NOTE FROM THE EDITOR

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Dear Friends, Colleagues and Otter Enthusiasts!

Some days ago, we have closed issue 41/3 of this year and issue 42/4 goes hereby online.

Maybe not such big news but I see recently at several occasions when reviewing for journals, when I am panel member in project applications but also as a member in COPE, the Committee on Publication Ethics, the increasing use of AI in preparing manuscripts. I recently came across a manuscript where we found three "invented references" which is typical for ChatGTP and other tools. With invented references I mean a reference that fits from the title to the submitted paper, should be in a journal I do even know but when you go to the issue there is no such article anywhere to be found.

So, the solution to this is simple. From today on each manuscript will be send back to the author to add a line in the Material and Methods section to describe whether and to what extent AI has been used for the preparation of the paper. Only manuscripts with this information will be send to reviewers. We will also use a tool to identify AI parts in the manuscripts and dependent on the amount not declared but then found I will take the freedom and power of being the editor-in-chief to decide whether it can go to review, needs to be send back for revision or whether the authors will be suspended from submissions. I am sorry to take such drastic actions, but I cannot accept any such behaviour.

I wanted to remind you on my recent proposal to have a section at the end of the issues where we have the title, abstract, university and date of defence for those of you who submit an MSc or PhD thesis. Of course, full articles are also welcome but with a section like this we would all be aware what is internationally ongoing in respect to otter studies. Feel free to send me such notes if your university and supervisors agree.

As we will have 5 issues this year, I really think Lesley deserves an extra thank you in 2024! Thanks Lesley from my side for all your dedication.

A R T I C L E

PRELIMINARY CHARACTERIZATION OF VOLATILE ORGANIC COMPOUNDS IN AFRICAN CLAWLESS OTTER *Aonyx capensis* SPRAINT

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Abstract: Chemical communication plays an important role in mate selection, territoriality, resource guarding, parental care and disease transmission in many taxa. Studies investigating olfactory communication and scent communication in wild animal populations are rare. To date there has been no analysis of the odours encoded in African clawless otter anal gland secretions. The volatile organic compound profiles of 14 wild African clawless otter anal gland secretion and faecal samples were investigated to determine the composition of odour profiles and infer on the potential role of particular compounds. Faecal and anal gland secretions were analysed through gas chromatography mass spectrometry. Across all samples a total of 73 compounds were found of which a total of 34 were provisionally identified. Nine of the identified compounds function as sex pheromones and/or reproductive status signals in other vertebrates, suggesting that African clawless otter latrines likely also play an important role in reproductive communication between individuals of the species. Further studies matching the identities of known individual African clawless otters and their reproductive status with the olfactory characteristics of their spraint are required to further validate the interpretations reported here.

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INTRODUCTION

Coding of information in animal chemical communication is believed to occur through a combination of behavioural and chemical means (Sun and Müller-Schwarze, 1998). Olfactory signals persist in the environment for prolonged periods of time (compared to visual and auditory signals) such that communication can occur over longer time frames where senders and receivers of signals do not necessarily need to be in close proximity (Vitale et al., 2020). The use of olfactory communication through scent marking is a common feature in mammals (Bradbury and Vehrencamp, 1998) and is employed for a variety of reasons including individual recognition (Brennan and Kendrick, 2006; Kulahci et al., 2014), group identity (Vaglio et al., 2016), territorial marking (Black-Decima and Santana, 2011; Marneweck 2013), and reproduction (Scordato and Drea, 2007; Melo and González-Mariscal, 2010). Mammals produce complex chemical signals with multiple intricate components. Consequently, the desirable initial method in deciphering these signals is to begin with a chemical analysis approach (Sun and Müller-Schwarze, 1998).

Otters belong to the family Mustelidae and all species in this family have well developed anal scent glands (Hutchings and White, 2000). Scent marking and the malodorous nature of secretions is an integral part of intraspecific communication in mustelids and as such they have been the focus of chemical and olfactory research (Burger, 2005). The anal gland volatiles of the following Mustelid species have been chemically analysed: the American mink, *Mustela vison* (Brinck et al., 1978); the stoat (*Mustela erminea*); the ferret, *Mustela putorius furo* (Crump and Moors, 1985); the European polecat, *Mustela putorius* (Brinck et al., 1983); the steppe polecat, *Mustela eversmanni* (Zhang et al., 2002a); the Siberian weasel, *Mustela sibirica* (Zhang et al., 2002b); European badgers, *Meles meles* (Noonan et al., 2019); and the Eurasian otter, *Lutra lutra* (Kean et al., 2011). The chemical information of these species has made them valuable model systems in the broad category of mammal chemical communication research (Zhang et al., 2002a). Otters represent 13 of the 58 extant species in the family Mustelidae, yet to date there has been little research to ascertain the composition of scent marking and olfactory communication (Kean et al., 2011).

African clawless otters (*Aonyx capensis*) are elusive, secretive and nocturnal, and are therefore challenging to study. The behaviour of African clawless otters at latrine sites have been previously described (Jordaan et al., 2017) and, more recently also the characteristics of latrine locations and associated otter behaviours (Nicolaides et al., 2024). These results suggest that otters may select latrine site locations to maximize their conspicuousness to conspecifics and that scent marking at these latrine sites likely play an important role in intra-specific communication. Despite these investigations, the role of scent marking in terms of olfactory communication and its role in the social behaviours of African clawless otters remain poorly understood. This study investigated the composition of odour profiles of African clawless otter anal gland secretions. By comparing the composition of odour profiles with published accounts for other species we further aimed to make inferences on the types of information conveyed through African otter anal gland secretions.

MATERIALS AND METHODS

Sample Collection

Otter faecal and anal gland secretions were identified based on their shape, size and characteristic odour (Stuart and Stuart, 2019). African clawless otter faeces are typically sausage shaped (one end pointed) and anal gland secretions typically accompany faeces as dark jelly like deposits (Stuart and Stuart, 2019). The faeces typically range from 25 to 35 mm and are full of fish scales, fish bones and shell fragments. African clawless otters have a characteristic odour that is described as being very musky and fishy, combined with a sweet taint (Estes, 1991; Stuart and Stuart, 2019). Upon discovery of otter spraint, coordinates were recorded using a hand-held GPS device. Individual fresh and unbroken spraint samples were collected, placed into individually labelled, sterile plastic sealable vials, and stored at -20 °C.

Chemical Analysis

Volatile organic compounds (VOCs) emitted by the faecal and anal gland secretion samples were sampled and analysed using solid-phase microextraction (SPME) and gas chromatography mass coupled to spectrometry (GC-MS). Approximately 0.2 g of frozen samples were transferred to 1.5 ml analytical glass vials (Machery Nagel, Separations, South Africa). Sample vials were then placed in a heating block at 40 °C to ensure a consistent temperature during sampling. A 65µm polydimethylsiloxane/divinylbenzene SPME fibre (Supelco, Merck South Africa) was exposed to the headspace above each sample for 15 min. Preliminary testing of exposure times of up to 30 min indicated that 15 min was sufficient to reach equilibrium. Fibres were conditioned according to manufacturer's recommendations and reconditioned for 6 min in the GC injection port at 300 °C if the fibre had not been used for several hours. An analysis of the fibre not exposed to a sample was conducted to detect non-sample compounds and any contamination or deterioration of the fibre.

Following exposure to headspace volatiles, the fibre was immediately manually injected into the GC-MS (Agilent 7890B gas chromatograph coupled to a 7977MSD quadrupole mass spectrometer). Samples were analysed on a 30 m, 0.25 mm inner diameter, 0.25µm film thickness, HP5 column (J&W, Agilent, South Africa), with helium as the carrier gas at constant flow rate of 1.2 L/min. Separation was achieved with a 2-min hold at 50 °C, followed by a linear temperature increase of 10°C/min to 300 °C and held at 300 °C for 2 min, resulting in a total programme time of 29 min. An external alkane hydrocarbon standard (1 µl) was injected using an automatic liquid injector for calculation of retention indices, in turn allowing for the calculation and standardisation of retention times.

The mass spectrometer (MS) operated in electron impact ionization EI+ mode, scanning from ion mass fragments 50 to 300 m/z. The mass spectra were deconvoluted using MassHunter 1.2 (Agilent) in conjunction with the NIST mass spectral library and the R-based statistics suite, Metababoanalyst. Data analysis and peak integration were performed using the program MassHunter. Compounds were identified based on comparison of mass spectra and retention times to the National Institute of Standards mass spectral library (NIST, 2017) and by calculating their retention indices. Peaks with a short retention time below 4 min were not included in the analysis because signals with retention times were not measurable with sufficient accuracy. The faecal matter samples from which the volatiles were extracted were air-dried to determine their dry weight.

The retention time, Kovat's retention index (KI), mean relative abundance, standard deviations, match factor to compounds in the NIST library and occurrence of each sample were determined. The retention index of each peak on the GC chromatogram was compared to experimentally determined KIs in the NIST library (Zang et al., 2021) (see Table 1). Peak areas were normalized by sample dry weight to obtain relative quantities of volatiles.

RESULTS

The VOCs of 14 anal gland secretion and faecal samples of African clawless otters were identified. The number of compounds per sample ranged between 24 and 51 (mean 32 ± 7.83). Across all samples a total of 73 compounds were recorded, of which 34 were provisionally identified using the NIST library and KI values (Table 1). The compounds identified comprised of a complex mixture of alcohols (40.54%), esters (10.81%), ketones (5.41%), benzenes (5.41%), phenols (5.41%), aldehyde (5.41%), aromatics (5.41%), alkanes (5.41%), diterpene (5.41%), monoterpenoids (2.7%) organic disulfide (2.7%), alkenes (2.7%) and long-chain fatty acid (2.7%) (Table 1). One compound provisionally identified as an amide was common across all 14 samples.

Table 1. Volatile organic compounds (VOCs) in the anal gland secretion and faeces (n=14) of African clawless otters, *Aonyx capensis*. RT min = Retention Times; KI = Kovat's Retention Index;MRA = mean relative abundance; SD = standard deviation.

Compound Identified	RT (min)	KI	MRA	SD	Sample	Occurrence
Phenol derivative 1	5.182	978.02	6.21	0.007	7,8	2
Phenol derivative 2	5.194	978.89	6.86	1.27	6,10	2
1-Pyrrol[tert-butyl(dimethyl)silyl]oxymorphopropan-2-ol	5.205	979.96	3.95	0.76	1,10	2
Methanol	5.211	980.54	6.73	2.64	4,11,12	3
Phenol	5.223	981.71	14.01	2.04	9,13	2
2-Cyclopenten-1-one, 3-ethyl-2-hydroxy-	6.366	1105.98	2.1	3.61	9,12,13	3
UNKNOWN 1	6.493	1121.46	26.68	5.06	10,11	2
UNKNOWN 2	6.499	1122.20	33.68	2.28	4,7,9	3
Ethyl n-butyl disulphide	6.476	1119.39	15.23	5.98	8,12	2
1-Nonanol	6.77	1155.24	0.0098	0.0048	2,3, 11	3
UNKNOWN 3	6.793	1158.05	8.22	0.43	8,9,12,14	4
UNKNOWN 4	7.313	1223.78	6.94	8.31	1,3,7,13	4
2-Cyclohexen-1-one, 2-methyl-5-(1-methylethyl)-, (S)-	7.319	1224.59	4.8	5.01	4,5,6	3
Benzyl isothiocyanate 1	8.001	1318.05	3.64	0.53	7,8,9	3
Benzyl isothiocyanate 2	8.006	1318.78	6.58	7.24	1,4,5,10,11,1213	7
1-Undecanol 1	8.301	1361.72	1.52	0.77	1,11	2
1-Undecanol 2	8.307	1362.59	1.11	0.042	6,8	2
1-Tetradecene	8.486	1388.65	0.83	0.43	3,8	2
Dodecanal	8.491	1389.37	0.47	0.38	4,6,10,11	4
UNKNOWN 5	8.595	1404.79	0.7	0.29	4,5,6,7,9,12, 13	7
UNKNOWN 6	8.971	1462.91	0.12	0.04	10,13	2
UNKNOWN 7	9.248	1506.06	3.06	1.74	1,4,5,6,8,9,11,12	8
Methyl salicilate	9.254	1507.03	1.69	1.54	2,7,10	3
1-Tridecanol 1	9.496	1546.57	4.45	2.69	5,7,8,11	4
1-Tridecanol 2	9.502	1547.55	7.29	6.8	1,4,6,10,13	5
2-Tridecenal, (E)-	9.641	1570.26	34.83	49.25	3,4	2

Zingiberenol	9.86	1606.41	0.44	0.35	3,5,6	3
UNKNOWN 8	9.8739	1608.82	0.006	0.001	6,8,9,12,13	5
UNKNOWN 9	10.322	1686.48	0.86	1.21	6,8,11,12,13	4
UNKNOWN 10	10.328	1687.52	1.07	0.34	1,4,7,11	3
2,6,10,14-tetramethyl-pentadecane	10.449	1708.93	1.14	0.76	2,7,10	2
UNKNOWN 11	10.576	1732.06	0.15	0.086	1,6,7,8,11,13	6
7-Methylheptadecane	10.646	1744.81	0.94	0.79	1,6,8,11,13	5
Benzyl benzoate	10.651	1745.72	0.54	0.32	5,7,9,10,11,12	5
Tetradecanoic acid	10.767	1766.85	0.44	0.22	6,7,10,11,13	5
Ethyl tetradecanoate	10.825	1777.41	0.26	0.16	12,14	2
(Z)-9-Tetradecenyl acetate	10.859	1783.61	0.19	0.035	4,7,13	3
UNKNOWN 12	10.963	1802.69	0.26	0.026	5,7,13	3
Phytane	11.021	1813.85	2.62	3.32	1,2,6	3
UNKNOWN 13	11.131	1835	0.69	0.34	4,6,8,9	4
UNKNOWN 14	11.217	1851.54	0.68	0.73	4,6,8,9	4
9-Heptadecanone	11.223	1852.69	2.48	2.76	4,7,10,11,12,13	6
UNKNOWN 15	11.35	1877.12	18.92	11.36	4,7,10,11,12,13	6
1-Hexadecanol 1	11.345	1876.15	5.05	2.04	1,3,9	3
1-Hexadecanol 2	11.344	1875.96	3.96	1.34	6,8,9	3
1-Hexadecanol 3	11.443	1895	13.2	9.43	2,14	2
UNKNOWN 16	11.495	1905.23	0.25	0.28	1,2,14	3
UNKNOWN 17	11.714	1949.30	1.39	0.83	1,3,4,5,6,7,8,9,10,11,12,13	12
Abietatriene	12.13	2034.24	4.07	4.33	3,4,6,7,10,11,13	7
UNKNOWN 18	11.939	1994.57	0.16	0.03	11,14	2
UNKNOWN 19	12.176	2043.84	0.47	0.66	1,14	2
UNKNOWN 20	12.222	2053.44	0.84	0.11	2,12	2
9,12-Octadecadien-1-ol, (Z,Z)-	12.205	2049.90	5.25	4.15	4,10,11	3
UNKNOWN 21	12.274	2064.30	1.35	1.34	3,5,7,10,11,13	6
UNKNOWN 22	12.199	2048.64	3.08	2.02	7,13	2

UNKNOWN 23	12.442	2099.37	1.9	1.02	1,5,6,7,8,9,10,11,12,13	10
UNKNOWN 24	12.211	2051.15	0.16	0.01	3,5	2
Pyrene	12.338	2077.66	0.39	0.32	1,3,5,11	4
Phytol	12.448	2100.66	0.29	0.01	2,3	2
UNKNOWN 25	12.569	2127.19	0.15	0.07	1,4,6,7,8,9,11,12,13	9
UNKNOWN 26	12.748	2166.45	0.34	0.13	6,7,8,9,10,11,12,13	8
UNKNOWN 27	12.938	2208.55	0.09	0.03	6,12	2
1-Octadecanol, TMS derivative	12.742	2165.13	0.31	0.01	4,14	2
UNKNOWN 28	13.406	2317.06	0.63	0.59	1,5,6	3
UNKNOWN 29	12.944	2209.93	0.13	0.09	8,9	2
UNKNOWN 30	13.62	2367.7	0.19	0.14	1,2,5,13,14	5
UNKNOWN 31	13.943	2446.29	0.8	0.43	4,7,8,9,10,11,12,13,14	9
UNKNOWN 32	13.891	2433.42	0.13	0.02	6,13	2
cis-13-docosenol, tBDMS	14.561	2603.47	1.46	0.85	2,3,4,5,6,7,8,9,10,11,12,13	12
UNKNOWN 33	13.949	2447.77	0.5	0.37	1,5,6	3
Unknown amide	14.752				1,2,3,4,5,6,7,8,9,10,11,12,13,14	14
1-(2-Hydroxyethyl)-2-imidazolidinone	15.705				9,13,14	3
n-Hexadecanoic acid	18.974				9,13	2

DISCUSSION

Olfactory communication plays an important role in the ecology of otters and their socio-spatial organisation (Johnson et al., 2000; Berzins and Helder, 2008; Kean et al., 2015; Mumm and Knörnschild, 2018). The precise mechanistic knowledge of how scent communication at latrine sites is conveyed between individuals remains an under-investigated topic. Many carnivores advertise their territory and resource ownership as a pre-emptive measure to avoid conflict and potentially costly agonistic encounters with conspecifics (Buesching and Stankowich, 2017). This is effectively achieved with low-maintenance long term signals that do not require the continued physical presence of the owner, but that can be matched to the individual who marked the site through individually identifiable scent. Given that a scent remains in the environment for some time it allows for the owner of the scent to be identified by rivals, even in the owner’s absence, reducing the costs of physical conflicts (Gosling, 1982; Leuchtenberger, 2018).

Of the thirty-four compounds provisionally identified in African clawless otters, eleven were identified in the literature as having been documented to play a role in the behaviour of several animal species (Table 2). The only other otter species where faecal VOC analyses were conducted to date is the Eurasian otter (Kean et al., 2015). Two compounds identified in African clawless otters here have also been identified in the Eurasian otter, namely Phenol and 1-Tridecanol.

Table 2. Eleven of the thirty-four volatile organic compounds identified in African clawless otter's spraint and the published report of their biological role in other animals.

No	Compound Name	Cited Relevance to Behaviour	
		Behaviour	**Species**
1	Phenol	oestrus, sexuality, differentiating female reproductive states, age differentiation	*Idea leuconoe* (Nishida et al. 1996); *Bos Taurus* (Sankar et al. 2007); *Mamestra brassicae* (Jacquin et al. 1991); *Bubalus bubalis* (Brahmachary and Poddar-Sarkar 2015); *Meles meles* (Noonan et al. 2019); *Lutra lutra* (Kean et al. 2015); *Panthera leo* (Soso and Koziel 2017); *Canis lupus signatus* (Martín et al. 2010)
2	1-Nonanol	sex pheromone	*Achroia innotata* (Francke and Schulz 1999); *Raphicerus campestris* (Burger et al. 1999)
3	Dodecanal	sexual attraction	*Lemur catta* (Shirasu et al. 2020) *Tachyglossus aculeatus setosus* (Harris et al. 2012)
4	1-Tridecanol	sex pheromone	*Junco hyemalis* (Whittaker et al. 2013)*; Lutra lutra* (Kean et al. 2015)
5	Zingiberenol	sex pheromone	*Tibraca limbativentris* (Blassioli-Moraes et al. 2020)
6	7-Methylheptadecane	sex pheromone	*Lambdina athasaria* (Duff et al. 2001); *Lambdina pellucidaria* (Duff et al. 2001)
7	Tetradecanoic acid	possible sex differentiation	*Caracal caracal* (Goitom 2017); *Suricata suricatta* (Leclaire et al. 2017)
8	(Z)-9-Tetradecenyl acetate	sex pheromone	Lepidoptera (Byers 2005); *Ostrinia zealis* (Huang et al. 1998); *Ostrinia zaguliaevi* (Ishikawa et al. 1999); *Agrotis segetum* (Löfstedt et al. 2014); *Spodoptera frugiperda* (Malo et al. 2015)
9	Phytane	reproduction	*Vipera ammodytes* (Shafi et al. 2021)
10	9-Heptadecanone	trail following behavior	*Pachycondyla tarsata* (Janssen et al. 1999)
11	1-Hexadecanol	sex pheromone, oestrus, kin recognition, stimulating parental care	*Caracal caracal* (Goitom et al. 2017); Bovidae (Shafi et al. 2021); *Junco hyemalis carolinensis* (Whittaker et al. 2016; Mas and Kolliker 2008), *Raphicerus campestris* (Burger et al. 1999), Suricata suricatta (Leclaire et al. 2017), *Mungos mungo* (Jordan et al. 2010)

Nine of the compounds identified in the African clawless otter spraint are associated with reproduction and/or as sex pheromones in other animals (Table 2). This suggests that latrines may be primarily used for individual-level sexual communication in African clawless otters, and not, as previously speculated (Jordaan et al., 2017) for maintaining territories and to facilitate inter-clan communication. Of course, such functions are not necessarily exclusive to one another, and we cannot exclude at this stage the possibility that latrines are important for both inter-individual, as well as inter-clan communication. The functions of specific VOCs may furthermore differ between different species. For example, 1-hexadecanol is a common compound in the excrement of several mammals. In the steenbok (*Raphicerus campestris*) (Burger et al., 1999) and meerkat (*Suricata suricatta*) (Leclaire et al., 2017) it functions as a sex pheromone, and in the caracal (*Caracal caracal*) (Goitom et al., 2009) and Bovidae (Shafi et al., 2021) it plays a role in oestrus signalling. The compound 1-hexadecanol has also been identified in an avian species, the dark-eyed Junco (*Junco hyemalis carolinensis*), where it functions in kin recognition (Célérier et al., 2011) and in stimulating parental care (Mas and Kolliker, 2008). Phenol has also been identified to play different functions across different species. In water buffalo (*Bubalus bubalis*) (Brahmachary and Poddar-Sarkar, 2015) phenol plays a role in signalling sexuality. Phenol plays different roles in other species too. For example, in cattle (*Bos taurus*) (Sankar et al., 2007) it indicates oestrus, in the European badger (Noonan et al., 2019) it differentiates female reproductive state and in the African lion (*Panthera leo*) (Soso and Koziel, 2017) and Iberian Wolf (*Canis lupus signatus*) (Martín et al., 2010) it communicates age differentiation. Phenol has also been identified as an insect pheromone in the large tree nymph butterfly (*Idea leuconoe*) (Nishida et al., 1996) and cabbage moth (*Mamestra brassicae*) (Jacquin et al., 1991).

In addition to suggesting a likely role in reproductive communication, our results illustrate that African clawless otter scent profiles are complex and diverse, with substantial variation in profiles between samples analysed both in terms of the number of VOCs present, as well as their composition. The variation across the 14 scent profiles may be associated with variables like sex, age, reproductive status, dominance and health (Kean et al., 2015; Leclaire et al., 2017; Noonan et al., 2019). Unfortunately, these variables are unknown for the samples in our study though and we can only speculate at this stage on their potential roles in explaining the reported variability. Moreover, the substrate type, time difference between deposition and collection and between the scats collection and analysis are all factors that contribute to the differences between the samples (Kean et al., 2015).

Studies assessing odour and olfaction are often able to equate certain behaviours with scent (Soso and Koziel, 2017), such that the role of individual compounds can be identified and linked to specific behaviour. For example, the ability of elephants to detect the compound cyclohexanone has led researchers to suspect that some must signals may be single compounds (Rasmussen et al., 1996). Further research on individual chemical compounds and their role in scent-marking and olfactory communication are required to gain an understanding of the influence of particular VOCs on elucidating the behaviour of African clawless otters (Soso and Koziel, 2017).

Conflict of Interest: *The authors declare that they have no conflicts of interest.*

Author Contributions: *SGN contributed to design of the study, reviewed literature, collected and analyzed the data, applied statistical analyses and wrote the manuscript; AH contributed to the design and development of the study, secured funding for the research and reviewed and edited the manuscript;*

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Data Availability: *Data is available upon reasonable request to the corresponding author.*

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RÉSUMÉ: CARACTÉRISATION PRÉLIMINAIRE DES COMPOSÉS ORGANIQUES VOLATILS DANS L'ÉPREINTE DE LOUTRE A JOUES BLANCHES, *Aonyx capensis*

La communication chimique joue un rôle important dans la sélection du partenaire, la territorialité, la protection des ressources, les soins parentaux et la transmission des maladies chez de nombreux taxons. Les études examinant la communication olfactive et la communication fécale dans les populations d'animaux sauvages sont rares. À ce jour, aucune analyse des odeurs codées dans les sécrétions des glandes anales de la loutre à joues blanches n'a été réalisée. Les profils des composés organiques volatils de 14 échantillons de sécrétions des glandes anales et de matières fécales de loutres à joues blanches sauvages ont été étudiés pour déterminer la composition des profils olfactifs et en déduire le rôle potentiel des composés spécifiques. Les sécrétions des glandes anales et fécales ont été analysées par chromatographie en phase gazeuse et spectrométrie de masse. Sur l'ensemble des échantillons analysés, 73 composés ont été trouvés dont 34 provisoirement identifiés. Neuf des composés identifiés fonctionnent comme des phéromones sexuelles et/ou des signaux d'état de reproduction chez d'autres vertébrés, ce qui suggère que les latrines de la loutre à joues blanches jouent probablement aussi un rôle important dans la communication de reproduction entre les individus de l'espèce. Des études complémentaires, permettant de corréler les identités des loutres à joues blanches connues et leur période de reproduction avec les caractéristiques olfactives de leur épreinte, sont nécessaires afin de mieux valider les interprétations.

RESUMEN: CARACTERIZACIÓN PRELIMINAR DE LOS COMPUESTOS ORGÁNICOS VOLÁTILES EN FECAS DE LA NUTRIA SIN UÑAS AFRICANA, *Aonyx capensis*

La comunicación química juega un rol importante en la selección de pareja, la territorialidad, la guarda de los recursos, el cuidado parental y la transmisión de enfermedades en muchos taxones. Los estudios que investigan la comunicación olfativa y la comunicación por marcas olorosas en poblaciones de animales silvestres, son raros. Hasta la fecha, no ha habido análisis de los olores codificados en las secreciones anales de la nutria sin uñas Africana. Investigamos los perfiles de compuestos orgánicos volátiles de 14 muestras de secreciones de glándulas anales y de fecas de nutria sin uñas Africana, para determinar la composición de los perfiles de olores e inferir el rol potencial de los compuestos particulares. Las secreciones fecales y de glándulas anales fueron analizadas por medio de cromatografía de gases acoplada a espectrometría de masas. En el conjunto de muestras, encontramos un total de 73 compuestos, de los cuales 34 fueron identificados provisoriamente. Nueve de los compuestos identificados funcionan como feromonas sexuales y/o señales de status reproductivo en otros vertebrados, sugiriendo que las letrinas de la nutria sin uñas Africana también juegan un rol importante en la comunicación reproductiva entre individuos de la especie. Para validar las interpretaciones aquí informadas, se requieren más estudios que asocien las identidades de individuos conocidos de nutria sin uñas Africana y sus status reproductivo, con las características olfatorias de sus fecas.

SHORT NOTE

EURASIAN OTTER (*Lutra lutra*) OCCURRENCE IN HIRAKUD RESERVOIR, INDIA: A RAMSAR SITE AND THE ONE OF THE LONGEST EARTH DAMS IN THE WORLD

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ABSTRACT: The Eurasian otter (*Lutra lutra*) is an apex predator in aquatic ecosystems. The species is found in the Himalayas along the northern part of India, extending from the northwest to the northeast, as well as in the Western Ghats and central India. Due to a lack of detailed information on its biology, the Eurasian otter is considered one of the lesser-known species in India. We report the occurrence of the Eurasian otter in the Hirakud reservoir of Odisha, India. Further research, monitoring, and awareness campaigns for local stakeholders are necessary to design effective conservation strategies for the species.
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Keyword: Eurasian otter, rescue, Mahanadi River, Jharsuguda forest division, Odisha, central India

OBSERVATION

Effective conservation of a species requires a sound understanding of its distribution, habitat preferences, and other ecological requirements (Lambeck, 1997). The Eurasian otter (*Lutra lutra*), classified as "Near threatened" by the IUCN, is one of the least studied otter species in India. It is one of the most widely distributed Palaearctic mammals, with a geographical range from Ireland in Western Europe to the Kamchatka Peninsula in eastern Asia, and from the Arctic region to North Africa, as far south as Sumatra and Indonesia in Southeast Asia (Mason and Macdonald, 1986). The species is now recovering in many parts of its range after suffering a substantial decline in Europe (Roos et al., 2015; Duplaix and Savage, 2018). The species is vulnerable to urbanization, pollution, poaching, and dam construction; and is also listed in Appendix I of CITES. The Eurasian otter lives in a wide range of freshwater habitats, including rivers, streams, canals, lakes, marshes, deltas, and artificial reservoirs.

The Eurasian otter in India is distributed north of the Ganges River, throughout the Himalayas and northeast region, and along the Odisha coast up to Madras and south India (Hussain, 1999). Historically, the species was considered absent from central India (Pocock, 1941; Prater, 1971). However, recent studies have recorded the Eurasian otter in various regions such as the Chenab catchment and Bhagirathi Basin in the western Himalayas (Pal et al. 2021; Singh et al. 2023), Tawang district and Pakke tiger reserve of East Kameng district in Arunachal Pradesh of the eastern Himalayas (Bhattacharya et al. 2019; Borker et al. 2022), Balaghat forest circle and Satpura tiger reserve in Madhya Pradesh, and Kathghora forest division of Chhattisgarh of central India (Jena et al., 2016; Joshi et al., 2016; Talegaonkar et al., 2021; Suraj et al. 2022), the Anamalai Hills in Tamil Nadu of the Western Ghats (Mudappa et al., 2018), Sundargarh district in western Odisha (Palei et al. 2022), and Chilika Lake on the eastern coast of Odisha (Adhya and Dey, 2020) (Table 1, Fig. 1).

On March 5th, 2022, a Eurasian otter was rescued from Palasada village (21.768363° N, 83.602356° E, altitude 221 m) in the Jharsuguda forest division of Odisha, India (Fig. 1, 2 and 3). The otter was a sub-adult male. The otter was identified by its pronounced muzzle, zig-zag, or "W"-shaped naked rhinarium and cone-shaped tail. The animal appeared healthy with no observed internal or external injuries. The following day, the Eurasian otter was released back into the Hirakud reservoir, which is 4 km away from the village where it was rescued. Recently, Palei et al. (2022) reported the presence of Eurasian otters in the Sundargarh district of western Odisha, approximately 60 km from our current location, indicating an expansion from their previously documented geographic range. During the survey, we encountered several otter spraints and footprints along the reservoir bank. Informal discussions with villagers confirmed the presence of different species of otters of in the reservoir area. However, based on the otter signs observed, we were unable to confirm the presence of other otter species such as the Asian small-clawed otter (*Aonyx cinerea*) and smooth-coated otter (*Lutrogale perspicillata*), which have been reported in different parts of the state (Mohapatra et al., 2014; Debata and Palei, 2020; Palei et al., 2020; Palei et al., 2023a). It is worth noting that a recent study by Palei et al. (2023b) reported the presence of smooth-coated otters near the Hirakud reservoir.

The Hirakud reservoir is a major man-made lake constructed between 1948 and 1956 across the Mahanadi River, one of the largest rivers in India. The reservoir serves multiple purposes, including irrigation, hydropower generation, and flood control. The reservoir covers an area of 743 km^2, with a length of approximately 55 km, and has a total storage capacity of 8.1 billion cubic meters, making it world's longest earthen dam. On October 12th, 2021, the reservoir was declared a Ramsar Site, and it has also been accorded the status of an Important Bird and Biodiversity Area (IBA) along with the Debrigarh wildlife sanctuary, supporting 112 water and water-dependent birds, including several threatened and endangered species (Nair et al. 2014). Therefore, the Hirakud reservoir is an important ecological site in the region. The habitat along the banks of the Hirakud reservoir comprises a mosaic of diverse ecological zones. These include forested areas adjacent to the Debrigarh Wildlife Sanctuary, open grasslands or scrublands in drier sections of the reservoir banks, and marshy areas found in low-lying or inundated zones. Aquatic vegetation and floating plants are observed in areas where water levels fluctuate.

Table 1. Recent records of Eurasian otter (*Lutra lutra*) in India

Sl. No.	Locations	References
1.	Upper Indus River, Ladakh	Jamwal et al. (2016)
2.	Balaghat, Madhya Pradesh	Jena et al. (2016)
3.	Satpura Tiger Reserve, Madhya Pradesh	Joshi et al. (2016)
4.	Anaimalai Hills, Tamil Nadu	Mudappa et al. (2018)
5.	Nyamjang Chu River, Arunachal Pradesh	Bhattacharya et al. (2019)
6.	Chilika Lake, Odisha	Adhya et al. (2020)
7.	Mangan, Sikkim	Khatiwara et al. (2020)
8.	Bhagirathi Basin, Uttarakhand	Pal et al. (2021)
9.	Kanha National Park, Madhya Pradesh	Uikey et al. (2021)
10.	Pakke Tiger Reserve, Arunachal Pradesh	Borker et al. (2022)
11.	Sundargarh Forest Division, Odisha	Palei et al. (2022)
12.	Korba & Kathagora Forest Division, Chhattisgarh	Suraj et al. (2022)
13.	Chinnar Wildlife Sanctuary, Kerala	Mohan et al. (2023)
14.	Chenab Catchment, Jammu & Kashmir	Singh et al. (2023)

note: Sl numbers of locations correspond with numbers in Figure 1.

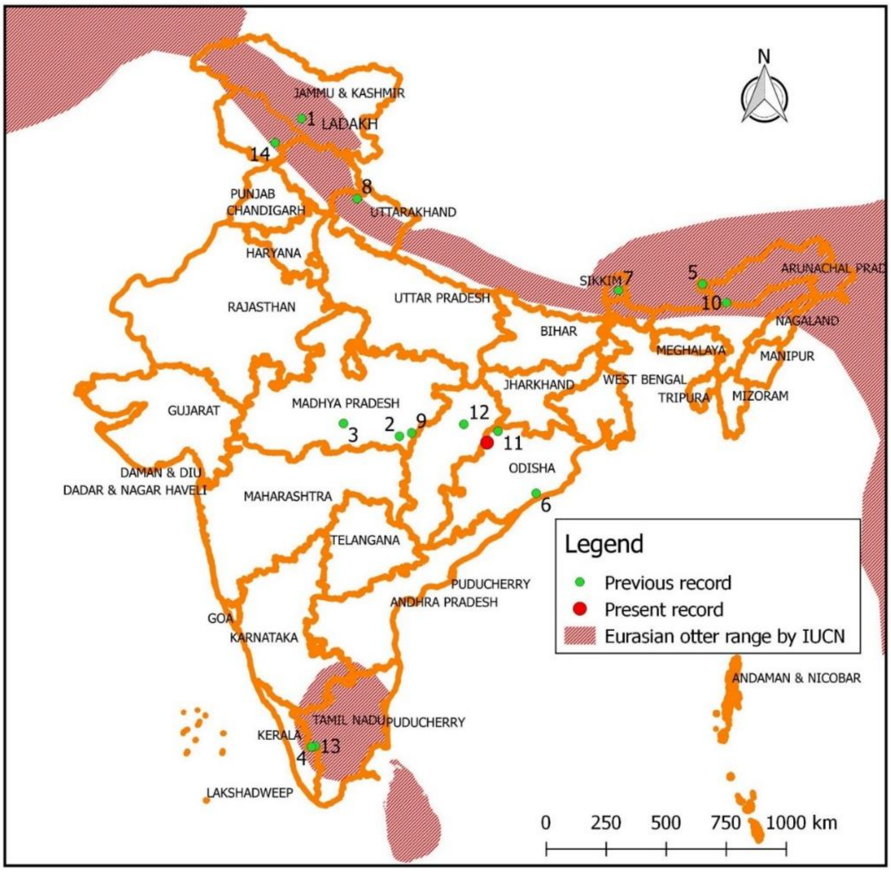

Figure 1. Map showing the recent records of Eurasian otter (*Lutra lutra*) in India (numbers refer to Table 1)

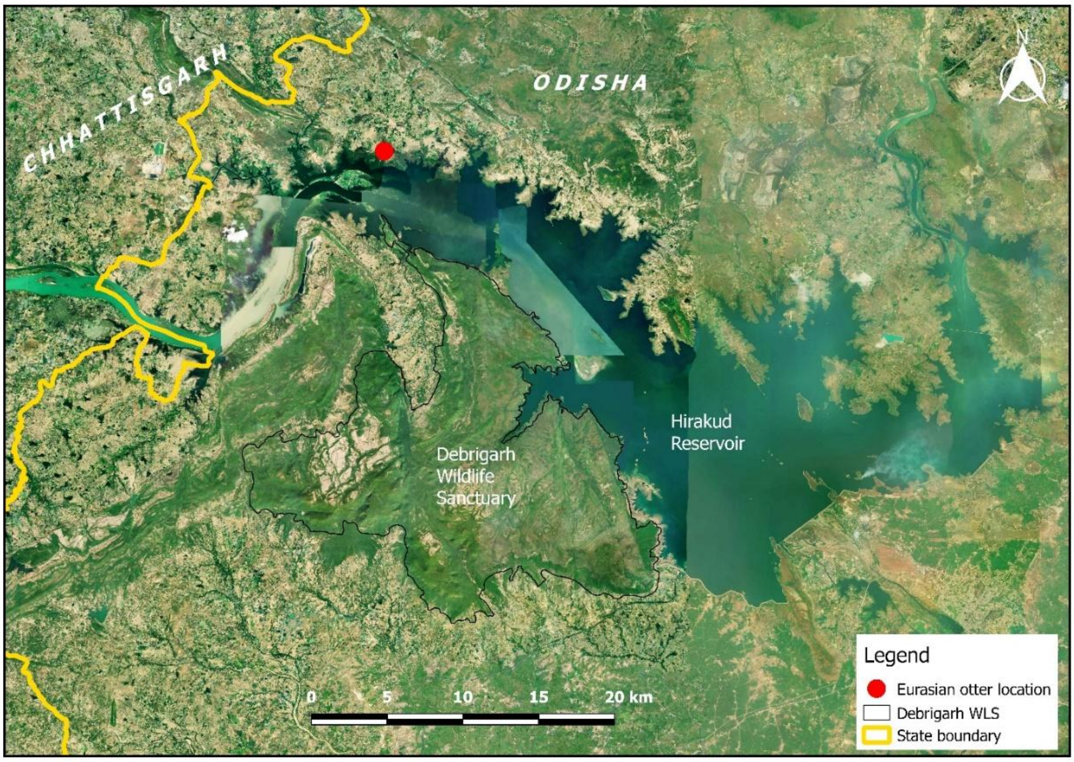

Figure 2. Map showing the Hirakud Reservoir and Eurasian otter (Lutra lutra) rescued location in Odisha, India

Figure 3. Rescued individual of Eurasian otter (*Lutra lutra*) near Hirakud reservoir, Odisha, India

Systematic surveys are required to monitor the status and distribution of the Eurasian otter population and any other otter species in the Hirakud reservoir. This will provide valuable information for the management of interventions and targeted conservation actions. The recent increase in the occurrence of Eurasian otters in various parts of Odisha and India is concerning, and there is a need for awareness-raising programs, particularly for the local communities and forest departments, who may occasionally identify the species.

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RÉSUMÉ: PRÉSENCE DE LA LOUTRE EURASIENNE (*Lutra lutra*) DANS LE RÉSERVOIR D'HIRAKUD EN INDE: UN SITE RAMSAR ET UN DES PLUS LONGS BARRAGES EN TERRE DU MONDE

La loutre eurasienne (*Lutra lutra*) est un prédateur au sommet des écosystèmes aquatiques. L'espèce se rencontre dans l'Himalaya, le long de la partie nord de l'Inde, s'étendant du nord-ouest au nord-est, ainsi que dans les Ghâts occidentaux et le centre de l'Inde. En raison d'un manque d'informations détaillées sur sa biologie, la loutre eurasienne est considérée comme l'une des espèces les moins connues en Inde. Nous signalons la présence de la loutre eurasienne dans le réservoir d'Hirakud à Odisha, en Inde. Des recherches, un suivi et des campagnes de sensibilisation supplémentaires auprès des acteurs locaux sont nécessaires afin de concevoir des stratégies de conservation efficaces pour l'espèce.

RESUMEN: OCURRENCIA DE LA NUTRIA EURASIÁTICA (*Lutra lutra*) EN EL RESERVORIO HIRAKUD, INDIA: UN SITIO RAMSAR Y UNA DE LAS REPRESAS DE TIERRA MÁS LARGAS DEL MUNDO

La nutria Eurasiática (*Lutra lutra*) es un predador tope en los ecosistemas acuáticos. La especie se encuentra en los Himalayas, a lo largo de la porción norte de India, extendiéndose de noroeste a noreste, así como en los Ghats Occidentales y en India Central. Debido a la falta de información detallada sobre su biología, la nutria Eurasiática es considerada una de las especies menos conocidas de la India. Informamos de la ocurrencia de nutria Eurasiática en el reservorio Hirakud de Odisha, India. Son necesarias ulteriores investigaciones, monitoreo, y campañas de concientización de los actores locales, para diseñar estrategias efectivas de conservación de la especie.

ସାରାାଂଶ:

ହିରାକୁଦ ଜଳାଶୟରେ ୟୁରାସିଆନ ଓଧର (*ଲୁଟ୍ରା ଲୁଟ୍ରା*) ଉପସ୍ଥିତି: ଯାହାକି ଏକ ରାମସାର ସ୍ଥଳ ଏବଂ ବିଶ୍ୱର ଏକ ଦୀର୍ଘତମ ମୃତ୍ତିକା ବନ୍ଧ

ୟୁରାସିଆନ ଓଧ (ଲୁଟ୍ରା ଲୁଟ୍ରା) ଜଳଜୀବ ପରିସଂସ୍ଥାର ଏକ ପ୍ରମୁଖ ଶିକାରୀ ଅଟେ। ଏହି ପ୍ରଜାତି ଭାରତର ଉତ୍ତର ଅଞ୍ଚଳରେ ହିମାଳୟ ପର୍ବତମାଳାରେ, ଉତ୍ତର ପଶ୍ଚିମରୁ ଆରମ୍ଭ କରି ଉତ୍ତର ପୂର୍ବ ଅଞ୍ଚଳ ପର୍ଯ୍ୟନ୍ତ ଏବଂ ଏହା ସହିତ ପଶ୍ଚିମଘାଟ ପର୍ବତମାଳା ଏବଂ ମଧ୍ୟ-ଭାରତରେ ମିଳେ। ଏହାର ଜୀବବିଜ୍ଞାନ ସମ୍ବନ୍ଧୀୟ ସୂଚନାର ଅଭାବ ହେତୁ, ୟୁରାସିଆନ ଓଧ ଭାରତର ସବୁଠାରୁ କମ୍ ଜଣା ଯାଇଥିବା ପ୍ରଜାତିଗୁଡ଼ିକ ମଧ୍ୟରୁ ଗଣାଯାଏ। ଆମେ ଓଡ଼ିଶାର ହିରାକୁଦ୍ ଜଳାଶୟରେ ଏଉରେସିଆନ୍ ଓଟର୍ର ସନ୍ନିହିତ ରହିବାର ସୂଚନା ଦେଇଛୁ। ପ୍ରଜାତିର ପ୍ରତିରକ୍ଷା ଯୋଜନା ଆକାର ଦେବା ପାଇଁ ଅଧିକ ଗବେଷଣା, ନିରୀକ୍ଷଣ ଏବଂ ସ୍ଥାନୀୟ ହିତଧାରୀମାନଙ୍କ ପାଇଁ ସଚେତନତା ଅଭିଯାନ ଆବଶ୍ୟକ।

R E P O R T

THE PRESENCE AND RELATIVE ABUNDANCE OF OTTERS (CARNIVORA: MUSTELIDAE) IN NORTHERN NAMIBIA

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Abstract: Four species of otter (Carnivora: Mustelidae) occur in Africa, of which the African clawless otter (*Aonyx capensis*) and spotted-necked otter (*Hydrictis maculicollis*) are known to occur in Namibia, although very little is known about their biology and distribution. Both species are listed as Near Threatened by the IUCN Red List of Threatened Species because of a reported decline in their numbers. The presence of the species in the Kunene and Okavango rivers was determined by recording local community sightings of the African clawless and spotted-necked otters, as well as signs (footprints and latrines). In addition, 40 camera traps were deployed along the banks of the Okavango River within the Bwabwata National Park in the winter of 2022, collecting data for a total of 967 camera days. Based on this, a relative abundance index (RAI) of 0.3 for African clawless otters was calculated. The RAI for the Okavango River was the lowest compared with similar studies conducted at six other natural areas in Southern Africa. There is an evident need for conservation of wetlands and restoration of water quality in the region. Furthermore, more expansive studies on the taxonomy, distribution, diet, and population density of otters that occur in all northern perennial rivers of Namibia are recommended as the most important steps towards ensuring the future of otters in Namibia.

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Keywords: African clawless otter, Spotted-necked otter, Habitat degradation, Near Threatened Species

INTRODUCTION

Four species of otters are known to occur in Africa: the Eurasian otter (*Lutra lutra*), spotted-necked otter (*Hydrictis maculicollis*), the African clawless otter (*Aonyx capensis*), and the Congo clawless otter (*Aonyx congicus*) (Jacques et al., 2009). Otters occur in an array of environments and aquatic habitats, from freshwater lakes to marine shorelines and surprisingly in episodic rivers in arid areas, provided that freshwater sources are fit for consumption and sufficient food is available. African otters are semi-aquatic predators that prey primarily on aquatic species such as fish, frogs, and crabs, as well as some insects and other taxa (Butler and Du Toit, 1994; Nel and Somers, 2007; Jordaan et al., 2015). Perrin and Carugati (2000) stated that the otters observed in the

Drakensberg mountains of KwaZulu-Natal preferred undisturbed areas with rock cover and dense natural vegetation.

Knowledge of the distribution of African otters is attained from museum specimens, sightings (not always reliable where two or more species are sympatric), and signs, e.g., distinctive tracks and spraints (faeces), or from diaries and expedition reports of earlier travellers (Nel and Somers, 2007). African clawless and spotted-necked otters are known to occur in Namibia, although very little is known about their biology and distribution. The International Union for Conservation of Nature (IUCN) Red List (Jacques et al., 2021; Reed-Smith et al., 2021) indicates the status of African clawless and spotted neck otters to be near threatened due to a decline in their numbers. This decline is primarily due to habitat loss and destruction, mainly from unsustainable agricultural land expansion, invasive species, pollution (Reed-Smith et al., 2021), and a continent-wide decrease in river water quality (Jacques et al., 2021). Human activities (e.g., fishing, cutting of reeds, domestic use of water, possible water pollution) along the northern rivers of Namibia are also a cause for concern.

In this study we aim to assess the presence of otters in the northern perennial rivers of Namibia, and to determine the relative abundance of otters occurring along the Okavango River in Namibia.

MATERIALS AND METHODS

Study Area

The study was conducted along the Kunene and Okavango rivers in northern Namibia. The Kunene (or 'Cunene') River is 1,050 km long with a basin area of 106,560 km² flowing from west central Angola to the border with Namibia, where it then flows west along the border until it reaches the Atlantic Ocean (Midgley, 1966). It is one of the few perennial rivers in the region. The Okavango (or 'Cubango') River is 1,700 km long with a basin area of 530,000 km² in southern Africa (Mendelsohn and El Obeid, 2004). It is the fourth-longest river system in southern Africa, running south-eastward for 1,600 km from central Angola to the Kalahari Desert in northern Botswana (Mendelsohn and el Obeid, 2004).

Data Collection

We used several approaches to obtain data on the presence and relative abundance of otters. Surveys for otter signs, especially observation and sampling of spraints, were conducted at different locations along the Kunene and Okavango riverbanks. The Okavango River was selected for determining the relative abundance of otters because of the high density of people living near the river (Mendelsohn and el Obeid, 2004; Kgathi et al, 2006).

Searches for signs of otter presence (e.g., latrines, spoor or holts) were undertaken along the Kunene and Okavango rivers, Namibia during the following times: 12 to 14 January 2022; 20 to 24 March 2022; and 21 to 31 July 2022. Two people used a four-wheel drive vehicle to travel up a road near the river until an accessible path to the river was found. When an accessible path to the river was found, a set distance of 400 m was walked along the riverbank to collect spraints and search for any otter sign. This was done within 10 m of the water's edge. Otter spraints were identified according to their shape, size, content, and characteristic odour (Somers and Nel, 2003).

In addition to sign surveys, we interviewed several community members on an opportunistic basis and recorded their reported sightings of otters. We also consulted iNaturalist (https://www.inaturalist.org/) and accessed logged records of otter and otter sign sightings in the study area (accessed on 21 August 2023).

Furthermore, we determined the relative abundance of otters in an area with confirmed otter presence. We set up 40 camera traps (Panthera PoacherCam (n = 20), Primos Proof Cam03 (n=10), and Browning Dark Ops (n=10) along the Okavango River in the Bwabwata National Park (Buffalo and Mahango Core Areas) from 16 July to 20 August 2022.

Camera traps were positioned within 15 m of the water's edge in areas considered to be accessible to otters (i.e. where the slope of the riverbank was accessible). Care was taken to avoid placing camera traps close to any latrines to approximate random probabilities of encounters and make our results comparable to previously recorded estimates of otter abundance (see Majelantle et al. 2021 and Lewis 2021). Whilst they generally faced in the direction of the water, camera traps were specifically positioned to record animals passing along terrestrial areas adjacent to the water's edge at each site. Accordingly, we did not avoid animal paths, but rather preferentially aimed camera traps at areas considered likely to be used for terrestrial movement. Only locations where the slope of the riverbank was accessible to the field team were considered. Camera traps were placed at least 100 m apart, with most of the cameras mounted on trees, while the rest were mounted on wooden stakes at average heights of 50 cm (max. 100 cm) and tilted slightly downwards. Camera traps were set to record a burst of four images when triggered, with the minimum delay between trigger events set to 10 s. All camera trap images were processed manually. When an otter was identified in an image, the study site, camera station, date, time, and group size were recorded.

Following Lewis (2021), a relative abundance index (RAI) for African clawless otters was calculated using the following equation:

$$\text{RAIspa} = \left(\frac{events * 100\ camera\ trap\ nights}{sampling\ effort}\right)$$

where RAIspa = relative abundance index for species 'a'; events = number of independent records per species; 100 camera trap nights = unit of standardisation to compare data with other studies; sampling effort = total number of nights that the camera trap stations were working (Arroyo-Arce et al., 2017).

RESULTS

The Presence of Otters

We recorded no signs of otter during the surveys along the Kunene River in the Kunene Region, Namibia. Excluding the camera trapping survey, we recorded 16 presence records of African clawless otters in the study region (iNaturalist=12, Community member reports=4) and 20 of spotted-necked otters (iNaturalist=10, Community member reports=9; Observation during survey=1) (Fig. 2). All spotted-necked otter reports were along the Okavango River, and no spotted-necked otter reports were found along the Kunene River, whereas African clawless otter reports were recorded from both river systems.

Both African clawless and Spotted-necked otters have been reported as present by the community as well as by iNaturalist contributors in the Okavango Region (Fig. 1). The dates of the Spotted-necked otter signs and sightings on the iNaturalist website in the Okavango region are between the years 2015 to 2023, whereas those for the African clawless otter are between the years 2017 to 2023.

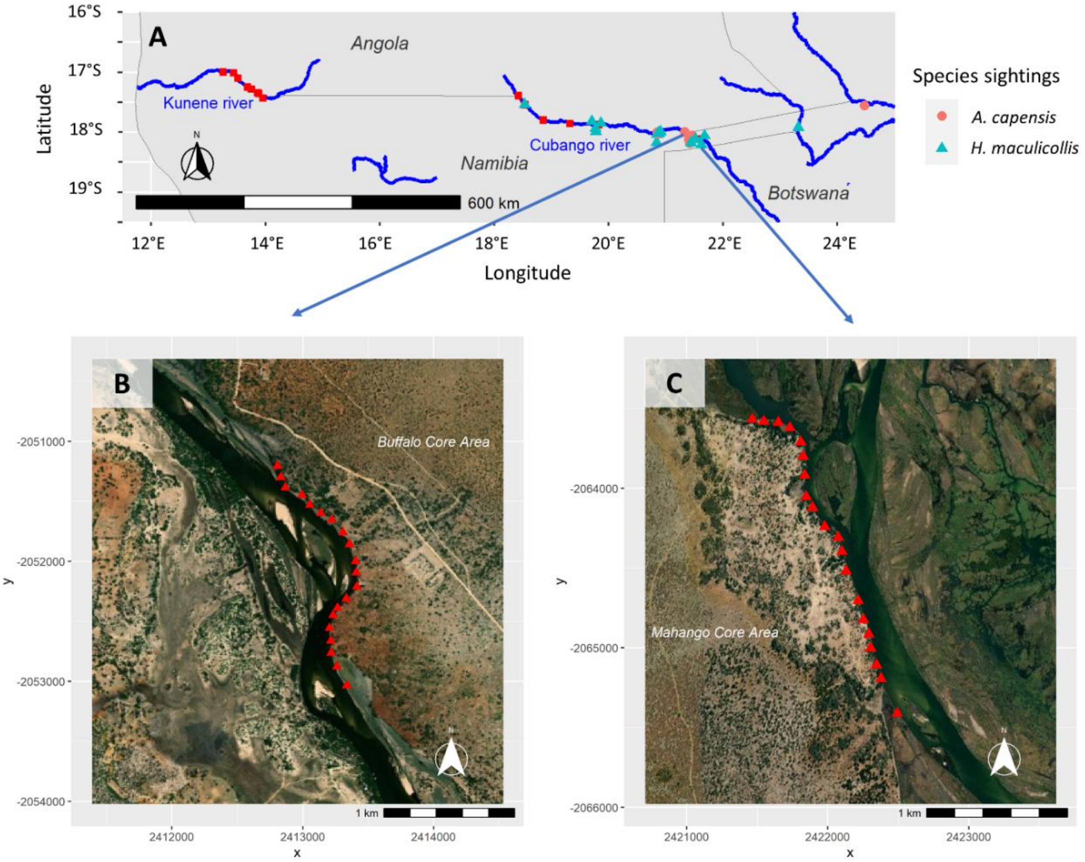

Figure 1. (A) Survey sites (red squares) and species-specific community sightings reported on iNaturalist. Locations where camera traps were placed along the Okavango (Cubango) River in the Bwabwata National Park are illistrated for the (B) Buffalo Core Area, and (C) Mahango Core Area.

The 40 camera traps recorded a total of 42,256 images. Three African clawless otter encounters were photographed (see Fig. 2). No spotted-necked otters were photographed. This resulted in a calculated RAI of 0.31 for African clawless otters in Bwabwata National Park.

Figure 2. Image of an African clawless otter captured by one of the camera traps in 2022.

DISCUSSION

According to a tour guide at Epupa River Lodge, Kunene Region (Kamburu, *pers. comm*, 2022), otters were last spotted in year 2020 in that area. Other local inhabitants claim to not have seen any otter during the previous decade. Furthermore, there are no recorded signs or sightings of either otter on iNaturalist for the Kunene Region. During the survey, extensive human activity was evident along and near the Kunene River, whereby people had cleared areas to make space for gardening, burning down of palm trees to keep monkeys and baboons away, and cutting down vegetation that was good for otters to hide in. Given the requirement of otters for adequate vegetation in floodplains and lacustrine habitats in the form of long grass, reeds, dense bushes, overhanging trees, and large boulder piles (Reed-Smith et al., 2021), such habitat destruction may have had a strong negative impact on the likelihood of otters using the area.

While both species are present in the Okavango region, the RAI (0.31) of African clawless otters in the Bwabwata National Park is low. Lewis (2021) reported RAI values obtained from a similar camera-trapping approach for six other study sites in southern Africa; these values ranged between 1.27 and 5.19 otters per 100 days of camera trapping effort. Such low densities of otters in our study area are seemingly further supported by the recent report of the National Geographic Okavango Wilderness Project (NGOWP) (2021), which indicated that the team observed only five spotted-necked otters when they travelled the length of 487 km over 17 days of the Okavango River from Angola to Botswana. No other otter species were recorded in that report (NGOWP, 2021).

Five of the study sites surveyed by Lewis (2021) are nature reserves and one is a wildlife ranch with little direct anthropogenic disturbance. These sites represent natural systems with potential otter predators, including African rock pythons (*Python sebae*), aerial predators such as fish eagles (*Icthyophaga vocifer*), and sometimes other large carnivores such as leopards (*Panthera pardus*) (Lewis, 2021). However, Nile crocodiles (*Crocodylus niloticus*) and hippopotamus (*Hippoputamus amphibius*) are notably absent from these sites. In contrast, the Okavango River is inhabited by abundant populations of both crocodiles and hippopotamuses (Aust et al., 2009). Given that predators such as crocodiles, pythons, large carnivores, domestic dogs, and fish eagles prey on the African clawless and spotted-necked otters (Reed-Smith et al., 2021), we speculate that the high abundance of crocodiles in the Okavango River could be one reason for the low relative abundance. Furthermore, the fear of the landscape with higher predator abundance can effectively alter the space use patterns of otters in their area, making the results obtained less comparable with those of the six study sites (Lewis, 2021) that do not have these predators.

Spotted-necked otters were not captured by any of the camera traps used in the present study, but one individual was observed swimming near the Shametu Lodge, Okavango River, next to the reeds on 21 July 2022. The lack of camera trap records of spotted-necked otters could be due to their movements being highly localised and restricted to areas around the lodges and not venturing to areas that are more open because of fear of predators (there are reeds around the lodges). Furthermore, spotted-necked otters are considered to be more aquatic than African clawless otters, potentially limiting their interaction with shore-based camera traps (Perrin and Carugati, 2000).

Fisherman– otter conflict could also contribute to the low relative abundance of otters. In many African countries where fishing and small-scale fisheries (using natural fish stocks) are common, communities depend on fish as a source of protein and/or financial income (Chan et al., 2019). Local communities are in permanent conflict with fish predators such as crocodiles and otters because of their dependency on fish (Akpona et al., 2015). Because the spotted-necked otter is an opportunistic feeder (Jordaan et al. 2020) and their social organisation may be variable, leading to territoriality (Reed-Smith et al. 2014), the minimum area needed to support a viable population is likely to depend on the availability of food resources. The availability of prey is vital because it affects factors such as population density, length and success of the breeding period, carrying capacity, time spent feeding in different patches, and mortality (Akpona et al., 2015). However, local communities also depend on food resource accessibility within the waterways for their subsistence, and this is typically the principal cause of conflict between fishermen and otters (Akpona et al., 2015). With the increase in local population and natural habitat degradation, the capacity of fishermen to obtain a reasonable harvest has been reduced (Akpona et al., 2015). Under such circumstances, it becomes difficult for local communities to tolerate otter damage to their nets as well as predation on the fish. Therefore, they may hunt and kill otters. The greatest cost of otter predation is equipment damage rather than the fish loss. In a single feeding bout, one otter can take fish from (and in this way harm) numerous lines and nets (Akpona et al., 2015).

Changes in top predator populations are usually the first noticeable indication of habitat deterioration (Kubheka et al., 2013). Otters may, therefore, be considered useful indicators of the health of the wetlands that they inhabit (Butler, 1994). Therefore, the relatively low otter abundance in the Okavango River and clear absence in the Kunene River can be an indication of habitat deterioration in the area. There is therefore an urgent need for further assessment of potential drivers of otter presence and abundance in the northern rivers of Namibia, and elsewhere in Africa.

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Research Ethics/Best practice - *This research was conducted in the protected areas with proper permission obtained from the NCRST and the Bwabwata National Park (MEFT) given to the team via permit number: AN202203002. Ethical clearance was obtained from the University of Namibia via the number: SOS-0041. We adopted a non-invasive technique (field survey and camera trapping) to collect the data, and no animals were harmed or handled during this study.*

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RÉSUMÉ: PRÉSENCE ET ABONDANCE RELATIVE DES LOUTRES (CARNIVORA : MUSTELIDAE) DANS LE NORD DE LA NAMIBIE

Quatre espèces de loutres (Carnivora : Mustelidae) sont répertoriées en Afrique, dont la loutre à joues blanches (Aonyx capensis) et la loutre à cou tacheté (Hydrictis maculicollis) qui sont présentes en Namibie, bien que l'on ait peu d'informations sur leur biologie et leur répartition. Les deux espèces sont classées comme quasi menacées sur la Liste rouge des espèces menacées de l'UICN en raison d'un déclin recensé de leur nombre. La présence de l'espèce dans les rivières Kunene et Okavango a été évaluée par la collecte des observations des communautés locales de loutres à joues blanches et à cou tacheté, ainsi que des indices de présence (traces de pas et latrines). De plus, 40 pièges photographiques ont été installés le long des berges de la rivière Okavango dans le parc national de Bwabwata durant l'hiver 2022. Ce dispositif a permis de collecter des données pour un total de 967 jours de caméra. Sur cette base, un Indice d'Abondance Relative (IAR) de 0,3 a été calculé pour les loutres à joues blanches. L'indice IAR pour le fleuve Okavango était le plus bas par rapport à des études similaires menées dans six autres zones naturelles d'Afrique australe. Il est évident qu'il est nécessaire de conserver les zones humides et de restaurer la qualité de l'eau dans la région. En outre, nous recommandons des études plus approfondies sur la taxonomie, la distribution, le régime alimentaire et la densité des populations de loutres présentes dans tous les fleuves pérennes du nord de la Namibie. Elles constituent les mesures les mieux adaptées afin d'assurer l'avenir des loutres en Namibie.

RESUMEN: PRESENCIA Y ABUNDANCIA RELATIVA DE NUTRIAS (CARNIVORA: MUSTELIDAE) EN NAMIBIA DEL NORTE

En África viven cuatro especies de nutria (Carnivora: Mustelidae), de las cuales la nutria sin uñas Africana (*Aonyx capensis*) y la nutria de cuello manchado (*Hydrictis maculicollis*) se sabe que ocurren en Namibia, aunque se conoce muy poco sobre su biología y distribución. Ambas especies están listadas como Casi Amenazadas por la Lista Roja de Especies Amenazadas de UICN, debido a que se ha informado una declinación de sus números. Determinamos la presencia de la especie en los ríos Kunene y Okavango, registrando avistamientos de las nutrias sin uñas Africana y la de cuello manchado, realizados por la comunidad, así como signos (huellas y letrinas). Adicionalmente, desplegamos 4 cámaras-trampa a lo largo de las barrancas del Río Okavango en el Parque Nacional Bwabwata, en el invierno de 2022, obteniendo datos de un total de 967 días-cámara. En base a esto, calculamos un índice de abundancia relativa (RAI en el texto en inglés) de 0.3 para la nutria sin uñas Africana. El RAI para el Río Okavango fue el más bajo comparado con estudios similares conducidos en otras seis áreas naturales en Sudáfrica. Hay una necesidad evidente de conservación de los humedales y de restauración de la calidad del agua en la región. Adicionalmente, se recomienda la realización de estudios más expansivos de la taxonomía, distribución, dieta, y densidad poblacional de las nutrias que viven en todos los ríos perennes del norte de Namibia, como pasos importantes para asegurar el futuro de las nutrias en Namibia.

R E P O R T

THE TRADE IN EURASIAN OTTER *Lutra lutra* IN NORTH KOREA

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Abstract: Exploitation for the purpose of trade is considered an important threat to all Asian otter species. To date, there has been limited information available regarding the use and trade of Eurasian otter (*Lutra lutra*) in the Democratic People's Republic of Korea (DPRK, or North Korea). This study provides the first assessment of otter trade in North Korea. Surveys with North Korean defectors revealed that despite hunting of the species having been banned in North Korea since 1959 and the species being listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Eurasian otters are opportunistically taken by North Korean hunters for illegal wildlife trade with buyers in the People's Republic of China (China). Otter skins are reported to command a high price, compared to those of other furbearers, in black market trade. Eurasian otters are also reported to be farmed for their fur by the North Korean state for international trade to China, and potentially for domestic use. We caution that reported trade may breach China's CITES commitments and should be addressed as a matter of priority.

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Keywords: Democratic People's Republic of Korea (DPRK), Wildlife farming, Illegal wildlife trade, Skin trade, China, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

INTRODUCTION

The Korean Peninsula is part of the native range of the Eurasian otter (*Lutra lutra*). The Eurasian otter is listed as Near Threatened by the *IUCN Red List of Threatened Species* (Loy et al., 2022), and has been classified as an endangered species in the Republic of Korea (ROK, or South Korea) since 1998 (Jo et al., 2018). In the Democratic People's Republic of Korea (DPRK, or North Korea), the hunting of Eurasian otters has officially been banned since 1959, with the species protected as a Natural Monument - a protected status granted to certain Korean natural resources, including some wild animals and plants (Jo et al., 2018). The Eurasian otter is also listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which prohibits all commercial trade in the species by Parties to the convention.

One of the main threats to otter populations in Asia is thought to be harvesting of animals for the purpose of trade (Duckworth and Hills, 2008; Shepherd and Nijman, 2014; Duplaix and Savage, 2018; Gomez et al., 2019), either as live animals for the pet trade (Siriwat and Nijman, 2018), skins for clothing, meat for human food, or body parts for traditional medicine (Gomez and Shepherd, 2019). Despite its protected status, the Eurasian otter is one of the species which continue to be traded illegally (Gomez et al., 2016).

Basnet et al. (2020) highlight the need for further investigation, monitoring and reporting of illegal trade and demand for otters, including the sources of traded animals. However, in their assessment of research effort pertaining to otters in Asia, they recorded no scientific publications on any aspect of the ecology, management, or conservation of otters in North Korea; in contrast, South Korea recorded the second highest number of such studies in Asia (Basnet et al., 2020).

Historical records from Joseon dynasty Korea (1392-1897) (Powell et al., 2021) show that the provision of high-quality otter fur was one of the valuable commodities historically submitted as tributary trade to China (see, for example, Sejongsilok, 1428a; Sejongsilok, 1428b; Sejongsilok, 1429; Munjongsilok, 1451; Sejosilok, 1460), with the species sometimes recorded alongside skins of tiger (*Panthera tigris*) and leopard (*P. pardus*) (Injosilok, 1639). By the mid-15th century, growing demand for otter fur among the Korean ruling classes led to the acquisition of otter skins both from domestic hunting and trade with the Jurchen tribes along Korea's northern border (Kim, 2011). However, not all skin trade was conducted through official channels. With the opening of trade routes with Qing dynasty China (1636–1912), Korean merchants purchased large quantities of otter skins from local hunters and then exported them to China (Yoo, 1997).

Continued harvesting for trade into the 20th century is known to have put further pressure on Korean otter populations (Jo et al., 2018). In South Korea, where otter fur had been regarded as an expensive material in the production of clothing (Jo et al., 2018), the Eurasian otter received protection through designation as Natural Monument No. 330 in 1982 and as a first-class endangered species in 1998, with prohibitions on capturing or taking from the wild. There is no longer considered to be any substantial demand for otter skins in South Korea (Jo et al., 2018). The Eurasian otter was also designated as a Natural Monument in North Korea and the 16th February 1959 Presidential Decree *About protecting and multiplying useful animals and plants* banned hunting of the species. However, information on implementation is scarce.

MATERIALS AND METHODS

In order to investigate wildlife trade in Eurasian otter alongside other carnivorans in North Korea, we interviewed 42 North Korean defectors in the UK and South Korea in 2021-2022. All participants were over the age of 18 and were former North Korean residents, but otherwise had a range of individual backgrounds and experiences, including as hunters, wildlife trade middlemen and buyers, veterinarians, and soldiers. Informed written consent was obtained following explanation of the nature of the study and research methodology (for further details, see, Elves-Powell et al., 2024). Interviews used a series of open-ended questions, pertaining to use and trade of wildlife (not specifically focal species). All interviews and the data collected were anonymous and recorded at a province level only, in order to protect the identity of participants and any family members still in North Korea.

RESULTS

Despite the Eurasian otter's protection under North Korean law, trade in Eurasian otter was reported by 9 participants in our study (21.4% of participants), including individuals with firsthand experience of illegal wildlife trade in North Korea, either as hunters or middlemen. Trade in otter skins, bodies and blood was reported (Fig. 1), with the People's Republic of China (China) identified as an important destination. The most recent report was from 2018, a case of attempted trade with China, and we suspect that trade is likely ongoing.

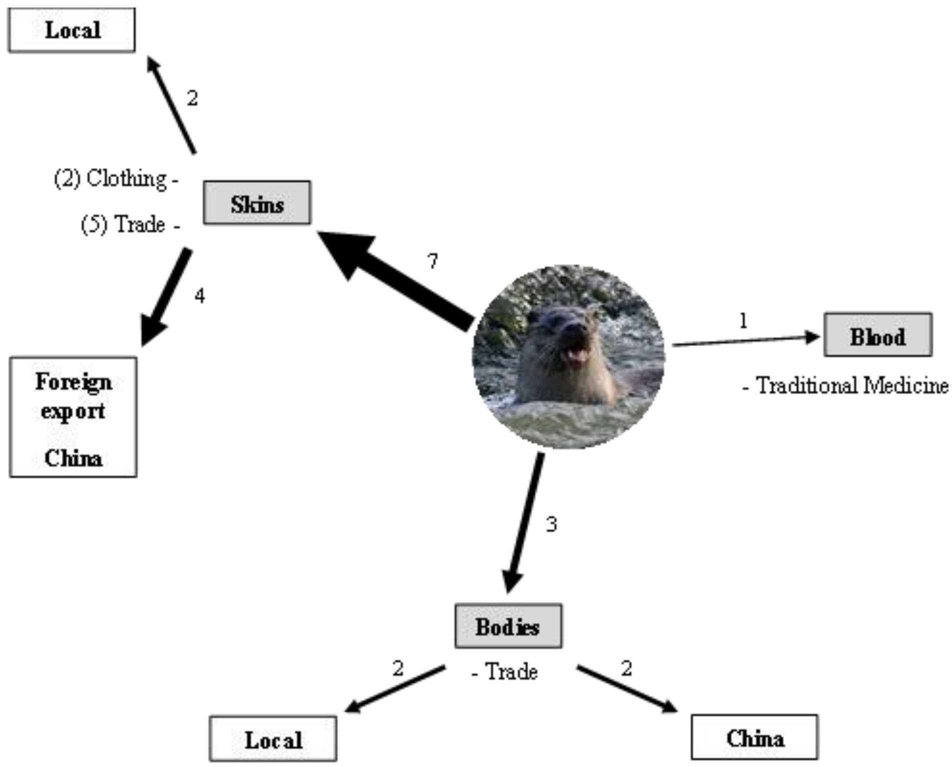

Figure 1. Eurasian otter (*Lutra lutra*) trade in North Korea, by products, use and destination, as reported by North Korean defectors. Weight of arrow and value corresponds to number of participants who mentioned (multiple answers allowed).

Eurasian otter was reportedly highly valued, with three participants who were familiar with black-market wildlife trade in North Korea noting that the species was more valuable than Siberian weasel (*Mustela sibirica*), a reported staple of North Korean skin trade. Indeed, the only other important furbearers considered to be more valuable were martens (*Martes* spp.). Participants reported that due to the high prices commanded by otter skins, they were used for international trade. Three different processes were identified by which otter skins and bodies would enter trade. In the first, hunters who captured otters in the wild would prepare skins and submit them to the North Korean state. It was not specifically stated who would be the recipient of these skins, but we note that government agencies involved in skin trade are known to exist in North Korea (Elves-Powell et al., *in press*). Alternatively, a wild animal would be captured alive, transported to an otter farm and reared, with otters then being subsequently traded to China. It was difficult to obtain information on otter farms in North Korea, which may be explained by the suggestion from one participant that the North Korean military was involved in their management. For example, it is not clear whether otters were actually bred at these sites, or whether wild-harvested animals were simply housed and reared there, a common concern regarding wildlife farms holding small carnivores (Elves-Powell et al., 2023). Finally, a hunter who had harvested an otter and wanted to privately sell it to China, could either directly sell the whole animal to cross-border smugglers, or ask a North Korean middleman to find a buyer. The porosity of the North Korea-China border to wildlife trade is illustrated by the observation that in one such case, the otter was returned to North Korea, because the buyer in China wanted a live animal rather than a body.

Domestic use of otter skins for clothing (for example, otter fur mufflers) was reported to have been popular in the past, but to have since declined. It was noted that relatively few households in North Korea would now have access to otter-derived products (the North Korean economy collapsed in the 1990s, resulting in severe economic hardship for the majority of the country's citizens) and these would be available only to those who personally knew hunters. Participants contrasted this to otter skins and bodies being widely sold to China.

DISCUSSION

The reported persistence of North Korean trade in Eurasian otter into the 21st century raises several important concerns. Legal protections for otters in North Korea are clearly not being implemented effectively, and all three identified processes by which otter body parts enter trade chains in North Korea likely involve some illegal activity. Black market trade in otter skins is, by its nature, unregulated and therefore potentially vulnerable to unsustainable harvesting practices. Perhaps of even greater concern is the North Korean state's apparent participation in Eurasian otter trade. Reported trade to China would be illegal under international law, as it concerns commercial, international trade in a CITES Appendix I species, which China is a Party to. The reported submission of otter skins by North Korean hunters to the North Korean state, and the suspected stocking of state-owned otter farms with wild animals, strongly suggests that official prohibition of the taking of wild Eurasian otters in North Korea is ignored by the state itself.

It is difficult to assess the impact of this trade, because there is little reliable information on Eurasian otter populations in North Korea (Jo et al., 2018). Similarly, quantifying volumes of trade is almost impossible. Even in contexts where government data on illegal trade is available, which is not the case for North Korea, gauging how this relates to actual levels of trade presents a substantial challenge (see, for example, Gomez et al., 2016). However, one participant in our study provided an assessment of changes they had observed: they reported that they saw Eurasian otters throughout their time in North Korea, up until when they left the country in 2014, but that the frequency of observation had decreased over time. The participant was of the belief that the otter population had declined because of harvesting and trade in otter skins, which they specifically linked to high demand from China.

Demand for otter skins and other body parts in China has been highlighted by previous studies (Lau et al., 2010; Gomez et al., 2016; Zhang et al., 2018) and Eurasian otter populations in the country's northeast are known to have declined heavily (Zhang et al., 2016), including in Changbaishan Nature Reserve, which borders North Korea (Piao et al., 2011). Otter skins linked to cross-border smuggling - originating from, or transiting through, India, Nepal, Bhutan or Myanmar (Burma) - have previously been seized by law enforcement authorities in China, including in consignments with Asian big cat skins (Gomez et al., 2016). However, we are not aware of any seizures having been made in China of otters, otter body parts, or derived products linked to North Korea, and no such records could be found on the TRAFFIC Wildlife Trade Portal (https://www.wildlifetradeportal.org/), Environmental Investigation Agency (EIA) Global Environmental Crime Tracker (https://eia-international.org/gect), or CITES Trade Database (https://trade.cites.org/).

We urge the North Korean state to cease involvement in the trade of otters and the stocking of otter farms with wild animals. We appeal to China to address the illegal import of Eurasian otter skins from North Korea and so fulfil its CITES commitments. Finally, we recommend that conservationists seeking to engage with otter conservation in North Korea at the current time do so with caution and conscious of important obstacles to collaboration, ongoing international sanctions, and Pyongyang's apparent willingness to engage in a wide variety of illicit trades to generate income (Kirby et al., 2014; Wang and Blancke, 2015).

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RÉSUMÉ: LE COMMERCE DE LA LOUTRE D'EURASIENNE *Lutra lutra* EN CORÉE DU NORD

L'exploitation à des fins commerciales est considérée comme une menace importante pour toutes les espèces de loutres d'Asie. À ce jour, les informations disponibles concernant l'utilisation et le commerce de la loutre eurasienne (*Lutra lutra*) en République Populaire Démocratique de Corée (RPDC ou Corée du Nord) sont peu nombreuses. Cette étude fournit la première évaluation du commerce de la loutre eurasienne en Corée du Nord. Des enquêtes auprès de déserteurs nord-coréens ont révélé que, bien que la chasse de l'espèce soit interdite en Corée du Nord depuis 1959 et que l'espèce soit inscrite à l'Annexe I de la Convention sur le commerce international des espèces de faune et de flore sauvages menacées d'extinction (CITES), les loutres eurasiennes sont capturées de manière opportuniste par des chasseurs nord-coréens pour le commerce illégal d'espèces sauvages pour des acheteurs de République populaire de Chine (Chine). Les peaux de loutres se vendraient à un prix élevé, par rapport à celles des autres animaux à fourrure, sur le marché noir. Les loutres eurasiennes seraient également élevées pour leur fourrure par l'État nord-coréen en vue d'un commerce international destiné à la Chine, et potentiellement à usage domestique.

Nous tenons à mettre en évidence le fait que le commerce signalé peut enfreindre les engagements de la Chine envers la CITES et devrait être traité en priorité.

RESUMEN: EL COMERCIO DE NUTRIA EURASIÁTICA *Lutra lutra* EN COREA DEL NORTE

La explotación con fines comerciales es considerada una amenaza importante para todas las especies de nutria de Asia. Hasta la fecha, ha habido disponible limitada información respecto al uso y comercio de la nutria Eurasiática (*Lutra lutra*) en la República Popular Democrática de Corea (DPRK, o Corea del Norte). Este estudio proporciona la primer evaluación del comercio de nutrias en Corea del Norte. Encuestas realizadas a desertores de Corea del Norte revelan que a pesar de que la caza de la especie se prohíbe en Corea del Norte desde 1959, y de que la especie está incluida en el Apéndice I de la Convención sobre el Comercio Internacional en Especies Amenazadas de Fauna y Flora Silvestre (CITES), en forma oportunística se cazan nutrias Eurasiáticas por parte de cazadores de Corea del Norte, para comercio ilegal con compradores en la República Popular China (China). Se informa que las pieles de nutria alcanzan un precio elevado en el mercado negro, en comparación con las de otras especies peleteras. También hay informaciones de que se crían nutrias Eurasiáticas por su piel, por parte del estado de Corea del Norte, para comerciarlas con China, y potencialmente para uso doméstico. Advertimos que el comercio del que se informa, puede infringir los compromisos de China en CITES, y debería ser abordado como un tema prioritario.

S H O R T N O T E

ONCE DISTRIBUTED THROUGHOUT THE KASHMIR VALLEY, NOW ON VERGE OF EXTINCTION: A SIGHTING OF THE EURASIAN OTTER (*Lutra lutra*) IN THE GUREZ VALLEY, JAMMU AND KASHMIR

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Abstract: This reveals the first photographic evidence establishing the presence of the Eurasian Otter in the Kishanganga River in the Gurez Valley of Jammu and Kashmir. This groundbreaking finding resolves uncertainties about the current status and occurrence of the species in the region. The Gurez Valley, tracing the course of the Kishanganga River and forming the upper reaches of the Neelum River in Pakistan, stands as an ecologically significant region inhabited by a diversity of rare, endangered, and unique flora and fauna. Unfortunately, this region has remained scientifically unexplored due to constraints imposed by military operations linked to border disputes and geopolitical tensions. During our camera trapping efforts aimed at studying Kashmir Musk Deer, two Eurasian otters were captured in camera traps. This revelation highlights the precarious state of small populations of mammals in the region, emphasizing the imperative for focused attention from the scientific community and relevant authorities to safeguard the delicate ecosystems of the Gurez Valley.
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Keywords: Camera trap, flagship species, holts and dens, semi-aquatic mammal, shore vegetation.

INTRODUCTION

Otters are semi-aquatic carnivore mammal belonging to the family Mustelidae, having seven genera and 13 species; they are found in every continent except Australia and Antarctica. Eurasian Otter (*Lutra lutra),* belonging to the subfamily *Lutrinae*, is an elusive, solitary animal with the most extensive range in Europe, Asia, and Africa (Corbet, 1966). Bhattacharya et al. (2019) identified seven subspecies of the Eurasian Otter, including *L.l. nair* found in southern India, Sri Lanka, Nepal, Bhutan, and Myanmar; *L.l. kutab* in northern India (specifically Kashmir); *L.l. aurobrunneus* inhabiting the Garhwal Himalaya and higher altitudes in Nepal; *L.l. monticolus* in Himachal Pradesh, Sikkim, and Assam; L.l. barang in southeastern Asia (Thailand, Indonesia, and Malaysia); *L.l. chinensis* residing in southern China and Taiwan; and *L. l. lutra* in Europe and northern Africa. In India, it can be found in the northern regions (Ladakh, Jammu and Kashmir, Himachal Pradesh, Uttarakhand), the northeastern part (mainly in the Himalayan foothills), Central India (Madhya Pradesh), the eastern region (Odisha), and the southern parts, covering portions of Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh (Hussain, 1993; Prater, 1998). Additionally, the species has been observed in the northern mountains of Pakistan, the Punatshanghchu basin in Bhutan (Yoxon and Yoxon, 2019), and Nepal (Basnet et al., 2019; Shrestha et al., 2021).

In Jammu and Kashmir the Eurasian Otter is regarded as an indicator of high-quality aquatic habitats (Cianfrani et al., 2011) and obtains food from fresh water ecosystems (Krawczyk et al., 2016). The species is listed as Near Threatened on the IUCN Red List (Loyet al, 2022), and Appendix I of CITES (CITES, 2023). In Himalaya, otters are found in cold streams and rivers, much like their counterparts in Europe. They can reach elevations of 3,660 meters in the Himalayas during the summer. These otters primarily occupy the land-water interface and prefer fast-flowing upper river sections where carp and other fish spawn.

OBSERVATION

During our study on musk deer in Gurez Valley, Jammu and Kashmir (Fig. 1), we deployed camera traps throughout the diverse ecosystem. The valley's unique topography, which includes riverine habitats, is particularly interesting for our research. Out of our network of 60 camera traps, 6 were positioned in these riverine areas, recognizing their critical role as wildlife corridors and watering points. This comprehensive approach allows us to document musk deer presence and gain valuable insights into other species in the valley. In an opportunistic sighting, one of the camera traps captured evidence of a Eurasian otter in the riverine habitat (Fig. 2). The otter sighting was recorded at 34.49° N and 74.27° E, at an altitude of 2600 meters. On August 6th, 2023, two Eurasian otters (*Lutra lutra*) were captured by camera traps in the Gurez Valley. These otters, displaying nocturnal behaviour, were observed at midnight, around 2:00 AM (Fig.2). The presence of otters in the area may be linked to the Kishanganga dam, which serves the 330 MW Kishanganga Hydro Electric Project located in the Bandipora District of Jammu and Kashmir. It is plausible that the dam has regulated water flow, creating more favourable conditions for otter habitat.

This camera trap was placed very close to the international border, around 200 meters from the Indian administrative army post known as "New post". The area is kept free of human presence, with only paramilitary activities permitted. After this sighting, we focused more efforts on the Indian territory. Unfortunately, due to heavy disturbance from fishing and other local and paramilitary activities, no further presence was documented. This sighting is from Gurez Valley, located at India-Pakistan border, where the Kishanganga River flows downstream through the Gurez Valley; originating from glaciers, it nourishes the valley's lush landscapes, supporting diverse flora and fauna. Kishanganga forms the upper part of the Nelum river passing through Pakistan. Gurez valley is a typical mountain area dominated by conifer and broadleaved *Betula* forests. Located in Jammu and Kashmir, India, in the west Himalayan region, it stands as a fascinating tapestry of geology, culture, and ecology. The valley extends from 34°40'48.81"N and 74°36'5.82"E to 33°22'43.30"N and 75°24'23.34"E and is bordered to the west and north by Pakistan-governed Kashmir and to the east by the union territory of Ladakh. The region's altitude ranges from 2600 meters in Kanazawa Gurez to above 4500 meters in Kawbul Gali Tulail. Snow in the valley gradually melts in the spring as daytime temperatures rise from 8 °C to 15°C; however, the nights are still freezing, and the temperature drops below freezing sometimes -10 °C. The valley has warm weather in summer, with daytime temperatures often ranging from 15 °C to 25 °C and more bearable night temperatures of 5 °C to 12 °C. This time of year sees increased precipitation, with thunderstorms and sporadic rain feeding the valley's flora.

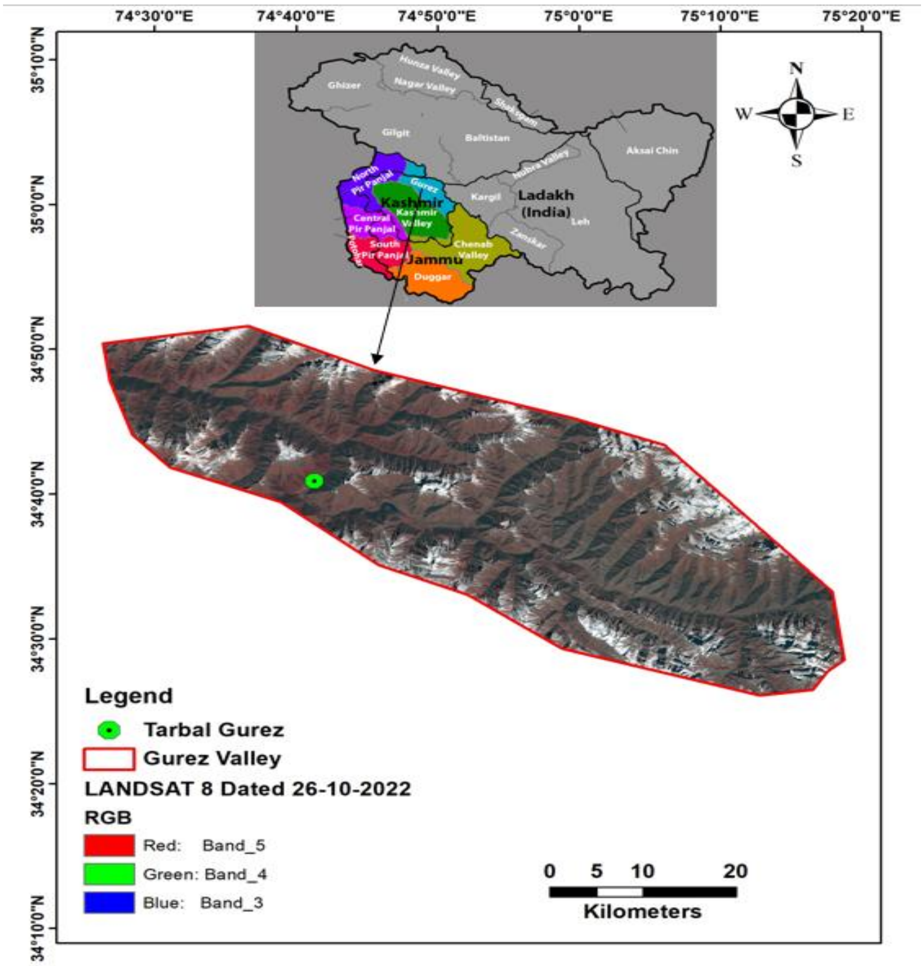

Figure 1. Study area map showing Jammu and Kashmir Gurez valley and Tarbal otter sighting point.

Figure 2. Eurasian otter camera trap record from Kishanganga river Gurez Valley.

DISCUSSION

The Eurasian otter is found in various regions across India, primarily in freshwater habitats such as rivers, lakes, and marshes. Its distribution in India is somewhat patchy and fragmented due to habitat loss, pollution, and human disturbances. Historically, the Eurasian otter was widely distributed across northern India, including the Himalayan foothills, the Gangetic plains, and parts of northeastern India. However, in recent decades, its range has become more restricted. Currently, the Eurasian otter is known to inhabit certain regions in northern India, including parts of Himachal Pradesh, Uttarakhand, Jammu, Ladakh, and the Terai region of Uttar Pradesh. In the northeast, it is found in some areas of Assam and Arunachal Pradesh. Additionally, there have been sightings reported in the Western Ghats of Karnataka and Kerala, indicating its presence in the southern part of the country.

Jammu, Kashmir and Ladakh are ecologically three distinct landscapes. Jammu, situated at lower altitudes, has a subtropical climate and harbours a rich biodiversity of flora and fauna. Ladakh, characterized by its high-altitude cold desert, features barren mountains, deep valleys, and sparse vegetation adapted to extreme cold and low precipitation. Despite its harsh conditions, Ladakh supports unique species like the snow leopard, Tibetan wild ass, and Himalayan marmot, showcasing remarkable adaptations to the environment. Kashmir is renowned for its lush greenery, serene lakes, and snow-capped peaks. Its temperate climate and fertile plains support a diverse array of flora and fauna, including endemic bird species and the endangered Hangul deer. Eurasian otter have been reported from both the Jammu and Ladakh valleys. In Jammu, in the Chinab valley, the Neru stream harbours Eurasian otters. Three individuals were photographed during a limited camera trap survey conducted in the Neru stream, a left bank tributary of river Chenab, during mid-October 2020 (Singh et al., 2023). The first systematic survey for otters (*Lutra lutra*) in Ladakh revealed their presence in the Indian Trans-Himalayas (Jamwal, et al, 2016). This underscores the significance of assessing otter populations in high-altitude regions, contributing to our understanding of their distribution and conservation needs.

The Gurez Valley forms part of the international border between India and Pakistan. The severe climate, alternating between harsh winters and warm summers, along with significant snowfall, dictates the rhythm of life. This climate profoundly shapes the valley's ecosystems, influencing the distribution of its abundant biodiversity. Amidst this natural magnificence, the people of the Gurez Valley weave a culturally diversified tapestry, preserving a wide range of customs and traditions. While the livelihood of the local community traditionally relies on daily labour, there is a noticeable shift towards tourism. Despite the valley's low human population density and minimal pressure on natural ecosystems, unmanaged tourism poses a significant threat to its future. Furthermore, the administration of the Gurez Valley by the Indian army, due to its proximity to the international border, has resulted in restrictions on access for local people. However, this administrative arrangement also fosters a positive attitude towards biodiversity conservation in some areas, one of which is the Tarbal area where the otter was sighted.

The riverine habitat, particularly Kishanganga, exhibits notable biodiversity. The area of Tarbal where the otter was sighted is a narrow valley of not more than 300 meters width. This area encompasses three different habitats - mainly open scrub, riverine and forest. Forest is mainly alpine, dominated by *Pinus wallichina*, Fir and Spruce, with mixed deciduous trees of Himalayan Mayapple. There is a diverse fauna of birds as the Kishanganga river is used by migratory waterfowl during winter as layover site, e.g. common Mergenser, Mallard, shoveler, and other shore birds.

Mammals include an overlap of black bear and brown bear distribution, common leopard, jungle cat, musk deer, Himalayan Iibex, fox , jackal and wolf. Land use within a 3 km² grid primarily consists of 1.43 km² of forest, a 0.24 km² stretch of riverine habitat, and 0.33 km² occupied by human settlements, with an additional 1 km² covered by scrubland.

The present study serves as the first photographic record of Eurasian otter from the Kishanganga river part of the Kashmir valley; earlier it was known that otters were distributed throughout the Kashmir valley, but due to multiple reasons they became rarely seen in the valley, and this needs further investigation on a landscape level. In recent years, new species of birds have been reported in the Kashmir Valley, possibly as a result of climate or ecological changes that have created habitats for these species. Among these recent sightings are the steep gull and white-breasted waterhen (Ahmad et al., 2022a, Ahmad et al., 2022b).

The otter habitat in the region is not extensively utilized by the local populace but experiences notable pressure from paramilitary activities and their accompanying dogs. Other wildlife species documented by the same camera trap include the Kashmir grey langur (*Semnopithecus ajax*), Himalayan black bear (*Ursus thibetanus laniger*), and red fox (*Vulpes vulpes*). Tourism in the area is in its nascent stages and necessitates immediate conservation efforts; otherwise, these species may not endure for an extended period. Otters, in particular, are highly sensitive to fluctuations in water quality and disruptions in their habitat, underscoring the ongoing necessity for conservation endeavors to safeguard the valley’s unique biodiversity. Moreover, the presence of otters in the valley highlights the importance of maintaining healthy river ecosystems, as otters’ sensitivity to environmental changes makes them vulnerable to disturbances such as pollution, habitat degradation, and fluctuations in water quality (Bouroş, 2007). Understanding the interdependence between otters and other elements of the ecosystem is crucial for holistic conservation efforts. Otters not only regulate prey populations but also contribute to nutrient cycling and ecosystem resilience. Thus, conserving otter habitats and ensuring the health of freshwater ecosystems is imperative for preserving the biodiversity and ecological integrity of the Gurez Valley.

CONCLUSIONS

The Eurasian otter was once widespread throughout the Kashmir Valley. However, over time, sightings of the species have declined, with no reported sightings in the last 10 years. The Lidder Valley and Jehlum Valley, including Wular Lake, were the primary distribution areas for this species in the region. Kishanganga river also supports the favourable habitat for the species but unfortunately, they are not present along the length of the river and this needs further investigation. Otters are shy and being indicator species, they are highly affected by change in ecosystem (Bouroş, 2007). Unregulated tourism in the Gurez Valley may disrupt otter habitats through uncontrolled pollution, garbage accumulation, increased carbon emissions, and habitat degradation, leading to potential population declines. Additionally, inadequate waste management near otter habitats can lead to contamination, affecting prey species and water quality, indirectly impacting otters by disrupting their food chain and exposing them to toxins (Leoncini et al, 2023). Changes in water chemistry, particularly fluctuations in pH levels, have the potential to harm otter habitats and prey species, resulting in health issues for otters and disturbances in aquatic life (Pedroso and Santos-Reis, 2006). Addressing these multifaceted challenges is crucial for the conservation and well-being of Eurasian otters. Kishanganga river is the last hope for revival of otter in Kashmir region.

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RÉSUMÉ: OBSERVATION DE LA LOUTRE EURASIENNE (*Lutra lutra*) DANS LA VALLÉE DE GUREZ, AU JAMMU ET AU CACHEMIRE. AUTREFOIS RÉPANDUE DANS TOUTE LA VALLÉE DU CACHEMIRE, L'ESPÈCE EST EN VOIE DE DISPARATION

Une première preuve photographique révèle la présence de la loutre eurasienne le long de la rivière Kishanganga située dans la vallée de Gurez au Jammu et au Cachemire. Cette découverte incroyable dissipe les incertitudes concernant le statut actuel et la présence de l'espèce dans la région. La vallée de Gurez, qui suit le cours de la rivière Kishanganga et forme le cours supérieur de la rivière Neelum au Pakistan, est une région écologique capitale, car d'une diversité floristique et faunistique rare, menacée et unique. Malheureusement, cette région est restée scientifiquement inexplorée en raison des contraintes imposées par les opérations militaires liées aux conflits frontaliers et aux tensions géopolitiques. Au cours de nos efforts de piégeage photographique visant à étudier le cerf porte-musc du Cachemire (*Moschus cupreus*), deux loutres eurasiennes ont été photographiées par nos pièges photos. Cette découverte met en évidence l'état précaire des populations de petits mammifères dans la région, soulignant la nécessité impérieuse d'une attention particulière de la communauté scientifique et des autorités compétentes afin de sauvegarder les écosystèmes fragiles de la vallée de Gurez.

RESUMEN: SE DISTRIBUÍA POR TODO EL VALLE DE KASHMIR, HOY ESTÁ AL BORDE DE LA EXTINCIÓN; AVISTAJE DE NUTRIA EURASIÁTICA (LUTRA LUTRA) EN EL VALLE GUREZ, JAMMU Y KASHMIR

Este trabajo revela la primer evidencia fotográfica que establece la presencia de la Nutria Eurasiática en el Río Kishanganga, en el Valle Gurez de Jammu y Kashmir. Este hallazgo novedoso resuelve incertidumbres acerca del status actual y la ocurrencia de la especie en la región. El Valle Gurez, que sigue el curso del Río Kishanganga y que forma las nacientes del Río Neelum en Pakistán, es una región ecológicamente significativa habitada por una diversidad de flora y fauna rara, amenazada, y única. Desgraciadamente, ésta región ha permanecido científicamente inexplorada debido a las restricciones impuestas por las operaciones militares ligadas a disputas fronterizas y tensiones geopolíticas. Durante nuestros esfuerzos con cámaras-trampa, dirigidos a estudiar el Ciervo Almizclero de Kashmir, fueron capturadas dos nutrias Eurasiáticas en cámaras-trampa. Este revelación destaca el estado precario de las pequeñas poblaciones de mamíferos en la región, enfatizando el imperativo de focalizar la atención de la comunidad científica y las autoridades relevantes, para salvaguardar los delicados eocsistemas del Valle Gurez.

R E P O R T

A CENTURIES-OLD OTTER-FISHING PRACTICE IN BANGLADESH: GOING, GOING, GONE?

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Abstract: We assessed the current status of centuries-old traditional otter-fishing in Bangladesh. Field surveys were conducted between July and December 2022, collecting data to evaluate otter populations, the status of otter-fishers, and the challenges of otter-fishing. We recorded a population of 39 Smooth-coated otters, *Lutra perspicillata* owned by 15 fishermen families across two southwest districts. Over a decade, captive otters experienced 77% population decline whilst the otter-fishers have been reduced to 59%. This drastic decrease could be attributed to the loss and degradation of fishing ground resulting in low income for otter-fishermen, which has led the age-old tradition of otter-fishing to be at risk of extinction. We recommend devising a careful management plan and providing incentives for otter-fishers to keep this long-lasting tradition alive for the conservation of otters in Bangladesh.

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Keywords: Captive-otters, *Lutra perspicillata*, Narail, Sundarbans

INTRODUCTION

Humans have coexisted with animals for millennia (Brumm, 2021). Over generations, human-wildlife interactions have evolved as an integral part of traditions where many animal species are of great significance to human culture. Rural communities in particular are considered the guardians of much of the world's biodiversity (Gadgil et al., 1993). For instance, bottlenose dolphins (*Tursiops truncatus gephyreus*) protected by community have been used for fishing by artisanal net-casting fishers in southern Brazil for over a century (Simões-Lopes, 1991). Indeed, the use of otters (*Lutra perspicillata*) in fishing in the southwest regions of Bangladesh showcases a unique example of human-animal interaction being evolved through mutualism. Similar practices were reported from the range of Asia, Europe and African countries where *L. perspicillata* and *L. lutra* have been used for fishing (Medway, 1978). Traditional lifestyles evolved over hundreds of years have developed practices that provided special protection to certain species that are important to the community (Kwapena, 1984). Otter-assisted fishing exemplifies a distinct traditional practice in Bangladesh, where fishermen use otters for earning livelihood (Feeroz et al., 2011). Once a widespread practice that was passed down from father to son throughout many communities in Asia, this is now confined to a few restricted locations in Narail district in Bangladesh.

Wild animals are facing burgeoning pressures to coexist with humans due to continued loss and degradation of natural habitats (Narayan and Rana, 2023). However, environmental changes could harm the human-wildlife mutualistic relationship thereby endangering their continued coexistence (Cantor et al., 2023). Species conservation and the sustainable use of natural resources require reliable information that often came from academic investigations. However, although the bulk of evidence typically stems from academic science, other knowledge systems often receive little attention (Asselin, 2015). Moreover, research findings indicate that local communities offer significant knowledge to the field of conservation and its practices (Berkes et al., 2000). While animal conservation in Bangladesh is largely embedded in formal management practices, the integration of local knowledge in management practices remain largely lacking and unrecognized. One such traditional practice of rearing and breeding globally threatened otter species by the rural community people in Bangladesh receive very little attention from the conservation authorities (Aziz et al., 2008). This puts the age-old traditional knowledge into jeopardy whilst the species may lose its long-lasting connection with humans forever. We explore the interplay to assess how this age-old traditional practice is being threatened by anthropocentric environmental changes.

METHODS

We conducted field surveys between June and December 2022 for data collection from the owners of captive otters. Based on previous records, we surveyed preselected locations and interviewed all fishermen who owned otters in the region using semi-structured questionnaire. We have collected information on otter populations including their age-sex structure, costs of rearing otters, quantity of fishes they could catch by otter-fishing, including other relevant issues such as the status of wetlands in the area. Data were also collected on socio-economic condition of otter-fishers and income-expenditure related to otter-fishing and the challenges they face for continuing this traditional otter-fishing.

The survey sites include Khulna, Madaripur, Narail and Gopalgonj districts in the southwest region of Bangladesh (Fig. 1). With reconnaissance information obtained, we narrowed down our survey effort to Narail and Gopalgonj districts where otter-fishers have been currently residing. The Narail district, covering an area of 990 km^2, consists of three upazila (next lower administrative unit of district) namely Kalia, Lohagara, and Narail Sadar. The overall literacy rate is 46%. The main source of income includes agriculture (62%), fishing, non-agriculture laborer, industry, commerce, transport, remittance, etc. Standing on the bank of the Chitra river, the other major river systems flowing through the Narail district comprise the Madhumati, Nabaganga, Atrai, and Bhairab. Covering an area of 1490 km^2, the Gopalgonj district includes 5 upazila namely Gopalganj Sadar, Kashiani, Kotalipara, Muksudpur, and Tungipara. The main occupation is agriculture (46%) whilst others are pisciculture, livestock rearing, industry, transport, government and private services, commerce, etc. (Bangladesh Bureau of Statistics, 2013). The Garai, Modhumati, Kaliganga, Old Kumar River, Ghagore are the notable rivers of the district. Besides, it has large waterbodies such as *beels*. The rivers including other waterbodies have been used for artisanal fishing by local communities.

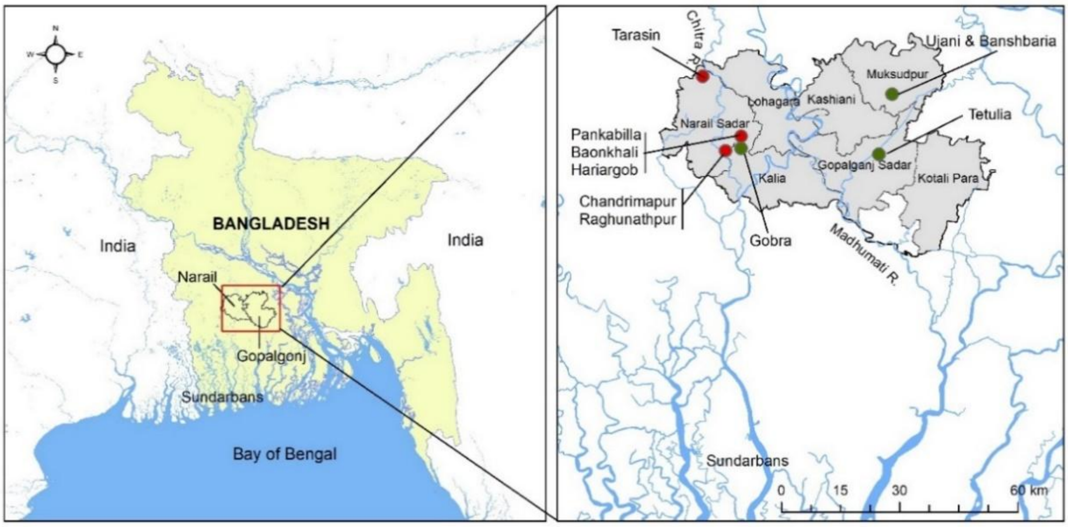

Figure 1. Location of past (red circle) and present (green circle) otter-fishing families in Narail and Gopalganj districts of Bangladesh.

RESULT AND DISCUSSION

Decline of Otter Population

Our survey recorded a total of 41 individuals of otters being used in otter-fishing in Narail and Gopalgonj districts of Bangladesh. In the village of Gobra of Narail district, a total of 19 otters belonging to 5 fishermen families were recorded whilst in Gopalgonj district 6 families owned a total of 12 otters. Of note, each of the new otter-fishermen at Gopalgonj district have only a pair without any evidence of captive breeding whilst the fishermen at Narail district have higher number of otters per family with subadults and infants (Table 1).

Table 1. Population structure of *L. perspicillata* captive otters in Narail and Gopalgonj of Bangladesh.

District Name	Upazila (Sub-District) Name	Village Name	Owner Name	Otter Population[a]				
				AM	AF	SAM	SAF	I
Narail	Narial Sadar	Gobra	Robin	1	1	-	-	-
	Narial Sadar	Gobra	Roben	1	2	-	-	-
	Narial Sadar	Gobra	Voben	2	1	1	-	-
	Narial Sadar	Gobra	Shyam	1	1	-	-	3
	Narial Sadar	Gobra	Dhrurpo	2	2	-	1	-
Gopalgonj	Muksudpur	Ujani	Prodeep	2	2	-	-	-
	Muksudpur	Ujani	Shanjeev	2	2	-	-	-
	Muksudpur	Ujani	Satya	2	2	-	-	-
	Muksudpur	Banshbaria	Gosai	2	2	-	-	-
	Muksudpur	Banshbaria	Sontosh	2	2	-	-	-
	Muksudpur	Banshbaria	Gonesh	2	2	-	-	-
	Gopalgonj Sadar	Tetulia	Bidhan	2	2	-	-	-
	Gopalgonj Sadar	Tetulia	Bikash	2	2	-	-	-
	Gopalgonj Sadar	Tetulia	Khudiram	2	2	-	-	-
	Gopalgonj Sadar	Tetulia	Tapan	2	2	-	-	-

[a]*Otter population: AM – adult male, AF – adult female, SAM – subadult male, SAF – subadult female, I – infant*

Our present count of captive otters and the respective number of otter-fishermen is remarkably low comparing the previous records (Fig 2). For instance, Feeroz et al. (2011) reported a population of 122 captive otters from Narail district a decade ago. They also reported another population of 54 otters in Khulna district. In 2011, another study documented a total of 27 families with a population of 97 otters dispersing across 7 villages in Narail district (Hasan, 2011). Conversely, this study found 19 otters in Narail and 20 otters in Gopalgonj; however, no otters were found in Khulna district. This data shows a population decline of 77% by a decade. In Gobra village alone, the rate of population reduction is even higher (80%). During 1990s, a premier study reported a population of approximately 500 otters used in otter-fishing across five districts of Bangladesh; however, details remain unknown (Kashem, 1997). If we take this record into account, the rate of decline could be even far-reaching.

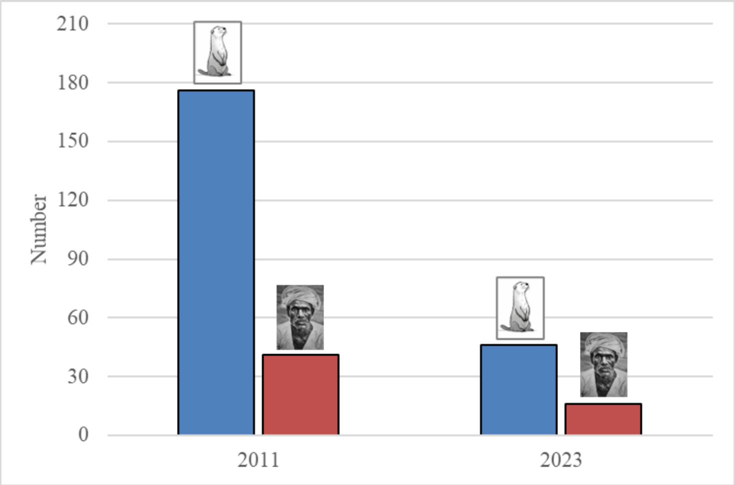

Figure 2. Decline of otter population and otter-fishermen between 2011 and 2023 in Bangladesh.

The otter-fishers at Gobra village are highly skilled in breeding otters in captivity through their age-old traditional knowledge achieved over generations (i.e., by forming appropriate pair, split up, re-pair, intensive nursing of pups, etc.). It appears that the new otter-fishermen of Gopalgonj district maintained only a pair of adult male and female otters; they obtain only adult individuals from Narail if their otters die for some reason. These new otter-fishers have found it difficult to rear newborn pups from their pair suggesting that they require traditional skills from Gobra otter-fishermen for successful breeding.

Figure 3. Otter-fishermen with otters (left) and visitors enjoying otter-fishing (right) in Narail.

Spatial Changes in Otter-Fishers

We have recorded 5 families owning otters in Narail district whilst 10 families in Gopalgonj district do so. However, no otters were found in Khulna involved in fishing, as had been previously reported (Feeroz et al., 2011). About a decade ago, there were 27 families distributed over 7 villages in Narail who used to fish with otters. This figure has now come down to only 5 families in 1 village who retain their otters. Captive otters have disappeared from 5 villages of Narail district and from all locations of Khulna district. However, 6 new families in 3 new villages in Gopalgonj district own otters, brought from Gobra village about 10 years ago (Figure 4, Table 1). In the past captive otters existed across 5 districts adjacent to the Sundarbans which now came down to only two districts (Feeroz et al., 2011).

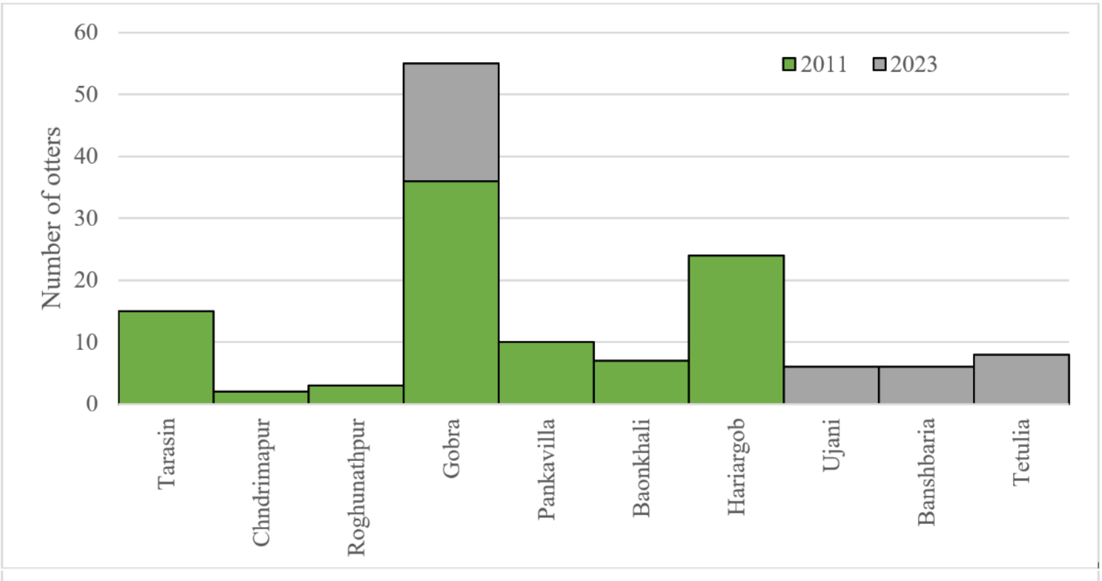

Figure 4. Changes in otter population across different geographic locations between 2011 and 2023.

It is quite perplexing to understand why the otter-fishers of Narail are leaving their forefathers' profession whilst a group of fishermen at Gopalgonj adopting the same practice. The factors influencing the otter-fishers of Narail district to sell their otters to the fishermen of Gopalgonj district remains unclear. One of the reasons might be the continued decrease of fishing opportunities in the upstream regions of Narail which might have forced the otter-fishers of Gobra village to leave this practice. The decline of aquatic organisms,, including fishes has been widely reported to be due to the construction of roads and embankments across waterbodies, together with drainage, flood control and natural siltation, the use of pesticides and fertilizers, pollution, upstream damming in major river systems in the region (Islam, 2012). On the other hand, it is also possible that the higher opportunities for fishing and alternative income generation activities (e.g., agriculture and daily labour) during off-season could be advantageous for the fishermen of Gopalgonj district.

The Future of Otter-Fishing

The analysis of our interview data regarding the willingness to keep otters for fishing revealed a bleak future. The insights from interview data show that overall, 38% of the next generation of otter-fishers are not interested in continuing this practice anymore. In particular, in the village of Gobra, where this unique human-otter mutualism is thought to have originated in the region, none of their next generation are willing to adopt their father's profession. This suggests that the otter-fishing practice will to be lost within the current generation of otter-fishers at Narail who are 50-65 years old. The otter-fishers' sons in Gobra , having some levels of education, have now been engaged in other livelihoods such as garment trade, and other businesses. However, the younger generation of otter-fishers in Gopalgonj, aged between 30 and 45 years old, who bought the otters from the Narail district, seem set to continue the practice for now. Their interest in doing so might be linked to the availability of widespread wetlands, rivers and creeks, and less competition with other fishermen. Our interview data also show that the otter-fishers surviving in Narail district currently mainly rely on incomes received from the foreign tourists who occasionally pay visit to enjoy the otter-fishing technique (Fig. 3b).

In the past, the otter-fishers used to fish in the Sundarbans, located approximately 100 kilometers from their village, because it was then profitable. Currently, however, the otter-fishers no longer go to the Sundarbans because each trip costs a lot of money, catches are down, fear of pirates, and complexities for entry permission into the mangrove forest (Feeroz et al., 2011). Moreover, the otter-fishers comprise a small section of the diverse fisher community in the region that uses a wide array of fishing techniques including the 'destructive' (e.g., current net, Chinese fishing net, etc.) fishing tools despite those being illegal according to the Protection and Conservation of Fish Act 1950. Use of these illegal techniques provides higher catches and are likely to further restrict the opportunities for otter-fishing, leading to frustration and low income for the family. We found that otter-fishers in Gobra village now solely rely on lumpsum monies (US$ 60-120/month) received from occasional visits (1-2 visits/month during winter) made by foreign tourists. Not all otter-fishers in the village get this opportunity equally due to a handful of tourists visiting, during winter months only.

During the 1990s, approximately 5000 local communities were directly and indirectly engaged with otter-fishing in 5 districts of Bangladesh (Kashem, 1997). The number of otter-fishers now stands at only 15 families comprising less than 100 beneficiaries. The decline of fish abundance due to decrease of upstream water flow, river pollution, degradation of river ecosystems, and use of modern fishing tools seriously endangers the future of otter-fishing. Artisanal fisheries assisted by cetaceans are also disappearing due to conflicts between cetaceans and industrial fisheries in the southern Brazil (Tixier et al., 2021).

The diversion of upstream water by the Farakka dam on the Ganges in India has significantly reduced the dry season discharge in the downstream of Bangladesh. One of the ecological consequences of such hydrologic alterations is the reduction of fish and fisheries in the southwestern river systems (Islam et al., 2020). In particular, waters in the Chitra river and associated canals, the major otter-fishing ground in Narail, are significantly reduced in winter months; also, the remaining waters become heavily polluted during winter season (June to September) due to traditional jute retting which might have led to the otter-fishers in crisis during winter months.

On top of that, the otter-fishers have to spend an average of US$ 3.09 (n=15) on food per day per otter, and this has forced the fishermen to feed otters by sacrificing their own meals during crisis periods. All these pressures are driving the otter-fishers of Gobra village to sell their otters and to leave their forefathers' profession.

CONCLUSION

As human populations continue to grow and spread over natural habitats of wildlife, specifically in the context of Bangladesh, which supports 1180 people km^2, the need for traditional ecological knowledge and their engagement in protecting threatened animal species is paramount. Therefore, the gathered information on the driving forces that threaten the ancient practice of otter-fishing could be useful in formulating the management plan for the preservation of the otter species. The provision of incentives to otter-fishers, developing ecotourism networks, and integrating their traditional knowledge into continued captive breeding could be considered to keep this centuries-old tradition alive.

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RÉSUMÉ: UNE PRATIQUE DE LA PÊCHE A LA LOUTRE ANCIENNE DE PLUSIEURS SIÈCLES AU BANGLADESH : TOUJOURS D'ACTUALITÉ, EN VOIE DE DISPARITION ?

Nous avons évalué l'état actuel de la pêche à la loutre, tradition vieille de plusieurs siècles au Bangladesh. A cette fin, nous avons mené des enquêtes sur le terrain entre juillet et décembre 2022 en vue de recueillir des données, d'évaluer les populations de loutres et le statut des pêcheurs à la loutre ainsi que les défis de la pêche à la loutre. Les résultats de cette enquête ont permis de comptabiliser une population de 39 loutres à pelage lisse, *Lutra perspicillata*, appartenant à 15 familles de pêcheurs dans deux districts du sud-ouest. En une décennie, les loutres en captivité ont connu un déclin de 77 % de leur population tandis que les pêcheurs à la loutre ont régressé de 59 %. Cette diminution drastique pourrait être due à la perte et à la dégradation des zones de pêche, ce qui a entraîné de faibles revenus pour les pêcheurs à la loutre. Cette situation pourrait conduire la tradition séculaire de la pêche à la loutre à sa disparition. Nous recommandons en conséquence d'élaborer un plan de gestion précis et d'offrir des incitants aux pêcheurs à la loutre afin de maintenir cette tradition séculaire pour la préservation des loutres au Bangladesh.

RESUMEN: UNA PRÁCTICA DE PESCA CON NUTRIAS QUE LLEVA SIGLOS EN BANGLADESH: SE VA, SE VA, ¿SE FUE?

Evaluamos el estado actual de la pesca tradicional con nutrias en Bangladesh, que lleva siglos. Condujimos relevamientos de campo entre Julio y Diciembre de 2022, para colectar datos para evaluar las poblaciones de nutrias, el estado de los pescadores con nutrias, y los desafíos de la pesca con nutrias. Registramos una población de 39 nutrias lisas, Lutra perspicillata, poseídas por 15 familias de pescadores en dos distritos sudoccidentales. A lo largo de una década, las nutrias en cautiverio experimentaron una declinación poblacional del 77%, mientras que los pescadores con nutrias se redujeron a un 59%. Este drástico descenso podría ser atribuido a la pérdida y degradación de las áreas de pesca, lo que resulta en bajos ingresos para los pescadores con nutrias, lo que ha conducido a la antigua tradición de pescar con nutrias a estar en riesgo de extinción. Recomendamos diseñar un cuidadoso plan de manejo y proporcionar incentivos para que los pescadores con nutrias mantengan viva esta antigua tradición, para la conservación de las nutrias en Bangladesh.

শতাব্দী-প্রাচীন ভোঁদড় দিয়ে মাছ ধরা পেশাটি কী হারিয়ে যেতে বসেছে?

সার-সংক্ষেপ: ভোঁদড় দিয়ে মাছ শিকার বাংলাদেশের একটি শতাব্দী-প্রাচীন ঐতিহ্যবাহী পেশা, যা বর্তমানে দেশের কেবল দক্ষিণ-পশ্চিমাঞ্চলেই প্রচলিত আছে। ২০২২ সালের জুলাই থেকে ডিসেম্বর মাস পর্যন্ত জরিপ পরিচালনা করে আমরা এই পেশায় নিয়োজিত জেলে সমাজ এবং ভোঁদড়ের বর্তমান অবস্থা পর্যবেক্ষণ করেছি। এ সময় ভোঁদড়ের সংখ্যা, এই পেশায় নিয়োজিত জেলেদের অবস্থা এবং এই পেশার প্রতিবন্ধকতাগুলো মূল্যায়নের জন্য তথ্য সংগ্রহ করা হয়েছে। আমরা দুইটি জেলায় ১৫ জন মৎস্যজীবী পরিবারের মালিকানাধীন ৩৯টি পালিত ভোঁদড় (*Lutra perspicillata*) রেকর্ড করেছি। গত এক দশকে ভোঁদড়ের সংখ্যা ৭৭% হ্রাস হয়েছে এবং এই পেশায় নিয়োজিত জেলের সংখ্যা

কমেছে ৫৯%। এই পরিবর্তনের কারণ হিসেবে নদীতে মাছ কমে যাওয়া, মাছ ধরায় অন্যান্য জেলেদের আধুনিক প্রযুক্তির প্রয়োগ এবং এর ফলে ভোঁদড় দিয়ে মাছ ধরা জেলেদের আয় কমে যাওয়াকে চিহ্নিত করা হয়েছে, যা প্রাচীন এই ঐতিহ্যকে বিপন্ন করে তুলেছে। আমরা একটি সঠিক পরিকল্পনা ও ব্যবস্থাপনা প্রণয়ন এবং মৎস্যজীবীদের উৎসাহ প্রদান করার সুপারিশ করছি, যাতে বাংলাদেশে বিপন্ন এই প্রাণীটি সংরক্ষণের মাধ্যমে প্রাচীন ঐতিহ্যটি রক্ষা করা যায়।