408, P< 0.05) were observed. More than 89% of spraints were within 200 cm of the nearest cover. Association between the presences of spraints and canals (χ^2= 21.547, P<0.05 and λ=0.086), and also “chars” (access routes through reed beds between land and open water) (χ^2= 63.691, P<0.05 and λ=0.210) were shown. “Reed Bed Breadth” in places with and without spraints differed significantly (U=495, P<0.05).

Keywords: *Lutra lutra*, seasonal sprainting differences, spraints distribution pattern

INTRODUCTION

Otters belong to the Mustelidae family, of which there are 13 species worldwide. More than half of them are listed as endangered or vulnerable (IUCN 2010). Investigations on the Eurasian otter show that its population worldwide has been declining despite its role as a “key species” in the stability of ecosystems (Carss, 1995). Moreover, susceptibility of otters to habitat changes has been confirmed (Foster-Turley et al. 1998; Preston et al., 2006; Georgiev and Stoycheva, 2006). Existence of this “indicator species” in ecosystems, and conservation of their populations could relieve our anxieties about mankind’s living status (Tüzün and Albayrak, 2004). These unique characteristics led scientists to pay more attention to otters as an important and threatened species. Signs proved to be an essential tool to study their distribution in last decades (Reuther et al., 2000). Almost all studies on these animals, whatever their aims, are based on the distribution of spraints, scats or faeces (Kruuk, 2006). These olfactory signals, which play significant roles in carnivores (Rostain et al., 2004), are one of the essential aspects of behavioral strategies in otters. Roughly speaking, there are no carnivores that produce these olfactory signals with their anal glands as much as some species of otters. Spraint is a distinct sign of the existence of an otter at a location. The presence or absence of this sign is used in many investigations on otters. Signs could provide valuable information for conservation aims on a wide scale (Mason and Macdonald 1987; Reuther et al. 2000; Kruuk 2006). These considerations show the importance of study on sprainting differences (individual or seasonal) in otters (Reuther et al., 2000). Among 13 species of otters, two species are found in Iran, namely the Eurasian (common) otter *(Lutra lutra)* and the smooth-coated or smooth otter *(Lutrogale perspicillata)* (Ziaie, 2009). These are Near Threatened (NT) and Vulnerable (VU) according to IUCN red list (IUCN 2010).

Earlier reports indicated that the Eurasian otter exists in wetlands, rivers and ponds in Iran (Karami et al., 2006). In addition, we have reports from fishermen and local people of the Eurasian otter's presence near the Caspian Sea shore. Since the species has a vast home range and there is particularly a lack of information on this species, conclusions about the Eurasian otter population is a difficult task. In the wake of the Ramsar Convention's declaration on the Montreux Record, it was revealed that Iranian Wetlands are disappearing (Ramsar Convention, 2010), and unfortunately these are one of the main habitats of Eurasian otters in this country. There are great perils for Eurasian otters, mainly due to habitat loss, land use changes (annexation of parts of wetlands to rice farms), construction of roads through the wetlands, etc. Other habitat destruction factors are the overuse of water from wetlands and rivers for irrigating rice farms and other agricultural usages, sand exploitation in river beds, and soil and water pollution due to misuse of pesticides, herbicides, human and industrial wastes etc. Eurasian otters are hunted illegally (mainly for fur and taxidermy); They are persecuted around fish farms, being considered as an enemy of fishes and they are also slaughtered by cars on the roads. These are the main threats to otters in Iran (Kiabi, 1993; Mirzajani, 1999; Hamzehpour, 2005; Karami et al., 2006; Mirzaei et al., 2009). In addition, decreasing numbers of observations of otters around fish farms may suggest that the population in the north of Iran is decreasing (Mirzajani, 1999). In this investigation, Eurasian otter sign distribution (particularly spraints) as a Species' Presence Index and some of the behavioral aspects of Eurasian otter like seasonal sprainting differences and their relation with food sources were studied in the Amirkelayeh W.R&I.W. The wetland, despite its international importance, is experiencing all sorts of severe threats. This could lead to the elimination of the otter population in the Amirkelayeh ecosystem before many other animals.

STUDY AREA AND METHODS

The study area, Amirkelayeh, is a Ramsar site in the northern part of Iran at 37°17´ N, 50° 12´E (Figure 1). This wetland, which has with 37 km of Caspian Sea coastal area, is surrounded by rice farmlands which belong to 8 villages (Fig.1). The Amirkelayeh wetland area was initially assigned 1230 hectares in 1971, but there were great changes in the area, because of land use change, up till 2008. The wetland lies between 27.2 m and 22.7 m below sea level. Moreover, Amirkelayeh W.R&I.W is considered the 18th most important wetland in Iran from an ecological importance viewpoint and has priority in conservation among 75 Iranian wetlands (Kiabi et al., 2005). The fauna and flora of Amirkelayeh consists of approximately 257 species including 75 plant species (Moradi, 1999), 15 fish (Nezami, 2004), 2 amphibians, 5 reptiles, 151 birds and 9 mammals (DOE).

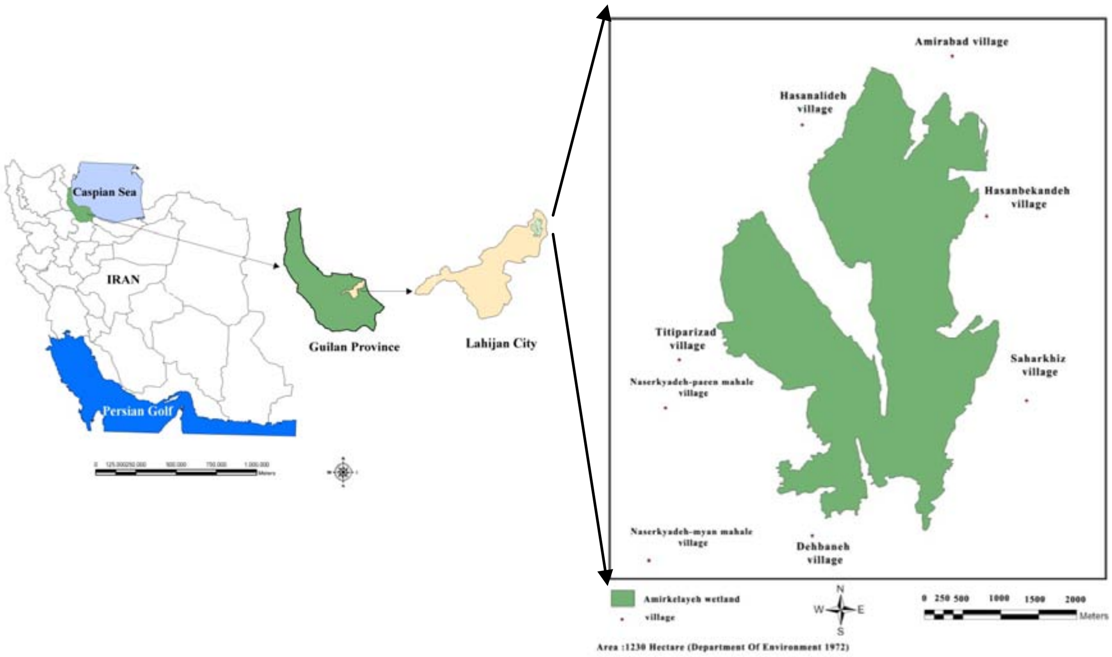

Figure 1. Study area; Amirkelayeh W.R&I.W, Lahijan city, Guilan province, Iran

This study was carried out between April 2009 and March 2010 on the entire coastal area of Amirkelayeh W.R&I.W, apart from a 4.8 km stretch of coast where access was very difficult due to deep, wide canals.

Sign Survey

The shore line of Amirkelayeh was surveyed for otter sign (spraints, tracks and pathways) every month for nine months. The location of all the observed signs were recorded using GPS (Garmin 76CSX) and enumerated. The Kruskal-Wallis test was used to compare all found spraints along the coast to test for differences in sprainting use by the Eurasian Otter. Due to anthropogenic effects, particularly the construction of water reservoirs and great disturbance of the coast at the far western end, we decided to use the other three parts of the coast (designated East, Middle, West) for this test. Chi-square test was performed to calculate the monthly sprainting differences on the coast of the wetland. For determination of “Spraint Presence Intensity” (SPI) in different places based on observation of spraint, we used the frequency of observations in percentage (FOb %) as the SPI. The coasts were divided into 50m×50m quadrates in places where sign was found, and the number of spraints was recorded during the 9 months. The frequency of observation was defined by the following equation (Equation 1).

$$FOb\% = \frac{\text{number of occurences of spraints in a quadrate}}{\text{number of visits}} \times 100$$

Equation 1

In order to prevent any statistical or biological errors, we simply used presence (1) and absence (0) of spraints in the quadrate in our other calculations. Associations between SPI and fish frequency and SPI with number of spraint were also tested by Spearman correlation coefficient test.

Fish frequency is the relative frequency of fishes in each season in percentage. For instance, total number of sampled fishes in 4 seasons (by net from Amirkelayeh wetland) was 1639 and the number of sampled fishes in spring was 451 it means that the relative frequency % of fishes in spring is 27.6 in spring.

Environmental Variables at Sprainting Sites

In order to gain a reasonable picture of sprainting sites distribution along the coast of the Amirkelayeh wetland, six types of environmental variables were measured, some with different categories (Table 1.). The difference between categories of “Sprainting Place Type”, “Height of Sprainting Place” (HSP) and “Distance of Sprainting Place to nearest Cover” (DSC) was examined by Chi-square test. Association of spraint presence with the existence of canals and “chars” (local dialect for access ways made by local people through the reeds between land and the open water). were examined by χ^2 contingency tables. For this, all canals and “chars” were recorded by GPS throughout the wetland, because no map was available; the whole coast of the wetland was then divided into 50m×50m quadrates. The presence and absence of variables were recorded per quadrate. The width of the fringing reed bed was measured by moving around the both sides (inner and outer side) of the reed bed. This is done by walking on the outer side and boating in the inner side in summer and winter seasons and recording position by GPS. By use of Mann-Whitney Test, we compared width of reed bed in the quadrates with or without spraints.

RESULTS AND DISCUSSION

The sign survey was conducted each month for nine months, totaling almost 290 kilometers of travel around the wetland. Results show clearly the presence of otters sign through all seasons (Figure 2,3). The total number of signs observed was 673. Of these, 649 were spraints. The results indicate that the mean number of spraints found in per survey was 72.11 (Table 2).

Table 1: Environmental variables measured in the Amirkelayeh wetland.

Environmental variables	**Criterion**	**Environmental variables**	**Criterion**
Sprainting Place Type	1. Plant remains 2. Stone 3. Sand 4. Mud 5.Tree trunk 6.Artificial substance	**Canal**	1= Presence 0= Absence
Height of Sprainting Place (HSP)	1. <20 cm 2. 20-40 cm 3. 40-60 cm 4. 60-80cm 5. >80 cm	**"Char"**	1= Presence 0= Absence
Distance of Sprainting place to closest Cover (DSC)	1. <50 cm 2. 50-100 cm 3. 100-150 cm 4. 150-200 cm 5. 200-250 cm 6. 250-300 cm 7. 350-400 cm 8. 400-450 cm 9. 450-500 cm	**Width of Reed Bed**	1. Summer 2. Winter

Table 2: Summary of Signs Observed

	Spraint	Track	Pathway
No. of visits	9	9	9
Sum	649.00	15.00	9.00
Mean	72.11	1.67	1.00
Minimum	20.00	0.00	0.00
Maximum	175.00	3.00	3.00
Variance	3750.61	1.00	1.50
Std. Deviation	61.24	1.00	1.22

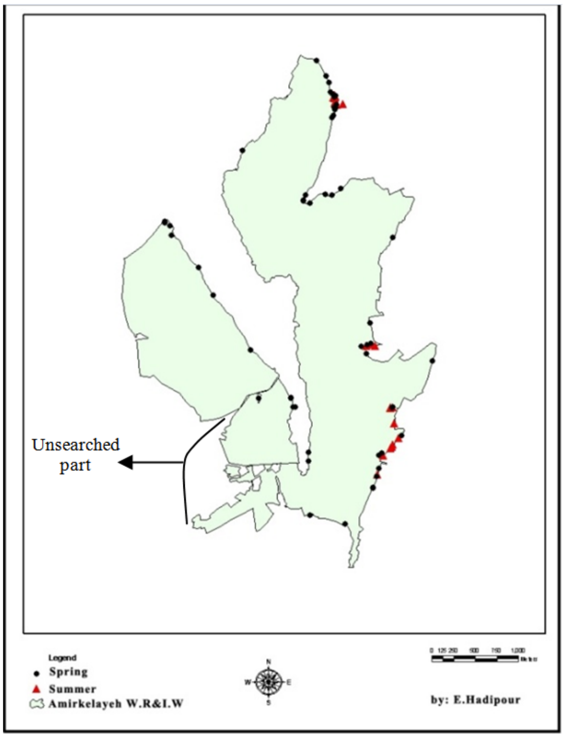

Figure 2. Otter sign distribution (Spring to summer).

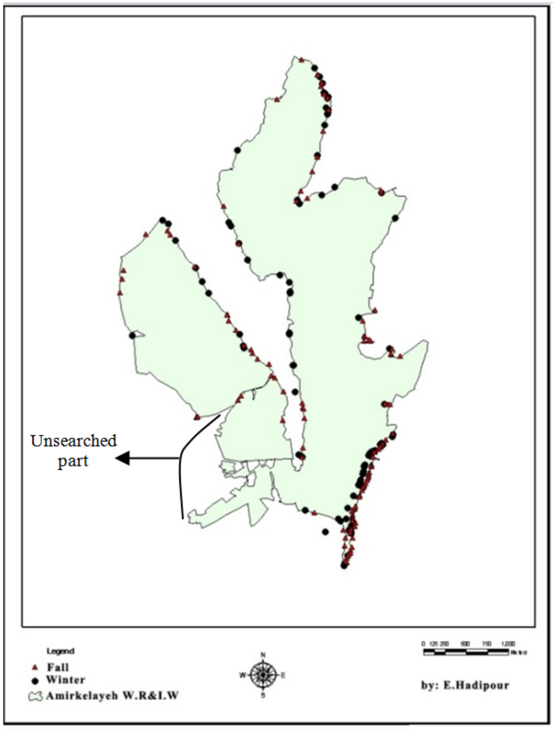

Figure 3. Otter sign distribution (Fall to winter).

The number of signs found fluctuated in different months, especially spraints (Figure 4).

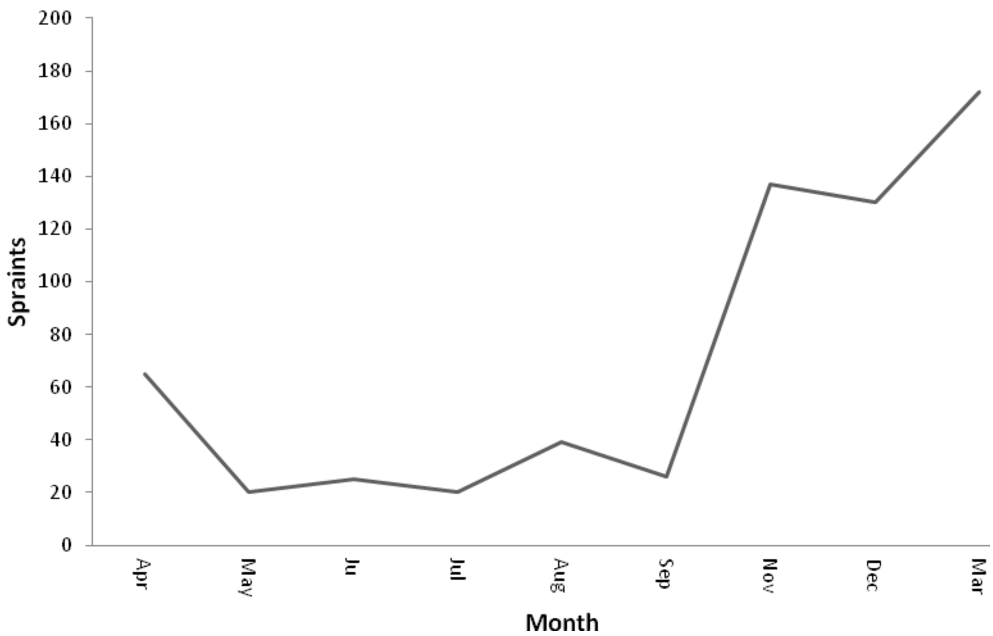

Figure 4. Variation in number of spraints found across the nine month period

There is a similar monthly variation in tracks and pathways. Among different signs of the presence of otters, spraint is the most utilized in investigations (Mason and Macdonald 1987); we therefore paid more attentions to this sign. As is demonstrated in Figure 4, the numbers of spraints varied in every month. The number of spraints found between November and April is substantially different from the period May to September. The distribution of spraints also differs from what was hypothesized (χ^2 =408.732 df=8, P<0.05), with a significant difference between numbers of spraints in different months. There are many factors which affect the finding of spraints, and number of spraints does not directly relate to the number of otters present. Food source availability, habitat structure, vegetation cover, preferred sprainting sites such as large stones, behavioral factors, maternal activity and seasonal sprainting variations and etc., have had influences on the number of spraints (Reuther et al., 2000; Rostain et al., 2004; Hamzehpour, 2005; Kruuk, 2006). One of the most important sprainting aspects is inhibition of inter or intraspecific competition through foraging activities. Sprainting has strong association with foraging and fishing by otters; also seasonal sprainting variations are associated with annual food availability fluctuations. (Kruuk, 2006). During season 4, we compared Spraint Frequency Percentage with Fish Frequency Percentage in the wetland (Nezami, 2004), assuming fish were the main food source, and found a high negative correlation between Fish Frequency and Spraint Frequency (r = -1, P<0.01) – Figure 5.

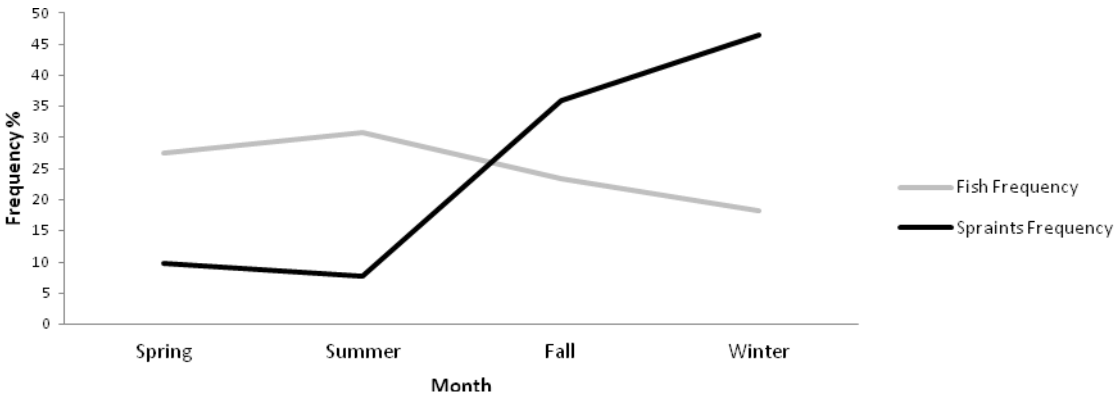

Figure 5. Comparison of Spraints and Fish Frequency in Amirkelayeh wetland in season 4

The negative correlation demonstrates the role of spraints in showing the main food sources (fish). High frequency of fishes can be caused by:

A. high density of prey or
B. high availability of prey

Actually when graph shows low frequency, it can be either low density or low availability of fishes as a main food. If there is just low density of fish, otters may remove all of them, but in the Amirkelayeh wetland, low availability of fishes is more probable. This needs more examination.

In summer, we observed an explosion in many animals' populations. These animals are potentially part of the Eurasian otter's diet such as amphibians, snakes, invertebrates and fish. However, fewer spraints were found than in winter, when more fish were observed. It appears that when the number of spraints found decreases, the number of fish observed increases. However, for a better judgment on this matter, further study is needed on the composition of otter diet in the Amirkelayeh wetland.

Different patterns of coastal usage for sprainting by Eurasian otters was found from the Kruskal-Wallis test. There is a significant difference between the different coastal stretched in number of spraints found (K=19.628 df= 2, $P<0.05$), indicating some preference by the otters for certain areas over others. The data shown in Figure 6 shows that otters used the eastern coastal area more than other areas.

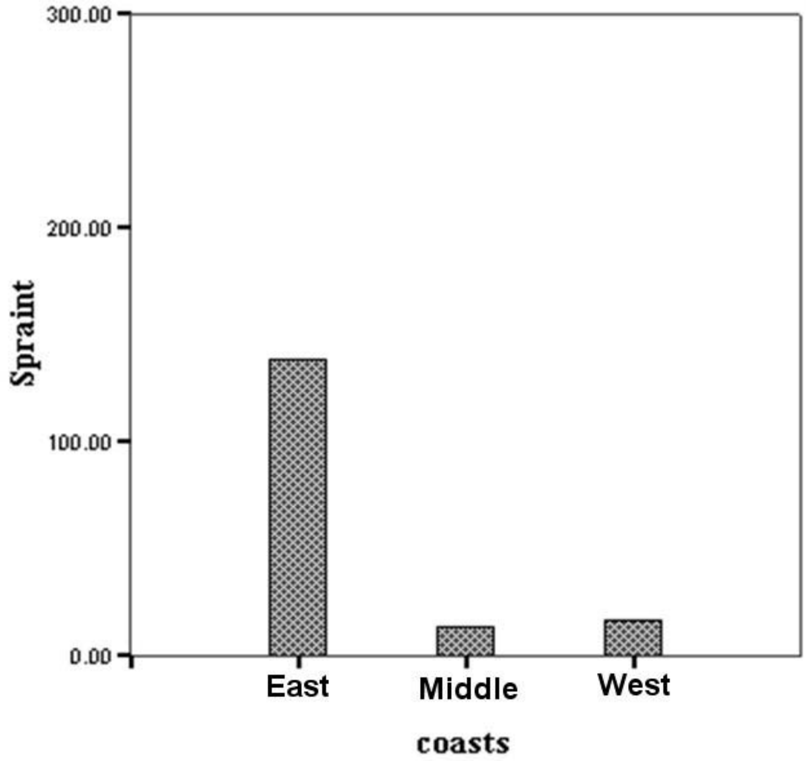

Figure 6. Observed spraints on different coasts (Eastern, Middle and Western)

The structure of the Amirkelayeh wetland, food source quality and distribution and anthropogenic threats may influence the distribution of spraints. The eastern branch of the wetland contains a big water body and it is the only open water area in the wetland. The western branch of wetland has continuous reed beds without any open water and there is no watercourse leading into it. It is clear that the eastern branch of the wetland has a higher fish population than the western one. This factor particularly, as well as other ones mentioned above, could be influencing the number of spraints found in the different coastal areas of the Amirkelayeh wetland. Although most spraint was found in the eastern area, this does not mean that the western reedbeds were not also used by the animals. Reed beds have important roles in attracting otters. The Eurasian otter likes to rest in reeds (Kruuk, 2006). The vast reed bed of the western branch would provide good opportunities for female otters to make natal holts and raise their young, removed from the main foraging area and threat of cannibalism or killing by other otters. It should be noted that otters do not spraint near natal holts (Kruuk, 2006). Thus, although the number of spraints on the western coast is less than on the other coasts, it doesn't mean that the western branch of the wetland has low importance for otters.

132 quadrates (50×50m) were defined in areas where spraints were found. Calculation of FOb% (Equation 1) shows that 62.12% of quadrates have 11.11% SPI; 21.21% of quadrates contain 22.22% of SPI; 9.85% of quadrates show 33.33% of SPI; 5.3% of quadrates have 44.44% of SPI and the quadrates with the 66.67% and 100% of SPI form just 0.76% of observations. However, it is clear that otters usually return to specific places for sprainting. Since sprainting is under the influence of behavioral and individual variables, density of spraints may not draw a reliable picture of otter population. However, taking into account the role of spraints in the otters' social organization and its function in the inhibition of intra and interspecific competition, and also specific features of sprainting behavior like visiting particular places repeatedly (Kruuk, 2006), we suggest the SPI can be used to define places which are visited very frequently by Eurasian otters.

Having determined these highly frequently visited locations, it may be possible to prepare a reasonable picture of otter population status in the Amirkelayeh wetland. Our results shows that there are nine quadrates with greater than 44% SPI. Only two hot spots with greater than 66% of SPI were found. This does not indicate a high-density otter population in the wetland.

Performance of "Spearman correlation coefficient" calculation for number of spraints and SPI shows a significant positive correlation (r=0.793 P<0.01). Although the correlation shows that the quadrates with numerous spraints are visited more frequently than other places by otters through the year, there are some exceptions in our calculations. For instance, there are some quadrates with many spraints but with low level of SPI (for example, number of spraints in quadrate are 26 and its SPI is 22.22%), and on the other hand there are some quadrates with a lower number of spraints but with high SPI (for example, number of spraints in one quadrate was 6 but the SPI was 44.44%). Similar exceptions to this may lead to over- or underestimation of status of Eurasian otters here. These exceptions also show the importance of seasonal or monthly surveys in spraint-based studies on Eurasian otters.

The analysis of 282 sprainting places based on type of substrate shows a significant difference between those substrates (χ^2=130.723 df=5, P<0.05), 37.49% of spraints were found on vegetation, particularly on grasses; the substrate of 22.7% of spraints was sand; 14.18% of spraints were on mud; 13.48% of spraining was done on artificial substances; 9.93% of spraints were found on stones/rocks and 1.77% were found on tree trunks. Vegetation, sand and mud are common in coastal areas, but artificial substances (like white gunnysacks, brightly-coloured pesticide or fertilizer containers, plastic tarpaulins over rice fields and so) and especially stones and rocks are rarely found along the shoreline. The significantly higher proportion of use of artificial substances and rocks for sprainting as shown above may indicate a preference for these in Eurasian otters.

The Height of Sprainting Place (HSP) categories have significant differences from each other (χ^2= 459.408 df=4, P<0.05). Measurements of 196 HSP (Table 3) show that 80.10% of observed spraints were found at a height of <20 cm from the surrounding ground surface,16.33% were found at 20-40 cm, 1.53% were found at 40-60 and 60-80 cm, and finally 0.51% of them were at a height of >80 cm from the surrounding ground surface.

Table 3. Descriptive statistic for measures of HSP (cm)

N	196
Minimum (MIN)	2.00
Maximum (MAX)	150.00
Mean	14.15
Standard deviation (Std.Dev)	15.53
Variance (VAR)	241.09

Use of agricultural machinery for making canals and digging trenches in order to gain more water for rice fields from wetland, as well as using the coastal area specifically for cultivation frequently damages the coast structure in the Amirkelayeh wetland. Eurasian otters need particular structures for sprainting. It is necessary to preserve these natural characteristics of the coast, which are vital for Eurasian otters, but this habitat has many anthropogenic disturbances, which cause loss of potential usefulness to otters.

There are significant differences between the values of Distance of Sprainting Place to closest Cover or DSC - see Table 1 (χ^2= 385.785 df=8, P<0.05). The distance of 260 sprainting places to closest cover (water and aquatic plants) was measured (Table 4). 68.5% of sprainting places were within 100 cm of nearest cover (Fig. 7). Moreover 89.2% of spraints were within 200 cm of the nearest cover. It seems that otters are "multi-use cover" species. In the Amirkelayeh wetland, water bodies and aquatic plants act as cover, in combination with riparian plants, diversity of coast shape, roughness of land and so on. Although riparian plants dominate everywhere on the coast of this wetland, DSC was based on distance of spraints to water which usually contained with aquatic plants as appropriate cover.

Table 4. Descriptive statistic for measures of DSC (cm)

N	260
MIN	2.00
MAX	600.00
Mean	96.01
Std.ev	87.78
VAR	7704.56

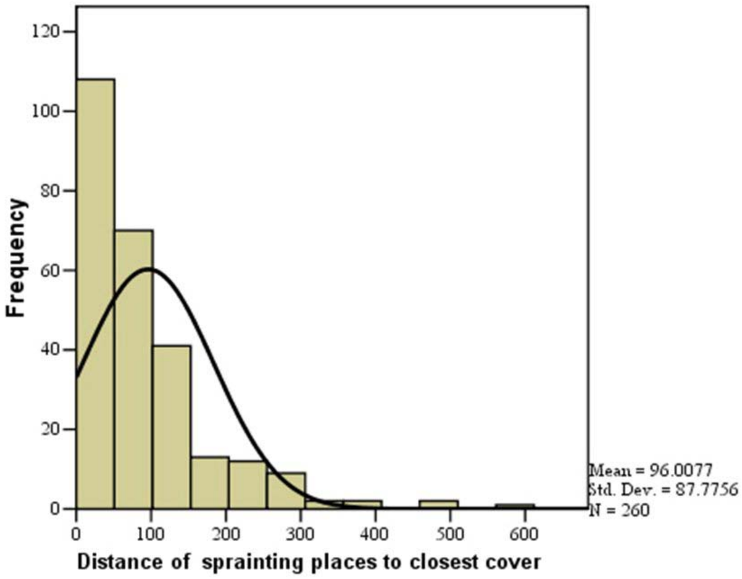

Figure 7. Sprainting places' distance to nearest cover

These results show the relative significance of these types of cover for the otter who wants to go about its normal business along the coastline of wetland (Table 4 and also Figure 7). Our investigation shows that a narrow strip (~2 meters) of Amirkelayeh shoreline contained almost 90% of spraints.

The association between presence of spraints and existence of canals (entrances or outlets of water) were examined in the 334 quadrates (Figure 8). The results show an association between two variables (χ^2= 21.547, df=1, P<0.05 and λ=0.086). Yates' correction was performed for this test.

Since the observed value is greater than the expected value, these variables have positive association, *i.e.* they are appearing together and disappearing simultaneously. But the value of λ shows that the predicted value of presence of spraint with respect to the presence of canals is fairly weak. Predicting sprainting places to be by canals has only reduced the error 12.2% in comparison with the random prediction.

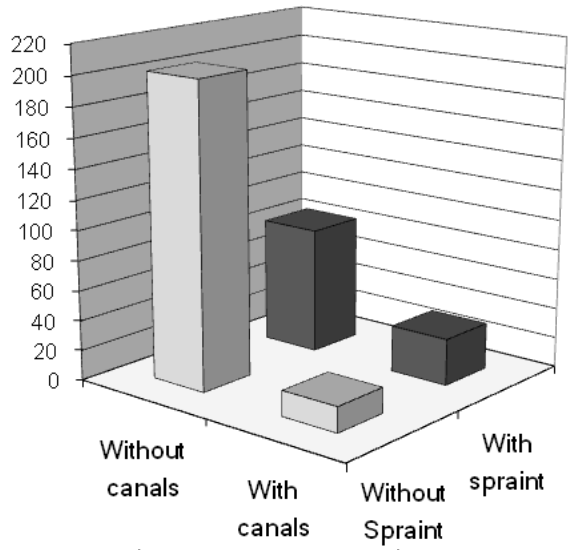

Figure 8. Presences of spraint and existence of canals in 334 quadrates

The dependency between spraint and “chars” was examined in the 273 quadrates (Fig. 9). The observations show significant positive association between two variables (χ^2= 63.69, df=1, P<0.05 and λ=0.210). Yates' correction was performed for this test too. However λ shows that prediction of presence of spraint with respect to “chars” is weak. Prediction of places with spraints by the existence of “chars” reduces the error rate of prediction 33% compared to random prediction, which is rather greater than with canals. The results show that we could expect to find more spraints next to the “chars” than next to the canals.

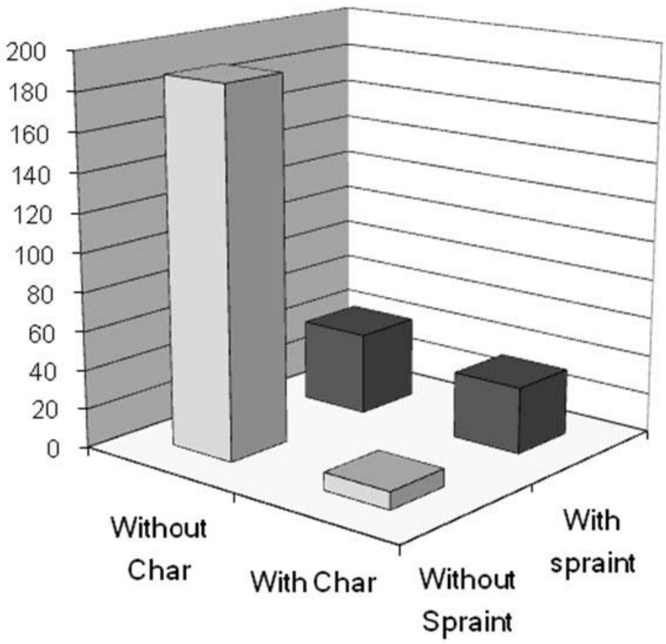

Figure 9. Presence of spraint and existence of "char" in 273 quadrates

Width of Reed bed was measured in the summer and winter. This was only done in eastern branch of the wetland as this is the only area that had any open water (Table 5). Reed bed width was measured in 77 places, which includes 37 quadrates with spraint and 40 random quadrates without spraint along the coast of wetland. Our results show that they have significant difference from each other (U=495 *P*=0.05). It has been realized that the quadrates with spraint are located beside narrower reed beds (Figure 10).

Table 5. Descriptive statistic for measures of Reed Bed Width

	Summer	Winter
N	60	60
min	39.12	39.12
max	983.77	895.61
mean	284.53	245.43
Std. ev	166.50	147.08
var	27720.71	21631.80

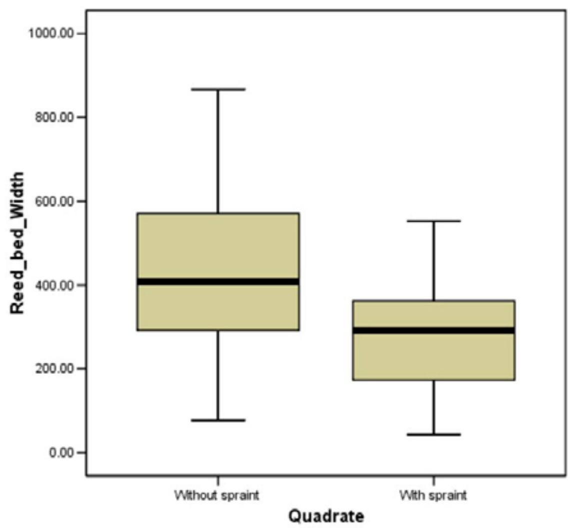

Figure 10. Width of reed bed in quadrates with and without spraints

The presence of spraints on the places with low breadth of reed bed as well as the significant positive association between spraints and “chars” by 33% of that predicted shows the importance of energy saving strategies for Eurasian otters. Energy and heat loss factors are crucial for otters (Kruuk 2006). Moving through the reed bed to reach the coast has energy costs for otters; thus it may be appropriate for them to find a short cut (like “chars” or places with low breadth of reed bed) to reach the coast.

CONCLUSION

There are insufficient and sparse studies about Eurasian otters in Iran; indeed, there have been no studies to date on this species in Iranian wetlands. Knowing the different aspects of otter ecology helps us to understand the concepts important in otter conservation; the animals are rapidly disappearing in our vicinity as their habitat vanishes. Our investigation considered Eurasian otter distribution and some small aspects of ecology based on spraint surveys in the Amirkelayeh W.R&I.W, which is abounding with many threats. We showed that Eurasian otter signs were found throughout the year in the Amirkelayeh wetland. We also found distinct fluctuations in the signs especially spraints throughout the 9 month period of our study, which is positively correlated with food source fluctuations. In addition we have established that one area of the coast was more used than others due to food source availability. For elimination of statistical or biological errors, SPI was adopted. This defines the places that are very frequently visited by Eurasian otters. This may indicate a reasonably accurate picture of Eurasian otter status for us. There are only two hot spots on the coasts of the wetland. Moreover we showed significant positive correlation between number of spraints and SPI, with of course with some exceptions as was expressed above. Eurasian otters spraint on different substances at different heights above the surrounding ground survey in the Amirkelayeh wetland. Vegetation at heights of less than 20 cm were used abundantly. But the distribution of these sites are very important. The small distance of spraints to water and plants as cover shows the importance of safety to the otters. Furthermore, association between presence of spraint with canals, “chars” and places with narrower reed beds was shown.

RECOMMENDATIONS

Further studies on the diet composition of Eurasian otter and studies on anthropogenic effects on these animals are necessary for understanding the status of otters and for perception of the Eurasian otter’s ecological role in the Amirkelayeh Wildlife Refuge and International Wetland.

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RÉSUMÉ

ETUDE SUR LA LOUTRE (*Lutra lutra*) DANS LA ZONE PROTEGEE D'AMIRKELAYEH, PROVINE DE GUILAN, IRAN DU NORD

Il n'y a jamais eu d'étude sur les loutres dans les zones humides d'Iran en particulier dans la zone protégée d'Amirkelayeh (Amirkelayeh W.R & I.W). Dans cette enquête, nous avons analysé la qualité des signes de présence de la Loutre (*Lutra lutra*) sur la côte d'Amirkelayeh (W.R & I.W). Pendant une période de neuf mois, 673 indices ont été identifiés dont la majorité étaient des épreintes. Le nombre d'épreintes découvertes variait significativement selon les mois ($\chi 2$=408,732, P<0,05). Les résultats indiquent une étroite anticorrélation entre la fréquence des poissons et la fréquence des épreintes (r=-1, P<0,01). Les rives de la zone humide présentent des différences significatives dans la valeur moyenne des épreintes collectées (K=19,628, P<0,05). Il existe deux sites présentant des valeurs supérieures à 66% "intensité de la présence d'épreintes" (SPI). Le nombre d'épreintes et le SPI sont corrélées de façon significative (r=0,793, P<0,01). En outre, nous observons des différences significatives entre les types de sites de marquage ($\chi 2$=130,723, P<0,05) et aussi entre la « hauteur » de ces sites ($\chi 2$=459,408, P<0,05). Plus de 89% des épreintes ont été déposées sur deux premiers mètres de la rive. Le rapport entre présence d'épreintes et canaux ($\chi 2$=21,547, P<0,05 et λ=0,086), mais aussi avec les «chars» ($\chi 2$=63,691, P<0,05 et λ=0.210) a été démontré. Des couches sur lit de roseaux dans les lieux avec épreintes et sans épreintes sont quant à eux significativement différents (U=495, P<0,05).

RESUMEN

UN ESTUDIO DE LA NUTRIA EUROASIÁTICA *(Lutra lutra)* EN EL REFUGIO DE VIDA SILVESTRE Y ZONA HÚMEDA DE IMPORTANCIA INTERNACIONAL DE AMIRKELAYEH (PROVINCIA DE GUILAN, NORTE DE IRÁN)

No existen estudios de nutrias en las zonas húmedas de Irán, ni en particular en el refugio de vida silvestre y zona húmeda de importancia internacional de Amirkelayeh (Amirkelayeh W.R&I.W). En la presente investigación muestreamos las huellas y señales de actividad de la nutria euroasiática para elaborar un índice de presencia de la especie en la costa de Amirkelayeh (W.R&I.W). Durante un período de nueve meses se identificaron 673 señales, la mayoría de las cuales eran excrementos. El número de excrementos presenta diferencias significativas intermensuales (χ^2=408.732, P<0.05). Los resultados obtenidos indican una correlación negativa entre la frecuencia de peces y la frecuencia de excrementos (r = -1, P<0.01). Las riberas de las zonas húmedas presentan diferencias significativas respecto al valor medio del número de excrementos encontrados (K=19.628, P<0.05). Durante los nueve meses de estudio, se han detectado dos lugares donde los valores del índice de Intensidad de presencia de excrementos (SPI) son superiores al 66%. El número de excrementos y los valores del SPI correlacionan significativamente (r=0.793, P<0.01). Además, existen diferencias significativas entre las características de los lugares donde se encontraron los excrementos (χ^2=130.723, P<0.05) así como entre las diferentes alturas sobre el nivel del suelo en que fueron localizados (χ2= 459.408, P< 0.05). Más del 89% de los excrementos estaban depositados a 0-200 cm de distancia de la cobertura vegetal más cercana. Existe una asociación significativa entre la presencia de excrementos y canales (χ^2= 21.547, P<0.05 and λ=0.086), así como entre la presencia de excrementos y de suelos turbosos (χ2= 63.691, P<0.05 and λ=0.210). Finalmente, la cobertura de los cañaverales en lugares con y sin excrementos resultó ser diferente (U=495, P<0.05).

A R T I C L E

EURASIAN OTTER (*Lutra lutra*) IN THE CENTRAL PART OF THE SLOVAK-HUNGARIAN BORDER AREA

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Abstract: The mapping of the Eurasian otter (*Lutra lutra*) distribution in the central part of the Slovak-Hungarian border was undertaken in winter 2010/2011 by searching for signs of presence of the otter. Authors checked 351 chosen survey sites (50-m transects, 242 points in Hungary and 109 in Slovakia). At every site, all signs of otter presence were surveyed. Preferably, survey sites were located under bridges (299). Sites were considered as either “positive” or “negative”. In total, 155 sites (44.1%, 105 in Hungary and 50 in Slovakia) were positive and 196 (55.8%, 137 in Hungary and 59 in Slovakia) were negative. Otters deposited spraints usually on specific substrate, mostly on blocks (201; 27.3%), concrete (189, 25.7%), and stone concrete (125, 17.0%). Altogether, 185 (61.9%) bridges and culverts were passable and 114 (38.1%) were not passable for the otters during mapping. The otters were regularly observed in optimal habitats (e.g. Ipeľ and Zagyva rivers and its larger tributaries) but also in suboptimal and marginal habitats such as regulated and narrow brooks and channels. The otter population in the central part of the Slovak-Hungarian border area was considered stable and otters occurred throughout this area.

Key words: *Lutra lutra*, mapping, distribution, spraints, bridges, habitats, southern Slovakia, northern Hungary

INTRODUCTION

The Eurasian otter (*Lutra lutra*) is a semiaquatic, territorial carnivore living in a large variety of aquatic habitats (Conroy and Chanin, 2002) and represents a flagship species for undisturbed rivers as well as for wetland recovery (Kruuk, 2006). The species has been protected in Slovakia since 1949 (Urban et al., 2011) and in Hungary since 1974, and this became strictly enforced from 1978 onwards (Kemenes, 1991). In the latest Red List of mammals of Slovakia, the otter is listed as "Vulnerable" (VU) (Žiak and Urban, 2001). In Hungary, it is classified as a "Near threatened" (NT) species (IUCN, 2001).

The otter occurs in most parts of Slovakia with the exception of the Western and South-Eastern lowlands (e.g. Urban, 2010a; Urban et al., 2010). The central part of the Slovak-Hungarian border area (in middle Ipeľ river catchment) is important from the "European Otter Habitat Network" (EUOHNE) point of view (Kadlečík, 1998). There is still a large otter population in Hungary, but according to recent observations, the population is decreasing, mostly due to unfavourable changes in wetland conditions (Gera, 2004, 2005). However, there is little available information on the distribution of otters from Nógrád and Heves counties (Lanszki, 2009), even though these territories are interesting from a distribution point of view (in this area are several protected wetlands). The current distribution of the otter in Hungary is depicted in the Atlas of Hungarian Mammals (Bihari et al., 2007).

Due to traditional and outstanding international cross-border cooperation between nature and landscape protection organisations (State Nature Conservation of the Slovak Republic, Banská Bystrica and Bükk National Park Administration, Eger), several studies have been carried out about otter distribution in this area. The first international Slovak-Hungarian otter mapping was undertaken in January and February 1996. This survey indicated that otters were present in most streams in this area in both countries (Urban and Kadlečík, 1996; Urban et al. 1996) (Fig. 1).

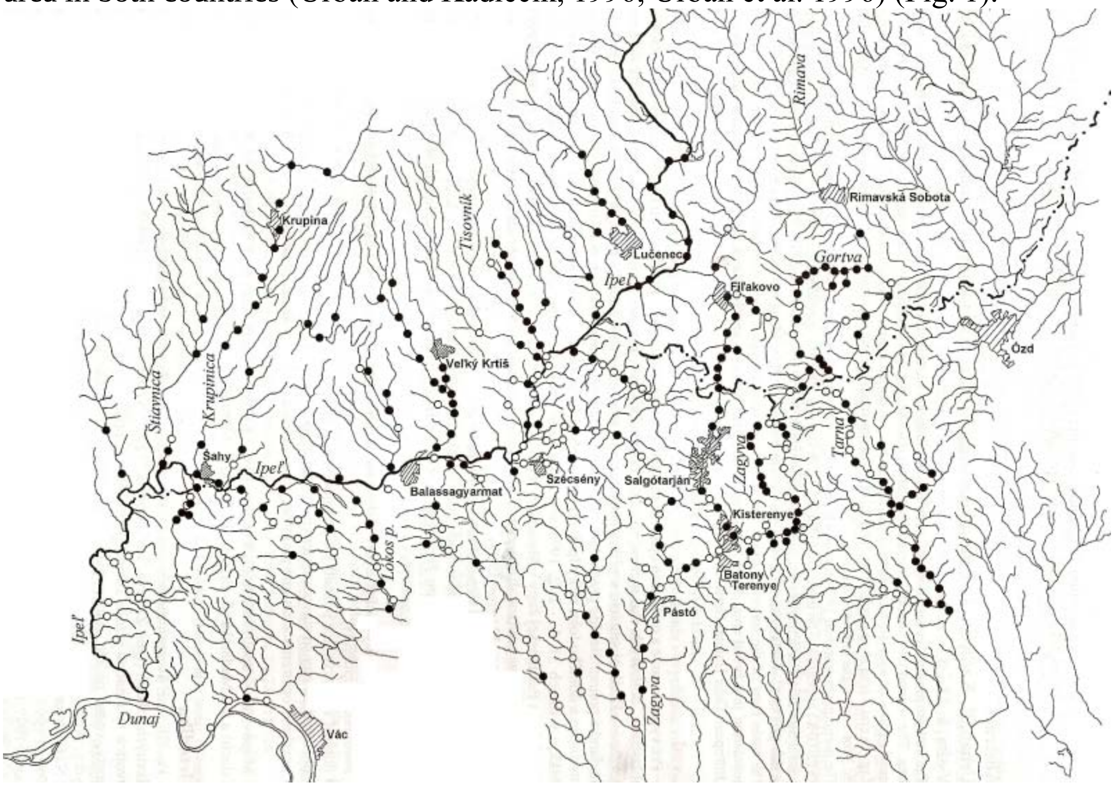

Figure 1. Results of the otter survey in the Novohrad/Nógrád region (Urban and Kadlečík, 1998)

The second mapping was carried out in November 1997 (Urban and Kadlečík, 1998; Urban et al., 1997) and the third (summer) one was held in September 1998 (Urban et al., 2000). The results showed that the otter population in southern Slovakia and northern Hungary can be considered viable and has a great potential to spread westward and northward (e.g. Kadlečík, 1998). The information gathered from these mappings is being used to understand otter distribution in general.

Several mappings of otter activity were carried out in the Slovak part of this territory - Novohrad region (Hrivnák and Urban, 1995), middle part of the Ipeľ river catchment (e.g. Urban 1992), Cerová vrchovina Protected Landscape Area (PLA) (e.g. Hrivnák and Balázs, 1995a, b), Lučenská and Ipeľská kotlina basins (e.g. Tučeková and Urban, 2000; Urban, 2000; Urban et al., 2008). In the Cerová vrchovina PLA, otters are common on water flows with a sufficient trophic base. The greatest density of spraints was recorded around water reservoirs in the agricultural area (Balázs et al., 2010).

There are conflicts between the interests of fisheries and nature protection, both in fish farms (ponds) and fresh flowing waters (rivers, small streams). Reliable scientific information on ecology, and potential risks, which are all important for evaluating conservation status, are still insufficient. In winter of 2010-2011, we carried out further mapping of the otter distribution was done in the central part of the Slovak-Hungarian border. The aim of this paper is to summarize knowledge on the current distribution of otters in the study area based on this survey.

STUDY AREA

The study area, situated in south-central Slovakia and north-central Hungary, is mostly a lowland landscape with intensely cultivated fields. The area comprised sections of two river catchments (Ipeľ/Ipoly and Zagyva). Concerning potential Eurasian otter habitats, this area offers the following types of wetlands: rivers, small streams (creeks, brooks), channels, artificial (man-made) water reservoirs, and small fish ponds used for carp production.

Ipeľ (Slovak) or Ipoly (Hungarian) is a 232 km long river in Slovakia and Hungary and a tributary of the Danube River. Its source is in central Slovakia in the Slovenské rudohorie Mountains. It flows south to the Hungarian border, and then southwest, west and again south along the border until it flows into the Danube near Szob. The catchment of the Ipoly river is 5,118 km^2, of which 1,521 km^2 is located in Hungary. The discharge comes from Slovakian tributaries and consequently, the dynamics of water output are controlled by the Slovakian streams. Rainfall contributes to this but the volume is about 720 mm in the Slovakian and 600 mm in the Hungarian parts of the catchment. Dynamics of the water regime are extreme because the natural reservoirs have a small capacity. An arid period lasts from July to October and the replenishing of reservoirs starts in November (Rádai, 1995). After the regulation of Ipoly and its branches the depth of the riverbed and the speed of the water had increased. The vegetation of river valleys (flood forests - softwood *Salicetum albae fragilis*, hardwood forest communities, and other typical plant communities that once bordered this river section) has been severely degraded over the last two centuries.

Zagyva River is a 160 km long river in northern Hungary. It originates near Salgótarján and flows into the Tisza River at Szolnok. *Salix* spp. and *Populus* spp. dominate in the riparian vegetation.

Parts of the Ipeľ/Ipoly River basin were officially declared as Wetlands of International Importance (so called Ramsar site): Poplie (in Slovakia; 40.9 ha; declared in 1998) and Ipoly Valley (in Hungary; 2,227 ha; declared in 2001) (Fig. 2). In 2007, these areas were recognised as a Transboundary Wetland of Importance by Hungary and the Slovak Republic. This long, flat and narrow valley contains oxbow lakes as well as shrub and alder bogs, which serve to minimize risks of flood damage. Seasonally flooded meadows are partly grazed by cattle and partly mowed, and groundwater replenishes drinking water supply. The site is an important stopover for migratory water birds and offers habitat to a significant number of fish species, some of them endangered, though its role as an important fish spawning ground has declined (Anonymus 2011a,b). Few serious threats to the site are foreseen, though increased cattle grazing and greater use of artificial fertilizers would not be welcome. This Ramsar site is also important for the otter population in southern Slovakia and northern Hungary (Urban et al., 2010, 2011).

Figure 2. Poiplie – Ramsar site in January 2011 (photo P. Urban)

To protect otter habitats in the study area, three Areas of European Interest (Alúvium Ipľa, Cerová vrchovina, and Dálovský močiar) have been designated, which were included in the Natura 2000 sites.

There are two Protected Landscape Areas in our study area: Cerová vrchovina (16,278 ha; declared in 1989) in Slovakia and Karancs-Medves (6,709 ha; declared in 1989) in Hungary.

METHODS

The mapping was undertaken in winter 2010-2011, during 14 days (between December 2010 and March 2011) by searching for signs of presence of the otter (footprints, anal gland secretions, spraints). We checked 351 chosen survey points (50-m lines, 242 points in Hungary, 109 in Slovakia) distributed along two rivers and brooks' catchments throughout this area. At every site, all signs of otter presence were surveyed. Spraints were rated in three categories - fresh (max. up to 5 days), medium (dry but between 6 and14 days), and old (dry, several weeks old, compact or broken into smaller components) (Bas et al., 1984; modified by Urban and Topercer, 2001). The otter presence marks and shelters were studied along on 300-m stretches (Urban et al., 2010). Using this methodology information on density of otters cannot be obtained. The survey sites start at bridges, other features, or points of access. Survey sites were preferably located under bridges (299) and the others were located along the riverbanks (29) and channels (3) without objects, small water reservoirs (5), fishpond (1), other types of wetlands (4), and fjord (1). The site was considered "positive" when at least a single otter sign was found and "negative" when no otter sign was found. The role of bridges as potential barriers for safe otter migration were also assessed, because otter road kills are currently among the most important recorded reasons of its mortality.

RESULTS

During the mapping of otter distribution in the middle of Ipeľ River and Zagyva River basins, we checked 351 localities. In total, 155 sites (44.1 %, 105 in Hungary and 50 in Slovakia) were positive and 196 (55.8 %, 137 in Hungary and 59 in Slovakia) were negative (Fig. 3).

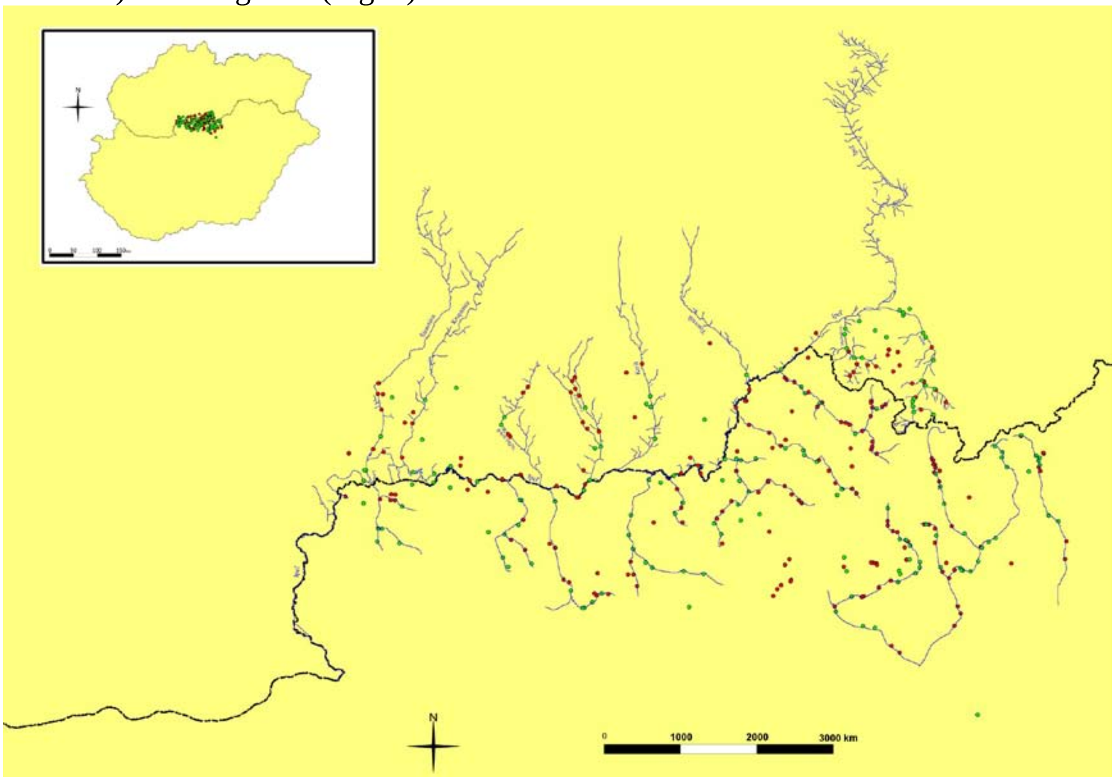

Figure 3. Map showing the location of the study area (green circles represent presence of spraints and red circles represent absence of spraints) (map author Ľ. Repiský)

In total, we have found 736 otter signs (spraints and scents): 88 (11.9 %) fresh spraints, 95 (12.9 %) medium spraints, 484 (65.8) old spraints, and 69 (9.4 %) scents. These were distributed throughout the mapped areas, although 612 (83.2 %) were concentrated under the bridges. Otters deposited spraints usually on specific substrate, mostly on blocks over 401 mm in size (201; 27.3 %), concrete (189; 25.7 %), stone concrete (125; 17.0 %), and stones 151-250 mm in size (112; 15.2 %).

For 299 localities representing bridges over rivers, small streams and channels (e.g. Fig. 4), 179 (59.9 %) were positive and 120 (40.1 %) were negative. Altogether, 185 (61.9 %) bridges and culverts were passable and 114 (38.1 %) (e. g. Fig. 5) were not passable for the otters during mapping. This fact was also determined by the low water flow of most streams, which allowed passage of objects, crossing rivers, creeks, brooks, and channels.

Figure 4. Example of positive small wooden bridge in Belinský potok (brook) (photo P. Urban)

Figure 5. Example of an otter passable bridge in Mučínsky potok (brook) (photo P. Urban)

Figure 6. Example of an otter unfriendly bridge in Fekete víz (brook) (photo P. Urban)

Spraints, scents, and footprints were also found in the case of types of bridging (bridges, culverts) without sprainting sites, but then on the banks (on grass, stones, boulders, blocks, stone concrete, or concrete) next to these objects (e.g. Fig. 6, 7).

Figure 7. Spraint on a piece of plastic next to an impassable bridge (photo P. Urban)

Otter signs were distributed on all streams in the study area. We found most otter signs along streams with widths of 2-5 m (306; 41.6 %) and depths of less than 30 cm (398; 54.1 %). The presence of the Eurasian otter has been confirmed in two Special Areas of Conservation (SAC, Sites of European Importance): Alúvium Ipľa and Cerová vrchovina. Negative results were found in SAC Dálovský močiar. The main water flow of the surveyed rivers and brooks provides good permanent habitat for the otter, mainly Ipeľ River (Fig. 8) and its larger tributaries (Belina, Krtíš, Plachtinský potok, Lókos patak), as well as Zagyva River.

Figure 8. Ipeľ/Ipoly River – example of an optimal habitat for otters (photo P. Urban)

Most of the small streams in the study area underwent considerable and unfavourable changes and now represent suboptimal and marginal habitats (regulated and narrow brooks). However, otter signs have been found even in these habitats. In our study area, the otter inhabits artificial canals that offer sufficient food resources and high herbaceous vegetation providing shelter. Man-made channels (Fig. 9) connect rivers and small streams with ponds or small reservoirs, and pass through different wetlands in agricultural landscapes. Most of the irrigation and drainage channels have disappeared during the last 20 years.

Figure 9. Narrow channel in agricultural landscape (photo P. Urban)

DISCUSSION

Spraints are the most durable of otter scent marks and some of them, for example those deposited under bridges, may persist for up to 1 year (MacDonald and Mason, 1988; Brzeziński and Romanowski, 2006). The disappearance of spraints is exponential with time and most (approx. 90%) usually they vanish within 7–8 weeks (Jenkins and Burrows, 1980; Mason and MacDonald, 1986). Otter response to the disappearance of spraints (washing away by flood or experimental disturbance) does not involve an increase in overall defecation rate (Brzeziński and Romanowski, 2006).

Results from south-central Slovakia (Urban and Topercer, 2001) demonstrated that sprainting behaviour was significantly seasonal with most of fresh spraints occurring in the winter. Individual spraint types showed a somewhat different seasonal pattern as the peak average numbers for fresh spraints that occurred during December - January and March, for old spraints in March and November - December, and for scent signs in January (Urban et al., 2010, 2011). Therefore, we carried out our mapping in winter.

The amount of water in streams is important for the otter's survival. Effects of water level, precipitation, and water flow can not only mask the influence of other variables on otter sprainting activity (e.g. Pedroso et al., 2007) but may also influence the passage of objects. On the other hand, low water levels in summer, insufficient food, and habitat loss has been identified during the previous mappings in the study area (Urban et al., 2000). Analysis of otter spraints from the Zagyva River catchment (samples from 1999) revealed a considerably unusual diet composition with surprisingly low frequency of fish (56.3 %), suggesting that food abundance for otters in this area is not sufficient (Koščo and Balázs, 1999; Koščo et al., 2000).

Optimal habitats for otters are defined as areas with unregulated rivers with trees and other plants providing good bankside cover (e.g. Macdonald and Mason, 1982; Bas et al., 1984; Lodé, 1993; Ruiz-Olmo et al., 2005), high prey availability (Kruuk et al., 1993; Beja, 1996), as well as low water pollution and human disturbance (Lunnon and Reynolds, 1991; Robitaille and Laurence, 2002; Ruiz-Olmo et al., 2005).

Sites of European Importance Alúvium Ipľa (406.1 ha) and Cerová vrchovina (2626,5 ha) are sufficiently large, with heterogenic and diverse mosaic of aquatic habitats, that provide adequate protection for otter. In smaller SAC Dálovský močiar (90,2 ha) were recorded negative results. Similar negative results were also found during the otter mapping in 91 SACs in summer 2010 (Urban et. al., 2010).

In study area, the otter inhabits artificial channels and small streams too. For small streams, it is very difficult to determine whether otters are present permanently or occasionally, or if they completely avoid these places (Gera, 2005). Considering that narrow streams have smaller discharges for diluting run-off, a stronger relationship would be predicted after correcting for the areas of water (Durbin, 1998). Dried-out or destroyed channels can be an issue for otter conservation, by potentially affecting their migration routes, or the links between different fishing areas (Gera, 2005). Most of the area mapped is intensively used for agricultural purposes. Agricultural practices are usually thought to be detrimental to otters owing to the effects of drainage, erosion, pesticide run-off, and nitrification (Foster-Turley et al., 1990). Kemenes and Demeter (1995) found a positive effect of land cultivation on the occurrence of otters around aquatic habitats in Hungary. There are indications that otters may use these man-made habitats in agricultural land (Lanszki, 2009; Urban et al., 2011). Results from systematic research of this species in the anthropic affected landscape in a broad Lučenec region (in northern part of study area in this paper) in 2007-2008 confirmed, that the otter occurs along nearly of all of mapping streams (Urban et al., 2008). Otters inhabited all of the studied stagnant waters but were less common in smaller streams (76%) (Lanszki, 2009).

Collisions between otters and cars in Slovakia have been described in sections of crossing roads with water bodies when so called “impassable” types of bridging (bridges, culverts) were used, which put otters off from passing under the road. Such “impassable” types of objects include pipe or frame culverts and those types of bridges where the water fills the space between vertical trestlework and walls of abutments temporarily or permanently in such a way that there is no elevated horizontal or bevelled surface from rather compact material where the otter could pass (Urban et al., 2010).

The Eurasian otter occurs in most of the study area. Results from both one-off otter mappings in Slovakia in winter 2007-2008 and in summer and autumn 2010 in a network of quadrats from the Databank of Slovak Fauna (DFS) grid (approx. 10 × 12 km), showed otter occurrence in all quadrats in this area. All 16 quadrats were positive (Urban 2010a; Urban et al. 2010). During verification of this methodology in the Krupinská planina (Krupina plateau Mts.) and Ipeľská kotlina (Ipeľ river basin) in autumn 2007, 14 quadrats (11 in Slovakia and 3 in Hungary) were controlled and all of them were positive (Urban, 2010b).

Results of otter mapping on the Hungarian side in 2004-2005 also confirmed the presence of otters in this part of the country. In all controlled UTM grid squares (10 × 10 km), located in our study area, had occurrences of otters. The Ipoly River basin was found to have a stable or increasing otter population, which is widespread throughout the mapping area, especially in tributaries with dead branches and plenty of fish (Gera 2004, 2005).

CONCLUSION

The otter population in the central part of the Slovak-Hungarian border area was considered stable and otters occurred throughout this area. During the winter mapping in 2010-2011, 44.1 % of controlled localities were positive. The otter was regularly observed in optimal habitats, represented mainly by Ipeľ and Zagyva rivers and its larger tributaries but also in suboptimal and marginal habitats such as regulated and narrow brooks and channels.

In the study area it is necessary not only to know distribution of otters, but population size and other aspects of biology and ecology this species, including risks factors too. Therefore we recommend to:

- carry out winter mapping of the distribution of otters at least once every 5 years,
- carry out snow tracking surveys - winter census of otters (Poledník et al., 2008) - depending on snow conditions in Special Areas of Conservation and Protected Landscape Areas,
- carry out regular monitoring for reporting in accordance with Article 17 of the Council Directive 92/43/EEC of May 21 1992 on the Conservation of natural habitats and wild fauna and flora (EC Habitats Directive) in all areas of European importance, in which is otter protected,
- carry out otter mapping in water reservoirs, dams and other water bodies,
- monitor threats to otter survival regularly,
- improve education and increase awareness of the importance of the otter and the need of its protection among target groups and stakeholders,
- ensure proper control of all protected areas with presence of otters through management plans.

The Eurasian otter population of southern Slovakia and northern Hungary is considered to be viable with potential for spreading to the south and west, but some measures to ensure recovery of certain areas are necessary to:

- remove concrete works and channels and restore stream habitat,
- improve water management and water regime in the area,
- construction of road underpasses, for otters and other animals on road to prevent mortality due to road traffic.

It is important to ensure protection of otter, and survival its populations in a favorable status, when population dynamics data of the species indicate that is maintaining itself on a long-term basis as a viable element of this natural habitats, a natural range of this species does not reduce and there is a sufficiency of habitats to maintain its population on a long-term basis.

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RÉSUMÉ

LA LOUTRE (*Lutra lutra*) DANS LA PARTIE CENTRALE DE LA ZONE FRONTALIERE ENTRE SLOVAQUIE ET HONGRIE

La cartographie de la distribution de la Loutre (*Lutra lutra*) dans la partie centrale de la frontière slovaque-hongroise a été entreprise durant l'hiver 2010/2011 en recherchant les signes de présence de l'espèce. Les auteurs ont vérifié 351 sites (50m de transect, 242 sites en Hongrie et 109 en Slovaquie). Sur chaque site, tous les signes de présence ont été recensés. Les sites ont préférentiellement été définis sous les ponts (299 sites) et ont ensuite été considérés soit comme «positifs» ou «négatifs». Au total, 155 sites (44,1%, 105 en Hongrie et 50 en Slovaquie) étaient positifs et 196 (55,8%, 137 en Hongrie et 59 en Slovaquie) ont été négatifs. Les loutres ont généralement déposé leurs épreintes sur un substrat spécifique, principalement sur des blocs (201; 27,3%), du béton (189, 25,7%), et du béton mélangé à de la pierre (125, 17,0%). Au total, 185 (61,9%) des ponts et autres passages ont été considérés comme praticables et 114 (38,1%) ne l'étaient pas. Les loutres ont été régulièrement observées dans des habitats optimaux (par exemple sur les rivières Ipel et Zagyva ainsi que sur leurs affluents les plus larges), mais aussi dans des habitats sous-optimaux et marginaux tels que les ruisseaux étroits et les canaux. La population de loutres dans la partie centrale de la zone frontalière "Slovaquie-Hongrie" est donc considérée comme stable et reste présente sur l'ensemble de cette zone.

RESUMEN

LA NUTRIA EUROASIATICA (*Lutra lutra*) EN ZONA CENTRAL DEL AREA FRONTERIZA ENTRE ESLOVAQUIA Y HUNGRIA

Se ha llevado a cabo la cartografía de la distribución de la nutria euroasiática (*Lutra lutra*) en zona central del área fronteriza entre Eslovaquia y Hungría durante el invierno 2010/2011 mediante la búsqueda de rastros y señales de la presencia de nutrias. Los autores inspeccionaron 351 puntos de muestreo (transectos de 50 metros, 242 puntos en Hungría y 109 en Eslovaquia). En cada punto se consideraron todos los signos de presencia de nutria. Los puntos de muestreo estuvieron localizados preferiblemente bajo puentes (299) y se consideraron resultados tanto negativos como positivos. En total, 155 puntos de muestreo (44,1%, 105 en Hungría y 50 en Eslovaquia) resultaron positivos y 196 (55,8%, 137 en Hungría y 59 en Eslovaquia) resultaron negativos. Las nutrias depositaron sus excrementos normalmente en sustratos muy específicos, principalmente sobre grandes piedras (>401mm) situadas en la orilla o en la corriente de agua (201; 27,3%), sobre la estructura inferior de hormigón de los puentes (189, 25,7%) y sobre pequeños guijarros y piedras cementados con hormigón en las orillas (125; 17,0%). En total, durante el muestreo 185 (61,9%) puentes y pasos de drenaje fueron transitados por nutrias mientras que 114 (38,1%) no lo fueron. Se observaron nutrias de forma regular en hábitats óptimos (por ejemplo, los ríos Ipel y Zagyva y sus afluentes principales) pero también en hábitat subóptimos y marginales como arroyos y canales estrechos o con cauces regulados. La población de nutrias en la zona central de la frontera entre Eslovaquia y Hungría se considera estable ya que las nutrias son frecuentes en toda la zona.

OSG MEMBER NEWS

OSG Members in the News

22/09/11: Prestigious scientific award for Vic Simpson -Vic Simpson was announced as the recipient of the British Veterinary Association's most prestigious scientific award for his immense contributions to increasing the knowledge base of the pathology of wildlife species in Great Britain. The Dalrymple-Champneys Cup and Medal, awarded to mark and recognise work of outstanding merit, which it is considered will encourage the advancement of veterinary science, were presented to Vic Simpson during the Awards Ceremony at the BVA's Annual Congress in London.

New Members of OSG

Since the last issue, we have welcomed 12 new members to the OSG: you can read more about them on the Members-Only pages.

Vanessa Bachmann, Peru: I am a wildlife veterinarian who has worked for four years with *Lontra felina* in captivity, and am now part of the marine otter conservation strategy in Peru. I am currently working on establishing baseline data to confirm the marine otter's role as a bioindicator species.

Silvana Campello, Brazil: As President of Instituto Araguaia, I am dedicated to promoting research that will help to preserve the giant otters in the Brazilian Amazon, and fostering stakeholder involvement in the conservation of Cantão State Park and the Araguaia River basin. An approach that emphasizes advancing locally driven initiatives to ensure successful conservation with benefits to local communities.

Leslie Cousins, UK: For the past four years, I have been a field surveyor for the Essex otter monitoring programme. My PhD is in applied ecology, evaluating terrestrial biodiversity. Maintaining links with the Wildlife Trusts, I continue to provide survey data, not only for otters but also water vole (which I have radiotracked) and bat species.

Oldemar Carvalho Junior, Brazil: In the wild, I am looking at regional migration of neotropical otters between hydrographic basins, population size and diet at different altitudes. In captivity, I focus on behaviour, environmental enrichment and physiology. I am also using social mobilisation to find more effective ways to protect otters. I am Projects and Research Coordinator at Insitute Ekko Brasil

Casey Day, USA: I am involved in a river otter reintroduction project in north-central Utah. Along with the reintroduction, I am looking at the feeding ecology and behavioral ecology of this species.

Claudia Elizondo, Uruguay: I am working with *Lontra longicaudis*, analyzing the genetic variability of Uruguayan population. Currently I am studying with Dr Gonzalo Medina-Vogel, and afterwards when I go back to Uruguay, I will be establishing the status of the Uruguayan populations are, and implement strategies for conservation.

Georgios Georgiadis, Brazil: My otter work is focused on developing a basis for a permanent, long-term population-monitoring program for *P. brasiliensis* in Cantão State Park. Estimating the size and behavior of the population of giant otters in Cantão, provides indispensable data for the management and conservation of the park, for giant otters are an umbrella species and its protection covers all the park's biodiversity.

Marco Pavanello, Italy: I'm deeply keen on ethology, ecology and population dynamics of otter which is naturally recolonizing the alpine regions. Moreover I'm interested in the human dimension aspects for the conservation of this species.

Claudio Prigioni, Italy: Claudio Prigioni is a researcher at the Department of Animal Biology, University of Pavia. His main research concerns studies on behavioral ecology of carnivores with special reference to the Eurasian otter (Lutra lutra). Claudio is Editor-in-Chief of the Italian Journal of Mammalogy, Hystrix, and, with Anna Loy and Anna Roos, organised the Colloquium in Pavia; he also gave us our OSG song!

Anja Roy, Germany: I have been a field researcher with *Lutra lutra* for twenty years, working in Norway, Austria and Germany. As the expanding population of otters has now reached my home state of North Rhine-Westphalen, I am currently working for a better understanding of the new arrivals by government, fishermen and hunters. My next projects concentrate on relationships between otter and fish (predator-prey-circle), conflict-management, ecology, population-ecology and expansion-strategies.

Roni Shachal, Israel: I am starting an M.sc. in Ecology about the otter population in north of Israel. The research will be focused on the factors that determine occupancy of the otters in the different habitats.

Graham Watkins, USA: Graham is Guyanese born biologist who has worked with Giant River Otters in the Rupununi, Guyana (see www.rupununi.org). Graham presently works as a senior environmental specialist for the Inter-American Development Bank in the area of environmental and social safeguards. Previously, Graham has worked as the Director of the Charles Darwin Foundation and the Director of the Iwokrama International Centre for Rain forest Conservation and Development.

Laura Venditozzi-Fraser, UK: I am a Zoology student studying at Glasgow University, Scotland and I am currently on work placement at Blair Drummond Safari Park in Stirling for my Msci Degree. I have chosen to work with Asian Short-Clawed otters (*Aonyx cinereus*) for my MSci thesis, and intend to investigate whether adding Potassium Citrate supplement to their daily food over 6 months helps reduce the presence of renal calculi (kidney stones).

CONFERENCES

Ekko Brasil organised recently a symposium that included also otter species. Please see the flyer below.

http://www.colacmar2011.com/site/index.php?option=com_content&view=article&id=63%3Aprogramacao-complementar&catid=30%3Aparalela&Itemid=11&lang=pt

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BOOKS AND REPORTS

Fifth otter survey of England
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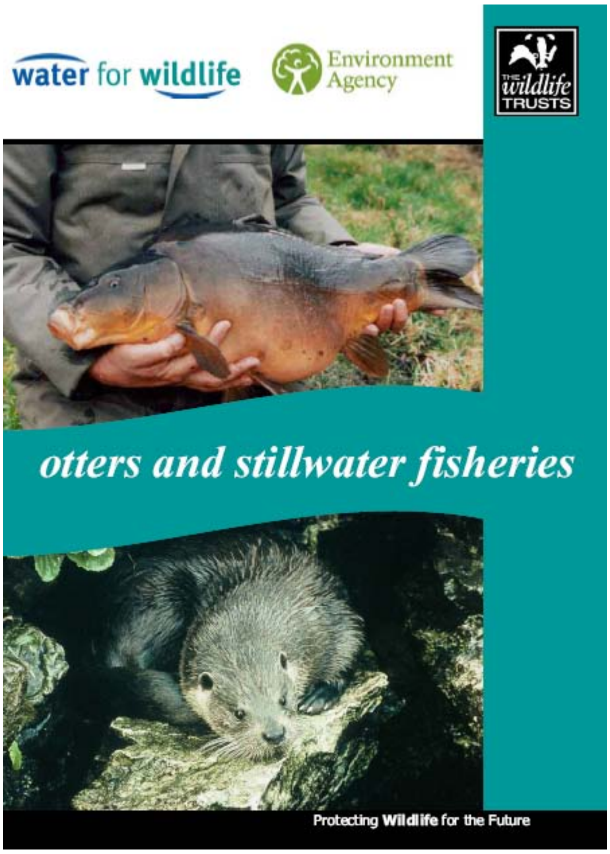
Summary report

The report can be downloaded at:
http://publications.environment-agency.gov.uk/PDF/GEHO1010BTDJ-E-E.pdf



The report can be downloaded at:
http://www.environment-agency.gov.uk/static/documents/Leisure/otters_and_stillwater_fisheriesv4_080501_FINAL_PRINT-CGS3.pdf

COINS

Luxembourg has issued a 5 Euro coin showing *Lutra lutra.*