NOTE FROM THE EDITOR

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Dear Friends, Colleagues and Otter Enthusiasts!

This is my last editorial in this strange year 2020 that asked most of us to a change in life and work style. I hope that you all are in good spirit and that we will see an improvement of the situation thanks to the starting vaccinations.

This is already issue number 4 of 2020. In addition, we had 3 special issues with updated and new bibliographies which we have now for 4 otter species. Furthermore, we opened the special issue for the Proceedings from our last international colloquium in China in 2018. Overall, this is a very exciting development and shows that our work is appreciated in the community.

I want to use this opportunity and express my special thanks to Gerard Schmidt and Claudio Chehebar for their tremendous work with the ever-increasing number of translations of the abstracts into French and Spanish. Merci! Gracias!

I would also like to mention to all future authors that abstracts in additional languages will be included if provided by the authors. I think it can be very important to have abstracts in the local language to reach a larger auditorium.

I also would like to thank the reviewers of 2020 for their very important contribution to keep up the standard of the published manuscript. Thanks a lot to Atul Borker, Bosco Chan, Anwaruddin Choudhury, Padma de Silva, Will Duckworth, Nicole Duplaix, Katrina Fernandez, Vania Fonseca, Nishikant Gupta, Syed Ainul Hussain, Gandhiv Kafle, Andreas Kranz, Miriam Marmontel, Roland Melisch, Alexey Oleynikov, Nisarg Prakash, Carolina Ribas, Hiroshi Sasaki, Melissa Savage, Anthony Sebastian, Sanjan Thapa, Peter Urban and Heike Weber. I hope I have not forgotten anybody. I also want to mention that our reviewers are usually very supportive especially when it comes to manuscripts submitted by young or inexperienced authors.

A last comment refers to an increasing submission of photo observations. I observe an increasing submission of photographic records of otters. In order to avoid disappointments, I ask the authors to carefully consider whether these pictures have a novelty? I will double-check this with senior experts from the area. In addition, submission information should contain GPS location data too be sure that pictures are correctly assigned. This information will not be published but used in the review process to ensure authenticity of the data.

Thank you, Lesley, for all the endless hours spend with the preparation of manuscripts to put them online and to check for still overlooked typos and missing references

R E P O R T

ASSESSMENT OF POPULATION OF SMOOTH-COATED OTTERS *Lutrogale perspicillata* IN TUNGABHADRA OTTER CONSERVATION RESERVE (TOCR), NORTH KARNATAKA, INDIA

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Abstract: Otters are considered as the 'ambassadors of wetlands'. Among 13 species of otters in the world, five species are found in Asia. Smooth–coated otter *Lutrogale perspicillata* is the largest among Asian otters. The presence of Smooth-coated Otters in Tungabhadra River was not documented earlier thus, a rapid assessment survey was conducted for four months from March to June 2017 to assess the population of Smooth-coated Otters in 35 kilometers stretch of Tungabhadra River from T. B. Dam reservoir to bridge near Kampli town. About 158 positive sites for Smooth-coated Otters were recorded along the river indicating the healthy population of *L. perspicillata*. Out of 158 recorded positive sites 46.83% positive sites are composed by communal spraints, 37.97% of resting and grooming sites and 15.18% of holts/ den sites. Otters prefer rocky area (54.18%) more than mud banks (25.94%) and sand banks (19.62%) and their habitat preference was very close to water body. The present study appends new geographical locations in the distribution range of Smooth coated otters in Karnataka and also helps to understand the complex ecological interaction of *L. perspicillata* in T.B. River will helps to mitigate the conservation problems.
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Key words: Smooth-coated Otter, *Lutrogale perspicillata*, Tungabhadra Otter Conservation Reserve, TOCR

INTRODUCTION

There are 13 species of otters in the world and five species in Asia, of which the Smooth-Coated Otter (*Lutrogale perspicillata*) is the largest. It is protected under

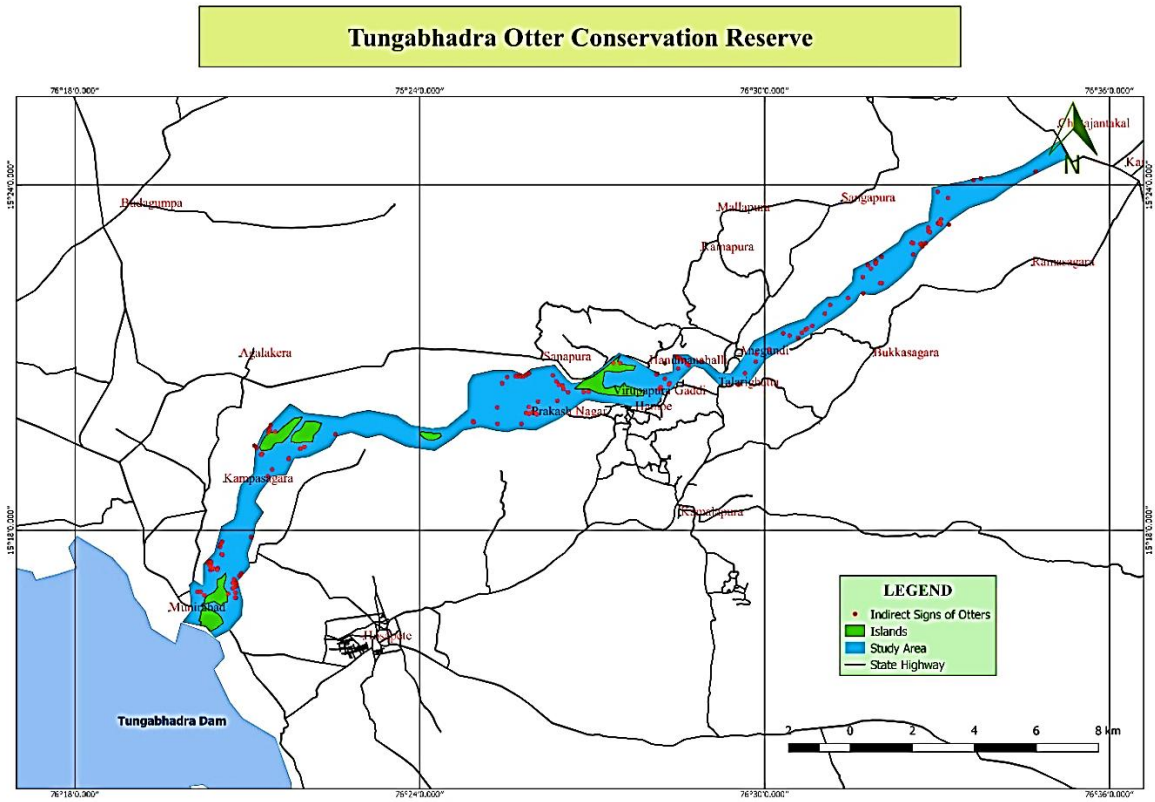
Schedule-II of Indian Wildlife (Protection) Act, 1972 and listed as "Vulnerable" by the IUCN (De Silva et al., 2015). Smooth–coated otters play a vital role in balancing the freshwater ecosystems as a top carnivorous species (Sivasothi, 1995; Acharya et al., 2010) and they may therefore significantly influence the overall spatio–temporal dynamics of the eco–region over a long period of time (Durbin, 1998; Prenda et al., 2001). The ideal habitats for *L. perspicillata* consist of fresh water bodies such as rivers, large lakes, back waters of reservoirs etc.; they also prefer rocky areas by rivers and mud banks covered by thick vegetation for shelter (Durbin, 1998; Kruuk et al., 1989; Hussain 1993). This species is found throughout South Asia and South-East Asian countries such as, Pakistan, India, Nepal, Bhutan, Bangladesh, Southwest China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Brunei, and an isolated population is reported in Iraq (Pocock, 1941; Medway, 1969; Mason and Macdonald, 1987; Corbet and Hill, 1992; Hussain, 1993; Hussain and Choudhury, 1997; Kafle, 2009; Khan et al., 2009; Anoop and Hussain, 2004, 2005; Acharya et al., 2010, Perinchery et al., 2011, Khan et al., 2014; Manjrekar and Prabhu, 2014; Khan, 2015).

Otters are considered to be an effective indicator species to assess environmental quality and are validated as wetland diplomats to promote the conservation of freshwater biomes (Durbin, 1998; Sivasothi, 1995; Prenda et al., 2001). In India, otter species face threats of habitat destruction due to the construction of large-scale hydroelectric projects, reclamation of wetlands for settlement and agriculture, reduction in prey biomass, poaching and contamination of waterways (Meena, 2002; Nawab and Gautam, 2008; Shenoy, 2006; Taigor and Rao, 2010; Hussain et al., 2011; Perinchery et al., 2011; Hussain, 2013; Khan et al., 2014). As a result, the distribution of otters is restricted to protected areas, and only a few published reports record their distribution in different parts of India (Hinton and Fry, 1923; Hussain, 1993, 1996; Hussain and Choudhury, 1998; Nawab, 2009; Kumara and Singh, 2007; Nawab and Gautam, 2008). However, the ecology, behaviour and natural history of most wild otter species is poorly known and recent evidence indicate that their range and population is shrinking because of poaching and loss of habitat (Meena, 2002). This present study appends new geographical locations to the known distribution of Smooth coated otters in Karnataka, improving understanding of their complex ecological interactions and will help in planning to mitigate conservation problems.

MATERIALS AND METHODS

Study area

Tungabhadra Otter Conservation Reserve (TOCR) is 20 km2 located between 15°161 to 15°251 N and 76°201 to 76°341 E (Map. 1), and was declared as the TOCR by the Government of Karnataka in 2015, under the Indian Wildlife (Protection) Act, 1972, to conserve the Rare, Endangered and Threatened (RET) species like Smooth-coated Otter (*Lutrogale perspicillata*), Muggar crocodile (*Crocodylus palustris*), four species of turtles and many more major aquatic flora and fauna found in the river stretch from Holey Mudlapura village near the dam on the river, to the bridge at Kampli, a town in Hospet taluk in the Ballari district of North Karnataka (Map. 1), which includes 9 anicuts (barrages that divert the river water to far off farmlands, in local Kannada language) like Bella, Hulagi, Shivapura, Turtha, Anegundi, Ramasagara, Upper Gangavathi, Lower Gangavathi and Kampli (Anonymous, 2017).



Map1: Map showing the study area and positive sites of otters at Tungabhadra Otter Conservation Reserve (TOCR).

Figure 1: Images of Smooth coated otters found in the study area

Methods

Four months' rapid survey was conducted between April to July 2017 along a 34 km stretch of the Tungabhadra river, starting from Holey Madlapura near the Tungabhadra Dam (TBD), and ending at Kampli bridge. This includes nine anicuts (Bella, Hulagi, Shivapura, Turtha, Anegundi, Ramasagara, Upper Gangavathi, Lower Gangavathi and Kampli), built across Tungabhadra River; some of them have a weir of 50-100 metres, and others are longer than two km. Most of the study centered around these anicuts, which covers 30% of TOCR. Before starting the intensive survey, a preliminary study was conducted in all these zones to gain an insight into the activity of the Otters; because activity appeared to be mainly nocturnal, indirect evidence like pug marks, scat, communal spraints, left over kills, nesting, denning and natal sites were considered as positive sites (Kruuk et al., 1986, Mason and Macdonald 1987; Hussain and Choudhury, 1997, Anoop and Hussain, 2004; Chettri and Savage, 2014). Local peoples like farmers and fishermen were interviewed to

understand the movement of otters in the river stretch. The study was carried out during the season when the water level in the river is lower and visibility is greater.

The main aim of the survey, however, was to prepare an index of positive sites of otter activity, which can help to identify the river stretch which needs to be monitored most closely for conservation purposes. Each positive site included communal sprainting areas (latrines), scats, pug marks, holts/denning sites, and basking and grooming sites located along the river side; these were identified, and the GPS locations marked for further studies (Map. 1), and photographic documents were made (Fig. 1) (Anoop and Hussain, 2004; Chettri and Savage, 2014). The positive sites were monitored for the whole day during the preliminary survey, to understand habitat use patterns by otters. Later, each positive site was visited twice in a week for four months, and otter behaviour was recorded (Melquist and Hornocker, 1983; Khan et al., 2014). Small islands located in the river were explored using a small boat to record any clues. Parameters were used to classify the positive sites like: (i) preferred location: rock, marsh, sand bank, mud banks; (ii) distance of the preferred location from edge of water; and (iii) presence or absence of holts, nests or breeding areas.

RESULTS

During the rapid biodiversity assessment, it is found that the population of Smooth-coated otters is high compared to rest of the other major fauna in TOCR. Out of 158 positive otter sites recorded in different parts of TOCR, 46.83% are composed of communal spraints (latrines) (74 sites), followed by 37.97% resting and grooming sites (60 positive sites) and 15.18% of holts/ den sites (24 positive sites) (Table 1, Fig. 2). The relative density at different anicuts was greatest near Rangasagara (35 positive sites), then 25 in Hulagi anicut, 24 at Bella and Anegundi anicut areas, 17 positive sites in Kampli anicuts, and 12 positive sites in Shivapura anicut areas. In contrast, only 9, 7, and 5 positive otter population sites were recorded from Turtha, Upper Gangavathi and Lower Gangavathi anicut regions respectively (Table 1).

Table 1. Positive sites recorded at different *anicuts* of Tungabhadra Otter Conservation Reserve (TOCR).

Site Nº	Name of the *Anicut*	Communal Spraint	Holts / Den Sites	Resting/ Grooming Area	Total
1	Bella	14	3	7	24
2	Hulagi	10	3	12	25
3	Shivapura	5	2	5	12
4	Turtha	3	2	4	9
5	Anegundi	12	4	8	24
6	Ramasagara	17	6	12	35
7	Upper Gangavathi	3	1	3	7
8	Lower Gangavathi	2	0	3	5
9	Kampli	8	3	6	17
	Total	**74**	**24**	**60**	**158**

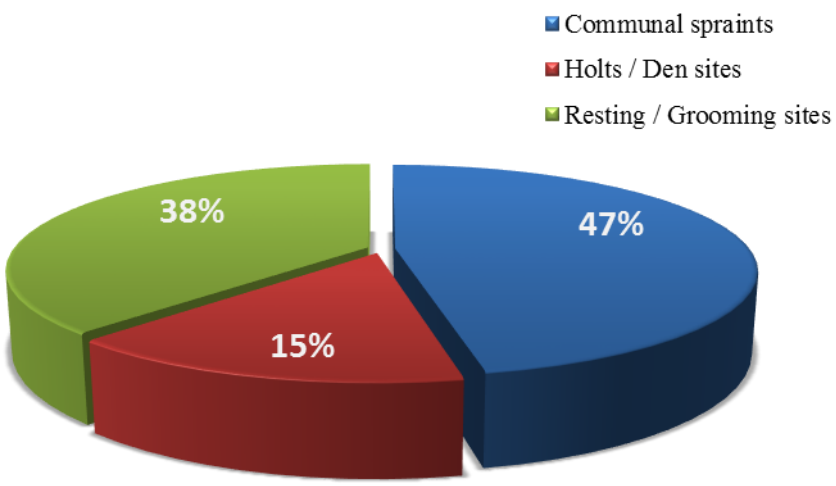


Figure 2. Percent occurrence of positive sites for *L. perspicillata* recorded at TOCR.

Looking at the different habitat types, more positive sites were found in rocky areas (54.43% positive sites), 25.94% positive sites on mud banks or islands, and only 19.62% positive sites were recorded on sand banks (Fig. 3). The distance between all positive sites and water resource was calculated to understand the habitat preference of otters: 65.18% of positive sites (103 sites) are found 1-5 metre from the water body, 23.41% (37 sites) within 5-10 meters from the edge of the water, and 12 positive sites (7.59%) were found about 10-15 meters away from water. Only 3.79% (6) of positive sites were found 15-20 meters away from the edge of the nearest water body (Fig. 4).

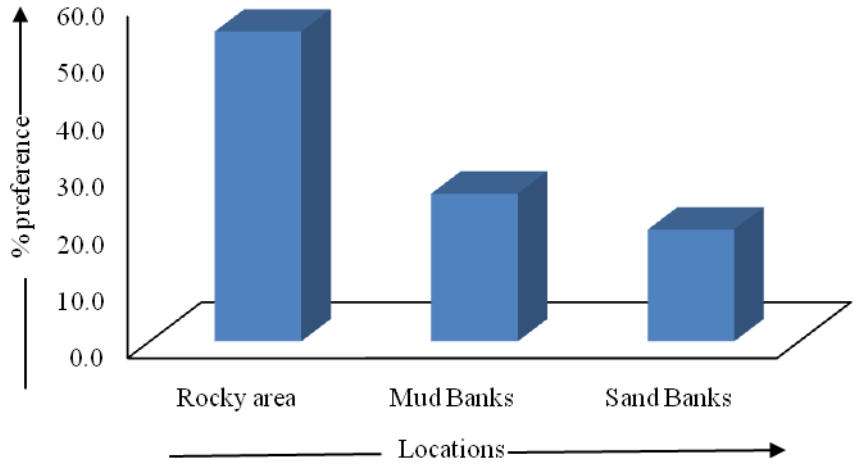


Figure 3. Habitat preferred by *L. perspicillata* around TOCR.

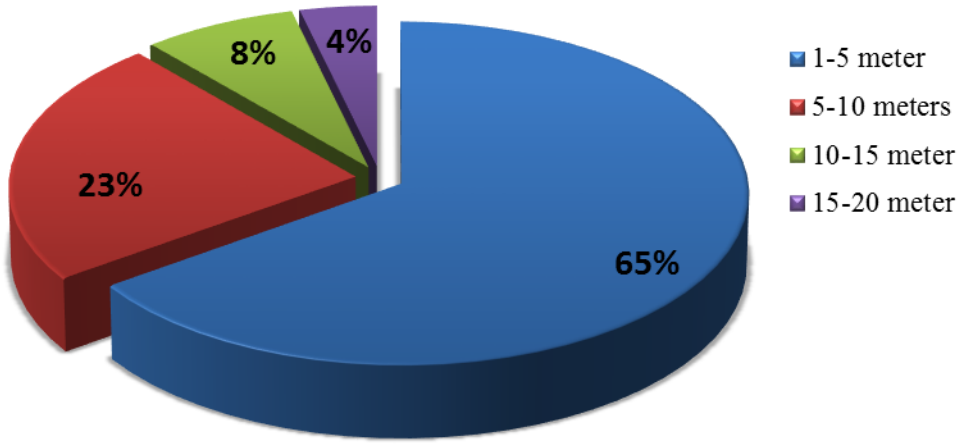


Figure 4. Distance between positive sites and water body preferred by *L. perspicillata* around TOCR

DISCUSSION

The distribution and presence of smooth coated otters can be equally determined by searching for tracks, spraints and other signs (Romanowski et al., 2013). Communal latrines, along with urine, is a way of olfactory marking in otters affected by many factors such as population density and structure, social status, reproductive cycle, dispersion and food availability (Erlinge, 1968; Kruuk and Hewson, 1978; Rostain et al., 2004; Prigioni et al., 2005). During the present study, many communal spraints latrines were recorded along the length of the river; this clearly represents the relative population density of the smooth-coated otters in the area. However, because of habitat destruction and anthropogenic disturbances, smooth-coated otters are declining throughout their range (Hussain et al., 2011) Deficiency of basic information is another problem for the conservation of this species (Hussain, 1996). Food availability, water resource, and shelter for resting, grooming and breeding are the vital factors known to govern habitat selection by otters (Kruuk, 1995; Anoop and Hussain, 2004; Nawab, 2009). In the present study, more positive sites were found in Ramasagara anicut, Hulagi anicut, and Bella and Anegundi anicuts: these anicuts of TOCR contain major fish species like Tilapia, Ruhu, Catla, Deccan mahseer etc. (Ramanjaneya and Ganesh, 2016) - fish that fishermen also depend on for their livelihood - implying that smooth-coated otters also rely on the availability of the food base as listed above. Haque and Vijayan (1995), and Anoop and Husain (2005), indicate that Smooth-coated otters predominantly feed on large fish, shrimps, crabs, frogs, insects, and sometimes upon birds and rats.

Significantly lower frequency of positive sites like spraints marks, holts / den sites and grooming sites are recorded from Shivapura, Upper Gangavathi, Lower Gangavathi and Turtha. Since these areas are more polluted with urban waste, leading to excessive growth of weeds, increased silting, and non-availability of clean water with sufficient prey base, it is concluded that the reduced otter population is due to an unsupportive and unhealthy habitat. Shallower and calmer regions are closely associated with the presence of smooth coated otters, as also shown by other studies (Hussain and Choudhury, 1997; Nawab, 2009; Acharya et al., 2010; Khan et al., 2014). The assessment revealed that the entire stretch of TOCR, in the past, has been an ideal habitat for the Rare, Endangered and Threatened (RET) species like Smooth-coated otter, Mugger crocodile, Giant soft-shelled turtles, various fish fauna and other

wildlife forms. As this study was dome in hot summer with a parched riverbed in most of the areas of the TOCR, we did not encounter much wildlife in the *anicuts*, which are infested with invasive alien weeds and excessive siltation. The study basically relied upon indirect evidence, within a short period of time, though maximum manpower was deployed for scouting the length and breadth of each *anicut* to identify signs of the existence of a healthy population of the Smooth-coated otters. The number of positive sites decreases as the distance from water increases: it is concluded that otters prefer sites near water for grooming, breeding and defecating, as this optimises the rate of prey capture per efforts. Reducing the effort required for capturing pray was deduced to be the most essential factor for otters in selecting the habitat, as also suggested by other studies (Kruuk, 1995; Anoop and Hussain, 2004; Nawab, 2009; Acharya et al., 2010).

The reason for this may be that most of the TOCR stretch has a rocky surface and banks than mud and sand. The habitat provides sufficient food for otters, such as fish, crabs, amphibians etc. Though the study area is declared as "Tungabhadra Otter Conservation Reserve", no strict conservation measures have been taken up. Potential threats like sand mining, excessive fishing, water pollution, eutrophication, excessive sedimentation, use of dynamite to harvest fish etc, are potential threats to the population of Smooth-coated Otters in the Tungabhadra River. There is a need to take up conservation measures such as patrolling by trained guards to prevent any instances of hunting, poaching and other threats to the life of otters, and the rest of the aquatic fauna. We also recommended that fishing in the areas of otter presence be restricted, fishing be discouraged during the breeding season, and a ban enforced on the harvesting of native species of fish, which are the major food base for otters. This species breeds once a year, and breeding season varies from one place to another, mainly depending upon favorable conditions for natal areas, an abundance of prey base etc. (Haque and Vijayan, 1995; Hussain and Choudhury, 1997; Hussain et al., 2011), Longevity and sexual maturity is governed by prey abundancy.

CONCLUSIONS AND RECOMMENDATIONS

This study for assessment of the population and distribution of Smooth-coated Otter revealed that the entire stretch of Tungabhadra Otter Conservation Reserve (TOCR) provides an ideal habitat for this rare species of mammal. However, the issues like lack of flooding in monsoon and sufficient natural flow of water regularly result in degradation of the aquatic ecosystem. This is aggravated by excessive sedimentation in the pools and ponds in the riverbed, resulting in a lack of sufficient water in the river. But more serious problem facing the aquatic ecosystem is excessive growth of invasive alien weeds such as Water Hyacinth *Eichornia crassipes* and *Ipomoea*. Eventually eutrophication results in the decline of otter populations due to reduced food availability. It is therefore recommended that water be released into the river regularly during monsoon; the river should flood sufficiently that it can wash all the sediments and weeds away. There is also a need to educate the farmers to switch over to organic forming and give up the excessive use of chemical fertilizers in the catchment area of the Tungabhadra River, as this encourages eutrophication. All release of industrial effluents and municipal sewage into the river is to be prevented, to provide a safe habitat for riparian biodiversity.

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REFERENCES

Acharya, P.M., Lamsal, P., Rajbhandari, S.L., Shrestha, P., Neupane, D., Pathak, M., Lama, B. (2010). Status and distribution of otters in Narayani River, Chitwan National park. *A fist phase research report submitted to Rufford Foundation, UK*.

Anonymous (2017). Vijayanagar Channel feasibility study report.Vol. 2b. Rapid Biodiversity survey report: *Karnataka Neeravari Nigama Ltd*. pp: 4-15.

Anoop, K.R., Hussain, S.A. (2004). Factors affecting habitat selection by smooth-coated otters (*Lutra perspicillata*) in Kerala, India. *Journal of Zoology*, **263**(4): 417-423.

Anoop, K.R., Hussain, S.A. (2005). Food and feeding habits of smooth-coated otters (*Lutra perspicillata*) and their significance to the fish population of Kerala, India. *Journal of Zoology*, **266:** 15-23.

Chettri, P., Savage, M. (2014). A Distribution Survey for Otters along a River in Central Bhutan.*IUCN Otter Specialist Group Bulletin,* **31**: 65-74.

Corbet, G.B., Hill, J.E. (1992). *The mammals of the Indomalayan region: a systematic review*. (Vol. 488). Oxford: Oxford University Press.

De Silva, P., Khan, W.A., Kanchanasaka, B., Reza Lubis, I., Feeroz, M.M., Al-Sheikhly, O.F. (2015). *Lutrogale perspicillata*. *The IUCN Red List of Threatened Species*, 2015-2.

Durbin, L.S. (1998). Habitat selection by five otters *Lutra lutra* in rivers of northern Scotland. *Journal of Zoology*, **245**(1): 85-92.

Erlinge, S. (1968). Food studies on captive otters *Lutra lutra* L. *Oikos*, **19**: 259-270.

Haque, M.N., Vijayan, V.S. (1995). Food habits of the Smooth Indian Otter (*Lutra perspicillata*) in Keoladeo National Park, Bharatpur, Rajasthan (India). *Mammalia*, **59:** 345-348.

Hinton, A.C.M., Fry, T.B. (1923). BNHS's mammal survey of India, Burma and Ceylon. *J. Bombay Nat. Hist. Soc.*, **29:** 415-428.

Hussain, S.A. (1993). Aspects of the ecology of smooth coated Indian otter *Lutra perspicillata,* in National Chambal Sanctuary. PhD Thesis, Center for Wildlife and Ornithology, Aligarh Muslim University, Aligarh.

Hussain, S.A. (1996). Group size, group structure and breeding in smooth-coated otter Lutra perspicillata Geoffroy in National Chambal Sanctuary. *Mammalia*, **60**: 289-297.

Hussain, S.A. (2013). Activity pattern, behavioural activity and interspecific interaction of smooth-coated otter (*Lutrogale perspicillata*) in National Chambal Sanctuary, India. *IUCN Otter Spec. Group Bull*, **30**: 5-17.

Hussain, S.A., Choudhury, B.C. (1997). Distribution and status of the smooth-coated otter *Lutra perspicillata* in National Chambal Sanctuary, India. *Biological Conservation*, **80**: 199-206.

Hussain, S., & Choudhury, B. (1998). Feeding ecology of the smooth-coated otter *Lutra perspicillata* in the National Chambal Sanctuary, India. In **N. Dunstone & M. Gorman (Eds.)**, Behaviour and Ecology of Riparian Mammals (Symposia of the Zoological Society of London, pp. 229-250). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511721830.015

Hussain, S.A., Gupta, S.K., De Silva, P.K. (2011). Biology and ecology of Asian small-clawed otter *Aonyx cinereus* (Illiger, 1815): a review. *IUCN Otter Specialist Group Bulletin*, **28**: 63-75.

Kafle, G. (2009). A review on Research and Conservation of Otters in Nepal. *IUCN Otter Specialist Group Bulletin*, **26**: 32-43.

Khan, M.S. (2015). Occurrence of the Smooth-coated Otter *Lutrogale perspicillata* (Geoffroy, 1826) in Punjab, India. *IUCN Otter Spec. Group Bull*, **32**: 3-7.

Khan, M.S., Dimri, N.K., Nawab, A., Ilyas, O., Gautam, P. (2014). Habitat use pattern and conservation status of smooth–coated otters *Lutrogale perspicillata* in the Upper Ganges Basin, India. *Animal Biodiversity and Conservation*, **37**: 69-76.

Khan, W. A., Qasim, M., Ahmad, E., Akbar, G., Habib, A. H., Ali, H., Akhtar, M. (2009). A survey of smooth coated otters (*Lutrogale perspicillata sindica*) in the Sindh province of Pakistan. *IUCN Otter Specialist Group Bulletin*, **26**: 15-31.

Kruuk, H. (1995). *Wild otters: predation and populations*. OUP Oxford.

Kruuk, H., Hewson, R. (1978). Spacing and foraging of otters (*Lutra lutra*) in a marine habitat. *Journal of Zoology* **185**: 205-212.

Kruuk, H., Conroy, J.W.H., Glimmerveen, U., Ouwerkerk, E.J. (1986). The use of spraints to survey populations of otters *Lutra lutra*. *Biological Conservation*, **35**: 187-194.

Kruuk, H., Moorhouse, A., Conroy, J.W.H., Durbin, L., Frears, S. (1989). An estimate of numbers and habitat preferences of otters *Lutra lutra* in Shetland, UK. *Biological Conservation*, **49**: 241-254.

Kumara, H.N., Singh, M.E.W.A. (2007). Small carnivores of Karnataka: distribution and sight records. *Journal of the Bombay Natural History Society*, **104**: 155-162.

Manjrekar, M.P., Prabu, C.L. (2014). Status of otters in the Sundarbans Tiger Reserve, West Bengal, India. *IUCN Otter Spec. Group Bull*, **31**: 61-64.

Mason, C.F., Macdonald, S.M. (1987). The use of spraints for surveying otter *Lutra lutra* populations: an evaluation. *Biological Conservation*, **41**: 167-177.

Mason, C.F., Last, N.I., Macdonald, S.M. (1986). Mercury, cadmium, and lead in British otters. *Bulletin of Environmental Contamination and Toxicology*, 37: 844-849.

Medway, L. (1969). The wild mammals of Malaya and offshore islands including Singapore.*The wild mammals of Malaya and offshore islands including Singapore.* pp. 20-127.

Meena, V. (2002). Otter poaching in Palni hills. *Zoos' Print Journal*, **17**: 696-698.

Melquist, WE and Hornocker, MG (1983). Ecology of river otters in west central Idaho. *Wildl. Monogr.*, **83**: 1- 59

Nawab, A. (2009). Aspects of the ecology of Smooth-coated Otter *Lutrogale perspicillata* Geoffroy St.-Hilaire, 1826: A review. *Journal of Bombay Natural History Society*, **106** (1): 5-10.

Nawab, A., Gautam, P. (2008). Otters: can they be saved? **In: Sengupta, M. & Dalwani, R. (eds.)** *Proceedings of Taal 2007: The 12th Lake Conference:* 591-596.

Perinchery, A., Jathanna, D., Kumar, A. (2011). Factors determining occupancy and habitat use by Asian small-clawed otters in the Western Ghats, India. *Journal of Mammalogy*, **92**: 796-802.

Pocock, R.I. (1941). The fauna of British India, including Ceylon and Burma. Mammalia. Volume 2. Taylor and Francis. London.

Prenda, J., López-Nieves, P., Bravo, R. (2001). Conservation of otter (*Lutra lutra*) in a Mediterranean area: the importance of habitat quality and temporal variation in water availability. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **11**: 343-355.

Prigioni, C., Remonti, L., Balestrieri, A., Sgrosso, S., Priore, G., Misin, C., Anania, R. (2005). Distribution and sprainting activity of the otter (*Lutra lutra*) in the Pollino National Park (Southern Italy). *Ethology Ecology & Evolution*, **17**: 171-180.

Ramanjaneya and Ganesh C.B. (2016). Fish faunal diversity in Tungabhadra Reservoir, Hosapete, Bellari District, Karnataka. *International Journal of Research in Fish and Aqua*, **6**: 21-25.

Romanowski, J., Brzeziński, M., Żmihorski, M. (2013). Habitat correlates of the Eurasian otter *Lutra lutra* recolonizing Central Poland. *Acta Theriologica*, **58**: 149-155.

Rostain, R.R., Ben-David, M., Groves, P., Randall, J.A. (2004). Why do river otters scent-mark? An experimental test of several hypotheses. *Animal Behaviour*, **68**: 703-711.

Shenoy, K., Varma, S., Prasad, K. D. (2006). Factors determining habitat choice of the smooth-coated otter, *Lutra perspicillata* in a South Indian river system. *Current Science*, **91**: 637-643.

Sivasothi, N. (1995). A review of otters (Carnivora: Mustelidae: Lutrinae) in Singapore and Malaysia, and the diet of the Smooth-coated Otter (*Lutrogale perspicillata*) in Penang, West Malaysia. *Unpublished MSc thesis, National University of Singapore*.

Taigor, S.R., Rao, R.J. (2010). Habitat features of Aquatic animals in the National Chambal Sanctuary, Madhya Pradesh, India. *Asian Journal of Experimental Biological Sciences*, **1**: 409-414.

RÉSUMÉ

EVALUATION DES POPULATIONS DE LOUTRE A PELAGE LISSE *Lutrogale perspicillata* DANS LA ZONE DE CONSERVATION DE TUNGABHADRA (TOCR), SITUÉE AU NORD DU KARNATAKA EN INDE

Les loutres sont considérées comme les «ambassadeurs des zones humides». Parmi les 13 espèces de loutres dans le monde, cinq se trouvent en Asie. La loutre à pelage lisse *Lutrogale perspicillata* est la plus grande des loutres asiatiques. La présence de loutres à pelage lisse dans la rivière Tungabhadra n'a pas été documentée jusqu'ici, et ainsi, une enquête d'évaluation rapide a été menée pendant quatre mois de mars à juin 2017 pour évaluer la population de loutres à pelage lisse sur un tronçon de 35 kilomètres de la rivière Tungabhadra à partir du bassin de rétention TB jusqu'au pont près de la ville de Kampli. Environ 158 sites positifs de loutres à pelage lisse ont été enregistrés le long de la rivière, ce qui indique une population saine de *L.*

perspicillata. Sur les 158 sites positifs enregistrés, 46,83% des sites sont constitués par des lieux de marquage communs, 37,97% par des aires de repos et de toilettage et 15,18% par des catiches et tanières. Les loutres préfèrent davantage les zones rocheuses (54,18%) que les plages de boue (25,94%) et les bancs de sable (19,62%) et leur habitat préférentiel est très proche d'un plan d'eau. La présente étude intègre de nouvelles localisations géographiques dans l'aire de répartition des loutres à pelage lisse au Karnataka. Elle nous aide également à comprendre l'interaction écologique complexe de *L. perspicillata* dans la rivière Tungabhadra et contribuera à atténuer les problèmes de conservation.

RESUMEN

RELEVAMIENTO POBLACIONAL DE NUTRIAS LISAS *Lutrogale perspicillata* EN LA RESERVA DE CONSERVACIÓN DE NUTRIAS TUNGABHADRA, NORTE DE KARNATAKA, INDIA

Las nutrias son consideradas "embajadoras de los humedales". De las 13 especies de nutrias del mundo, cinco se encuentran en Asia. La nutria lisa *Lutrogale perspicillata* es la más grande de las nutrias asiáticas. La presencia de la nutria lisa en el Río Tungabhadra -cerca de Hampi- no había sido previamente documentada, de manera que condujimos un relevamiento rápido de evaluación, durante cuatro meses -de Marzo a Junio de 2017-, para evaluar la población de nutrias lisas en un tramo de 35 km del Río Tungabhadra -desde el embalse de la represa T.B. hasta el puente cerca de Kampli. Registramos 158 sitios positivos de nutrias lisas a lo largo del río, indicativos de una población saludable de *L. perspicillata*. De los 158 sitios positivos, 46,83 % están compuestos por letrinas comunales, 37,97 % por sitios de descanso y acicalamiento, y 15,18 % por sitios de madrigueras/cuevas. Las nutrias prefieren áreas rocosas (54,18 %) más que barrancas barrosas (25,94 %) y barrancas arenosas (19,62 %), y su preferencia de hábitat es muy cercana al cuerpo de agua. El presente estudio agrega nuevas localizaciones geográficas al rango de distribución de nutrias lisas en Karnataka, y también ayuda a entender la compleja interacción ecológica de *L. perspicillata* en la Represa T.B., lo que va a ayudar a mitigar los problemas de conservación.

R E P O R T

FIRST PHOTOGRAPHIC EVIDENCE OF THE EURASIAN OTTER, *Lutra lutra*, IN AN INLAND SALINE LAKE OF THE TIBETAN PLATEAU, CHINA

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Abstract: The Eurasian otter *Lutra lutra* is a widespread carnivore of aquatic ecosystems native to Eurasia and Palaearctic Africa, while knowledge about its ecology and distribution in the Tibetan Plateau, particularly within the inland drainage systems is still limited. Recent camera-trap records verify its occurrence in a salt-lake basin, the Siling Co in the Tibet Autonomous Region, China. It is the first time this species has been photographed in this unique high-elevational habitat (4,572 meters above sea level). Conservation decision makers should immediately improve local management for this species in the region. In this unique habitat, the otter's local ecology and evolutionary history warrant follow-up studies.
Citation: Bian, X and Liang, (2020). First Photographic Evidence of the Eurasian Otter, *Lutra lutra*, in an Inland Saline Lake of the Tibetan Plateau, China. IUCN Otter Spec. Group Bull. **37** (4): 191 -195
Keywords: Eurasian otter, *Lutra lutra*, Qinghai-Tibet Plateau, elevational distribution, salt lake

INTRODUCTION

The Eurasian otter, *Lutra lutra*, is one of the most widely distributed Palaearctic mammals, ranging across Europe, North Africa, and Asia (Conroy et al., 1998). It survives in various habitats including fresh water of streams (Lanszki and Sallai, 2006), lakes (Jancke and Giere, 2011), swamps (Melisch et al., 1998), coastal salt marshes (Lovett et al., 1997), and lagoons (Gormally and Fairley, 1982). The Eurasian otter, however, is listed as a Near Threatened species on the IUCN Red List of Threatened Species due to multiple reasons including the population declines, its sensitivity to sudden changes in threats, and lack of information in many parts of its range (Roos et al., 2015).

In China, the Eurasian otter occurs mainly along the southeast coast, and in the central provinces, northeast forest, and the Tibetan Plateau (Li and Chan, 2017; Zhang et al., 2018). The latter is considered to be an otter-rich region, where strong evidence supports otter distribution along the Yarlung Zangbo (also known as the Brahmaputra), Nujiang (Salween), and Lancang (Mekong) rivers (Zhang et al., 2018). Contrary to the increasing trend of otter reports in those drainage basins, the interior region of Tibetan plateau, that contains a large inland river network, has received limited research attention. Scientific proof of otter distribution there is rare up to date (Gao, 1987; Liu and Yin, 1993; Zhang et al., 2018).

In April 2017, during an intensive camera trapping effort for the snow leopard (*Panthera uncia*) in the interior Tibet, a video footage of the Eurasian otter was unintentionally captured by an infrared camera, which was located at 4,572 meters above sea level, on the rocky shore of the southwestern rim of an inland salt lake, the

Siling Co (also Selincuo; Figure 1, Figure 2, Table 1). Other sympatric carnivores, as potential competitors that could cause mutual interference with otters, were present at the same camera station, namely snow leopard, Tibetan fox (*Vulpes ferrilata*), red fox (*Vulpes vulpes*), and beech marten (*Martes foina*).

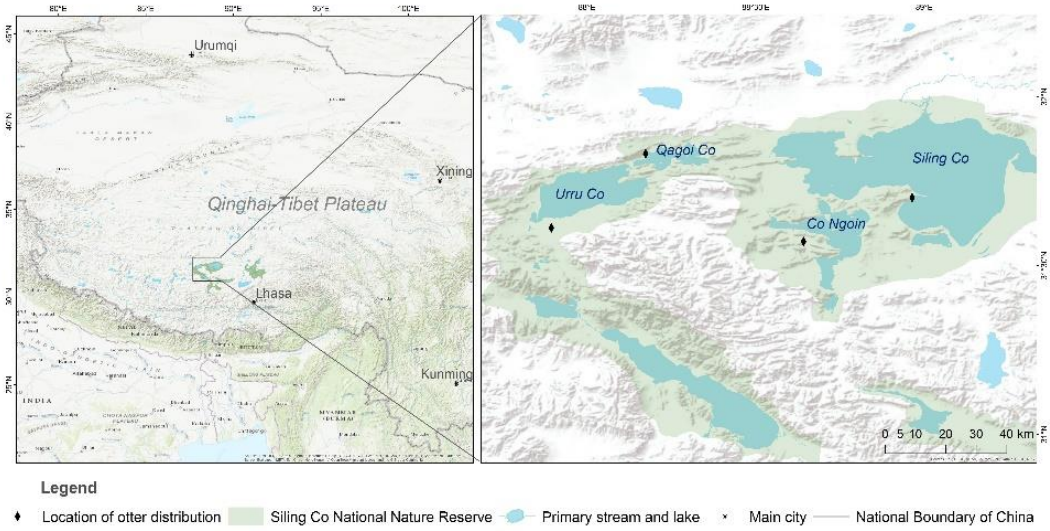

Figure 1. Study area: Locations of records of the Eurasian otters in the Siling Co National Nature Reserve

Subsequently, quick surveys were conducted in the adjacent region. Spraints were found along the shore areas of three inter-connected lakes within the Siling drainage system, namely the Co Ngoin, Urru Co and Qagoi Co (Figure 1, Table 1). We also interviewed eight pastoralists from four local villages for their sighting reports of otters. Sighting records were considered valid only where the interviewees described clearly the morphological characteristics of the Eurasian otter (no other otter species could plausibly occur in this area, but other genera of Mustelidae are potential confusion species) and the asserted sightings took place between 2016 and 2019.

Table 1. Coordinates, altitudes, and evidence types of otter occurrence records, associated with the lake names and their reported salinity (Yan et al., 2018)

Lake	Latitude/°	Longitude/°	Altitude/meter	Salinity/g·L^{-1}	Evidence
Siling Co	31.7005	88.9644	4572	6.9	camera trap, sighting
Co Ngoin	31.5707	88.6421	4574	0.2	spraints
Urru Co	31.6113	87.8942	4567	NA	spraints, sighting
Qagoi Co	31.8308	88.1735	4601	0.2	spraints

Figure 2. Images of the Eurasian otters recorded by Siling Co and the landscape of the lake

According to our knowledge to date, our findings provide the first verifiable evidence of the Eurasian otter's distribution in a closed drainage with saline water, among the highest altitudinal presence records of the species across its known global range (Liu and Yin, 1993; Smith and Xie, 2010; Editorial Team for the Report on Otter Investigation and Conservation of China, 2019). Geoscience studies have suggested that the Siling Co basin separated from other drainage systems at a minimum distance of 150km (i.e. the Nam Co lake) since about 30ka B.P., which implies that the local otter population may have evolved independently at least during Holocene and achieved adaptive biological characteristics to survive in low oxygen and saline environment (Zhao et al., 2011; Crait et al., 2012). Therefore, this population's bio-physiology, ecology and evolutionary history warrant deep study in an interdisciplinary manner, to contribute new insights to the species and the ecosystems it within.

At present, the connected lakes and streams of the Siling Co basin system, along with the waterfront landscape together form the Siling Co National Nature Reserve that covers a total area of more than 20,000 square kilometers (Figure 1 left). Due to the enhanced law enforcement effort by government and the locally dominant Buddhist religion that against killing wildlife, poaching of otters has been rare during the past decade in the region (personal communication). Despite this, the local otter population is still exposed to various challenges, particularly induced by the escalating influence of local economic development (Cui and Graf, 2009). For instance, local communities start to build dikes on the rivers feeding into the Urru Co so as to redirect the flows away from their pasturelands to make room for livestock.

The Tibetan government is making efforts to boost tourism for the region (Xiang, 2018). Accessibility to local otter habitats has been greatly improved through the enhanced road network, potentially leading to increased anthropogenic disturbance, or poaching by outsiders. In addition, no in-place management scheme has intentionally considered otters, although this local otter population may be found to form a unique conservation unit of the species. Thus, we strongly recommend Tibetan policy makers to, first, support systematic baseline surveys within the Siling Co basin to identify key habitats for otters; second, improve the local conservation management plan in consideration of ecological needs of the species; and third, quickly enhance both patrolling and monitoring efforts within known otter habitats.

Acknowledgements - We appreciate the strong support and coordination from the Tibetan Forestry and Grassland Bureau, and its affiliates of Naqu Prefecture and Shenzha County. We are enormously grateful for the valuable contribution of local community rangers of Shenzha county. We also want to thank Dr. Bosco P. L. Chan and Fei Li for reviewing the manuscript. The initial snow leopard monitoring project is funded by Panthera.

REFERENCES

Conroy, J., Melisch, R., Chanin, P. (1998). The distribution and status of the Eurasian Otter (*Lutra lutra*) in Asia - a preliminary review. *IUCN Otter Spec. Group Bull.,* **15:** 15-30.

Crait, J.R., Prange, H.D., Marshall, N.A., Harlow, H.J., Cotton, C.J., Ben-David, M. (2012). High-altitude diving in river otters: coping with combined hypoxic stresses. *J. Exp. Biol.,* **215:** 256-263.

Cui, X., Graf, H.-F. (2009). Recent land cover changes on the Tibetan Plateau: a review. *Climatic Change,* **94:** 47-61.

Gao, Y. (1987). Fauna Sinica: Mammalia, vol. 8, Science Press, Beijing.

Gormally, M.J., Fairley, J.S. (1982). Food of otters *Lutra lutra* in a freshwater lough and an adjacent brackish lough in the West of Ireland. *J. Zool.,* **197:** 313-321.

Editorial Team for the Report on Otter Investigation and Conservation of China. (2019). A report on otter Investigation and Conservation in China [in Chinese]. http://www.shanshui.org/wp-content/uploads/2020/02/20200224074256676.pdf

Jancke, S., Giere, P. (2011). Patterns of otter *Lutra lutra* road mortality in a landscape abundant in lakes. *Eur. J. Wildl. Res.,* **57:** 373-381.

Lanszki, J., Szallai, Z. (2006). Comparison of the feeding habits of Eurasian otters on a fast flowing river and its backwater habitats. *Mamm. Biol.,* **71:** 336-346.

Li, F., Chan, B.P.L. (2017). Past and present: the status and distribution of otters (Carnivora: Lutrinae) in China. *Oryx,* **52:** 619-626.

Liu, W.L., Yin, B.G. (1993). Precious wildlife of Tibet and conservation, China Forestry Press, Beijing.

Lovett, L., Kruuk, H., Lambin, X. (1997). Factors influencing use of freshwater pools by otters, *Lutra lutra*, in a marine environment. *J. Zool.,* **243:** 825-831.

Melisch, R., Young, L., Sadovy, Y. (1998). Eurasian otter (*Lutra lutra*) still present in Hong Kong. *IUCN Otter Spec. Group. Bull,* **15:** 44-46.

Roos, A., Loy, A., de Silva, P., Hajkova, P., Zemanová, B. (2015). *Lutra lutra*. pp. e.T12419A21935287. The IUCN Red List of Threatened Species.

Smith, A.T., Xie, Y. (2010). *A Guide to the Mammals of China,* Princeton University Press.

Xiang, B. (2018). *China Focus: Tourism booming at World's Third Pole.* http://www.xinhuanet.com/english, Lhasa.

Yan, L., Sun, M., Yao, X., Gong, N., Li, X., Qi, M. (2018). Lake water in the Tibet Plateau: quality change and current status evaluation. *Acta Scientiae Circumstantiae,* **38:** 900-910.

Zhang, L., Wang, Q., Yang, L., Li, F., Chan, B.P.L., Xiao, Z., Li, S., Song, D., Piao, Z., Fan, P. (2018). The neglected otters in China: Distribution change in the past 400 years and current conservation status. *Biol. Conserv.,* **228:** 259-267.

Zhao, X., Zhao, Y., Zheng, M., Ma, Z., Cao, J., Li, M. (2011). Late Quaternary Lake Development and Denivellation of Bankog Co as well as Lake Evolution of Southeastern North Tibetan Plateau during the Last Great Lake Period. *Acta Geoscientica Sinica,* **32:** 13-26.

RÉSUMÉ

PREMIÈRE PHOTOGRAPHIE EVIDENTE DE LA LOUTRE EURASIENNE, *Lutra lutra*, DANS UN LAC SALÉ INTERIEUR SUR LE PLATEAU TIBÉTAIN EN CHINE

La loutre eurasienne *Lutra lutra* est un carnivore répandu des écosystèmes aquatiques originaire d'Eurasie à l'Afrique paléarctique. Cependant, les connaissances sur son écologie et sa répartition sur le plateau tibétain, en particulier dans les systèmes de drainage intérieurs, sont encore limitées. Des enregistrements récents à l'aide de pièges photographiques ont permis de confirmer sa présence dans un bassin d'eau salée, le Siling Co dans la région autonome du Tibet, en Chine. C'est la première fois que cette espèce est photographiée dans cet habitat unique de haute altitude (4.572 mètres d'altitude). Les décideurs en conservation devraient immédiatement améliorer la gestion locale de cette espèce dans la région. Dans cet habitat unique, l'écologie locale et l'histoire évolutive de la loutre justifient des études et un suivi.

RESUMEN

PRIMERA EVIDENCIA FOTOGRÁFICA DE NUTRIA EURASIÁTICA, *Lutra lutra*, EN UN LAGO SALINO INTERIOR DE LA MESETA TIBETANA, CHINA

La nutria eurasiática *Lutra lutra* es un carnívoro de amplia distribución en ecosistemas acuáticos de Eurasia y Africa Paleártica; y el conocimiento de su ecología y distribución en la Meseta Tibetana, particularmente en los sistemas de drenaje interiores, es aún limitado. Registros recientes con cámaras-trampa verifican su ocurrencia en la cuenca de un lago salado, el Siling Co, en la Región Autónoma de Tibet, China. Es la primera vez que esta especie ha sido fotografiada en este hábitat único de gran altitud (4.572 metros sobre el nivel del mar). Los tomadores de decisiones de conservación deberían mejorar inmediatamente el manejo para esta especie en la región. En éste hábitat único, la ecología local y la historia evolutiva de la nutria ameritan estudios de seguimiento.

R E P O R T

UPDATE ON THE STATUS OF THE EURASIAN OTTER *Lutra lutra* IN ARMENIA

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Abstract: There is little information on the status of Eurasian otters (*Lutra lutra*) in most parts of Asia including Armenia where the species is designated as "Endangered" on the Armenian Red List. Otters have declined in Azerbaijan and Iran, which neighbour Armenia, so it is critical to assess otter status in Armenia. To accomplish this, we used sign surveys, interviews and trail camera stations (n=4) on the majority of river systems and major lakes in Armenia. Our results confirmed otter presence in all areas surveyed, suggesting otter recovery, especially in the far northwest, the south-central province of Vayots Dzor and around Lake Sevan in central Armenia. In many areas, conflict is now increasing from otter predation at fish farms, and otters are sometimes killed in response. Fencing and dogs have been used to prevent conflict, and more research is needed to find the most cost-effective ways to mitigate conflict. In addition to otters killed because of conflict, other threats to the otter population include illegal hunting for fur, by-catch in illegal fishing nets and pollution from mining. An otter hotspot was identified in the Arpa River catchment of Vayots Dzor, and future work is necessary in the remaining parts of Armenia to identify more hotspots where conservation efforts can be focused.

Citation: Buzzard, PJ, Gyonjyan, A, Kaloyan, G and Aghasyan, L. (2020). Update on the Status of the Eurasian Otter *Lutra lutra* in Armenia *IUCN Otter Spec. Group Bull*. **37** (4): 196 - 204
Keywords: Eurasian otter; Armenia; *Lutra lutra*; human-wildlife conflict

INTRODUCTION

The Eurasian otter (*Lutra lutra*) is classified as Near Threatened on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Roos et al., 2015), and they are considered Endangered on the Armenian Red List (Aghasyan and Kalashyan, 2010). There is little information, however, on otter status in most parts of Asia including Armenia, where no comprehensive otter research has been conducted during the last three decades. Trapping and commercial sale of otter fur in the South Caucasus (Armenia, Georgia, and Azerbaijan) started in

1925 (Gorgadze, 2004), and at Armenian fur collection stations, the total number of otter pelts collected per year from 1949 to1959 averaged 60.5 and ranged from 24 to 88 (Aghadjanian, 1986). After this period, there was a rapid decrease in the number of pelts, and from 1969-1978 no otter pelts were recorded at the collection stations. According to Aghadjanian (1986), overhunting for fur, as well as river pollution and habitat destruction contributed to the continuous decline of the species, and by the 1980s, the Eurasian otter was believed to be extinct in Armenia. Moreover, there was a dramatic drop in the water level at the largest lake in Armenia, Lake Sevan, further negatively affecting the otter population (Red Data book of Armenian Soviet Socialist Republic (SSR), 1987). The otter was not common in Armenia during the 1990s either with only rare sightings across the country (Ghasabyan, 2001).

The Eurasian Otters is rare or declining in the countries that border Armenia. In the South Caucasus fur trade of the early 20th century, most pelts were obtained from the Georgian population (Wereshagin (1959) referenced in Gorgadze, 2004), and by the end of the 1980s, the Georgian population had become fragmented (Kokhodze (1991) referenced in Gorgadze, 2004). Preliminary population assessment studies in different parts of Georgia demonstrated that the otter has already disappeared from many areas or has formed isolated sub-populations (Gorgadze (2001) referenced in Gorgadze, 2004), and the Eurasian otter is on the Red List of Georgia (Oleynikov and Saveljev, 2015). In addition, the most recent otter surveys in Azerbaijan suggest that otter numbers there have declined drastically since the mid 1980s primarily from overhunting and pollution (Kasumova et al., 2009), and overhunting and pollution as well as habitat disturbance also threaten otters across Turkey (Thol-Schmitz, 2004; Ozen and Gunduz, 2015; Uluturk and Yurumez, 2017). The otter has been reported across Iran (Karami et al., 2006), but they have declined recently, especially from the Mesopotamian marshlands and the Anzali wetlands primarily because of pollution and habitat degradation (Mirzaei et al., 2010; Naderi et al., 2017; Mohtasebi and Tabatabaei, 2018). In the Anzali wetlands, otters are also killed for consuming fish at fish farms (Naderi et al., 2017).

It is, thus, crucial to obtain current information on otter distribution and status in the river systems and major lakes of Armenia, so conservation actions can be initiated where most needed. This paper documents otter status and threats using sign surveys for otter feces (or 'spraints'), feeding remains and tracks (Reuther et al., 2000; Meleros et al., 2017); trail cameras; and interviews with locals about otter presence and attitudes towards otters. We were able to confirm otter presence in the majority of Armenia's river systems and document threats to its conservation. In many areas, otter populations seem to be increasing, which has led to increases in otter-human conflict from otters raiding fish farms.

METHODS

The Greater and Lesser Caucasus Mountains create heterogeneous habitats in Armenia, and as a result Armenia is part of the Caucasus Mountains biodiversity hotspot in southwest Asia (Fig. 1, Mittermeier et al., 2004). To assess otter status in Armenia, we conducted three week-long expeditions in June and November 2018 as well as May 2019. During expeditions, we conducted sign surveys and open-ended interviews for otter presence in the major rivers and lakes of the drainage basins marked with horizontal lines on Figure 2. We plan to search rivers in all basins as indicated on Fig. 1, but this initial work focused on areas where there was prior information on potential otter presence.

In Armenia, the Eurasian otter is the only otter species present, and according to the IUCN Red List of Threatened Species, the American mink (*Neovison vison*) is not present in Armenia (Reid et al., 2016). To ensure that there was no confusion with other semi-aquatic mammals such as coypu (*Myocaster coypu*), a rodent native to South America that was introduced to Armenia for fur production around 1940 and now lives in feral populations (ISSG, 2011), we also asked about behaviors characteristic of otters such as piscivorous feeding habits, which was usually relevant because many of the interviewees had fish farms.

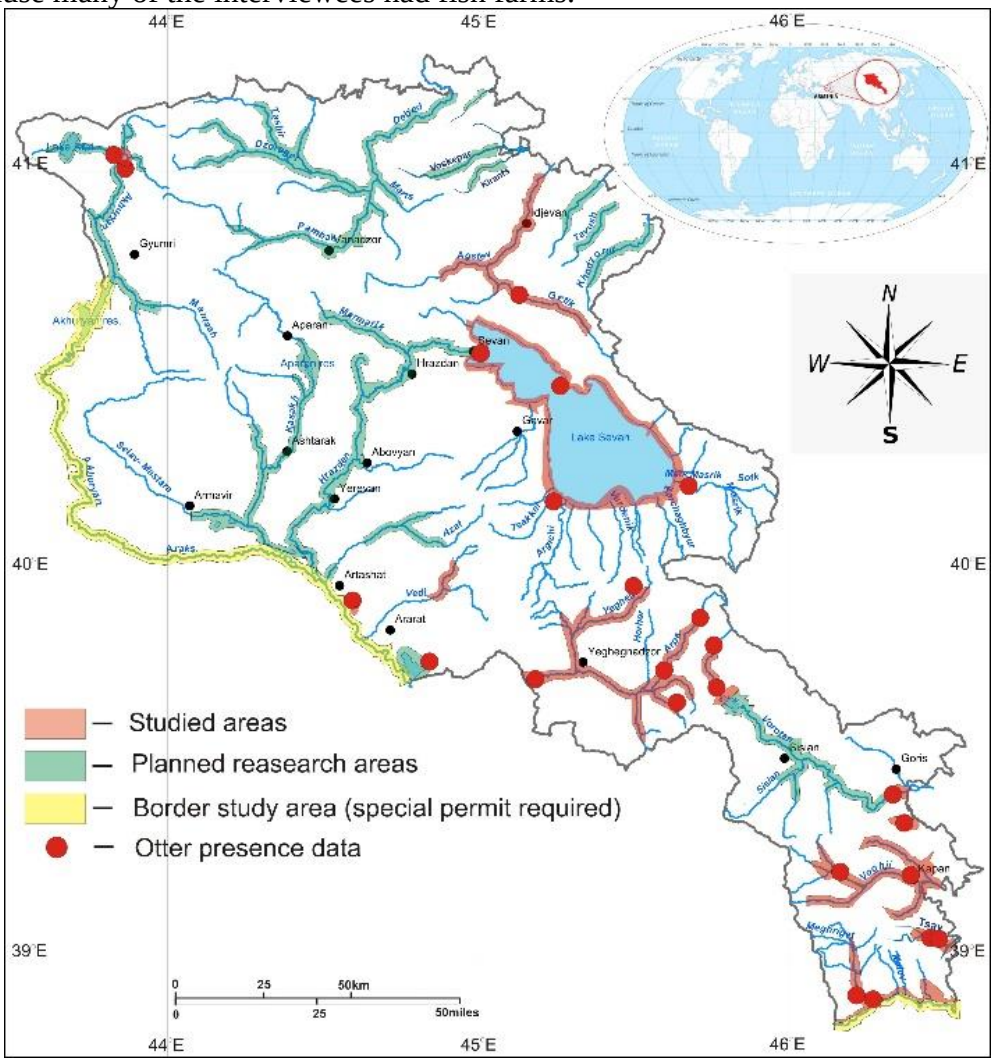

Figure 1. Armenia's location in Asia with areas studied, otter location data and areas planned for future study.

Sign surveys for otter tracks, spraints and feeding remains used the IUCN standard method (Reuther et al., 2000; Meleros et al., 2017). The Standard Method involves walking transects of 600 m spaced at least 5 km apart along banks to look for spraints as well as tracks and feeding remains. We searched both sides of rivers when possible to improve the accuracy of the method (Elmeros and Bussenius, 2002) and stopped transects when an otter sign was found. We interviewed a variety of locals about otter presence and attitudes towards otters including National Park Staff, fish farmers, World Wild Fund for Nature (WWF-Armenia) staff, hydropower staff, dam guards, riverside restaurant owners, fishery scientists, and wildlife rangers.

In promising areas for otters, we set five Reconyx Utrafire motion-detecting trail cameras attached to trees, rocks or bridges 0.25-1 m off the ground (Table 1).

We considered successive pictures notionally independent if they occurred at least one hour apart (Rovero and Marshall, 2009). In November 2018, we set two cameras in the far northwest Akhuryan River catchment (Fig. 1) at Arpi Lake National Park. The cameras were over 3 km apart along the Akhuryan River: one next to otter feeding remains and the other near a likely den at the base of a bridge. At the other three camera sites, we used Caven's otter lure as an attractant. In October 2018, in the Vorotan River catchment (Fig. 1), we set one trail camera near otter feeding remains at a hydropower station upriver of the Spandarian reserve. In June 2018, we set the other two cameras in the Arpa River catchment (Fig. 1): one near otter feeding remains near a fish farm in the midsection of the Arpa river and the other near feeding remains on the Arpa River near Areni village.

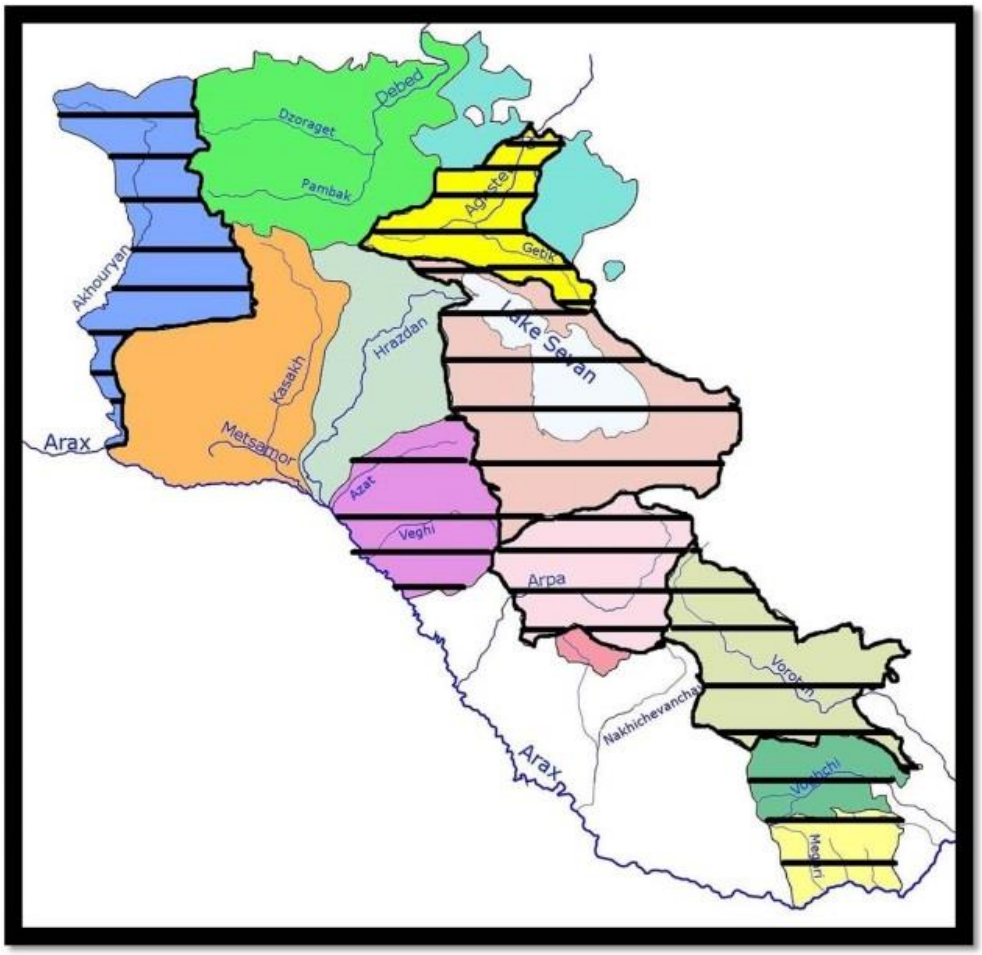

Figure 2. The major river systems and lakes of Armenia with separate drainage basins represented by different colors. Horizontal lines represent the basins where we assessed otter status). For basin integrity, Figure 2 includes areas in white that are in neighboring countries.

RESULTS

We found otter presence in every drainage basin we searched, but we do not provide GPS locations to protect the otters (Figs. 1, 2). In the northwest, we visited Arpi Lake National Park. Park staff reported that otters were common at Arpi Lake, and along two stretches of the Akhuryan River over three kilometers apart we found sign of otter feeding remains (fish with just the head eaten) or tracks and feces within the first 50 m of sign surveys. In both areas, we set trail cameras and obtained pictures of otter at both cameras including at least five individual otters (one lone male and a family with four individuals, Table 1).

Table 1. Trail camera data

Camera Location	Start Date	Stop Date	Trap-days	Nº of Pictures* & Individuals
Power Station, Vorotan River	Oct. 21, 2018	Nov. 27, 2018	37	0; 0
Fish farm, Arpa River	Jun. 21, 2018	May 04, 2019	348	0; 0
Arpa River (close to Areni village)	Jun, 20, 2018	Jul 15, 2018	25	10; at least 1
Arpi Lake National Park, Akhurian River	Nov. 17, 2018	Apr. 12, 2019	148	27; at least 4
Arpi Lake National Park, Ackhurian River	Nov. 18, 2018	Apr. 12, 2019	147	66; at least 1

* Notionally independent pictures

In November 2018, we found no sign of otters north of Lake Sevan, in the Agasten/Getik Rivers basin. We walked unsuccessful sign surveys around Lake Parz of Dilijan National Park and along Ijevan reservoir. An interview at an Ijevan fish farm and two interviews at Barepat village in Getik valley indicated that otters had probably been hunted out and had not been seen for several years, but several weeks later several students from Dprabak village sent us a picture of otter tracks, which were found along the Getik River bank (Fig. 2).

In November 2018, we interviewed rangers at the protection station at Sevan city northwest of Lake Sevan as well as scientists involved with restocking Lake Sevan trout (*Salmo ischchan*) in the northeast of Lake Sevan and a fish farmer in the southwest (Fig. 1). The rangers said otters were present, and otter families with probable young could be seen, especially in winter while scientists reported conflict from otters making holes in nets used to raise trout. The fish farmer also reported conflict claiming that otters come from approximately 2 km away to eat fish. In May 2019, we interviewed a fish farmer in the southeast of Lake Sevan (Fig. 1); the farmer reported seeing many otters in the last 25 years, but he did not mind the otters eating his fish.

In the Azat and Vedi Rivers basin west of Lake Sevan (Fig. 1), staff at the Khor Virap Nature Sanctuary reported otter, and there was a stuffed otter specimen in the visitor center. In addition, fish farmers in the Armash wetland reported conflict from otters eating fish. South of Lake Sevan in the Arpa River basin, there was much evidence of otters (Fig. 1).

In the eastern part of the region at Jermuk town, several people reported seeing otters. A fish farmer interviewed near Jermuk had high walls so no otter conflict, but he reported seeing otters in the river stealing fish from fishermen's nets. In addition, at the Kechut Reservoir downstream from Jermuk guards at the dam reported seeing otters often in the winter at the base of the dam. At a fish farm farther downstream on the Arpa River, the owner informed us that in the last 20 years they found four dead otters, which had climbed into their pools and were unable to get out; also, he informed that otter presence around his fish ponds was more common in winter, and dogs were effective at keeping otters away. Our trail camera set nearby did not take any photos of otters, however (Table 1). At Artavan village, a farmer reported conflict from otters eating fish, usually just the head and entrails in winter; he also showed us the skin of an otter killed; after installing a fence, he had no conflict. During an interview in Shatin village, a farmer with an orchard along the Yeghigis river reported that otters were much more common and hunted in the 1970s and 1980s but rare now; he reported, however, that an otter had been photographed near a new hydroelectric dam on Yeghigis River. At a fish farm in Artabuynk, the owner reported that in

August 2017 otters ate carp, and in winter 2017, otters ate the head and entrails of trout. In 2018, a fence was installed to prevent depredation. We also received a report of otter conflict in the middle part of the Arpa River between Areni and Yeghighis villages and that an otter had been killed at Vardahouvit village. Finally, near Areni village and along the Arpa River, we interviewed a ranger from a nearby private wildlife sanctuary; this ranger reported that several otter families could be seen at once and that illegal fishermen were common. Our camera set nearby obtained pictures of an otter (Table 1) as well as three illegal fishermen (a group of two and a lone fisherman).

The ranger reported that, according to locals, older hunters still ate otters in the second half of last century, but this is not common anymore. Hand-made traps can be found along the riverbanks, which are likely used to hunt coypu; otters can be unintended victims of these traps. One of the major threats is the fluorocarbon fishing nets left in the river, which are illegal, but annually more than 1000 nets can be found in a 15 km section of the Arpa River before the Nakchivan (Azerbaijan) border.

In June 2018 at the Vorotan River basin (Fig. 1), we conducted interviews at three hydropower stations upstream from Spandarian Reservoir (Fig. 2). At the first station, there were no otters, but they reported that otters were present at Spandarian. At the other two stations, interviews indicated that otters were present. At the second station, staff said that a female otter with young was seen at a bridge 250 m away; we conducted a sign survey and found feces with feeding remains and set a trail camera nearby. No otter pictures were obtained, however. In May 2019, we visited a fish farm close to the Tatev hydroelectric dam on the Vorotan river. They informed us that otters were in the river, but because of new fencing, there had been no otter conflict for over two years.

Interviews with locals and field trips along the river Voghchi south of Vorotan (Fig. 1) showed that the otter does not occur in the upstream of the river, and it is rare mid-stream near the Kajaran copper and molybdenum mine. According to interviews with staff at WWF- Armenia, otters can be found farther downstream in Kapan town as well as in upper stream of the Geghi River, a tributary of Vogchi. In addition, local rangers provided us the registrations of otter occurrence at a reservoir close to the Geghi River.

In the southernmost drainage basin of the Meghri River, a fish farmer from Meghri town told us that otters cause big damage to his fish farms and showed us a video from his security cameras of an otter stealing a fish from the pond despite a dog. He also showed the areas along Meghri River where otters can be found, and he showed us an otter that he had killed and made into a mount. A restaurant down river from the farm also reported that otters ate their ducklings occasionally. Another restaurant on the Iranian border also reported otters travelling from the small lake at the restaurant to the Araks River, which serves as the border between Armenia and Iran. Newly installed hydroelectric stations in Meghri River, as well as non-regulated irrigation, have caused water levels to drop forcing otters to migrate to the Araks River. The dropping water level is a key threat to the otter population in Meghri and to the otter population in the whole Meghri river ecosystem. North of Meghri, we interviewed two fish farmers along the river Tsav, not far from Tsav village. Both farmers indicated that otter conflict had increased and become a big problem in the last 4-5 years, and at one farm, an otter had been killed; they also reported conflict at another farm 2-3 km downstream.

DISCUSSION

Although preliminary, our results strongly suggest that otters are recovering in many parts of Armenia as has been documented in many countries of Western Europe (Refs. in Duplaix and Savage, 2018). This recovery was most evident in the northwest at Lake Arpi National Park; in the center at Lake Sevan and Arpa River basin; and to a lesser extent in the far south at the Meghri basin. Our evidence of otter presence came from sign surveys, credible interviews with a range of people including fish farmers to scientists to reserve staff as well as trail cameras. We heard from farmers across Armenia about otters eating fish and ducklings, and to further substantiate otter recovery, some farmers reported that conflict has increased in the last five years or longer. For example, conflict was reported at the Armash wetlands, but during field work in the Armash wetlands from 1992-1995 no otters or conflict were encountered (D. Klem Jr., pers comm.). Otters are listed as Endangered on the Armenia Red List, but a re-assessment may be justified.

We were also able to document threats to otter recovery. Pollution from a molybdenum/copper mine is likely the primary threat to otters in the Voghchi basin, and pollution has been implicated as a threat to otters in other areas (Roos et al., 2014; Pountney et al., 2015). The illegal hunting of otters for their fur is a threat everywhere in Armenia, in particular, north of Lake Sevan and near the village Areni in the Arpa basin where otters were formerly hunted for meat. Overhunting for fur has been the main cause for the decline of the Eurasian otter in Russia and Central Asia, and illegal hunting is still an issue in these areas (Oleynikov and Saveljev, 2015). Otters can also be killed mistakenly by hunters that are targeting coypu, or otters can be caught in traps set for other animals such as coypu and fish. Illegal fishing nets were especially widespread on the Arpa River by the border with Azerbaijan (Nakchivan). Hydropower stations can also negatively affect fish populations and in turn threaten otter populations as reported in the Meghri River catchment bordering Iran.

In many areas of Armenia, otters are numerous enough so cthat they raid fish farms and cause conflict with farmers who sometimes kill otters in retribution as reported for other parts of Asia (Naderi et al., 2017). In Armenia, the conflict was reported to be most common in winter, and otters often ate only the head and entrails of fish. Conflict has demonstrably been mitigated with walls or fencing around fish ponds, and dogs were also effective at times keeping otters away. Future work is needed to find the most cost-effective ways to reduce conflict.

Future research is also necessary to assess otter status in the remaining drainage basins of Armenia, especially the northeast of the country (Fig. 1). In addition, more complete surveys would be beneficial over the entire country to identify otter hotspots where conservation efforts can be focused such as in the Arpa River catchment. Non-invasive genetic sampling of feces can be used in this area and others to estimate otter populations (Lampa et al., 2015; Sittenthaler et al., 2015).

REFERENCES

Aghadjanian F.S. (1986). An analysis of the dynamics of the quantity of carnivorous mammals in the Armenian SSR. Academy of Sciences of Armenian SSR, Institute of Zoology, Zoological Papers XX, pp 150-161. Yerevan [In Russian].

Aghasyan, A., Kalashyan, M. (2010). The Red Book of Animals of the Republic of Armenia. Zangak Press, Yerevan, Armenia.

Duplaix, N., Savage, M. (2018). The Global Otter Conservation Strategy. IUCN/SSC Otter Specialist Group, Salem, Oregon, USA.

Elmeros, M., Bussenius, N. (2002). Influence of Selection of Bank Side on the Standard Method for Otter Surveys. *IUCN Otter Spec. Group Bull*. **19**(2): 67-74.

Ghasabyan, M.G. (2001). Predator mammals of Armenia. Dissertation. Institute of Zoology of NAS Armenia, Yerevan (In Russian).

Gorgadze, G. (2004). The Eurasian Otter in the South Caucasus. *IUCN Otter Spec. Group Bull*. **21**(1): 19-23.

ISSG (2011). Invasive Species Specialist Group of the IUCN Species Survival Commission. http://www.issg.org/database.

Karami, M., Mirzaei, R., Hamzehpour, M. (2006). Status of Eurasian otter (*Lutra lutra*) in Iran. *IUCN Otter Spec. Group Bull*. **23**(1): 27-33.

Kasumova, N.I., Askerov, E., Aidinov, T.G., Mamedrzweva, E.T., Mamedov, A.A. (2009). Current status of the Eurasian otter (*Lutra lutra*) in Azerbaijan. In: **Zazanashvili, N., Mallon, D.** (Eds.), Status and Protection of Globally Threatened species in the Caucasus. WWF, Tblisi, Georgia, pp. 92-97.

Lampa, S., Mihoub, J-B., Gruber, F., Klenke, R., Henle, K. (2015). Non-invasive genetic mark-recapture as a means to study population sizes and marking behavior of the elusive Eurasian otter (*Lutra lutra*). *PLoS ONE* **10**(5): e0125684.doi:10.1371/journal.pone.0125684.

Meleros Y, Palazon S, Gosalbez J, Martelo, J., Bonesi, L. (2013). Is the standard Eurasian otter *Lutra lutra* survey strategy suitable for surveying the American mink *Neovison vison*? *Acta Theriologica* **58(2):** 169-177.

Mirzaei R., Conroy J., Yoxon, P. (2010). Otters in the Hawr Al Azim Wetland, Iran. *Hystrix It. J. Mammal*. **21**(1): 83-88.

Mittermeier, R.A., Robles-Gil, P., Hoffmann, M, Pilgrim, J.D., Brooks, T.B., Mittermeier, C.G., Lamoreux, J.L., Fonseca, G.A.B. (2004). Hotspots revisited: Earth's Biologically Richest and Most Endangered Ecoregions. CEMEX, Mexico City, Mexico.

Mohtasebi, S., Tabatabaei, F. (2018). Evidence of the presence of *Lutra lutra* in Taleqan, Alborz Province, Iran. *IUCN Otter Spec. Group Bull*. **35**(3): 156-158.

Naderi, S., Mirzahani, A., Hadipour, E. (2017). Distribution of and threats to the Eurasian Otter (*Lutra lutra*) in the Anzali Wetland, Iran. *IUCN Otter Spec. Group Bull.* **34**(2): 84-94.

Oleynikov, A.Y., Saveljev, A.P. (2015). Current Distribution, Population and Population Density of the Eurasian Otter (*Lutra lutr*a) in Russia and some Adjacent Countries – a Review. *IUCN Otter Spec. Group Bull.* **33**(A): 21-30

Ozen, A.S., Gunduz, M. (2015). A new record in distribution region of otter (*Lutra lutra*) in Turkey. *GU J Sci*. **28**(3): 353-358.

Pountney, A., Filby, A.L., Thomas, G.O., Simpson, V.R., Chadwick, E.A., Stevens, J.R., Tyler, C.R. (2015). High liver content of polybrominated diphenyl ether (PBDE) in otters (*Lutra lutra*) from England and Wales. *Chemosphere*. **118***:* 81-86.

Red Data book of Armenian SSR. (1987). Rare and threatened species of animals. Erevan. Academy of Sciences of Armenian SSR. Institute of Zoology [In Russian].

Reid, F., Schiaffini, M., Schipper, J. (2016). *Neovison vison*. *The IUCN Red List of ThreatenedSpecies* 2016: e.T41661A45214988. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41661A452 14988.en. Downloaded on 09 May 2020.

Reuther, C., Dolch D., Green, R., Jahrl, J., Jefferies, D., Krekemeyer, A., Kucerova, M., Madsen, A.B., Romanowski, J., Roche, K., Ruiz-Olmo, J., Teubner, J., Trindad, A. (2000). Surveying and Monitoring Distribution and Population Trends of the Eurasian Otter (*Lutra lutra*). *Habitat* 12, Hankensbüttel, Germany.

Rovero, F., Marshall, A. (2009). Camera trapping photographic rate as an index of density in forest ungulates. *J Appl. Ecol*. **46**(5):1011-1017.

Roos A., Eriksson, U., Berger U., Riget F. (2014). Temporal trends of PCBs, DDE, polybrominated biphenyl ethers (PBDEs), HBCDD and perflourinated alkyl acids (PFAAs) in otters (*Lutra lutra*) in Sweden with a focus on transfer from mother to cub. *Dioxin* 2014.

Roos, A., Loy, A., de Silva, P., Hajkova, P., Zemanová, B. (2015). *Lutra lutra*. The IUCN Red List of Threatened Species 2015 http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12419A21935287.en. Downloaded on 26 September 2017.

Sittenthaler, M., Bayerl, H., Unfer, G., Kuehn, R., Parz-Gollner, R. (2015). Impact of fish stocking on Eurasian otter (*Lutra lutra*) densities: A case study on two salmonid streams. *Mamm. Biol*. **80**: 106-113.

Thol-Schmitz, H. (2004). Status of the Eurasian otter, *Lutra lutra*, in Turkey, and experiences with establishing a National Otter Data Base. *Zool. in Middle East*. **33**: 109-118.

Uluturk, S., Yurumez, G. (2017). New records of *Lutra lutra* Linnaeus, 1758 from Turkey. *Commagene J Biol*. **1**(1): 21-24.

RÉSUMÉ

MISE A JOUR DU STATUT DE LA LOUTRE EURASIENNE, *Lutra lutra*, EN ARMENIE

Il existe peu d'informations sur le statut de la loutre Eurasienne (*Lutra lutra*) dans la plupart des régions d'Asie, y compris en Arménie, où l'espèce est considérée comme «en danger» sur la liste rouge arménienne. Les populations de loutres ont diminué en Azerbaïdjan et en Iran, pays voisins de l'Arménie, il est donc essentiel d'évaluer le statut de la loutre en Arménie. Pour ce faire, nous avons effectué des sondages, des entretiens et utilisé des caméras de surveillance (n = 4) sur la majorité des cours d'eau et les principaux lacs d'Arménie. Nos résultats ont confirmé la présence de loutres dans toutes les zones étudiées, suggérant un rétablissement de la loutre, en particulier dans l'extrême nord-ouest, la province centre-sud de Vayots Dzor et autour du lac Sevan dans le centre de l'Arménie. Dans de nombreuses régions, les conflits s'intensifient désormais à cause de la prédation des loutres dans les fermes piscicoles, et les loutres sont parfois tuées en réaction. La pose de clôtures et les chiens ont été utilisés pour prévenir les conflits, et des recherches supplémentaires sont nécessaires pour trouver les moyens les plus rentables en vue atténuer ces conflits. En plus des loutres tuées à cause des conflits, d'autres menaces pèsent sur les populations de loutres comme la chasse illégale pour la fourrure, les prises accessoires dans les filets de pêche illégaux et la pollution due à l'exploitation minière. Un point chaud pour la loutre a été identifié dans le bassin versant de la rivière Arpa de Vayots Dzor, et des travaux futurs seront nécessaires dans les parties restantes de l'Arménie pour identifier davantage de points chauds où des efforts de conservation pourront être concentrés.

RESUMEN

ACTUALIZACIÓN DEL STATUS DE LA NUTRIA EURASIÁTICA *Lutra lutra* EN ARMENIA

Existe poca información sobre el status de la nutria eurasiática (*Lutra lutra*) en la mayor parte de Asia, incluyendo Armenia, donde la especie está designada como “En peligro de extinción” en la Lista Roja Armenia. Las nutrias han declinado en Azerbaijan e Irán, vecinos de Armenia, de manera que es crítico evaluar su status en Armenia. Para lograr ésto, hemos utilizado relevamientos de signos, entrevistas y estaciones de cámaras-trampa (n=4) en la mayoría de los sistemas de ríos y los principales lagos de Armenia. Nuestros resultados confirmaron la presencia de nutrias en todas las áreas relevadas, sugiriendo una recuperación de la especie, especialmente en el extremo noroeste, la provincia sud-central de Vayots Dzor y alrededor del Lago Sevan en Armenia central. En muchas áreas, se está incrementando ahora el conflicto a partir de la depredación por nutrias en estaciones piscícolas, y a veces se mata a las nutrias en respuesta. Se han usado cercos y perros para prevenir el conflicto, y se necesita más investigación para encontrar las maneras más costo-eficientes para mitigar el conflicto. Además de las nutrias que son muertas a causa del conflicto, otras amenazas a la población de nutrias incluyen la caza ilegal por su piel, la captura incidental en redes de pesca ilegal, y contaminación por minería. Se identificó un “punto caliente” -para nutrias- en la cuenca del Río Arpa -en Vayots Dzor-, y se necesita trabajo a futuro en las restantes partes de Armenia para identificar más “puntos calientes” en los cuales se puedan focalizar esfuerzos de conservación.

ՀԱՅԱՍՏԱՆՈՒՄ ԵՎՐԱՍԻԱԿԱՆ ՋՐԱՍԱՄՈՒՅՐԻ (*Lutra lutra*) ԿԱՐԳԱՎԻՃԱԿԻ ԹԱՐՄԱՑՈՒՄ

Ասիայի շատ մասերում, ինչպես նաև Հայաստանում, անբավարար տեղեկություններ կան Եվրասիական ջրասամույրի (*Lutra lutra*) կարգավիճակի վերաբերյալ: Հայաստանի Կարմիր գրքում տեսակն ընդգրված է որպես «Վտանգված»: Հարևան Իրանում և Ադրբեջանում ջրասամույրների թվաքանակը նվազել է, ուստի վերջինիս կարգավիճակի գնահատումը Հայաստանում անչափ կարևոր է: Այն իրականացնելու նպատակով Հայաստանի գետային և լճային էկոհամակարգերի տարբեր հատվածներում իրականացվել են տեսակի կենսագործունեության հետքերի հետազոտություններ, հարցազրույցներ, ինչպես նաև ուսումնասիրություններ ֆոտոթակարդների (n = 4) միջոցով: Ստացված արդյունքները հաստատեցին ջրասամույրի առկայությունը հետազոտված գրեթե բոլոր տարածքներում, ինչը ենթադրում է ջրասամույրի պոպուլյացիայի վիճակի բարելավում, հատկապես հյուսիս-արևմուտքում, Վայոց Ձորի հարավ-կենտրոնական մասում և Սևանա լճի ավազանի որոշ հատվածներում: Շատ շրջաններում մեծանում են կոնֆլիկտները ձկնաբուծարաններում ջրասամույրների կատարած ոսի հետևանքով, ինչին ի պատասխան ջրասամույրներն երբեմն ապօրինաբար որսվում են: Բախումները կանխելու համար օգտագործվում են ցանկապատեր և շներ, սակայն հակամարտությունը մեղմելու առավել ծախսարդյունավետ եղանակներ գտնելու համար անհրաժեշտ են ավելի խորն ուսումնասիրություններ: Հակամարտության հետևանքով սպանված ջրասամույրներից բացի, վերջիններիս պոպուլյացիայի համար այլ սպառնալիքներ են՝ մորթու համար ապօրինի որսը, անօրինական ձկնորսական ցանցերում կենդանիների հայտնվելը և հանքարդյունաբերության հետևանքով կենսամիջավայրերի աղտոտումը: Վայոց Ձորի մարզում՝ Արփա գետի հովտում, հայտնաբերվել է ջրասամույրների կարևորագույն ապրելավայր, և հետագա աշխատանքներ են անհրաժեշտ Հայաստանի մյուս հատվածներում առավել շատ նմանատիպ տարածքների հայտնաբերման ուղղությամբ, որտեղ հետագայում հնարավոր կլինի իրականացնել նաև պահպանության միջոցառումներ.

R E P O R T

POPULATION STATUS AND ACTIVITY PATTERN OF SMOOTH-COATED OTTER (*Lutrogale perspicillata*) IN BHITARKANIKA NATIONAL PARK, ODISHA, EASTERN INDIA

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Abstract
The smooth-coated otter *Lutrogale perspicillata* is an IUCN-Vulnerable species as a result of habitat loss and poaching. The objective of this study was to estimate the population status and activity pattern of smooth-coated otter in Bhitarkanika National Park. To achieve this, 15 camera trap stations were established in the study area between 16th June and 5th August 2019.We recorded notionally 30 independent capture events of smooth-coated otter, over a total of 725 camera trap days. The encounter rate of smooth-coated otter was 2.06/photo-captures/100 trap days, with a diurnal activity pattern. Further research and monitoring, and awareness campaigns for local stakeholders is required in order to design effective conservation strategies of the species.
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Keywords: *Lutrogale perspicillata*, Camera trapping, Kernel density, mangrove Forest, coastal area, Bhitarkanika National Park

INTRODUCTION

The smooth-coated otter *Lutrogale perspicillata* (Geoffroy), a medium sized otter weighing between 7 and 11 kg (Prater, 2005) is distributed throughout southern Asia from Indonesia, through Southeast Asia, and westwards through southern China, Pakistan and India, with an isolated population in Iraq (Pocock, 1941; Hussain, 1993; de Silva et al., 2015). In India, it is widely distributed from the foothills of Himalayas southward to southern India occurring in major rivers and coastal areas (Prater, 2005; Hussain, 1993). Smooth-coated otter is semi-aquatic social carnivore depending upon wetland habitats, which are currently among the most threatened and vanishing

ecosystems worldwide (Davidson, 2014). Poaching for pelt and retaliatory killing as a result of otter-human conflicts are detrimental to the survival of this species across its distributional range (de Silva et al., 2015). Therefore, it has been categorized as 'Vulnerable' in the IUCN Red List of Threatened Species (de Silva et al., 2015) and legally protected under Schedule II Part II of the Indian Wildlife (Protection) Act, 1972.

In Odisha, three species of otters have been reported earlier *viz*; the smooth-coated otter, Eurasian otter *Lutra lutra* and the Asian small-clawed otter *Aonyx cinereus* (Illiger) (Acharjyo, 1999; Mohapatra et al., 2014; Adhya and Dey, 2020). Although, smooth-coated otter's distribution covers most parts of the state of Odisha, ecological data of the species in the state are not available. This lack of ecological data may be due to the often elusive behaviour or typically low density of the species (Kruuk, 2006), or probably due to the lack of targeted surveys which is evident recent faunal inventories (Debata et al., 2015; Palei et al., 2018a; Debata et al., 2018; Kar et al., 2018). In recent years, camera trapping is increasingly used for species inventories and population status estimation, especially of cryptic species (Karanth and Nichols, 1998; Datta et al., 2008; Rovero and Marshall, 2008) and has been widely used in the state of Odisha as well (Palei et al., 2015; Debata and Swain, 2018; Palei et al., 2018b; Palei et al., 2019a,b).

In order to improve existing knowledge about smooth-coated otter across the range, the objective of this study was to determine the population status and activity pattern of the species in Bhitarkanika National Park, Odisha, eastern India. To achieve this goal, we conducted a camera trap survey in Bhitarkanika National Park.

STUDY AREA

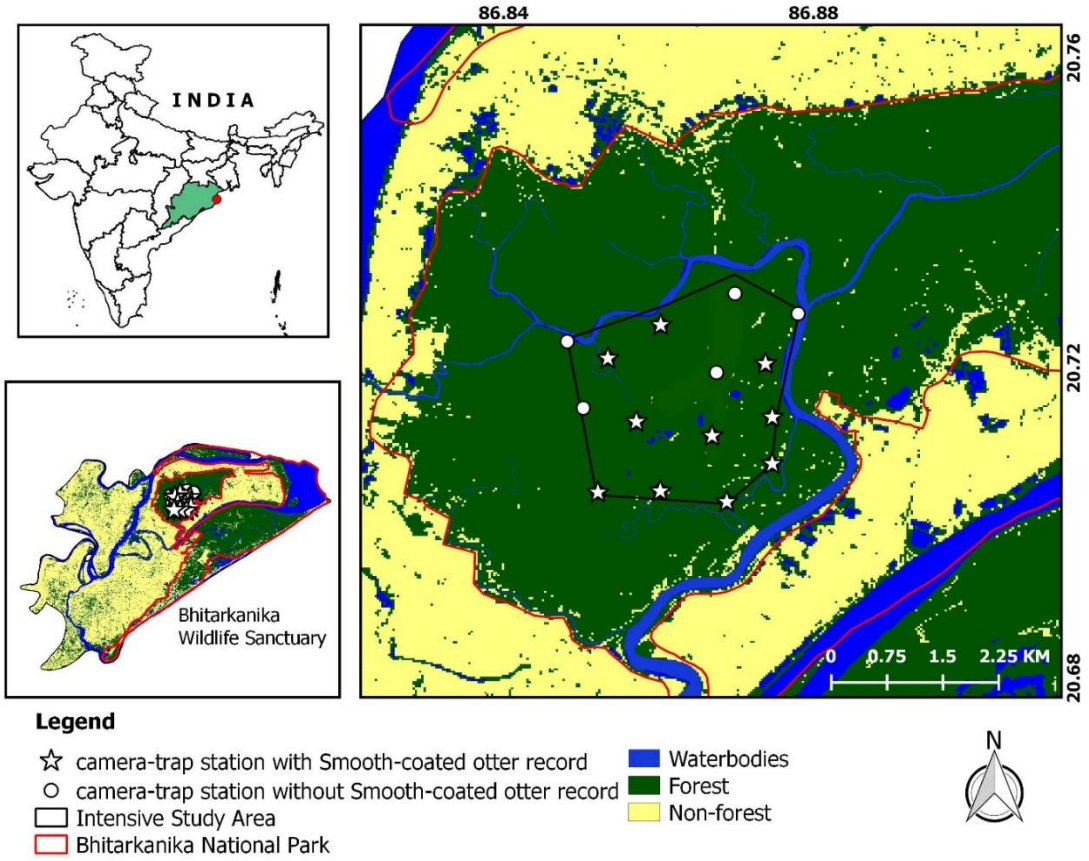
We conducted the study in the Bhitarkanika National Park (BhitarkanikaNP; 20° 30' – 20° 48' N; 86° 45' – 87° 03' E), a mangrove forest area of 145 km^2 in the state of Odisha, Eastern India (Fig. 1). It is characterized by rich alluvial deposits of the Brahmani, Baitarani, and Dhamra rivers. The major habitat type of the study area includes mangrove vegetation, creeks, estuaries, mudflats and water bodies. The area receives an average annual rainfall of 1680 mm, with minimum and maximum monthly temperature variations between 15 ºC and 40 ºC. The climate is humid tropical coastal with pronounced dry(hot) and wet seasons. The land elevation ranges from3.66 m to 8.23 m. Bhitrakanika NP has a wide network of rivers and creeks, which are mainly fed by tidal water. The major vegetation associations along the creeks consists of mangrove species, such as *Heritiera fomes* Buch.-Ham., *Sonneratia apetala* Buch.-Ham, *Avicennia officinalis* Linnaeus and *Excoecaria agallocha* Linnaeus.

The area is a home to more than 24 species of mammals (Venkatraman et al., 2016), 264 species of birds (Gopi and Pandav, 2007) and 51 species of herpetofauna comprising 37 species of reptiles and 14 species of anurans (Jena et al., 2013;Venkatraman et al., 2016).

METHODOLOGY

Camera trap survey was carried out from 16th June to 5th August 2019 as a part of a broader study of mammalian diversity. The survey was conducted within the "intensive study area" (ISA) of 10 km^2, representing all major habitat found in the Bhitarkanika NP (Fig. 1). We divided the ISA into 1 km^2 grids and systematically choose grids for camera locations based on preliminary sign surveys. We deployed 30 camera traps in 15 locations with the nearest-neighbour distance between them at least

1 km in the ISA to ascertain the status of the mammal. We selected most suitable camera trap locations (otter trails, near waterbodies and along the water's edge of creeks) which are likely to allow the camera-trapping of animals based on preliminary sign surveys. Camera traps were strapped to trees or stakes approximately 40 cm above ground. In this survey, all cameras were operational 24 hours per day for 50 days. No baits or lures were used in any camera trap station during the survey.



Cameras were checked every week to replace the batteries and memory cards and to ensure their proper functioning. Total sampling effort was calculated as the sum of the effective days across all stations that each camera was functioning (Boitani and Powell, 2012). We considered photos separated by at least 30 minutes as notionally independent events (Ohashi et al., 2013; Guo et al. 2017). Photos more than one individual of smooth-coated otter in the frame were counted as one detection for the species.

Figure 1. Study area showing locations of camera traps in the Bhitarkanika National Park, eastern India.

To determine the local status of smooth-coated otter, the encounter rate is expressed as the number of notionally independent picture events/total sampling effort x 100. Kernel-density estimation was used to describe temporal activity of smooth-coated otter. This method considers each photographic record as a random sample of an underlying continuous distribution, instead of grouping photographic records in blocks of predefined discrete time categories (Ridout and Linkie, 2009). The analysis was performed using package "overlap" implemented in R version 3.5.1. (Meredith and Ridout, 2017; R Development Core Team 2019).

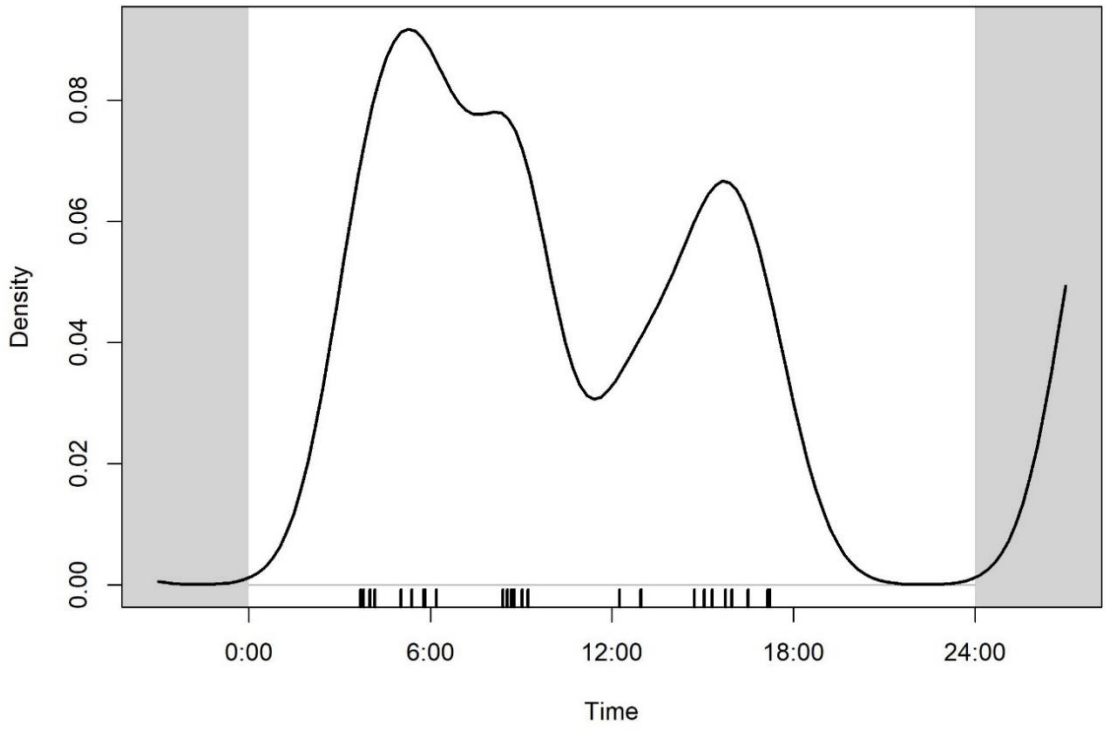
RESULTS

The sampling effort totaled 725 camera trap days. Smooth-coated otter was detected at 10 of the 15 sites (67%) at least once during the sampling period in total of 30 notionally independent events with at least one individual (Fig. 2). The encounter rate of smooth-coated otter was equal to 2.06 events/100 camera trap days. Smooth-coated otter was mostly diurnal, with more actively between 06:00 and 18:00 (67% of the notionally independent movement) with a peak around morning (Fig. 3). Smooth-coated otter showed bimodal peaks in its activity; the first peak was observed from early morning to mid-day and the second smaller was in the late afternoon. Though smooth-coated otters were active throughout the day they exhibited reduced activity during the hottest hours of the day (Fig. 3).

Figure 2. Smooth-coated otters documented by camera traps in Bhitarkanika National Park, eastern India.

DISCUSSION

To our knowledge, this is the first camera trap based data on encounter rate and activity patterns of smooth-coated otter in its range. Therefore, it is difficult to compare this encounter rate with those from any other studies. Smooth-coated otters exhibited a diurnal and crepuscular activity pattern that peaked around early morning in our study area. Similar observation was reported for river otter *Lontra canadensis* (Schreber, 1777) in Canada, where otters were active throughout the day, but with bimodal peaks during the early morning and late evening hours (Martin et al., 2010).



However, our results differ from those from National Chambal Sanctuary, India where the annual activity pattern of smooth-coated otters were substantially nocturnal (Hussain, 2013). Several factors may affect the abundance and activity pattern in otters, such as predators, prey availability, anthropogenic disturbance, or quality and type of habitat (Hussain, 2013). The absence of large predators like tiger *Panthera tigris* (Linnaeus) and leopard *P. pardus* (Linnaeus) and very low anthropogenic disturbance in Bhitarkanika NP may explain the high level of day-time smooth-coated otter activity there.

Figure3. Kernel-density estimates of the daily activity patterns of smooth-coated otter in Bhitarkanika

Our data should be used as baseline information for making future management and conservation strategies of the species in Bhitarkanika NP. The rapidly changing, human-dominated landscape poses the major threat to smooth-coated otter survival through range reduction and fragmentation (de Silva et al., 2015). Therefore, further detailed research should focused on smooth-coated otter beyond protected areas in order to have better understanding and management of the species in human dominated landscape.

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References

Acharjyo, L.N. (1999). Status of Mustelids, Viverrids and Herpestidsof Orissa. In: Envis Bulletin on Wildlife and Protected Areas. Hussain, S.A. (Eds) WII, Dehradun, **2:** 62–64.

Adhya, T., Dey, P. (2020). First record of Eurasian otter (*Lutra lutra*) from chilika lagoon: a Ramsar site situated on the east coast of India. *OTTER, Journal of the International Otter Survival Fund*, **6**: 49–55.

Boitani, L., Powell, R.A. (2012). Carnivore ecology and conservation: a handbook of techniques. Oxford University Press.

Datta, A., Anand, M.O., Naniwadekar, R. (2008). Empty forests: Large carnivore and prey abundance in Namdapha NationalPark, north-east India. *Biological Conservation*, **141:** 1429–1435.

Davidson, N.C. (2014). How Much Wetlands has the World Lost? Long-term and Recent Trends in Global Wetland Area. *Marine and Freshwater Research*, **65(10):** 934–941.

de Silva, P., Khan, W.A., Kanchanasaka, B., Reza Lubis, I., Feeroz, M.M., Al-Sheikhly, O.F. (2015). *Lutrogale perspicillata*. *The IUCN Red List of Threatened Species* 2015: e.T12427A21934884. Downloaded on 19 February 2020.

Debata S., Palei H.S., Mohapatra P.P., Palita S.K. (2015). Additional Records of Cantor's Leaf-Nosed Bat *Hipposiderosgaleritus*Cantor, 1846 (Mammalia: Chiroptera: Hipposideridae) in Eastern India: Odisha. *Journal of Threatened Taxa,***7(8):** 7477–7479.

Debata S., Swain K. K. (2018). Estimating mammalian diversity and relative abundance using camera traps in a tropical deciduous forest of Kuldiha Wildlife Sanctuary, eastern India. *Mammal Study*, **43:** 45–53.

Debata, S., Kar, T., Swain, K.K., Palei, H.S. (2018). The vulnerable Indian Skimmer *Rynchops albicollis* Swainson, 1838 (Aves: Charadriiformes: Laridae) breeding in Odisha, eastern India. *Journal of Threatened Taxa*, **9:** 10961–10963.

Gopi, G.V., Pandav, B. (2007). Avifauna of Bhitarkanika Mangroves, India. *Zoos' Print Journal*, **22(10):** 2839–2847.

Guo, W., Cao, G., Quan, R.-C. (2017). Population dynamics and space use of wild boar in a tropical forest, Southwest China. *Global Ecology & Conserv*ation, **11:** 115–124.

Hussain, S.A. (1993). Aspects of the ecology of smooth-coated otters *Lutra perspicillata* in National Chambal Sanctuary. Unpublished Ph.D Thesis. Centre for Wildlife and Ornithology. Aligarh Muslim University. Aligarh, India.

Hussain, S.A. (2013). Activity pattern, behavioural activity and interspecific interaction of smooth-coated otter (*Lutrogale perspicillata*) in National Chambal Sanctuary, India. *IUCN Otter Specialist Group Bulletin*, **30(1):** 5–17.

Jena, S.C., Palita, S.K., Mahapatra, M.K.(2013). Anurans of Bhitarkanika mangroves, Odisha, east coast of India. *Check List*, **9(2):** 400–404.

Kar, T., Palei, H.S., Debata, S. (2018). Breeding reports and conservation implications of the Endangered Black-bellied Tern *Sterna acuticauda* J.E. Gray, 1831 (Aves: Charadriiformes: Laridae) in Odisha, eastern India. *Journal of Threatened Taxa*, **10(13):** 12840–12843.

Karanth, K.U., Nichols, J.D.(1998). Estimation of tiger densities inIndia using photographic captures and recaptures. *Ecology*,**79:** 2852–2862.

Kruuk, H. (2006). Otters: ecology, behaviour, and conservation. Oxford University Press Inc., New York.

Martin, D.J., Mcmillan, B.R., Erb, J.D., Gorman, T.A., Walsh, D.P. (2010). Diel activity patterns of river otters (*Lontra canadensis*) in south-eastern Minnesota. *Journal of Mammalogy*, **91(5):**1213-1224.

Meredith, M., Ridout, M. (2017). Overview of the Overlap Package. R project.

Mohapatra, P. P., Palei, H.S., Hussain, S.A. (2014). Occurrence of Asian Small-Clawed Otter *Aonyx cinereus* (Illiger, 1815) in Eastern India. *Current Science*, **107(3):** 367–370.

O'Brien, T.G., Kinnaird, M.F., Wibisono, H.T. (2003). Crouching tigers, hidden prey: Sumatran tiger and prey populations in a tropical forest landscape. *Animal Conservation*, **6:** 131–139.

Ohashi, H., Saito, M., Horie, R., Tsunoda, H., Noba, H., Ishii, H., Kuwabara, T., Hiroshige, Y., Koike, S., Hoshino, Y., Toda, H., Koichi, K. (2013). Differences in the activity pattern of the

wild boar *Sus scrofa* related to human disturbance. *European Journal of Wildlife Research*, **59:** 167–177.

Palei, H.S., Das, U.P., Debata, S. (2018a). The vulnerable fishing cat *Prionailurus viverrinus* in Odisha, eastern India: status and conservation implications. *Zoology and Ecology*, **28(2):** 69–74.

Palei, H.S., Palei, N.C., Rath, B.P., Mishra, A.K. (2019a). Records of the globally threatened rusty-spotted cat in Odisha, India. *Nature Conservation Research*, **4(3):** 112–116.

Palei, H.S., Pradhan, T., Sahu, H.K. and Nayak, A.K. (2015). Estimatingmammalian abundance using camera traps in the tropical forest of Similipal Tiger Reserve, Odisha, India. *Proceedings of the Zoological Society*, **69:** 181–188.

Palei, N.C., Rath B.P., Palei H.S., Mishra A.K. (2018b). Occurrence of melanistic leopard in Odisha, eastern India. *Cat News*, **68:** 7–8.

Palei, N.C., Rath, B.P., Palei, H.S., Mishra, A.K. (2019b). Photographic evidences of Indian grey wolf (*Canis lupus pallipes*) in Sundargarh forest division, Odisha, India. *e-planet*, **17(2):** 152-156.

Pocock, R.I. (1941). *The fauna of British India, including Ceylon and Burma. Volume 2, Mammals*, pp. 265–317. Taylor and Francis, London.

Prater, H.S. (2005). *The Book of Indian Animals*. New Delhi: Oxford University Press.

R Development Core Team. (2019). R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing. www.R-project.org.

Ridout, M.S., Linkie, M. (2009). Estimating overlap of daily activity patterns from camera trap data. *Journal of Agricultural Biological and Environmental Statistics*, **14:** 322–337.

Rovero, F., Marshall, A.R. (2008). Camera trapping photographicrate as an index of density in forest ungulates. *Journal of Applied Ecology*,**46:** 1011–1017.

Venkatraman, C., Padmanaban, P., Shrinivaasu, S., Sivaleela, G. (2016). Faunal diversity of Bhitarkanika mangroves, Odisha. *Records of the Zoological Survey of India*, **116:** 407–430.

RÉSUMÉ

STATUT DE LA POPULATION ET PROFIL D'ACTVITE DE LA LOUTRE A PELAGE LISSE (*Lutrogale perspicillata*) DANS LE PARC NATIONAL DE BHITARKANIKA, A ODISHA, DANS L'EST DE L'INDE

La loutre à pelage lisse *Lutrogale perspicillata* est classée comme espèce vulnérable par l'UICN en raison de la perte d'habitat et du braconnage. L'objectif de cette étude était d'estimer l'état de la population et le schéma d'activité de la loutre à pelage lisse dans le parc national de Bhitarkanika. Pour ce faire, 15 pièges photographiques ont été installés dans la zone d'étude entre le 16 juin et le 5 août 2019. Nous avons enregistré théoriquement 30 événements indépendants de loutres à pelage lisse, sur un total de 725 jours de piégeages photographiques. Le taux de rencontre de la loutre à pelage lisse était de 2,06 / captures-photo / 100 jours de piégeages, avec un modèle d'activité diurne. Des recherches et un suivi supplémentaires, ainsi que des campagnes de sensibilisation des décideurs locaux sont nécessaires afin de concevoir des stratégies de conservation efficaces pour l'espèce.

RESUMEN

STATUS POBLACIONAL Y PATRONES DE ACTIVIDAD DE LA NUTRIA LISA (*Lutrogale perspicillata*) EN EL PARQUE NACIONAL BHITARKANIKA, ODISHA, INDIA ORIENTAL

La nutria lisa *Lutrogale perspicillata* es una especie catalogada como Vulnerable por la UICN como resultado de pérdida de hábitat y caza furtiva. El objetivo de este etudio fue estimar el status poblacional y los patrones de actividad de la nutria lisa en el Parque Nacional Bhitarkanika. Para lograrlo, fueron establecidas 15 estaciones de cámaras-trampa en el área de estudio, entre el 16 de Junio y el 5 de Agosto de 2019. Registramos 30 eventos de captura fotográfica de nutria lisa -conceptuados como independientes-, sobre un total de 725 días-cámara-trampa. La tasa de encuentro con nutrias lisas fue de 2.06 foto-capturas/100 días-trampa, con un patrón de actividad diurno. Se requiere más investigación y monitoreo, y campañas de sensibilización de los actores locales, para diseñar estrategias de conservación efectivas para esta especie.

R E P O R T

A DISTRIBUTION SURVEY FOR OTTERS IN SIKKIM, INDIA

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Abstract: Little research or conservation attention has been directed towards otter species in the rich biological assemblages in the Eastern Himalayan region of India. We present the findings from the first physical and social survey of otters in the Indian State of Sikkim. We searched riverbanks along the major river of Sikkim, the Teesta River, and three of its tributaries, the Rangit, Lachen and Lachung for scats, tracks, dens and latrines of otters. We quantified 1) bankside vegetation cover and substrate, and 2) levels of human disturbance to habitat. Awareness programs were conducted in villages and schools adjacent to surveyed river stretches, and residents were queried about their familiarity with otters. We found very little evidence of otter presence on the banks of major rivers in Sikkim, from either the physical or social surveys, which may be attributed to increasing habitat degradation and little familiarity with otters among local people, particularly in the younger generation.
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Keywords: Otters, Sikkim, India

INTRODUCTION

Three species of otter have been reported in the Eastern Himalayas region (Das, 2010; Choudhury, 2013; Talukdar and Choudhury, 2017), but thus far, no systematic studies particularly on otters in the small Indian state of Sikkim. Sikkim is a part of the Eastern Himalayan biodiversity hotspot (Myers et al., 2000). Most conservation work in the region, however, focuses mostly on large and charismatic species, neglecting the small but ecologically important group of small mammals, including the otters.

Otters are little studied in Sikkim due to its remote location and rugged and steep terrain. There is scanty mention of Eurasian otter (*Lutra lutra)* (Biswas and Ghose, 1982; Ghose et al., 2014), Small-clawed otter (*Aonyx cinereus*) and Smooth coated otter (*Lutrogale perspicillata*) (Choudhury, 2013) presence in Sikkim. There has been only one confirmed record of a live Eurasian otter in Sikkim in recent decades on 2 November 2018 (http://epaper.sikkimexpress.com/date/2018-11-02/), officers and staff of the Forest and Environment Department rescued, rehabilitated, and released a female Eurasian otter found in a small hill stream near the village of Malling, Mangan (N 27.49808˚; E88.54851˚) at an elevation of 1442 m asl in northern Sikkim.

This study aims to address the knowledge gap hindering conservation of otters in Sikkim by conducting a systematic otter survey and by assessing human threats to otter habitat. I present data on a physical survey of otters in the major river of Sikkim, the Teesta, and three of its tributaries. Awareness programs were conducted for local villagers, who were asked about their familiarity with otters.

STUDY AREA

Sikkim is a small, mountainous state in the north of India (7,096 km^2); Bhutan lies to the east, Nepal to the west, and China to the north. An immensely rich biological diversity is fostered by the many eco-climatic niches along the state's steep elevation gradients from 300 m asl in the lowland plains to 8,598 m asl at Mt. Kanchendzonga.

The Teesta (Fig. 1) is the largest river in Sikkim, originating from glaciers in North Sikkim at an elevation of about 5,200 m asl. It collects numerous tributaries in its descent, including the Rangit River, Zemu Chu, Lachung Chu, Rangyong Chu, Dik Chu, Rani Khola, and Rangpo Khola. The Rangit is the largest tributary, originating in the mountain peaks of West Sikkim and joins the Teesta at the southern border with the State of West Bengal. The seasonal flows of these rivers are highly variable, and depend on snowmelt from the Tibetan Plateau and surrounding mountain ranges, together with a long monsoon season. The Teesta and Rangit River stretches surveyed were mostly low-elevation, ranging mostly between 200m and 400 m asl. The two higher elevation tributaries of the Teesta surveyed the Lachen and the Lachung Chu, flow from 4,500 to 1,200 m and joins the river Teesta at the small town of Chungthang. River banks were generally rock-strewn, with cobbles or boulders.

Figure 1. A view of the Teesta River, running north-south through the centre of Sikkim.

METHODS

We followed a sampling protocol used in the western and central Himalayas (Jamwal et al., 2016; Chettri and Savage, 2014), recording indirect otter signs, comprising tracks, scats, latrines, and dens, and human disturbance variables. Plots were placed 900 m apart along one bank of each river, and were 100 m by 10 m, adjacent to the river edge, for a 1,000 m^{2}plot. The survey was conducted over three and half weeks in January and February, 2017. High water flow during the monsoon

in Sikkim, up to 8 months of rain, leaves a small window for sampling in winter months.

As the survey proceeded, it became apparent that otter signs were scarce, so if the terrain allowed, additional observations were made along the transect between plots. This was possible on the Teesta and Rangit Rivers, but not on the Lachen and Lachung Chu, where extremely steep and challenging terrain may have led to some otter sign being missed. Vegetation cover was classified in categories of bare, light, medium, moderate, and dense. Bank substrate was classified into categories of sand/mud, cobbles, small rock, large rock, and boulders. Habitat disturbance was recorded as none, light, moderate, or severe.

Presentations on otter ecology were made in villages and schools to make local people aware of the value of otters. We distributed an informative poster, and flashcards of otters and other wildlife, to school teachers, students and local villagers and delivered oral presentations on the biodiversity of Sikkim and the important role that otters play in aquatic ecosystems. Community members and school children were asked if they recognized otters and if they had seen them recently or in the past.

RESULTS

Otter Sign and Habitat Characteristics

A total of 82 plots were sampled: 41 plots along the mainstream Teesta River, 27 plots along the Rangit, 10 plots along the Lachen, and 4 plots along the Lachung Chu. Very little otter sign was found along the Teesta and Rangit Rivers. I recorded only four otter positive sites on surveyed stretches of Teesta River (scat = 2, latrines = 1, tracks = 1) and five positive sites from Rangit River (scat = 4, latrines = 1). No otter dens were identified. Only one otter track was documented, on the bank of the Teesta. River banks on all transects were extremely rocky, and that together with fluctuating water levels, contributed to a lack of track impressions. The small sampling effort conducted in North Sikkim, on two tributaries of the Teesta, small mountain streams that flow swiftly on steep gradients at much higher elevations, yielded no sign of otters. The otter sign locations on the Teesta and Rangit Rivers are shown in Figure 2.

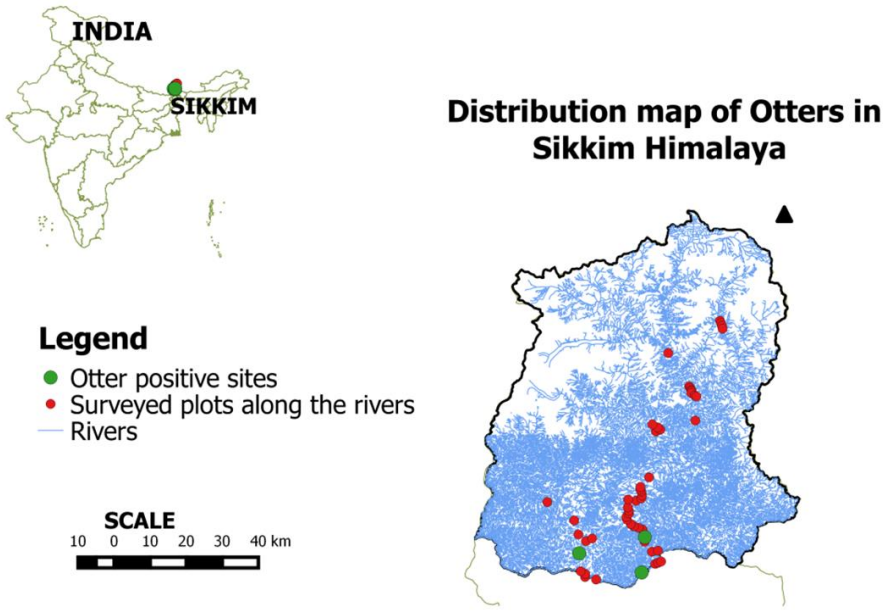

Figure 2. Map of otter sign, Teesta, Rangit, Lachen and Lachung Rivers, Sikkim. Green dots represent positive sites for otters and red dots represent the plots along the four surveyed rivers in Sikkim.

The banks of all sampled rivers were overwhelmingly bare of vegetation; 98 % of plots on the Teesta (40 of 41), 89% on the Rangit (23 of 26 plots), 80% on the Lachen (8 of 10) and 50% on the Lachung Chu (2 of 4), had between 0 and 5% vegetation cover. As a result, the river banks, whether narrow or wide, were dominated of rocks of various sizes. Bankside substrate was largely comprised of cobble and large rocks with numerous large boulders and very few sandy areas.

Habitat Disturbance

We investigated human disturbance threats on a small scale along the selected study rivers. Human disturbance along river banks was measured by factors such as abundance of dog and cow tracks, trash, sand mining, nearby industry, dams, bankside human tracks and roads and proximity to houses (Fig. 3). Along the main river of Sikkim, the Teesta, more than two-thirds of the plots showed severe human impacts (none = 9%; light = 9%; moderate = 15%; severe = 68%). Along the Rangit River, more than half the plots showed no sign of disturbance, but more than a quarter showed severe impacts (none = 58%; light = 8 %, moderate = 8 %; severe = 27 %). Along the two high elevation tributaries, there was almost no human disturbance.

Figure 3. Rangit River near Jorthang in South Sikkim. Smoke from a factory located next to the river can be seen in the distance.

Social Survey

We asked community members in 80 villages, engaging 3,300 individuals from age 18 to 89 years about their familiarity with and observations of otters. Of this group, the forty respondents who recognized otters reported noting a decreasing trend in otter sightings over the last decade. Senior citizens appeared to have some knowledge about otters, but younger villagers were unfamiliar with the species. I also conducted awareness and outreach activities in five schools in villages along the

surveyed rivers, querying 180 students from age 6 to 16 about their knowledge of otters. Only 6 students reported knowledge of otters and their habitat.

Figure 4. One of many heavily disturbed stretches of the Teesta River near Singtam town in East Sikkim.

Threats to Otters

Despite the abundance of rivers and wetlands in the Eastern Himalayas, otters still face numerous threats in the region. Otter populations across South Asia are in steep decline (Duplaix and Savage, 2018) owing to rising human populations, habitat fragmentation, decreasing water quality and quantity, loss of adequate prey base and the illegal pelt and pet trade (Gomez et al., 2016; Gomez and Bouhuys, 2018). In Sikkim, severe human disturbances to otter habitat include hydroelectric dams, sand mining, pollution, and stone quarrying. A particular threat comes from habitat fragmentation and alteration created by the high concentration of existing and planned hydroelectric dams. The Teesta River currently has two large and three smaller hydroelectric dams, and the Rangit River has one large dam. Large portions of rivers will be diverted into tunnels during construction, disrupting aquatic ecosystem dynamics (Fig. 4). In addition, the steepness of most of Sikkim's landscape means that towns discharging urban pollution, as well as pharmaceutical, tanning, and distilling industries, tend to be concentrated on the flanks of riverbanks.

DISCUSSION

Otter populations in Sikkim, India appear to be extremely rare and highly threatened. The presence but extreme scarcity of otter sign along the Teesta and Rangit Rivers, and a captured Eurasian otter, indicate that while otters still inhabit Sikkim's two main rivers, their populations are very low. Impressions recorded from older citizens suggest that otter populations may be dwindling in the big rivers and are perhaps already extirpated from the highly disturbed tributaries. Threats to otter habitat are only increasing in the state, as population rises, water quality declines, and more planned dams disrupt continuous habitat. Water quantity in Sikkim's rivers is

also likely to decline in the future as climate warming diminishes the glaciers that feed rivers.

There is a compelling need for a conservation strategy for otters in Sikkim. Wildlife management agencies at the state and national level, together with the network of Himalayan otter researchers and conservationists, urgently need to develop and implement a strong plan for the protection and recovery of otter populations. Without such a protective strategy, it seems unlikely that otters will persist in Sikkim in the near future.

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REFERENCES

Biswas, B., Ghose, R.K. (1982). Progress report on pilot survey of the World Wildlife Fund-India/Zoological Survey of India collaborative project on the status survey of the lesser cats in eastern India. Zoological Survey of India, Calcutta, India.

Chettri, P., Savage, M. (2014). A distribution survey for otters along a river in Central Bhutan. *IUCN Otter Spec. Group Bull*. **31**(2): 65-74.

Choudhury, A. (2013). The mammals of North east India. *Gibbon Books and the Rhino Foundation for Nature* in NE India, Guwahati, Assam, India.

Das, C. (2010). First Record of Eurasian Otter (*Lutra lutra*) in Rajiv Gandhi Orang National Park, Assam. *Tigerpaper* **37**(3): 32

Duplaix, N., Savage, M. (2018). Global Otter Conservation Strategy. *IUCN Otter Spec. Group Publication.* 168 pp.

Ghose, P.S., Shrestha, P., Theengh, L.T., Pintso, T., Shar, B.K. (2014). Records of small carnivores in Barsey Rhododendron Sanctuary, Sikkim, India. Small Carnivore Cons. **51**:42-45**.**

Gomez, L., Leupen, B.T.C., Theng, M., Fernandez, K., Savage, M. (2016). Illegal Otter Trade: An Analysis of Seizures in Selected Asian Countries (1980-2015). TRAFFIC, Petaling Jaya, Selangor, Malaysia.

Gomez, L., Bouhuys, J. (2018). Illegal otter trade in Southeast Asia. *TRAFFIC Report*, Petaling Jaya, Selangor, Malaysia. 51 pp. http://epaper.sikkimexpress.com/date/2018-11-02/

Jamwal, P. S., Takpa, J., Chandan, J., Savage, M. (2016). First systematic survey for otter (*Lutralutra*) in Ladakh, Indian Trans Himalayas. *IUCN Otter Spec. Group Bull*.**33**(2): 79-85.

Myers, N., Mittermiler, R.A., Mittermiler, C.G., Gustava, A.B., Da Foseca, Kent, J.(2000). Biodiversity hotspots for conservation priorities. *Nature.* 403:853-858

Roos, A., A. Loy, de Silva, P., Hajkova, P., Zemanova, B. (2015). *Lutra lutra*. The IUCN Red List of Threatened Species 2015: e.T12419A21935287 http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12419A21935287.en.Downloaded on September 13, 2019.

Talukdar, N.R., Choudhury, P. (2017). Conserving wildlife wealth of Patharia Hills Reserve Forest, Assam, India: A Critical Analysis. *Global Ecology and Cons.* **10**: 126-138.

RÉSUMÉ

ETUDE DE LA DISTRIBUTION DES LOUTRES DANS L'ETAT DU SIKKIM EN INDE

Les espèces de loutres des riches écosystèmes de la région de l'Himalaya oriental en Inde ont été jusqu'ici peu étudiées en matière de recherche et de conservation. Nous présentons ici les résultats de la première enquête physique et sociale sur les loutres dans l'État indien du Sikkim. Nous avons cherché des épreintes, des pistes, des tanières et des latrines de loutres sur les berges des principales rivières de l'état du Sikkim, à savoir la rivière Teesta et trois de ses affluents : le Rangit, le Lachen et le Lachung,. Nous avons quantifié 1) la couverture végétale et le substrat des berges, et 2) les niveaux de perturbation humaine de l'habitat. Des programmes de sensibilisation ont été menés dans les villages et

les écoles adjacentes aux tronçons de rivière étudiés, et les résidents ont été interrogés sur leur connaissance des loutres. Nous avons trouvé très peu de preuves de la présence de loutres sur les rives des principales rivières de l'état du Sikkim, à partir des enquêtes physiques ou sociales, ce qui peut être attribué à une dégradation croissante de l'habitat et à une faible connaissance des loutres parmi les populations locales, en particulier dans la jeune génération.

RESUMEN

RELEVAMIENTO DE DISTRIBUCIÓN DE NUTRIAS EN SIKKIM, INDIA

Se ha dirigido poca investigación o atención de conservación hacia las especies de nutrias en los ricos ensambles biológicos de la regióna Oriental de los Himalayas, en la India. Presento los hallazgos del primer relevamiento físico y social de nutrias en el Estado Indio de Sikkim. Exploré las barrancas ribereñas a lo largo del mayor río de Sikkim, el Río Teesta, y tres de sus tributarios, el Rangeet, el Lachen y el Lachung, en busca de fecas, huellas, madrigueras y letrinas de nutrias. Cuantifiqué 1) la cubierta vegetal y el sustrato ribereño, y 2) los niveles de disturbio humano del hábitat. Se condujeron programas de sensibilización en poblados y escuelas adyacentes a los tramos de río relevados, y los residentes fueron encuestados acerca de su familiaridad con las nutrias. Encontré muy poca evidencia de presencia de nutrias en las barrancas de los principales ríos de Sikkim, sea en los relevamientos físico ó social, lo que puede atribuirse al incremento de la degradación del hábitat y a la poca familiaridad de la gente local con las nutrias, particularmente en las jóvenes generaciones.

A R T I C L E

A SURVEY OF THE EURASIAN OTTER *Lutra lutra* AND HUMAN-OTTER INTERACTION IN THE MIDDLE OUM ER RBIA RIVER, MOROCCO

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Abstract: The Eurasian otter is listed as "near threatened" in IUCN's Red List of Threatened species and in Appendix I of CITES. In Morocco, *Lutra lutra* occurs in the Middle and High Atlas, the Rif Mountains and in the plains of the central Morocco. The status of this species in Morocco is far from clear and there is limited available information on its distribution and ecology. Our aim was to confirm the presence of the Eurasian otter in the Middle Oum Er Rbia River, especially in the province of Fkih Ben Salah, to describe any human-otter conflicts and to identify the current and potential threats to the species. Between November 18, 2019 and February 29, 2020, a combination of standardized interviews combined with a field survey to gather information about otters in the study area was used. Results of the interviews and surveys confirmed the presence of this mammal in two sites. Our evidence is based on footprints, spraint and cadavers of otters. We have found that there is a conflict between local people, especially fishermen, and otters due to the competition for fish. Otters are facing extreme threats by human-induced habitat destruction, in particular gravel and sand extraction from the river bed, disturbances by local people, pollution, low water quality and vegetation burning. In conclusion, efforts must be focused on the conservation of this species by protecting its habitat and reducing conflict between local people and otters.

Keywords: Eurasian Otter, Middle Oum Er Rbia River, human-otters conflict, conservation.

INTRODUCTION

The Eurasian otter *Lutra lutra* Linnaeus 1758 is the most widely distributed otter species in the world, its range include parts of Europe, Asia and Africa (Nancy and Chris, 2016). Major threats to the surviving populations of *Lutra lutra* are habitat

degradation, pollution, continuous deforestation, construction of hydroelectric power projects, overexploitation, poaching and trading (Mucci et al., 2010; Bhattacharya et al., 2019). This Otter is listed as "near threatened" in IUCN's Red List of Threatened species (IUCN, 2019), in Appendix I of CITES (CITES, 2019) and in Appendix I of the Bonn Convention. One subspecies, *Lutra lutra angustifrons*, is endemic to Africa and occurs in Morocco and Algeria (Broyer et al., 1988). In Morocco, *Lutra lutra* occurs in the Middle and High Atlas, the Rif Mountains and in the plains of the central Morocco (MacDonald and Mason, 1984; Jacoby and Williams, 1995; Cuzin, 2003; Delibes et al., 2012). Healthy otter populations appear to remain in the foothills of the Middle and High Atlas but the trend of populations disappearing from the relatively flat Atlantic, therefore *Lutra lutra* tended to be confined to less cultivated, mountainous areas (Delibes et al., 2012). The status of this species in Morocco is far from clear and there is limited available information on its distribution and ecology. Recently the species has been sighted in a new locality in the Western Rif Mountains (Waters and El Harrad, 2018).

Little published Data is available on the Eurasian otter in Morocco. There isn`t any information available on their distribution in the Middle Oum Er Rbia River. The objective of this study was to confirm the presence of *Lutra lutra* in the Middle Oum Er Rbia River, especially in the province of Fkih Ben Salah, an area of about 80 km², to describe any human-otter conflicts, to identify the current and potential threats to the Eurasian otter, and to make recommendations for the protection of the species in this area.

MATERIALS AND METHODS

Study area

The Oum Er Rbia River is *one* of the major *rivers* in Morocco and is 550 km long and has a catchment area of 48 000 km². It originates in the region of Khenifra *(*32°56′22″N5°40′3″W), located in the Middle Atlas Mountains, and it flows into the Atlantic Ocean at Azemmour city (33°17′16″N8°20′32″W). The study was conducted in the Middle Oum Er Rbia area, province of Fkih Ben Salah, especially between the village of h in the east and the village of Dar Ould Zidouh in the west (Fig. 1) and comprises an area of about 80 km². This region belongs to the plain of Tadla which covers an area of approximately 3 600 km². This plain is crossed by the River of Oum Er Rbia. The regions of Sidi Aissa Ben Ali, Ouled Slimane and Lahbabeza (Fig.1) belong to the zone of Beni Moussa which is located on the left of this river. Beni Moussa is a vast irrigated agricultural area covering an area of 695 km². The regions of Lamrabta and Aaribate (Fig. 1) belong to the zone of Beni Amir which is located on the right of the Oum Er Rbia River. Beni Amir is an irrigated agricultural area covering an area of 275 km² hectares. The study region is characterized by a very cold winter and a hot summer. Some of the riparian vegetation types are *Tamarix sp*., *Nerium oleander, Phragmites australis, Ficus carica, Juncus sp., Scirpus sp*., *Ballota hirsuta, Nicotiana glauca, Olea europea var. sylvestris,* and some *Populus alba* trees near the village of Sidi Aissa Ben Ali.

Data Collection

In October 2019, preliminary observations were made on four days in the study site. This period allowed the observers to become familiar with the terrain. Between November 18, 2019 and February 29, 2020, a combination of standardized interviews combined with a field survey to gather information about otters in the study area was used.

Interviews

Preliminary information on the Eurasian otter was obtained through interviews with 48 inhabitants in the study area. The focus was on the inhabitants who work near the river and in particular the shepherds, the wood collectors, the farmers and the fishermen. These people have valuable information on the wild aquatic and semi-aquatic fauna. Interviews were administered in the local language (*Darija*); motivating the interviewees to speak freely. Color pictures of the Eurasian otter were shown and the main questions asked were: what are the main economic activities of the interviewee? Does he work near the Oum Er Rbia River? Did the interviewees *fishes in the river*? Did the interviewee recognize the Eurasian otter on the picture? Are Eurasian otter present in the region? What is the period of the day he/she observed them? Are otters present year-round or seasonally? Are otters captured and/or killed in the region? What are advantages and disadvantage of the otter's presence?

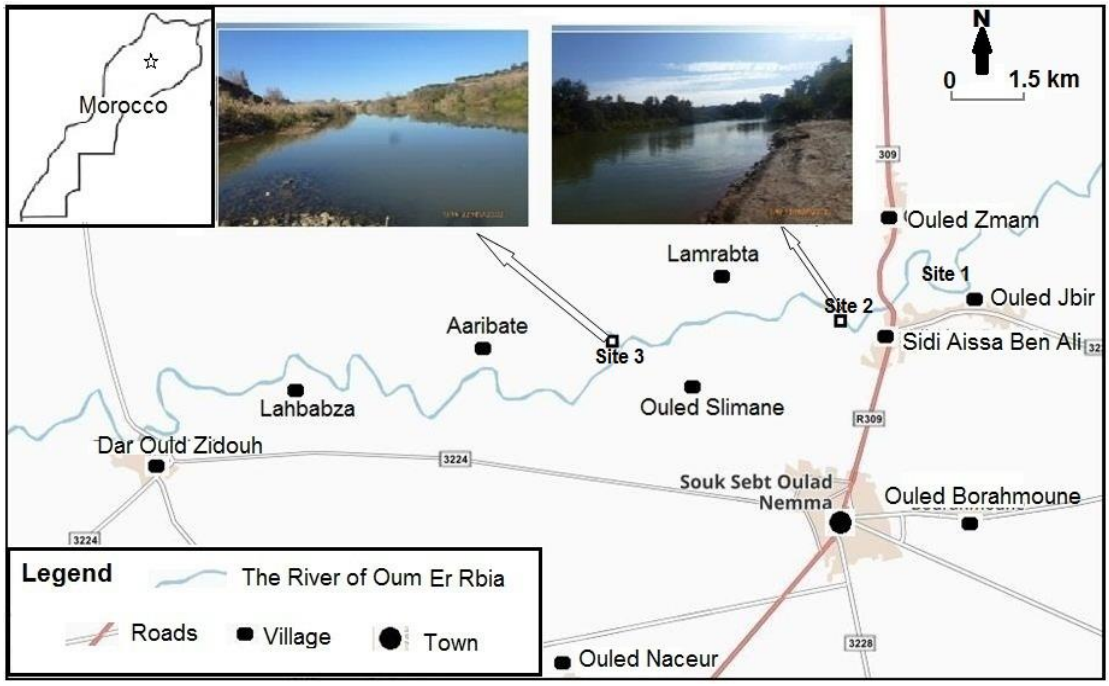

Figure 1. Map of the study area showing the River of Middle Oum Er Rbia and the main roads and localities. The rectangle on the inset indicates the location of the study region in the Morocco map.

Surveys

Five surveys were conducted in the Middle Oum Er Rbia, in the region limited by the village of Ouled Jbir to the east and the village of Lahbabza in the west (Fig. 1). To search for otters, the observers moved slowly and quietly along the River of the Middle Oum Er Rbia to look for evidence of otters including spraints, footprints, food remains, cadavers, soil displacement and grooming and rolling areas. Otter's footprints and scats were compared with *those of* the specimens living in the Rabat Zoo and with published data (e.g. Bhattacharya et al., 2019).

RESULTS AND DISCUSSION

Distribution of Lutra lutra in the study area

Interviews results showed that 65 % of the interviewees confirmed the presence of *Lutra lutra* in three sites in the Middle Oum Er Rbia: in Ouled Jbir (site 1, Fig. 1), in site called '*la Chutte'* located to west of the village of Sidi Aissa Ben Ali (site 2, Fig. 1), and in the south west of the village of Lamrabta (site 3, Fig. 1). The inhabitants who confirmed the presence of otters are the people who frequent permanently the river (shepherds, fishermen and farmers). Other people do not know that otters exist in the river although they live in villages near this river. In the study area, the local name of the Eurasian otter is '*Kalb Alma*'. '*Kalb*' means the dog and '*Alma*' means the water. This name comes from the morphological resemblance between the otter and the dog and its semi-aquatic way of life. The majority of interviewees reported that the population of the Eurasian otter decreased in the study region in the past decades.

Results of the surveys confirmed the presence of *Lutra lutra* in two sites: in '*La Chutte*' (site 2, Fig.1) and in the south west of the village of Lamrabta (Site3, Fig. 1). In Ouled Jbir (site 1, Fig. 1), although 11 local inhabitants confirmed the observation of an otter's cadaver near this village in 2019, we did not find any sign of the actual presence of otters. In the sites 2 and 3, we found spraints (Fig. 2, Fig. 3) and footprints of otters (Fig. 4). According to inhabitants who frequent the river at night, at least 7 otters were observed in site 2, and 5 otters in site 3. In the south west of the village of Lamrabta (site 3, Fig. 1), we found cadavers of two juvenile otters (Fig. 5). Results of the interviews showed that the two dead otters were not killed by inhabitants. The majority of the interviewees who frequent permanently the river confirmed that they find cadavers of dead otters in the river during the last two years. Observation of the scats found showed the presence of scales and fish bones with a dominance of the shells of freshwater gastropods, namely the subclass of Prosobranchs and other taxa of Gastropods. The presence of these preys in the otter's diet has been already confirmed by several studies (Mason and Macdonald, 1986, 1993; Lanszki and Kormendi, 1996; Kingston et al., 1999; Lanszki and Molnar, 2003; Lanszki and Sallai, 2006).

Figure 2. Footprints of *Lutra lutra* found in the Middle Oum Er Rbia River, west of the village of Sidi

Aissa Ben Ali (site 2, Fig. 1) (November 2019).

Figure 3. Footprints of *Lutra lutra* found in the south west of the village of Lamrabta (site 3, Fig. 1) (February 2020).

Figure 4. Scats of *Lutra lutra* found in the south west of the village of Lamrabta (site 3, Fig. 1). (February 2020).

Figure 5. A cadaver of *Lutra lutra* found in the south west of the village of Lamrabta (site 3, Fig. 1) (February 2020).

In this study, we were unable to photograph otters in the study region. Otters are quite difficult to see in the wild. In the study region, *they* are very discreet and they flee from humans because inhabitants throw stones at them. These mammals are principally nocturnal or crepuscular and they spend a lot of time in the water. In addition, the study region is frequented by fishermen and other inhabitants overnight. For this reason we were not allowed to install the camera during the time required to collect additional data. Several researchers were unable to photograph otters, although they installed cameras for months. For example, at Sungai Relau and Sungai Ceruai, seven months of continuous camera trapping, riverbank surveys and observations resulted in no Hairy-nosed Otter records (Fernandez, 2018).

During the study period we recorded three otters died, two juveniles and one adult, but the causes of this mortality remain unknown. Several factors can be responsible for this mortality, namely water pollution, food shortage, inter and intra-specific competition. In the wild otters, many factors can lead to death. Kruuk and Conroy (1991) reported that food shortage was considered to be the ultimate cause of natural mortality in coastal dwelling otters in Shetland, with the effects of mercury and perhaps polychlorinated biphenyls (PCBs) as contributing factors (Mason, 1989, 1995).

Local People-Otter Conflict

Interview results showed that the Eurasian otter is viewed unfavorably in the study region (78 % of the interviewees). Only few interviewees in the study region (3 % of the interviewees) recognized the ecological and cultural values of the presence of this mammal in the River. We have found that there is a conflict between local people, especially fishermen, and otters due to the competition for fish. All interviewed fishermen reported that otters are responsible for the decrease of the amount of fishing in the river. In this region, fishermen use two methods. The first is the fishing rod. The second technique consists to use of large fish net. Fishermen

spread the fishing net between the two banks of the river and the current brings the fish back to the net. The trapped fish are then removed by hand or by shaking the net. This technique, called '*Jerraf*' by local people, allows catching significant quantities of fish. But the otters catch the trapped fish in the net and this is the main factor for the presence of the conflict with local people. Consequently, otters constitute for fishermen unwanted animals.

Humans and otters share habitats and explore similar resources. In the study region, there is an increase in negative interactions between otters and inhabitants. All interviewed fishermen reported that the most common response to the observation of otters is to keep them out of site where they installed their fishing net. No otter mortality from fish net entanglement was reported in the study area. Some interviewees declared that they throw stones at otters. At least three otters have been killed by stone throwing during the last years. In several European and Asian countries, *Lutra lutra* is persecuted for being a nuisance to fisherman, eating fish and playing in rice fields (Rasooli et al., 2007). In many Central European countries, conflicts arising from *Lutra lutra* predation on commercial fish are nowadays a common phenomenon (Poledníková et al., 2013). Mirzajani (1999) reported that the most recent conflicts between humans and otters in Iran are in relation to fishery activities and around fish farm ponds where many dead otters have been found (in: Naderi et al., 2017). But in many cases, although the fishermen attribute fish losses to otters, scientific data show that otters are no threat to fish farming (Bodner, 1995).

Habitat Conversion and Destruction

In the study area, there is a growing demand for sand and gravel, especially for construction purposes. Therefore rivers are subject to heavy exploitation due to sand and gravel extraction. Survey results showed that the Banks and the bed of the Oum Er Rbia River are extensively exploited by humans, especially in the south of the Lamrabta village. In some sites, the banks have been completely destroyed with elimination of riparian vegetation (Fig. 6). These works have a negative impact on the otter population because of the destruction of their habitat. Otters live in underground burrows protected by riparian vegetation. Young otters cannot swim until they are three months of age. In the study region, otters survive in inaccessible sites as shelters. The preferred sites are inaccessible to humans and have dense riparian vegetation. Information from interviews has indicated a dramatic decline of *Lutra lutra* population in this region since the companies began extracting sand and gravel from the river. All the interviewed fishermen confirmed that there is a decrease of the amount of fishing in the river since the companies began extracting sand and gravel from the river.

The extraction of sand and gravel from this river affect the riparian vegetation. In some sites, the vegetation is removed completely. This will influence the food supply of otters as well as reducing cover. The removal of riparian vegetation has been one of the major impacts on the river ecosystem (Mason, 1995). For example, habitat degradation and transformation of river valleys has been recognized as one of the reasons for the pan-European disappearance of otters (Foster-Turley et al., 1990). In some cases, habitat degradation could only to some extent limit the density of otters. Several studies have found relationships between the number of otter signs and bank side cover. For example, Macdonald and Mason (1984) reported that the number of signs of otters was significantly correlated with the density of mature *Fraxinus excelsior* and *Acer pseudoplatanus* trees and with the number of potential holts, 46% of which were in the root systems of these trees (In: Mason, 1995).

Figure 6. Picture showing the destruction of *Lutra lutra* habitat in the Middle Oum Er Rbia River at Lemrabta region.

River Low Flows and Pollution

The Oum Er Rbia River originates in the Middle Atlas Mountains. From its source, the Oum Er Rbia River covers more than 200 km. All interviewees confirmed that the river flow has decreased in the last decade. The low flow is due to the building of dams, to water abstraction for irrigation and to river flow droughts. The river receives *agricultural drainage from* agricultural lands and the treated and untreated industrial and domestic wastewater from many towns and villages. During our study, wide varieties of waste including plastic bags and bottles were found in the river. All the interviewed fishermen confirmed that in recent years, the cases of *fish mortality* have *increased* in the River. During surveys, we frequently observed dead fish floating in the Middle Oum Er Rbia River (Fig. 7). According to personal observations and information from reviews, the cases of *fish mortality have increased in November-February every year. In this period,* olive oil mills harvest the olives to extract the juice necessary for the production of olive oil. These olive oil mills produce, as a waste material, a dark liquid rich in toxic substances (Hamdi, 1991) and a large amount of this liquid is poured into the secondary streams which transport it towards the river. The river must contain various pollutants resulting from human activities, especially industry, agriculture and household. These pollutants have many effects on the aquatic flora and fauna in the river.

The vulnerability of water resources pollution of the River of Oum Er Rbia and its tributaries is due to strong agricultural and industrial activity including oil mills, phosphate extraction, livestock farming, and sugar beet processing (Barakat et al., 2016). These authors reported that the Oum Er Rbia River water is affected from the pollutants in the river catchment area and highlighted the need to treat industrial and municipal wastewater and to encourage sustainable agricultural practices to prevent adverse health effects (Barakat et al., 2016). Water quantity is important to otters, especially where low flows destroy the food base, namely fish (Mason, 1995).

Figure 7. Dead fish floating in the Middle Oum Er Rbia River, west of the village of Sidi Aissa Ben Ali (site 2, Fig. 1)

Vegetation Burning

Survey results showed that the riparian vegetation is burned in some places. In this region, vegetation burning is practiced by inhabitants during certain times of the year. One of the main goals is the eradication of spontaneous vegetation and encouraging the growth of *Phragmites australis.* This plant tolerates fire if water is above the soil. It is used by local people for multiple purposes. Fires affect animals and damage their habitat. During surveys, we observed carcasses of animals dying from burning vegetation (e.g. Fig. 8). Animals affected directly by fires include birds, reptiles, mammals (e.g. otters, rodents, hares and red fox), insects and frogs. Fires affect otters because of the destruction of their habitat and effects on their preys. We observed that the burned sites are the same places as are suitable places for otter burrows.

Figure 8. Carcass of a turtle and a bird's nest impacted by the fires in the Middle Oum Er Rbia River, south west of the village of Lamrabta (site 3, Fig. 1) (February 2020).

CONCLUSION

The Eurasian otter has categorized as Near Threatened in IUCN's Red List of Threatened species and in Appendix I of CITES. Although the results of this study

confirmed the presence of *Lutra lutra* in two sites in the Middle Oum Er Rbia River, it seems that *Lutra lutra* may be threatened in the study area. Otters are facing extreme threats due to human-induced habitat destruction, disturbances by local people, pollution, low water quality and vegetation burning. We suggest that cohabitation with humans is possible in this region. During the study period, we have held discussions with local people living or working near the Middle Oum Er Rbia River on the ecological roles of otters and the benefit from their presence in the river. We have explained in particular how this otter regulates the populations of many species of fish, invertebrates, reptiles, amphibians and rodents.

Conservation of the *Lutra lutra* population is required to increase habitat protection, to raise the awareness of local people about the conservation of otters, to encourage research and development projects involving local communities, local authorities and associations in the surveillance of the wild fauna. Finally, it is *extremely* urgent to find solutions for pollution problems in the Oum Er Rbia River and its tributaries, especially as Morocco ratified the Stockholm Convention in June 2004, which calls for the elimination of the use of PCBs in equipment by 2025, and the Basel and Rotterdam Conventions regarding hazardous waste.

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REFERENCES

Barakat, A., El Baghdadi, M., Rais, J., Aghezzaf, B., Slassi M. (2016). Assessment of spatial and seasonal water quality variation of Oum Er Rbia River (Morocco) using multivariate statistical techniques. *International Soil and Water Conservation Research* **4**(4): 284-292.

Bhattacharya, M., Watham, T., Gopi, G.V. (2019). Photographic Records of Eurasian Otter (*Lutra lutra* Linnaeus, 1758) from Nyamjang Chu River, Arunachal Pradesh, India. *IUCN Otter Spec. Group Bull*. **36**(2): 103-109.

Bodner, M. (1995). Fish loss in Austrian fish-ponds as a result of otter (*Lutra lutra* L.) predation. *IUCN Otter Spec. Group Bull.* **12**: 3-10.

Broyer, J., Aulagnier, S., Destre, R. (1988). La loutre *Lutra lutra angustifrons* Lataste, 1885 au Maroc. *Mammalia* **52**:361-370.

CITES (2019). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Appendices I, II and III. https://www.cites.org/eng/app/appendices.php

Cuzin, F. (2003). Les grands Mammifères du Maroc méridional (Haut Atlas, Anti Atlas et Sahara): Distribution, écologie et conservation. PhD theses, University of Montpellier II, Montpellier. pp. 340.

Delibes, M., Calzado, J., Clavero, M., Fernandez, N., Gutierrez-Exposito, C., Revilla, E., Roman, J. (2012). The near threatened Eurasian Otter (*Lutra lutra*) in Morocco: No sign of recovery. *Oryx* **46**:249-252.

Fernandez. K, (2018). Status of the Hairy-Nosed Otter (*Lutra Sumatrana*) In Peninsular Malaysia. *IUCN Otter Spec. Group Bull*. **35**(2):85-96.

Foster-Turley, P., Macdonald, S., Mason, C. (eds) (1990). Otters: An Action Plan for their Conservation. IUCN, Gland, 126 pp.

Hamdi, M. (1991). Nouvelle conception d'un procédé de dépollution biologique des margines, effluents liquides de l'extraction de l'huile d'olive. PhD theses, University of Provence, 180 pp.

IUCN Red list of Threatened Species (2019). "*Lutra lutra* (Common Otter, Eurasian Otter, European Otter, European River Otter, Old World Otter). https://www.iucnredlist.org/species/12419/21935287

Jacoby, M.C., Williams, L.R. (1995). Recent otter records from central Morocco. *IUCN Otter Spec. Group Bull.* **12**:11-12.

Kingston, S., O'Connell, M., Fairley, J.S. (1999). Diet of otters *Lutra lutra* on Inishmore, Aran Islands, west coast of Ireland. *Biol. Environ.:Proc. R. Irish Acad.* **99B**(3): 173-182.

Kruuk, H., Conroy, J.W.H. (1991). Mortality of Otters (*Lutra lutra*) in Shetland. *Journal of Applied Ecology* **28**(1): 83-94.

Lanszki, J., Kormendi, S. (1996). Otter diet in relation to fish availability in a fish pond in Hungary. *Acta Theriol.* **41**: 127-136.

Lanszki, J., Molnar, T. (2003). Diet of otters living in three different habitats in Hungary. *Folia Zool.* **52**: 378-388.

Lanszki, J., Sallai, Z. (2006). Comparison of the feeding habits of Eurasian otters on a fast flowing river and its backwater habitats. *Mamm. Biol.* **71**: 336-346.

MacDonald, S.M., Mason, C.F. (1984). Otters in Morocco. *Oryx* **18**(3):157-159.

Mason, C.F. (1989). Water pollution and otter distribution: a review. *Lutra* **32**(2): 97-131.

Mason, C.F. (1995). Habitat quality, water quality and otter distribution. *Hystrix* **7**(1-2): 195-207.

Mason, C.F., Macdonald, S.M. (1986). Otters: Ecology and Conservation. Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press. 236 pp.

Mason, C.F., Macdonald, S.M. (1993). Impact of organochlorine pesticide residues and PCBs on otters (*Lutra lutra*): a study from western Britain. *Science of the Total Environment* **138**: 127-145.

Mirzajani, A. (1999). Study on common otter (*Lutra lutra*) status. *The Environment* [in Farsi] **25**: 70-74.

Mucci, N., Arrendal, J., Ansorge, H. *et al.* (2010). Genetic diversity and landscape genetic structure of otter (*Lutra lutra*) populations in Europe. *Conservation Genetics* **11**: 583-599.

Naderi, S., Mirzajani, A., Hadipour, E. (2017). Distribution of and threats to the Eurasian otter (*Lutra lutra*) in the Anzali wetland, Iran. *IUCN Otter Spec. Group Bull.* **34**(2): 84-94.

Nancy, H., Chris, J.L. (2016). *Lutra lutra* (Carnivora: Mustelidae), *Mammalian Species* **48**(940): 109-122.

Poledníková, K., Kranz, A., Poledník, L., Myšiak, J. (2013). Otters causing Conflicts the Fish Farming Case of the Czech Republic. R.A. Klenke et al. (eds.), Human-Wildlife Conflicts in Europe, Environmental Science and Engineering, Springer-Verlag Berlin Heidelberg 2013.

Rasooli, P., Kiabi, B.H., Abdoli, A. (2007). On the status and biology of the European otter, *Lutra lutra* (Carnivora: Mustelidae), in Iran. *Zoology in the Middle East* **41**:25–29.

Waters, S., El Harrad, A. (2018). New location for the Eurasian otter *Lutra lutra* in the catchments of the western Rif Mountains of Morocco. *IUCN Otter Spec. Group Bull.* **35**: 230-234.

RÉSUMÉ

ETUDE DE LA DISTRIBUTION DE LA LOUTRE *Lutra lutra*, DE SON INTERACTION AVEC LES HABITANTS LOCAUX ET DES PRINCIPALES MENACES A SA SURVIE DANS LA RIVIERE DU MOYEN OUM ER BIA, AU MAROC

La loutre Eurasiatique *Lutra lutra* est classée comme une espèce quasi-menacée dans la liste rouge de l'union internationale pour la conservation de la nature (UICN). En plus, elle est listée dans l'annexe I de la convention sur le commerce international des espèces de faune et de flore sauvages menacées d'extinction (CITES). Actuellement, *Lutra lutra* est la seule loutre à l'état sauvage qui vit dans l'Afrique du Nord. Son aire de répartition couvre la majorité de l'Europe, de l'Asie et de l'Afrique du Nord. Au Maroc, ce carnivore occupe les principales rivières du Moyen Atlas, du Haut Atlas, du Rif et des plaines du centre du pays. Les études scientifiques réalisées sur l'espèce sont rares. Cette étude a été effectuée en 2019-2020, elle s'intéressait à l'étude de la distribution de *Lutra lutra* dans la rivière d'Oum Er Rbia. Dans cette étude, la méthode suivie a consisté à mener des enquêtes avec les habitants locaux, puis à collecter de nouvelles données par exécution de sorties pour observation sur le terrain à la recherche directe et indirecte des loutres. Les résultats ont montré que la loutre Eurasiatique existe actuellement dans deux sites. La présence des loutres a été confirmée par l'observation des épreintes et des traces de leurs pattes. En plus, nous avons trouvé trois cadavres des loutres mortes dans la région de l'étude. Les résultats des enquêtes ont montré que le conflit entre les habitants locaux, en particulier les pêcheurs, et les loutres ne cessent d'augmenter. Les observations faites au terrain ont montré que

l'habitat de la loutre est soumis à une forte pression anthropique. A cause des travaux de prélèvement de sables et des graviers du lit de la rivière, une grande partie des deux rives a été détruite. En plus, la végétation riveraine, indispensable à la survie des loutres, a été brulée par les habitants pour des fins économiques. La rivière reçoit également divers polluants d'origine domestique, agricole et industrielle. En général, cette loutre est menacée d'extinction dans la région de l'étude. La présente étude suggère que la survie de *Lutra lutra* dans cette région dépend de prendre des mesures de protection de son habitat.

ABSTRACT

RELEVAMIENTO DE NUTRIA EURASIÁTICA *Lutra lutra* Y DE LA INTERACCIÓN HUMANOS-NUTRIAS EN EL TRAMO MEDIO DEL RÍO OUM ER RBIA, MARRUECOS

La nutria eurasiática está categorizada como "casi amenazada" en la Lista Roja de Especies Amenazadas de UICN, e incluida en el Apéndice I del CITES. En Marruecos, *Lutra lutra* ocurre en los Atlas Medio y Alto, las Montañas Rif, y las planicies de Marruecos central. El status de esta especie en Marruecos está lejos de estar claro, y hay disponible información limitada sobre su distribución y ecología. Nuestro objetivo fue confirmar la presencia de nutria eurasiática en el tramo medio del Río Oum Er Rbia, especialmente en la provincia de Fkih Ben Salah, y describir cualquier conflicto que hubiera entre humanos y nutrias, así como identificar las amenazas actuales y potenciales para la especie. Entre el 18 de Noviembre de 2019 y el 29 de Febero de 2020 utilizamos una combinación de entrevistas estandarizadas, y un relevamiento de terreno para recolectar inormación sobre las nutrias en el área de estudio. Los resultados de las entrevistas y los relevamientos confirmaron la presencia de este mamífero en dos sitios. Nuestra evidencia está basada en huellas, fecas y marcas olorosas, y cadáveres de nutrias. Encontramos que hay un conflicto entre la gente local, especialmente pescadores, y las nutrias, debido a la competencia por los peces. Las nutrias están enfrentando amenazas extremas debido a la destrucción de hábitats inducida por el hombre, en particular extracción de grava y arena del lecho del río, disturbios por los habitantes locales, contaminación, baja calidad del agua y quema de vegetación. En conclusión, deben enfocarse esfuerzos de conservación sobre esta especie, protegiendo su hábitat y reduciendo el conflicto entre la gente local y las nutrias.

دراسة حول القضاعة الأوراسية بوادي أم الربيع الأوسط و العلاقة مع السكان المحليين و أهم المخاطر المهددة لبقائها بالمنطقة

تعتبرالقضاعة الأوراسية -أو ثعلب الماء- نوعا حيوانيا مهددا بالإنقراض. فقد أدرجت في اللائحة الحمراء للإتحاد العالمي لحماية الطبيعة كنوع قريب من التهديد. كما أنها محمية عالميا من طرف الإتفاقية العالمية لمنع الإتجار بالأنواع الحيوانية و النباتية المهددة بالإنقراض. و يستوطن هذا الحيوان مناطق عدة في قارات أوروبا و آسيا و إفريقيا الشمالية. و قد انخفضت ساكنة القضاعة بشكل مهول خلال القرن العشرين. تهدف هذه الدراسة إلى التأكد من تواجد هذا الحيوان بوادي أم الربيع الأوسط و تحديدا بإقليم الفقيه بن صالح و التعرف على علاقته بالسكان المحليين و تحديد أهم المخاطر التي تهدد بقاء هذا النوع بالمنطقة. و نشير إلى أنه لا توجد معطيات علمية حول القضاعة بهذه المنطقة. و قد أكدت الدراسة تواجد هذا النوع بموقعين بالمنطقة المدروسة. أولهما يقع غرب قرية سيدي عيسى بن علي وثانيهما يقع بجنوب غرب قرية المرابطة. و قد تم إيجاد آثار أقدام حديثة و بقايا المخلفات الخاصة بهذا النوع و كذلك ثلاث جثث لثعالب الماء في النهر. أثبتت الدراسة أن هناك تعارضا حادا بين ثعالب الماء و السكان المحليين وبالخصوص الذين يصطادون الأسماك في النهر. فهذه الحيوانات اللاحمة تهاجم الأسماك العالقة داخل شباك الصيد و تلتهم جزءا منها. و قد نتج عن هذا نقمة كبيرة للسكان على تواجد القضاعات في النهر بالمناطق المحاذية لقراهم. لذلك فقد أكد جميع الصيادين أنهم يدافعون عن مناطق صيدهم و أنهم يهاجمون هذه الحيوانات و يرمونها بالأحجار. كما بينت الملاحظات الميدانية أن الوسط الطبيعي للقضاعة بالمنطقة المدروسة يتعرض للإندثار بسبب عوامل عدة أهمها تدمير حافتي النهر بسبب أشغال استخلاص الرمال من النهر و حرق النباتات الطبيعية المحاذية للنهر. كما تبين أن صبيب النهر يعرف تناقصا هاما خاصة في فصل الصيف كما أن مياهه تضم ملوثات عدة. و عموما فهذا النوع مهدد بالإنقراض في المنطقة المدروسة. لذا يتوجب اتخاذ عدة إجراءات لحماية القضاعة و وسطها الطبيعي. من اجل هذا الهدف يتوجب العمل على توعية السكان المحليين بالأدوار الإيكولوجية لهذا النوع و إشراكهم في برامج للتنمية المستدامة التي تم الشروع فيها بالمملكة المغربية منذ مطلع القرن الجاري.

OSG MEMBER NEWS

Since the last issue, we have welcomed 2 new members to the OSG: you can read more about them on the Members-Only pages.

Samara Almeida, Brazil: Since 2014, I have been working on the ecology, behavior, biology, and ethnobiology of Giant Otters in the Cerrado-Amazone ecotone in Brazil. I am currently studying behaviour and vocalizations, and intend to investigate indigenous knowledge of Giant Otters.

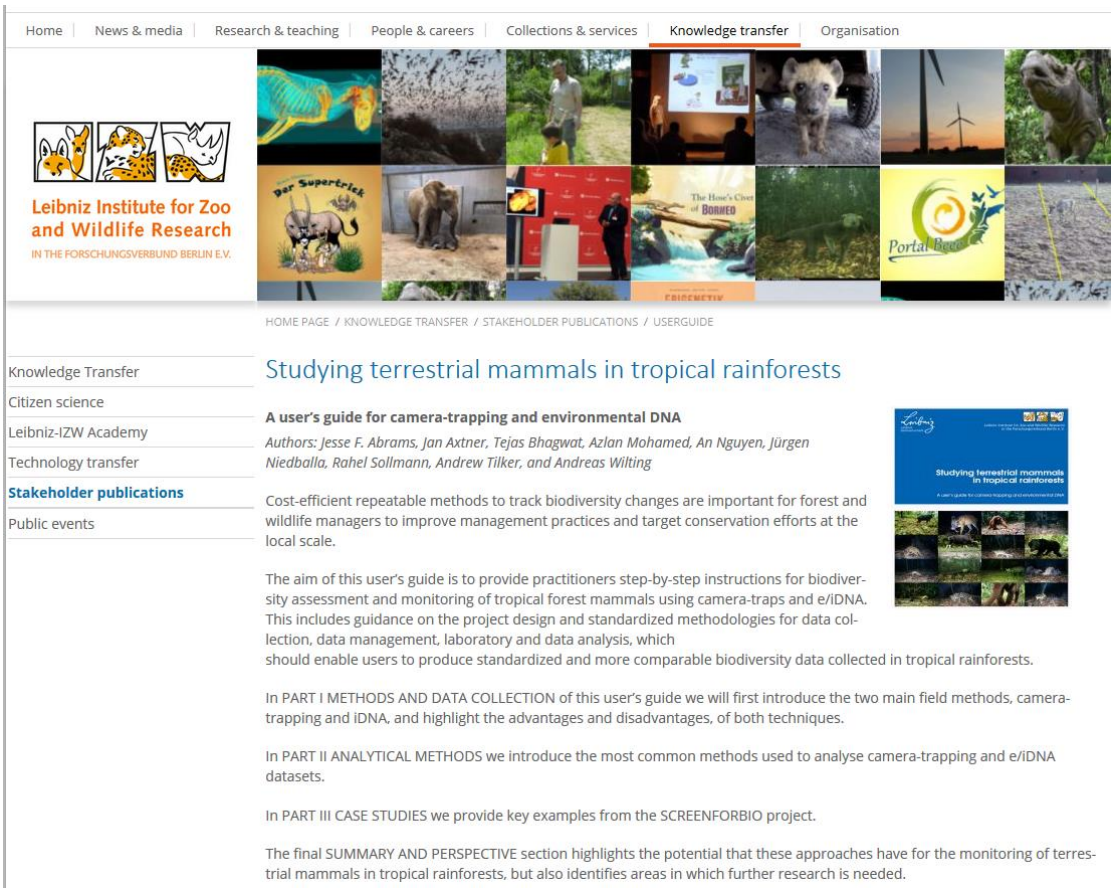
Miriam Simoni, Italy: I work in Cilento National Park in southern Italy on regularly surveying a 1.5 km stretch of river, collecting spraint for genetic analysis by Anna Loy and her team. I have also helped to develop a hiking trail along ancient mule trails (Otter Valley Trail Casaletto Spartano); we intend to create a permanent educational exhibition on the otter and life in and around the river.

NEW BOOK

Studying Terrestrial Mammals in Tropical Rainforests - A User's Guide for Camera-Trapping and Environmental DNA

Available at http://www.leibniz-izw.de/en/userguide.html

This publication is in English, with supplementary material in English, Malay and VIetnamese, and a link to a Metabarcoding and Workflow paper



VIDEO

Here is a link to a recently published TV film regarding the otter in the Netherlands (in Dutch...). Great footage of this wonderful species. Hard to imagine that it was extinct and we brought the species back in 2002. Currently over 450 individuals!
https://www.youtube.com/watch?v=4asZW-1Q2oU

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