NOTE FROM THE EDITOR

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Dear Friends, Colleagues and Otter Enthusiasts!

Shortly after we entered 2023, we also open the first issue 40/1 of this year. As earlier mentioned in fact this issue is already completed and the articles will go online in the weeks to come. Even better, we have at least half of issue 40/2 finished and I can promise we do have interesting manuscripts in the pipeline.

Looking back on a successful year with 4 issues I take the opportunity to thank last year's reviewers that did an excellent job with so many submitted manuscripts. My sincere thanks to Aadrean, Katrina Fernandez, Atul Borker, Murthy Kantimahanti, Nicole Duplaix, Syed Ainul Hussain, Miriam Marmontel, Melissa Savage, Mohan Shrestha, Anna Loy, Romina Fusillo, Aarati Basnet, Caroline Leuchtenberger, Will Duckworth, Hannah Krupa, Fernando Marques Quintela, Sunita Khatiwara, Anna Roos, Katarina Loso and Carin Wittnich for their careful and thoughtful reviews that were always encouraging and improving the manuscripts.

So many manuscripts also mean an extra burden and a lot of work for my two dear friends Gerard Schmidt and Claudio Chehebar. Thank you so much for all the abstract translations including observations of last inconsistencies in abstracts and text.

The large number of manuscripts with more pictures, embedded videos and very large literature lists ask a lot from Lesley who does not only serve as the webmaster for the IUCN OSG Bulletin but also has the final task to check completeness of references, typos, language issues etc. I am well aware about the workload for Lesley. Lesley, thank you so much you do to make this journal an increasing success.

A R T I C L E

DISTRIBUTION, HABITAT SELECTION AND DIET OF SMOOTH-COATED OTTERS (*Lutrogale perspicillata*) IN THE KOLLIDAM AND THENPENNAI RIVERS IN SOUTH INDIA

Ravikumar JAYASURYA, Mahaly MOORTHI*, Selvarasu SATHISHKUMAR[1], Ravichandran SRIMATHI [1]

[1]*PG & Research Department of Zoology and Wildlife Biology, A.V.C. College (Autonomous), Mayiladuthurai – 609305, Affiliated to Annamalai University, Chidambaram, Tamil Nadu, India.*
**Corresponding author: moovim24@gmail.com*

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Abstract: We document the presence of the Smooth-coated otter (*Lutrogale perspicillata*) in the Kollidam River in Tamil Nadu and Thenpennai River in Puducherry, South India. Prior to this, there was no information about this animal in these Kollidam and Thenpennai Rivers, although the species is known to inhabit Tamil Nadu and Puducherry, where it is often found in mangrove ecosystems and estuaries. The Smooth-coated otter is currently listed as Vulnerable on the IUCN Red List. A total of 22 km of river bank were surveyed in 2019 and 2020, 15 km along Kollidam River and 7 km along the Thenpennai River. A total of twenty-seven individual otters were observed in the study areas, 15 along the Kollidam River and 12 along the Thenpennai River. Otter diet consisted of 53% and 46% fish, respectively, and included small percentages of insects, rodents, crabs, and prawns. Eight parameters, including leaf litter, loose soil and canopy cover were positively correlated with otter presence, while river width and depth and hard soil were negatively correlated. Smooth-coated otters appear to be threatened by poaching and habitat degradation in the area.

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Key Words: Smooth-coated otter, South India, habitat, diet

INTRODUCTION

We conducted a survey that confirms the presence of Smooth-coated otters in the Kollidam and Thenpennai Rivers in South India. Several studies have previously recorded Smooth-coated otter presence in Tamil Nadu (Joshi et al., 2016; Kalaimani et al., 2021; Arivoli and Narasimmarajan, 2021; Narasimmarajan et al., 2021), where it is often found in the mangrove ecosystems and estuaries. Pollution and degradation of aquatic habitats is rampant in many urban areas of India. The concretization of river banks and modifications to coastal environments often drastically change riparian habitats that are critical for otters, including den and grooming sites (de Silva et al., 2015). Human pressure in South India has resulted in water pollution, habitat fragmentation and shrinking water bodies (Raj, 1941; Ruiz-Olmo and Consalbez, 1997; Gupta et al., 2020; Narasimmarajan et al., 2021). This study was intiated to document distribution, habitat, and diet of the species as a basis for conservation in the Kollidam and Tenpennai Rivers in Tamil Nadu and Puducherry.

MATERIAL AND METHODS

Study area

The survey was conducted along stretches of the Kollidam and Thenpennai Rivers in Tamil Nadu and Puducherry (Fig. 1). The Kollidam River is a tributary of the Kauveri River which separates from the main channel at the delta and flows independently into the Bay of Bengal. This area has a healthy mangrove forest, good water quality and food availability, and sparse human settlement. The Thenpennai River flows for a distance 320 km in the state of Tamil Nadu, starting in Dharmapuri District and ending in Cuddalore District, where it also flows into the Bay of Bengal, north of the Kauveri Delta. The region around the Thenpennai River is heavily used for agricultural and industrial activities.

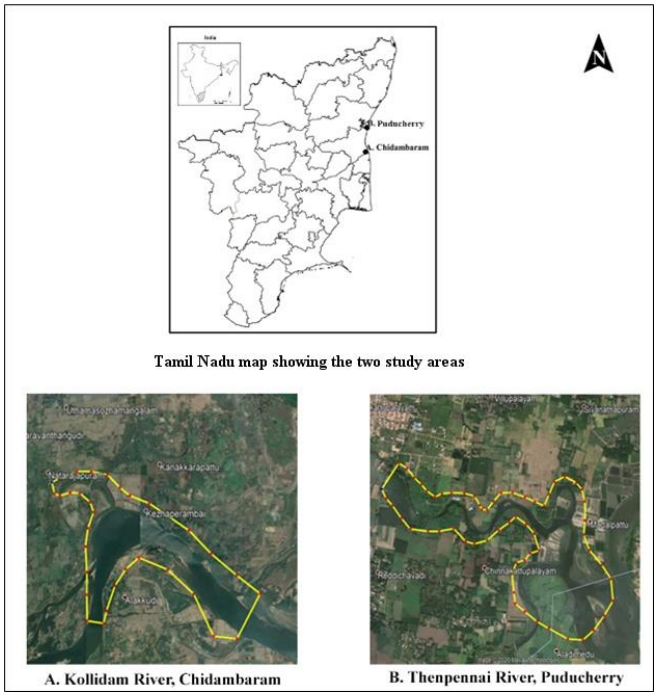


Figure 1. Map of the study area.

This study surveyed 22 km of riverbank, their tributaries and other adjoining water bodies, 15 km in Kollidam River and 7 km in Thenpennai River (Fig. 2). Both rivers have a rich invertebrate fauna and fish community in estuarine and wetland in their lower reaches. *Avicennia marina, Acanthus illicifolius,* and *Rhizophora mucronata* are common plants along the Kollidam River, and *Eichhornia crassipes, cocos nucifera* along the Thenpennai River, together with other herbs and shrubs. The climate of the Kollidam is characterized by hot, humid summers with highs of around 35-45 ºC and mild, pleasant winters with an average high temperatures around 28 ºC. The climate of the Thenpennai River is classified by hot, humid summers with highs of around 40-46 ºC and warm, pleasant winters with average high temperatures of 25-29 ºC.

Data collection

Survey methodology and habitat and den analysis

Smooth-coated otter population surveys were conducted in 2019 and 2020, by direct and indirect sighting methods following Hussain and Choudhury (1997). Direct observation of otters was recorded using a 10'×50" binocular and zoom telescope.

Canon EOS-1300D cameras (24.1MP) were used for image capture. A range finder was used to find the distance from the observer to the animals. The presence of otters was also determined through indirect signs, such as scat, tracks, and grooming sites.

Field surveys were conducted by foot along both river banks and other waterbody banks (Brzeziński et al, 1993; Anoop and Hussain, 2004). Islands in the river were investigated by boat and the number of individuals and their movement on the islands was noted. The river stretches were divided into 500m transects, and 5m × 5m plots were systematically laid every 100m on both river banks and on the islands. Indirect signs such as scat, tracks, dens, and grooming sites of otters were recorded in the plots. Data was collected on habitat parameters such as river width (m), river depth (m), canopy cover (%), temperature (ºC), leaf litter (%) and type of substrate (hard sand, loose sand, or rock) in each section (Hussain et al., 2011; Nawab and Hussain, 2012; Khan et al., 2014).

Collection and analysis of scat samples

Scat was collected from the study area, stored in zip-lock bags, and soaked in detergent then thoroughly washed in tap water. The washed material was drained with 1mm mesh and the samples were stored separately with date and location and kept for analysis (Anoop, 2001). Diet composition was determined using a methodology of Goszczyński (1974) and Jędrzejewska et al. (2001). The undigested prey body parts were recovered for species analysis (Conroy and Chanin 2000). To help identify prey composition, fish scales, crabs, prawns, and other components of the scat were removed and studied using a compound microscope (Wise et al., 1981).

Data analysis

Data from both study sites were combined. The data were statistically analyzed using SPSS and 'R' Programme. First, the compiled data were checked for homogeneity of variance and normality prior to detailed analysis. Since the data were not normal, non-parametric tests were used. Mann-Whitney U test was used for two variables variation and Kruskal-Wallis test was used for analysis of 3 variables. Box-whisker plots were used to represent the results of the Mann-Whitney U test. The data were pooled together for habitat selection. A Principal Component Analysis (PCA) test was used to find the factors influencing habitat use. Parameters with a factor loading >=0.3 were considered significantly important in contributing to a particular factor or principal component. The percentage of diet component were calculated by using methodology of Wise et al. (1981) and Fonseca et al. (2008). The percentage of samples in each category relative to the overall sample count was used to express the results, as follows, where:

$$\mathbf{FO(\%) = (100\ n) / N}$$

FO (%): Relative frequency of occurrence of a prey category
n: Number of samples with occurrence of a prey category
N: Total number of fecal samples analyzed

RESULTS

Otter distribution

Twenty-seven individuals were observed throughout the two study areas. Fifteen individuals were found in various sites along the Kollidam River. At this site, otters were most abundant in mangroves at 47%, followed by 33% on river islands, and 20% along riverbanks. Twelve individuals were found in various sites along the Thenpennai River, 58% on river islands and 42% along river banks (Fig. 2, 3).

A. Kollidam River, Chidambaram

B. Thenpennai River, Puducherry

Indirect sign Direct sign

Figure 2. Distribution of evidence of Smooth-Coated otter in Kollidam (A) and Thenpennai (B) Rivers.

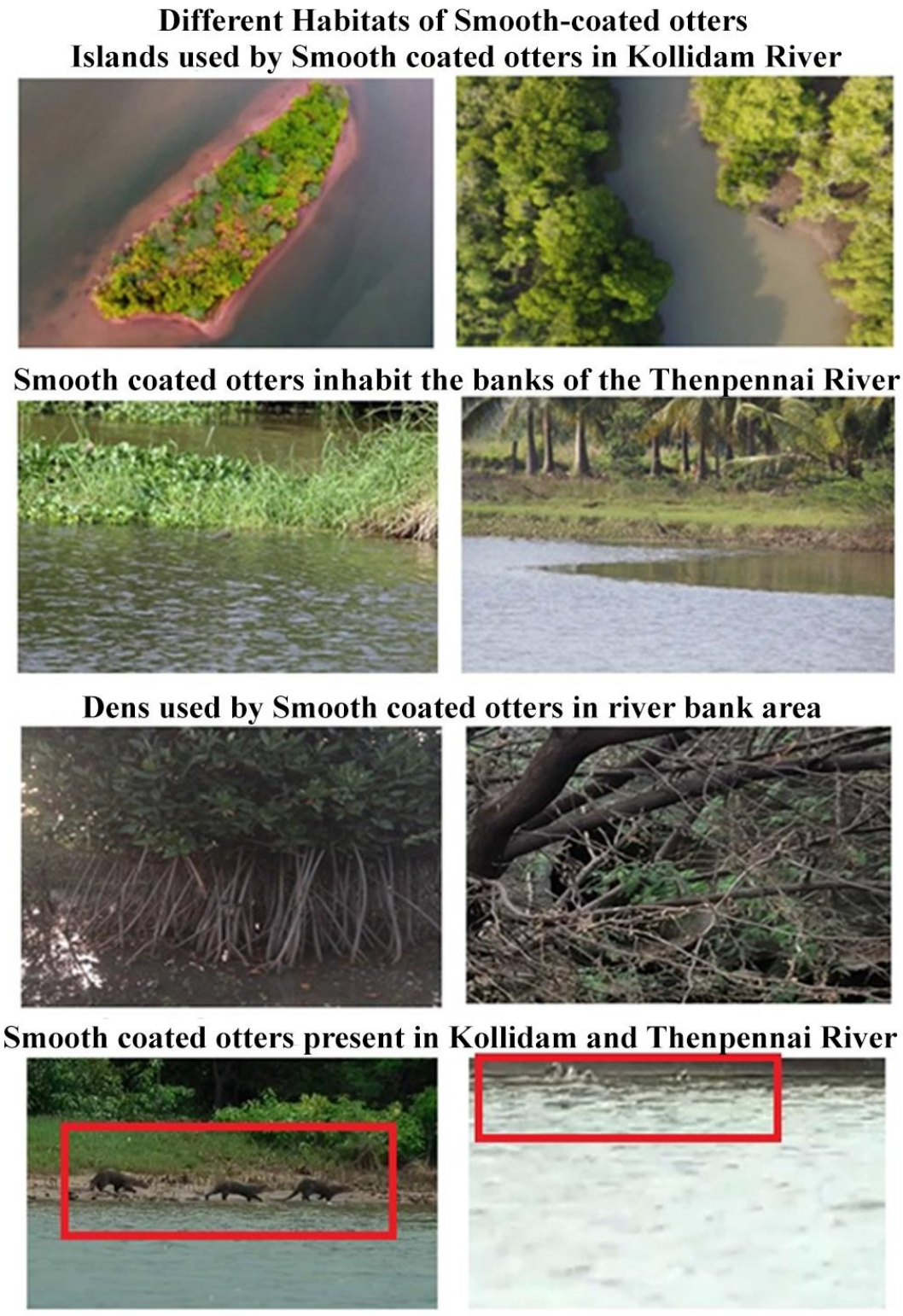


Figure 3. Habitats used by Smooth-coated otters and observed otters.

Habitat characteristics of the study areas

Habitat parameters were significantly different between the Kollidam and Thenpennai Rivers with the exception of leaf litter. The Kollidam River was significantly wider than the Thenpennai (M-W-U = 161; $P<0.001$). The Kollidam River was significantly deeper than the Thenpennai (M-W-U -165.0, $P<0.001$). The Kollidam had a significantly higher canopy cover than the Thenpennai (M-W-U = 651.5,

P=0.018). The Kollidam was significantly warmer than the Thenpennai (M-W-U - 434.0, *P*<0.001) (Fig. 4). Hard soil substrate had the highest percentage in the Kollidam (52%) and Thenpennai (48%), followed by loose soil and rock, (Table 1, Figs. 4, 5).

Table 1. Details of habitat parameters to identify their influence on otter habitat selection at the two study areas.

Sl. No	Parameter	Scale	Observation
1	River width	Metre	The width of the river was measured by rangefinder
2	River depth	Metre	The depth of the water was measured by boat using a long pole
3	Canopy cover	Percentage	Ocular estimate of canopy cover
4	Temperature	Celsius	Measured by thermometer
5	Leaf litter	Percentage	Ocular estimate of leaf litter
6	Hard soil	Percentage	Tightly packed sand estimated as percent of area
7	Loose soil	Percentage	Density of soil of 0-15% as a percent of area
8	Rock	Percentage	Estimate of the area covered by boulders

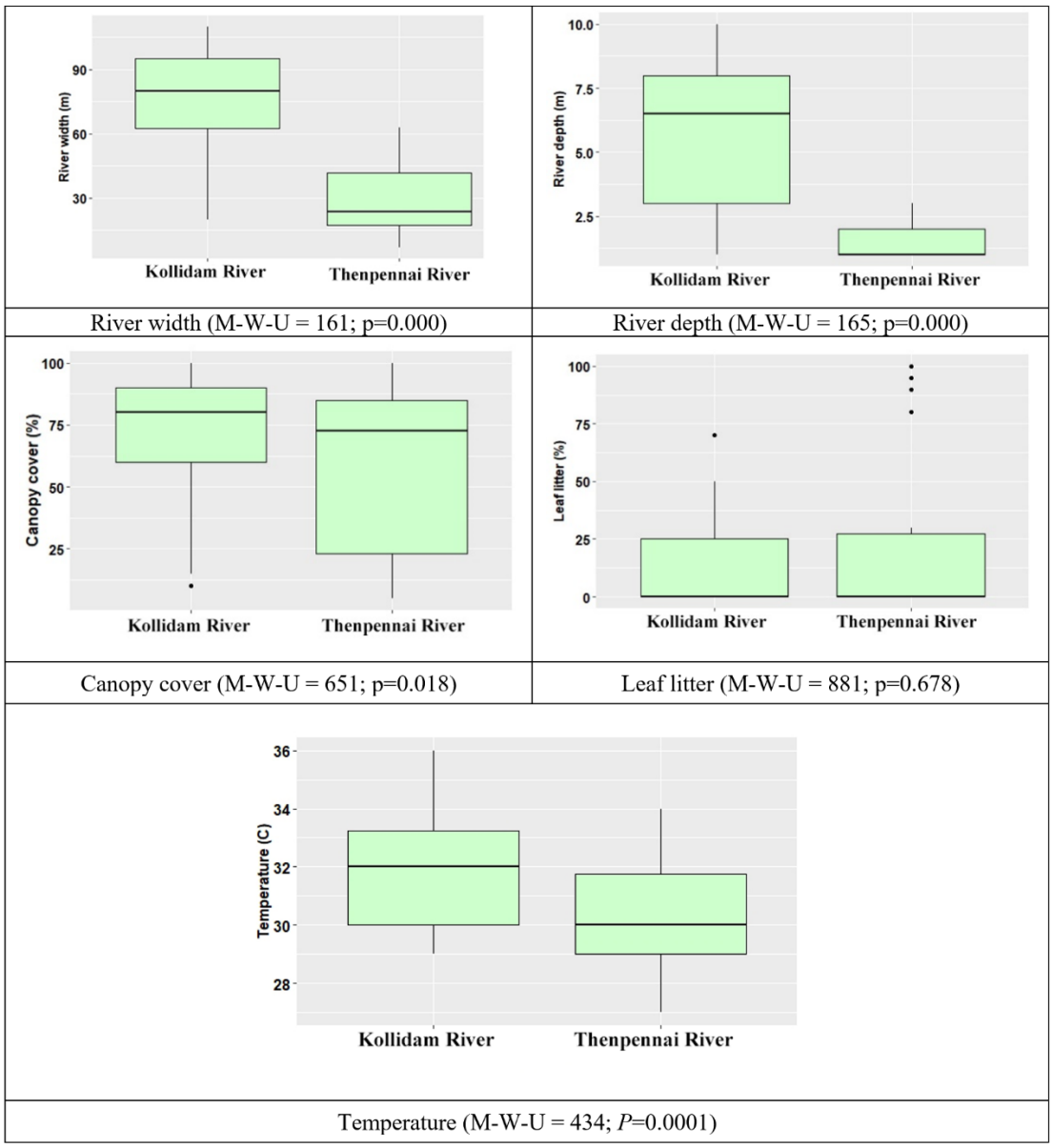


Figure 4. Habitat characteristics of the two study areas.

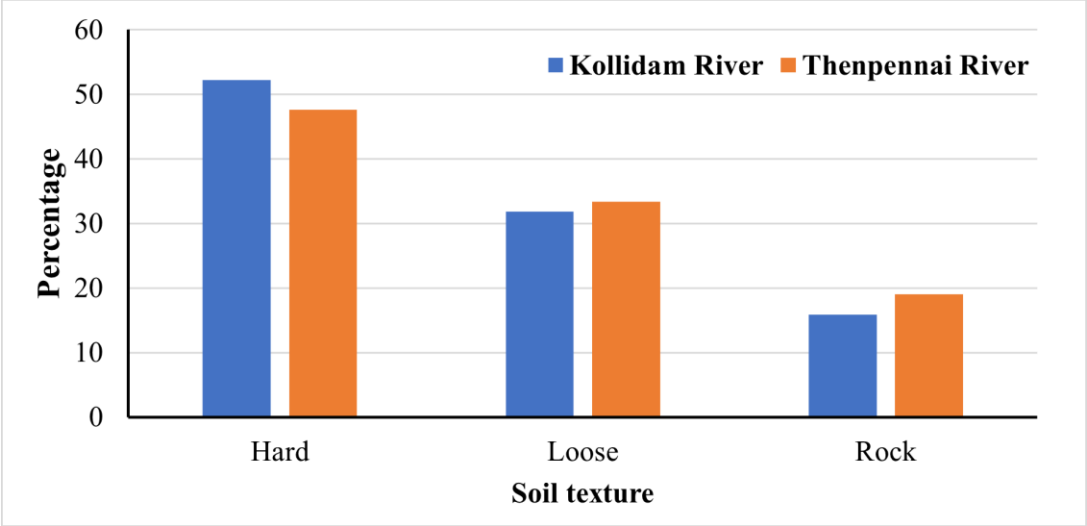


Figure 5. Differences in substrate between the two rivers (Kruskal Wallis Test =6.56; *P*=0.052)

Dens

Twelve dens, both active and inactive, were identifed in the study areas, mainly in mangrove, sand, and cave-like sites. On the Kollidam River, the otters primarily used riverbanks and mangrove roots for temporary dens, and primarily riverbank and tree roots along the Thenpennai River. The number of den entrances varied from two to four, and den depth ranged from 1m to 3m, with an average width of about 1m. Average distance from water was <1m (Fig. 6).

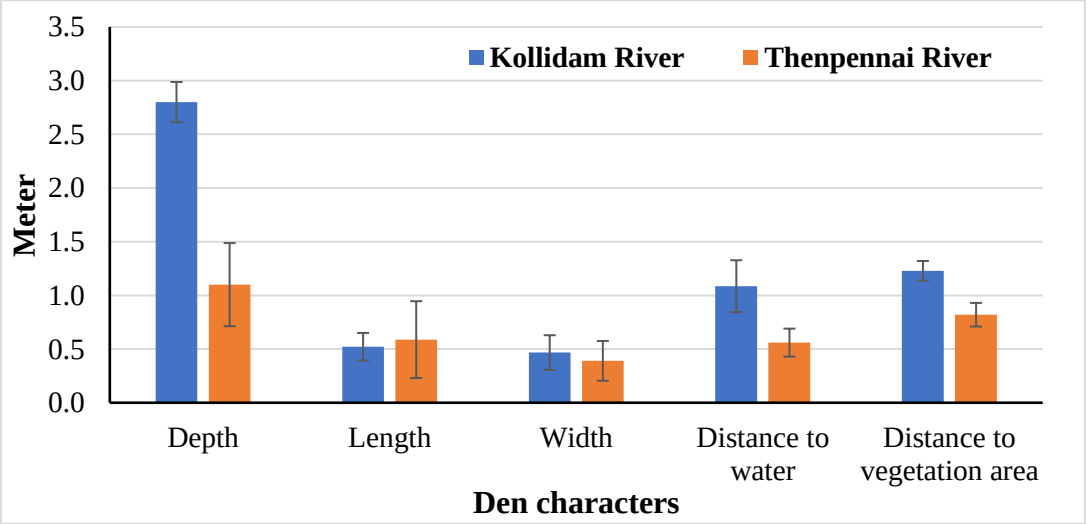


Figure 6. Den characteristics in the study rivers.

Diet Composition

A total of 66 scat samples were collected from the two study sites. Fish were the main prey category in the diet of otters in Kollidam and Tenpennai Rivers at 53% and 46% respectively. Other prey included shellfish, 15%, and crabs, 11%, with a rare representation of rodents (Fig. 7). No amphibian remains were recorded.

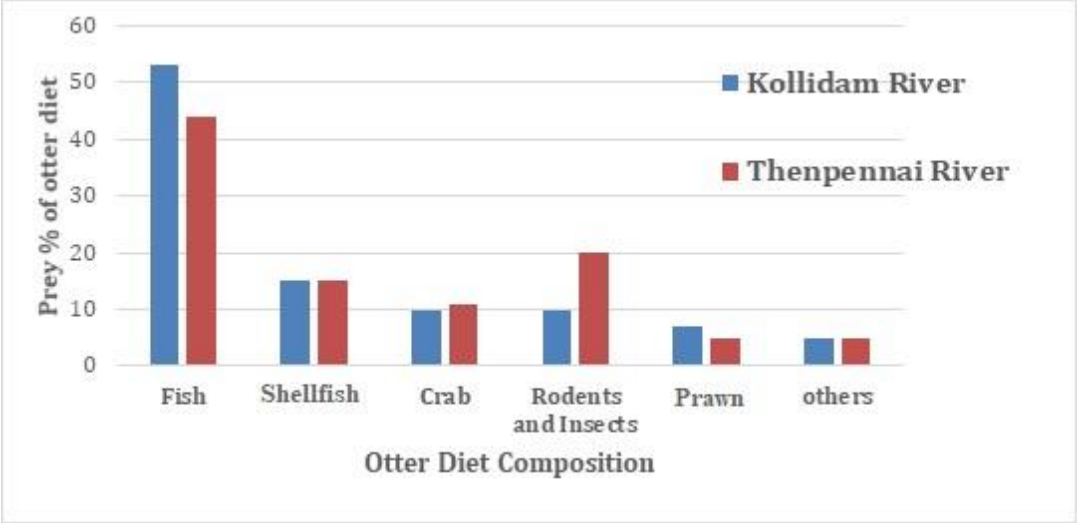


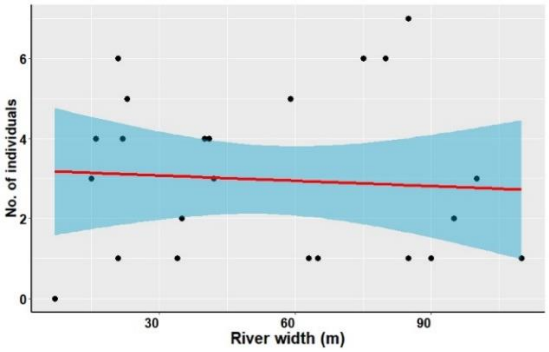
Figure 7. Diet of Smooth-coated otters in the two study areas.

Factors affecting on habitat selection

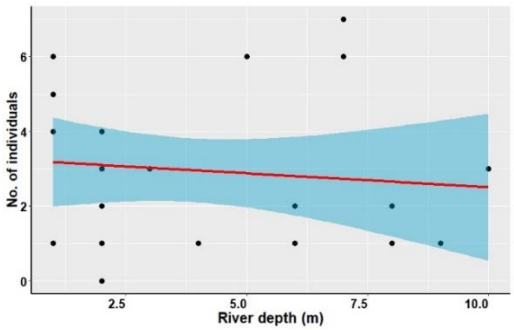
Of eight habitat parameters, leaf litter, loose soil and canopy cover showed a positive relationship with otter presence. In contrast, river width, river depth and hard soil showed a negative relationship. The greater representation (Cos^2) of the variables >0.30 are in boldfaced in Table 2. In this analysis, the first three principal components explain 68.37% of the variation, an acceptably large percentage. These principal components from the data were considered for the PCA interpretation. The first principal component is strongly correlated with four variables and the total variance is 41.21%. In the first principal component increased with increasing loose soil (0.47), canopy cover (0.31) and decreased with hard soil (-0.38), river width (-0.56) and river depth (-0.46). The second principal component increased with only one of the values – temperature - (-0.31) are decreased with 32.1% of variance (Table 2, Fig. 8).

Table 2. Principal component analysis showing the descriptive relationship among covariates

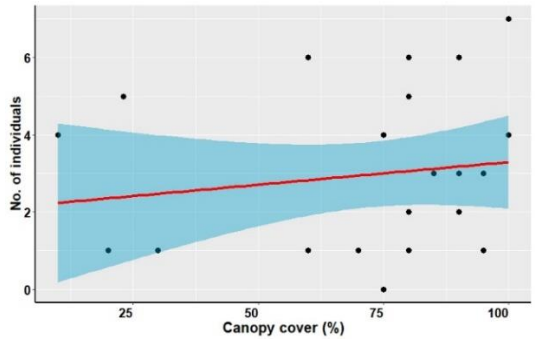
Habitats	Principal component		
	1	2	3
Loose soil	0.47	0.28	0.15
Hard soil	-0.38	-0.21	0.15
River width	-0.56	-0.28	0.01
River depth	-0.46	-0.11	0.65
Canopy cover	0.31	0.02	0.26
Temperature	0.01	-0.31	0.08
Eigenvalue	3.42	1.99	1.65
% of variance	41.21	32.1	24.56
Cumulative % of variance	31.21	54.12	68.37



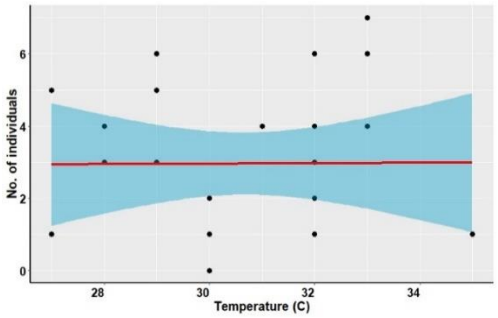
a) River Width



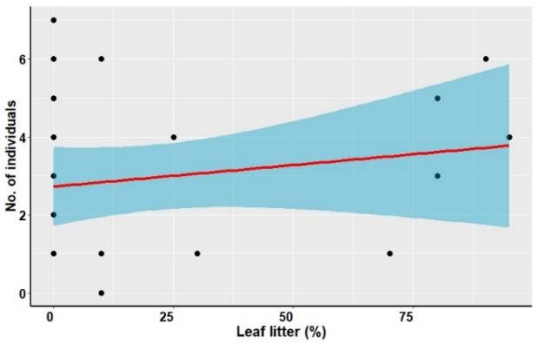
b) River Depth



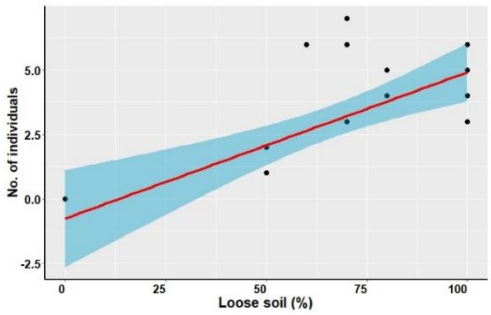
c) Canopy Cover



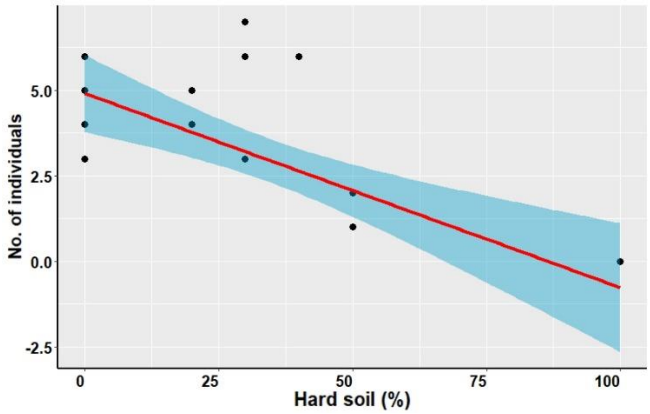
d) Temperature



e) Leaf Litter



f) Loose Soil



g) Hard Soil

Figure 8. Relation between otter occurrence and habitat parameters

DISCUSSION

This study documented otter presence in the Kollidam River and Thenpennai River for the first time. Several studies have documented the observation and occurrence of otter species in other areas, according to otter surveillance records in Tamil Nadu and Puducherry (Cauvery Wildlife Sanctuary, Tamil Nadu - Shenoy et. al. 2006; Sankaraparani River, Puducherry - Raman et al. 2019; Moyar valley, Western Ghats - Narasimmarajan et al., 2021; Kilnathur Lake, Arunagiri Park pond, Thiruvannamalai - Kalaimani et al., 2021; Vaduvoor Bird Sanctuary, Thiruvarur - Arivoli and Narasimmarajan, 2021). Arivoli and Narasimmarajan 2021 recorded 6 otters at Vaduvoor Birds Sanctuary. A Smooth-coated otter site was recently recorded at Kilnathur Lake, Arunagiri Park pond, Thiruvannamalai (Kalaimani et al., 2021). The habitat preferences of otters of the present study is similar to those previously reported. Shenoy et al. (2006) reported the same of loose soil as a positive, and hard soil as a negative, factor for otter presence. River depth and width had a negative relationship with otter presence, as reported by Raha and Hussian (2016). Otter dens were mainly found in mangroves, in rock crevices, and in sandy environments, similar to results reported by Hussain and Choudhury (1997). Fish were the major diet component of otters in these two rivers, with insects and rodents a small percent of total diet. Fifty-three percent of diet, as analyzed from scat samples, consisted of fish scale and bone. Hussain (1993) and Anoop (2001) also documented fish as the main food for Smooth-coated otters. The association between habitat selection and prey abundance are the main influences to otter occurrence.

CONCLUSION

Otters thrive in South Indian environments that are conducive to their presence: mangrove vegetation, shallow water, rocks, loose sand and riverine banks with good riparian cover. But polluted waters, infrastructure construction and human settlements have created fragmmented habitat and reduced food for otters. Poaching and general degradation of natural habitats threaten otter populations in South India. There is a potential for the further declines of Smooth-coated otter populations in the South Indian states of Tamil Nadu and Puducherry. We recommend a more comprehensive survey of these two river basin and public awareness programs to better conserve Smooth-coated otters, an important component of freshwater ecosystems in the region.

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(video no longer available 02/03/23)

RESUME

DISTRIBUTION, SELECTION DE L'HABITAT ET REGIME ALIMENTAIRE DE LA LOUTRE À PELAGE LISSE (*Lutrogale perspicillata*) DES RIVIÈRES KOLLIDAM ET THENPENNAI EN INDE DU SUD

Nous documentons la présence de la loutre à pelage lisse (*Lutrogale perspicillata*) sur les rivières Kollidam au Tamil Nadu et Thenpennai à Pondichéry, dans le sud de l'Inde. Auparavant, il n'y avait aucune information sur cette espèce dans les deux rivières, bien que sa présence soit connue dans le Tamil Nadu et à Pondichéry, où on la trouve souvent dans les écosystèmes de mangroves et les estuaires. La loutre à pelage lisse est actuellement répertoriée comme vulnérable sur la liste rouge de l'UICN. Au total, 22 km de berges ont été sondés en 2019 et 2020, 15 km le long de la rivière Kollidam et 7 km le long de la rivière Thenpennai. Un total de vingt-sept loutres ont été observées dans les deux zones d'étude, 15 le long de la rivière Kollidam et 12 le long de la rivière Thenpennai. Le régime alimentaire de la loutre se composait respectivement de 53 % et 46 % de poisson et comprenait de faibles pourcentages d'insectes, de rongeurs, de crabes et de crevettes. Huit paramètres, y compris la litière des feuilles, le sol meuble et la couverture de la canopée, avaient une corrélation positive liée à la présence des loutres, tandis que la largeur et la profondeur de la rivière et le sol dur étaient corrélés négativement. Les loutres à pelage lisse semblent être menacées par le braconnage et la dégradation de l'habitat dans la région.

RESUMEN

DISTRIBUCIÓN, SELECCIÓN DE HÁBITAT Y DIETA DE LA NUTRIA LISA (*Lutrogale perspicillata*) EN LOS RÍOS KOLLIDAM Y THENPENNAI, SUR DE LA INDIA

Documentamos la presencia de la nutria lista (*Lutrogale perspicillata)* en el río Kollidam en Tamil Nadu, y en el río Thenpennai en Puducherry, sur de la India. Previamente, no había información sobre éste animal en los ríos Kollidam y Tenpennai, aunque se sabe que la especie habita en Tamil Nadu y Puducherry, donde se la encuentra a menudo en ecosistemas de manglar y estuarios. La nutria lisa (*Lutrogale perspicillata*) está actualmente listada por la Unión Internacional para la Conservación de la Naturaleza (UICN) como vulnerable. Fueron relevados un total de 22 km de barrancas de ríos en 2019 y 2020, 15 km en el río Kollidam y 7 km en el río Thenpennai. Fueron observados veintisiete individuos en ambas áreas de estudio, 15

individuos en el río Kollidam y 12 en el río Thenpennai. En los ríos Kollidam y Tenpennai, las dietas de las nutrias consistieron en 53 % y 46 % respectivamente, de peces, e incluyeron pequeños porcentajes de insectos, roedores, cangrejos y camarones. Ocho parámetros, incluyendo hojarasca, suelo suelto y cobertura del dosel correlacionaron positivamente con la presencia de nutrias, mientras que el ancho del río, su profundidad, y el suelo duro correlacionaron negativamente. Las nutrias lisas parecen estar amenazadas por la caza furtiva y la degradación de hábitat en el área.

R E P O R T

OCCURRENCE OF SMOOTH-COATED OTTERS (*Lutrogale perspicillata*) IN MUDASAL ODAI COASTAL BACKWATERS, TAMIL NADU, INDIA

Udhayakumar UTTHAMAPANDIAN[1], Dipani SUTARIA[2], Pichaiyan FRANCIS[3], Rathinasami ARULMOHAN[1], Augustinraj ALEX KIRUBAKARAN[1], Davidkanagaraj LOUWIN ANAND[1], Ayyappan SARAVANAKUMAR[1*]

[1]*Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, Cuddalore, Tamil Nadu, India*
[2]*Adjunct faculty, College of Science and Engineering, James Cook University, Townsville, Australia*
[3]*Wildlife Institute of India, P.O. Box # 18, Chandrabani, Dehradun 248001, Uttarakhand, India*
[*]*Corresponding author: e-mail: asarvaan@gmail.com*

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Abstract: The studies on coastal predators are minimal in Tamil Nadu and at large, the whole country. The present study is a recce survey to reveal the presence/absence of otters, population, distribution and human otter interactions in Mudasal Odai backwaters, southern

stretch of Vellar estuary, Cuddalore, Tamil Nadu, India. The preliminary survey during the study exposed the presence of two packs of otters, four individuals in one and a standalone animal inhabits the site. The hard structures, features and abundance of prey make the inhabitation easy in the site of interest. The interaction between humans and otters remains to be critical due to the damages caused economically to the local communities by the otters.
Citation: Utthamapandian, U., Sutaria, D., Francis, P., Arulmohan, R., Alex Kirubakaran,A., Louwin Anand, D. and Saravanakumar, A. (2023). Occurrence of Smooth-Coated Otters (*Lutrogale perspicillata*) in Mudasal Odai Coastal Backwaters, Tamil Nadu, India. *IUCN Otter Spec. Group Bull.* **40** (1): 16 - 25
Keywords: Smooth-coated otters, Mudasal odai backwaters, Human-otter interaction, Vellar estuary, Cuddalore, Habitat preference

INTRODUCTION

The Indian coastline incorporates myriad biomes and ecosystems which include every tropic level of the local food chain. Among other predators, otters occupy the place of top predators in shallow tributaries of river streams and estuaries. Looking at the three species found in India, Smooth-coated otters (*Lutrogale perspicillata)* constitute the major part of the population (Johnsingh and Manjrekar, 2013) and can be found in major and minor floodplains, rivers, estuaries and upstreams (Hussain and Choudhury, 1997; Foster-Turley, 1992). Habitat preferences of otters are established by considering the availability of prey such as fishes, shrimps, molluscs, small vertebrates and insects (Hussain and Choudhury, 1998). However, with limited resources, studies on otters are meagre even in terms of population. In accordance with the IUCN Species Red List Index, smooth coated otters are classified as vulnerable and categorized under Schedule II of Indian Wildlife Protection Act, 1972 (De Silva et al., 2015). Otters are considered as biological indicators and are vulnerable to the disruption of habitats by anthropogenic activities (Sutaria, 2013). For these mammals, which rely on land equally, both loss of habitat and poaching are major threats (Raha and Hussain, 2015).

MATERIALS AND METHODOLOGY

Study area

Mudasal Odai (Lat.11°29'N; Long. 79°46' E) backwaters (Fig. 1,2) is a typical nutritious zone which is replenished by the estuarine input of river Vellar from north and the nutrient rich backwaters from Coleroon estuary, which passes through Pichavaram reserve from south. The elevated amount of nutrients is the mainspring for the abundance of prey such as various species of fishes, crabs, shrimps and molluscs. The place also possesses various artificial structures and vegetation which make up the place an suitable habitat for otters.

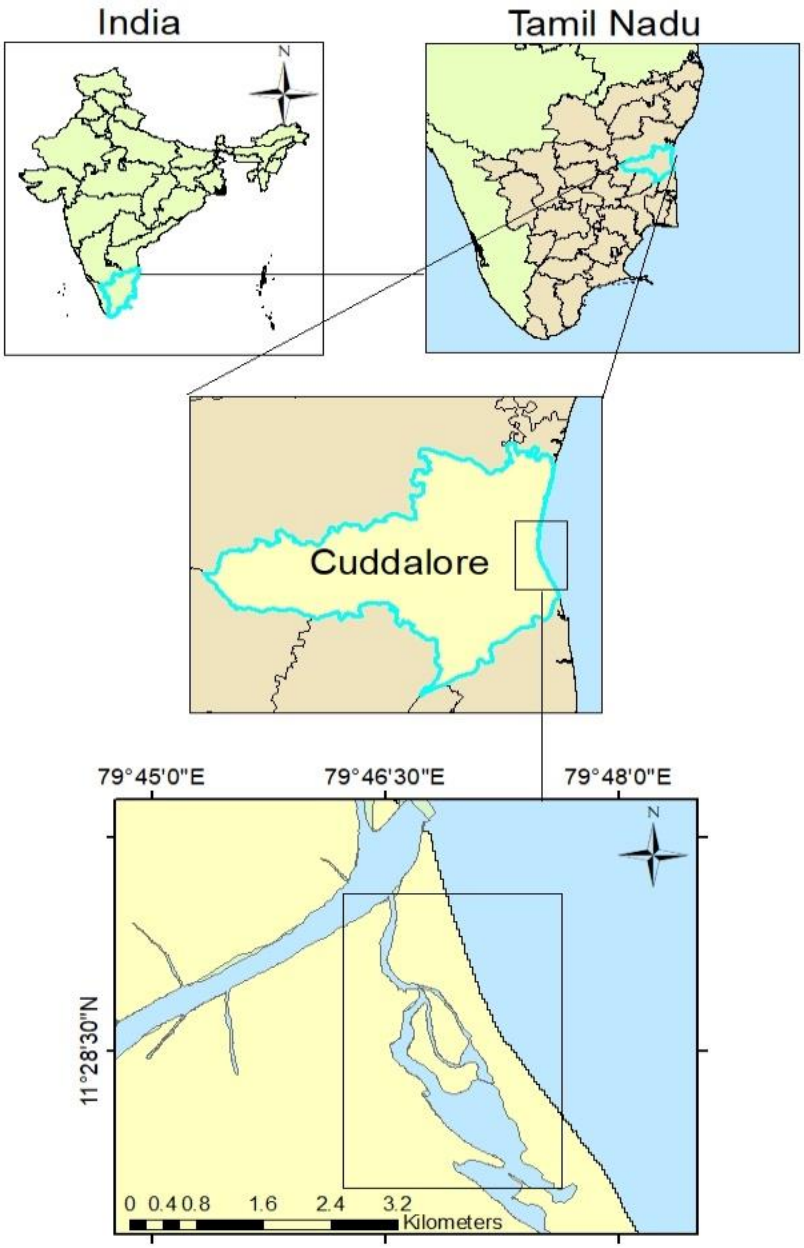

Figure 1. Study area

Methods

The survey was carried out by both walking and using boats. The study area is restricted within the distance of 4km from Mudasal odai fish landing centre intended so that it does not reach the reserved mangrove forest of Pichavaram. Foot surveys were done to assess various habitats including mangroves, mudflats, salt marshes, dense forests of *Prosopsis juliflora*. The region is engineered well with models including fish bone models for mangrove plantations and mitochondrian models for tidal fish farming.

Data was collected by direct sightings of otters and indirect indications of otter presence such as dens, spraints, pugmarks, tail tracks, groom sites and scratch marks. Interview surveys were done using questionnaires with local fishermen community and traditional fishermen.

Figure 2. Study area

RESULTS

Population

The site is highly utilized by local fishermen and Irula tribes due to the large availability of fin fishes and shell fishes. Based on primary evidence, the banks of fish bone models and backwaters are used by, a pack of four otters (Fig. 3.) and a lone individual separately. Both the pack and the lone animal were seen to utilize the same grooming sites (Fig. 4) and fishing grounds but separately following different patterns of time and tides.

Figure 3. A pack of otters basking on the bank of backwaters

Figure 4. A single otter grooming at the same site

Habitat Preference

The anthropogenic structures include ponds in the form of 'fish bone' pond sets and mitochondrian ponds (Fig. 5), which are difficult to explore by manpower. This makes the habitat suitable as an important site to be inhabited by otters. Along the banks of the backwater, the survey comprised a total of 10 fish bone sets. The dens were seen on the central land patch which facilitates easy ways to escape in all the directions. During the survey, sediment sampling was done by random sampling after identifying the grooming sites. The sloppy banks of fish bone ponds and the silt accumulations are utilized as grooming sites. The sites also possess sandy and clayey texture and not utilized by the animals for digging dens and grooming. On considering the positions of dens, all the three were under the roots of sparse *P. juliflora* vegetation providing a better substrate for digging (Fig. 6), and provifde cover for hiding.

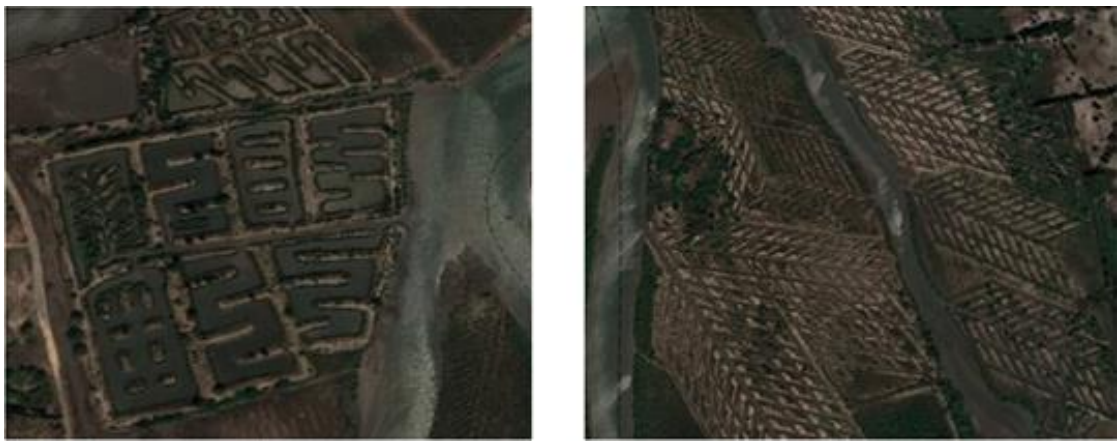

Figure 5. Mitochondrian tidal ponds (left) and fish bone pond sets (right) on the site

Figure 6. Locals pointing the dens below *P. juliflora* roots

Seasonal Distribution and Drinking Water

The otters were observed in the dense core backwater structures during monsoon and post monsoon seasons, seen near the Irula tribe settlement along the banks, and near to the roads during summer and pre-monsoon seasons. The backwater of Mudasal Odai is influenced by saline water from the estuary of the river Vellar and Pichavaram mangrove reserve. The artificial land patterns on the site tend to retain saline water in confined areas, and this tends to concentrate by evaporation during summer and pre-monsoon seasons. The landmass, and many of the rain-collecting ponds dry out, causing the animals to gather in any remaining rain ponds, seeking fresh water to drink. The otters in the Mudasal Odai backwater have learnt to drink fresh water from the rainwater ponds (Fig. 7) found near the Irula tribal settlements, crossing two busy roads used by local fishermen to get there (Fig. 7). This means that sightings are frequent, during high tide. The marked difference in patterns in seasonal usage of habitats were also confirmed by the interview surveys acquired from the Irula community.

Figure 7. An otter crossing the road to drink fresh water (left). Rainwater collection pond (right)

Human Otter Interaction

The banks of Mudalsal Odai backwaters possess mitochondrian type tidal ponds which are frequently hunted in both the group, and lone otters (Fig. 8). Interaction in the process of chasing them out of the ponds is dangerous for the otters (Fig. 8). Foraging behavior also poses a threat to otters because the most used equipment here are gill nets, which the otters raid for fish, damaging the nets which are vital to the livelihood of the fishermen (as is common throughout the area). However, the otters do not appear afraid of either boats or settlements.

Figure 8. An otter foraging in one of the tidal ponds (left). A local fisherman trying to chase the otter from the pond (right)

CONCLUSION

The Mudasal Odai backwater is one of the highly exploited areas along the coast of Cuddalore. It constitutes one of the three major fish landing centres of the Vellar estuarine stretch, and local people are highly committed to, and dependent on the fishery business. This study identified five otters in two groups living around the region, exposed to comparatively frequent interaction with the local fishermen. The hard structures and availability of sufficient prey makes the place attractive for otter inhabitation. Even though the behavioural adaptation that the otters exhibit in the site is exceptional, it still leads to negative interaction with local fishermen. The opportunities for road-kill are high whenever the otters cross the roads to drink. In the perception of the local people, in the past, otters were cherished, but in recent times, the foraging of otters in the ponds from which they make their own living is frustrating,

but fear of the wildlife protection acts prevents them from terrorizing otters. No mortalities or killings were recorded at the site during the study but without implementing conservation measures and awareness among local community, this will become very likely in the near future.

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RÉSUMÉ:

PRÉSENCE DE LA LOUTRE À PELAGE LISSE (*Lutrogale perspicillata*) DANS LES MARIGOTS CÔTIERS DU MUDASAL ODAI, AU TAMIL NADU, EN INDE

Les études sur les prédateurs côtiers sont rares au Tamil Nadu et dans l'ensemble du pays. La présente étude est une enquête de reconnaissance visant à révéler la présence/l'absence de loutres, d'une population, sa distribution et les interactions entre l'homme et les loutres dans les marigots de Mudasal Odai, situés au sud de l'estuaire du Vellar, dans le district de Cuddalore, au Tamil Nadu, en Inde. L'enquête préliminaire de l'étude a révélé la présence de deux groupes de loutres : un groupe de quatre individus et un individu solitaire fréquentent le site. La présence de structures durables, les caractéristiques et l'abondance de proies facilitent leur présence dans ce site prioritaire. L'interaction entre l'homme et les loutres reste critique en raison des dommages économiques causés par les loutres aux communautés locales..

RESUMEN :

OCURRENCIA DE NUTRIAS LISAS (*Lutrogale perspicillata*) EN LOS REMANSOS COSTEROS DE MUDASALODAI, TAMIL NADU, INDIA

Los estudios sobre predadores costeros en Tamil Nadu - y en todo el país - son mínimos. Este estudio es un relevamiento de reconocimiento para revelar la presencia/ausencia

de nutrias, así como poblaciones, distribución e interacciones humanos-nutrias en los remansos Mudasal Idai, en la franja sur del estuario Vellar, Tamil Nadu, India. El relevamiento preliminar de este estudio expuso la presencia de dos grupos de nutrias, de cuatro individuos en uno y un animal solitario en el otro caso. Las estructuras sólidas, los rasgos del lugar y la abundancia de presas hacen que el sitio de interés sea fácil de habitar. La interacción entre humanos y nutrias resulta ser crítica debido a los daños económicos causados por las nutrias a las comunidades locales.

சுருக்கம்:

இந்தியா, தமிழ்நாடு, முடசல் ஓடை கடலோர உப்பங்கழியில் மென்-தோல் நீர்நாய்களின் (லுட்ரோகேல் பெர்ஸ்பிசில்லாட்டா) வாழ்வுமுறை

கடலோர வேட்டை பிராணிகள் பற்றிய ஆய்வுகள் தமிழ்நாடு மற்றும் ஒட்டுமொத்த நாடு முழுவதும் மிகக் குறைவு. தற்போதைய ஆய்வு, இந்தியாவின் தமிழ்நாடு கடலூரில் உள்ள வெள்ளாறு முகத்துவாரத்தின் தென்பகுதியில் உள்ள முடசல் ஓடை உப்பங்கழியில் நீர்நாய்களின் இருப்பு/இல்லாமை, எண்ணிக்கை, வாழ்விட பங்கீடு மற்றும் மனிதன்-நீர்நாய் இடைவினைகள் ஆகியவற்றை வெளிப்படுத்தும் ஒரு ஆய்வாகும். ஆய்வின் போது நடத்தப்பட்ட பூர்வாங்க கணக்கெடுப்பில் இரண்டு நீர்நாய் கூட்டம் இருப்பதும், இவற்றில் ஒன்றில் நான்கு நீர்நாய்களும், ஒரு தனியான விலங்கு அந்த இடத்தில் வசிப்பதும் அம்பலமானது. கடினமான கட்டமைப்புகள், அம்சங்கள் மற்றும் இரையின் மிகுதி ஆகியன இவ்விடத்தை எளிதான வசிப்பிடமாக்குகிறது. நீர்நாய்களால் உள்ளூர் சமூகங்களுக்கு பொருளாதார ரீதியாக ஏற்படும் சேதங்கள் காரணமாக மனிதர்களுக்கும் நீர்நாய்களுக்கும் இடையிலான தொடர்பு முக்கியமானதாக உள்ளது.

सारांश:

मुदसाल ओडीई कोस्टल बैकवाटर्स, तमिल नाडु, भारत में चिकने-लेपित ऊदबिलाव (लूट्रोगेल पर्सपिसिलटा) की उपस्थिति

तमिलनाडु और बड़े पैमाने पर, पूरे देश में तटीय शिकारियों पर अध्ययन न्यूनतम हैं। वर्तमान अध्ययन मुर्दासल ओडाई बैकवाटर्स, वेल्लार मुहाना के दक्षिणी खंड, कुड्डालोर, तमिलनाडु, भारत में ऊदबिलाव, जनसंख्या, वितरण और मानव ऊदबिलाव इंटरैक्शन की उपस्थिति / अनुपस्थिति को प्रकट करने के लिए एक रेकी सर्वेक्षण है। अध्ययन के दौरान प्रारंभिक सर्वेक्षण ने ऊदबिलाव के दो पैक, एक में चार व्यक्तियों और एक अकेला जानवर की उपस्थिति को उजागर किया। शिकार की कठिन संरचनाएं, विशेषताएं और बहुतायत ब्याज की

साइट में निवास को आसान बनाती हैं। ऊदबिलाव द्वारा स्थानीय समुदायों को आर्थिक रूप से होने वाले नुकसान के कारण मनुष्यों और ऊदबिलावों के बीच बातचीत नाजुक बनी हुई है।

A R T I C L E

DISTRIBUTION AND HABITAT PREFERENCE OF CAPE CLAWLESS OTTERS (*Aonyx capensis*) AND WATER MONGOOSES (*Atilax paludinosus*) IN THE SOUTPANSBERG, SOUTH AFRICA

Céline HARING[1], Sina WEIER[2], Birthe LINDEN[2,3]

[1]HAS University of Applied Sciences, Onderwijsboulevard 221, 5223 DE 's-Hertogenbosch, The Netherlands
[2]SARChI Chair on Biodiversity Value & Change, Faculty of Science, Engineering and Agriculture, University of Venda, Private Bag X5050, Thohoyandou, 0950 South Africa
[3]Lajuma Research Centre, P.O. Box 522, 0920 Louis Trichardt, South Africa
Corresponding author: Birthe Linden, e-mail: bibi@lajuma.com

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Abstract: Over 84% of the river ecosystems in South Africa are threatened and, accordingly freshwater dependent species such as the Cape clawless otter (*Aonyx capensis*) and the water mongoose (*Atilax paludinosus*) are also declining in numbers. These species share a similar diet and habitat preference and in certain places in South Africa it is known that they occur in sympatry. Our study focused on a pristine river system in the far western Soutpansberg where little is known about the local distribution and habitat preferences of these species. To determine the distribution and fine scale habitat preferences of otters and water mongooses, tracks and signs (TS) and camera traps were used, and spraint content analysed to establish differences in diet. Based on the TS that were found, the Cape clawless otter and water mongoose are both widely distributed along the river system and mostly occur separate from each other. The observed amount of TS of Cape clawless otters was higher in areas with pools, rocky riverbanks and areas with a stream width of 2 - >5 m in diameter. The number of water mongoose TS recorded was higher in wetland areas with leafy riverbanks and areas with a stream width of up to 2 m. We suggest that Cape clawless otters and water mongooses may avoid direct competition by habitat partitioning in the western Soutpansberg.
Citation: Haring, C., Weier, S. and Linden, B. (2023). Distribution and Habitat Preference of Cape Clawless Otters (*Aonyx capensis*) and Water Mongooses (*Atilax paludinosus*) in the Soutpansberg, South Africa. *IUCN Otter Spec. Group Bull*. **40** (1): 26 - 38
Keywords: Camera traps**,** mountain range, Limpopo Province, spraints, niche separation

INTRODUCTION

Freshwater ecosystems, which play a vital role in sustaining life, are one of the most endangered habitats on the planet (Harrison et al., 2010; Green et al., 2015). Alien species, overexploitation, modification of waterflow, water pollution and transformation, global climate change and loss of habitat are the main threats to freshwater ecosystems (Allan and Flecker, 1993; Malmqvist and Rundle, 2002; Rahel, 2002; Dudgeon et al., 2005; Revenga et al., 2005), with biodiversity loss in these systems appearing to be even greater than recorded for any of the most affected terrestrial ecosystems (Sala et al., 2000).

In South Africa, over 84% of the river ecosystems are threatened (Nel and Somers, 2007) and with this many terrestrial species that are water dependent (Revenga and Kura, 2003; Balian et al., 2008), including the Cape clawless otter (*Aonyx capensis*), spotted-necked otter (*Hydrictis maculicollis*) and water mongoose (*Atilax paludinosus*). According to the IUCN, Cape clawless otter and spotted-necked otter

populations are declining, resulting in the two otter species globally listed as Near Threatened (Jacques et al., 2021; Reed-Smith et al., 2021). On a regional scale, the Cape clawless otter is also listed as Near Threatened (Okes et al., 2016) whereas the spotted-necked otter is listed as Vulnerable (Ponsonby et al., 2016). The water mongoose is listed as Least Concern both globally and regionally, with global population trends decreasing and regional population trends unknown (Do Linh San et al., 2015; Baker et al., 2016). In certain localities in South Africa it is known that Cape clawless otter, spotted-necked otter and water mongoose occur sympatrically, suggesting that these three species share similar habitat and diet preferences (Skinner and Smithers, 1990; Rowe-Rowe, 1991).

The Soutpansberg mountain range in far northern South Africa is a nationally recognised Strategic Water Source Area (SWSA; Le Maitre et al., 2018) with numerous perennial streams and rivers providing suitable habitat for otters and water mongooses. While there is substantial anthropogenic pressure on freshwater ecosystems in the eastern parts of the mountain range (Le Maitre et al., 2018), the western Soutpansberg is comparatively intact due to the low human population density (Statistics South Africa, 2012).

Our study focused on a pristine river system in the far western Soutpansberg where Cape clawless otters and water mongooses are known to occur (Baker et al., 2016; Okes et al., 2016; GBIF.org, 2022 a,b), but where spotted-necked otters have not been recorded. Little is known about the local distribution and habitat preferences of these species in far northern South Africa. Previous studies on the three species suggest some degree of niche separation along river systems between otters and mongooses, with the former expected to prefer shallow to deep pools with rocky riverbanks and dense vegetation and the latter preferring wetland areas with dense vegetation (Rowe-Rowe, 1977; Stuart, 1981; Kingdon, 1997; Perrin and Carugati, 2000; Nel and Somers, 2007; Kundu et al., 2008). In this study we aim to add more detailed spatial and ecological data from this so far understudied area of the species' national distribution range through a first systematic survey.

MATERIALS AND METHODS

Study area

The study was conducted at the Lajuma Research Centre, a private property situated on the southern slopes of the western Soutpansberg (23°02'17.1"S 29°26'26.5"E; elevation: 1000-1300 masl). It is part of the Luvhondo Nature Reserve, which lies within the UNESCO Vhembe Biosphere Reserve. Our study focused on one of the main north-south flowing rivers in the reserve, the Kutetsha and one of its tributaries (Fig. 1). The banks surrounding the Kutetsha and its tributary range from rocks, to gallery forest and marshy wetland areas and natural pools are formed regularly along the course of the system. Riparian vegetation along this river system generally consists of tall grass, reed beds and trees (Fig. 2). The Kutetsha river system is a tributary to the Hout river, in turn a tributary of the Sand river within the Limpopo river catchment area.

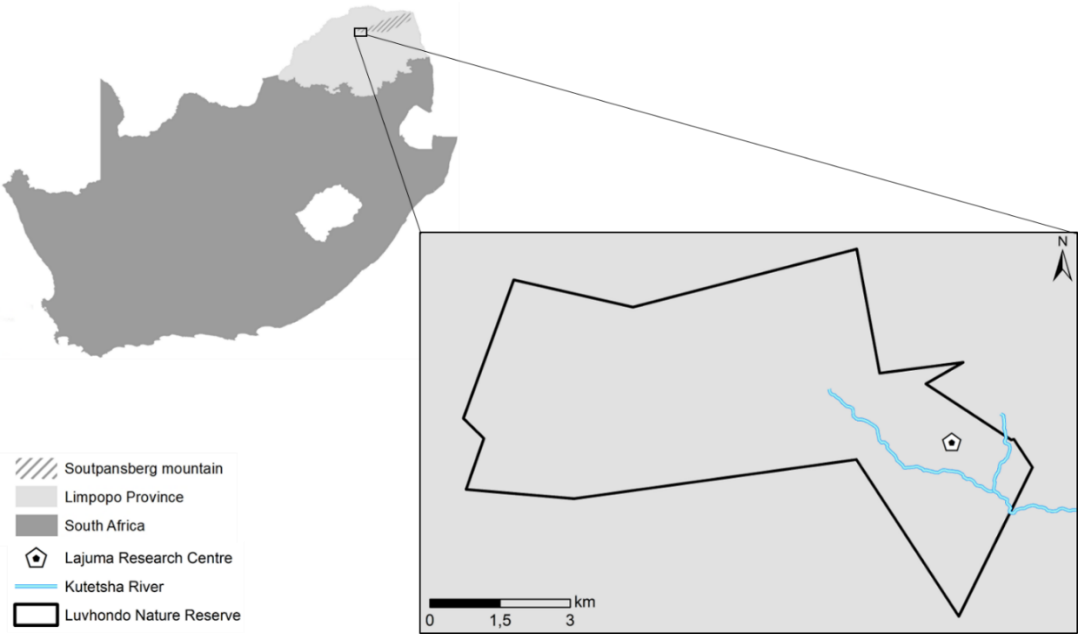

Figure 1. Map of the study area showing the Kutetsha river and its tributary at the Lajuma Research Centre in the Luvhondo Nature Reserve in the western Soutpansberg of South Africa's Limpopo Province.

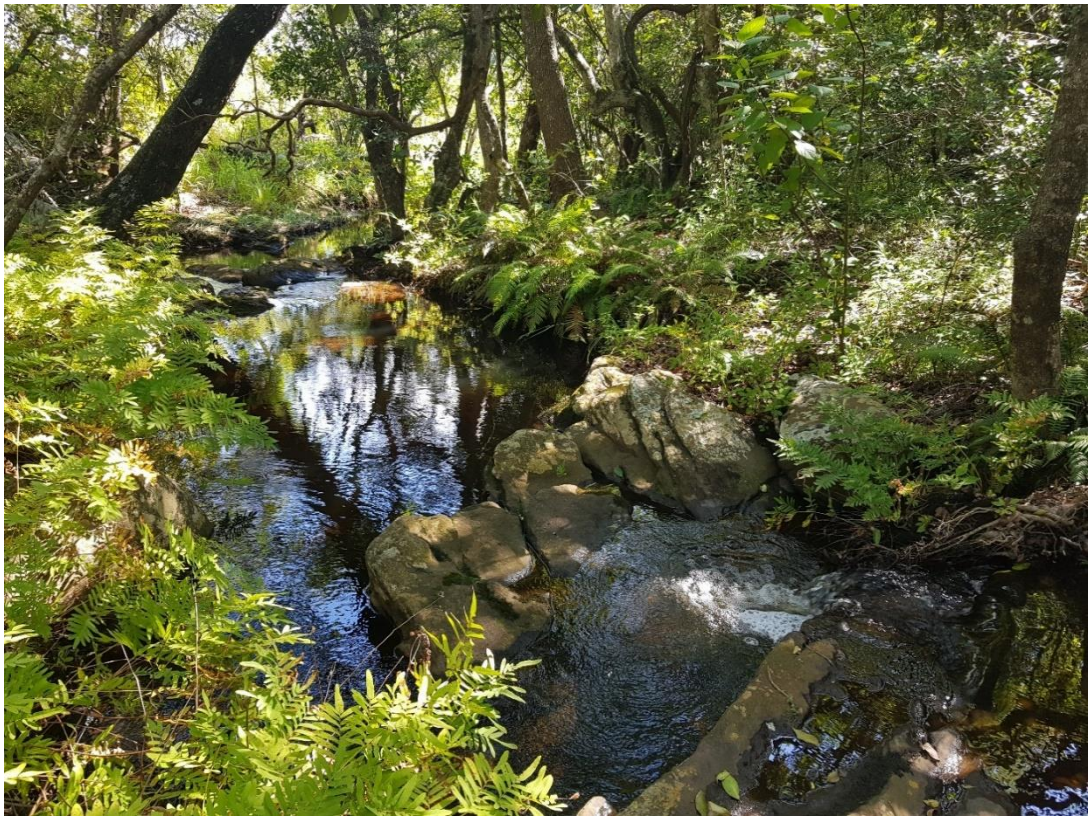

Figure 2. The Kutetsha river system in the Luvhondo Nature Reserve, western Soutpansberg, South Africa.

Data collection

Tracks and signs

To establish occurrence and habitat preference of the three species, we conducted surveys for tracks and signs (TS) over a 10-week period between February 2019 and June 2019. Surveys consisted of slowly walking along and visually scanning both banks

of the Kutetsha river and its tributary to search for TS: feeding sites and spraints using a tracks and signs field guide for identification (Stuart and Stuart, 2013). In total, five km of river were surveyed during 48 survey walks. Three starting points were chosen for the TS survey, moving downstream from north to south. Each section of the river was surveyed 16 times during the 10-week survey. GPS coordinates were taken for all TS found.

River characteristics

To determine habitat preference by species, a description of the environment was recorded at the location at which TS were found. Four river characteristics were described: location (river, pool, wetland), substrate (leaf litter, rocks, silts), visual estimate of stream width (< 0.5 m, 0.5-1 m, 1-2 m, 2-5 m, > 5 m or 'not applicable') and water depth (< 0.5 m, 0.5-1 m, 1-2 m, > 2 m or 'not applicable'). The criteria 'not applicable' was used whenever TS were found away from the river system. Stream width and depth classes were recorded by either wading into the river and estimating the depth or by visual estimates in areas where the river was too deep for wading in (Harding et al., 2009).

Spraint content

Fresh spraints were collected for dietary content analysis. Spraints were collected in a paper bag, dried in an outdoor environment and stored until analysis. The spraint content was analysed using a magnifying glass with a magnification of 2.5x. The content of the spraints was categorised as crustaceans, small mammals and insects (Jacobsen, 2004; Kloskowski, 2005; Palazón et al., 2008; Guertin et al., 2010).

Camera trap survey

Wherever TS were found, a camera trap (Ltl Acorn LTL-6210MC HD Trail Camera) was deployed in the area to visually confirm presence of the species and left for a duration of minimum seven days. The camera settings were set on "picture" (12MP), at which 3 images were taken after movement was detected by the camera. An interval of one second was set between each picture. When pictures of an otter species or water mongoose were recorded, the camera was left in the location until no new pictures of the species were recorded. If after seven days no otters or water mongooses were recorded, the camera trap was moved to another locality where TS were found.

Data analysis

Given that our data collection only included presence data, we chose descriptive data exploration over statistical analyses. Maps were created using ArcGIS 10.5.

RESULTS

Distribution

No TS or camera trap images of spotted-necked otters were recorded, hence all analysis focussed on water mongooses and Cape clawless otters. Based on the TS that were found, Cape clawless otter and water mongoose both occurred along the river system sections surveyed in this study (Fig. 3). The TS that were found suggests that both species seem to largely occur separately from each other. Only one area along the river system was found where both species overlapped. Five Cape clawless otter TS were recorded ad libitum on a single lane dirt road in the Nature Reserve, 317 m away

from the river system surveyed (Fig. 3). These outlying distribution records were excluded from further analysis.

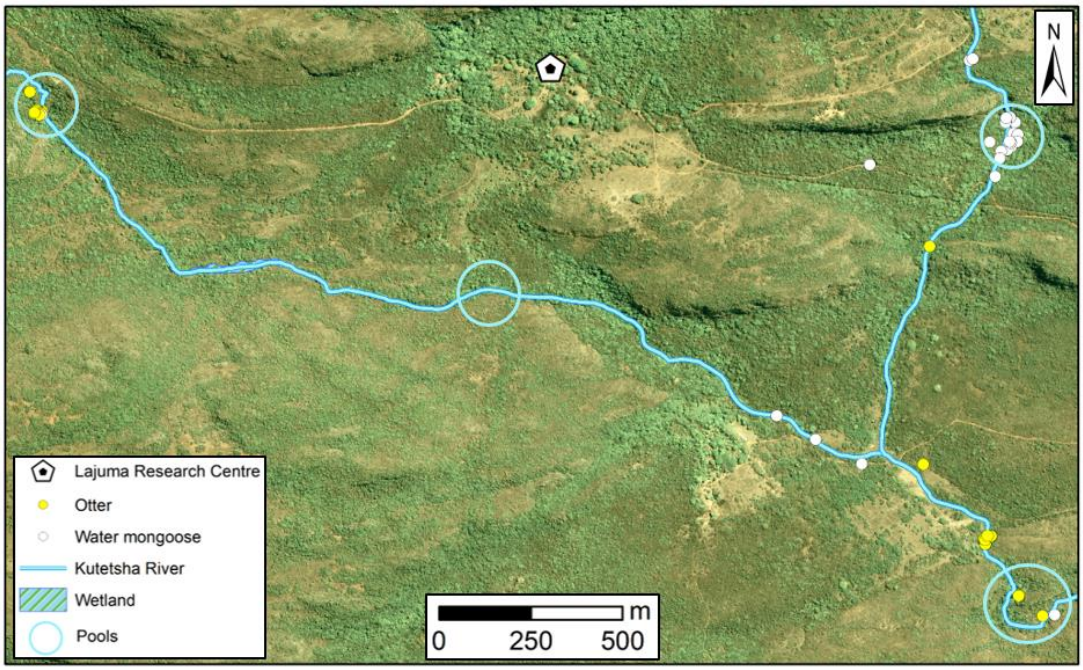

Figure 3. Sections of the Kutetsha river and its tributary surveyed for Cape clawless otter (*Aonyx capensis*) and water mongoose (*Atilax paludinosus*) tracks and signs (TS) in the Luvhondo Nature Reserve, western Soutpansberg. Areas circled in blue indicate river sections with natural pools.

Habitat Preference

We collected a total of 32 Cape clawless otter TS of which most were found at pools (63%) and on rocky substrate (88%) (Supplementary Table 1, Fig. 4). Only one Cape clawless otter TS was found on silts and no TS were found in wetland areas (Fig. 4). In comparison, we found the majority of the 24 collected water mongoose TS on the substrate type leaf litter (83%) and in wetlands (71%) with only one TS found on rocks (Fig. 4). While the two species did not seem to have a preference for a certain water depth (Table 1), we found more TS of the Cape clawless otter at wider areas of the river of 2 to >5 m (91%) while we found more TS of water mongooses at locations with a narrow waterbody of up to 2 m (88%) (Fig. 5).

Table 1. Number of Cape clawless otter (*Aonyx capensis*) and water mongoose (*Atilax paludinosus*) records (tracks and signs) at different waterbody depths along the Kutetsha river system, South Africa.

Waterbody Depth	Otter	Water Mongoose
< 0.5 m	14	10
0.5 - 1 m	4	4
1 - 2 m	0	8
2 - 5 m	14	2
TOTAL	**32**	**24**

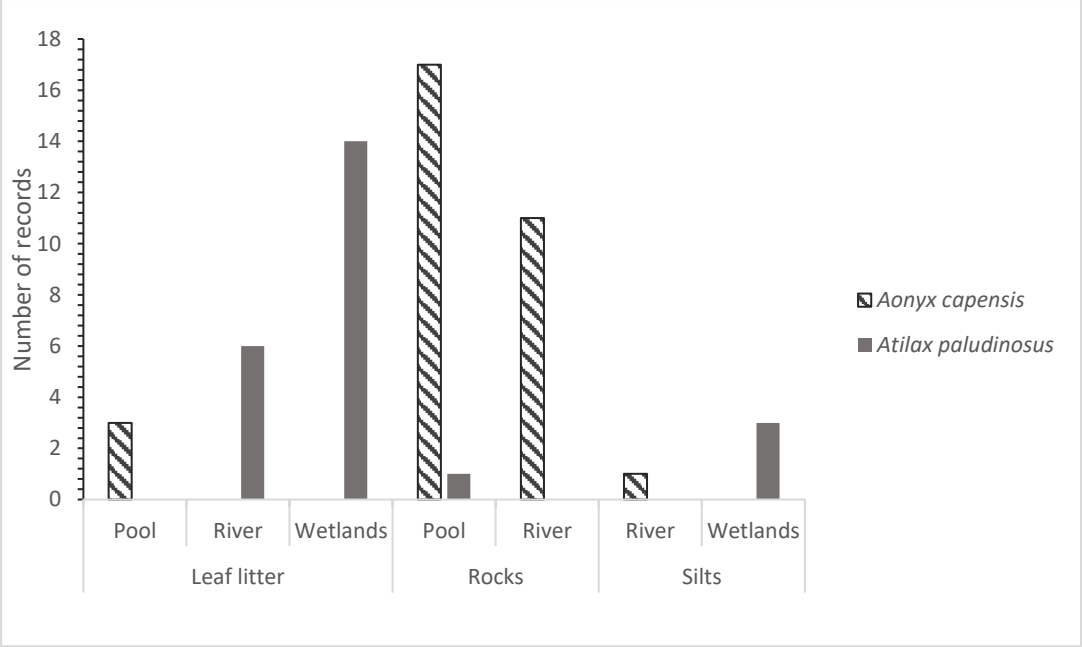

Figure 4. Number of Cape clawless otter (*Aonyx capensis*) and water mongoose (*Atilax paludinosus*) records (tracks and signs) in different locations and on different substrate types along the Kutetsha river system.

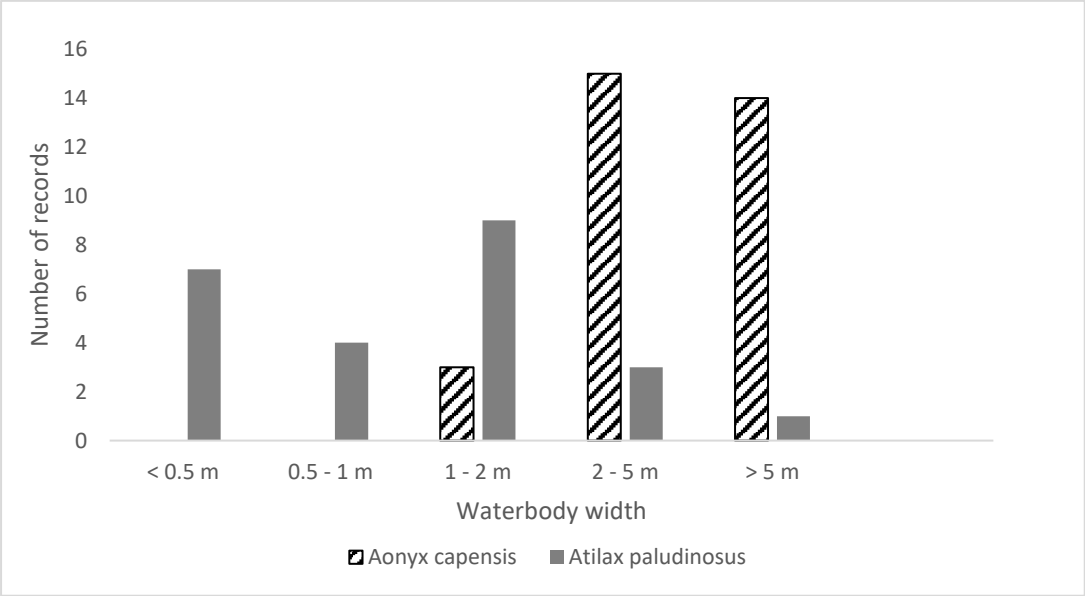

Figure 5. Number of Cape clawless otter (*Aonyx capensis*) and water mongoose (*Atilax paludinosus*) records (tracks and signs) at different widths of the waterbodies along the Kutetsha river system.

Spraint Content

We collected one fresh water mongoose spraint and four fresh Cape clawless otter spraints. The spraint of the water mongoose was collected near a waterfall. The content of the latter consisted exclusively of crustaceans, including abdomina, legs and several halves of pincers. All spraints of Cape clawless otters were collected near a waterfall and a pool. All otter spraints collected also exclusively consisted of crustaceans, with the carapace, abdomina, legs, whole and halve pincers found.

Camera Trap Survey

Cameras were deployed in five different localities and recorded 3622 pictures including 16 images of otters and two of water mongooses (Fig. 6). Camera trap localities included two areas with natural pools (below a waterfall), one shallow-river area surrounded by gallery forest and marshy wetland, one rocky shallow-river area lined by shrubs and low canopy trees, and one area with gallery forest and natural pools. In one of the five survey localities (area with natural pools, situated below a waterfall) camera traps captured images of both Cape clawless otters and water mongooses. Images of the Cape clawless otter were taken throughout the day with most images (n=9) taken at night-time, between 18:00 and 00:00. The two images of the water mongoose were also taken between 18:00 and 00:00.

Figure 6. Camera trap images of a Cape clawless otter *(Aonyx capensis)* (left) and water mongoose *(Atilax paludinosus)* (right) along the Kutetsha river system.

DISCUSSION

Distribution

We found that both Cape clawless otters and water mongooses occurred along the Kutetsha river system sections surveyed in our study. Results from the TS suggest that both species mostly occur spatially separate from each other. However, camera trapping revealed that both species can occur in the same locality (area with pools and a waterfall) despite no water mongoose TS found in the area during our surveys. Rowe-Rowe (1991) stated that the Cape clawless otter and water mongoose coexist in several areas in Africa and Skinner and Smithers (1990) stated that the two species use similar habitats. A longer-term survey using camera traps in our study area would be necessary to reach more conclusive results. The presence of the spotted-necked otter could not be confirmed in this study.

Habitat Preference

Cape Clawless Otter

Differences were clearly observed for all habitat variables investigated, except for water depth. TS of Cape clawless otters were more frequently recorded in areas with a rocky substrate and areas where the river was wide (e.g. pools). It was expected that the Cape clawless otter would occur in areas with shallow pools and rocky banks (Perrin and Curagati, 2000). An explanation for TS of Cape clawless otters found more frequently in localities with pools may be that these pools provide a permanent supply of prey throughout the year (Perrin and Carugati, 2000). Signs of Cape clawless otter presence were more often recorded near shallow water, which could be explained by

the foraging behaviour of the Cape clawless otter (Curagati, 1995; Perrin and Curagati, 2000), catching freshwater crabs and frogs in shallow waters (Rowe-Rowe, 1977). Perrin and Curagati (2000) also observed that Cape clawless otter signs were associated with shallow water and pools less than 0.6 m deep. Previous studies found that Cape clawless otters occur in areas with rocky riverbanks where rocks are covered with vegetation, likely as the probability of a high local food biomass is greater (Perrin and Curagati, 2000; Nel and Somers, 2007). Comparable results have been observed in numerous other habitats and studies (Van der Zee 1982; Verwoerd, 1987, Rowe-Rowe, 1992; Butler and Du Toit, 1994). The reason for Cape clawless otter TS found at greater river width in our study might be that most (63%; Table 1) TS were found near pools. According to Stuart (1981) Cape clawless otters are found at a variety of water bodies, such as major river systems but also at small reservoirs and non-perennial streams, which suggest that this species tolerates various waterbody widths. However, this has so far not been studied extensively.

We found several signs of Cape clawless otters on the road, a distance (317 m) away from the river. Cape clawless otters have been found to travel between different water bodies, using existing trails such as roads or game trails (Rowe-Rowe, 1978, 1985) and individuals may travel >30km long distances through sandy, waterless habitat and cross saddles between mountain watersheds (Nel and Somers, 2007).

Water Mongoose

The TS of water mongooses were observed more frequently in wetland areas on leaf litter or silt substrate and in narrow areas of the river system. Although we did not find any differences for the various water depth categories, TS of water mongooses were more frequently recorded (88%) in areas with a water depth of up to 2 m, suggesting a preference for shallow waters. Wetland riverbanks in our study area consisted only of silts and leaf litter. Kundu et al. (2008) categorised the water mongoose as a species which is endemic to wetland areas with leafy banks and shallow waters. The observed TS near shallow water (<0.5 m) could be explained by the water mongoose's foraging behaviour as they mainly forage in the littoral zones of water bodies (Baker, 1989) generally only submersing their head in the water (Rowe-Rowe, 1977).

Spraint Content

Spraint content analysed for both species consisted exclusively of crustaceans. For Cape clawless otters, this would be expected as they are physically adapted to primarily feed on crustaceans (Rowe-Rowe and Somers, 1998). Previous studies showed that apart from their predominantly freshwater crab based diet, the spraints of Cape clawless otters may also contain frog and insect remains, depending on local prey availability (Turnbull-Kemp, 1960; Donnelly and Grobler, 1976; Rowe-Rowe, 1977; Kruuk and Goudswaard, 1990; Butler, 1994; Ligthart et al., 1994; Purves et al., 1994; Somers and Purves, 1996; Rowe-Rowe and Somers, 1998). Water mongooses are highly adaptable predators with spraints commonly containing aquatic prey items including insects, freshwater crabs and frogs, and terrestrial prey items such as mammals (Somers and Purves, 1996; Rowe-Rowe and Somers, 1998).

Generally, spraints analysed in highland elevations show a high percentage of crabs compared to fish as freshwater crabs are more abundant, and as freshwater prey diversity is overall lower in such localities (Rowe-Rowe, 1977). Fish diversity of the Kutetsha sections surveyed in our study is, with two recorded species (African longfin eel (*Anguilla mossambica*) and stargazer mountain catfish (*Amphilius uranoscopus*)),

comparatively low (Ian Gaigher, pers. comm.). Regarding frogs, five species have been recorded from the Kutetsha system in the study area (striped stream frog (*Strongylopus fasciatus*), clicking stream frog (*S. grayii*), Delalande's river frog (*Amietia delalandii*), painted reed frog (*Hyperolius marmoratus*), African clawed frog (*Xenopus laevis*)) (Jabu Linden, pers. comm.). In addition to elevation, the percentage of other food items included in the diet may also vary depending on differing availability along the river system and over seasons (Rowe-Rowe and Somers, 1998). Lastly, given the very small sample size of spraints analysed in our study, dietary diversity, particularly of water mongooses, may increase with study period and sample size.

Camera Trap Survey

During our survey we found one locality in which camera traps captured both Cape clawless otters and water mongooses. Based on these images it is confirmed that both species may share or overlap in certain areas along the Kutetsha river system. We found that both species were most active in the evening. This was in line with previous studies showing that Cape clawless otters are described to be predominantly active during early morning, late afternoon and early evening in freshwater habitats (Rowe-Rowe, 1978; Maddock and Perrin, 1993). Water mongooses are described to be active in the late afternoon, night and early morning (Maddock and Perrin, 1993).

CONCLUSION

Our study shows that Cape clawless otters and water mongooses have slightly different habitat preferences along river systems in the western Soutpansberg and that there is dietary overlap. Direct food competition between the two species may be avoided since there is possibly enough difference between their diet and/or as food availability is sufficient enough to sustain both species. We recommend that future studies include additional, more detailed habitat variables such as the type of riverbank (rocks, rocks with vegetation, reeds or grass), percentage of vegetation cover on rocks, type of vegetation cover (low grass, high grass or bush) surrounding the water body, and the substrate of the riverbed. Furthermore, we recommend that further research be conducted on both species not only in the western Soutpansberg but across the mountain range to aid our understanding particularly of the population status of the Near Threatened Cape clawless otter. The Soutpansberg has been identified as an important biological refugium (Hahn, 2011) and could play a key role in protecting Cape clawless otter populations in far northern South Africa.

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RESUME

RÉPARTITION ET PRÉFÉRENCE D'HABITAT DES LOUTRES A JOUES BLANCHES DU CAP *(Aonyx capensis*) ET DES MANGOUSTES DES MARAIS *(Atilax paludinosus*) DANS LE SOUTPANSBERG, EN AFRIQUE DU SUD

Plus de 84% des écosystèmes fluviaux d'Afrique du Sud sont menacés et, par conséquent, les espèces d'eau douce telles que la loutre à joues blanches du Cap (*Aonyx capensis*) et la mangouste des marais (*Atilax paludinosus*) sont également en déclin. Ces espèces partagent un régime alimentaire et une préférence d'habitat similaires et, dans certaines régions d'Afrique du Sud, elles se coexistent en sympatrie. Notre étude s'est concentrée sur un système fluvial vierge dans l'extrême ouest du Soutpansberg où l'on sait peu de choses sur la distribution locale et les préférences d'habitat de ces espèces. Pour déterminer la distribution et les préférences d'habitat à petite échelle des loutres et des mangoustes des marais, des Traces et des Signes de présence (TS) et des pièges photographiques ont été utilisés. Le contenu des épreintes a été analysé pour établir les différences de régime alimentaire. Sur la base des TS qui ont été trouvés, la loutre à joues blanches du Cap et la mangouste des marais sont toutes deux largement distribuées le long du système fluvial et vivent principalement séparées l'une de l'autre. La quantité observée de TS de loutres à joues blanches du Cap était plus élevée dans les zones avec des mares, des berges rocheuses et des zones avec une largeur de cours d'eau de 2 m à plus 5 m alors que Le nombre de TS de mangoustes des marais enregistré était plus élevé dans les zones humides avec des berges feuillues et des zones avec une largeur de cours d'eau allant jusqu'à 2 m. Nous suggérons donc que les loutres à joues blanches du Cap et les mangoustes des marais pourraient éviter une concurrence directe en se répartissant l'habitat dans l'ouest du Soutpansberg.

RESUMEN

DISTRIBUCIÓN Y PREFERENCIAS DE HÁBITAT DE LAS NUTRIAS SIN UÑAS DEL CABO (Aonyx capensis) Y LAS MANGOSTAS ACUÁTICAS (Atilax paludinosus) EN EL SOUTPANSBERG, SUDÁFRICA

Más del 84% de los ecosistemas fluviales de Sudáfrica están amenazados y, concordantemente, las especies dependientes del agua dulce como la Nutria sin uñas del Cabo (Aonyx capensis) y la mangosta acuática (Atilax paludinosus) también están declinando en abundancia. Estas especies comparten una dieta y preferencias de hábitat similares, y en algunos lugares de Sudáfrica se sabe que ocurren en simpatría. Nuestro estudio se enfocó en un sistema fluvial pristino en el Soutpansberg más occidental, donde se sabe poco acerca de la distribución local y preferencias de hábitat de éstas especies. Para determinar la distribución y preferencias de hábitat a escala fina de las nutrias y las mangostas acuáticas, se usaron huellas y signos y cámaras-trampa, y se analizó el contenido de fecas para establecer diferencias en la dieta. En base a las huellas y signos que encontramos, la nutria sin uñas del Cabo y la mangosta acuática están ampliamente distribuidas a lo largo del sistema fluvial, y ocurren más que nada separadamente una de otra. La cantidad observada de huellas y signos de las nutrias sin uñas del Cabo fue mayor en áreas con piletones, barrancas fluviales rocosas y áreas con un ancho del curso de agua entre 2 y 5 m de diámetro. La cantidad de huellas y signos de mangosta acuática registrados fue mayor en áreas de humedales con barrancas fluviales con vegetación y hojarasca y áreas con un ancho del curso de agua de hasta 2 m. Sugerimos que las nutrias sin uñas del Cabo y las mangostas acuáticas pueden evitar la competencia directa mediante la partición del hábitat en el Soutpansbereg occidental.

SHORT NOTE

NOTES ON FEEDING BEHAVIOUR OF ASIAN SMALL-CLAWED OTTERS IN NAMDAPHA TIGER RESERVE, ARUNACHAL PRADESH, INDIA

Yumlam Benjamin BIDA[1*]

[1]*Ashoka Trust for Research in Ecology and the Environment, Regional Office Eastern Himalaya-Northeast India, NH 10, Tadong-737102, East Sikkim, India*
e-mail: benjamin.bida@atree.org

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Abstract: Very little is known about the feeding habits and ecology of the Asian Small-clawed Otter (*Aonyx cinereus*) in their natural habitats, especially from the northeastern part of India, where intensive studies on Asian Small-clawed Otters, and otters as a group, are yet to be carried out. Herein we report two independent observations of Asian Small-clawed Otters preying on fishes in the rivers of Namdapha Tiger Reserve in Arunachal Pradesh, India.
Citation: Bida, Y.B. (2023). Notes on Feeding Behaviour of Asian Small-Clawed Otters in Namdapha Tiger Reserve, Arunachal Pradesh, India. *IUCN Otter Spec. Group Bull.* **40** (1): 39 - 41
Keywords: feeding behavior, Co-operative hunting

OBSERVATION

On 06 March 2020 at 0610hr, while conducting field surveys to monitor White-bellied Herons along river Noa-dehing, near Deban forest camp of Namdapha Tiger Reserve (27° 29' 45" N, 96° 23' 49" E; WGS 84; 321 m elev.), we observed a group of four Asian Small-clawed Otters, two adults and two juveniles, preying on fishes. At the time of observation, the raft of otters was seen attempting to catch prey in the shallow waters of the fast-flowing Noa-dehing river, ca. 300m upstream from the point of observation. After 4 mins the raft moved downstream continuing their pursuit of fishing. The adults kept diving into the water, and would remain submerged for ca. 5 secs each time. At 06h15, after five dives in ca. 3 mins, one adult otter was seen emerging out with a fish in its mouth. The fish was later identified as *Gara* sp. After the catch, it immediately moved on top of a boulder and started consuming the fish, without the use of its claws. It was quick to chew on the fish before any of the other individuals could reach it, and showed no intention of sharing its catch. The head of the fish was consumed first, and later the entire body was chewed as fast as it could. The otter completely consumed the fish in ca. 10 secs (Video at https://doi.org/10.6084/m9.figshare.20066603.v1). During this time other individuals in the raft were observed to be still fishing in vicinity. After ca. 3 minutes in that spot, the raft of otters moved downstream into deeper waters, still continuing to dive in search of fishes. At 06h25 all four individuals of Asian Small-clawed Otter came out of the river towards the other side for c. 1 min, and then moved back in to swim upstream still trying to catch a prey. After ca. 5mins of unsuccessful hunt they came back out to the river bank and later moved into the adjacent forest.

On another occasion, at 15h00, on 31 March 2021, while returning back to our base camp, we observed two Asian Small-clawed Otters swimming in the deep waters

of Namdapha river, Namdapha Tiger Reserve, Arunachal Pradesh, India (26° 59' 8" E, 96° 59' 46" N; WGS 84; 533 m elev.) ca. 300m away from the point of observation. The two individuals were observed diving into the river simultaneously for ca. 14 minutes in the fast-flowing stretch of the river where numerous boulders are present. During this period, we observed the otters making 20-25 dives that resulted in no catch. Finally, at 15h15, one of the otters emerged out on a boulder, holding a larger, anterior portion of a fish in its claws. Subsequently, we observed the other otter also with a catch which may have been the smaller portion of the same fish, as it had the posterior half of the fish. The fish was later identified as *Tor* sp. The uneven sloping surface of the boulder hindered us from getting a clearer view of the second individual consuming its portion of the fish. The first individual with the larger portion of the catch was observed to consume the fish from head first and then towards the pelvic fin. After ca. 25s emerging out from the water the second otter had completely finished consuming its share and was observed to approach the first otter, which could still be seen chewing on its share. As the second otter approached the first, it tried to steal the share of the first otter with an act of aggression showing its canines, to which the first responded by turning away still chewing on its share (Video at https://doi.org/10.6084/m9.figshare.20088614.v1). The first otter finished consuming its share in ca. 2 mins, following which the second otter approached it once again and consumed the left-over bones and gut of the fish (Fig. 1). Once the otters were done consuming the fish completely, they rest on the same boulder for ca. 5 mins, after which they dive back into the river at 15h40. After four dives near in the same location, they swam upstream, probably in search of more food. As the otters swam more than 500m away from us, we were unable to observe or photograph them further.

Figure 1. Asian Small-clawed Otters feeding on *Tor* sp. in Namdapha River.

To our knowledge, this is the first report with photographic evidence of Asian Small-clawed Otters feeding on *Gara* sp. and *Tor* sp. from their natural habitat. For Asian Small-clawed Otters, even though they are social animals, there is no evidence of cooperative hunting among individuals of this species (Harris, 1968; Kruuk et al., 1993). However, the observations presented in the current report suggests that they do hunt in groups but show little to no intention of sharing their catch with one another.

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RESUME

NOTES SUR LE COMPORTEMENT ALIMENTAIRE DES LOUTRES CENDRÉES D'ASIE DANS LA RÉSERVE DU TIGRE DE NAMDAPHA, DANS L'ARUNACHAL PRADESH, EN INDE

On sait très peu de choses sur les habitudes alimentaires et l'écologie de la loutre cendrée d'Asie (Aonyx cinereus) dans ses habitats naturels, en particulier dans la partie nord-est de l'Inde, où des études poussées sur les loutres cendrées d'Asie et les loutres en tant que groupe, sont en court de réalisation. Nous rapportons ici deux observations indépendantes de loutres cendrées d'Asie se nourrissant de poissons dans les rivières de la réserve du Tigre de Namdapha dans l'Arunachal Pradesh, en Inde.

RESUMEN

NOTAS SOBRE EL COMPORTAMIENTO ALIMENTICIO DE LA NUTRIA DE UÑAS PEQUEÑAS ASIÁTICA EN LA RESERVA DE TIGRES MANDAPHA, ARUNACHAL PRADESH, INDIA

Se sabe muy poco acerca de los hábitos alimenticios y la ecología de la Nutria de Uñas Pequeñas Asiática (*Aonyx capensis*) en sus hábitats naturales, especialmente en la parte nor-oriental de la India, donde aún están pendientes de realizarse estudios intensivos sobre las Nutrias de Uñas Pequeñas Asiáticas y sobre las nutrias como grupo. Aquí informamos dos observaciones independientes de Nutrias de Uñas Pequeñas Asiáticas predando sobre peces en los ríos de la Reserva de Tigres Mandapha, en Arunachal Pradesh, India.

A R T I C L E

RESULTS OF FOURTH OTTER SURVEY IN SPAIN: 2014-2018

Santiago PALAZÓN MIÑANO

Otter Group SECEM, European Mink Association, Fauna and Flora Service, Government of Catalonia, Charlie Rivel 35, 08880 Cubelles, Spain.
e-mail: santiago.palazon@gmail.com

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Abstract: In the fourth national otter survey in Spain, 8,024 sampling points were carried out covering the entire Spanish mainland. Sampling unit used was the UTM grid (10x10 km). A total of 4,019 cells were prospected, representing 77.3% of the mainland Spain grids. Inside every grid, we made transects of 600 m distance (n=4,822; 60.1%) and spot-check (n=3,202; 39.9%). An overall value of 5,199 locations sampled with a positive presence of otter was obtained, representing 64.8%. Regarding UTM grids, 2,920 were otter positive, where at least one sampling point was found with valid otter traces or signals, representing 76.4% of the cells sampled. Percentage of the territory of mainland Spain with otter was 59.9%. Overall, the results were more positive in the Spain western half than in the eastern one, and more positive in the Spain northern half than in the southern one. By regions, the maximum percentage of positive sampling points and grids was reached in Galicia (north-western Spain), with 95.4% and 96.8% respectively. On the contrary, the minimum values of positive sampling points and grids were obtained in Valencia (eastern Spain), with 15.0% and 20.7% respectively. In relation to the third survey (2004-2006), otter has continued its spread, more slowly than a decade before, and mainly on Mediterranean basins. The numbers and percentages indicate a similar otter distribution in the 2000s and 2010s decades. In several territories, some cells with otter presence in the third survey were not sampled in the current survey; This fact has reduced the percentages obtained for the presence of otters in Spain.
Citation: Palazón Miñano, S. (2023). Results of the Fourth Eurasian Otter (*Lutra lutra*) Survey in Spain: 2014-2018. *IUCN Otter Spec. Group Bull.* **40** (1): 42 - 61
Keywords: otter, distribution, survey, Spain, recovery

INTRODUCTION

Eurasian otter (*Lutra lutra* Linnaeus, 1758) is the species with the widest distribution in the world, and the only one in the subfamily *Lutrinae* present in Europe. Besides Europe, it inhabits northern Africa, Near East and Asia, including East Russia, Korea, Japan, central Asia, China, Taiwan, southern India, Sri Lanka, Malaysia and Sumatra (Wilson and Mittermeier, 2009; Hung and Law, 2016; Duplaix and Savage, 2018). In Spain, as in the rest of Europe, the subspecies is *L. l. lutra* (Hung and Law, 2016).

It is an animal perfectly adapted to aquatic life. Its habitat is aquatic ecosystems, from seashore to high mountains. In the Iberian Atlantic Ocean (Galicia, Asturias, south

and south-west of Portugal and south-west of Andalusia) otters also use the sea, in the waters of the estuaries, river mouths and also on the most exposed coast, but they prefer areas with fresh water available, with less exposure to waves and with the presence of a wide area of shallow waters and springs (Clavero et al., 2006; Romero, 2006, 2008, 2018); they are less frequent in Mediterranean marine environments (Ruiz-Olmo, 2014; Saavedra, 2002). The most common natural habitats are rivers, streams, lakes, lagoons, marshes and any place with a permanent presence of water. They can also be found in reservoirs, canals, ditches, cisterns, golf course lakes and in other artificial environments (Ruiz-Olmo and Delibes, 1998; Ruiz-Olmo et al., 2005; Pedroso et al., 2007; Duarte et al., 2011; Pedroso, 2012).

The factors that determine habitat use and selection are the potential availability of food (persistence of water, especially important in Mediterranean environments) and shelter (Prenda et al., 2001; Ruiz-Olmo et al., 2005, 2011; Kruuk, 2006). Otters combine the use of reservoirs, where they can access abundant food, with the use of rivers and streams, where they find shelter (Pedroso et al., 2007).

The otter can live in mountain areas, with maximum height reported in the Pyrenees at around 2,400 m altitude, but its presence is scarce from 1,500 m above sea level; it does not usually reproduce above 800-1,000 m (Ruiz-Olmo, 2007). The presence of the otter at altitude requires the availability of sufficient food, the absence of snow and ice that prevent access to water and prey, and the absence of large barriers such as waterfalls and artificial dams in canyons (Ruiz-Olmo et al., 2005).

In Spain, the otter is included in Annex II (Animal and plant species of community interest for whose conservation it is necessary to designate special conservation areas) of Law 42/2007, of December 13, on Natural Heritage and Biodiversity, which is the transposition to Spain of the Habitats Directive (92/43/EEC of the Council), relating to the conservation of natural habitats and fauna and flora. According to Royal Decree 139/2011, of February 4, for the development of the List of Wild Species under Special Protection Regime and the Spanish Catalogue of Endangered Species, the otter is not included in the Spanish Catalogue of Endangered Species, but it is in the List of Wild Species under Special Protection Regime.

The European otter is included in Appendix I of the CITES treaty and according to the IUCN Red List (2015) it is classified as "Near Threatened NT" (Roos et al., 2015). Due to the recovery of the Iberian population in recent years, the IUCN Category of the otter in Spain has become "Least Concern LC" (Blanco, 2007).

Three previous national otter surveys were carried out in Spain (1980s, 1990s and 2000s decades) (Delibes, 1990; Ruiz-Olmo and Delibes, 1998; López-Martín and Jiménez, 2008).

ANIMALS, MATERIAL AND METHODS

From 2014-2018 we carried out the fourth national otter survey in Spain. We surveyed almost all provinces of peninsular Spain (n=46) on 15 Autonomous Communities and Andorra (Fig. 1); one province was not surveyed, because otter were not found in the three previous Spanish otter surveys (López-Martín and Jiménez, 2008). All Spanish hydrographic basins (Atlantic, Cantabrian and Mediterranean watersheds) were surveyed (Fig. 2). We used, according the recommendation by "*Information System for Otter Survey*", the square Universal Transverse Mercator UTM (10x10 km) as sampling unity (Reuther et al., 2002). We surveyed 8,024 sampling points on 3.738 cells (Fig. 3), on a total number of 5,319 UTM cells in Spain (70.3% of cells). We surveyed an average of 2.15 points per cell.

Figure 1. Map of Spain, showing the different Regions (Autonomous Communities).

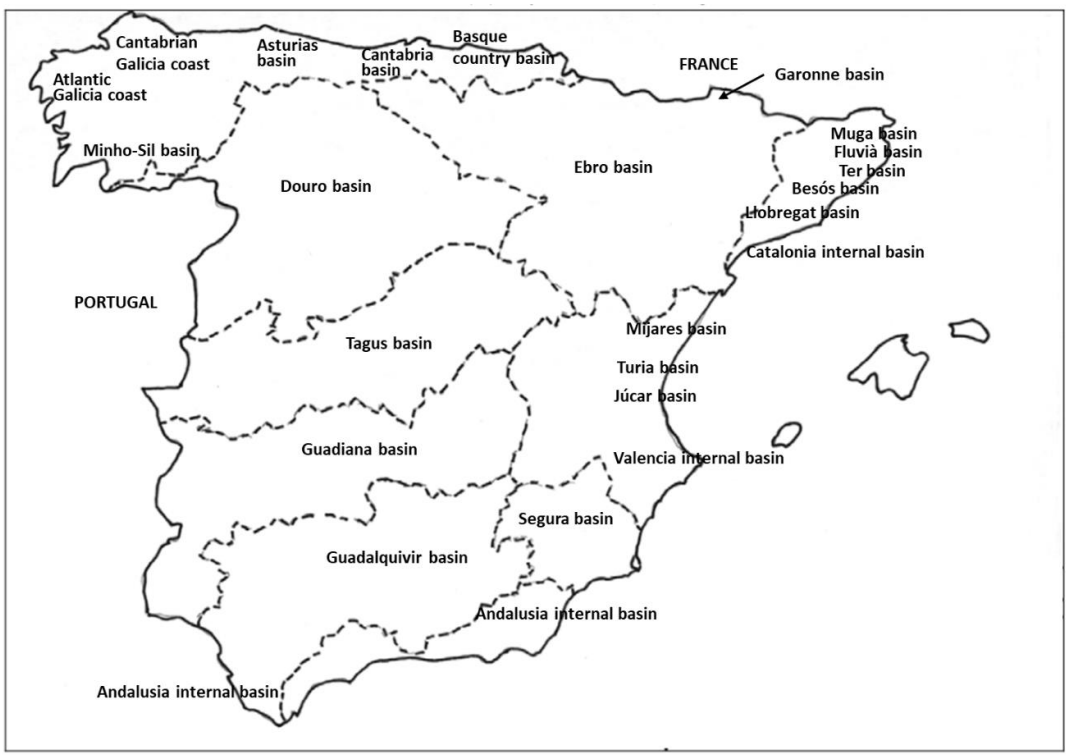

Figure 2. Map of Spain, showing the main hydrographic basins (Cantabrian, Atlantic and Mediterranean watersheds).

The total number of points surveyed was greater than in former surveys (3,966 in 1984-85, 4,049 in 1994-96 and 5,293 in 2004-06) (López-Martín and Jiménez, 2008). The total number of cells UTM (10x10 km) surveyed was higher than in first and second otter surveys (3,061 in 1984-85 and 2,934 in 1994-96) but a little less than in the third

one (4,206 in 2004-06), although in that last survey some squares were counted twice or more times in different territories (López-Martín and Jiménez, 2008).

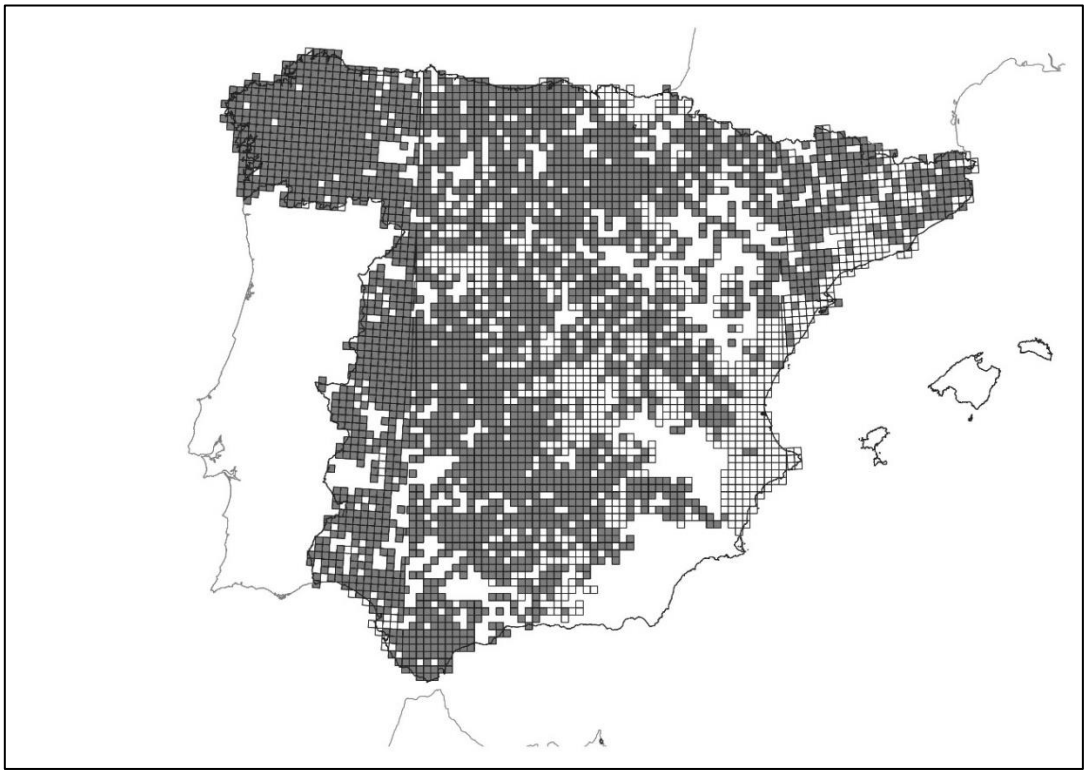

Figure 3. Location of 10x10 km cells surveyed in fourth otter survey (2014-2018) in Spain: otter presence (in black) and no presence (in white).

We carried out two different field surveys. First, and more important, the 600 m itinerary (n=4,822, 60.1%) and second, the spot-check (n=3,202, 39.9%), where a high probability exists to find otter tracks (under bridges, conjunction two rivers, large extensions of mud, etc.) (Chanin, 2003), to complement the first and main prospection. We used the Chi-Square test prove to compare the otter presence among different watersheds and altitudinal bands.

In the fourth Spanish otter survey took part 1,087 collaborators, who surveyed more than 2,280 km of rivers, streams, lakes, pounds, reservoir waters, beaches and coasts.

RESULTS

We found 5,199 points with positive presence of otter (64.8%) (Table 1) and 2,920 UTM (10x10 km) cells were positive (78.1% of surveyed cells) (Fig. 4, Table 2). Respect to total cells in mainland Spain (n=5,319), positive squares with otter presence were 54.9%, what was the percentage of peninsular Spanish territory with presence of otter (Table 2). That result was important to compare the otter occupancy of peninsular Spanish territory with three previous national otter surveys.

Results and Analysis by Territories

In short, results were more positive in the Western and Northern half than in the Eastern and Southern ones. By regions, maximum percentages of positive points and cells were reached in Galicia (north-west), with 94.1% and 96.8%, respectively (Tables

1, 2 and 3). At the opposite end, minimum percentages were reached in Valencian Community (central-east), with 15.0% and 23.2% respectively (Fig. 5).

Table 1. Results (sampling points) of fourth otter survey in Spain, by Regions.

Regions	Sampling Points			Nº 600 m itineraries	Nº spot check
	N	N Positive	% Positive		
Andalusia	877	687	78.34%	577	300
Aragon	479	373	77.87%	397	82
Asturias	223	141	63.68%	189	34
Cantabria	117	100	85.47%	79	38
Castile La Mancha Mancha	1,266	640	50.55%	759	507
Castile and León	1,714	1,234	72.0%	979	735
Catalonia and Andorra	775	373	48.13%	566	209
Extremadura	635	581	91.51%	201	434
Galicia	387	369	95.35%	309	78
Madrid	171	94	54.97%	124	47
Murcia	67	48	71.64%	62	5
Navarre	208	168	80.77%	98	110
Basque Country	398	183	46.98%	24	374
La Rioja	147	124	84.35%	56	91
Valencia	560	84	15.0%	402	158
SPAIN	**8,024**	**5,199**	**64.79%**	**4,822**	**3,202**

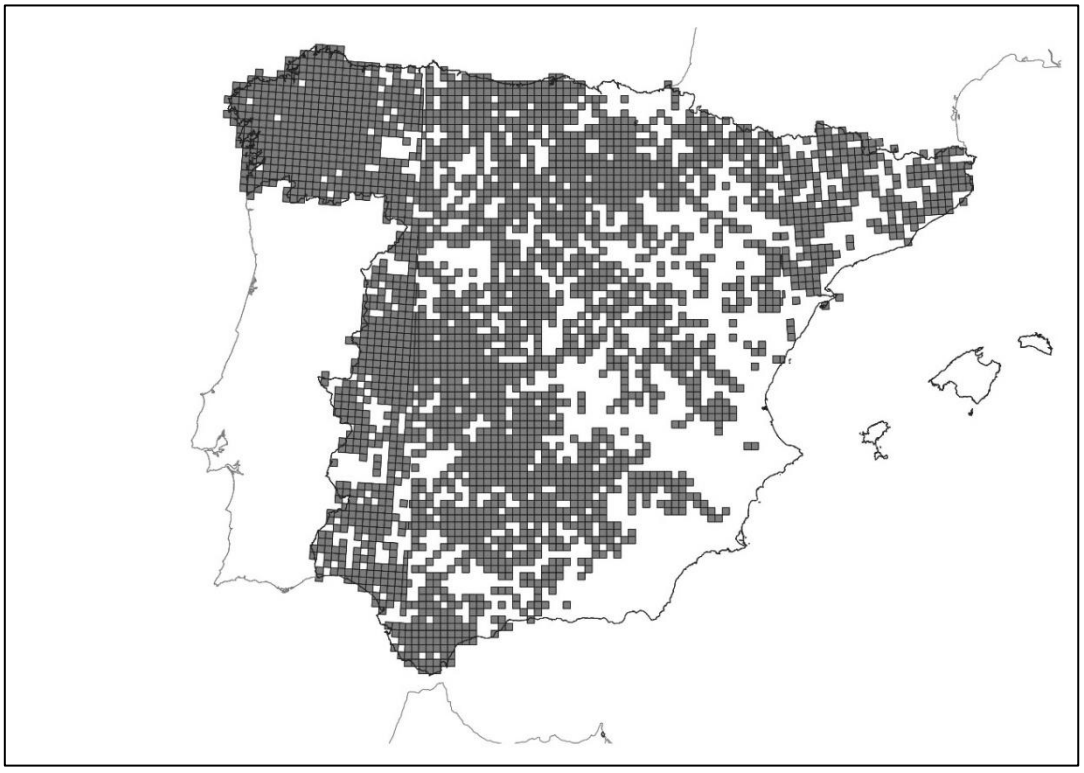

Figure 4. Distribution of otter in Spain: 10x10 km positive squares in fourth otter survey (2014-2018).

Otter presence was detected in all Spanish provinces (n=47), except in one, Almeria, set in the corner south-east of Iberian Peninsula, which not was surveyed (Table 3). The countryof Andorra was included inside the Catalonia region because is a continuation of the same hydrographic basin. The number of points and grids, and the sampling area were greater than in previous surveys. Provinces with the lowest otter presence were Alicante (1.5%), Gipuzkoa (13.3%), Murcia (15.5%) and Biscay (22.2%), counted as a percentage of sampling cells with positive presence relative to the total number of sampling cells (Murcia) and with respect to the sampled grids (Alicante, Biscay and Gipuzkoa) (Table 3).

Table 2. Results (UTM 10x10 km cells) of fourth otter survey in Spain, by Regions. N1: Cells with 100 km^2, N2: Cells with less than 100 km^2.

Regions	UTM (10x10 km) cells							% Otter Territory
	N1	N2	N Total	N Surveyed[1]	% Surveyed	N Positive	% Positive	
Andalusia	897	42	939	602	64.11%	508	84.39%	54.10%
Aragon	468	32	500	241	48.20%	206	85.48%	41.20%
Asturias	116	12	128	101	78.91%	86	85.15%	67.19%
Cantabria	66	0	66	63	95.45%	56	88.89%	84.85%
Castile La Mancha	835	0	835	709	84.91%	478	67.42%	57.25%
Castile and León	855	55	910	821	90.22%	660	81.09%	76.81%
Catalonia-Andorra	362	0	362	333	91.99%	209	62.76%	57.73%
Extremadura	418	50	468	319	68.16%	315	98.75%	67.31%
Galicia	343	0	343	332	97.79%	322	96.99%	93.88%
Madrid	97	0	97	72	74.23%	56	77.78%	57.73%
Murcia	123	0	123	24	19.51%	18	75.0%	14.63%
Navarre	111	0	111	83	74.77%	71	85.54%	63.96%
Basque country	89	0	89	75	84.27%	43	57.33%	48.31%
La Rioja	61	0	61	58	95.08%	55	94.83%	90.16%
Valencia	268	19	287	276	96.17%	57	20.65%	19.86%
SPAIN[2]	**5,109**	**210**	**5,319**	**4,109[2]**	**77.25%**	**3,140[2]**	**76.42%**	**59.03%**
SPAIN[3]	**5,109**	**210**	**5,319**	**3,738[3]**	**70.28%**	**2,920[3]**	**78.12%**	**54.90%**

[1]Cells shared by two or more provinces without counting more than once.
[2]Sum of all regions, counting more than once cells shared by two or more regions.
[3] Cells shared by two or more regions without counting more than once.

Table 3. Results (summary) of fourth otter survey in Spain (2014-2018) by Provinces and Regions.

Provinces and Totals for Region	Sampling Points			UTM (10x10 km) cells		
	N	Pos[1]	% Pos[1]	N	Pos[1]	% Pos[1]
Almería	0	0	0	0	0	0
Cádiz	125	94	75.20	96	77	80.21
Córdoba	222	152	68.47	141	118	83.69
Granada	88	55	62.50	60	39	65.0
Huelva	135	123	91.11	85	81	95.29
Jaén	144	101	70.14	141	100	70.92
Málaga	51	50	98.04	44	43	97.73
Seville	112	112	100.0	73	73	100.0
Andalusia	**877**	**687**	**78.06**	**602**	**508**	**84.39**
Huesca	226	196	86.73	110	105	95.45
Teruel	125	71	56.80	66	45	68.18
Zaragoza	128	105	82.68	78	67	85.90
Aragon	**479**	**373**	**77.87**	**241**	**206**	**85.48**
Asturias	**223**	**141**	**63.23**	**101**	**86**	**85.15**
Cantabria	**117**	**100**	**85.47**	**63**	**56**	**88.89**
Albacete	97	54	55.67	63	46	73.02
Ciudad Real	294	208	70.75	209	162	77.51
Cuenca	337	143	42.43	160	92	57.50
Guadalajara	161	99	61.49	111	78	70.27
Toledo	377	136	36.07	181	111	61.33
Castile La Mancha	**1.266**	**640**	**50.55**	**709**	**478**	**74.85**
Ávila	216	136	62.96	88	60	68.18
Burgos	219	163	74.43	113	105	92.92
León	237	231	97.47	128	128	100.0
Palencia	167	118	70.66	83	68	81.93
Salamanca	227	195	85.90	96	85	88.54
Segovia	121	67	55.37	74	50	67.57
Soria	130	72	55.38	71	53	74.65
Valladolid	144	77	53.47	70	45	64.29
Zamora	253	175	69.17	124	93	75.0
Castile and León	**1.714**	**1.234**	**72.0**	**821**	**660**	**80.39**
Barcelona	235	89	37.87	79	45	56.96
Girona	110	63	57.27	68	41	60.29
Lleida	175	123	70.29	111	85	76.58
Tarragona	213	62	29.11	85	36	42.35
Andorra	42	36	85.71	8	8	100.0
Catalonia and Andorra	**775**	**373**	**48.13**	**333**	**209**	**62.76**
Badajoz	236	227	96.19	130	122	93.85
Cáceres	399	354	88.72	192	192	100.00
Extremadura	**635**	**581**	**91.50**	**319**	**315**	**98.75**
A Coruña	115	111	96.52	99	93	93.94
Lugo	109	108	99.08	102	101	99.02
Orense	88	81	92.05	75	71	94.67
Pontevedra	75	69	92.00	60	60	100.0

Galicia	**387**	**364**	**95.35**	**332**	**322**	**96.99**
Madrid	**171**	**94**	**54.97**	**72**	**56**	**77.78**
Murcia	**67**	**48**	**71.64**	**24**	**18**	**75.0**
Navarre	**208**	**168**	**80.77**	**83**	**71**	**85.54**
Álava	192	166	86.46	37	35	94.59
Gipuzkoa	158	13	8.23	27	6	22.22
Bizkaia	48	4	8.33	15	2	13.33
Basque country	**398**	**183**	**45.98**	**75**	**43**	**57.33**
La Rioja	**147**	**124**	**84.35**	**58**	**55**	**94.83**
Alicante	123	1	0.81	66	1	1.52
Castellón	140	24	17.14	83	19	22.89
Valencia	297	59	19.87	127	37	29.13
Valencia	**560**	**84**	**15.0**	**276**	**57**	**20.65**
SPAIN	**8,024**	**5,197**	**64.73**	**4,109***	**3,140***	**76.42**

[1]Pos: positive points.
*With no count more than once the squares shared by two or more Regions (N=3,738; Pos=2,920; %pos=78.12).

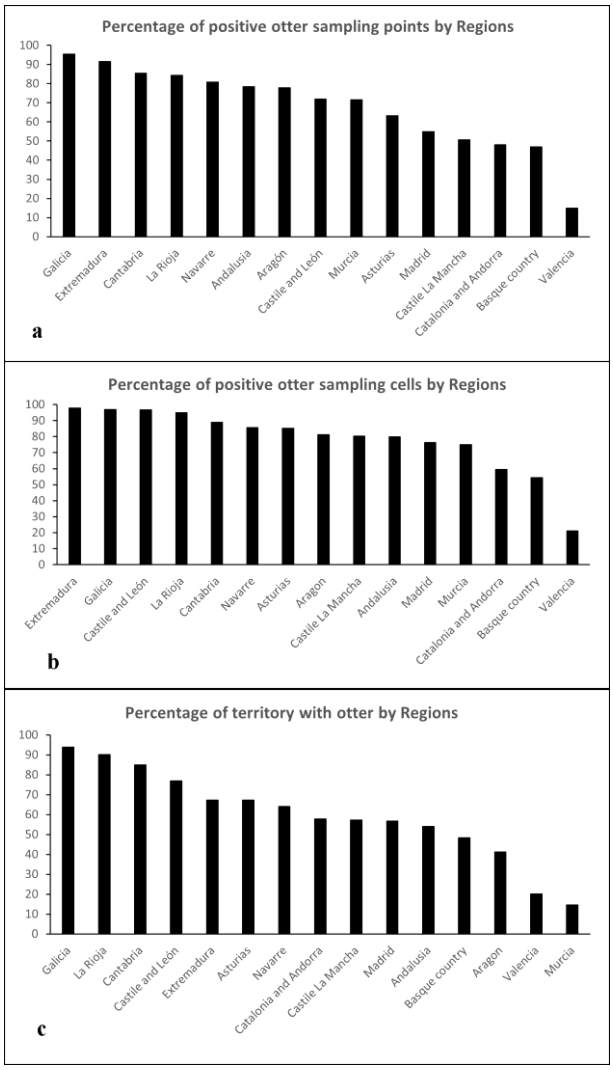

Figure 5. Comparison of three percentages (from higher to lower) of positive otter surveys (a), squares (b) and territory with otter (c), by different Regions in the fourth Spanish otter survey.

The second otter survey takes into account 7.7% (n=4,049) dry stream beds, ravines, streams and small rivers. That value increased significantly in the third survey, up to 11.0% (n=4,692) (χ^2=27,96; *P*<0.0001). In the present survey, we counted 253 points on dry stream beds (3.2%, n=8,028), with a significant decreasing from third survey (*P*<0,0001). We found otter presence in 32 dry streams visited (12.6%).

Results and Analysis by Hydrographic Basins

Otters were present in all hydrographic basins of peninsular Spain (Table 4). Otter distribution was significantly higher in the Atlantic and Cantabrian watersheds (69.7% of positive sampling points, n=5,169 surveyed), and lower in the Mediterranean watershed (55.9% of positive sampling points, n=2,855 surveyed) (*P*<0.0001) (Table 4).

Table 4. Results (summary of sampling points) of fourth otter survey in Spain by watershed and hydrographic basins (2014-2018).

Watershed	Basin	N	Positive	% Positive
Mediterranean	La Muga	12	8	66.67
	Fluvià	25	20	80.00
	Ter	53	32	60.38
	Besós	48	23	47.92
	Llobregat	142	49	34.51
	Catalonia internal basin	156	27	17.31
	Ebro	1,505	1,121	74.49
	Mijares	42	8	19.05
	Turia	104	30	28.85
	Júcar	377	128	33.95
	Valencia internal basin	181	5	2.76
	Segura	147	83	56.46
	Andalusia internal basin	63	61	96.83
	Total	**2,855**	**1,595**	**55.87**
Atlantic	Andalusia internal basin	163	133	81.60
	Guadalquivir	612	458	74.84
	Guadiana	708	532	75.14
	Tagus	1,185	722	60.93
	Douro	1,484	1,079	72.71
	Minho-Sil	191	182	95.29
	Galicia Coast	196	185	94.39
	Total	**4,539**	**3,291**	**72.30**
Cantabrian	Galicia Coast	42	39	92.86
	Asturias internal basin	229	148	64.63
	Cantabria internal basin	121	93	76.86
	Basque country internal basin	221	27	12.22
	Garonne	8	5	62.50
	Total	**621**	**312**	**50.24**
Atlantic-Cantabrian	**Total**	**5,160**	**3,603**	**69.65**

In the Mediterranean watershed, there were strong differences between basins (Fig. 6). From the border with Francein the north-east, to the Gibraltar strait, we describe the otter situation. In the rivers of Girona province, in the north-east corner, there was more than 60% otter presence (Muga: 66.7%, Fluvià: 80.0% and Ter: 60.4%), largely because it is the population resulting from a reintroduction carried out in the second half of the 1990s (Saavedra, 2002). The rest of the basins of Catalonia were below 50.0%, with 17.0% in the small rivers of Barcelona and Tarragona provinces, while the large rivers of Barcelona province (Besós and Llobregat) reached values of 47.9% and 34.5% respectively. The Ebro river basin reached 74.5% presence of otters. The rivers of the Valencian Community were below 30.0% positive samplings, except in Júcar (34.0%), with very low values in the internal basins of that region (2.8%). The Segura river basin presented a percentage of samplings with otters above 56.0%, indicating an excellent recovery, but a very scarce presence in the final stretch, from the city of Murcia. On the other hand, the internal Mediterranean basins of Andalusia (not counting Almería) presented a very high value, 96.8% of otter presence. Otters arepresent in almost all the Mediterranean rivers in the provinces of Granada, Malaga and Cádiz.

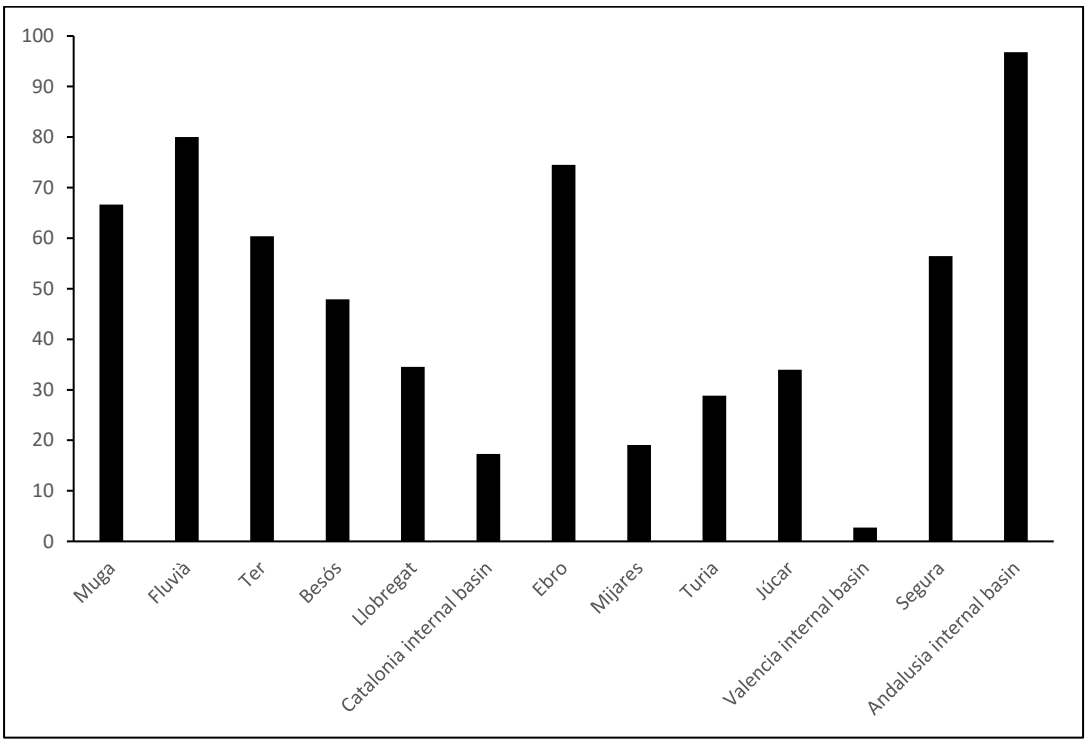

Figure 6. Percentage of positive otter surveys by hydrographical basins in Mediterranean watershed (from north-east to south-west).

The Atlantic basins, as expected, offered the highest values, with an average 72.5% of otter presence (Fig. 7). From Gibraltar strait to the border with France, northward and then eastward, we describe the otter situation. The Galician coastal basins and the river system of Minho-Sil stood out with 94.4% and 95.3%, respectively. The basin with the lowest percentage of positives was the Tagus River, with only 60.9%. The basins of the Guadalquivir, Guadiana and Douro rivers presented positive sampling percentages above 70.0%. These percentages would probably have been higher if the provinces of Seville (Guadalquivir), Badajoz (Guadiana), Valladolid and León (Douro) could have been be sampled more completely. As in the Mediterranean

basin, the internal Andalusian ones of the Atlantic also presented a significant otter presence, with 81.6% (provinces of Cádiz and Huelva).

In the Cantabrian basin, there is a decrease in the presence of otters from west to east, with maximum values of 92.9% in the Galician coastal rivers and minimum values of 12.2% in the Basque country rivers (Fig. 7), next to France. The internal basins of Asturias and Cantabria presented 64.6% and 74.9% of positive samplings, respectively. In addition, in Garonne basin, at its headwaters in the Aran Valley (Catalonia), with a 62.5% positive presence of otters found.

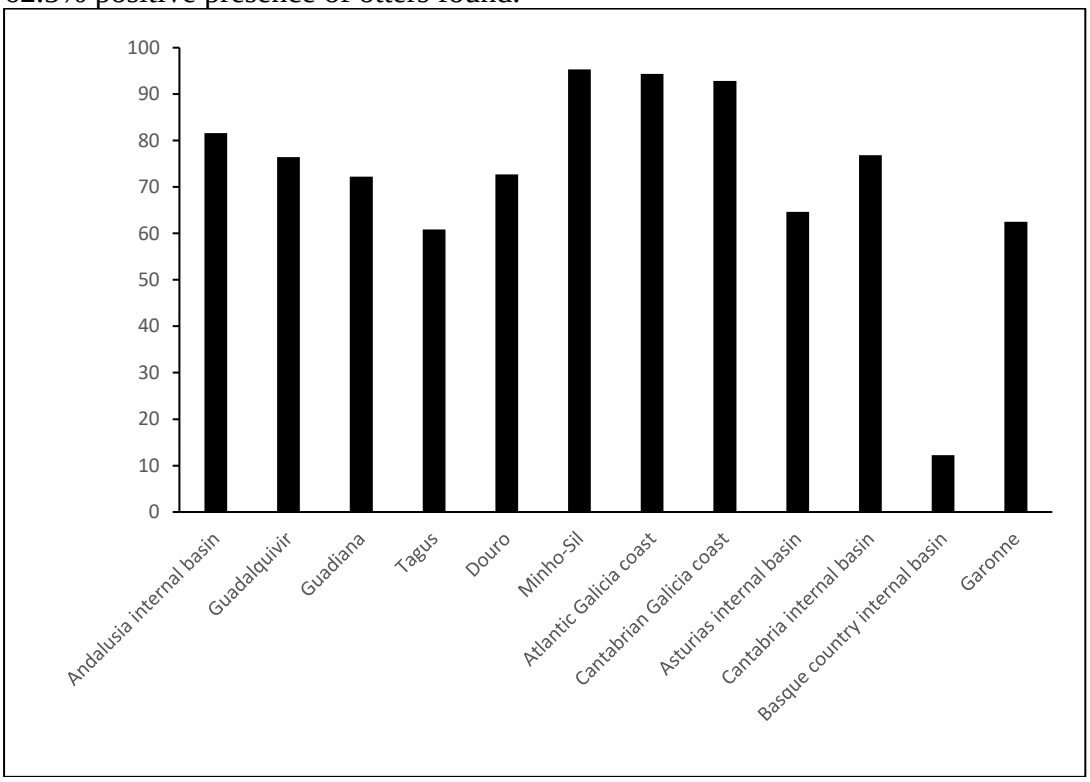

Figure 7. Percentage of positive otter surveys by hydrographic basins in Atlantic and Cantabrian watersheds (from south-west to north).

Results and Analysis by Waterbody Typology

In flowing waters (lotic ecosystems, as rivers, streams, channels, irrigation canals, ravines, etc.), the number of surveyed cells was 7,213, with 4,578 positive for otter (63.5%). There were important differences among Cantabrian (49.9%), Atlantic (71.2%) and Mediterranean (55.0%) watersheds (Fig. 8).

In static waters (lentic ecosystems, such as reservoir waters with fixed and variable level, lakes, pounds, pools, lagoons, marshes, etc.), the number of surveyed points was 645, with 508 positive ones in otter (78.7%). Comparing surveys of otter presence, there were also important differences among Cantabrian (n=7; 42.9%), Atlantic (79.7%) and Mediterranean (77.6%) watersheds.

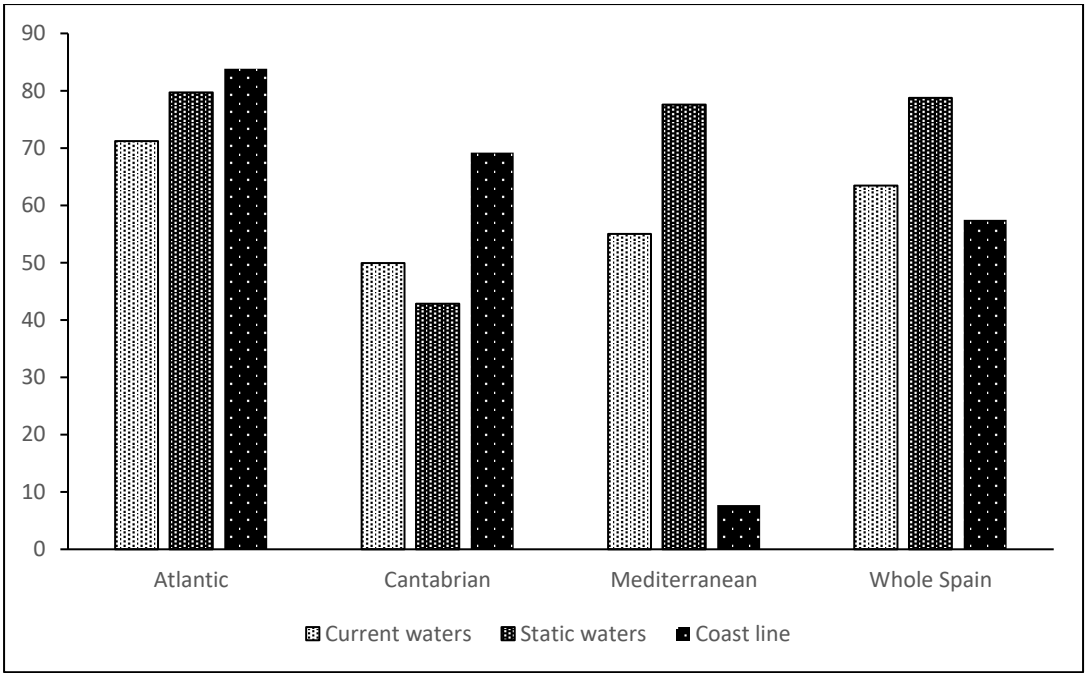

Figure 8. Percentage of positive otter surveys by typology of waterbodies (current, static and coasts) in the three watershed and the whole Spain.

Although otters are more frequent in continental aquatic environments, it occupies the coastline, even using the sea. A total of 120 points was surveyed in littoral areas and coasts, with 57.5% positive (n=69). The positive percentage was 81.5% (n=81 surveys) in Atlantic-Cantabrian watersheds and was 7.7% (n=39 surveys) in the Mediterranean one (P<0,0001).

Along the Mediterranean the otter is present in the marshes "Aiguamolls de l'Empordà" (Girona), in the final stretches of Besós and Llobregat rivers (Barcelona), in the Ebro delta, in the final stretches of Mijares (Castellón), Segura (Alicante) rivers and all rivers of Málaga and Cádiz provinces. On the Atlantic coast of Andalusia, otters are found in the marshes that form the Guadalete (Cádiz), Guadalquivir (Seville), Tinto, Odiel and Guadiana (Huelva) mouths.

On the Galician coast, otters were detected in 49 of 53 coastal samplings (92.5%). In Asturias, otter sign was found just once, in the Eo estuary. In Cantabria, otter sign was found in five points of the Pombo and Oyambre wetlands and the Agoños estuary. With only two coastal records in Basque country, otter sign was found in the Mundaka estuary and the mouth of Plentzia river.

Results and Analysis by Altitude

The highest altitude where otter sign was found, sover 2,000 meters above sea level, were in the Pyrenees (Lleida and Andorra) and the Cantabrian Mountains (Palencia). In Catalonia, otter presence was detected at 2,220 m, inside "Aigüestortes and Sant Maurici Lake National Park"; in Andorra at 2,070 m and in two Palencia lakes at 2,045 and 2,020 m.

The altitude distribution of otter presence is differs by watershed and altitudinal band. Most percentages of positive sign were between 200 and 400 m altitude (79.0%) and between 400 and 600 m (71.2%). The minimum value was more than 1.800 m (36.4%). The rest of altitudinal bands comprise values between 50 and 65% of positive points (Table 5, Fig. 9). When the altitudinal range of the otter is compared with the presence of otters (percentage of positive samplings) in the three watersheds (Atlantic,

Cantabrian and Mediterranean) there were some remarkable differences. In the first three altitudinal bands (from 0 to 599 m) the differences between the three watersheds were significant (P<0.0001 and P=0.0168), with a higher percentage of positive samplings on the Atlantic one (Table 5, Fig. 10). Percentages of sampling points with otters on the Mediterranean watershed are lower in the 0-199 m range and increase considerably between 200 and 599 m. Between 600 and 799 m there were no altitudinal differences between the three watersheds, although the highest percentages of otter presence occurred in the Cantabrian one. Between 800 and 1,199 m, there were statistical differences again (P=0.0082 and P<0.001); Cantabrian watershed presented the highest percentages of positive samplings and the Mediterranean the lowest ones. Between 1,200 and 1,399 m, the maximums occurred on the Atlantic watershed, but without being a significant difference. Differences were not found between 1,400 and 1,599 m, but highest percentages of otter presence were found on the Mediterranean watershed. Above 1,600 m of altitude there were not enough samples to compare the three watersheds.

Table 5. Comparison of percentage of positive surveys along altitude range (200 meters) among three watersheds (Atlantic, Cantabrian and Mediterranean) and whole Spain.

Altitude range (m)	Watershed			Whole Spain	P (χ^2, 2 d.f.)
	Atlantic	Cantabrian	Mediterranean		
0-199	86.33%	45.64%	39.38%	57.15%	< 0.0001*
200-399	89.19%	54.05%	69.76%	79.0%	< 0.0001*
400-599	76.26%	51.35%	67.51%	71.18%	0.0168*
600-799	62.67%	72.09%	58.94%	61.99%	0.4923
800-999	61.65%	70.59%	46.7%	29.27%	0.0072*
1,000-1,199	71.34%	71.43%	36.67%	41.95%	< 0.0001*
1,200-1,399	64.95%	38.89%	42.47%	57.54%	0.0544
1,400-1,599	62.3%	50.0%	78.38%	68.0%	0.6147
1,600-1,799	66.67%	0.0%	55.56%	60.0%	-
>1,800	33.33%	0.0%	62.5%	36.36%	-

**Statistically significant*

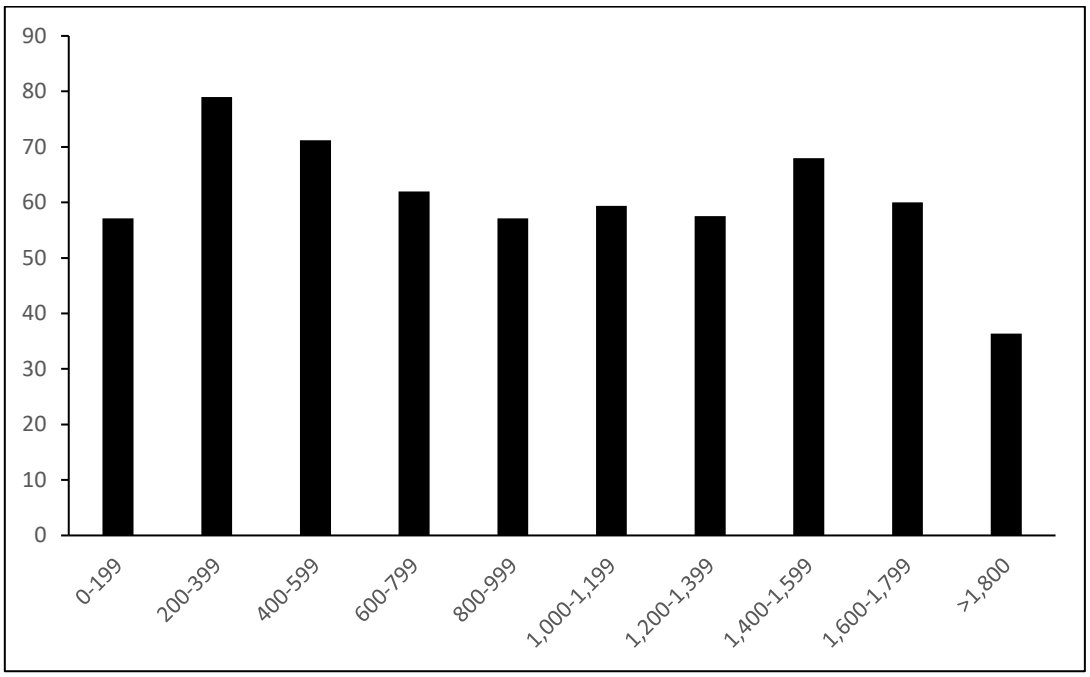

Figure 9. Percentage of positive otter surveys in Spain along altitudinal bands of 200 m.

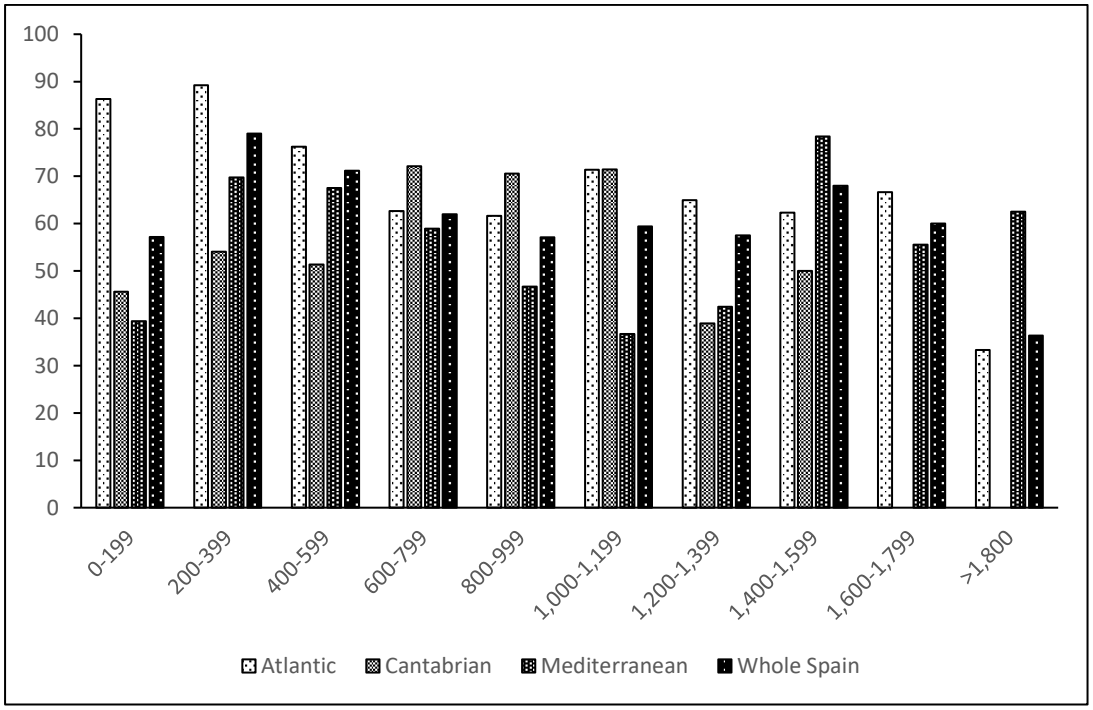

Figure 10. Comparison of percentage of positive surveys by altitude bands of 200 m among three watersheds (Atlantic, Cantabrian and Mediterranean) and the whole Spain.

DISCUSSION

Otter Surveys

Since the 1980s, four national otter surveys have been carried out in Spain, each around the middle of decades (1980s, 1990s, 2000s and 2010s) (Delibes, 1990; Ruiz-Olmo and Delibes, 1998; López-Martín and Jiménez, 2008; Palazón, 2021). In some regions, such as Catalonia, Navarre and Valencia, intermediate surveys (Urra and Castien, 2021; Palazón, 2017a; Jiménez and Crespo, 2021) have been carried out. The general trend of the species has been to recover from a critical situation that reached its lowest peak in the 1980s (Delibes, 1990). With the beginning of the new century, the Eurasian otter began to recover in a stable way in a lot of territories where it had disappeared, from its mountain refuges to lower areas. This fourth survey has confirmed the expansion of the species, both in distribution and population growth, which was detected in the third national survey (Jiménez, 2005; López-Martín and Jiménez, 2008; Jiménez et al. 2009).

Few European countries have carried out four or more national otter surveys like Spain. A special case is Great Britain (Wales, England, Scotland, Northern Ireland and the Republic of Ireland) where surveys have been carried out since the late 1970s and early 80s (Strachan, 2015; Crawford, 2003, 2010; Findlay et al., 2015; Reid et al. 2013a, 2013b). Also in some Central European countries, surveys have been carried out over decades; examples are Denmark and Austria (Therkildsen et al., 2020; Kranz and Polednik, 2020) from the 1980s to the present.

Historic threats to Otters in Spain

The causes that led to the near disappearance of otters in many Spanish regions were very diverse. First was the direct persecution of the species; trappers almost wiped out the entire population of some rivers (Ruiz-Olmo, 2014). For instance, of 88 cases of otters killed between 1970 and 1985, 72.7% were killed directly, by shooting or

trapping (Jiménez and Delibes, 1990). The large dams built in Spain throughout the 20th century fragmented the otter's habitat, since some were and are strong obstacles, very difficult to overcome (Jiménez et al., 2008). These large infrastructures force the otters into open urban stretches, crossing roads, swimming in hydroelectric canals, etc., increasing mortality due to predation, or due to being run over in traffic. In addition, large dams decrease the connectivity of the otter population between upstream and downstream, and that of the potential prey (fish) populations from downstream to upstream. Finally, water pollution by phytosanitary and industrial products affected the reproduction and growth of some animals (Ruiz-Olmo et al., 2000).

Recovery of Otters in Spain

The turning point for otter populations recovery was also diverse. Firstly, the total absence of direct persecution. There are no longer any "illegal" trappers (poaching) dedicated to this "trade", because the otter has been a strictly protected species in Spain since 1973 (Delibes, 1990). For example, of 81 otters killed between 1997 and 2008, none were killed by direct action or human persecution (Jiménez et al., 2009). In addition, the proliferation of Special Conservation Areas (ZEC in Spanish), established according to the EU Habitat and Birds Directive (Natura 2000 network) in the last 20 years in many stretches of rivers, lakes and marshes, have contributed to otter conservation.

Secondly, progressive reduction in the level of contamination of most Spanish riverbeds, mainly due to the start-up of treatment plants and the decrease in phytosanitary products (reduction of organochlorines and PCBs) used in agriculture and residual products (heavy metals) used in industry. The elimination of these bio-accumulative products was very important. The decrease in pollution has also favored the increase in the otter's potential prey, such as fish, and an increase in the biological diversity that inhabits aquatic ecosystems.

The conservation, and in some cases, the improvement of riparian vegetation, especially due to the abandonment and reduction of rural life, have assisted the otter increase. As river habitat has recovered, the otter has been gaining ground and colonizing new stretches of rivers. The proliferation of the red swamp crayfish (*Procambarus clarkii*) and the signal crayfish (*Pacifastacus leniusculus*), especially in Mediterranean rivers, acts as a supplementary source of food for otters, especially in times of scarcity as occur in Mediterranean regions in summer. Red swamp crayfish have spread throughout Spain since the early 1980s, followed later by the signal crayfish. In the Segura basin, the otter has gone from consuming native species of fish to preying on non-native species in just 20 years (Dettori et al., 2022). In Asturias rivers, otter preyed on exotic fish such as mountain trout (*Salvelinus fontinalis*), river bream (*Chondrostoma polylepis*), minnow (*Phoxinus phoxinus*) and rainbow trout (*Oncorhynchus mykiss*) (Palazon, 2021).

The presence of shelter (habitat) and food (fish and crabs) has been and is essential for the recovery of Spanish otter populations. The future of the otter in Spain is favorable. Advances are already known, after this study, in some Mediterranean rivers, reaching the sea and the coast (Jiménez and Crespo, 2021; Palazón, 2021; Ruiz-Olmo, 2014) in Valencia and Catalonia. For instance, the Galicia coast is ideal for otters because of the numerous short rivers with abundant flow, and the topography of the coastline due to the typical Galician estuaries.

Current Threats to Otters in Spain

There are still problems that threaten watercourses and other aquatic areas, such as agricultural intensification, increase of intensive livestock, growth of cities, and the presence of more and more non-native species, especially fish and plants in aquatic systems (Jiménez et al., 2008). The scarcity of water in some river courses in the south and east of Spain is due to periodic episodes of drought and the increasing demands for water by the agricultural (irrigation) and livestock sectors, and human consumption. Water pollution continues, despite the numerous treatment plants that exist throughout Spain. Many of these have become obsolete and they use outdated technology. There are no resources to renew them or for their good maintenance and they allow many pollutants to pass into the rivers. In recent years, chemical pollution from agricultural sources (intensive irrigation) and livestock (macro farms with their nitrogen purines) has increased.

There also continues to be destruction and fragmentation of habitat, especially due to the large infrastructure projects and emergency measures applied by the water management administrations after periodic floods, mainly in Mediterranean rivers, but also in Cantabrian rivers. The presence of construction channels (houses and farms) and crop fields in flood zones creates strong social pressure to "clean dirty rivers", dredging the beds to make them deeper, cutting or cleaning riparian vegetation, including large trees, building retaining walls or breakwaters, etc. All these actions should be very prompt, only where truly necessary, and very short lived. The natural course of the life of a river, with its periodic floods, make these remedies totally inefficient in the face of the next swelling of the river and the subsequent flood of mainland. More long-term planning and fewer automated responses are needed.

Linked to global warming, water demand for human supply and new irrigation is increasing, leaving water levels very close to the limit. Today, less water passes through Spanish rivers than 30 years ago (Palazón, 2021). This factor will be aggravated in the future, and more efficient water consumption should be promoted to reduce demand and guarantee a minimum ecological flow.

The otter has always shared its habitat with other native mammals, but always as the "apex-predator" of continental aquatic ecosystems. Currently it must also share with the European mink (*Mustela lutreola*) (since 1950s), American mink (*Neovison vison*), the coypu (*Myoscastor coipu*) and the beaver (*Castor fiber*) (Ruiz-Olmo, 2014; Palazon, 2017b; Palazón and Melero, 2014, 2017; Palazón et al., 2021).

On the banks of the rivers there are poplar plantations, mainly to produce paper. During the felling of these crops, the last 10 meters closest to the riverbed must be protected. Plantations with native species, typical of river groves, with a width sufficient to act as biological corridors, should be encouraged. The presence of natural islands is very important as areas of reproduction, refuge, and protection against human presence.

Road traffic is one of the most important current causes of otter mortality. In Catalonia alone, between 2008 and 2016, 42 otters were run over (Palazon, 2017a, 2021). The improvement of highways, greater density of traffic, modern, fast vehicles, more straight sections where speed limits are exceeded, and roads that run parallel to the riverbeds and that cross several times produce more points or "black sections" where otters and other semi-aquatic mammals are run over. The authorities are trying to correct these problems, but there are very few actions carried out in Spain to prevent otter mortalities.

In recent years there has been greater concern amongst citizens for the conservation of habitats and species. There is greater environmental awareness, surely

due to a better dissemination of knowledge, and a closer awareness of natural values, to which global warming and the scarcity of water resources have contributed. The otter has an increasing number of allies who will monitor its presence and take care of the improvement of its habitat.

Otters have been able to occupy areas with a high degree of artificiality, ignoring the proliferation of human presence in the riverbeds or riparian environments. Special cases are the presence of otters in the Manzanares river, in the city of Madrid, and in the Llobregat and Besós rivers, both in the city of Barcelona; both cities are made up of metropolitan areas where more than three million people live (Palazón, 2021).

Since the Third Survey, otters have continued to expand, more slowly, and mainly in Mediterranean areas (López-Martín and Jiménez, 2008). The numbers and percentages indicate a similar distribution of otters to that in the 2000s, but we believe that it is because in some territories a significant number of grids which showed positive presence of otter in the third survey were not sampled in this survey.

CONCLUSIONS

Otter expansion continues throughout the decade of the 2010, mainly in the direction of the Mediterranean Sea, occupying dry areas with temporal water bodies and where the food is more difficult to get, and occupying areas near to great towns and cities. Otters have yet to arrived on the Mediterranean coast, though the species reached the Atlantic and Cantabrian seashores ten years erlier. Otters are more and more abundant in Spain; the increase of visual observations and road casualties are a consequence of that. Because of this, some regional administrations are considering lowering legal protection of otter. Otter studies in the future should be focused on coexistence between otters, and human and their activities, especially in zones with great industrial activity and high human density.

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We all want to regret the death of Rafael Romero in October 2022, a great lover of otters.

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RÉSUMÉ

RÉSULTATS DE LA QUATRIÈME CAMPAGNE DE PROPECTION SUR LA LOUTRE EURASIENNE (Lutra lutra) EN ESPAGNE : 2014-2018

Lors de la quatrième enquête nationale sur la loutre en Espagne, 8.024 points d'échantillonnage ont été réalisés sur l'ensemble du territoire espagnol. L'unité d'échantillonnage utilisée était la grille UTM avec des carrés de 10x10 km. Au total, 4.019 carrés ont été prospectés, représentant 77,3 % du réseau de l'Espagne continentale. À l'intérieur de chaque carré, nous avons fait des transects de 600 m de long (n = 4.822 ; 60,1 %) et des vérifications ponctuelles (n = 3.202 ; 39,9 %). Sur l'ensemble des sites échantillonnés soit 5.199, nous avons obtenu des indices de présence positifs dans 64,8 % des cas. En ce qui concerne les carrés UTM, 2.920 étaient positifs pour la loutre, avec au moins un point d'échantillonnage comportant des traces

ou des indices de présence de loutre validés, ce qui représente 76,4 % des carrés échantillonnés. Le pourcentage de présence de la loutre sur le territoire de l'Espagne continentale était de 59,9%. Dans l'ensemble, les résultats ont été davantage positifs dans l'ouest de l'Espagne que dans l'est, et davantage positifs dans le nord que dans le sud de l'Espagne. Par région, le pourcentage maximum de points et de carrés d'échantillonnage positifs a été atteint en Galice (nord-ouest de l'Espagne), avec respectivement 95,4 % et 96,8 %. Au contraire, les valeurs minimales des points d'échantillonnage positifs et des carrés ont été obtenues à Valence (est de l'Espagne), avec respectivement 15,0 % et 20,7 %. Par rapport à la troisième campagne de prospection (2004-2006), la loutre a poursuivi son expansion, mais plus lentement que la décennie précédente, et principalement dans le bassin méditerranéen. Les nombres et les pourcentages indiquent une répartition similaire des loutres dans les décennies 2000 et 2010. Dans plusieurs régions, certains carrés UTM positifs lors la troisième campagne, n'ont pas été prospectés dans le présent relevé; Ce fait a pour conséquence de réduire les pourcentages de présence de la loutre en Espagne.

RESUMEN

RESULTADOS DE LA CUARTA ENCUESTA DE NUTRIA EUROASIÁTICA (Lutra lutra) EN ESPAÑA: 2014-2018

En el cuarto sondeo nacional de nutria en España se realizaron 8.024 puntos de muestreo cubriendo la casi totalidad del territorio español peninsular. Se utilizó como unidad de muestreo la cuadrícula UTM (10x10 km), con un total de 4.019 cuadrículas prospectadas, representando el 77,3% del territorio español. En cada cuadrícula, se realizaron itinerarios de 600 m de distancia (n = 4.822; 60,1%) y puntos "spot-check" (n = 3.202; 39,9%). De todos los puntos muestreados, 5.199 fueron positivos en nutria, representando el 64,8%. De todas las cuadrículas muestreadas, 2.920 fueron positivas, con al menos una localidad con indicios o señales de nutria, representando el 76,4%. Las cuadrículas con nutria fueron el 59,9% de territorio peninsular español. A nivel general, los resultados fueron más positivos en la mitad oeste de España que en la este, más positivos en la mitad norte que en la sur. Por regiones, los máximos porcentajes de puntos y cuadrículas positivas se alcanzaron en Galicia (noroeste de España), con 95,4% y 96,8%, respectivamente. En el lado contrario, los mínimos valores se obtuvieron en la Comunidad Valenciana (este de España) con 15,0% y 20,7%, respectivamente. En comparación con el tercer sondeo, la nutria ha continuado expandiéndose, a un ritmo más lento, principalmente por las cuencas mediterráneas. Los números y los porcentajes indicaron una similar distribución de la nutria en las décadas 2000s y 2010s. En varios territorios, algunas cuadrículas con presencia de nutria en el tercer sondeo no fueron muestreados en el actual sondeo; este hecho ha hecho disminuir los porcentajes obtenidos de presencia de nutria en España.

OSG MEMBER NEWS

The Otter Specialist Group contains 396 members at 18 April 2023.

New Members of OSG

Since the last issue, we have welcomed 3 new members to the OSG: you can read more about them on the Members-Only pages.

Ferdi Andeska, Indonesia: I am an active otter researcher, and a social media content creator regarding information and education on otters in Indonesia. My goal is to share information and raise awareness about otter conservation in Indonesia on social mediasocial media (Instagram (berang.berang.indonesia and website berang-berang.com).

Samantha Hamilton, USA: I am a PhD student conducting baseline assessments at Northern California sites to determine sea otter reintroduction suitability. My interests are sea otter ecology and population dynamics, marine mammal management and conservation, and mentorship and advocacy for women in STEM.

Rama Mishra, Nepal: I have worked in wildlife research and conservation since 2012, studying Smooth-Coated Otters and Fishing Cats, working with local NGOs and youth networks in the communities of Nepal's terai. I am currently doing a PhD at the University of Antwerp.