# OTTER

the Journal of the International Otter Survival Fund

IOSF
INTERNATIONAL OTTER SURVIVAL FUND
www.otter.org

Volume 7 2021, May 26

**The International Otter Survival Fund** (IOSF) was inspired by observing otters in their true natural environment in the Hebrides. Because the otter lives on land and in the water and is at the peak of the food chain it is an ambassador species to a first class environment. IOSF was set up in 1993 to protect and help the 13 species of otter worldwide, through a combination of compassion and science. It supports projects to protect otters, which will also ensure that we have a healthy environment for all species, including our own.

**OTTER** is the annual scientific publication of the IOSF.

The publication aims to cover a broad spectrum of papers, reports and short contributions concerning all aspects of otter biology, behaviour, ecology and conservation. It also contain information on the work of IOSF and reports on our activities.

**Submission of manuscripts**
**OTTER** is a peer-reviewed journal and authors are asked to refer to the Guidelines for Contributors before submitting a paper. These Guidelines may be found at the back of each Journal or can be sent as a pdf upon request. Papers should be submitted through enquiries@otter.org.

**Publication**
The Journal will be available to download free on the Media and Resources page of the IOSF website (www.otter.org). A limited number of copies will be printed and these will be available for sale on the Otter Shop (www.ottershop.co.uk).

**Back Issues**
These are all available to download free on the Media and Resources page of the IOSF website (www.otter.org). This includes the following special issues:

*Issue 1: Proceedings of the First Otter Toxicology Conference,* Published 2002 – OUT OF PRINT

*Issue 2: Proceedings of the European Otter Conference "Return of the Otter in Europe – Where and How?"*, held on the Isle of Skye in 2003, Published 2007 - available on a CD at the Otter Shop (www.ottershop.co.uk).



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Published by the International Otter Survival Fund, 7 Black Park, Broadford, Isle of Skye, IV49 9DE, Scotland, UK. www.otter.org.
Reg No 109031. Charity No SC003875. Regulated by OSCR

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# ASIAN OTTER CONSERVATION NETWORK REPORT 2021

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2020 has been a very strange year across the world and many otter projects have had to be put on hold because of Covid-19 restrictions. This obviously effected World Otter Day events, and social media was an important tool in spreading information on otters worldwide. Many Asian countries still took part including Cambodia, Hong Kong, India, Iraq, Japan, Laos, Malaysia, Nepal, Pakistan, Singapore, Sri Lanka and Taiwan. Information about some of the activities is given below.

IOSF has various educational resources available for workers in Asia on the website (www.otter.org), including the IOSF video in Arabic, Chinese, Japanese, Nepalese, Khmer, Sinhalese, and Lao, as well as resources specifically for children, The IOSF education programme, Team Otter network is growing in Asia and there are now Team Otter clubs in Bangladesh, Laos, and Nepal with more planned for Malaysia and Nepal once restrictions allow.

The Facebook page is for people concerned with otters in Asia and the conservation of their wetland habitats. AOCN wants to share and gather more information on their distribution but will not post actual sighting locations as this could lead to disturbance and possibly hunting threats. However, we do want to get as much data as we can for their protection so please contact us to give us the details or any sightings or possible illegal trade. Please send any information to enquiries@otter.org

The illegal trade in otters is still a serious problem and IOSF has set up a special Illegal Trade Fund to support sanctuaries caring for rescued animals in Cambodia, Indonesia, Thailand, and Vietnam. Most of the otters are Asian small-clawed although Eurasian and hairy-nosed otters have also been rescued in Indonesia. A paper was published in 2020 by Okamoto et al. on “The situation of pet otters in Japan – warning by vets” which looks at the animal welfare issues of otters being kept by people who do not understand what is needed for their care.

Despite Covid-19 restrictions some projects have been able to proceed and a summary is given below by the regional co-ordinators.

## SOUTHEAST ASIA: ADREAN, INDONESIA

**The Pet Trade** continues, and even the protected hairy-nosed otter (*Lutra sumatrana*) can easily be found in the online market and social media. It is important to continue to push for legal protection of the Asian small-clawed otter (*Aonyx cinereus*) in Indonesia.

### Cambodia

In March the Cambodian Fishing Cat Project put a post on Facebook about the rescue of a baby smooth-coated otter in Kratie province. The cub had been caught in a fisherman's net and he took it home as a pet. He was eventually persuaded to return it to its family and the group of six otters came to take it back. The Kla Trey team from the project gave the fishermen some money to compensate him for the cage he had built and the fish he had fed the cub. Conflicts between fishermen and otters are common in the area but this positive action by the fishermen will hopefully encourage more local people to have a positive attitude towards otters.

### Indonesia

SUMECO (Sumatra Eco-project) is an organisation that is tackling the illegal trade in Sumatra. They are very much hands-on and work with many species, rescuing them from traffickers. In December 2020 they received three hairy-nosed otter cubs, but unfortunately two died: this is the real cost of the pet trade. The third cub is progressing well and they also still have the Eurasian otter rescued earlier in the year.

### Malaysia

Malaysian Nature Society (MNS) celebrated their first World Otter Day after receiving an IOSF World Otter Day grant 2020 for an event themed "Born to be WILD; Not caged; Live WILDLY".

During their event, MNS established the Malaysia Otter Network (MON), the very first, long-term, national effort focusing on the protection of the four species of otter in Malaysia. It aims to bring together a group of like-minded experts from different regions across the nation to share data on otter research, identify priorities and strengthen conservation actions for otters in Malaysia.

On 21 May 2020, Woo Chee Yoong and Balu Perumal from MNS attended a meeting held by the Kuala Lumpur City Hall (KLCH), together with representatives from the Department of Wildlife and National Parks (PERHILITAN) for Peninsular Malaysia. There is now a proposed partnership forming between the three agencies to initiate the first ever urban otter conservation project in Malaysia.

On 15 June 2020, MNS held the first MON virtual meeting attended by nine experts. They identified the group's objectives and set up priority conservation actions to encourage more research to fill the gap in ecological knowledge and develop education activities, such as celebrating World Otter Day annually in Malaysia.

Included in this issue of the *OTTER Journal* is a paper by Woo on "Recent records of the endangered hairy-nosed otter (*Lutra sumatrana*) in Selangor, Malaysia".

**Singapore**

Singapore is well known for its urban otters and the problems associated with human/otter interactions. Sivasothi, dubbed "The Otter Man", was part of a group that held an online talk about otters within the city state for World Otter Day.

**Rescue and Rehabilitation**

In addition to the otters in the care of SUMECO in Indonesia mentioned above, IOSF is also supporting rescued otters in Cikananga, also in Indonesia, Save Vietnam's Wildlife, Wildlife Friends Foundation, Thailand, and Phnom Tamao Wildlife Rescue Centre in Cambodia.

## SOUTH ASIA: JYOTI BHANDARI, NEPAL

**India**

As a part of her MSc, Shaik Shaheen completed a thesis on "Assessment of status and distribution of smooth-coated Otters in Hyderabad and Medak of Telangana, India" for the Institute of Environment Education and Research, Bharati Vidyapeeth Deemed University, Pune, Maharashtra, India.

This project was funded by IOSF and looked at the otters' status, distribution, habitat, biology, ecological role, behaviour and ecology, feeding habits, breeding, and threats. Surveys were carried out during August–November 2020, looking for secondary signs such as spraints, footprints, holts, etc. and also any potential threats. These threats included cattle grazing, habitat loss, illegal fishing/overfishing, sand mining, and poaching. A social survey was conducted with the villagers so as to understand the situation from a local perspective.

A paper will be submitted on this work for the 2022 *OTTER Journal*.

**Nepal**

There is a lot of positive otter work being carried out in Nepal by various researchers.

Aarati Basnet and colleagues held a webinar for around 200 people as part of World Otter Day to raise awareness of otters and the delicate ecosystem of which they are a vital part. Aarati also visited Shuklaphanta National Park to deliver community education and set up a Team Otter club. More on this can be found in the Team Otter report.

In 2020, Rohit Jha et al produced a paper on “Status of otters in Nepal: a link with ancient waterways and people” as a chapter in *Hindu Kush-Himalaya Watersheds Downhill: Landscape Ecology and Conservation Perspectives*, edited by G. R. Regmi and F. Huettmann. This gives an overview of the three otter species in Nepal (smooth-coated, Eurasian, and Asian small-clawed), examining the threats and the future for otters in the country.

IOSF was pleased to provide Mohan Bikram Shrestha with a grant for his project “Gathering substantial evidence of the presence of Eurasian otter (*Lutra lutra*) in West Rukum, Nepal”. The project involved collecting information on habitat, taking samples for genetic analysis, camera trapping, and discussions with local communities. Mohan has recently returned from the field with a lot of data but as the original field site was being disturbed by road construction the survey was carried out further upstream and the team had to extend their days in the field. Samples will be submitted for genetic analysis and a full report will be submitted in due course.

Further projects are planned in Bardia National Park and Chitwan National Park.

A video of smooth-coated otters in Bardia National Park was shared by Otters of the Himalayas and can be seen at https://www.youtube.com/watch?v=l08mD2Ei-Ts

Educational booklets in Nepalese and English on smooth-coated and Eurasian otters have been produced by the Small Mammals Conservation and Research Foundation.

**Pakistan**

IOSF supported Zafeer Ahmed Shaikh’s project studying the smooth-coated otter in the Thatta District wetlands near Karachi. His paper entitled “Understanding the recent presence of smooth-coated otters (*Lutrogale perspicillata race sindica*) in selected wetlands of Thatta District, Sindh Province of Pakistan” is included in this issue of the *OTTER Journal*.

**Sri Lanka**

Padma de Silva has continued to work with Chaminda Jayasekara, of Jetwing Vil Uyuna, who is observing and recording the wildlife alongside the hotel, including the Eurasian otters. He has done much to conserve the Eurasian otters within their area and is constantly monitoring their progress. Chaminda is also very active in creating public awareness through social media and through the Sri Lankan media. Again, he carried out a programme for World Otter Day.

Padma herself went to her village and took her otter story books for distribution to the children. She also met most of the girls who made otter bags for the IOSF Chinese workshop participants. The girls enjoyed sharing a cup of tea with Padma and talking about otters and learning more about the behaviour, feeding habits, etc. At the end of this informal meeting the girls donated a number of small bags, purses etc. which they had made in their homes as part of a small industries scheme. They want these to be sold to help IOSF and otters.

In addition, Padma gave a parcel of books to be donated to the priest residing in the temple at Galagedera. These will be stored in the library to be used in the English classes held every Sunday. The priest was very impressed and called to say a big "Thank you" as there are not enough funds to buy English books for light reading.

## EAST ASIA: LING-LING LEE, TAIWAN

### Japan

A paper was published in 2020 by Okamoto et al. on "The situation of pet otters in Japan – warning by vets". This looks at the animal welfare issues of otters being kept by people who do not understand what is needed for their care. They looked at clinical data of 20 pet Asian small-clawed otters which had been kept privately by an owner of an otter café and nine of these had been imported illegally. Most of them were either in a critical condition or already dead when they were taken to the vet. The most common problem was kidney stones, an issue which often occurs in zoos too. There was also pneumonia, dehydration, and malnutrition as a result of an incorrect diet. Stress was also identified in two otters kept in an otter café with petting by many different people. In 2019 the law in Japan was changed to give more protection to Asian small-clawed otters but more monitoring is needed to improve otter care and prevent such deaths.

## MIDDLE EAST: OMAR AL-SHEIKHLY

### Iran

In Issue 6 (2020), Al-Sheikhly et al. published "A preliminary population estimate of the vulnerable smooth-coated otter, *Lutrogale perspicillata maxwelli* (Hayman 1956) in the Hawizeh Marsh in south eastern Iraq with confirmed occurrence in the Hoor Ol-Azim wetland in south western Iran".

In this current issue, Hafezi et al. have published a paper on "Further records of the Mmesopotamian otter (*Lutrogale perspicillata maxwelli*) in Iran". This includes a record of two otters from 4 March 2021 at the Hour Al-Azim wetland.

### Iraq

In February 2021 the first video footage of a Eurasian otter was taken in northern Iraq (Kurdistan). This footage was taken by Emily Garthwaite in the Rawandoz valley of Erbil province. This is the only documented video footage of this species in northern Iraq but Emily has seen otters in this region a number of times, and local communities report regular sightings.

Emily is keen to work with IOSF to bring more attention to the plight of otters in Iraq and the Kurdistan Region. In 2021, Emily will be following the River Tigris from source to sea for three months, and will be investigating life along the Tigris.

# AFRICA REPORT

Again Covid-19 restrictions have had an effect on otter work in Africa but we are encouraged with what has actually been achieved.

## CAMEROON

In Cameroon, Ape Action Africa (AAA), received a tiny Congo clawless otter, who was named Beni. Naturally, the expertise of AAA was in primates so they turned to IOSF for advice and help on how to deal with the otter. IOSF immediately sought the advice of the Kikongo Otter Sanctuary in the Democratic Republic of Congo. Logistics made it impossible to get the otter across the border to Kikongo. So AAA took it upon themselves to care for the little otter and even built this rare species its own enclosure.

## DEMOCRATIC REPUBLIC OF CONGO

Kikongo Otter Sanctuary has cared for many Congo clawless otter cubs, following the arrival of Mazu in 2010. In 2020, they were brought two little spotted-necked otter cubs, the other species native to the country. Unfortunately, one of the otters did not survive but the other, Mbu, thrived and was released back to the wild in February 2021.

Kikongo's experience in caring for Congo clawless cubs allowed us to gain a fascinating insight into the differences between the two species such as their behaviour, diet, etc. Despite both species sharing the same habitats, there were marked differences. The Congo clawless otters were much bigger than the spotted-necked otters. They also much preferred prey such as worms, which Mbu had little interest in, preferring a fish-based diet. This made the Congo clawless much more destructive as they spent long periods digging for worms, while the spotted-necked otter loved spending time in the water.

Despite all our experiences, it is these observations that help us to learn more about the species – including that despite their similarities, there are considerable differences too.

## LESOTHO

One of the IOSF World Otter Day grant winners was the Human Nature Projects Lesotho, a conservation organisation based in the Southern African enclave. They held their event at the Memorial Hall in Maseru, the country's capital. A variety of people were invited, such as local communities, youth representatives, and Lesotho's Environmental Ministry officials; the United Nations Development Programme (UNDP) also sent a representative.

The presentations focused on raising awareness of otters and the importance of conserving them and their habitats. Although based in Maseru, media outlets publicised the event across the whole nation.

Human Nature Projects Lesotho are planning to continue their work and are planning their next steps to helping otters and the environment in the country.

**MOROCCO**

The Maghreb sub-species of Eurasian otter (*Lutra lutra splendida*) is a threatened species in Morocco, and Nature Solutions received an IOSF World Otter Day grant for 2020.

Due to Covid-19 restrictions, their outreach plans had to be postponed. Initially, they held an online webinar inviting individuals to attend to learn about otters, conservation, and wetland habitats. The webinar was a huge success with over 150 people attending, including attendees from neighbouring Tunisia and Algeria. Furthermore, the recorded video has now been watched over 7,000 times, so really spreading the word (https://fb.watch/5ateYXaD3a). Following the webinar there is now much interest across the three countries to move forward and work together to conserve the Eurasian otter populations in the area through the new North African Otter Network.

Since then, education materials have been produced in Arabic and French to be used in schools, for visitors, associations, and conservation authorities.

**TANZANIA**

William Mgomo is a long-term friend of IOSF and attended the IOSF African workshop in 2015. He continues to work with the schools and fishing communities of Lake Nyasa in Tanzania. He focuses his passions on educating children to teach them more about otter conservation and maintaining wetland habitats. He also works with fishing communities helping them to have an understanding of the benefits of having otters and looking at ways to reduce otter/fishermen conflicts on the Lake.

William now has plans to visit more communities in the area, thanks to the support of IOSF.

**TUNISIA**

2019 World Otter Day grant winners, Association Tunisienne de la Sauvage, continue to work on otter and wildlife conservation across the country. IOSF's Dr Paul Yoxon was invited to their World Otter Day presentation and webinar on otters and working together to conserve them.

**UGANDA**

The Mutanda Community Conservation Organization (MUCCO) are working hard for otter and wetland conservation on Lake Mutanda, Kisoro District.

# TEAM OTTER PROGRAMME: RECONNECTING CHILDREN WITH NATURE

BEN YOXON

IOSF Education Officer

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IOSF's Team Otter programme is reconnecting children with nature, wildlife, and the environment and igniting a passion that will last their whole life. It is well known that we, as a race, have become disengaged from the natural world and as a result we are having a massive detrimental impact on it. IOSF's Team Otter programme is helping to change that and ensure future generations understand the role they play and the steps they can take to ensure a healthier tomorrow for all. Although we use otters as a mascot, we focus on all things in the natural world.

Inevitably Covid-19 restrictions worldwide have meant that all clubs have had reduced meeting times or have had to temporarily suspend all activities. Below are brief updates on some of the clubs around the world:

## UNITED KINGDOM

The Broadford Team Otter is very active and is doing a significant amount to help their natural environment on the Isle of Skye. During the more restricted times we met online to take part in wildlife and natural world quizzes. The children continued to grow their knowledge of both local and global wildlife and natural world issues. Some children have been carrying out their own projects with their parents including litter picking and watching wildlife. This is particularly encouraging as they have taken their own initiative to continue the project.

Now that we are allowed to meet outdoors, we are back to working on the task of cleaning up the area and making people aware of the threat to wildlife from litter. Birds and animals can get caught in this waste, which also enters our seas and becomes an issue for various marine creatures, including otters.

The club is also looking at reducing the amount of litter being dropped and have created signs to encourage the local community to reduce waste. We are also now a

part of the Kids Against Plastic movement and are creating a video to encourage more people to make a difference and reuse/recycle as much as possible.

During some meetings we take the opportunity to visit various habitats and learning more about the flora and fauna of the area, and the great biodiversity we have in our local area.

**GUYANA**

Prior to the global pandemic, the wildlife club in Yupukari was meeting twice a week. One session focused on teaching the children about otters in a classroom capacity, and they had an opportunity to go "into the field" and see otters, birds, flora, and other natural aspects local to them. As a result, the children were growing more of an interest in protecting their natural world.

As the pandemic situation increased, and given Yupukari's close proximity to Brazil, which was a particularly problem area, face-to-face meetings were heavily restricted to ensure everyone's safety. There have been considerable efforts to offer the children continued access to learning materials so that they can continue to learn from home with materials being dispersed "door-to-door".

When the situation improves, face-to-face wildlife club meetings will begin once again.

**LAOS**

IOSF's Team Otter programme in Laos is led by workshop attendee Kiengkai Khoonsrivong. In summer 2020, Kiengkai visited the Bolikhamxay province visiting schools to talk about otters. A children's artwork competition was held, with the teachers picking the eventual winner. The children had fun and learnt about the importance of otters and wetland habitats.

At the end of 2020, Kiengkai continued his outreach programme visiting schools in Pakphoy, Namtek, Faen, and Donexay, and he also talked to local communities about presence, perceptions, and other factors relating to otters.

IOSF is delighted to support this project and help to grow awareness for otters in Laos and we look forward to seeing more from Kiengkai and his team moving forward.

You can read more about Kiengkai's community programme in this Issue of the *OTTER Journal*.

**MALAYSIA**

In Malaysia, the Malaysia Nature Society's sub-group Malaysian Otter Network plan to start a Team Otter club. To date, restrictions have meant that this has not been possible but the club will start when allowed to do so.

## MONTENEGRO

NGO Living Green have seven Team Otter clubs and they are now planning a World Otter Day 2021 event for the end of May. They work predominantly on a major otter habitat called Lake Skadar, which is the largest lake in southern Europe and spans across Montenegro and Albania.

## NEPAL

IOSF was delighted to be able to support Aarati Basnet and her community outreach programme in Shuklaphanta National Park, Nepal, focusing on the indigenous "Rana Tharu" community. This is one of the last strongholds for smooth-coated otters in Nepal and the aim was to increase awareness of otters including threats, facts, and their importance to local communities and children of the area. The children's aspect of the project used fun and engaging games and talks with the view to starting a Team Otter club for children with a real passion to help. Students from six different schools attended and ten interested children formed a Team Otter club, known as "Oat ko toli" in the local language. They are fascinated with the idea of local otter conservation and teaching what they have learnt to their friends and other members of society. They also have plans to conduct conservation awareness programmes across their area which will increase awareness about otters and a desire to help solve conservation issues.

There are now further plans at starting Team Otter clubs in both the Bardia and Chitwan National Park areas.

## SOUTH AFRICA

Team Otter is delighted to be able to link with the Hoerikwaggo Kids Club and they are now affiliated to our education programme connecting children with the natural world.

## UGANDA

The Mutanda Community Conservation Organization (MUCCO) have started a club in the Kisoro District, near Lake Mutanda, an area where otters are known to exist. MUCCO and the club have visited local habitats, have reduced otter trade and are working on ways to improve farming methods to maintain this important habitat.

## MORE TEAM OTTERS

IOSF will continue to increase the impact of Team Otter and would love to have more clubs around the world. Should you have any interest in joining our network and form your own club then please contact our Education Officer at ben@otter.org.

# WORLD OTTER DAY 2020

IOSF World Otter Day was very different this year due to the current circumstances. Plans were well underway to have our biggest celebration around the world but the pandemic understandably changed that. It was important that we all stay safe and follow the relevant restrictions.

That being said, World Otter Day was still a success and we were delighted with how many people joined us to help make 27 May a #WorldOtterDay takeover!

As always, IOSF offered three grants to support events around the world and thanks to another anonymous donation, we could offer a fourth grant. These were awarded to Lesotho, Malaysia, Morocco and Nepal.

**Lesotho**

This community event helped to raise awareness across the African enclave as, although otters are present, very little is known about them or done to protect them. An otter education programme for volunteers and other relevant stakeholders was held in Maseru, the country's capital. It focused on distribution, history of otters in Lesotho, the importance of otter conservation and how everyone can help. Participants included the UN agency representative, relevant Government Ministry officials and media guests, as well as the expert from Lesotho University. Media coverage ensured the entire nation was involved. Moving forward, The Human Nature Project Lesotho, who ran the event, have some exciting plans for otters.

© Leona Wai

**Malaysia**

Malaysian Nature Society (MNS) celebrated their first World Otter Day with an event themed "Born to be WILD; Not caged; Live WILDLY". During this event, MNS established the Malaysia Otter Network (MON), the first, long-term, national effort focusing on protecting all four species of otter present. It will bring together a group of like-minded experts from different regions to share data on otter research, identify priorities and strengthen conservation actions. Their first virtual meeting was held on 15 June with nine experts. MON will encourage more research to fill gaps in ecological knowledge and more education activities, such as celebrating World Otter Day annually in Malaysia.

On 21 May Woo Chee Yoong and Balu Perumal from MNS attended a meeting with Kuala Lumpur City Council and representatives from the Department of Wildlife and National Parks for Peninsular Malaysia (PERHILITAN). Woo presented on the conservation of urban otters around Kuala Lumpur, given their increased presence. This resulted in a partnership between the three agencies to initiate the first ever urban otter conservation project in Malaysia. More on the work of the Malaysian Otter Network is included in this issue of the *OTTER Journal.*

**Morocco**

The Maghreb subspecies of Eurasian otter (*Lutra lutra splendida*) is a threatened species in Morocco due to pollution, climate change and human persecution. The National Park of Talassemtane is a stronghold of the species but it still only lives in remote upper freshwater streams. For IOSF World Otter Day, Nature Solutions held an online webinar with over 150 attendees from all over Morocco, as well as neighbouring Tunisia and Algeria. IOSF's education officer, Ben Yoxon, gave a presentation on otters of the world and their long-term conservation.

Education materials have been produced in Arabic and French for distribution to schools, visitors, local associations and conservation authorities. Plans to engage with local communities have been postponed due to current restrictions.

More on the otter work in Morocco is included in this issue of the *OTTER Journal.*

**Nepal**

Aarati Basnet and a group of Nepalese otter conservationists held a webinar for about 200 people to raise awareness of otters and the delicate ecosystem of which they are a vital part.

Once conditions allow, Aarati will visit local children to start a new Team Otter club near Shuklaphanta National Park, where wild otters are found.

A paper on the otters of Shuklaphanta National Park is included in this issue of the *OTTER Journal*.

Other events included:

**Russia**

Novosibirsk, in Siberia, is an area that regularly holds World Otter Day events. This year they held a webinar attended by IOSF's Ben Yoxon at which they proposed plans to conserve their local otter populations.

**Pakistan**

As in 2019, the Pakistan Wildlife Foundation held an event to celebrate otters in their area, inviting people to come and join in their fun-filled otter education activities.

**Online webinars**

As face-to-face events had to be cancelled or postponed, we were delighted to take part in many online webinars. It was a great way to spread the word about otters and hold events with many people worldwide, while still being safe.

In addition to the event in Morocco mentioned above, we were delighted to be invited to webinars in the following countries:

**Tunisia**
IOSF's Dr Paul Yoxon joined Association Tunisienne de la Vie Sauvage for their webinar and presented on otters in a world context and how we can join together to conserve them.

**USA**
Akron Zoo held an online presentation on otters, and particularly the North American river otter. IOSF's Ben Yoxon, was invited to speak about all the world species and how to raise awareness of their conservation needs. The event was very popular and there is now interest in starting an IOSF Team Otter club in Akron, Ohio.

**OTHER WEBINARS**

It seems that this is the way to get our message out to many people all over the world without putting safety at risk, so IOSF has been delighted to join more online sessions:

**UK**
Sharon Lashley of Climate Change North arranged a webinar as part of World Environment Day on 5 June. Although, not World Otter Day it gave an opportunity to tell people about the importance of otters to our environment. The theme was "Time for Nature" and IOSF's Grace Yoxon gave a presentation on the importance of making time for otters as so many are at severe risk from loss of habitat, hunting, disturbance, etc. There was a lot of interest from the audience particularly on the education side and we hope to welcome more local Team Otter clubs.

**Iraq**

IOSF's co-ordinator for the Middle East, Omar Al-Sheikhly is working on a project entitled "Art for Conservation" supported by Guan Eden. The aim of the project is to encourage young wildlife photographers to record the biodiversity of the area, including both the Eurasian and Maxwell's otter, a sub-species of smooth-coated otter, found only in Iraq and Iran. Photographers can obtain so much important data, as in the case of the photo taken at Mosul Dam by Bruce McLennan and Bob Zook in 2017. This was the first photographic record of the Eurasian otter in northern Iraq ever! (OTTER Journal Issue 3).

Omar invited IOSF's Grace Yoxon to give a presentation on "Tools for Otter Conservation" in a Zoom meeting on 15 September 2020. With over 40 attendees it was great to see so many people who are passionate about otters and the Iraqi marshes and we are excited to work with the group moving forward.

A report on the project by Omar is included in this issue of the *OTTER Journal*.

# IOSF OTTER OSCARS 2020

The IOSF Otter Oscars for 2020 provided us with a good number of nominations to consider, yet again. The range of projects that people are involved in from a variety of countries, is what makes the Otter Oscars interesting for us but challenging to decide on our winners. We appreciate the work and efforts people are making for otters and hope this continues, as does your support for these Awards.

2020's award winners are:

**Special Award – Diana J Limjoco, Philippines**

Diana Limjoco has cared for Asian short-clawed otters in the Philippines and has also campaigned, successfully, to protect the bay from development of a huge tourist project which would have destroyed much of the habitat there. Diana is also concerned with the lack of proper care for "orphaned" otters and is working with IOSF and others to establish proper protocols to be used whenever such animals arrive. She is an ambassador for otters across Palawan and her hard work has ensured that habitats remain intact and otters in need receive the appropriate care.

*Image ©Diana J Limjoco*

**Young Person's Award – Chloe Shanks, England**

Chloe brought together her two passions, running and otters, to fundraise for otter conservation. Before her 12th birthday, she decided to run a half marathon for IOSF. Setting her initial target at £250, this was eclipsed by the final total of £813! Chloe has supported the building of a brand new enclosure for neotropical otter rehabilitation operated by COBEA (Mexico)!

*Image: ©Kate Shanks*

**Research – Alejandro Valenzuela, Argentina**

Alejandro Valenzuela has been working on southern river otter conservation since 2005. He has been researching this shy species on a number of aspects such as general ecological research, human interference, conservation actions and much more. He also works on outreach to raise awareness to the species, which is largely under-studied.

**Group/Organisation Award – Save Vietnam's Wildlife, Vietnam**

Save Vietnam's Wildlife (SVW) continue to work for wildlife across the southeast Asian nation, including otters. They are working to increase awareness of species, reduce trade and rescue any individuals that have been "caught up" in the illegal trade. SVW have successfully released a number of otters back to the wild and aim to release more in time. They also produced a video for social media encouraging people to leave otters in the wild, and where they belong.
*www.svw.vn Image: ©SVW*

**Community Achievement – Kiengkai Khoonsrivong, Laos PDR**

Kiengkai attended IOSF's Lao workshop in 2018 and has continued to work for otters ever since. His passion to raise the profile of otters took him to the Bolikhanxai province. There he visited a number of villages to spread the word on otters, gauge human perceptions and start Team Otter clubs across a number of schools within the region.
*Image: ©Kiengkai Khoonsrivong*

**Photography/Artwork – John Reeves-Womble, Scotland**

Young John, aged 11, loves wildlife and being at home during Covid restrictions ignited this passion further. He spent hours out and about in his local area documenting otters, their behaviours, diet and much more to increase his knowledge. During this time he began a love of photography and his photo, above, is a worthy winner of this award.
*Images: ©John Reeves-Womble*

# COMMUNITY EDUCATION IN LAO PDR

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Representative of otter conservation in Laos

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**Abstract**

*Four species of otter have been recorded in Lao PDR: Asian small-clawed (*Aonyx cinereus*), smooth-coated otter (*Lutrogale perspicillata*), hairy-nosed otter (*Lutra sumatrana*), and Eurasian otter (*Lutra lutra*). However, little work had been done on these species and the hairy-nosed and Eurasian otter had not been recorded in recent times.*

*In April 2018, IOSF held a training workshop in Lao PDR and Kiengkai Khoonsrivong assisted in the organisation of the event. There were 36 participants many of whom worked at the Department of Forestry (DOF), Province of Agriculture and Forestry Office (PAFO), and District of Agriculture and Forestry Office (DAFO). There was also considerable support for the project from the Lao Government, particularly Mr Asoka Rasphone, who at that time was Deputy Director of International Organisation Department of Ministry of Foreign Affairs .*

*Before this the Wildlife Conservation Society had a few records from the Nam Et Phou Louey National Park but they had no identification of the species. In 2016, Project Anoulak carried out a preliminary project involving camera traps and community interviews. This revealed evidence of Asian small-clawed (*Aonyx cinereus*) and smooth-coated otters (*Lutrogale perspicillata*), but there were no reports of the possible presence of Eurasian otters (*Lutra lutra*). However, evidence of this species was found during the field work element of the workshop.*

*Since the workshop the author has been carrying out education and public awareness work and this is the report on the latest part of the project.*

***Keywords**: Asian small-clawed otter; Eurasian otter; smooth-coated otter; hairy-nosed otter*

## OVERVIEW

Four species of otter have been recorded in Lao PDR: Asian small-clawed (*Aonyx cinereus*), smooth-coated otter (*Lutrogale perspicillata*), hairy-nosed otter (*Lutra sumatrana*), and Eurasian otter (*Lutra lutra*). The Eurasian otter had not been recorded for many years and as hairy-nosed otters are known to be present in neighbouring countries (Cambodia, Myanmar, Thailand, and Vietnam), it is likely that they are also been present in Laos. However, little work had been done on these

species, and there is still little knowledge on the species distributions, populations, and habitat use.

In 2016, Project Anoulak produced a report on their preliminary camera trap survey in Nakai Nam Theun National Protected Area. As part of the project, they interviewed local villagers who confirmed that there were two species: Asian small-clawed (*Aonyx cinereus*) and smooth-coated otters (*Lutrogale perspicillata*) (**Coudrat 2016**).

In April 2018 the International Otter Survival Fund (IOSF) held a workshop at Nam Theun 2 Watershed Management and Protection Authority, Oudomsouk village, Nakai District, Khammoune Province on "The conservation of endangered otters and their habitats in Laos through education and reducing illegal trade" (**IOSF 2018**). During this workshop field visits found evidence of Eurasian otters at the site.

Otters have been hunted for their fur, meat, and parts for traditional medicine despite legal protection to prohibit catching and hunting (including removal of carcasses, organs, and parts). They are also an important part of the wildlife trade, together with tigers and leopards. In some parts of Asia, otters (particularly Asian small-clawed otters) are taken from the wild for the pet trade and many of these are kept in terrible conditions and die. This trade for both fur and pets is seriously threatening the survival of otters and, in some areas, they have become locally extinct.

## OBJECTIVE OF OUTREACH

1. To raise otter awareness in the community, their role in the ecosystem and the importance of their protection.
2. To create a sense of "ownership" and responsibility for otters in the area of their community.
3. To reduce disturbance of otter habitat.

## STUDY AREA

Four areas were chosen for the project and their locations in Lao PDR are shown in Figure 1:


***Figure 1. Location of 4 study villages in Lao PDR***

## METHODS

Pakphoy and Namtek were visited in June/July 2020; Faen and Donexay in December 2020.

### *Discussion and data collection with villagers*

A field visit was made to the districts to identify target villages for the purpose of the project.

### *Adult outreach*

A meeting was then held with villagers to present the purpose of the activities and to introduce them to the otter species in the world, and particularly those in Lao PDR. The adult community members discussed the following:

- Otter species
- Status of otters in the study area
- Why are otter populations declining?
- Ecosystem/habitat loss
- Climate change
- Trade
- Community participation in otter conservation

### *School activities*

- Introduce the otter species of the world
- Otter species and situation in Lao PDR
- Question and answer session on otters
- Students created artwork on otters bearing in mind the importance of habitat and the artwork was displayed for others to see
- Teachers selected the winner for Pakphoy, Faen, Donexay schools
- A group of student friends selected the winner for Namtek school

## RESULTS

A total of 275 people attended the various sessions including both adults and children:

- Pakphoy – 65 participants
- Namtek – 50 participants
- Faen – 106 participants
- Donexay – 54 participants

Community members and students obtained a basic knowledge about otters and there was discussion about the reasons for a decline in the otter population: hunting and

trade, habitat loss, lower water levels in the rivers, climate change, and food chain crisis. They were asked about the extent of hunting and trade in the community and their vision for otter protection in the future.

***Otter reports***

The local people reported that ten years ago they found otters quite frequently as compared to the present situation and they believed that numbers have reduced by about 80%. They believe this has been caused by deterioration in water quality, over-fishing with zero control, habitat destruction including clearance of bankside riparian vegetation, and hunting otters for food and the sale of their skins.

Villagers in Pakphoy and Namtek reported that they had found otters along the rivers Nam Xoun, Nam Meud, and Nam Xard. They have seen them living in a group four or five times during October to December 2019. In Namtek a student said that he had found the body of an otter in Nam Xard, which he described as being quite a small otter, dark brown in colour.

In Faen, the community reported that they have recently seen otters in the rivers Nam Kat and Nam Kho. In Donexay they reported that 10 years ago they found otters in the Nam Leung. It was not possible to identify species from the descriptions given.

The majority of people reported that otters pulled their nets and ate the fish on top of a rock and beside the river.

***Otter protection***

The students promised to try and stop hunting and trade in otters and to encourage the community to protect otters in their village areas.

The main comments from the community about otter protection were:

1. Improve the environment.
2. Reduce illegal trade with a strong performance from top level to grass-roots – government staff should be responsible for law-enforcement and its impact on the natural environment and wildlife.
3. The government should work seriously with communities on otter protection.
4. Government and international organisations should work together on otter protection.

## RECOMMENDATIONS

In order to protect otters in Lao PDR there should be:

- More research into the status of wild otter populations in order to understand the distribution of the four species, threat levels, and to guide conservation actions.

- Enhanced law enforcement knowledge and capacity to investigate and convict criminals hunting and trading in protected species, including otters.
- Better collaboration between enforcement agencies in Lao PDR and International Non-Government Organisations (INGO) to stem cross-border trafficking of otters, enhance monitoring and enforcement efforts at known otter strongholds, monitor and report on any illegal trade in otters to support law enforcement efforts. The Wildlife Witness app can be used to report any illegal trade of protected species.

This should result in reduced trade in otters, an increased awareness and appreciation of otters by local communities and subsequently increased protection of otters to stop – or at least reduce – the population decline.

**Acknowledgements**

On behalf of myself and the Lao Government we would like to thank the International Otter Survival Fund for supporting the budget for this project and for guidance on otter community outreach. We hope to receive your support again in further activities in otter research in our country.

**Disclosure Statement**

No potential conflict of interest was reported by the author.

**Author Biography**

KIENGKAI KHOONSRIVONG works for the Wildlife Conservation Society as Bolikhamxai Landscape Programme Coordinator. His previous experience included working with related programmes of monitoring and evaluation, improving livelihoods for communities, and land use planning.

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# ART AS A CONSERVATION TOOL IN THE MESOPOTAMIAN MARSHES, SOUTHERN IRAQ, USING MAXWELL'S OTTER (*Lutrogale perspicillata maxwelli*) AS AN EXAMPLE

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The Mesopotamian marshes are vast wetlands situated in southern Iraq and stretching the geographical range of three Iraqi southern provinces (Basra, ThiQar, Mayssan). The biodiversity of the marshes faced a dramatic decline due to anthropogenic disturbance, habitat destruction/fragmentation, and climate change (**Al-Sheikhly et al., 2013**); therefore, the current status of many of its indigenous species is enigmatic. Besides governmental contributions, efforts from independent researchers, environmental activists, and NGOs to conserve the native biota of the marshes were made since its inundation in early 2003. Since then, there has not been enough public awareness to conserve its key/flagship species of fauna and flora. According to **Nature Iraq** (**2017**), one of the impacts contributing to the decline of the native biodiversity in the Mesopotamian marshes has been attributed to the lack of knowledge among local communities with only a few recent awareness campaigns. Furthermore, artwork and hand crafts made of reed and clay which represent the native biota of the region (e.g. otters, waterfowl, water buffalo, etc.) were considered as ancient traditional knowledge of the Marsh Arabs (indigenous inhabitants of the Mesopotamian marshes); yet, such professions may be depleted and faded due to the modern lifestyle (**CBD-6NR, 2018**).

Raising awareness to mitigate the loss of native biodiversity was one of the important issues highlighted by the International Union for Conservation of Nature (IUCN) and the Biodiversity Conference of Parties COP 14. This was further emphasised by the Iraqi Ministry of Health and Environment (IMoHE) in its Sixth National Report to the Convention of Biodiversity as a Sustainable Development Goal (SDG-15), an issue which warrants further attention and urgent actions. Furthermore, the use of art as an effective tool to conserve one of Iraq's endemic species, Maxwell's otter, (*Lutrogale perspicillata maxwelli*) was recently highlighted by **Al-Sheikhly (2020)**.

Guan Eden is a support programme for cultural creators and environmental activists living in Iraq. It financially supports artistic campaigns on environmental topics with up to €10,000 if they target children and young people. It also promotes the networking and further education of artists and environmental activities from all over Iraq.

Guan Eden is a project of the Goethe-Institut, supported by the German Federal Foreign Office. Each year, they offer a small grant to encourage local scientists and artists working on projects and campaigns to raise awareness of sustainable development of local communities, preserving culture heritage and conserving natural ecosystems. The Goethe Institute supported a project entitled "Art for Conservation" which aimed to use native biodiversity of the Mesopotamian marshes in artwork (e.g. photographs, video documentaries, handmade crafts) as an effective tool to raise awareness among local communities. The main objectives of the project were to (i) conserve the marshes wildlife, (ii) create a potential self-sustaining career, (iii) encourage sustainable ecotourism in the Mesopotamian marshes, and (iv) preserve the traditional knowledge of the Marsh Arabs.

The Art for Conservation project selected the following groups: (i) Students (high secondary school/university undergraduates of different majors), (ii) youths from local communities who expressed interest and willingness to learn (young artists and conservationists), and (iii) local environmental and cultural NGOs working within the geographical extant of the marshlands of the three Iraqi provinces mentioned above. The awareness campaign raised by the project had many target groups: the public throughout Iraq; local communities of the Mesopotamian mashes area; local fishermen and hunter associations; those who have direct conflict/interaction with the native biodiversity; Iraqi environmental stakeholders and decision-makers; and Iraqi environmental, cultural, and educational institutes and universities (mainly those related to ecological studies).

The project had three phases:

***Phase I: Training*** (*ex situ* and *in situ*) of the participants. This phase included training on the principles of wildlife photography/video documentation, identification and monitoring of the native species of fauna and flora, especially those of conservation concern, and importance in hand-crafting as part of the native traditional heritage, and also advocating for ecotourism in the Mesopotamian marshes. There was a total of 69 applicants (age range 18–25 years with gender equality) from four Iraqi provinces (Baghdad, Basra, DhiQar, and Mayssan). Twenty to thirty candidates (20% from Baghdad and 80% from three Iraqi provinces; 26.6%) were selected to participate in according to their motivations to the subject in scope and residence within the geographical extant of the marshes. Two training sessions were conducted in Baghdad and DhiQar provinces and each session was divided into three major groups (photography, painting, hand-crafting) and candidates were grouped according to their interest and skills. The first training session was held in Baghdad at the training centre of the Iraqi Society for Photography (Al-Wazeryah, Baghdad) on 5 September 2020 and lasted for seven days (Figure 1). The second training session was held at Al-Chebaeish Organization for Ecotourism-Iraqi Marshes Museum Gallery Room (DhiQar) on 24 September 2020 and also lasted for

seven days (Figure 2). At the end of the training sessions, the trainees' abilities to identify the key biota and major environmental obstacles were tested and certified.

***Figure 1. Training session in Baghdad (training center of the Iraqi Society for Photography). Dr Hajer Hadi (IGCO) giving an introductory on wildlife conservation in the Mesopotamian marshes. Photo © Omar Al-Sheikhly.***

***Figure 2. Training session in Chebaeish Organization for Ecotourism-Iraqi Marshes Museum Gallery Room. The instructor (Dr. Mukhtar K. Haba- IGCO) teaching on the identification of two different otter sympatric species using otter skins. Photo © Omar Al-Sheikhly.***

***Phase II: Fieldwork***: media collection by the participants. Participants used the skills learned in Phase I to create their own artworks through a suggested period of

16 August to 7 October 2020 in three Iraqi southern provinces (Basra, DhiQar, Mayssan) within the region of the Mesopotamian marshes.

***Phase III: Presentation*** of the artworks collected/created by the participants. A total of 40 of the best selected artworks (photographs and wildlife documentaries) collected/created by the participants were presented at an art exhibition in the Iraqi Society for Photography in Baghdad on 3 October 2020. Furthermore, after the completion of the project, several presentations targeted towards young children (mainly kindergarten and primary schools) were performed. Artworks obtained by the trainees especially photographs and documentaries were used as educational materials to raise awareness on the endangered wildlife of the marshes and to express the daily livelihood and chores of Marsh Arabs (Figure 3).

***Figure 3. Artworks (photographs) collected by the project trainees used as educational materials for kindergarten pupils. Photo © Omar Al-Sheikhly.***

With the presence of many talented and eco-motivated young artists and conservationists who were willing to learn, we were highly motivated to achieve the aforementioned aims. We also believed that a regular monitoring of the native fauna and flora of the Mesopotamian marshes, especially those of conservation concern, will be carried out by the selected trainees. The materials (photograph/video records) obtained will be used as key data for Iraq's environmental programmes, reports, and publications. This is especially important now that Iraq is a signatory to several international authorities such as UNESCO, CBD, the Convention of Migratory Species (CMS), and the Convention of Illegal Trade of Endangered Species (CITES), and reporting the status of the biodiversity of the Mesopotamian marshes regularly. The main theme of the project was focused to use the most endemic wildlife (e.g. Maxwell's otter *Lutrogale perspicillata maxwelli*, Basra reed warbler *Acrocephalus griseldis*, Iraq babbler *Argya altirostris*, Mesopotamian crow *Corvus*

*cornix capellanus*, Euphrates soft-shell turtle *Rafetus* (*Trionyx*) *euphraticus*) in the Mesopotamian marshes as key species in the participants' art representations. As a result, when such art materials are presented and marketed, conservation awareness of those species will be raised, there will be financial benefits to the trainees, and traditional heritage will be preserved.

**Acknowledgements**
We are grateful to the Goethe Institute-Iraq for its generous support and funding to Omar Al-Sheikhly 2019–2020 for the Art for Conservation project. We would like to thank the project partners: Iraqi Green Climate Organization (IGCO), Al-Chebaeish Organization for Ecotourism, Iraqi Wildlife Center (IWC), The International Otter Survival Fund (IOSF), and the Iraqi Society for Photography. We appreciate the thoughtful comments, assistance, and support received from Dr Mukhtar K. Haba (University of Baghdad and IGCO), Hadi Al-Najar (Iraqi Society for Photography), Ra'ad H. Al-Assady and Habeeb T. Al-Assady (Al-Chebaeish Organization for Ecotourism), Hajer Hadi and Noor S. Atiyah (IGCO), Mahdi L. Al-Haidari (IWC), and to all participants of this project.

**Disclosure Statement**
No potential conflict of interest was reported by the author.

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# A REVIEW OF TRAPPING OF NORTH AMERICAN RIVER OTTERS (*Lontra canadensis*)

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## Abstract

*In years gone by otters, among other species, were heavily hunted for their luxurious fur. Sea otters (*Enhydra lutris) *have since been protected and are classified as Endangered in the IUCN Red List. The North American River Otter (*Lontra canadensis) *is also classified as Least Concern and is still legally trapped across much of their range. Considerable conservation efforts have been made to restore otter populations across North America and these have been largely successful. However, lessons have not been learnt and legalised trapping still occurs across a large part of the range of the North American River Otter. The fur trade is largely dependent on price and demand. With demand appearing to drop, prices have also gone down and therefore the number of otters trapped has declined too. However, this could change at any time. Otter numbers are hard to quantify given their behaviour, so any suggestion that otter trapping is sustainable is questionable. Without recent and sound data of otter populations we cannot be sure of the impact of trapping on these populations. With increasing pressures from other factors, such as habitat loss and pollution, it can be said that the population of North American River Otters is still under threat.*

***Keywords:*** *North American river otter;* Lontra canadensis*; trapping; Canada; United States of America*

## INTRODUCTION

Historically, people have used animal furs as a need rather than a luxury. Given people's physiological traits, using animal fur to keep warm and protect them from the elements where they live was a necessity **(Dolin, 2010)**. In some areas, winters can be particularly harsh so this was a sensible way to survive.

As time passed furs were used less as a necessity and more as a sign of wealth, and so ensued the root of the problem of the fur trade – greed. As the thirst for furs across Europe drove fur-bearing species to the brink of extinction, a new source had to be found, and that source was North America. Native Americans were already using furs so the Europeans that went to North America in the sixteenth century were not the first people to use this resource, nor were they even the first Europeans in the area **(Dolin, 2010)**. They were, however, the first to make it a large-scale business and exploit these animals on a monumental scale. The fur trade became a major

economic endeavour and otters were near the top of the most sought-after furs **(Innis, 1999)**, leading to obvious impacts on their populations. This led to animal populations suffering massively, and many have struggled to recover ever since. Some were lost for ever; some species, such as sea otters (*Enhydra lutris*) were nudged to the brink of extinction; and others, not directly involved in the trade, like the Steller's sea cow *(Hydrodamalis gigas*), became extinct due to the disappearance of keystone species such as sea otters **(Estes et al., 2016).**

So where does that leave us now, particularly in relation to otters? The sea otter somehow did manage to "escape". Due to their luxurious fur, the thickest of any mammal in the natural world **(Cohn, 1998)**, they were hunted so ferociously at the height of the fur trade that it put extreme pressures on their populations. In 1911, they were on the brink of extinction and so a treaty was passed which made it illegal to hunt them **(Ravalli, 2009)**. The North American River Otter (*Lontra canadensis*), like its marine cousin the sea otter, was also heavily hunted during this period of the fur trade. There were also other factors which led to the species losing much of its previous range, such as increased urbanisation of rural areas, and pollution in waterways. It is believed that North American River Otter (NARO) populations became extinct in 11 US states and suffered a severe decline in 9 more **(Raesly, 2001)**. Since then, considerable conservation efforts have been made to increase numbers across their range and restoration efforts have been made in 23 states, and one Canadian province (Alberta) **(Erb et al., 2018).** It is believed that nearly all of these restoration efforts were successful across the programme and NARO are now considered to live across 90% of their previous range (**Melquist et al., 2003**). They are only absent in two areas: Hawaii, which never had otters, and Prince Edward Island where more recently there have been incidents of otters being caught in beaver traps. These are believed to have swum across from Nova Scotia or New Brunswick and perhaps have reclaimed some of their previous habitat **(CWHC, 2017)**. NARO are believed to have a stable population and are listed as Least Concern in the IUCN Red List.

Despite populations showing signs of recovery, lessons have not been learnt, and legalised trapping takes place across much of the species' range, including in states where they have been reintroduced. The aim of this paper is to gain a better understanding of the trapping of NARO and its sustainability. The paper will look into correlations between harvest numbers, fur prices, where otter furs are most sought after, as well as looking into whether the fur trade is sustainable and not having a detrimental impact on populations.

## METHODS

It is important to understand how many otters are being harvested per year and how this has changed due to demand, which is often affected by the price of pelts **(Banci**

**and Proulx, 1999)**. Harvest numbers (Table 1), were obtained through the official body for each state, such as the Department for Fish and Wildlife. The information came from online publications or by direct correspondence with the governing bodies.

All figures for prices/numbers sold were obtained from the Fur Harvesters Auction Inc (FHA) website (https://www.furharvesters.com/auctionresults.html; accessed 2 February 2021), and any annual figures were produced by averages from the three or four auctions held during the year. The FHA is one of the two main fur auction facilities in North America, the other being the North American Fur Auctions (NAFA).

All import numbers were taken from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Trade Database (https://trade.cites.org/).

## RESULTS

The results provide information on a variety of aspects in relation to the legal trapping of NARO across their range, including number trapped, prices, destinations, restoration/relocation programmes and trapping across the region. These factors all contribute to whether such trapping is sustainable or not.

***Table 1. North American River Otter trapping numbers***

| **CANADA** | | | | | | |
|---|---|---|---|---|---|---|
| | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** | **2018/19** |
| Alberta (AB) | 269 | 283 | 311 | 261 | 213 | 220 |
| Manitoba (MB) | 909 | 1035 | 617 | 445 | 509 | 295 |
| New Brunswick (NB) | 751 | 446 | 365 | 263 | 370 | 251 |
| Newfoundland & Labrador (NL) | 1579 | 837 | 635 | 563 | 528 | 213 |
| North West Territories (NT) | 31 | 21 | 41 | 31 | 5 | 42 |
| Nova Scotia (NS) | 539 | 369 | 309 | 243 | 281 | 284 |
| Nunavut (NU) | DO NOT KEEP HARVEST INFORMATION | | | | | |
| Ontario (ON) | 4723 | 3638 | 3199 | 2699 | 2664 | 2300 |
| Quebec (QC) | 3217 | 2802 | 2795 | 2031 | 2147 | 1705 |
| Saskatchewan (SK) | 522 | 482 | 480 | 308 | 255 | 290 |
| Yukon (YT) | DO NOT KEEP HARVEST INFORMATION | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| British Columbia (BC) | 7 | 22 | 9 | 3 | 10 | 6 |
| **UNITED STATES OF AMERICA** | | | | | | |
| Alabama (AL) | NO ACCESS TO INFORMATION | | | | | |
| Alaska (AK) | 2139 | 1398 | 1495 | 882 | 957 | 706 |
| Arizona (AZ) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| Arkansas (AR) | 2065 | 1383 | 778 | 1348 | 993 | 727 |
| California (CA) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| Colorado (CO) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| Connecticut (CT) | 160 | 103 | 122 | 153 | 159 | 141 |
| Delaware (DE) | 22 | 16 | 7 | 8 | 5 | 23 |
| Florida (FL) | 4 | 8 | 5 | 6 | 8 | 7 |
| Georgia (GA) | 1323 | 1869 | 1869 | 1126 | 1045 | 1211 |
| Idaho (ID) | 165 | 153 | 125 | 92 | 106 | 115 |
| Illinois (IL) | 1303 | 1136 | 980 | 1033 | 1118 | 1060 |
| Indiana (IN) | No trapping | No trapping | No trapping | 518 | 498 | 589 |
| Iowa (IA) | 1165 | 835 | 692 | 556 | 430 | 576 |
| Kansas (KS) | 158 | 172 | 116 | 132 | 167 | 128 |
| Kentucky (KY) | 1214 | 1016 | 595 | 700 | 770 | 725 |
| Louisiana (LA) | 3660 | 1138 | 290 | 1215 | 852 | 1091 |
| Maine (ME) | 408 | 292 | 496 | 322 | 531 | 390 |
| Maryland (MD) | 338 | | | | 167 | 165 |
| Massachusetts (MA) | 166 | 102 | 57 | 101 | 62 | 35 |
| Michigan (MI) | 849 | 834 | 856 | 711 | 665 | 721 |
| Minnesota (MN) | 2824 | 2154 | 1955 | 1195 | 1295 | 1351 |
| Mississippi (MS) | 2519 | 1745 | 1850 | 1009 | 1149 | 959 |
| Missouri (MO) | 2584 | 2154 | 1368 | 1602 | 2025 | 1412 |
| Montana (MT) | 99 | 83 | 91 | 84 | 72 | 71 |
| Nebraska (NE) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |

| | | | | | | |
|---|---|---|---|---|---|---|
| Nevada (NV) | 5 | 5 | 2 | 1 | 3 | 12 |
| New Hampshire (NH) | 256 | 177 | 166 | 154 | 97 | 125 |
| New Jersey (NJ) | 43 | 45 | 51 | 40 | 51 | 39 |
| New Mexico (NM) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| New York (NY) | 1099 | 723 | 943 | 714 | 836 | 635 |
| N Carolina (NC) | 2908 | 2102 | 1254 | 1450 | 1072 | 2019 |
| N Dakota (ND) | No trapping | No trapping | No trapping | No trapping | 17 | 17 |
| Ohio (OH) | 137 | 91 | 137 | 163 | 146 | 193 |
| Oklahoma (OK) | 489 | 405 | 329 | 317 | 301 | 397 |
| Oregon (OR) | 534 | 362 | 203 | 263 | 237 | 211 |
| Pennsylvania (PA) | No trapping | No trapping | 46 | 36 | 35 | 28 |
| Rhode Island (RI) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| S Carolina (SC) | 545 | 442 | 306 | 248 | 296 | 152 |
| S Dakota (SD) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| Tennessee (TN) | ONLY STARTED KEEPING NUMBERS DURING 19/20 SEASON | | | | | |
| Texas (TX) | 476 | 216 | 129 | 186 | 93 | 210 |
| Utah (UT) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| Vermont (VT) | 246 | 154 | 155 | 113 | 128 | 93 |
| Virginia (VA) | 1106 | 676 | 505 | 417 | 455 | 435 |
| Washington (WA) | 278 | 171 | 130 | 159 | 165 | 192 |
| West Virginia (WV) | 193 | 156 | 109 | 105 | 90 | 106 |
| Wisconsin (WI) | 907 | 1204 | 1251 | 1617 | 1515 | 1531 |
| Wyoming (WY) | No trapping | No trapping | No trapping | No trapping | No trapping | No trapping |
| **TOTAL (excluding Maryland)** | **44596** | **33455** | **28224** | **25623** | **25426** | **24039** |

Table 1 shows the trapping numbers for each province or territory within Canada and each state in the USA from the 2013/14 season to the 2018/19 season as obtained through each region's official body, such as the Department for Fish and Wildlife.


***Figure 1. Trapping and restoration across Canada and the USA***

***Table 2. Average sale and prices for NARO pelts***

| | Average sold % | Average Price (US$) | Highest Price (US$) | Other information |
|---|---|---|---|---|
| **2013** | 94.6 | 95.48 | 170 | |
| **2014** | 68.3 | 52.76 | 110 | |
| **2015** | 42.7 | 40.72 | 90 | |
| **2016** | 44.9 | 21.05 | 56 | Two sales went mainly unsold |
| **2017** | 48.3 | 28.57 | 68 | One sale went mainly unsold |
| **2018** | Mainly unsold | Mainly unsold | Mainly unsold | All auctions went mainly unsold |

Table 2 shows the sales and prices for otter furs from the 2013/14 season through to the 2017/18 season based on data from the Fur Harvesters Auction Inc. auction results.

***Figure 2. Relationship between fur harvest numbers and average price for otter pelts.***

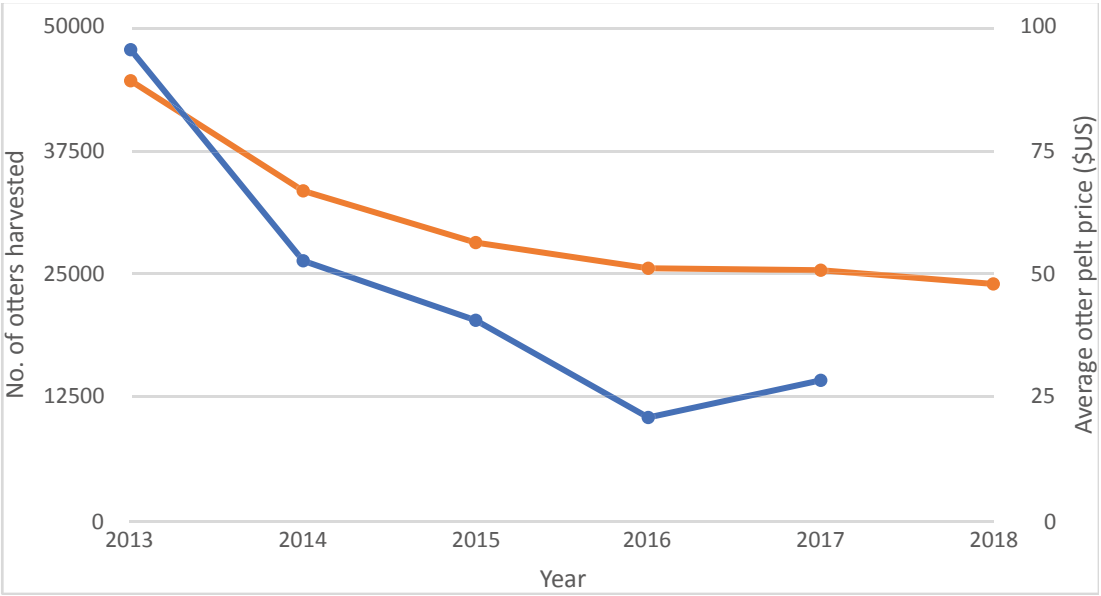


***Table 3. NARO otter pelt import numbers (CITES, The Convention on International Trade in Endangered Species of Wild Fauna and Flora)***

| **Country** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **TOTAL** |
|---|---|---|---|---|---|---|---|
| Australia | | | 1 | | | | 1 |
| Belgium | 1 | 5 | 3 | | | | 9 |
| Canada | 23719 | 23811 | 10940 | 6594 | 6328 | 6993 | 78385 |
| Switzerland | 1 | | | | | | 1 |
| Chile | 2620 | | | | | | 2620 |
| China | 21669 | 18452 | 15270 | 10339 | 13633 | 23657 | 103020 |
| Czechia | | | 2 | | | | 2 |
| Germany | 1361 | 1073 | 761 | 2 | 194 | 58 | 3449 |
| Estonia | 145 | | | | | | 145 |
| Finland | | 900 | 852 | 481 | 433 | 378 | 3044 |
| France | 3 | | | 1 | | 4 | 8 |
| United Kingdom | 2 | 1 | 267 | | | 1 | 271 |
| Greece | 918 | 666 | 514 | 35 | | | 2133 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hong Kong | 10098 | | | | | 901 | 10999 |
| Israel | | | | | 70 | | 70 |
| Italy | 1481 | | 107 | | | | 1588 |
| Japan | 27 | | | | | | 27 |
| North Korea | | | 3 | | | | 3 |
| South Korea | | | 147 | | | | 147 |
| Lebanon | 1 | | | | | | 1 |
| Lithuania | 334 | | | | | | 334 |
| New Zealand | | | 5 | 1 | | | 6 |
| Poland | | 100 | | | | | 100 |
| Russia | 1510 | 1467 | 564 | 180 | 137 | | 3858 |
| Turkey | | 970 | | 652 | | | 1622 |
| Ukraine | 254 | 102 | | | | | 356 |
| USA | 2960 | 3371 | 3550 | 2239 | 1833 | 1274 | 15227 |
| South Africa | | | 4 | | | | 4 |
| **TOTAL** | **67104** | **50918** | **32990** | **20524** | **22628** | **33266** | **227430** |

## DISCUSSION

The number of otters that are harvested each year across their range, as well as the states that do or do not trap is shown in Table 1. Across both Canada and USA there are now only eight regions that do not trap otters, out of a total of 61. This follows South Dakota's recent decision in 2020 to remove the species from the Threatened Species List and start a trapping season allowing for 15 otters to be trapped. It seems strange that any species would go from being listed as "threatened" to a situation where trapping is allowed without any intermediary monitoring period. This means that from 2013/14 to the present, four more states have introduced otters as a listed furbearer and, therefore, they can now be trapped. Utah and Arizona are also considering a trapping season in the future.

For the purposes of this study, Maryland has not been included in the final results. This is due to the fact that full harvest numbers were not provided. In 2013/14, 44,596, otters were trapped across Canada and the USA. These numbers have gradually reduced to 24,039 in the 2018/19 season, a decrease of 46.1% (Table 1). The exact reason for this is likely to be the fact that furs have dropped significantly in value, and are also being sold less in auctions, suggesting a drop in demand. The biggest decrease in otter harvest numbers by percentage was in the Canadian

province Newfoundland and Labrador which saw a decrease of 86.5% between 2013/14 and 2018/19. By number, the biggest decrease was in the US state of Louisiana which recorded a drop of 2569 otters harvested over the same time period.

Despite the general trend showing a decrease in harvest numbers there are nine states/provinces that have shown an increase in otter harvest numbers comparing numbers in 2013/14 to those in 2018/19. Three states (Indiana, North Dakota, and Pennsylvania) did not allow trapping in the 2013/14 season but have since changed that. Six other states/regions have shown an increase in otter harvest number: North West Territories (+35.5%), Delaware (4.5%), Florida (75%), Nevada (140%), Ohio (40.9%), Wisconsin (68.8%); however, all apart from Ohio and Wisconsin have relatively low trapping numbers – the latter showing an increase of 624 individuals.

Figure 2 shows the correlation between pelt prices and harvest numbers. It shows how the gradual drop in price has led to a gradual drop in otters harvested. In 2013, 94.3% of otters were sold at auction at an average price of $94.58; however, by 2017, the average price had dropped by 70% to $28.57, and in 2018, most of the otter pelts were been left unsold (Table 2). The 2017 pelt prices were actually an increase on their previous year but also had one auction having pelts which were mainly unsold.

Fur in fashion is becoming more frowned upon, particularly in western culture **(Singleton, 2013)** which is leading to fewer individuals and fashion designers choosing furs as their go to materials This is emphasised in Table 3. In 2013, excluding the two trapping nations, USA and Canada, and the two highest importers, China and Hong Kong, 14 other nations imported NARO skins. By 2018, this number had dropped to four leaving just France, Finland, Germany, and the UK as the only other importers, and these imports only equated to 0.01% of the total that year.

Could this have led to a drop in demand and therefore price? The role of celebrities or other social influencers should not be underestimated. It is well known that the attitudes and actions of these people can impact purchase preference **(Chetioui et al., 2020)**. In China, for example, where trade is still high with 103,020 otter pelts sold over the six-year period, if someone of “high influence” was suddenly to endorse otter fur, there would be a quick spike in demand and the popularity for otter fur would boom. Given that more states are now allowing trapping, should demand for otter furs increase we would expect to see a higher number of trapped individuals across the area.

Figure 1 shows us the history of the restoration/reintroduction process, with regard to whether each state traps or does not trap for otters. Of the 23 states, and one Canadian province that have had major restoration or reintroduction programmes, only five do not allow otter trapping. This means that 77% of the regions that have made major conservation efforts to restore otter populations reduced by the fur trade,

have once again allowed a fur trade to convene. Clearly, they have not learnt from past mistakes. Were they reintroduced just to re-allow trapping further down the line?

The argument that trapping is sustainable is questionable. In many cases populations are "believed" to be stable. In the 2017/18 report, Arkansas stated that their otter populations were "probably stable" **(Sasse, 2018)**. In the 2018/19 report it says that they are "increasing". However, this information is based on "perception" of trappers **(Sasse, 2019)** and not on any sound scientific data. This simply is not good enough and is not scientifically valid nor quantifiable. "Probably" and "perception" do not equate to anything; it looks to be closer to a guess.

Monitoring population of otters is very difficult due to their behaviour and characteristics. They can travel large distances within a single day and are therefore difficult to count and the same animal can be recorded several times **(Chanin, 2003)**. Spraint can tell you of an otter's presence but offers no indication of numbers **(Yoxon and Yoxon, 2014)**.

Given the fact that otter numbers are famously hard to establish, there is limited data available for otter populations within Canada and USA. In the US, "population monitoring" is carried out by most states, through a variety of different methods. Of the 49 US states where the species is found, four are not monitoring their populations, or did not report any monitoring programmes (Nevada, Rhode Island, Utah, Wyoming), while 35 are using harvest survey data as part of their otter monitoring programmes **(Roberts et al., 2020)**. This means that in order to monitor otter populations within their states, they are using otters that have been trapped. Trapping numbers will clearly give some indication of otter numbers but it must also be remembered that obviously the animals counted for that area are now deceased and therefore no longer part of the population.

***Where is the demand?***

Fur has become much less fashionable in recent years. Many top brands such as Gucci, Chanel, and Armani have chosen to become "fur-free" with many celebrities supporting this too **(Marriott, 2020)**.

It is now believed that China accounts for around 80% of the global fur trade **(Gaskin, 2018)**. Indeed, Table 3 shows that of the 227,430 otter pelts that were exported/imported during the time period 2013 to 2018, over 50% were sent to China and Hong Kong, considerably more than any other nation in the world which does not have native North American River Otters. The high number for Canada and USA can be attributed to otter furs being sent across the border, which accounts for 40.2% of the trade. The remaining sales went to a variety of countries across the world with numbers particularly high (over 2000) in Chile, Germany, Finland, Greece, and Russia. By 2018, 98.2% of the furs imported were again by China or Hong Kong

(excluding Canada and the USA), showing that the vast majority of the demand is coming from that region of the world.

The figures offered in Table 3 are higher than the numbers trapped across the home range of the species. This is due to the fact that some of the pelts imported could have crossed borders on more than one occasion, for example, across from USA to Canada, then to a country outwith their natural range, or because otters caught in previous years have been re-sold. This also only relates within the CITES database to "Skins" and not any other items traded (bodies; carvings; fur products; garments; hair; leather; live; skulls; specimens; tails; teeth; trophies; unspecified), which have not been considered within this study.

With China's fur manufacturing believed to be due to increase from 6.6bn to 6.9bn **(Marriott, 2020)**, what does that mean for otters? Will demand and therefore trapping of otters follow suit as a result?

***Other threats***

Table 4 gives the number of otters killed or euthanised by the Wildlife Services (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs).

***Table 4. The number of NARO that have been killed/euthanised each year by the Wildlife Services in USA. Figures available from United States Department of Agriculture Animal and Plant Health Inspection Service***

| YEAR | NO. OF STATES | | | KILLED/EUTHANISED | | |
|---|---|---|---|---|---|---|
| | Intentional | Unintentional | TOTAL | Intentional | Unintentional | TOTAL |
| **2013** | 10 | 22 | 32 | 131 | 397 | 528 |
| **2014** | 7 | 19 | 26 | 64 | 390 | 454 |
| **2015** | 9 | 19 | 28 | 83 | 409 | 492 |
| **2016** | 11 | 24 | 35 | 120 | 415 | 535 |
| **2017** | 13 | 21 | 34 | 88 | 587 | 675 |
| **2018** | 12 | 21 | 33 | 173 | 537 | 710 |
| **Total** | | | | 659 | 2735 | 3394 |
| **Average per year** | | | | **109.8** | **455.8** | **565.7** |

This shows that during the period 2013 to 2018 an average 566 (ranging from 710 to 454) otters were killed annually by intentional and unintentional means, and these are in addition to those trapped each year. These figures are only available for certain states within the US and no areas of Canada, so the figure is likely to be considerably higher.

It is also important to remember that wildlife, including otters, face other pressures and that trapping is not the only threat to their population. The various struggles that

wildlife is facing have been highly documented and otters are no different. Aspects such as pollution, habitat degradation, human interference, loss of prey all have detrimental impacts on wildlife populations. Combine this with other threats such as road traffic accidents, euthanasia and accidental capture by state departments outlined above and all these pressures on a single species could have potentially catastrophic outcomes for their populations.

## CONCLUSIONS

The argument in favour of the trapping of NARO, and other species for that matter, is that it is sustainable and that trapping will have no detrimental impact on the species population as a whole.

River otter trapping numbers have decreased quite dramatically from the 2013/14 season to the 2018/19 season. This could be due to a lack of demand, due to a reduction in price being offered for the furs, due to their being less otters, or all of the above. There is a very clear argument that should prices increase, then otter harvests would quickly follow.

It is also imperative to understand the number of otters that are dying due to other reasons to understand the sustainability of trapping. Aspects such as pollution, lack of prey, habitat loss, and other anthropogenic factors could all lead to a sudden drop in otter populations which could go unnoticed.

Should demand and prices suddenly rise then the likelihood is that trapping, and therefore numbers removed from the wild, would increase also. With accurate population figures unknown and hard to determine, how do we know the consequences of current trapping levels, or the impact of any increase on the long-term survival of the North American River Otter?

## LIMITATIONS

The figures shown in Table 1 are those provided by the Department of Fish and Wildlife for each individual state. These are not always exact trapped numbers and can be obtained through other means such as export numbers, animal purchases or estimated trapping numbers. Furthermore, there were no harvest numbers for four states/provinces, Nunavut and Yukon in Canada; Alabama and Tennessee in the US, and incomplete data for Maryland. However, the data which was provided for Maryland suggests their trapping numbers follow the average trend of decrease during the study period.

Figures from Table 4 only equate for a certain number of US states and do not account for numbers in the remaining states nor Canada. Therefore, figures are likely to be more than those specified.

## Acknowledgements

I am grateful to those states, provinces, and territories who have provided data for this study.

## Disclosure Statement

No potential conflict of interest was reported by the author.

## Author Biography

BEN YOXON is the Education Officer for the International Otter Survival Fund and is responsible for the education programme, Team Otter. He is involved in the regular monitoring of the otter population on the Isle of Skye and carries out otter surveys.

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# THE OTTER (*Lutra lutra*) ON THE ISLE OF WIGHT, 2020

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**Abstract**

*This short report is the first official account of an otter utilising the inland river systems of the Isle of Wight since the 1950s. Whilst sporadic reports have been recorded on the island since, especially during the 1980s and 1990s, they have mainly been associated with the coastal regions and the lower reaches of the rivers.*

***Keywords:*** *Eastern Yar; Eurasian otter; Isle of Wight;* Lutra lutra*; River Medina; spraints*

## INTRODUCTION

The Isle of Wight is the largest island in England, and lies off the south coast of Hampshire, separated from the mainland by a stretch of the water called The Solent. Reports of otters on the Isle of Wight are very rare and official verified records even more so.

During a recent water vole (*Arvicola amphibius*) survey of the Isle of Wight (**Rothwell, 2021**), otter activity was also discovered on several of the watercourses in three of the island's main river catchment regions. This is the first time that otter activity has been officially recorded on a river system inland on the Isle of Wight since the 1950s.

Historically, the otter was described as widespread throughout the Isle of Wight (**Heal, 1955**). In more recent times, official reports of otters on the island have been very few and far between, with most centred around Newtown Harbour (**Grogan and Strachan, 1997; Grogan, 1998; Rothwell, 2004**). The species is no longer perceived as a resident of the Isle of Wight, and only occurs on the island infrequently (**Grogan, 1998**). It has been recorded as a visitor from the mainland as early as 1988 (**Grogan, 1998**).

## METHODS

The parameters were based on a water vole survey rather than a dedicated otter survey. Consequently, only incidental observations of otter activity were made. The survey sites mainly concentrated on the Eastern Yar and the northeast Wight

catchments. In addition to the watercourses in these regions, the River Medina and the Western Yar (main rivers only), and Newtown Harbour were also examined.

Each watercourse was divided into a series of survey sections of 500m. At the start of each section the watercourse was thoroughly examined for the evidence of water voles (droppings/latrines, burrows, footprints, and feeding remains). If such evidence was found, up to a further 100m of watercourse was methodically examined in order to give an immediate indication of utilisation by water voles. Thereafter, all comprehensive searching would cease until the start of the next survey section. However, any *ad hoc* evidence observed between the comprehensive searching and the start of the next section was also noted.

In addition to the water vole, the occurrence of three other important riparian mammals was also recorded; namely otter (*Lutra lutra*), mink (*Neovison vison*), and brown rat (*Rattus norvegicus*). In summary this involved looking for droppings, footprints, and rest-sites (areas utilised for sleeping or resting) for each of these species.

An assessment of any spraints found were made in the field with a x10 magnification hand lens in the first instance. Where spraint analysis could not be readily carried out in the field, samples were taken for subsequent examination in a more controlled environment. In the laboratory, each spraint collected was put into a separate jam jar with hot water and a denture-cleansing tablet. The samples were soaked in this solution for 24 hours and then rinsed through a 0.5mm sieve. The spraint contents were allowed to dry at room temperature on filter paper. The dry spraint contents were then examined under a binocular microscope and identified using published keys from **Webb** (**1977**), **Watson** (**1978**), **Wheeler** (**1978**), and **Conroy et al.** (**1993**).

## RESULTS

A total of 49 spraints were found on the Isle of Wight during the water vole survey conducted between 2 June to 10 October 2020 (**Rothwell, 2021**). This survey covered the watercourses on the eastern side of the island together with the western Yar and Newtown Harbour, on the western half. Most of the spraints were categorised as old (Table 1), and the majority were spread along the Eastern Yar River between its upper and lower reaches, and on some of its tributaries (Figure 1).

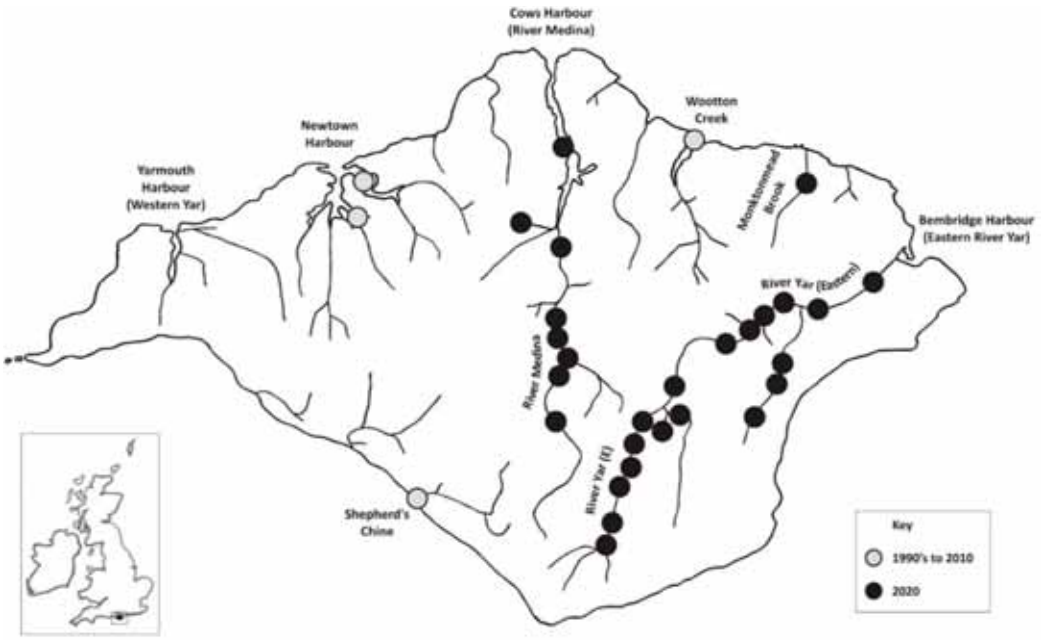


***Figure 1. Distribution of otter activity (spraint sites) on the Isle of Wight during the recent studies on the island.***

***Table 1. The number and condition of spraints found on the Isle of Wight 2020***

| | | **Spraint Condition** | | | |
|---|---|---|---|---|---|
| **Catchment Area** | **Watercourse** | Fresh | Recent | Old | ***Totals*** |
| Eastern Yar | River Yar (Eastern) | 1 | 4 | 19 | 24 |
| | Scotchells Brook (*trib.*) | | | 7 | 7 |
| | Wroxall stream (*trib.*) | | | 1 | 1 |
| | Sandford stream (*trib.*) | | | 1 | 1 |
| | St Catherine's Hill stream (*trib.*) | 2 | 1 | | 3 |
| Northeast Wight | Monktonmead Brook | | 1 | 1 | 2 |
| Medina | River Medina | | 1 | 9 | 10 |
| | Gunville stream (*trib.*) | | | 1 | 1 |
| ***Totals*** | | 3 | 7 | 39 | **49** |

This area is practically the furthest point from the northern coast of the Island, which is the nearest coastline to the mainland.

Further explorations by an otter were observed from two spraints found on the lower reaches of the Monktonmead Brook, on the northeastern part of the island. This represents the most isolated of the spraint sites found (Figure 1). There are several possible routes which an otter might take to cross over into these two different catchment areas. Communication between the Eastern Yar River and the Monktonmead Brook, although not direct, would only be a short distance overland to reach the associated minor tributaries of each of these watercourses.

Only ten spraints were found on the River Medina, mostly around the mid to lower reaches, which is also effectively the closest region to the Eastern Yar River (Figure 1).

One spraint was found on the Gunville Stream (another tributary of the River Medina), which suggests that this area is only a small part of the foraging excursions by an otter, whilst exploring the Medina catchment. However, this stream is a potential link between Newtown Harbour (via the Rodge Brook) and the River Medina. No evidence of otter activity was observed on the Newtown Harbour complex, or the Western Yar during 2020.

***Spraint analysis***

It is not surprising that an otter has ventured onto the Eastern Yar River and indeed the River Medina. These are the main rivers on the island and would presumably be a good source of prey.

An assessment of the contents was made from each of the spraints found on the island. Freshwater fish species were the dominant prey item, with the salmonids (salmon and trout *sp*.) the most abundant fish group in the diet on the Eastern Yar catchment (Figure 2); on the Medina catchment the principal prey item was the bullhead (*Cottus gobio*), although this was matched by the quantity of unidentified fish bone fragments in the spraints (Figure 3).

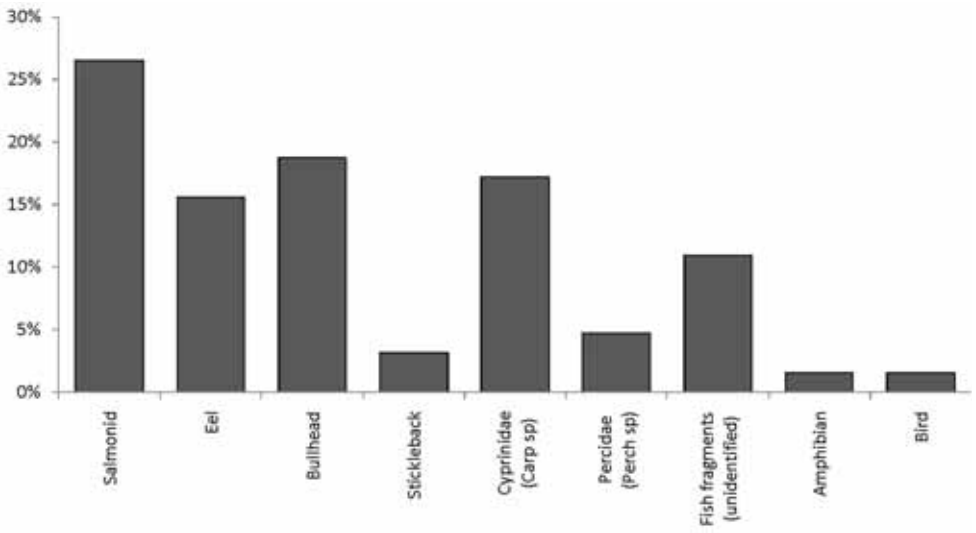


***Figure 2. Combined percentage occurrence of prey items from spraints found (n=36), from watercourses surveyed on the Eastern Yar catchment.***

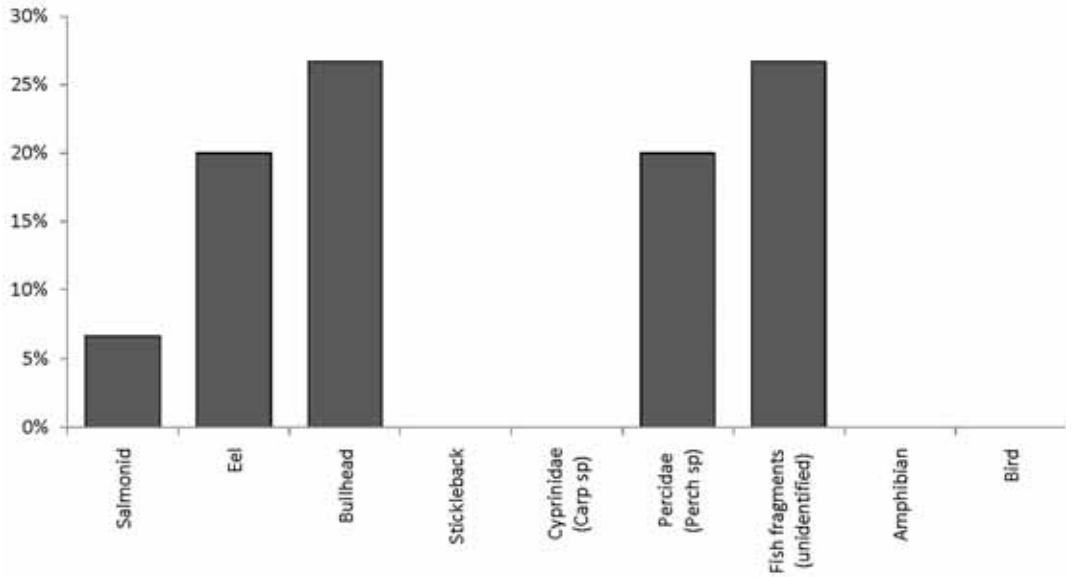


***Figure 3. Combined percentage occurrence of prey items from spraints found (n=11), from watercourses surveyed on the Medina catchment.***

It was interesting to note that the percentage of Cyprinidae (carp *sp*.) and Percidae (perch *sp*.) found in the spraints differed depending on the catchment. There were no Cyprinidae in the spraints found on the Medina catchment and quite a high frequency of Percidae. Whereas spraints from the Eastern Yar catchment showed a dominance of Cyprinidae remains over the Percidae. The majority of the Cyprinidae remains were not identifiable at species level, but those that were came from dace (*Leuciscus leuciscus*) and roach (*Rutilus rutilus*).

There were only two examples of spraints containing non-fish items. These were both found on the Eastern Yar River. One spraint contained bird feathers, identified as mallard (*Anas platyrhynchos*), and the other containing amphibian bones (either frog or toad).

The two spraints from the Monktonmead Brook only contained bones from eel (*Anguilla anguilla*).

## DISCUSSION

Whilst the main aim of the survey was dedicated to water vole activity, it also represented a snapshot of otter occurrence on the Isle of Wight during 2020. It is likely that it was a single otter travelling across large distances. Otters tend to have vast home ranges, particularly on freshwater systems (**Green, Green and Jefferies, 1984; Kruuk et al., 1993; Durbin, 1998**), and their subsequent spraint distribution on the island may reflect that. However, the number of spraints found and their distribution does not indicate the number of otters present or whether the animal is resident (**Yoxon and Yoxon, 2014**).

It has mostly been assumed that otters swim across The Solent from the mainland, and forage around Newtown Harbour or the Western Yar (both approximately 4.5km from the mainland), and then travel back. Historically an otter crossing the sea on the northeastern side of the island has been reported by passengers of the mail boat from Portsmouth to Ryde (**Heal, 1955**). Linearly this would represent a distance travelled of approximately 6.3km.

With otter activity confirmed on the island at the time of the Newtown Harbour and Western Yar survey visits in 2020, it would be reasonable to suggest that an otter may have already passed through these areas and moved on to the main river systems on the eastern half of the island? Field signs will not last long before they are weathered away and an historical study by **Jenkins and Burrows (1980)** showed that 83–94% of spraints disappeared after seven weeks.

Newtown Harbour, in geographical terms, is one of the closest points to the mainland. However, it is still quite an impressive undertaking as an otter would not only have to negotiate across one of the relatively busiest stretches of sea, but also navigate through some very challenging strong currents.

Otter activity at Newtown Harbour has been confirmed from two previous water vole surveys of the island. Firstly in 1996 (**Grogan and Strachan, 1997**) (Figure 1). Additionally, two otters were later observed around Newtown Harbour at the time of the survey (**Grogan, 1998**); and secondly, an old spraint was found on the banks of Clamerkin Lake salt marsh at Newtown Harbour in 2003 (**Rothwell, 2004**) (Figure 1).

Prior to the 2020 observations, the most recent record of an otter on the island was back in April 2010 (**Roberts, G, *pers. comm.***), when a spraint was found on the Atherfield Brook approximately 550m up from the coastline of Brighstone Bay, along Shepherd's Chine (Figure 1). It is interesting to note that this same site was found to be negative for otter activity three months previous, during the Fifth Otter Survey of England (**Crawford, 2011**). Ironically a similar result was obtained from the Third Otter Survey of England (**Strachan and Jefferies, 1996**) and all of the official survey sites on the western half of the Isle of Wight were negative for otter evidence; however, two otters were independently reported at Wootton Creek on the eastern half of the island.

There are a multitude of routes which an otter could use to travel from one catchment area to the next, but they may not necessarily choose the shortest link between adjacent catchments (**Rothwell, 2020**). Not all of the watercourses on the island were surveyed during 2020 (**Rothwell, 2021**), and the recent incidental observations of otter activity from the water vole survey are far from conclusive to show how an otter has presumably travelled from the mainland and ended up on the far side of the island.

It is hoped that a future survey dedicated towards otters on the Isle of Wight can be conducted in order to establish whether the otter has remained on the island, or is still just an occasional visitor.

**Acknowledgements**

My principal and most grateful thanks go to Richard Grogan (Isle of Wight AONB Lead Officer) who entrusted me with the initial task in hand of the water vole survey of the Isle of Wight, and provided an insight into the current and historic otter records on the island.

I am also very grateful indeed to Val Gwynn for providing accommodation and several key contact details.

I must also thank all of the islanders, land managers, landowners, and tenants alike who allowed me to encroach on their land, as without this access the successful completion of this project would not have been possible.

Graham Roberts (retired Otters and Rivers Project Officer) for the Hampshire and Isle of Wight Wildlife Trust, kindly provided the data for the record on the Atherfield Brook.

**Disclosure Statement**

No potential conflict of interest was reported by the author.

**Author Biography**

ANDREW ROTHWELL is a freelance zoological surveyor, specialising in otter and water vole surveys. With an avid passion for the natural world since childhood, he has continued to be amazed and enchanted by the magic of catching a glimpse of the very charismatic and endearing otter.

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# A STUDY OF THE DIET AND DISTRIBUTION OF THE EURASIAN OTTER (*Lutra lutra*) ON THE WATER OF LEITH, EDINBURGH

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## Abstract

*To date there has been little research on the Eurasian otter* (Lutra lutra) *in the urban waterways of the UK, but more sightings of otters are being recorded in this environment. This study sought to assess the diet and distribution of this otter population in the Water of Leith, Edinburgh, Scotland, using presence/absence surveys, camera trap deployment, and sightings records. Surveys carried out between November 2019 and February 2020 provided evidence that otters are utilising the Water of Leith from Balerno to Leith Docks and confirmed that this section of the river is home to the core or partial territories of more than one otter. At least three adult otters were identified in the study area during the study period and sightings of cubs confirm that the river contains suitable habitat for breeding. 102 spraint samples were examined to determine prey type and this revealed that the otters here were predominantly piscivorous during the study period, their main prey being the European bullhead* (Cottus gobio) *with a Relative Frequency of Occurrence of 45%. These findings have increased our knowledge of otters on this river. Further research would benefit conservation efforts and should include the use of DNA to identify individual otters. DNA analysis of prey remains in spraints could also be used to provide a more accurate assessment of the diet.*

***Keywords:*** Lutra lutra*: Eurasian otter diet; urban otters; Water of Leith*

## INTRODUCTION

The Eurasian otter is probably the most studied of the otter species (**Gallant, 2007**) but recent studies of otters in Scotland have concentrated on their coastal habitats and fewer studies have been made of otters in rivers than of those in ponds and lakes (**Grant and Harrington, 2015**). Much less is known of the movements of urban otters in the UK despite them inhabiting populated areas where they might be expected to be sighted more frequently. Research is needed to find out how otters are using urban waterways and to what extent it is dependent on prey availability in this different environment.

A number of factors may contribute to more sightings of otters in urban areas in general and in particular on the Water of Leith, which runs through the heart of the

city of Edinburgh. There may be more people to spot wildlife and publicity may lead to more sightings. Or it may be that, as former otter habitats are lost or degraded, they are forced to inhabit areas which would previously have been considered sub-optimal in terms of resource availability (**Romanowski et al., 2013**).

Most studies of the urban otter concentrate on other otter species outwith the range of *L. lutra*. However, there are many reports of Eurasian otters beginning to colonise urban rivers and canals (for example, **Bouros et al., 2021**). This expansion has been hypothesised as being a result of two main factors, i.e., reduction in pollution in our urban rivers (**Clavero et al., 2010)** and the dispersal of a growing population forcing otters into urban areas (**Delibes et al., 2009**) and habitats which previously would have been considered less than optimal. A third factor has recently been highlighted by the International Otter Survival Fund (IOSF) who believe that reduced prey availability is necessitating the establishment of larger home ranges in order to find adequate food, perhaps even supplementing wild prey with captive species in ponds in suburban gardens (**G. Yoxon, IOSF, pers. comm, 19 May 2020**).

*L. lutra* seems to be a species which tolerates indirect disturbance from humans (**Gormally et al., 1983, Chanin, 2013**) and so, provided the habitat is clean and prey availability is high, urban areas can provide suitable habitat for the expansion of otter populations. With continued anthropogenic encroachment into wild habitats and an increase in sightings of wildlife within our towns and cities comes a need to learn how best to manage them (**Clark and Schwaibold, 2018**).

The Water of Leith, with its good tree cover and mostly intact riparian vegetation is potentially important to the species, given the level of threat associated with loss of this habitat to otters (**Weinberger and Kranz, 2019**).

This study aimed to investigate the distribution and diet of otters on a 12-mile stretch of the Water of Leith and was undertaken in collaboration with the Water of Leith Conservation Trust (WOLCT) and the IOSF.

Identification of habitat use was sought by using sightings records and survey evidence while the diet of the otters was investigated using spraint analysis. The long-term goal of this study is to provide more information on these otters in the hope that this will contribute to future conservation.

## METHODS

There is much debate surrounding the use of spraint records as a method of estimating population levels of otters (**Kruuk et al., 1986; O'Sullivan, 1994; Ruiz-Olma, 2001; Yoxon and Yoxon, 2014**) and finding spraints may be affected by inclement winter weather and/or heavy rainfall causing spate in rivers, seasonality of spraint deposition (**Conroy and French, 1987; Kruuk et al., 1991**) as well as

irregularity of fieldwork. However, the indigestible remains found in spraints give an invaluable indication of at least some of their prey (**Conroy et al., 2005**).

Spraint collection and sampling is recognised as having the potential to provide some good information on the otter (**Kruuk, 2006**) and, in the absence of availability of DNA analysis due to financial limitations, this was chosen as the best method to analyse distribution and diet in this study.

A 12-mile stretch of the river was selected and 15 volunteers from the WOLCT were selected to survey a portion of this each. The length of each survey area was not equal and the division of the stretches was adopted according to the ease with which it could be surveyed. The topography of the banks of the Water of Leith dictated that transects were decided by running between obvious features in the landscape. The public nature of the area meant that marking out the transects was impractical. Volunteers were shown sample otter spraints, to ensure they recognised otter faeces in the field. They were issued with a Digimap® map of their survey area and a key to otter and other mustelid prints. These areas were then given a study area number (1–15) for the purposes of analysis.

Volunteers were asked to photograph and mark the location of their finds wherever possible. This map was then submitted with the spraint samples.

Each volunteer carried out five surveys at regular intervals between mid-November 2019 and the end of February 2020.

Because otters use spraints as their primary communication method (**Kean et al., 2011**) each surveyor collected only partial specimens rather than the whole spraint when found. Samples were then sent by post to the author for analysis.

Two infra-red motion sensor camera traps were deployed in order to add to the records of confirmed otter presence for this study.

Sightings records were gathered from the National Biodiversity Network Atlas (NBN), The Wildlife Information Centre (TWIC), WOLCT, and IOSF. These were collated, cross checked, and updated throughout the study period.

Once received, spraints were inspected, recorded and classed as wet intact, dry intact, and dry fragmented (**Williams, 2010**) before being transferred into lidded plastic pots and labelled.

Spraints were soaked in these tubs in a solution of generic biological washing agent and water at a ratio of 1:10 for a period of no less than 24 hours (**Conroy et al., 2005**). After 24 hours the spraints were brushed gently and soaked again if necessary. Care was taken to avoid cross contamination. Once clean, samples were rinsed through a 0.6mm sieve and left to dry when they were then transferred to a petri dish and examination carried out as follows:

Ten prey remains were selected from the centre of the petri dish. Only vertebrae, scales, and pharyngeal teeth were selected from fish remains. Otolith identification was rejected for the purposes of this study as they are often damaged (**Hermsen and Maarseveen, 2011**). Mammal and amphibian bones were included in this selection process while fur was omitted. Prey occurrence was defined as follows: if it was determined that the initial 10 samples were from the same species, it was assumed that this was the only species present in the spraint. If more than one species was identified in the initial 10 samples, the selection process was repeated with another 10 prey items. If this selection revealed no new species, it was assumed that only the species from the first selection were present. If the second selection revealed more species, the process was repeated until no new species were discovered.

This selection process is adapted from that of **Hermsen & Maarseveen** (**2011**) and was chosen due to the very large numbers of prey remains found in most of the spraint samples. Identification of prey remains was determined using the established key of **Conroy et al.** (**2005**).

## DATA ANALYSIS

All findings from each survey area were collated and displayed graphically to show distribution.

Camera trap records were combined with sightings records and displayed graphically in order to analyse temporal patterns in the data. Spearman's rank correlation coefficient was then applied to test for significance of increases in sightings over two selected time frames.

The survey areas were classed according to predominant habitat type, level of density of riparian vegetation, and the potential for the riverbank to be disturbed by anthropogenic activity as shown in Table 2.

Habitat classification was adapted from the JNCC Phase 1 Habitat Classification for Environmental Audit (2010), from aerial imagery, knowledge gleaned from WOLCT, and walkovers of the study area. The general levels of riparian vegetation density were classified as follows:

- Poor = Sparse vegetation, poor tree cover and gaps
- Good = Good tree cover with few gaps
- Very good = Very good tree cover with very few gaps
- Excellent = Excellent tree cover with few gaps

The classification of areas according to the potential risk for disturbance was assessed using a combination of gathered local knowledge and the author's own assessment based on over 10 years' experience of otter surveys.

Spraint identification results were analysed using the Frequency of Occurrence of prey species. Each item of prey found represents an occurrence.

Percentage Frequency of Occurrence was calculated as:

$$FO = \frac{np}{ns} x\ 100$$

Where $np =$ number of spraints containing a particular prey species and $ns$ = number of spraints examined.

Relative Frequency of Occurrence was calculated as:

$$RFO = \frac{np}{tns} x\ 100$$

Where $tns$ = total number of prey species occurrences in total number of spraints.

These results were then inspected to determine if there is any relationship between frequency of certain prey occurrence and frequency of evidence of otter presence and location on the river.

## RESULTS

Table 1 illustrates the location and distance of the 15 study areas. 118 spraints were found in 10 of the designated areas of the river. Twelve spraints were discarded due to difficulty in cleaning fully, while two were discarded as they contained only soil.

***Table 1. Water of Leith Otter Survey 2019/20: Volunteer Survey Stretches***

| Study Area | DigiMap® Number | Geographical Reach | Transect Distance (miles) |
|---|---|---|---|
| 1 | –4, –3, –2 | Balerno – Currie Bridge | 1.3 |
| 2 | –1, 1, 2 | Currie Bridge – Baberton Loan | 1.1 |
| 3 | 3, 4 | Baberton Loan – West Mill Road | 1.0 |
| 4 | 5 | West Mill Road – Dell Road | 0.4 |
| 5 | 6 | Dell Road – Redhall footbridge | 0.4 |
| 6 | 7, 8, 8.5 | Redhall footbridge – Redhall Walled Garden | 0.7 |
| 7 | 9, 10, 11 | Redhall Walled garden – Gorgie Road | 1.2 |

| | | | |
|---|---|---|---|
| 8 | 12, 13, 14 | Gorgie Road – Saughtonhall Avenue | 1.1 |
| 9 | 15, 16, 17 | Saughtonhall Avenue – Belford Footbridge | 1.2 |
| 10 | 18, 19, 20 | Belford Footbridge – Arboretum Avenue | 1.1 |
| 11 | 21, 22 | Arboretum Avenue – Warriston Road | 0.8 |
| 12 | 23 (part) | Warriston Road – Redbraes Weir | 0.3 |
| 13 | 23 (part), 24 | Redbraes Weir – Anderson Place | 0.5 |
| 14 | 25 | Anderson Place – Great Junction Bridge | 0.3 |
| 15 | 26, 27 | Great Junction Bridge – Victoria Swing Bridge | 0.5 |

One of the camera traps was damaged early in the study period and could no longer be used so footage was combined with sighting records. Only two locations returned positive results. Data was extracted from the sighting records during the same approximate seasonal time periods as this study, i.e., November 2019–February 2020 inclusive (Figure 1). This process was repeated for data from April 2015–March 2020 inclusive (Figure 2).

The April–March data was chosen to show the annual records as the most recent records end in March 2020.

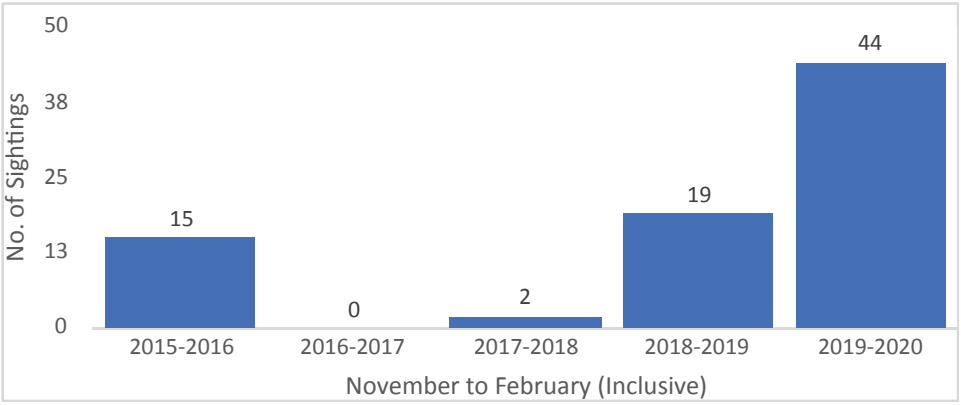


***Figure 1. Recorded sightings Nov–Feb (inclusive) 2015–2020 in Areas 1–15***

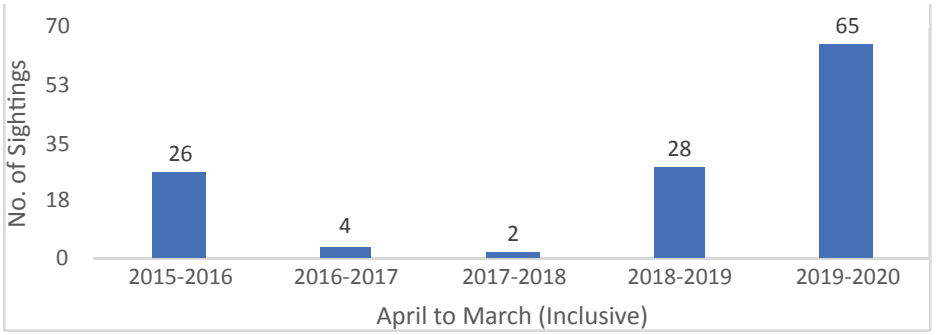


***Figure 2. Recorded sightings Apr–Mar (inclusive) 2015–2020 in Areas 1–15***

Testing with Spearman's rank correlation coefficient, shows that there is no significant relationship between each time frame and recorded sightings.

Figure 1: time frame ($r_s$ = 0.6, *p* (2-tailed) = 0.28476).
Figure 2: time frame ($r_s$ = 0.7, *p* (2-tailed) = 0.18812).

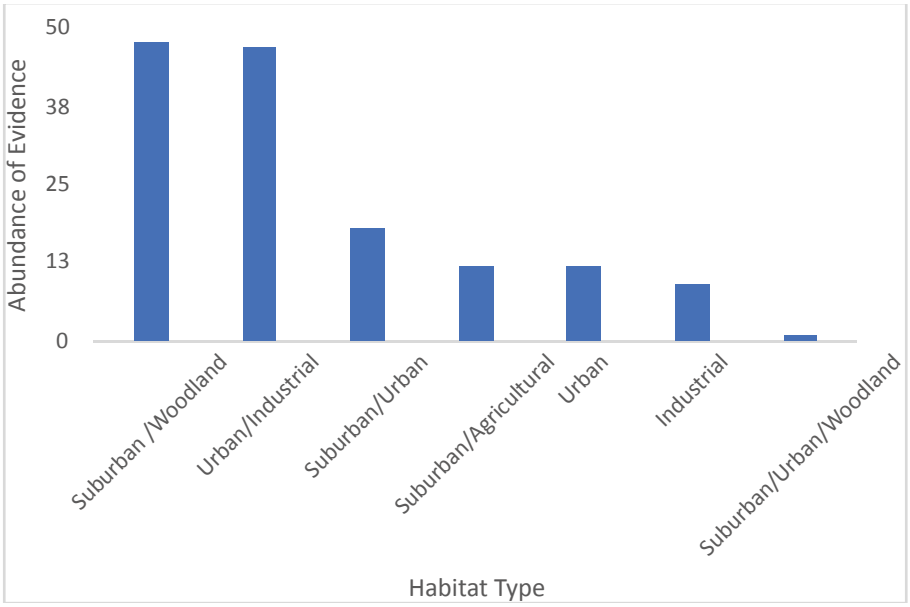


***Figure 3. Abundance of evidence (spraints, sightings, and prints) according to habitat type, Areas 1–15***

The number of prey items identified in the 102 spraints numbered 174.

*Table 2. Comparison of evidence by area including habitat type, density of riparian vegetation and potential disturbance level*

| AREA | SPRAINTS | PRINTS | SIGHTINGS | TOTAL ABUNDANCE | HABITAT TYPE | RIPARIAN VEGETATION | DISTURBANCE POTENTIAL |
|---|---|---|---|---|---|---|---|
| 1 | 7 | 1 | 1 | 9 | Suburban/Agricultural | Good | Low |
| 2 | 1 | 1 | 1 | 3 | Suburban/Agricultural | Good | Low |
| 3 | 18 | 0 | 0 | 18 | Suburban/Urban | Good | Medium |
| 4 | 0 | 1 | 0 | 1 | Urban/Woodland | Very Good | Medium |
| 5 | 30 | 1 | 0 | 31 | Suburban/Woodland | Excellent | Medium |
| 6 | 15 | 1 | 1 | 17 | Suburban/Woodland | Excellent | Low |
| 7 | 6 | 0 | 6 | 12 | Urban/Industrial | Poor | High |
| 8 | 0 | 0 | 11 | 11 | Urban/Industrial | Poor | High |
| 9 | 17 | 1 | 5 | 23 | Urban/Industrial | Poor | High |
| 10 | 0 | 0 | 8 | 8 | Urban | Very Good | Low |
| 11 | 2 | 1 | 1 | 4 | Urban | Good | Medium |
| 12 | 0 | 1 | 0 | 1 | Urban/Industrial | Good | Medium |
| 13 | 2 | 1 | 0 | 3 | Industrial | Poor | High |
| 14 | 0 | 0 | 2 | 2 | Industrial | Poor | High |
| 15 | 4 | 0 | 0 | 4 | Industrial | Poor | Very High |

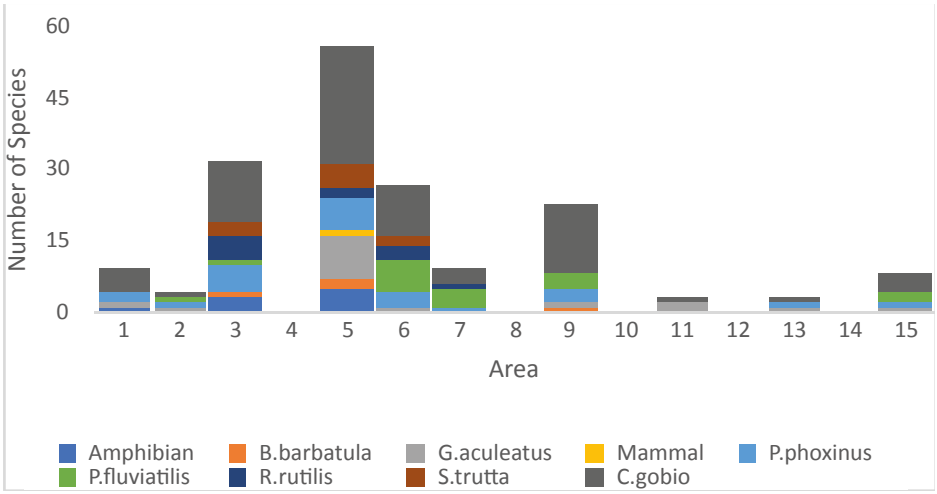


***Figure 4. Number of species identified in spraints in each survey area***

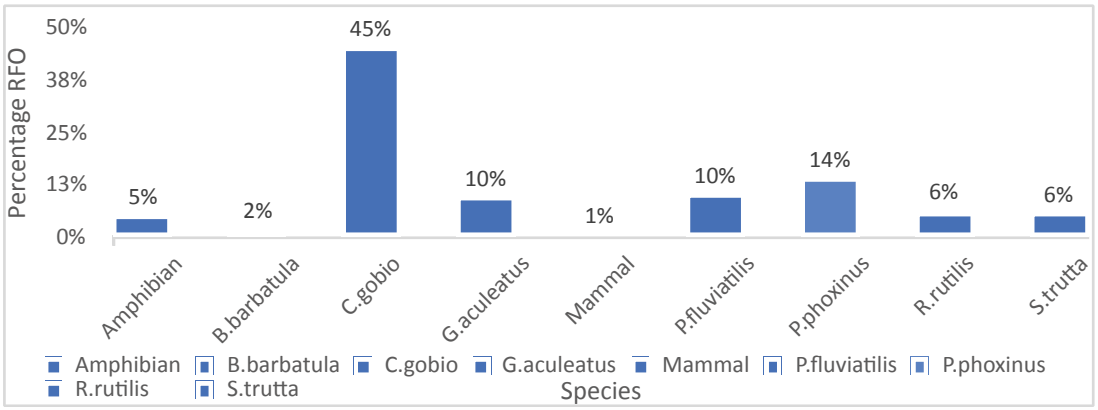


***Figure 5. Relative Frequency of Occurrence of species in total spraints.***

## DISCUSSION

The survey results show that there is evidence of otter presence along the entire study area. The results vary in terms of abundance of spraints found, prints, and sightings, and in how these compare to factors such as habitat type, density of riparian vegetation, and potential for anthropogenic disturbance.

*C. gobio* was the species with the highest Frequency of Occurrence and Relative Frequency of Occurrence. It was also the species with the highest RFO in all but three areas. This result is unsurprising given that the last electrofishing survey of the river, albeit not a survey of the full study area, revealed *C. gobio* to be present at a rate of 98.91 per 100m$^2$ and an RFO of 84.9% (**McColl et al., 2012**).

*C. gobio* tends to be crepuscular (**Mills and Mann, 1979**) which may suit the otters if they too forage more at dusk and dawn, as would be expected in a freshwater environment (**Carrs et al., 1990**). It may be the case that the abundance of the species means that they are a staple prey species on this river. Other studies on

different rivers have shown *C. gobio* to be the most frequent prey item when spraints are analysed but it remains unclear if this is due to the fact that they are a preferred prey item or that they are simply more abundant (**Grant and Harrington, 2015**).

Several prey species known to inhabit the river, i.e., European eel (*Anguilla anguilla*), European river lamprey (*Lampetra fluviatilis*), European flounder (*Platichthys flesus*), grayling (*Thymallus thymallus*), and Atlantic salmon (*Salmo salar*) were absent from the samples. This may be accounted for by the random nature of the selection process but it might be expected that the large sample size would increase the chances of at least one of these species being identified at least once.

*A. anguilla* is a preferred prey item of the otter (**Webb, 1975**) but the species is in decline (**Bilotta et al., 2010**). The survey period coincided with the migration of the species in winter (**Murphy and Fairley, 1985**) and the fact that any specimens remaining in the study area over this period are subject to much reduced activity. There is some evidence to suggest that they are taken more frequently by otters during the summer months (**Murphy and Fairley, 1985**).

The relatively low incidence of brown trout (*Salmo trutta*) was unexpected, given that the river has been stocked with this species for angling purposes in the past although the last stocking took place in 2012. The low RFO of amphibian remains was perhaps surprising, given that some studies report that frogs and toads may be an important component in an otter's diet (**Lanzski et al., 2001**). However, this study took place in the winter and before these species began to emerge in great numbers from hibernation, when otter predation of frogs and toads has been noted to increase (**Ludwig et al., 2002**).

Bird remains were absent despite abundant bird life on the river. Although studies have found that otters predate birds more often in the summer months (**de la Hey, 2008**) there is evidence to suggest that birds form, albeit a secondary place, in the otter's diet all year round (**Clavero et al., 2003, Mirzaei et al., 2014**).

These results demonstrate that the otters on the river are predominantly piscivorous which may indicate that there is sufficient preferred prey that they are not displaying the trophic diversity which may come about due to low abundance of fish (**Geidezis, 1996**). Without updated electrofishing data, it is impossible to assess abundance of species in particular areas along the river.

The results of levels of abundance, when considered with habitat type, illustrate that suburban/woodland habitat provided the greatest abundance of evidence which might be a natural conclusion given the suitability of this type of habitat for otters. However, there was only one less piece of evidence in urban/industrial, a habitat type which might be assumed to be suboptimal for otters. Suburban/urban gave the third highest incidence of abundance, again, a somewhat surprising result.

Similarly, the results for density of riparian vegetation were not as expected, as areas with a paucity of density provided the highest abundance of evidence. It is important to note here that other factors may combine to make even the most optimal areas for otter habitat less preferred by the species. Without being able to assess the abundance of prey density in every area this puzzle will always have a missing piece.

A sighting of a female otter and initially her three cubs confirm that there is suitable habitat for the otters to breed within the study area. This may also indicate good prey availability, a known factor in successful breeding (**Kruuk et al., 1987**).

At least three individual adult otters were recorded by sightings in the study area during the survey period. If the Water of Leith is classed as a resource patch, it is being shared by these otters to some extent although there is no way of knowing if any of the otters sighted were merely passing through. It is possible that the river is rich enough in prey that it is being permanently shared, a phenomenon which occurs when the habitat is linear and confrontation inevitable (**Kruuk, 1995**).

Without further study and identification of individual otters through DNA analysis, it is impossible to state if this is habitat sharing or territory overlap. Adult male otters on a river can occupy a territorial range of approximately 39 km while that of dispersed yearlings may be around 20 km. An average adult female otter's range on a river is 16 km (**Chanin, 1985**). A male's territory will overlap with that of the females in his range in an intrasexual territoriality which is classic among mustelids (**Powell, 1979, O'Neill et al., 2009**). Female territorial overlap is common but is rarer in the case of male dyads (**Quaglietta et al., 2014**) although some overlap is seen among sub-adult males who may venture into an adult male's territory (**Chanin, 1985**). There is also increasing evidence to suggest that resting sites are often shared among different individuals and that social behaviour in otters may be more flexible than previous studies have suggested (**Quaglietta et al., 2014**).

Abundance of spraints or latrines in an area may suggest that there are characteristics preferred by otters or that there is a greater need for communication in that location (**Guter et al., 2008**). The otters using the river may be sharing their territory, or at least overlapping with each other, in a way that is not their preferred choice (**Kruuk, 1995**) although some overlap is common in all but their core territories (**Kruuk, 1992**). Both **Kruuk** (**2006**) and **Jenkins** (**1981**), however, highlighted that abundant prey sites may correlate with smaller female home ranges and greater tolerance of other otters leading to a smaller socio-spatial dynamic. An alternative view is that this overlap of territory may be the only way that otters can survive in this linear habitat where, unlike other species who can forage in a central space, they have no choice but to stay close to their preferred feeding patch (**Kruuk, 1995**). Determining the socio-spatial interaction of the otters would not be possible to assess conclusively without radio-tracking (**Quaglietta et al., 2014**), but further research, using an extension of the methods of this study may be useful, as a combination of visual and

fresh print surveys by an experienced surveyor can give good results on otter numbers (**Ruiz-Olmo et al., 2001**).

The dietary analysis of spraints did not reveal any apparent species preferences, given that most species were identified across the survey area, although *C. gobio* may be selected as it is preferred rather than simply the most abundant species. Some small species may also have been present by means of secondary ingestion. No feeding remains were found on the river banks that would have confirmed that large prey is being captured and eaten on land.

The fact that all sightings came from the river itself may illustrate that the otters are using it to travel, thus preventing them from the need to cross roads, thus reducing the risk of road deaths.

Sightings along the river have increased, as they have on the nearby Union Canal, a watercourse of approximately 31 miles, which has the potential to support several otter territories. Otters were filmed in the Fountainbridge area of the city, close to the canal, during the study period (**Cawthorn, 2020**). Following this, reports of otter sightings also came in from across the city. A check of the timings of these revealed them to be several distinct otters.

## LIMITATIONS

Important among the limitations of spraint studies, is that the absence of spraints does not necessarily indicate the absence of otters (**Kruuk et al., 1986**), nor does the existence of spraint reflect otter abundance (**Garcia and Arvelo, 2009; Yoxon and Yoxon, 2014**). Issues surround the legitimacy of spraint surveys as a means of establishing how otters are utilising an area, given that they may spraint in places where spraints are difficult to find such as dense vegetation. Female otters may avoid sprainting near a natal holt (**Chanin, 2003**), sprainting may take place in the water (**Kruuk, 2006**), and there will always be a possibility that evidence is missed (**Kruuk and Conroy, 1987**).

Another consideration is the effect the digestive process has on prey remains with some prey species being more susceptible to digestive acids, while the effect of an individual otter's activity levels on the digestive process must also be considered (**Guillaud et al., 2017**).

Using Frequency and Relative Frequency of Occurrence in data analysis may produce a bias for taxa with a greater number of indigestible parts (**Ottino and Giller, 2004**). The fact that soft tissue is not preserved and large prey may be taken to the river bank to be consumed may lead to a significant underestimation of larger prey (**Chanin, 1985**). The usefulness of Frequency of Occurrence is also limited by the fact that an individual fish may be counted several times when using random selection (**Carss and Parkinson, 1996**).

Although direct observation of otters may be considered as the most accurate method of estimating population (**Kruuk et al., 1991**), sightings records have drawbacks in terms of overestimation or underestimation of the species (**Garcia and Arvelo, 2009**) as the same otter may be recorded several times while others may not be seen at all. Camera traps, although useful in studies, will always have the potential to miss the target species.

There are other study specific limitations which must be considered, including accessibility to some parts of the river bank and that poor weather conditions during the study period made surveying difficult.

More robust results may have been obtained using equal transect lengths. This was not possible in this study due to inaccessibility of some areas. Another limitation may have been the lack of knowledge of fish presence across the entire survey area.

Seasonality affects various factors, including prey activity and abundance (**Martínez-Abraín et al., 2020**), density of vegetation, and potential for disturbance as anthropogenic activity decreases in poor weather. Therefore, a study carried out over the winter months has obvious limitations.

The adoption of a random selection process of prey remains may have influenced the results. This process was used to save time. Collection of partial spraints may also have meant that some prey species were missed but it was necessary to ensure social communication through scent could continue.

Increased sightings reports may have resulted from increased media interest and promotion of this study by WOLCT.

Notwithstanding the limitations described above, studies such as this can provide a baseline of data regarding distribution which can act as a springboard for further research (**Yoxon, 1999**).

## FURTHER STUDY

Further work should aim to reduce the limitations of this study. Most of this could be achieved by using DNA analysis to identify individual otters. More in depth spraint analysis, whereby all prey items are identified microscopically in conjunction with DNA analysis of the spraints would be extremely beneficial to a better understanding of diet which is essential for conservation design (**Mirzaei et al, 2014**).

Access to updated electrofishing data based on a larger survey area than that of 2012 would help to determine type and abundance of prey in the otters' territories.

More robust camera trapping at areas such as latrines could provide better results on how many otters are producing spraint in a specific area. Performing a study using the RFTC model (**Rowcliffe et al., 2008**) whereby density is calculated from

encounter rates with the target species using detection areas defined by radius and angle of observation (**Garcia and Arvelo, 2009**) may be a worthwhile exercise.

Extending the study area to include a section of the Union Canal and beyond Leith Basin into the docks area would also be interesting in terms of distribution.

Another possibility to consider would be the use of population distribution modelling such as Moran's test (**Hong et al., 2020**), as has been used successfully elsewhere (**Barbosa et al., 2003**) to identify clusters of populations and their densities (**Yurkowski et al., 2019**).

## CONCLUSION

While habitat loss and pollution remain negative forces in the recovery of otter populations (**Hung et al., 200**4), riverine habitat restoration, in particular the restoration of habitat connectivity (**Carranza et al., 2012**) will positively impact otters (**Carone et al., 2014**). The Water of Leith Walkway can continue as an important recreational asset while improving the habitat for otters and the other species which contribute to the biodiversity of this unique place. Otters may only be affected in the very short term by disturbance from human leisure activities (**McCafferty, 2005**), and while long-term effects on breeding from anthropogenic activities are less known (**McCafferty, 2005**), the fact that otters are breeding successfully on the river gives hope for this population.

Urban ecological studies are revealing new ways to think about ecological principles (**Forman, 2016**) and increased knowledge of urban ecology is useful where wild habitat continues to shrink. Recent work has shown that recolonisation by species like the otter is more affected by improvements in water health than by density of human population and industry (**Marcelli and Fusillo, 2009**) and it is accepted that conserving and improving riparian vegetation is an extremely important factor for otters (**Hysaj et al., 2013**).

An important outcome of this study is the way in which volunteers can become involved in species' conservation through citizen science as well as practical conservation exercises. Volunteers are a potentially powerful resource in terms of supplementing further study and the importance of their continued monitoring of these otters should not be underestimated (**Okes and O'Riain, 2019**).

**Acknowledgements**

The author gratefully acknowledges the input of the Water of Leith Conservation Trust and their dedicated volunteers to this study. Huge thanks also go to the International Otter Survival Fund for their collaboration and to Dr Ellie Devenish-Wilson, supervisor of the dissertation on which this publication is based.

## Funding

This study was undertaken in partial fulfilment of the degree of Master of Science in the College of Veterinary Medicine in Biodiversity, Wildlife and Ecosystem Health at the University of Edinburgh.

## Disclosure Statement

No potential conflict of interest was reported by the author.

## Author Biography

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# URBAN OTTERS OF BUCHAREST, ROMANIA: THREATS AND CONSERVATION

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## Abstract

*Little is known about the distribution and abundance of the Eurasian otter (*Lutra lutra*) in large cities of Romania, although in recent years more and more sightings have been recorded. Due to conservation actions, legal protection, and limitation of the use of hazardous pollutants, the otter population began to thrive around Bucharest, and so they have naturally occupied urban habitats in the city. We recorded the Eurasian otter distribution and abundance in the most densely populated city in Romania, Bucharest. This focused on the Văcărești wetland area, which was declared the first urban protected area in Romania in 2016, and is the largest green area of the city. Our findings along with unpublished records of otter presence in Bucharest suggest that the otter population in the city is present only on the two important river corridors, namely Colentina and Dâmbovița. The highest density of otters is inside the Văcărești Natural Park, where we have estimated 5 or 6 individual otters, based on field surveys and camera trapping. These urban aquatic habitats are not ideal and otters face many threats, such as collision with vehicles, water pollution, plastic pollution, wildfire, and conflict with free-ranging dogs. Despite the challenges that come with this newly conquered territory, the growing otter populations in Bucharest is a good sign for ecosystems and human inhabitants alike. Otters are a good way to engage local communities and policymakers with the health of rivers, lakes, and other otter habitats.*

***Keywords:*** *Bucharest; Eurasian otter;* Lutra lutra; *urban otters; Văcărești Natural Park; Dâmbovița; Colentina.*

## INTRODUCTION

Eurasian otters (*Lutra lutra*) are elusive and nocturnal carnivores and spotting them is a rare and extraordinary experience. This is why their presence in urban areas is surprising to most people living in big cities. People are more likely to see evidence of otters rather than the animals themselves. These include spraints, footprints and slides into the water, and these can all be observed by people with a trained eye.

In recent years, otters have been reported in many cities in Romania, from smaller cities such as Oradea, Tulcea, Braila, and Galati, to large cities, such as Bucharest, Iasi, Cluj-Napoca, and Constanta. In this article we will focus on the busiest city in Romania, the capital Bucharest.

Bucharest is the most densely populated city in Romania, with an area of approximately 240 km$^2$ and there are over two million inhabitants, representing more than 10% of the country's total population **(RSDBM, 2019)**. In such an urbanised place it is hard to believe that there is still a place for wildlife. And yet this does exist and we can even find medium-sized carnivores, such as the otter (*Lutra lutra*), especially on the two urban river corridors of the city, the rivers Colentina and Dâmbovița.

Eurasian otters suffered a serious decline in the twentieth century in Western and Central Europe **(Chanin, 2003)**. We can only assume that the situation was similar in Eastern Europe, although there is a lack of historical information on the distribution and abundance of otters in this region.

The factors that caused the decline of otters were largely due to rapid industrial and urban development from the 1960s to the 1980s: habitat destruction, isolation of populations, mortality due to hunting and poaching, traffic accidents, drowning in fishnets, and conflict with fisheries. Most of these factors still limit the otter population in Romania; however, the contamination of aquatic habitats with organochlorine pesticides and polychlorinated biphenyls was the factor that led to the drastic decrease of the otter population throughout Europe, and it also caused changes in prey availability (**Mason, 1989; Kruuk and Conroy, 1996; Smit et al., 1998; Roos et al., 2001; Mason and Macdonald, 1986; Foster-Turley et al., 1990**).

After the 1990s the limited use of certain hazardous chemicals in agriculture and industry (mercury, DDT, dieldrin and polychlorinated biphenyls – PCBs) led to a decrease in the contamination of the otter's prey resources and the accumulation of these pollutants in the otters themselves. As a positive consequence of the end of the socialist industrial era, otter populations have steadily recovered in Romania, and they have been reported in many aquatic ecosystems.

Otters are territorial animals, and they need quite large home ranges and thus they were forced to enter cities. The otter population in Romania has begun to thrive, due to conservation actions, the legal protection, and the limitation of the use of hazardous pollutants.

Otters have naturally moved into urban habitats of Bucharest and other large cities in Romania. These urban aquatic habitats may not always be ideal, but any city with a lake or river will have some fish and frogs for otters to eat, but in order to survive in such areas they need to adapt quickly.

## STUDY AREA

Bucharest has been the capital city of Romania since 1659 and is the most important city in terms of the number of residents and its various functions (economic, political, cultural and many more). It is located in the southeastern part of Romania, within the Argeş River watershed, in a region belonging to the Romanian Plain, where elevations are 60–90 m a.s.l. (Figure 1).

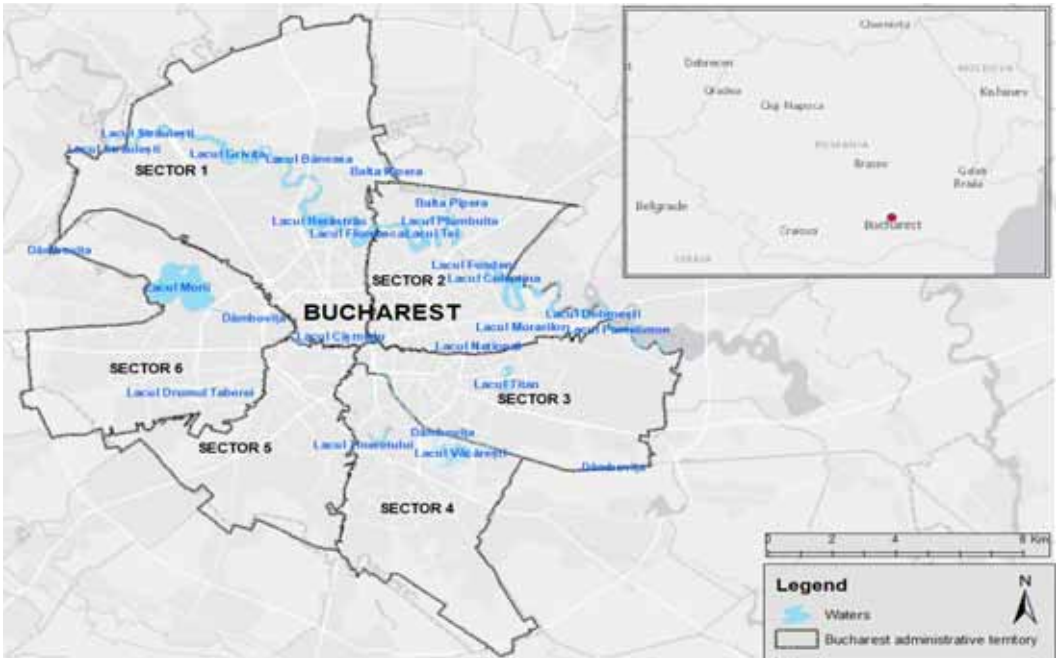


***Figure 1. Bucharest: location and aquatic habitats***

Its territory is crossed in a northwest–southeast direction by the Dâmbovița (Figure 2) and Colentina rivers (Figure 3), which have large floodplains and terraces, and where the city has good conditions to expand. However, because of this location in a floodplain area, there is also a high flood risk. Consequently, in order to avoid such events, since the eighteenth century the authorities have imposed a number of protection measures and developed engineering techniques. There are other rivers in the vicinity of Bucharest: Argeș, Sabar, Ciorogârla, Ilfov, Ialomița, and Pasărea. Over time, all of these were engineered and included in a complex management scheme, aimed at meeting the water demands of the Bucharest urban area, as well as protecting the city against flooding (**Zaharia et al., 2016**).

***Figure 2. Dâmbovița river***

***Figure 3. Colentina river and lake***

Our study focuses on one particular area inside Bucharest - the Văcărești wetland area (Figure 4). Stretching over about 180 hectares, south of the Dâmbovița valley, the man-made embankments of the swampy lands of the Văcărești area were initiated during the communist period. In the 1980s, Ceaușescu was willing to turn

the area into a recreation lake and sports facility (Figure 5). However, the lacustrine basin, which was to create a more favourable microclimate and to become a recreation area for citizens of the city, was never filled with water. This was because the improvement works were not completed and also because hydrotechnical studies showed that the hydrostatic level would rise and flood the basement of adjacent apartment buildings (**Cocoș, 2006**).

***Fiaure 4. Văcăresti lake 2013***

***Figure 5. Văcărești lake 1989 (Photo: Andrei Bîrsan)***

In the last two decades nature turned this failed communist plan into Bucharest's unique urban park. Văcărești Natural Park was established by the Governmental Decision No. 349/2016 and it is the first urban protected area in Romania, and the largest green area of the capital.

At present, it shelters more than 100 bird species (waterfowl, raptors, passerines), fish species, insects, mammals (foxes, least weasel, otters, voles, shrews and muskrats), reptiles and amphibians (aquatic snakes, pond turtles, lizards, toads, frogs, and newts) (**Lascu, 2012**).

## METHODS

The research methodology consisted of surveys on the banks of the lakes and rivers looking for spraints, tracks including footprints and trails, slides on the riverbank, holts, and resting places. These surveys were conducted during the period of 2013 to 2020.

In order to establish the transects for the otter survey, we used the UTM grid 1x1km, using GIS, and we selected only the grids that overlap the administrative territory of Bucharest (n = 300 UTM grids 1x1km). From these 300 UTM grids, using GIS and OSM (**OpenStreetMap**) data on waterways, we selected only those with potential suitable habitats for otters (n = 99 UTM grids 1x1km). During the otter surveys only these 99 grids were visited to search for otter signs (Figure 6).

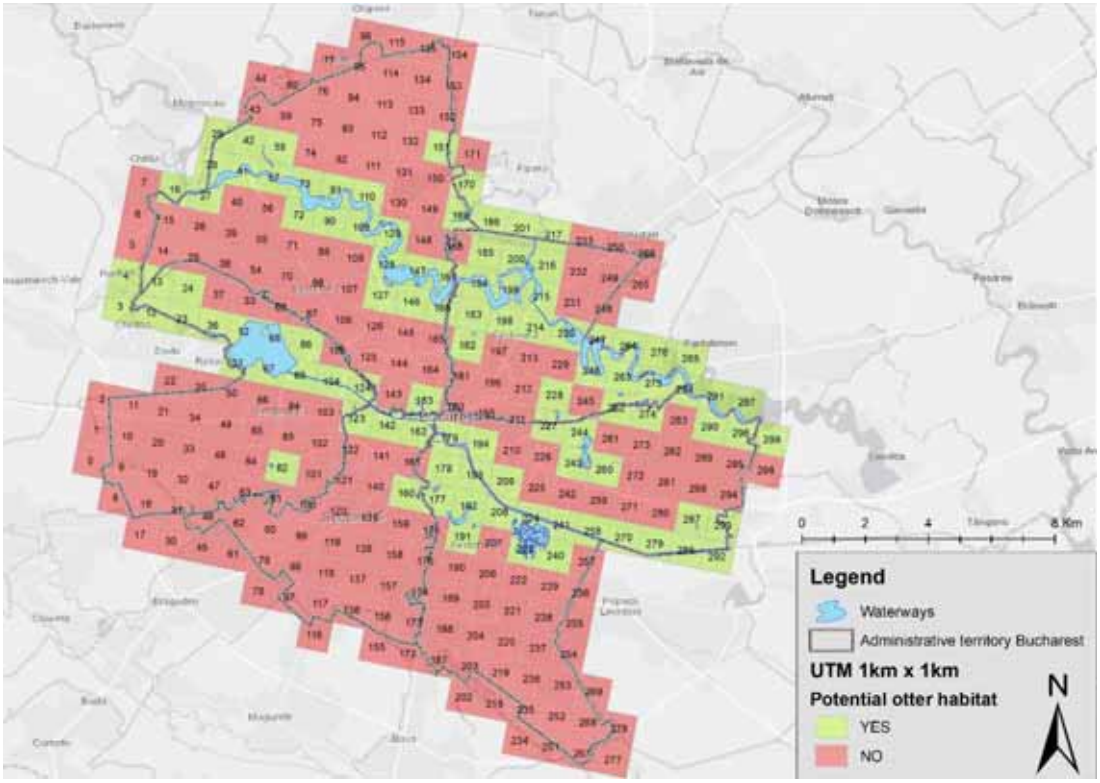


***Figure 6. Otter survey map - UTM grid 1x1 km***

From the field otter survey data (Figure 7), we can confirm that otters were present in the city all year round, although the data was not recorded with a view to investigating any seasonality in use of various areas. However, we have noticed over the years that during dry periods or when certain lakes are intentionally emptied they will use the nearest aquatic habitats.

***Figure 7. Field otter survey 2015***

***Figure 8. Otter camera trapping 2013***

Using camera trap technology it was possible to evaluate the number of otters in Văcărești Natural Park, between 2013 and 2020. Camera traps (Bushnell 12MP Trophy Cam) with IR-Flash were placed in the selected otter observation sites at about 0.5m above the ground and attached to firm structures such as tree stems and

stumps. The cameras were camouflaged and hidden as much as possible leaving enough room for the lens, motion sensor, and infrared projector. From 2016, when the Văcărești area became an urban natural park, camera trapping became a challenging task, because many visitors appeared in the area and the risk of the camera traps being stolen increased (Figure 8).

In addition we searched on the internet and recorded in a database all the reported sightings of otters from Bucharest found on internet browsers and various nature fora and groups.

## RESULTS AND DISCUSSION

### *Eurasian otter distribution*

The first mention of otters in Bucharest is from 2011, and it came from the Enache family who were living in makeshift shelters in the Văcărești wetland (**H. Ignat, pers. comm. 2015**). They knew the area very well, exploring all the corners during their daily activities. They were engaged in fishing, waste collection, and recycling, and the exploitation of reeds for funeral wreaths.

The first otter footprints in the Văcărești wetland were reported by Helmut Ignat in 2012, when he was documenting in the field for the National Geographic article, about the Văcărești wetland: “the delta between blocks” (**Lascu 2012**).

In March 2013, Helmut Ignat with the help of the Enache family, used an IR camera trap to obtain the first image of an otter in Bucharest (Figure 9), from the Văcărești wetland area, just 200m from a four-star hotel.

***Figure 9. First otter captured, March 2013***

***Figure 10. Otter and three cubs, November 2013***

Initially, it was thought that there were some sporadic otter reports, but we obtained proof that there is a stable otter population in the city when we recorded a female with three large cubs in November 2013 (Figure 10). This was a clear sign that the otters had suitable breeding conditions in the Văcărești wetland area. Successful breeding requires the availability of high-quality food resources necessary for offspring development, but there are also many other factors which can affect

breeding, in particular the presence of mates and availability of safe breeding sites (**Doligez and Boulinier, 2008**).

The first otter survey of the Văcărești wetland area was made in December 2013, when we found a high density of otter spraints and footprints around all the lakes, especially in the northern lakes of the wetland. Based on the surveys from 2013 to 2014, and by analysing the density of spraints and dimensions of the otter footprints found (Figure 11), we estimated that there were five to six individuals in the area (Figure 12). We assume that the individuals who use the area of the Park, also use the Dâmbovița river for foraging. These two aquatic habitats are connected by a sewer, located in the northeast corner of the Park (44°24'10.6"N 26°08'26.6"E). The discovery of otter marking places and spraints in the sewer confirm that it is indeed used intensively by otters.

***Figure 11. Otter footprints in Văcărești***

***Figure 12. Eurasian otter in Văcărești***

***Both photos: Helmut Ignat)***

In October 2014 children from the Enache family reported five different otter individuals, which were observed at 7.45am in the area of a spring (44°24'07.2"N 26°07'59.9"E). This story is credible, because the two children related everything with great enthusiasm and detail.

Since 2015 we have continued the monitoring of the otter population from Văcărești but we also extended the otter surveys to all areas of the city. We have made occasional surveys on the banks of the lakes and rivers, mainly on the two river corridors of Bucharest: Dâmbovița and Colentina.

On Dâmbovița we found signs of otter presence (mainly spraints), almost continuously downstream of Morii Lake to Glina water treatment plant (Figures 13 and 14). We also received reports of otter presence from people and even night videos of an otter swimming in the Dâmbovița river in the centre of the city on the bridge from Unirii Square (44°25'43.5"N 26°06'03.7"E).

*Figure 13. Otter spraint, Morii Lake*

*Figure 14. Otter spraint, Dâmbovița river*

The other river which drains the northern part of Bucharest, the Colentina, was a mild, meandering flow with lakes, pools, and cesspools near settlements. However, in 1933 an extensive project was started to dam the river and creating a chain of 15 lakes, to form the main recreational areas of the northern part of the city. In 1970, the entire chain of lakes on the Colentina River was completed and this remains today.

On this chain of lakes, we encountered a higher density of otter presence signs than on the Dâmbovița. Spraints were found from Lake Străulești, which is located upstream, along the entire chain to Lake Pantelimon, in Pantelimon park (Figures 15 and 16), which is located downstream of Colentina. Otter spraints were identified even in the most crowded recreational areas of Bucharest such as Herăstrău Park and Bordei Park.

*Figure 15. Otter spraint, Colentina lake*

*Figure 16. Otter spraint, Pantelimon lake*

Based on the surveys from 2015 to 2020, we found that otters are present only on the two important river corridors of Bucharest: Colentina and Dâmbovița, and were absent from the recreational areas which are not connected with them. Surveys were also carried out on the banks of lakes in important parks: Tineretului, Carol, Cișmigiu, Alexandru Ioan Cuza, and Titan. However, in none of them were any signs of the otter identified. Of the 99 UTM grids surveyed, 60 were found to be positive (59.4%) with signs of otter presence (Figure 17).

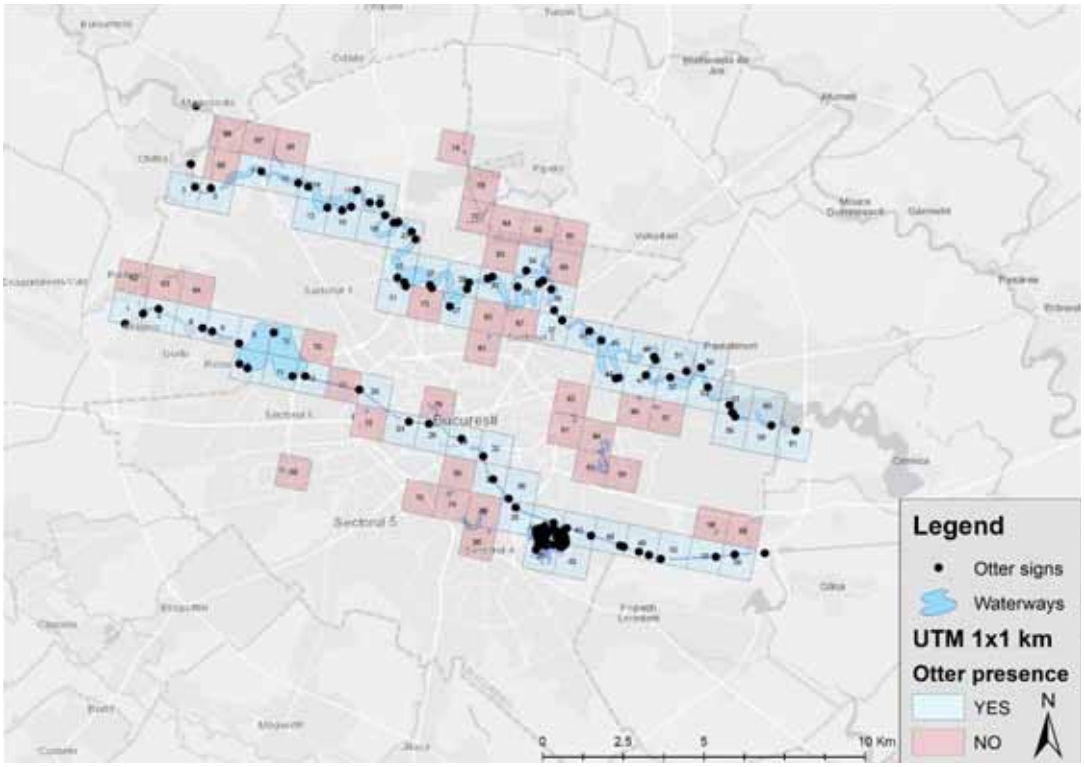


***Figure 17. Eurasian otter (*Lutra lutra*) distribution map in Bucharest***

In 2020, we identified the lowest density of otter signs in Văcărești, which was caused by the extreme drought which caused many ponds to dry out. The only water bodies present were restricted to deeper ponds located in the northeast area of the Park. Only towards the end of 2020 did the situation recover and water levels in the ponds started to increase, and at the same time the number of otter signs also increased.

### *Threats*

For an otter, the choice to live in a city like Bucharest is a big risk. If they do not adapt and learn to deal with all the dangers of the city, they die quickly. Otters living in freshwater are generally associated with natural rivers, but in their absence, they will use canalised rivers and the canal network (sewers and pipes) of the city, as we can see on the Dâmbovița river.

The main threat to urban otters is car traffic and in the last three years, there have been three cases of otters killed by cars (Figure 18) in the same area between the Dâmbovița river and the Văcărești Natural Park (44°24'13.5"N 26°08'32.7"E). Two of these were reported in this area in 2017. In this area there is a lack of continuity of the river banks, caused by the presence of two waterfalls that represent a migration barrier for otters, so they are not able to swim downstream or upstream, and so they must get out of the water and cross the street or sidewalk, thus exposing themselves to the risk of collision. In October 2017 the Văcărești Natural Park Association

requested the local authorities to install speed limiters and warning signs about the presence of otters for drivers, but so far these requests have not materialised.

***Figure 18. Eurasian otter killed by car in Bucharest, October 2017 (Photo: Visul Luanei)***

The habitats of otters in Bucharest require better connectivity in order to prevent inbreeding and allow free movement of otter individuals.

As long as there are roads parallel to the Dâmboviţa and bridges that cross it, there is a high probability of finding more otter roadkills if we do not adapt the existing infrastructure and make it permissible to the otter, through providing an underpass, fish ladder, and ledges for the continuity of the banks.

Water pollution is also a concern for otters; contamination of Bucharest waters with toxic substances, especially heavy metals, has raised concerns due to the persistence of these chemicals in the environment, contamination of food chains, and various health risks to humans (**Deák et al., 2019**). After entering into the aquatic environment, the potentially toxic elements accumulate in tissues and organs of aquatic and semi-aquatic organisms, such as the otter (**Sophia et al., 2017**). In 2016 and 2018 there was an assessment of potentially toxic elements (Cadmium {Cd), Lead {Pb}, Mercury {Hg}, Copper {Cu}, Chromium {Cr}, Nickel {Ni} and Zinc {Zn}) accumulated in the muscle tissues of different fish species from the Colentina and Dâmboviţa rivers in Bucharest (**Ionescu et al. 2020**). The fish species studied were *Alburnus alburnus, Carassius gibelio, Scardinius erythrophthalmus, Ameiurus nebulosus, Perca fluviatilis, Lepomis gibbosus* and the results show that most of the toxic elements were above maximum permissible levels covered by the legislation (**Commission Regulation (EC), No 1881/2006; Ionescu et al., 2020**).

For example, the concentration of Cd was higher in *Scardinius erythrophthalmus* (Herastrau Lake) and *Perca fluviatilis* (Pantelimon Lake) when compared to the maximum permitted level provided by the (**Commission Regulation 1881/2006**).

The values of Pb exceeded the maximum permitted level for all fish species studied, being approximately 25 times higher in the case of *Ameiurus nebulosus*, 14 times for *Lepomis gibbosus*, 9 times for *Scardinius erythrophthalmus*, 8 times for *Perca fluviatilis*, and 3 times for *Carassius gibelio*. For *Perca fluviatilis* captured from the Dâmbovița River, the Hg concentration in muscle tissue was higher that the limit recommended. However, the concentration of Cr, Co, and Ni, did not exceed the maximum permitted level provided by the World Health Organisation (**1988; 2001**).

It has been observed that the Zn content in *Scardinius erythrophthalmus* and *Alburnus alburnus* (Mogosoaia Lake) and *Carassius gibelio* (Pantelimon Lake) showed slightly higher values compared to the maximum permitted level (**Ionescu et al., 2020**).

The information on concentrations of toxic elements in fish tissues is very important for otter conservation, because this is their main prey source and toxins accumulated in fish will then bioaccumulate in otters through food chain (**Smit et al., 1996**). Fish and otters are also known as good bioindicators of the contamination with potentially toxic elements as they are constantly exposed to chemical substances in contaminated water and occupy different trophic levels and differ in size. Also the older an animal is the more contamination it will take in (**Ruiz-Olmo et al., 1998**; **Milačič et al., 2019**). As we see the water quality from Bucharest needs major improvements so that aquatic habitats can sustain the city's otter population in the long term.

Plastic pollution is another threat to otters in the city and microplastic may be ingested by various aquatic organisms ranging from plankton and fish to birds and even otters. This has been confirmed by the presence of microplastics in undigested spraint remains (**Smiroldo, 2018**). Under environmental conditions, larger plastic items degrade to so-called microplastics, fragments typically smaller than 5 mm in diameter (**Arthur et al., 2009**). Their bioaccumulation potential is considered to increase with decreasing size. In riverine environments from Colentina and Dâmbovița, the dispersal and transport of microplastics is comparable to sediment transport.

Wild fires have an important negative impact on otters and are probably one of the most frequent ecological disturbances in the Văcărești Natural Park. Ash deposition and toxic slurry can be immediately fatal or cause chronic stress to fish in freshwater systems (**Spencer and Hauer 1991**; **Hauer and Spencer, 1998**) and otters can show signs of detoxifying PAHs (Polycyclic aromatic hydrocarbons) and reduced immune system function, which would make them more vulnerable to diseases (**Bowen et al., 2015**). Increases in stream pH and phosphorus concentrations from ash deposition, as well as increased ammonium and nitrate, have been documented from wild fires (**Spencer and Hauer, 1991**; **Hauer and Spencer, 1998**).

***Figure 19. Wildfire in Văcărești Natural Park – 24 February 2020 (Photo: Mihai Petre)***

We note with concern that the highest number of wild fires usually occur in the Natural Park, in September–November and February–March, and about five to six large fires occur annually. The last wild fire erupted on 24 February 2020 and spread over an area of approximately 30,000m$^2$ of vegetation (Figure 19).

Most of the fires are caused by people's negligence – cigarette butts thrown into the reeds, burning cables for extracting the copper wires, or burning trees for heating. The fires spread rapidly due to the dry vegetation but also because it is difficult for firefighters to control it in the area. There are no water inlets and fire trucks enter the Park with great difficulty.

Another important threat to otters in Bucharest are free-ranging dogs. Dogs act as predators of a variety of native fauna, primarily mammals but also birds, reptiles, amphibians, and invertebrates, and also prey on domestic animals (**Hughes and Macdonald, 2013; Ritchie et al., 2014; Vanak and Gompper, 2009; Young et al., 2011**). Free-ranging dogs also carry pathogens transmissible to wildlife and humans, serving as reservoirs and vectors for disease such as rabies and canine distemper virus (**Knobel et al., 2014; Macpherson et al., 2013**). Otters can be predated but zoonoses can also be transmitted from free-ranging dogs. There were many reports of guardian dogs that killed otters in Romania and the same is reported in other countries (**Wierzbowska et al., 2016**).

On 21 December 2020 a dead adult otter was reported close to the big lake in the Văcărești Natural Park. The otter had marks and bites around the head and neck and these signs indicate that the attack was most likely by a larger predator, such as a dog (Figure 20). At the beginning of January 2021, a fox killed by stray dogs was also found in the Park, which also has signs of biting in the neck area. These incidents are not isolated and they are caused both by stray dogs and by dogs whose owners have let them wander free to roam in the Park.

*Figure 20. Eurasian otter killed by free-ranging dogs in Văcărești Natural Park*

### *Conservation*

Despite the challenges that come with the newly conquered territory, growing otter populations in Bucharest are a good sign for ecosystems and human inhabitants alike. Eurasian otters, as a flagship species, are a good way to engage local communities and policymakers with the health of rivers, lakes, and other urban otter habitats.

The creation of the Văcărești Natural Park (Figure 21) and the discovery of otters in Bucharest has brought about a change in the city and made people care about conservation as never before.


***Figure 21. The otter is the symbol of Văcărești Natural Park***

The Văcărești Natural Park is the only place protected by law that can offer a safe refuge for otters in Bucharest. In addition, the NGO that founded the park, the Văcărești Natural Park Association, monitors the otter population and carries out various awareness activities to educate the public in the conservation of the urban otters and their habitats.

Among the conservation measures taken to ensure the survival of the otter population in the Văcărești Natural Park, are:

- Mapping and estimating the otter population in the Văcărești Natural Park;
- Maintaining and planting trees on the banks of the ponds in order to provide shelter (resting places and dens) for the otter;
- Construction of artificial otter dens;
- Ensuring the connectivity of the otter population from Văcărești with other populations in the area in order to ensure the genetic flow and avoid inbreeding;
- Improving the trophic resource for otters in Văcărești Natural Park by prohibiting fishing;
- Elimination/reduction of stray dogs present in the Văcărești Natural Park;
- Regulation of tourist and leisure activities in the Văcărești Natural Park so that they have a minimal impact on the otter population;
- Regulation of development plans and construction projects in the area so as to have a low impact on the otter population in the Văcărești Natural Park;
- Ensuring habitat conservation, in the sense of maintaining the favorable conservation status of habitats occupied by otters;
- Maintaining/improving water quality and reducing pollution sources in the Văcărești Natural Park.

The Eurasian otter is a strictly protected species under national and international law and various conventions throughout all Romanian territory, not only in natural protected areas. The otter is listed in Annexes II and IV of the Habitats Directive, CITES Annex I, Annex II to the Berne Convention, and Annex I to the Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS), which recommends the highest degree of protection. Also hunting legislation in Romania (Law 407/2006, Law 197/2007, Law 215/2008, and GEO 102/2010) imposes a strict protection for the otter. According to Law 407/2006 and Law 197/2007, if someone is found guilty of poaching an otter, the amount of "compensation for the prejudice created" that must be paid is 2000 euros.

We have proved that otters are using some aquatic habitats in Bucharest and now all developments and other planned activities causing disturbance should also take the otters into account. The presence of the otter on the two main river corridors of Bucharest can be a really positive conservation outcome for all the wildlife in Bucharest, because other species benefit from conservation activities of habitats used by the otter.

The restoration of wildlife habitats in the city and the return of otters, have made people more aware of the benefits of more green space in the city: for well-being, cleaner air, cleaner water, reduced flood risk, and for wildlife.

Bucharest can and should be managed to support a higher biodiversity, including more mammals at the top of the food chain, like otters. This could be an important indicator of life quality and of a healthy city not just for wildlife but also for the human inhabitants.

**Acknowledgements**

We would like to express our gratitude to Helmut Ignat and Cristian Lascu who kindly provided data on reported *Lutra lutra* sightings from Văcărești Natural Park.

## Disclosure Statement

No potential conflict of interest was reported by the author.

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GEORGE BOUROȘ is a geographer, ecologist, and biologist dedicated to the study and conservation of Eurasian otters. He has been a member of the IUCN Otter Specialist Group since 2013. He is actively contributing to the conservation of endangered species and habitats and to a sustainable development based on respect for nature.

DAN BĂRBULESCU is one of the founders of the Văcărești Natural Park and the Executive Director of the Văcărești Natural Park Association. He has 15 years of work experience in NGOs and 10 years in ecology and environmental protection projects. He is currently working on a PhD on the ecosystem services offered by the Văcărești Natural Park.

VLAD CIOFLEC is a herpetologist and ecologist involved in the study and conservation of urban wildlife. He has been monitoring the fauna of Văcărești Natural Park since 2006 and has guided thousands of young nature enthusiasts through this unique ecosystem.

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# THE DIET OF THE EURASIAN OTTER (*Lutra lutra*) IN A SOUTHERN MEDITERRANEAN AQUATIC ENVIRONMENT

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**Abstract**

*A study was carried out in 2018 on the diet of the Eurasian otter* (Lutra lutra) *at Ifrane National Park to determine the proportion of fish, amphibians, reptiles, invertebrates, birds, and mammals and relate them to hydrological parameters of their aquatic habitats. In addition, the diet was analysed temporally on different rivers. The diet of otters in Ifrane National Park is similar to those in the north Mediterranean and consists predominantly of fish, with some alternative prey. Although there is no significant difference in the temporal modification of the otter diet, a declining trend in fish populations and an increase in the availability of alternative prey were identified following a decrease in water resources. The results, therefore, tend to demonstrate the importance of the availability of water on the preferred prey, fish. This study therefore demonstrates the importance of the semi-aquatic character of the animal.*

***Keywords:*** *Eurasian otter;* Lutra lutra*; spraint; diet; water resources; habitat degradation*

## INTRODUCTION

There are 13 species of otter in the world, all perfectly adapted to a semi-aquatic life. The range of the Eurasian otter (*Lutra lutra*) extends across Eurasia and north-western Africa (**Jacques et al., 2005; Roos et al., 2015**). The Eurasian otter is likely to have become sufficiently differentiated in the Maghreb ecosystems to form the subspecies *Lutra lutra angustifrons* (**Broyer et al., 1988**). Over most of its range, it is a specialist predator feeding mainly on fish, and shows no prey preference

adapting its diet to the fish populations that are available (**Krawczyk et al., 2016; Sittenthaler et al., 2019**). However, otters do show a preference for small fish (small species or juveniles of large species) (**Mercier, 2000**).

The Eurasian otter has been given the status of a Vulnerable species in Morocco (**Aulagnier et al., 2017**). The distribution comprises a large part of the country's hydrographic systems but over the last fifteen years it seems to have disappeared from the whole of the Atlantic plains area north of the Atlas Mountains (**Sehhar, 2005; Aulagnier et al., 2017**). Its distribution also appears to be shrinking in the southernmost regions, such as the Lower Draa valley. In the Souss otters have disappeared at the same rate as water resources have declined, even in the mountains, although heavy flooding results in fluctuations in flow. Otter numbers in Morocco remain unknown, but there is every reason to believe that they are decreasing (**Cuzin, 2003; Delibes et al., 2012**).

As otter presence is strongly influenced by the availability of fish, a river with a fish biomass of 100kg/ha represents optimal habitat and becomes unfavourable when the biomass falls below 50kg/ha (**Jacquet, 2007**). Furthermore, **Ruiz-Olmo et al.** (**2001**) showed that there is a correlation between the abundance of food resources and the number of breeding females living in a stretch of river. This shows that otters are a food-limited species (**Kruuk and Carss, 1996**). Otters living in Mediterranean ecosystems are present where fish populations are available throughout the year, and this is strongly influenced by the amount of water in the environment (**Erlinge, 1986; Riesco et al., 2020**).

The Mediterranean area is a transition zone between a temperate and a dry tropical climate and is characterised by a combination of cold, wet winters and hot, dry summers. These dry summers result in a marked decrease in water resources (**Prenda et al., 2001**) and consequently in the flow, width, and depth of rivers. Freshwater ecosystems are especially sensitive to environmental variations, both predictable and unpredictable, that characterise this climate and these variations influence the diet of *Lutra lutra*. There is indeed a link between trophic diversity of the otter diet and the hydrological components of its habitat (**Clavero et al., 2003**).

If otters increase their dietary flexibility this will decrease their energy demand (**Gittleman and Purvis, 1998**). Although fish remains the preferred prey, at lower latitudes they take more alternative prey such as crayfish, reptiles, amphibians, aquatic invertebrates, birds, and to a lesser extent mammals. The diet therefore shows a greater trophic diversity (**Clavero et al., 2003**), which is reflected in the frequency of observation of the remains of these organisms in their spraints (**Adrian and Delibes, 1987**). The greater availability of alternative prey makes it possible, but not necessary, to increase the trophic diversity of the diet. Consequently, this implies that for otters to show prey diversity, their preferred prey must show a reduction in abundance or availability (**Stephens and Krebs, 1986**). Otters thus show more

generalist predation in streams and rivers than in lakes and estuaries where fish are more common (**Jedrzejewska et al., 2001**).

The higher proportion of alternative prey taken in lower latitudes is largely caused by the reduction in fish habitat during certain periods of the year and consequently a decrease in their biomass. Indeed, **Clavero et al.** (**2003**) conclude that the low and unpredictable availability of fish in Mediterranean freshwater ecosystems is more important than the high abundance of alternative prey, and this influences the trophic diversity of the Mediterranean otter diet. The diet can thus vary according to the environment or seasons which effect prey availability (**Prenda and Granado-Lorencio, 1996**; **Blanco-Garrido et al. 2008**). Seasonality and the scarcity of water may indeed facilitate the capture of aquatic prey due to the creation of pools, calm zones or the narrowness of the river bed (**Lignon et al., 2006**).

Spraints contain the indigestible remains of prey caught within a fairly small radius of their deposition site (**Lignon et al., 2006**). No study on the diet of the otter has been carried out previously in the Ifrane National Park but close to it in the Beht river (**Libois et al., 2015**). It is therefore interesting to verify whether the diet of otters present in the Middle Atlas is similar to those in Mediterranean countries. According to **Clavero et al.** (**2003**), the trophic diversity of otter diet in the Mediterranean environment reaches its maximum when fish populations are strongly affected by droughts. The present study will therefore examine whether hydrological parameters of the Middle Atlas rivers effect the frequency of fish being taken as prey as stated by **Clavero et al.** (**2003**). We will examine the temporal variation in otter diet in the rivers Fellat and Bekrit, which show a significant decrease in water levels in the hottest summer months.

## STUDY AREA

Figure 1 shows the Ifrane National Park which was created in 2004 and covers an area of 125,000 ha. Its territory extends over the western part of the Middle Atlas Mountains and areas within the provinces of Ifrane and Boulmane. From a bioclimatic point of view, it belongs to the Mediterranean humid bioclimatic stage and which is rich in endemic and sub-endemic species **(Dakki, 1987; 1997; Azeroual, 1997**).

The protected area is crossed by many small high mountain rivers – the Fellat, Bekrit, Admer Izem, Amghass, and Tizguit. The Bekrit flows over 25km from the cascades to the confluence with the Oum-er-Rbia. The Fellat has its source at Mount Serroual (2108m) and together with the Bekrit they form part of the Oum-er-Rbia catchment area. The Admer Izem, has an approximate length of 35km and is also part of the Oum-er-Rbia catchment area. The Amghass is approximately 13km long. The Tizguit is a river of greater importance and is fed mainly by the Zerrouka river at the Tizguit springs (**Grovel, 2007**), which provides a significant quantity of water.

Most of these small rivers dry up periodically depending on the season and the quantity of water in the Fellat and Bekrit rivers decreases considerably in the summer season so that they are dry over long distances downstream.

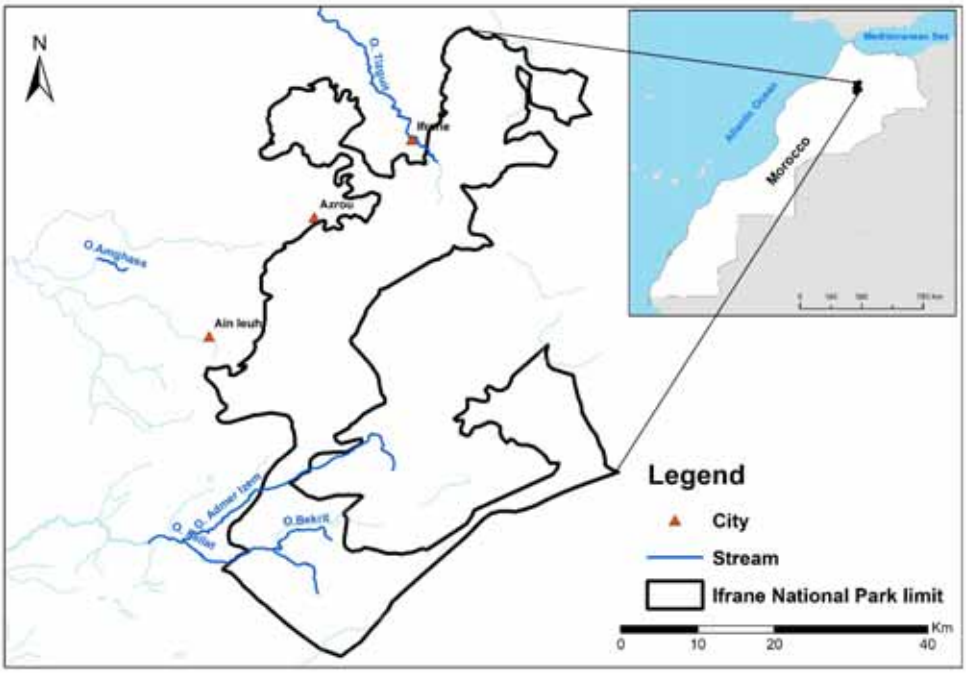


***Figure 1. Map the Ifrane National Park and the rivers studied.***

## MATERIAL AND METHODS

The transects surveyed were determined in 2018 particularly according to their accessibility. The transects of Bekrit (n=5), Fellat (n=4), and Tizguit (n=3) start at their tributaries, while the transects on Admer Izem (n=4) start at the village of Mersoualli and Amghass (n=3) and were investigated from the village of Amghass. The transects are mostly 2–3km apart, but in places this is as much as 5km depending on accessibility. Each transect was surveyed over a distance of 600m (**Reuther, 2000; Prenda et al., 2001**), and the length of the transect surveyed, was calculated using GPS (Garmin Model Vista HCx/etrex). Subsequently, the geographical data collected contributed to the construction of a Geographical Information System on which the distribution of the otter is shown. In addition, on each transect, the presence of footprints, spraints, and latrines were checked on all rocks, on various human constructions, and on clumps of vegetation either on the banks or on small islands in the centre of the rivers. All transects on the Fellat river and three transects downstream on the Bekrit river were surveyed twice.

The study of the otter diet was based on the analysis of prey remains in the spraints. During each transect, the spraints found were placed in a plastic bag with the transect

of origin and date of survey so that each spraint can be linked to the hydrological characteristics of its original transect.

When spraints were found superimposed, we tried to separate them and they were then regarded as two spraints (**Mercier, 2000**). To achieve the best representation of the diet the minimum number of spraints on which the analysis is based depends on the quantity of species found in the spraints as well as the degree of precision sought. It is however accepted that only a significant number of spraints, i.e. a hundred or so, will allow a certain degree of a certain smoothness in the results (**Mercier, 2000**). As the total number of spraints collected in the present study was 104 one can assume that this sample is representative of the diet of *Lutra lutra* in the rivers of the National Park.

Six categories of prey were considered in this study, namely: fish, reptiles, amphibians, mammals, birds, and invertebrates (**Clavero et al., 2003**). The analysis method used in this study is based on the Frequency of Occurrence for each class of prey item found. The occurrence of a class in a spraint refers to the presence of remains, regardless of their number. The Frequency of Occurrence is then obtained by the number of times each class is represented in a spraint out of the total number of spraints (**Jedrzejewska et al., 2001; Mercier, 2000**). Moreover, in order to compare the results obtained on otter diet in Mediterranean areas by **Clavero et al.** (**2003**), the Relative Frequency of Occurrence of each prey class was obtained by the number of occurrences of remains of a certain class, out of the total number of occurrences of all prey classes combined. The spraints were dried in the oven at approximately 42°C and each spraint was then placed in a petri dish. The osseous parts were put aside for identification.

## STATISTICAL ANALYSIS

Since spraints are generally concentrated not far from feeding areas (**Conroy and French, 1987**), each spraint was associated with the average hydrological conditions prevailing in its transect of origin at the time of collection. This would demonstrate the influence of hydrological parameters (depth, width, temperature, and current velocity of the stream) on the proportions of the different classes in the otter diet.

Pearson's correlations between the presence of the remains of each prey class and the different hydrological parameters were established in order to measure the degree of linkage between the dependent variables (**Durand, 1997**). In this case these variables were the presence of remains of different prey classes and the hydrological parameters of the habitat. Moreover, Pearson's correlations were also carried out between the presence of the various classes of prey in order to show if there were significant links between these classes.

In order to determine whether there were temporal variations in the frequency of the different prey classes on the Fellat and Bekrit rivers at two different times, a t-test was conducted. The study also looked at temporal differences in hydrology in these two rivers to see if they were significant. A t-test for comparison of means was therefore

performed to compare each of the hydrological parameters on the same river measured at different times.

A t-test with comparison of the means of a single sample whose values were derived from **Clavero et al.** (**2003**) was carried out to check whether the Relative Frequency of Occurrence (RFO) of each prey class were similar to those of representatives of the species in the northern Mediterranean area. In the study by **Clavero et al.** (**2003**), invertebrates were subdivided into "crayfish" and "other invertebrates". In the present study the values of these two RFOs were added together to compare them with the RFO of the class of all invertebrates. The RFO was previously calculated for each spraint, for a total n of 104 RFO for each class of prey. All statistical analyses were performed in R-4.0.3 software (R Development Core Team, 2018).

## RESULTS

***Table 1. Density of spraints, footprints and signs of presence of* Lutra lutra *per transect***

| River | Transect | Spraint density/600m | Footprint density/600m | Density of signs/600m |
|---|---|---|---|---|
| **Bekrit** | B1 | 0 | 0 | 0 |
| | B2 | 0 | 0 | 0 |
| | B3 | 1 | 0 | 1 |
| | B4 | 2 | 1 | 3 |
| | B5 | 2 | 0 | 2 |
| | ***Mean*** | ***1*** | ***0.2*** | ***1.2*** |
| **Fellat** | F1 | 6 | 0 | 6 |
| | F2 | 3 | 0 | 3 |
| | F3 | 1 | 0 | 1 |
| | F4 | 10 | 0 | 10 |
| | ***Mean*** | ***5*** | ***0*** | ***5*** |
| Admer Izem | AI1 | 0 | 0 | 0 |
| | AI2 | 0 | 0 | 0 |
| | AI3 | 0 | 0 | 0 |
| | AI4 | 0 | 0 | 0 |
| | ***Mean*** | ***0*** | ***0*** | ***0*** |
| Amghass | AM1 | 11 | 0 | 11 |
| | AM2 | 1 | 0 | 1 |
| | AM3 | 6 | 4 | 10 |

| | | | | |
|---|---|---|---|---|
| | ***Mean*** | ***6*** | ***1.3*** | ***7.3*** |
| Tizguit | T1 | 3 | 0 | 3 |
| | T2 | 7 | 1 | 8 |
| | T3 | 4 | 4 | 8 |
| | ***Mean*** | ***4.6*** | ***1.6*** | ***6.3*** |

For Bekrit river, Table 1 shows that, although signs of presence were not found on all transects, the otter is present in this water system. Despite the absence of signs on transects B1 and B2, otter presence was detected on transects B3, B4, and B5, the most downstream transects. With regard to Fellat, Amghas, and Tizguit rivers, the otter evidence was detected on all transects (Figure 1). No evidence of the otter was detected at Admer Izem on any of the transects. The distribution of otters certainly varies between the rivers. Table 1 shows the density of the different signs and the total number of signs per transect. Although densities of footprints, and thus evidence of presence, were excluded from the analyses due to the great variability between river substrates favourable to their creation, they were placed in Table 1 for information purposes.

The density of spraints also varies according to the river and also according to the transects on the same river. Thus, Bekrit shows relatively low densities and Fellat, Amghass, and Tizguit show overall higher densities, although there are lower densities locally on some transects. On average, the highest densities were found on Amghrass. However, the difference between the average density of spraints on the Fellat, Amghass, and Tizguit according to the *Post-hoc test* with *ANOVA* is not significant (1-factor LSD anova $F = 3.457$, $p = 0.037$). Thus the density on these rivers is similar despite apparent superiority over Amghass.

As expected, the density of spraints on Admer Izem differs significantly to that on Fellat, Amghrass, and Tizguit according to the *Post-hoc test*. The difference between the average densities of spraints on Bekrit is significantly different from Fellat and Amghass, without being significantly different from Tizguit and Admer Izem. Thus it is possible to deduce that the otter is more abundant on Fellat and Amghass than on the other rivers. It should be noted that since no spraints were found on the Admer Izem, this river does not appear in the analyses related to diet. Table 2 shows the Frequency of Occurrence of the different classes of prey according to the rivers.

***Table 2. Frequency of Occurrence of each prey class in relation to the river***

| Class of prey items | Fish | Invertebrates | Birds | Mammals | Reptiles | Amphibians |
|---|---|---|---|---|---|---|
| **Fellat n=20** | 95 | 10 | 0 | 5 | 0 | 15 |
| **Bekrit n=5** | 40 | 80 | 0 | 0 | 20 | 40 |
| **Amghass n=20** | 100 | 5 | 5 | 0 | 15 | 35 |
| **Tizguit n=14** | 64.29 | 21.43 | 21.43 | 0 | 7.14 | 28.57 |
| **Fellat2 n=43** | 79.07 | 13.95 | 2.33 | 4.65 | 16.28 | 44.19 |
| **Bekrit2 n=2** | 0 | 100 | 50 | 0 | 50 | 50 |
| **Mean** | 82.35 | 17.31 | 6.73 | 0.96 | 12.5 | 34.62 |

### *Diet and hydrological parameters of the habitat*

Pearson's correlations between each habitat parameter and the presence of the remains of different prey classes in the spraints were thus established in order to clarify the links existing between these variables (Table 3.)

With regard to the presence of fish remains in spraints, according to the results obtained, this seems to vary according to the width (R=0.281, $p \leq 0.01$) and depth of the river and the size of the fish (R=0.281, $p \leq 0.01$), depth (R=0.342, $p \leq 0.001$), and is negatively correlated with some alternative prey classes, including invertebrates (R=-0.613$p \leq 0.001$), birds (R=-0.256, $p \leq 0.01$), and amphibians (R=-0.356, $p \leq 0.001$). In this sense, the presence of reptile remains appears to be related to that of mammals (R=0.260, $p \leq 0.01$) and amphibians (R=0.331, $p \leq 0.01$). In terms of the presence of invertebrates, in addition to being negatively correlated with fish remains, this also seems to be negatively correlated with the depth of the river (R=-0.209, $p \leq 0.05$) and positively with the current speed (R = 0.261, $p \leq 0.01$). With regard to the presence of bird remains, this seems to be negatively related to the depth of the river (R=-0.207, $p \leq 0.05$).

### *Temporal variation in otter diet in the Fellat and Bekrit rivers*

It is interesting to look at the temporal variation in otter diet on the rivers where data were collected over two periods (May 2018 and June 2018). Table 4 shows some variation between the Frequencies of Occurrence of the different prey items, with a decrease in the presence of fish remains and an increase in classes, except for mammals in Fellat.

***Table 3. Pearson correlation table for all independent variables and spraints density (*: p between [0.05% and 0.01% [, **: p between [0.01% and 0.001%] and ***: p less than 0.001%)***

| Variables | Spraints density | Temperatures | Witdh | Deep | Current Speed | Vegetation cover | Obstruction 1m | Human habitat | washing place | Livestock | irrigation | crops | Layaout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spraints density | | | | | | | | | | | | | |
| Temperatures | 0,23 | | | | | | | | | | | | |
| Witdh | 0,447 | 0,601(**) | | | | | | | | | | | |
| Deep | 0,37 | 0,119 | 0,670(**) | | | | | | | | | | |
| Current Speed | -0,138 | -0,392 | -0,388 | -0,046 | | | | | | | | | |
| Vegetation cover | 0,601(**) | 0,102 | 0,361 | 0,229 | 0,09 | | | | | | | | |
| Obstruction 1m | 0,649(**) | 0,333 | 0,425 | 0,229 | -0,242 | 0,894(***) | | | | | | | |
| Human habitat | 0,399 | -0,185 | -0,1 | -0,06 | 0,414 | -0,141 | -0,257 | | | | | | |
| washing place | 0,095 | 0,068 | -0,098 | -0,104 | 0,322 | -0,122 | -0,258 | 0,305 | | | | | |
| Livestock | -0,151 | 0,114 | -0,24 | -0,027 | -0,277 | -0,651(**) | -0,478(*) | -0,199 | -0,167 | | | | |
| irrigation | 0,053 | -0,097 | -0,362 | -0,423 | 0,631(**) | -0,039 | 0,177 | -0,267 | -0,04 | -0,028 | | | |
| crops | 0,057 | -0,324 | -0,408 | -0,32 | -0,022 | -0,122 | 0,013 | -0,099 | 0,021 | -0,247 | 0,419 | | |
| Layaout | 0,459(*) | 0,362 | 0,556(*) | 0,039 | -0,116 | 0,665(**) | 0,651(**) | -0,123 | -0,154 | -0,623 | 0,047 | -0,19 | |

***Table 4. Frequency of Occurrence of the different prey classes on the Bekrit and Fellat rivers at two given times***

| Prey classes | Fish | Invertebrates | Birds | Mammals | Reptiles | Amphibians |
|---|---|---|---|---|---|---|
| **Fellat** n=20 | 95 | 10 | 0 | 5 | 0 | 15 |
| **Fellat-2** n=43 | 79.07 | 13.95 | 2.33 | 4.65 | 16.28 | 44.19 |
| **Bekrit** n=5 | 40 | 80 | 0 | 0 | 20 | 40 |
| **Bekrit-2** n=2<br>0 100 50 0 50 50 | 0 | 100 | 50 | 0 | 50 | 50 |

However, with regard to the Fellat, surveyed in May as well as in June, there is no significant difference in the occurrence of prey of different classes, and the results of t-tests for equality of means are non-significant (fish $p$ = 0.164, invertebrates $p$ = 0.822, birds $p$ = 0.160, mammals $p$ = 0.323, reptiles $p$ = 0.079, and amphibians $p$ = 0.056). However, the results for amphibians and reptiles are close to significance. There is no significant difference between the hydrological parameters over time on this river.

For Bekrit, surveyed on 5 and 12 May and 8 June 2019, the results of the t-tests for equality of means support the absence of difference between the Frequencies of Occurrence of the different prey items (fish $p$=0.374, invertebrates $p$=0.374, birds $p$=0.500, reptiles $p$=0.656 and amphibians $p$=0.878). It should be noted that the t-test could not be carried out with the mammal class as the standard deviations were zero in both cases, as mammal remains were never found in spraints from this river. These results, which show no significant difference between the proportions of the prey classes, are supported by equally non-significant results regarding a difference between hydrological parameters over time.

### *Comparison with northern Mediterranean ecosystems*

The result of the t-test for comparison of the means with a single value showed that there was no significant difference between the RFO in otter spraints from the Ifrane National Park of fish ($p$=0,700), reptiles ($p$=0,268), mammals ($p$=0,967) and less so of birds ($p$=0,077). However, there were significant differences in the RFO of invertebrates (p=0.000) and amphibians ($p$=0.004). The results of this test are shown in Table 5.

***Table 5. Results of the t-test for the comparison of the RFO of the North Mediterranean otters and that of the Ifrane National Park (*: p between [0.05% and 0.01%] , **: p between [0.01% and 0.001%[ and ***: p less than 0.001%)***

| | **Relative Frequency of Occurrence** | | |
|---|---|---|---|
| **Classes of prey** | **North Mediterranean** | **Ifrane National Park** | **T-value** |
| Fish | 62.6 | 52.8 | 0.386 |
| Amphibians | 9.6 | 22.6 | 2.943** |
| Reptiles | 3.3 | 8.2 | 1.113 |
| Birds | 1 | 4.4 | 1.786 |
| Mammals | 0.7 | 0.6 | 0.04 |
| Invertebrates | 22.3 | 11.3 | –5.590*** |

## DISCUSSION

This study looked at the diet of the Eurasian otter in the Ifrane National Park. The aim was to determine the proportions of the different prey classes depending on hydrological parameters and a certain temporality on the Fellat and Bekrit rivers. In addition, these proportions of prey classes were compared to those of otters in a northern Mediterranean ecosystem.

The Eurasian otter, although strongly associated with the presence of fish in the majority of the habitats it frequents (**Clavero et al., 2003**), seems to be a fairly generalist predator in the rivers surveyed during this study. The average of the Frequency of Occurrence of the prey classes shows that it feeds mainly on fish, although amphibians, invertebrates, reptiles, birds, and more rarely mammals are also taken. This occurrence of alternative prey confirms a trophic diversity specific to the Mediterranean context.

The increase in the diversity of alternative prey in the diet is usually explained by a decrease in the abundance of its preferred prey (**Stephens and Krebs, 1986**), fish, due to hydrological constraints, i.e. the significant scarcity of water resources during the dry period (**Clavero et al., 2003**). This study showed that there is a correlation between certain hydrological parameters and the presence of fish in spraints. Indeed, the results of the tests of correlation show that the consumption of fish is influenced by the depth and width of the streams which are two parameters that are related to water quantity. Furthermore, as shown above, there is a negative correlation between the Frequency of Occurrence of fish and the occurrence of invertebrates. This indicates that otters on the rivers in this study predate more on these prey classes when they do not consume fish. A significantly positive correlation between the presence of amphibians and reptiles in the spraints was also shown. Although the relationship was not significant between the presence of fish and reptiles, there was a negative trend between these two prey classes suggesting that otters also tend to feed on reptiles when their fish consumption is

reduced. It is therefore logical to find a correlation between amphibians and reptiles as both classes become more representative under the same effect, i.e. a reduction in fish abundance and a need for otters to turn to alternative prey. A significant link between the presence of reptiles and mammals was also shown, although this was based on only one occurrence of mammal remains in the 104 spraints collected. We cannot therefore reject the hypothesis that these two classes are linked by a certain chance.

The correlation results also show an interesting relationship between invertebrate presence and current velocity. This is explained biologically since coarse and permeable substrates in water with a fast current are the most productive areas for invertebrates (**Wasson et al., 1995**). The otter will therefore find more invertebrates in environments where the current speed is increased. The quantity of invertebrates combined with a decrease of fish availability supports results in a higher proportion of invertebrates found in spraints. Moreover, a significantly negative correlation was found between invertebrates and depth (R=-0.209, $p \leq 0.05$). The disadvantage of sticking to such a broad taxonomic level is that it is difficult to generalise about ecological constraints of invertebrates as some prefer deeper water and others shallower water. However, it is generally accepted that shallow areas provide a better habitat for aquatic invertebrates in which to lay their eggs (**Humphries, 1996**).

***Temporal variation in the diet of otters***

The results of the temporal difference in the Frequency of Occurrence of the different prey classes on the Fellat and Bekrit rivers showed no significant difference. Indeed, the presumed driver of change in these relative frequencies is the availability of water affecting the preferred prey, fish. No significant temporal differences were found in the hydrological parameters of these rivers, which may suggest that the amount of fish is relatively constant, which does not drive otters to alternative prey. Although the differences are not significant, a tendency towards a decrease in the proportion of fish in otter spraints is perceptible. The proportion of fish in spraints tends to decrease between the two sections on the Fellat. Although the average of the hydrological conditions does not reflect a decrease in the quantity of water, a decrease was observed with some zones completely dry.

These observations prove once again that it would be necessary to record the characteristics of the habitat several times in order to achieve a real representation of the environment. Nevertheless, a decrease in water resources was observed and is combined with a reduction in the proportions of fish and a notable increase in reptiles, amphibians, and to, a lesser extent, invertebrates, with the t-test results showing differences close to being significant for amphibians and reptiles. This tendency thus supports the fact that the reduction of the hydric resources has a negative impact on the proportion of fish in spraints (**Clavero et al., 2003**). The otter thus increases its predation on alternative prey sources (**Stephens and Krebs, 1986**) as the tendency in the results of the Relative Frequency of Occurrence shows.

## COMPARISONS WITH THE DIET OF NORTHERN MEDITERRANEAN OTTERS

When comparing the Relative Frequency of Occurrence (RFO) of the different prey classes represented in the otter diet on the Ifrane National Park rivers with those found by **Clavero et al.** (**2003**) for otters in northern Mediterranean environments, the results vary according to the classes.

As shown in Table 5, there is no significant difference between the RFO of fish, reptiles, birds, and mammals found in the Park's rivers and those of north Mediterranean environments, but there is a significant difference between the RFO for amphibians and invertebrates, reflecting an increase in amphibians and a reduction in invertebrates in the diet in the Park compared to those in the north Mediterranean. This suggests that fish in the rivers in the current study are subject to the same hydrological constraints characteristic of northern Mediterranean environments. This limits fish abundance compared to temperate environments and has repercussions on otter diet. The presence of birds and mammals in spraints is rather marginal in both environments. It can also be assumed that reptiles are of approximately the same abundance in the Park, hence the conclusions of **Clavero et al. (2003).** Although the Relative Frequency of Occurrence of the otter's preferred prey, fish, in Ifrane National Park is similar to that of otters in northern Mediterranean environments, the frequency of alternative prey items varies. Indeed, although the first criterion for an increase in alternative prey consumed is a decrease in fish abundance (**Stephens and Krebs, 1986**), the proportion of alternative prey depends on their abundance (**Clavero et al., 2003**). Thus, we can assume that one reason for the difference is that aquatic invertebrates in the National Park of Ifrane are less abundant and amphibians are in greater numbers than in aquatic ecosystems of the northern Mediterranean and this is reflected in their Frequency of Occurrence in spraints.

The impact of decreasing water resources may have an important effect on population density via food abundance (**Prenda et al., 2001**), and otter conservation depends in particular on the conservation of its food resources (**Lignon et al., 2006**). This study confirms that in addition to the known impact of water resources on fish, it also affects other species linked to the aquatic environment. For example, amphibians and invertebrates, whose life cycles are strongly linked to the aquatic environment, will decrease in number with a reduction in water resources and this will impact the otters as they are the main alternative prey classes in the National Park. Furthermore, although at a certain limit, the consumption of alternative prey can meet the energy demand of the species, it can be assumed that at a certain threshold, this has too much influence on the otter's body mass. Thus if water resources in the Middle Atlas continue to decline, resulting in dry rivers for longer periods of time, otters may experience a drop in body mass due to a significant decrease in food resources.

In several species, a decrease in body mass is accompanied by a decrease in breeding success, and this has been observed in otters (**Ruiz-Olmo et al., 2001**) and litter sizes are smaller when there is less food availability (**Kruuk and Carss, 1996**). This affects recruitment to populations due to the smaller number of juveniles, and it could eventually threaten the maintenance of the populations in the Park (**Prenda et al., 2000**). It is therefore necessary to preserve water resources, as well as vegetation, both of which show a regression at Park level. Otters in the National Park are therefore experiencing the same threats as 86% of the world's threatened mammal species, i.e. habitat loss (**Roos, 2015**), threatening their long-term survival. Given the otter's large home range (**Conroy et al., 2005**) and the high connectivity of aquatic environments throughout the catchment, conservation measures need to be taken on a relatively large scale (**Lignon et al., 2006**). The otter can thus be an interesting umbrella species, especially in this context where the aquatic environment is little used, with few studies carried out in the Ifrane National Park, and where it is subject to poor management. The principle of an "umbrella species" is one whose conservation confers subsequent protection on a large number of species that share the same environment (**Roberge and Angelstam, 2004**). Thus, the protection of water resources should have an effect on the majority of species in the Park, whose attraction to this fundamental liquid is no longer in question, and this can be highlighted through the otter.

## CONCLUSIONS

The present study has made it possible to fill in gaps in the knowledge of the diet of *Lutra lutra* in Ifrane National Park. In addition, the negative impact of scarcity of water resources in the Park can now be identified through its impact on the preferred prey, fish. Otters in the Mediterranean environment show a greater trophic diversity in their diet due to hydrological constraints that affect fish availability.

Otters in the Park show trophic diversity typical of otters in northern Mediterranean environments. Although fish remains the preferred prey, the spraints contain evidence of alternative prey within the limits of the Park, mainly amphibians, invertebrates, and reptiles – ranging from 12.5 to 34.62%. Furthermore, the results show a positive relationship between the quantity of water (width and depth) and the amount of fish in the spraints, demonstrating the importance of water availability for fish.

The results of the study, although not statistically significant, tend to show that a reduction in water resources in a river leads to a reduction in the amount of fish consumed in favour of alternative prey. The real status of otter populations in the National Park are largely unknown and we can only assume their vulnerability through the destruction of their habitat. Therefore steps must be taken to ensure sustainable management of water resources to reduce degradation of aquatic environments and maintain sufficient food resources for the survival of otter populations. The diversion of water for irrigation must be reduced and rational and sustainable irrigation practices

must be adopted. Awareness campaigns should also be conducted to show the benefits of biodegradable detergents on the environment. Given the otter's home range, which can extend for several kilometres, and the high connectivity of aquatic environments throughout the catchment area, conservation measures must be taken on a relatively large scale.

**Acknowledgements**

The authors are grateful to Ben Yoxon for very helpful comments on an earlier draft of this paper. We also thank the Editors of the *Otter Journal* for their comments and advice.

**Disclosure Statement**

No potential conflict of interest was reported by the authors.

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# DISTRIBUTION OF THE MESOPOTAMIAN OTTER (*Lutrogale perspicillata maxwelli*) IN IRAN

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## Abstract

*The Mesopotamian otter* (Lutrogale perspicillata maxwelli) *is a sub-species of the smooth-coated otter* (Lutrogale perspicillata) *and is one of the most poorly known carnivore species in Iran. It is also known as Maxwell's Otter. The Hoor Al-Azim wetland is an important habitat for water birds, the Euphrates softshell turtle* Rafetus euphraticus *and the otter. During the period 2009 to 2021 we surveyed Hoor Al-Azim wetland for otters and documented 16 records to create a distribution map using ArcGIS 10.2. We also noted defensive behaviour against stray dogs and in some cases curiosity about human presence. Potential threats to the otter include stray dogs, road kill, fishing nets, fishing using electroshock, and poison. Thus, the species is in need of conservation projects to ensure its survival.*

***Keywords:*** *Distribution; group size; Hoor Al-Azim wetland; Mesopotamian otter*; Lutrogale perspicillata maxwelli*; record*

## INTRODUCTION

The smooth-coated otter (*Lutrogale perspicillata*) is distributed in Palearctic and Oriental realms (**de Silva et al., 2015; White 2004**) and the species is reported from Iraq, Iran, Pakistan, India, China, Bangladesh, Nepal, Indonesia, Malaysia, Thailand, Vietnam, Bhutan, Singapore, and Myanmar (**de Silva et al., 2015**). In Iran, the Mesopotamian otter *Lutrogale perspicillata maxwelli* is a sub-species and was recorded for the first time in 1972 by two pelts for sale in a local market. In 1974 a

poached specimen (head and body length = 62 cm, tail length = 40 cm and hind foot = 13 cm) was found in the Hoor Al-Azim wetland (**Ziaie, 2008; Ziaie and Gutleb, 1997**).

Before 2010 the status of otter species in Iran was largely unknown (**Foster-Turley et al., 1990; Gutleb et al., 1996; Mirzaei et al., 2010**) but it has since been confirmed that there are two species of otter in the Alborz and Zagros rivers and Hoor Al-Azim international wetland (**Ziaie, 2008; Karami et al., 2016**). The Eurasian otter (*Lutra lutra*) occurs in rivers of the Alborz and Zagros Mountains, and the Mesopotamian otter has only been recorded in the Hoor Al-Azim wetland (**Ziaie, 2008; Karami et al., 2016**). However, two suspected records of the Mesopotamian otter recorded are documented in the Shadegan international wetland and Arvandrud River (**Karami et al., 2016**). The otter is a well-known species for local people and even has a local name (Cheleyb Al-My = aquatic dog) used by villagers around the Hoor Al-Azim wetland. Here, we present 15 further records of the Mesopotamian otter in the country.

## MATERIAL AND METHODS

### *Study area*

The Hoor Al-Azim wetland (Susangerd marshes, Hawizeh marshes) is located on the Iran–Iraq border, Khuzestan province, southwestern Iran, and is a Ramsar site, important bird area and protected area. The main water courses of the wetland are the Karkheh River in Iran and Tigris River in Iraq. Hoor Al-Azim is an important wintering site for waders such as the black-winged stilt (*Himantopus himantopus*), surface-feeding ducks such as marbled teal (*Marmaronetta angustirostris*), and geese such as greylag goose (*Anser anser*) (**BirdLife International, 2021**). The wetland is also one of the habitats of the Euphrates softshell turtle (*Rafetus euphraticus*) in Iran (**Taskavak et al., 2016**). Land use of the area is agriculture, rangeland/pastureland, nature conservation and military (**BirdLife International, 2021**).

### *Data collection and methodology*

Data on the presence of the Mesopotamian otter in the Hoor Al-Azim wetland were collected using sandy roads within the wetland as line transects. Data recorded were locations using GPS, vegetation cover, number of otters seen crossing roads, swimming, or basking. ArcGIS 10.2 was used to create a distribution map of the Mesopotamian otter in Hoor Al-Azim wetland.

## RESULTS

During the period 2009 to 2021, 16 records of the Mesopotamian otter were documented in the Hoor Al-Azim wetland. The average group size was 3.2 individuals but the largest group was 10 (Table 1). Of the locations, 13 observations

were reported in the southern areas, three observations in the central areas, and one observation in the northern part of the wetland (Figures 1, 2, 3, and 4). During the study, defensive behaviour against stray dogs and in some cases apparent curiosity about human presence was also recorded. The main vegetation cover of the locations was *Phragmites australis*.

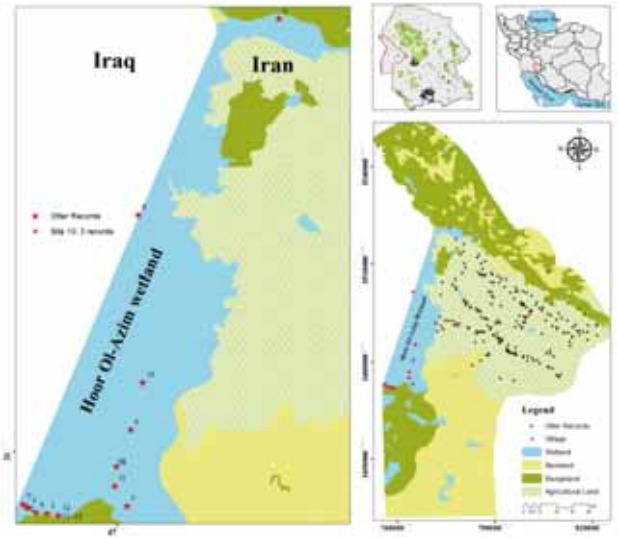


***Figure 1. Distribution of the Mesopotamian otter records (red stars) in Hoor Al-Azim wetland, southwestern Iran during 2009–2021.***

***Figure 2. Two Mesopotamian otters in the Hoor Al-Azim wetland taken during February 2019. © Amir Momtaz (left) and otters basking on land at Hoor Al-Azim wetland © Mohammed Saki (right).***

***Figure 3. One of the two Mesopotamian otters seen at Hour Al-Azim wetland on 4 March 2021 © Keramat Hafezi.***

***Figure 4. A Mesopotamian otter in Hour Al-Azim wetland in April 2021 © Reza Nikfalak.***

***Table 1. Records of Mesopotamian otter in the Hoor Al-Azim wetland during 2009–2021.***

| Record No | Record date | No of individuals | Coordinates |
|---|---|---|---|
| 1 | 15 Feb 2009 | 2 | 47.9169° Long, 31.794431° Lat |
| 2 | 11 Jan 2013 | 3 | 47.69125° Long, 31.364585° Lat |
| 3 | 17 Jan 2013 | 4 | 47.79302° Long, 31.620241° Lat |
| 4 | 10 Feb 2019 | 2 | 47.694278° Long, 31.362389° Lat |
| 5 | 11 Mar 2019 | 2 | 47.695972° Long, 31.361611° Lat |
| 6 | 15 Apr 2019 | 10 | 47.69125° Long, 31.364585° Lat |
| 7 | 31May 2020 | 5 | 47.786139° Long, 31.430694° Lat |
| 8 | 12 Dec 2020 | 1 | 47.712389° Long, 31.356389° Lat |
| 9 | 1 Feb 2021 | 2 | 47.78308° Long, 31.36299° Lat |
| 10 | 10 Feb 2021 | 1 | 47.702441° Long, 31.357385° Lat |
| 11 | 9 Feb 2021 | 1 | 47.772164° Long, 31.381005° Lat |
| 12 | 4 Mar 2021 | 2 | 47.722333° Long, 31.354722° Lat |
| 13 | 21 Mar 2021 | 5 | 47.723139° Long, 31.354111° Lat |
| 14 | 21 Mar 2021 | 3 | 47.723139° Long, 31.354111° Lat |
| 15 | 24 Mar 2021 | 2 | 47.723139° Long, 31.354111° Lat |
| 16 | 8 Apr 2021 | 7 | 47.773468º Long, 31.398169º Lat |

## DISCUSSION

The smooth-coated otter is listed in the IUCN Red List as a "Vulnerable" species and is listed on Appendix I of CITES. It seems that the Mesopotamian otter urgently needs conservation projects and habitat restoration in Iraq and Iran, because of the low population and habitat destruction. In many countries otters are protected from poaching and trade (**de Silva et al., 2015**). However, the otter is not a protected species in Iran although there is a fine of US$154 for each poached otter. Until the 1970s, thousands of pelts of both otter species (*Lutrogale perspicillata* and *Lutra lutra*) were traded to other countries from Khuzestan Province (**Ziaie, 2008**). Today, both species need conservation projects due to the threats including stray dogs, road kill, fishing nets, fishing using electroshock, and poison.

### Disclosure Statement

No potential conflict of interest was reported by the authors.

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GRACE YOXON is the Director and co-founder of the International Otter Survival Fund, which was established in 1993. She has carried out many otter surveys and co-organised training workshops in Asia, Africa and South America. She is also responsible for the day-to-day running of the specialist otter hospital.

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# PRESENCE OF SMOOTH-COATED OTTER (*Lutrogale perspicillata*) IN SELECTED WETLANDS OF THATTA DISTRICT, SINDH PROVINCE OF PAKISTAN

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## ABSTRACT

*Smooth-coated otters used to exist along the River Indus throughout the Sindh Province and in upper Sindh, lower Indus valley, and eastern Nara. In Pakistan, smooth-coated otters are mainly found along the Indus River and its tributaries but they now have a disjunct distribution along the Indus river in Sindh. This survey was conducted to study the presence of smooth-coated otters in selected wetlands of Thatta district, Sindh Province of Pakistan. We believed that smooth-coated otters could have become extinct in the wetlands of lower Sindh, specifically in Thatta district. The study areas were selected to include a variety of habitats from artificial freshwater lakes, canals, seepage zones to natural small lakes locally called 'dhands' and inundation areas. The main sites for the survey were Haleji lake and adjoining areas, Mirpur Sakro and adjoining areas, and Sakro canal heading off to Ladiun. Literature review, interviews with local villagers, fishermen, fish farmers, wildlife department officers, and other relevant personnel, as well as track count method, were utilised for data collection along with a questionnaire addressing most of the major questions in terms of their distribution, occurrence, threats, etc. The results of the survey indicate that the smooth-coated otter (*Lutrogale perspicillata; *race* sindica*) still occurs, although in relatively small and isolated pockets around the selected wetland sites, and there is an immediate need for conservation actions.*

***Keywords:*** *Haleji lake; Mirpur Sakro; Thatta; smooth-coated otter; Sindh; sindica otter, wetlands*

## INTRODUCTION

Two species of otter i.e. smooth-coated otter (*Lutrogale perspicillata*) and common or Eurasian otter (*Lutra lutra*) occur in Pakistan (**Roberts, 1997**). The smooth-coated otter is described as a subspecies, *L. p. sindica* (**Pocock, 1939**) with the common name Sindh otter. Smooth-coated otters existed along the River Indus throughout the Sindh Province (**Blanford, 1881; Murray, 1884**) and in upper Sindh, lower Indus valley, and eastern Nara (**Pocock, 1939**). In Pakistan, smooth-coated otters are mainly found along the Indus river and its tributaries but now they have a disjunct distribution along the Indus river in Sindh. This survey was carried out to study their presence in selected wetlands of Thatta district, Sindh Province of Pakistan.

## STUDY SITES

The study areas are shown in Figure 1 and were selected to include a variety of habitats from artificial freshwater lakes, canals, and seepage zones to natural 'dhands' and inundation areas. Agricultural areas close to the main study site also included many paddy fields. Haleji Lake is an artificial freshwater lake bordered by brackish seepage lagoons and supports abundant aquatic vegetation in Thatta District of Sindh Province. It is also a Ramsar site **(https://rsis.ramsar.org/ris/101)**. There are many villages and households surrounding Haleji lake. Mirpur Sakro is a collection of villages located about 75 km from Karachi city. The villages are mixed with farmlands mainly rice paddies, cotton farms, and small fruit groves. The villages have a wide interlinked system of freshwater canals (Table 1). An extension to the survey was made of a selected wetland site of Keenjhar lake adjoining Jhampir plains.


***Figure 1. Location of survey sites: (1) Haleji lake main; (2) Haleji lake adjoining areas; (3a) Effendi lake, Sakro; (3b) Sakro main bazaar; (3c) Chachh dhand/ lake; (4) Sakro canal; (5) Keenjhar lake backwaters***

***Table 1. Details of selected study sites showing exact coordinates and brief habitat description.***

| Site.no | Location | Coordinates | Habitat description |
|---|---|---|---|
| 1 | Haleji lake | 24.788, 67.756 | Large freshwater lake with plenty of thick vegetation alongside. Good, secure habitat. |
| 2 | Haleji adjoining areas | 24.747, 67.682 | Still a few freshwater tracts present with some thick vegetation but declining. |
| 3 | Private fish farms Sakro | 24.560, 67.670 | Small artificially constructed freshwater bodies with some ideal otter habitat. Having thick *Typha* vegetation alongside but fairly isolated from main canals or waterways. |
| 4 | Sakro canal en route Ladian | 24.573, 67.660 | Average width, long canals with some thick *Typha* vegetation on edges bordered by farmlands. |
| 5 | Keenjhar backwaters | 25.007, 68.072 | Dry arid land surrounded by thick marginal growth on the edges of the lakeside with thick marsh growth including *Typha* and *Sacharum*. |

## METHODS

Data was obtained for this study using literature review, interviews with local villagers, fishermen, fish farmers, wildlife department officers and other relevant personnel, as well as track count method. Equipment used during the survey was a digital camera (Nikon P900), a monocular telescope (35x50), and field guides.

In addition to the field sites, interviews were held at the Main Mirpur Sakro bazaar (located at 24.552, 67.627) which is a community centre. A questionnaire was created addressing most of the major questions in terms of otter distribution, occurrence, threats, etc. A picture collage containing pictures of the following species was also used: fishing cat (*Prionailurus viverrinus*), jungle cat (*Felis chaus*), Indian or black-naped hare (*Lepus nigricollis*), small Indian civet (*Viverricula indica*), Indian porcupine (*Hystrix indica*), and the smooth-coated otter. The collage was printed and shown to the interviewees who indicated that they had seen the otter. This was a tactic to remove possible misidentifications of otter sightings by local people and exaggeration.

## RESULTS

The data collected, mainly from local interviews, is summarised in Table 2. The results were classified on the basis of local information available, habitat reviews, and threats identified.

***Table 2. Data collected across each study site***

| Study site | Interviews | Habitat review | Direct observations | Indirect observations |
|---|---|---|---|---|
| 1 | Otters definitely occur but in very small numbers. Locals believe otters occur near the edges of the lake in thick vegetation but have declined in recent years. | Good, intact habitat. The lake is now being revived by the wildlife department with freshwater supply and active conservation measures (not specifically for the otters) | None | None |
| 2 | Otter presence is doubtful in recent years. They were frequent residents before. | Some areas still have thick marginal vegetation but it was being cut for different purposes by the local communities as observed during the survey. | None | None |
| 3 | Otters most likely do not occur near the fish farms because of both anthropogenic pressures as well as lack of denning and resting areas which require good, thick vegetation. | Little vegetation on the edges of the fish farms and private lakes. There are clear, large areas between widely separated fish farms with little to no vegetation. | None | None |
| 4 | Otters must still be present. The review by locals strongly suggests that some otter populations still exist in the surrounding areas. | Many interconnected canals and small freshwater lakes can provide good habitat for smooth-coated otters with very thick *Typha* and *Saccharum* growth in places. | None | None |
| 5 | Locals were well aware of the native name for smooth-coated otters but reported a steep decline in the last decade. | A large, natural lake adjoining dry, hilly areas with good, thick marsh growth and widespread intact area for otters. | None | None |

***Figure 2. Thick* Typha *and* Saccharum *growth at Haleji lake***

***Figure 3. Main Haleji lake***

***Figure 4. Canal leading to Haleji lake***

The interviews at Haleji lake (Figures 2 and 3) and surroundings resulted in a considerable amount of information. The locals, both villagers and wildlife field officers, are well aware of the presence of smooth-coated otters in the area and were very positive that they had seen them. All people interviewed positively identified the otter from the picture collage indicating strong otter presence in the area (Table 3), both in the lake and main canals nearby (Figure 4), at least historically.

***Table 3 Details of interviewees based on each site and positive identifications of otters.***

| Site no. | No of people interviewed | Percentage of positive identification (%) |
|---|---|---|
| 1 | 18 | 100 |
| 2 | 10 | 86 |
| 3 | 16 | 72 |
| 4 | 5 | 82 |
| 5 | 13 | 94 |
| **Total** | **62** | **–** |

At Site 1, Haleji, the case of a captive breeding centre of smooth-coated otters was also questioned. As per the information available from the wildlife department, there was a pair of smooth-coated otters kept in an enclosure at Haleji lake near the wildlife department office for captive breeding and display purposes. One was perhaps caught locally while the other individual was obtained from East Narra wetlands. However, approximately five years ago the pair clawed open the enclosure mesh and escaped into the surrounding waters of the lake. This indicates the strength and biting force of the animals. Locals in the adjoining villages were fairly aware of otter presence. At Main Mirpur Sakro bazaar, interviews revealed that otters are found in the areas adjoining Mirpur Sakro (Figure 5). Buharo, Gharo, and Ghulamullah (Figure 6) must have had a strong otter presence previously but not in recent years due to the increased human growth and settlements.

***Figure 5. Farm land at Sakro***

***Figure 6. Canal en route Ladiun***

Near Site 3, private fish farms, due to the lack of settlements very few people were interviewed. It was found that these areas only have otters sporadically. The increased anthropogenic pressures combined with habitat degradation have been the main threats here. Site 3, Sakro canal en route Ladiun, was very promising otter habitat and this was supported by local interviews. The last recorded sightings were

from only two years back at an isolated lake. It was interesting to note that locals also positively identified the other species on the picture collage (Figure 7).

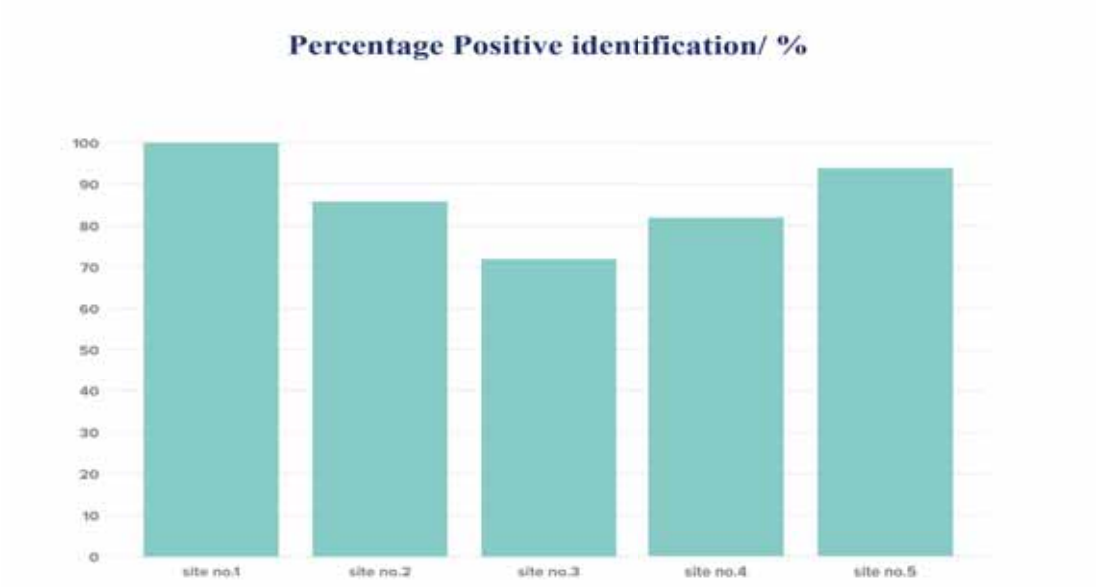


***Figure 7. Percentage positive composition bar graph based on each study site.***

At Site 5, locals, mainly with the profession of net-fishing, readily identified the otters. However, no threats were identified by the interviewees and they reported a steady decline in otter numbers from the last decade. In most places the habitat at the backwaters of the Keenjhar lake (Figure 8) seemed unaltered and thus, the threats are most likely unnatural.

***Figure 8. Onion cultivation adjoining Keenjhar lake***

There were no direct or indirect observations which is largely attributed to lack of time during the study.

### *Threats identified*

From our survey we concluded that the most dangerous threat to smooth-coated otters in the study sites was habitat degradation. At study Site 2, we found local

communities cutting marginal vegetation (Figure 9). Most of the thick vegetation near the Sakro canals had also been reduced by people in the surrounding settlements. Increased anthropogenic pressure is to be blamed and rapid growth of settlements around suitable otter habitats is also a big threat to the otters. Threats identified include:

- Habitat loss
- Anthropogenic pressures
- Lack of awareness/fear psychosis
- Water pollution
- Illegal wildlife trade

***Figure 9. Thick marginal vegetation being cut by locals before Haleji lake***

## DISCUSSION

From the data collected through this small initiative and preliminary investigation it can be confirmed that the smooth-coated otter (*Lutrogale perspicillita* race *sindica*) still occurs, although in relatively small and isolated pockets, around the selected wetland sites. However, the future of smooth-coated otter populations in Lower Sindh wetlands appears bleak. Numbers are rapidly declining largely due to the following threats: decimation of wetlands; human–wildlife conflicts, principally conflicts with fish farmers; pollution; lack of awareness, and illegal wildlife trade **(Khan et al., 2009)**. This species has hitherto not been studied in detail in Pakistan (**Hussain and Chaudhry, 1997**), where a deficiency of studies on the biology and genetics of the local smooth-coated otter population was identified by **Khan et al. (2010);** but since then, detailed work has been carried out in 2017 **(Moretti, 2017)**. The results of this study highlight the need for timely and effective conservation measures to protect the smooth-coated otters and their habitat in Lower Sindh.

**Acknowledgements**
The author sincerely thanks the cooperative and helpful Sindh wildlife field staff at the Haleji lake. This survey would not have been possible without the support of the International Otter Survival Fund and the help of the local villagers who assisted and guided us along the survey.

**Funding**
The author is also very grateful to the International Otter Survival Fund for generously providing financial support for this small initiative and assisting in shedding light on the plight of this species in Pakistan.

**Disclosure Statement**
No potential conflict of interest was reported by the author.

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# ACTIVITY BUDGETS AND BEHAVIOUR OF THE SMOOTH-COATED OTTER (*Lutrogale perspicillata*) IN A HUMAN-DOMINATED LANDSCAPE

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**Abstract**

*Habitats suffer from numerous threats, including fragmentation, destruction, and degradation, endangering the species encompassed within these ecosystems. Freshwater ecosystems are vulnerable to numerous stressors which impact the fauna found within them. Smooth-coated otters (*Lutrogale perspicillata*) inhabit freshwater ecosystems, acting as a keystone species and bioindicator. Populations are declining due to numerous threats calling for further research and improved conservation strategies. Standardised camera trapping was used to study three family groups of smooth-coated otters on Chorão Island, Goa, India, to understand their behaviour and activity budgets at different distances from anthropogenic activity. Smooth-coated otter and human presence was recorded to understand how the species have responded to human encroachment. Data collection took place over six weeks during the dry season in 2019. The results reveal distinct activity patterns, with low smooth-coated otter presence during the peak human activity and a high presence during low human activity. Activity budgets between the groups varied greatly, the species exhibited increased alertness when close to human activity. The species may have adapted to coexist with humans by changing their behaviour and visitation times. Further research is required, especially to understand the impact of smooth-coated otters exhibiting sentry behaviour for prolonged periods.*

***Keywords:*** *Smooth-coated otter; activity budget; mangrove; human-dominated; sentry*

## INTRODUCTION

Human activity in natural landscapes is increasing, threatening indigenous biodiversity. Habitat use is characteristically determined by resting sites, feeding, and reproduction **(Perrin and Carranza, 2000)**. A species' habitat is multidimensional, involving several variables and conditions resulting from interactions with the environment **(Madhusudhan and Johnsingh, 1998)**.

As the human population continues to grow exponentially, the smooth-coated otter (*Lutrogale perspicillata*) habitat will increasingly be under threat. As their habitat becomes encroached by humans, they are forced to coexist alongside us. To tolerate such conditions, they may have changed their behaviour to adapt. Little literature exists regarding the smooth-coated otters' ability to adapt to diverse habitats, especially under anthropogenic pressures. There is a lack of research into the population dynamics and behaviours of the species in India. This may be due to their elusive nature and difficulty in collecting data with marginal disturbance. Understanding the behaviour of smooth-coated otters coexisting in a landscape with

anthropogenic activity is essential for identifying threats and providing an insight into the future of the species' population as the human population continues to grow.

This study aims to understand the behaviour of smooth-coated otters in a human-dominated landscape and how they have adapted to coexist with humans. Smooth-coated otter and human presence were recorded to identify activity patterns, and activity budgets for the species were formed to evaluate their behaviour in response to humans.

## MATERIALS AND METHODS

### *Study site*


***Figure 1. Location of study area in Goa***

Smooth-coated otters were studied on Chorão Island (15.5256 ° N, 73.8753 ° E), located along the Mandovi River in Goa, India (Figure 1). The island has an approximate size of 20km$^2$, and the human population is approximately 7000, with settlements located across much of it. The island is mainly accessed by two ferries, resulting in frequent river disturbance. A traditional eco-friendly production system functions on the island, known as the Khazan lands. Khazans are land that has been reclaimed from the sea or river **(Bhonsle and Krishnan, 2011)**, and are primarily used for fishing activities causing frequent human disturbance for otters.

### *Camera trapping for smooth-coated otters*

The study took place over seven weeks, including a one-week pilot study, during March and April 2019. Standardised camera trapping was used to capture the behaviour and activity of smooth-coated otters within a human-dominated landscape. Two Apeman 16MP 1080P Trail Wildlife Camera Traps and one Bushnell Megapixel Trophy(R) Essential E3 HD Low-Glow Camera Trap were used to record three different smooth-coated otter family groups. Camera traps were placed in mangrove environments located in the Khazan lands and were active 24 hours a day.

### *Exploratory survey*

An exploratory survey was conducted to assess potential locations for camera traps. All accessible water bodies on Chorão Island were surveyed over three days and smooth-coated otter activity was marked using a GPS device. Activity recorded included spraints, defecation areas, pugmarks, grooming sites, den (holt) sites, and direct observations (Figure 2). To represent the current activity on the island, spraints and defecating areas were only marked if they were recent, based on the colour and odour.

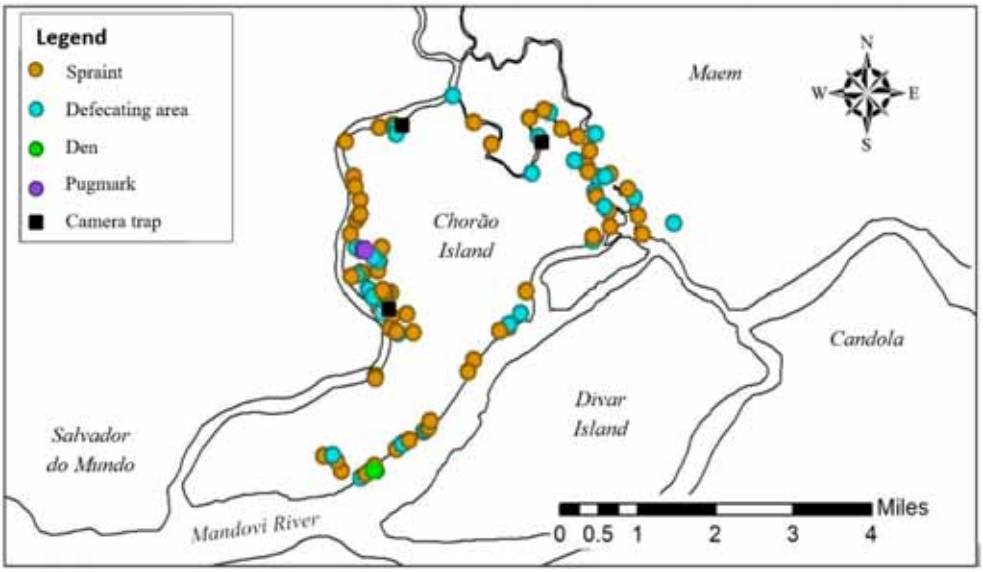


***Figure 2. GPS data from exploratory survey for smooth-coated otter activity and camera trap locations.***

### *Pilot study*

Data from the exploratory survey provided information for camera trap locations based on smooth-coated otter activity. The maximum home range estimates of smooth-coated otters are 2.1–6.6km$^2$ for males and 2.1–2.7km$^2$ for females **(Hussain and Choudhury, 1993)**. The camera traps were placed at least 2.1km from one another to film three different smooth-coated otter groups and avoid an overlap between the home ranges. The size of the island and areas of activity meant only the lower habitat range limit could be achieved. The pilot study lasted for one week to assess the viability of the locations.

### *Camera trap locations*

Each of the camera traps was located near a defecating area. The first camera trap location (low: 12m) was closest to human activity (Table 1). There was a high volume of river disturbance in the surrounding waterbody with a nearby sluice gate (20.70m away) and frequent ferries in the main river. Due to frequent human activity, there was an established path through the vegetation passing the defecating area, leaving it exposed. The defecating areas of the second (medium: 143m) and third

(high: 368m) camera traps were located on retaining walls surrounding a fishing pool with frequent human activity. Adjacent to each wall was an established path occasionally used by vehicles.

***Table 1. Distance of each camera trap to anthropogenic activity.***

| **Human activity** | **Distance (m)** | | |
|---|---|---|---|
| | Low: 12m | Medium: 143m | High: 386m |
| Fishing hut | 12.39 | 142.48 | 367.81 |
| Settlement | 36 | 783.77 | 487.76 |
| Road | 16.75 | 447.06 | 777.9 |

### *Data collection*

The locations used during the pilot study remained. Humans present during checks were documented to display the frequency of human activity at each location. Caution was taken when conducting camera trap checks to ensure disturbance was not caused to the species.

There were 41 camera trap days recording for 983 hrs, collecting 1738 recordings (low: 12m, 680 clips; medium: 143m, 336 clips; and high: 368m, 722 clips). Of the recordings, 7.8% (135.6 hrs) featured smooth-coated otters with a variation in the number of clips captured at each location (low: 12m, 73 clips; medium: 143m, 45 clips; high: 368m. 18 clips). For the footage, 869 minutes were captured, and of these 68 minutes were clips containing smooth-coated otters. The camera trap at high: 368m was stolen at the end of the fourth week of the study; thus, the camera trap effort was 432 hrs. This highlights the intensity of human presence within the smooth-coated otter habitat.

Data collected from each camera trap has been combined to understand smooth-coated otter activity and human activity across the island. The presence of smooth-coated otters and humans was calculated using the total number of clips in which they appeared. When calculating human presence, camera trap checks were not included. Average activity budgets have been created by timing and recording the behaviours exhibited by each member of the groups. Fishing times were obtained from an online source and used to create the daily average major fishing periods **(Tides Chart, 2019)**.

## RESULTS

### *Activity budgets*

The activity budgets for each camera trap display the behaviour of the smooth-coated otter groups at each location (Figure 3). From low: 12m to high: 368m, there is a

substantial decrease in the percentage of time spent exhibiting sentry and grooming behaviour. Grooming may be due to the suitability of the location rather than human influence. The low: 12m group spent the lowest percentage of time defecating, while the other groups spent approximately a fifth of the overall time. Just over half the time at high: 368m was spent exhibiting locomotion; this is significantly higher than the other locations. Resting was not observed at medium: 143m and the time spent resting at the remaining locations was relatively low.

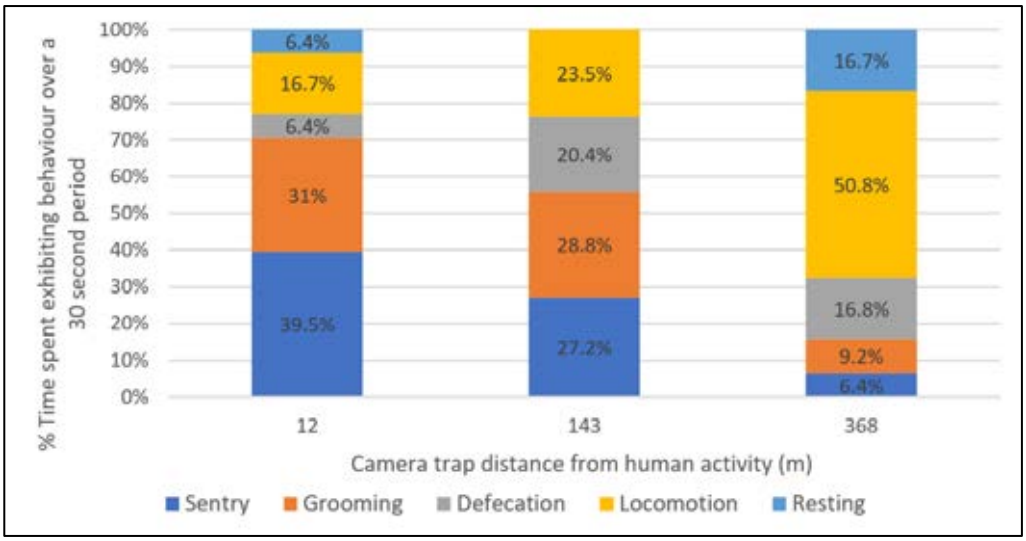


***Figure 3. Average activity budget for smooth-coated otters at each camera trap location using data from entire study. Behaviour is represented as a percentage of the 30-second video clip.***

### *Smooth-coated otter and human activity*

Breaking the day down into 10-minute segments allows for a detailed analysis. The combined camera trap data demonstrates that human activity primarily occurs during hours of daylight, while smooth-coated otter activity is in sporadic periods throughout the day, with increased activity during the night (Figure 4). There are clear overlaps of activity, however, when activity is highest for each species, the other has a low presence. A polynomial line of best fit has been used to represent the fluctuating data. The lines of best fit demonstrate that as human activity increases throughout the day, smooth-coated otter activity has a slight decrease.

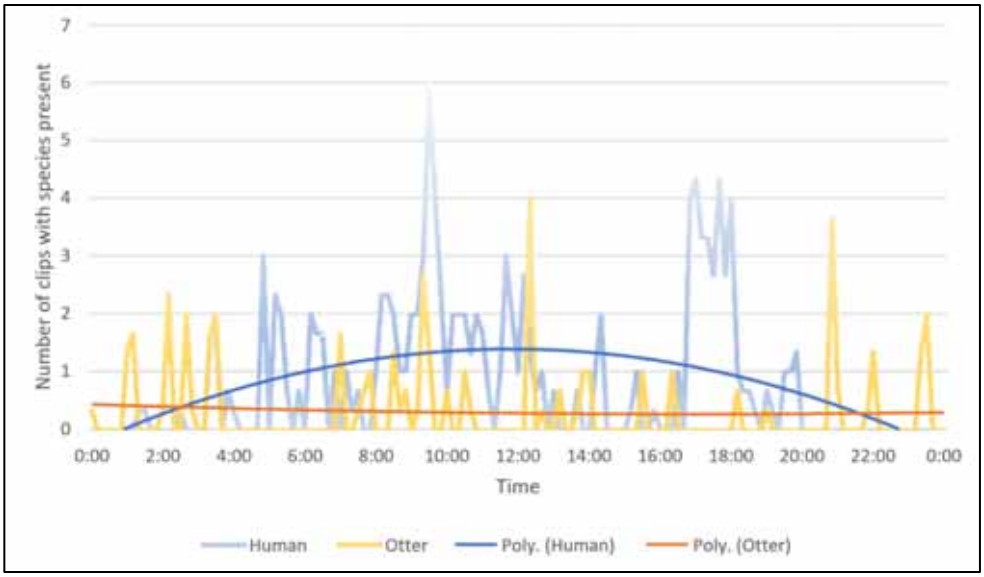


***Figure 4. Combined data from all camera traps for smooth-coated otter and human activity every 10 minutes over 24 hours.***

A Spearman's correlation tested smooth-coated otter presence against human presence and demonstrated a very weak negative correlation $r_s$ value = -0.116, $n$ = 6, and $p$ = 0.827. The weak correlation suggests there is no relationship as it is not significant.

During each camera trap check, human presence was recorded. Human presence was 54.5% at low: 12m, 91.7% at medium: 143m, and 100% at high: 368m.

### *Fishing periods and visitation patterns*

The number of smooth-coated otter individuals during each visit varied. At low: 12m, the number of individuals that visited were one 20%, two 26%, three 8%, four 7%, and five 39%. At medium: 143m, the number of individuals that visited were one 29%, two 13%, three 36%, four 20%, and five 2%. The high: 368m camera trap had one individual visiting most often (67%), with another smooth-coated otter occasionally joining (33%).

Smooth-coated otter activity between camera traps has been compared to display the impact that distance from human activity has on their behaviour (Figure 5). The low: 12m population was most active during the night, with less activity during daylight hours. The medium: 143m population had intermittent activity throughout the 24 hours, while the high: 368m population was most active during the day with only two hours of activity during the night. There was no activity at any of the locations between the hours of 4:00 and 6:00. Referring to Figure 4, these are the hours when human activity begins to take place, indicating that smooth-coated otters avoid interaction at this hour.

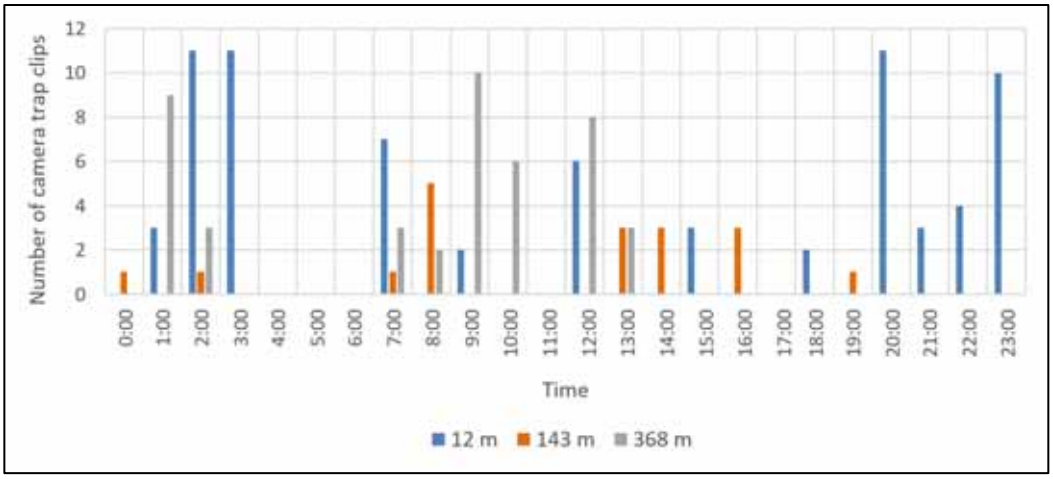


***Figure 5. Number of camera trap clips at each location containing smooth-coated otters over 24 hours.***

The average time for the two fishing periods across the study was calculated (first period, 05:57–07:57; second period, 17:58–19:58) and plotted against smooth-coated otter activity (Figure 6). The species has a higher presence during the first major fishing period than the second. Referring to Figures 4 and 5, human presence is high in the second period.

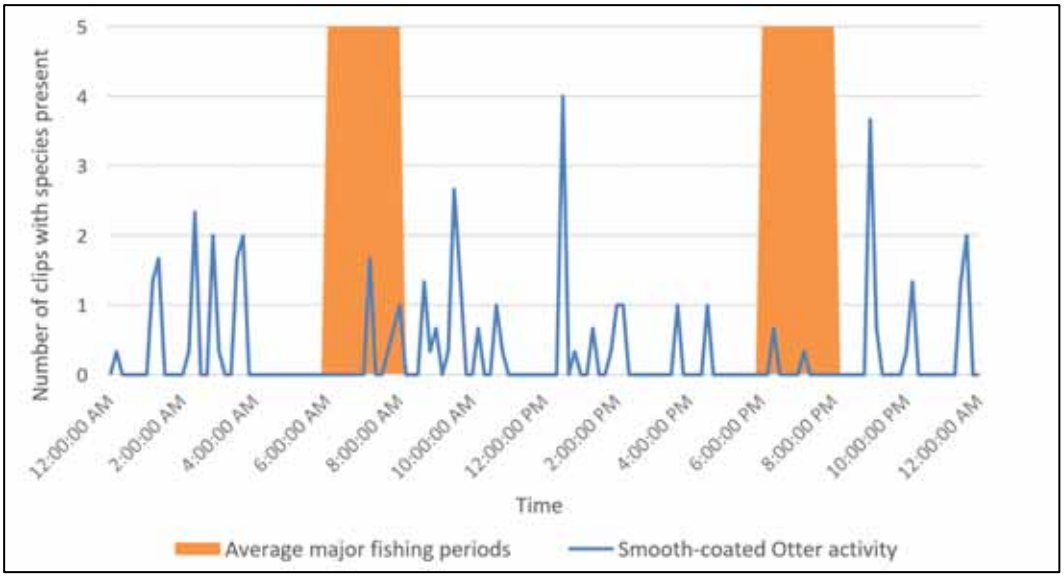


***Figure 6. Smooth-coated otter activity every 10 minutes compared to average major fishing periods across study.***

### *Sentry behaviour*

Sentry behaviour indicates the level of alertness exhibited by the species and how cautious they are in a location. Comparing the length of time humans are present on the footage to the length of time sentry behaviour is exhibited allows for a relationship to be identified (Figure 7). Human presence has a clear increase until

midday, followed by a decrease. The average sentry time of smooth-coated otters follows a similar trend but does not decrease as significantly. There are four instances when smooth-coated otters are not present at all; in contrast, the length of time that humans are present is among the highest values recorded.

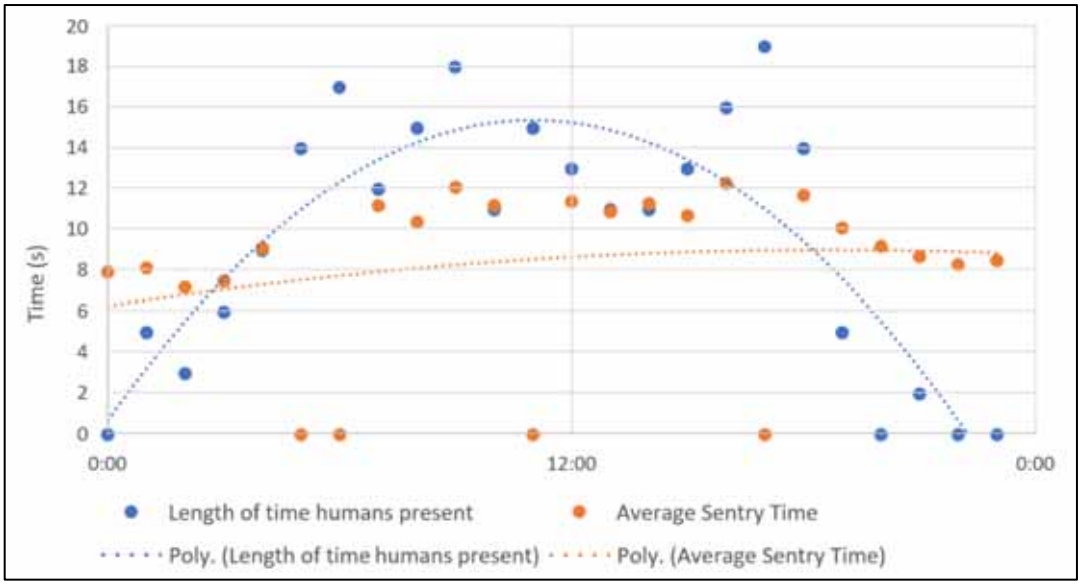


***Figure 7. Comparing the length of time humans are present on the camera trap to the length of time that smooth-coated otters exhibit sentry behaviour. Data represent each hour of the day.***

A Spearman's correlation was carried out comparing the length of time humans were present on the camera trap to the length of time smooth-coated otters exhibited sentry behaviour. There is a weak positive correlation between human activity and sentry behaviour $r_s$ value = 0.110, $n$ = 24, and $p$ = 0.610. The correlation is not significant, therefore there is no relationship.

The gap between exhibiting sentry behaviour displays how often smooth-coated otters stop the behaviour they were exhibiting to be alert. At low: 12m, the average sentry gap was lowest (2.4s), followed by medium: 143m (4s), with the highest sentry gap at high: 368m (12.1s).

## DISCUSSION

This is the first study to explore the behaviour and activity budgets of smooth-coated otters in a human-dominated landscape in India. **Kamjing et al. (2017)** mentioned that visitation patterns need to be studied, the research conducted in this study provides an insight into this area of activity. Additionally, it assesses the activity of smooth-coated otters concerning human activity to understand the impact anthropogenic activity has on the species and whether this has caused changes in their behaviour.

Smooth-coated otter activity was at its highest when human presence was absent or

minimal. However, the species' activity was not limited to these hours of low human presence and they displayed occasional relatively high levels of activity during peak periods of human activity. The group at low: 12m was primarily nocturnal with infrequent activity during the day, in contrast to the other groups which exhibited diurnal behaviour. Groups at medium: 143m and high: 368m contrast with a study along the Chambal River where they were predominantly nocturnal **(Hussain, 2013)**. The nocturnal behaviour observed was presumed to be an adaption to avoid disturbance, limit exposure to the tropical heat, and exploit prey. However, fish activity **(Hussain 2013)** was largely restricted to dark periods whereas fishing periods on Chorão occurred during daylight hours. **Khan et al. (2014)** discovered that smooth-coated otter occurrence is associated with calm and shallow regions with a low water velocity and fishing pools on Chorão Island have a gentle flow with a relatively shallow depth.

Visitation patterns display a decrease in smooth-coated otter activity during the day as human activity rises. It can be assumed that the species have adapted their behaviour to human activity and are minimising interactions with humans. **Ali et al. (2010)** suggested that smooth-coated otter presence decreases as the distance to human activity decreases, and this is consistent with the findings of this study. The number of individuals present during each visit varied. On occasion, members of the group would return to the site to mark their territory. There was one individual who visited the site furthest from human activity most often, and it was most likely a transient male. The male may be part of the group at medium: 143m as the fifth member of the group was not present throughout the whole study, and this would explain the adult's absence.

Smooth-coated otters are present during the first major fishing period; this will be a peak time for them to feed as there is a high density of prey available, requiring less energy to hunt. The results for human presence indicate that fishermen focus efforts on the second major fishing period. While there is a prominent human presence in the morning, it declines from 07:00, and smooth-coated otter activity increases then. The species may take advantage of the fishing period after fishermen have finished. Following the second fishing period, there is a spike in smooth-coated otter activity. Their activity around these fishing periods suggests they have adapted their hunting times around aquaculture activities.

Smooth-coated otters have adapted to the human-dominated landscape by increasing their level of alertness when close to anthropogenic activity. The activity budgets demonstrate that they spend a greater proportion of time exhibiting sentry behaviour when they are closer to human activity regularly checking the surroundings. The average sentry gap is greater when the distance to human activity is larger; this is likely to be due to the species feeling less threatened and are therefore less alert. It is a necessary behaviour essential for coexisting with humans.

Only one den site was located during the exploratory survey indicating that while the species coexist with humans, the dens are in inaccessible areas far from human activity. The smooth-coated otter population on Chorão is not the only example of the species inhabiting a human-dominated landscape, such as the population in Singapore **(Theng and Sivasothi, 2016)** and groups present in other Asian countries, including the Inner Gulf of Thailand **(Kamjing et al., 2017)**. Smooth-coated otter presence in these regions has been linked to aquaculture and the availability of resources. **Kamjing et al. (2017)** studied the occurrence of smooth-coated otters in the Inner Gulf of Thailand and stated that the roads in the area studied were relatively minor, much like those on Chorão. Despite the minimal infrastructure, there was still a negative association between the urban cover and smooth-coated otter occupancy.

Khazan lands provide a suitable habitat for smooth-coated otters, matching factors that affected habitat selection for a population studied in Kerala, India **(Anoop and Hussain, 2004)**. Fishing pools provide a constant supply of prey. However, while they may provide an appropriate habitat, there is constant disturbance by fishermen. Local human disturbance may also be caused by other factors such as infrastructure and communities. **Theng and Sivasothi (2016)** found that provided there are sufficient prey and patches of suitable habitat available, smooth-coated otters can persist in urban areas. Thus, potentially the abundance of prey outweighs the disturbance.

Camera trapping records species in their natural environment with minimal invasion. However, camera trapping was still disruptive as checks needed to be conducted twice a week. This continual presence will have contributed to the overall human presence and potentially adversely impacted the likelihood of smooth-coated otter presence. Smooth-coated otters are aquatic mammals; therefore, much of their time is spent in the water. This must be considered when comparing their presence and activity with that of humans. It could be that their limited presence on land during fishing times was because they were present in the water.

Attitudes towards smooth-coated otters from fishermen requires further understanding. **Kamjing et al. (2017)** conducted interviews with aquaculture farmers and found that they largely had negative attitudes towards smooth-coated otters. To increase the number of people with a liberal attitude, **Kamjing et al. (2017)** advised that meetings between farmers with opposing views could reduce hostility towards the species and facilitate knowledge sharing. While the attitude of fishermen on Chorão Island is unknown, engaging them in the conservation of smooth-coated otters will be beneficial to the species and the fishermen. In Singapore, public records have played a key role in understanding the distribution of smooth-coated otters, enhancing the success of ongoing conservation efforts.

Existing research focuses on the habitat of smooth-coated otter, but further research

is key in gaining a greater understanding of the species' behaviour, ecology, threats, and other areas of their lifecycle. Living in a human-dominated landscape means that species are spending a large proportion of their time exhibiting sentry behaviour. The physical behaviour can be identified, but the biological effects are not known. Physical changes could occur which could adversely impact their health. Populations of smooth-coated otters inhabiting areas within a different landscape, encompassing greater infrastructure, and a higher human population need to be studied to understand the different threats to the species. While there are temporal and spatial limitations, the research provides an understanding of smooth-coated otter behaviour.

Anthropogenic activities are a constant threat to the species **(Qureshi et al., 2009)**. A lack of community awareness is the root of the issue **(Suthar et al., 2017)**. **Khan et al. (2009)** stated that it is mandatory to conserve smooth-coated otters as their population diminishes due to increasing threats endangering their existence. Further research will increase the species database allowing for well-informed plans and policies to be created. This study suggests that smooth-coated otters have adapted their behaviour to live alongside anthropogenic activity; however, we need to understand long-term coexistence to ensure we are not further threatening their survival.

## CONCLUSION

The research demonstrates that smooth-coated otters have adapted to live in a human-dominated landscape and coexist alongside humans. Activity budgets and behaviour, alongside visitation patterns, display apparent changes when the species is close to human activity. Despite the disturbance, the species appear to have remained on the island, potentially due to the availability of resources.

Sentry behaviour raises concerns as we do not understand the health implications of the species exhibiting such a high level of alertness for extended periods. There are many other gaps in data calling for increased research efforts, which will support conservation actions. Awareness is fundamental in ensuring the success of conservation strategies. Forming community organisations will create a multidisciplinary approach to conserving the species. As diverse ecosystems will cease to function without their presence, conserving smooth-coated otters is essential.

## Acknowledgements

I would like to thank my supervisor, Dr Jake Bicknell, for his help and guidance throughout the project, especially in assisting me with my data. I am also thankful for the support given by other members of the Durrell Institute of Conservation and Ecology. Data collection would not have been possible without the help of Wild Otters, especially Katrina Fernandez. Finally, I am immensely grateful for the support given by my family and friends.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Disclosure Statement

No potential conflict of interest was reported by the author.

## Author Biography

KATRINE BURFORD-BRADSHAW graduated in 2020 from the University of Kent with a First Class degree in Wildlife Conservation with a year in Professional Practice. Research was collected during their placement year with Wild Otters. The author is an Environmental and Media Consultant and an Academic Editor.

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# DISTRIBUTION, THREATS AND COMMUNITY PERCEPTIONS OF OTTERS IN SHUKLAPHANTA NATIONAL PARK, NEPAL

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**Abstract**

*This research recorded otter signs in the Chaudhar River and Kalikich Lake in Shuklaphanta National Park, Nepal. We also surveyed the perceptions of otters held by local community members and investigated the distribution and status of otters. The field survey was carried out by a transect survey and a total of 68 transects were carried out (n=68). A survey of key informants (n=9) and a questionnaire survey was also given to local people (n=90). During the survey, 75% of otter signs were in the form of spraints (scats), 15.6% were tracks, and 9.4% were actual sightings of the otters. The study also explored the threats to otter populations in Shuklaphanta National Park, which included water pollution, hunting, forest fires, loss of wetland habitat, and overall loss of prey. A majority of the local people supported the conservation of otters. This paper recommends the implementation of conservation activities such as further awareness programmes for the local people and policy makers as well as for the appropriate management of otter habitats. We hope this study will encourage government agencies, academic institutions, and other stakeholders to increase research and conservation activities as well as to initiate scientific researches to ensure a minimum viable population of the species in the country.*

***Keywords:*** *Awareness; otters; Shuklaphanta National Park; Chaudhar River; Kalikich Lake; threats*

## INTRODUCTION

Otters are members of the family Mustelidae, Order Carnivora (Class Mammalia), which live as a semi-aquatic animal (**Duplaix, 1980**). They are important biological indicators of the health of the environment especially in aquatic habitats including wetlands, freshwater river systems, and also along coastal habitats (**Hussain and Choudhury, 1997**). Most otter species are nocturnal and/or are crepuscular (**Green et al., 1984**) and feed mainly on fish and crustaceans. Otters have faced a dramatic

historic decline worldwide from the mid-1980s with a rate of 17.5%/year in the 1990s. Research conducted by **Duplaix and Savage** (**2018**) reported that otters in Asia are threatened by many factors including habitat destruction, hunting and environmental pollution.

Globally, to date, 13 species of otter have been recorded, and three species occur in Nepal, i.e., Eurasian otter (*Lutra lutra*), smooth-coated otter (*Lutrogale perscipillata*), and Asian small-clawed otter (*Aonyx cinereus*).

Eurasian otters are mainly distributed in mountain streams, rivers and lakes (**Acharya and Rajbhandari, 2012; 2014**) and are also reported in the different lakes and rivers of Pokhara metropolitan city which includes Begnas Lake, Rupa Lake, and West Seti river (**Acharya and Gurung, 1994**). They usually have a holt (den) on the banks of lakes and rivers covered with ferns and other bushes (**Acharya and Gurung, 1994**). They are categorised as Near Threatened (NT) in the International Union for Conservation of Nature (IUCN) Red List, are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Annexes II of the Bern Convention, and Annex II and IV of EC Habitat Directive (**Mason and Macdonald, 1986; Roos et al., 2015**).

Smooth-coated otters are reported in the rivers of Karnali, Mahakali, Koshi and Narayani Rivers (**Evans et al., 1985**) and in Annapurna Conservation Area, Bardia National Park, Makalu Barun National Park, Shuklaphanta National Park, and Chitwan National Park (**Suwal and Verheught, 1995**). They are protected in Nepal by the Aquatic Life Protection Act (2002). They require bankside vegetation adjacent to the water for security. The species is classified as Vulnerable in the IUCN Red List and is in CITES Appendix I.

Asian small-clawed otters are recorded in Kailali and Kanchanpur districts (**Suwal and Verheught, 1995**) and are classified as Nearly Threatened in IUCN Red List.

Obtaining estimates of population parameters and habitat requirements for otters pose challenges because of their elusive nature and semi-aquatic lifestyle. It has been reported that the number of otters is declining rapidly as wetlands are under threat due to adverse anthropogenic disturbances (urbanisation, industrialisation, poisoning, etc.) and natural factors (**Duplaix and Savage, 2018**). Habitat destruction due to slash and burn agricultural practices, cutting of trees, trapping and hunting of wildlife, human disturbances, conflicts with fishpond owners, water pollution, intentional killing, and inadequate awareness are the major threats to otters in Nepal (**Kafle et al., 2008**). Global climate change patterns and the micro-climate patterns in wetlands have also played a role in declining their population. Climate change is associated with a rise in global average temperature, which can dry out wetlands and promote the growth of bacteria and parasites in water that can affect the health of otters (**Mawdsley et al., 2009**). Elusive carnivores like otters are very hard to detect and monitor so we have to rely on indirect methods for their detection e.g. sign

surveys such as camera trapping, faeces, footprint, scratches, and live trapping. Sign surveys are the most efficient method both in economic and logistic terms (**Barea-Azcón, et al., 2006**).

In Nepal, there has been little research into the status, distribution, and conservation threat of otters. Therefore, Shuklaphanta National Park (ShNP) has been chosen to conduct this research, to help assess information on the existing otters. Since there is clearly an issue over the status of otters and a growing human population as otters live in perennial streams and other freshwater ecosystems, which are also utilised by local people. Overall, the objective of this study is to document the distribution and threats to otters and to raise awareness with the authorities and local people about their importance in the balance of nature and conservation. The present study will explore the status, distribution and conservation threats to otter species found inside the ShNP river ecosystems. It will also serve as a baseline data for future research, action plan preparation, and implementation.

## STUDY AREA

The study was conducted in Chaudhar river (CR) and Kalikich lake (KL) located inside the Shuklaphanta National Park (ShNP), and flows from the eastern side of the National Park. ShNP is located at the southwest corner and is the farthest from the capital of Nepal situated in the Terai arc landscape (TAL). The Park lies between 28° 43’ 9.65” N and 29° 3’ 5.42” N latitude and 80° 3’ 39.09” E and 80° 24’ 43.08” E longitude with a total area of 305km$^2$ and altitudinal ranges from 80m to 600m above mean sea level. It has been considered an important protected area having a largest grass land of Nepal with over 56 species of mammals, 450 species of birds, 56 species of reptiles, 15 species of amphibians, and 24 species of fish. There are also 665 plant species within 438 genera and 118 families. This National Park is considered to have the highest biodiversity among the protected areas in Terai. Annual average precipitation was estimated 1832mm during the period of 1992 to 2001, while the maximum was recorded during August with 639.17mm and minimum was 3.98mm during November.

Geographically, ShNP is bound by the Syali river in the east, Mahakali river in the west, the Siwalik Hills in the north and east, and the Luggabhugga florican reserve of India in the south. The main water sources of the Park are four rivers (Mahakali, Syali, Bahuni, and Chaudhar). While selecting the sites, Kalikich, Sikari, Rani, Ghumauna, and Baba Lakes, and Chaudhar River were visited, as these are prime habitats of otter in Shuklaphanta NP. After a reconnaissance survey, these two sites, the Chaudhar river and Kalikich lake were chosen, as the most common habitats of the otter. After the reconnaissance survey the Park officials and rangers too were consulted regarding the habitats of otter.

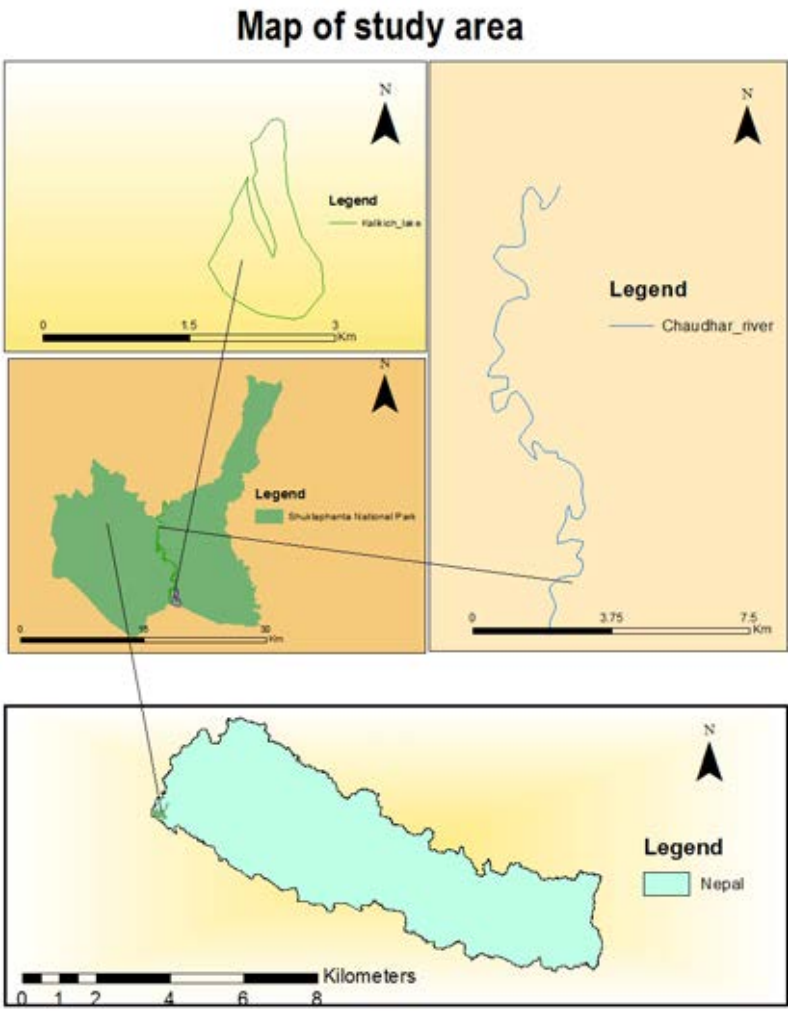


***Figure 1. Map of study area***

## METHODS

### *Transect survey*

For data collection, a linear transect sampling design was applied to observe the different otter signs along the bank of the waterways (both river and lake). Transects were 300m long, with a gap of 100m between transects to avoid spatial autocorrelation in data. A total of 68 transects were surveyed along the Chaudhar River and Kalikich Lake. These transects were sampling units for data collection. The survey was based on locating and recording reliable signs (mainly tracks and spraints). Otters defecate on prominent structures, such as rocks, tree trunks, islands, and river banks, and these droppings, known as spraints, can be easily observed in the field. Otter tracks are also clearly visible on sandy banks and in muddy sites along rivers (**Gupta et al., 2020**). The conspicuous nature of otter spraint enables researchers to easily verify the presence of otters in an area (**Reuther, 1999; Reuther and Roy, 2001**). Tracks of the otters were identified by a round impression

of five toes and faint webbing marks (**Jamwal et al., 2016**), whereas spraint of the otters were identified by the color and the state of decomposition and was classified as very fresh, fresh, old, and very old. GPS location was recorded for each sign surveyed and distribution map was prepared using GIS software.

### *Key informant survey*

Representatives from different buffer zones were taken as key informants. For this, a total of nine people (n=9) were chosen to gather information on threats to otter and their perceptions about the conservation of otter species. A checklist was prepared for interviewing them. Formal and informal interviews were organised among the Park staff, wildlife biologists, wildlife technicians, school teachers, and community/ local leaders.

In addition, a semi-structured questionnaire was used to interview ninety (n=90) local community members, including local fisher communities and tour guides to understand their attitudes towards otters. The local community members answered the questions about the distribution, threats and the status of otters in the study area. The responses of the local people were measured in Likert scale.

### *Data analysis*

Data collected from field survey was thoroughly analysed, using appropriate statistical tools or programmes, figures, charts, or tables depending on the nature of the data. Collected data was entered in MS-excel-2010, SPSS 19 and Arc Map 10.3. A map of otter distribution was prepared with the help of Arc Map 10.3. MS-excel, SPSS 19 were used to analyse data and the results were shown through simple tables and graphs. Descriptive statistics like mean, percentage, and frequency, and Likert scale were also used to interpret the results obtained.

## RESULTS AND DISCUSSION

### *Types of signs recorded*

Figure 2 represents the distribution of otter where various signs of otters were observed. A number of various signs, tracks, and otter spraints were sighted along the Chaudhar River and Kalikich Lake of ShNP. In the diagram, the green plot represents ShNP, and inside the green plot, the enclosed green border represents the Kalikich Lake (KL) and the blue line represents the Chaudhar River (CR). The circle represents where the otters were sighted, triangle represents the tracks observed, and the rectangle represents the spraints.

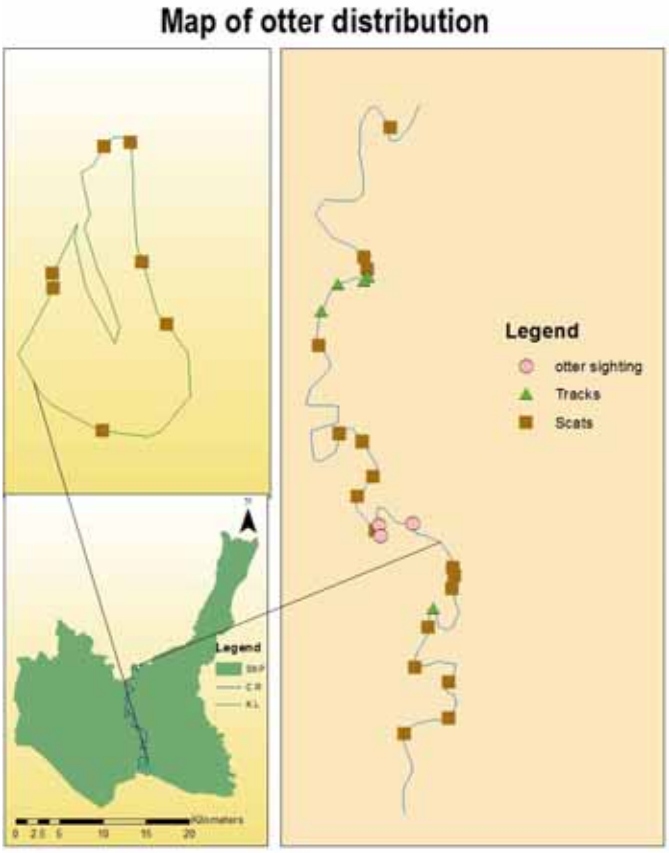


***Figure 2. Map of otter distribution***

Sixty-eight transects were surveyed in which 52 transects were along Chaudhar River and 16 were surveyed along Kalikich Lake. Otter signs, spraints, and tracks were recorded, and in some cases otters themselves were observed. During the survey, 13 otters were sighted; nine otters were sighted in the river and four on the river banks. Seventeen spraint signs and five tracks were recorded on the transects along Chaudhar River, whereas only seven spraint signs were observed along Kalikich Lake.


***Figure 3. Types of signs and photo of an otter taken during the study period***

Figure 3 represents the spraints comprising most of the signs (75%), tracks comprising (15.6%) and observed otters (9.4%). In our research, more spraints were observed in comparison to tracks and otter sightings.

Spraints were identified by tarry color, fishy and fragrant smell, and a size smaller, thinner, and darker than dog scat. The presence of fish bones in the spraint (**Jamwal et al., 2016**) was also identified using a location on single rocks 0.5–1m from the river edge. The identification of otter tracks was highly conservative, due to the abundance of feral dog tracks.

### *Condition of otter spraint*

The survey was conducted in March and April, when most of the seasonal rivers have very little water and lack fish, causing otters to migrate to nearby perennial rivers, which may account for more spraints found in the old and very old categories. A study carried out by **Hussain and Choudhury** (**1997**) also noted a similar situation in February and March, when swamps begin to dry and fish biomass is depleted, causing otters to move to perennial rivers.

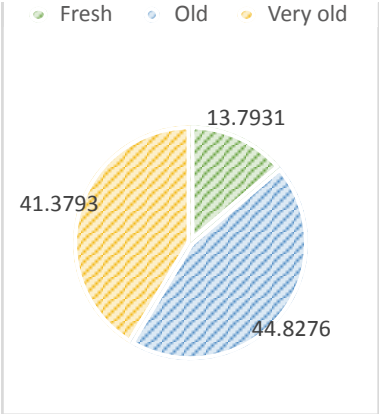


***Figure 4. Condition of spraint***

Figure 4 represents the condition of spraint in Chaudhar River site and Kalikich Lake. 44.1% was found to be in a very old condition, 44.8% in an old condition, and 13.8% was in a fresh condition.

### *Human disturbance in the study area*

As shown in Figure. 5, the study area is used by local communities for a variety of purposes namely: 75.9% for livestock grazing, 6.9% for tree logging; the remaining area of 17.2% did not have any disturbance at all.

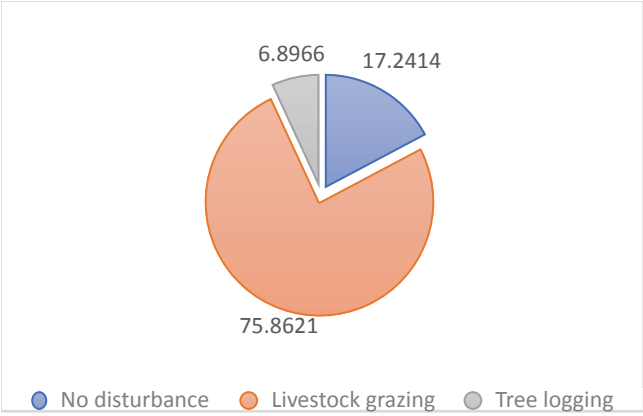


***Figure 5. Human disturbance***

### *Habitat preference by otters*

Most signs were collected near riverine forest with dense bankside vegetation, fallen logs, and dense canopy cover, and a few signs were collected near *Shorea robusta* forest (Figure 6).

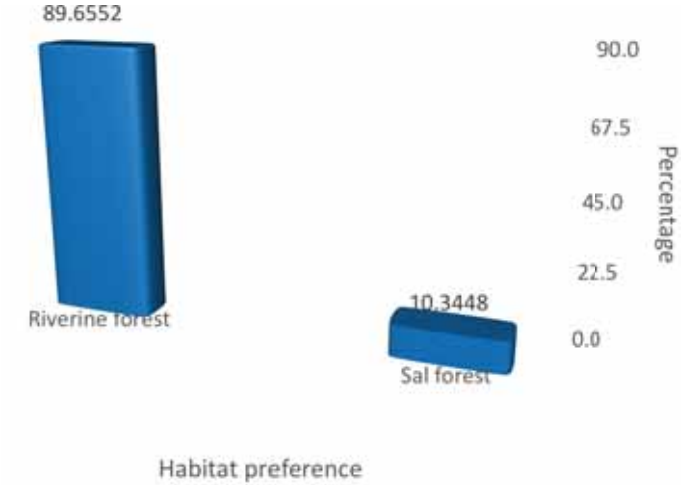


***Figure 6. Habitat preference***

89.7% signs were collected near riverine forest and only 10.3% signs were collected near *Shorea robusta* forest. Otters preferred nearby dense vegetation as places for resting.

### *Threats to otters*

Key informants reported that the major threats to otters in the study area were habitat degradation including loss of wetlands, water pollution, fish traps, loss of prey, hunting, and predation by other wild animals. The main causes of habitat degradation mentioned were forest fires, deforestation, illegal hunting, water pollution, encroachment, grazing, and fodder/grass collection. Local inhabitants also believe that climate change has affected the otter population because of a reduction in rainfall, and fluctuating temperatures.

Visiting the sites and conducting field surveys revealed that human disturbance, coverage of water with water hyacinth (*Eichhornia crassipes*), and loss of wetland could be the major threats. Kalikich Lake is almost covered by water hyacinth. Some of the other lakes like Ghumauna and Rani Lakes are also slowly drying up. These two lakes were also found to be good habitat of otters as reported by Park staff members and local people. But the loss of water has created threats to their lives. With regard to signs, high presence of old spraint compared to fresh spraint also proves that there may have been high human disturbances.

**Savage and Shrestha** (**2018**) reported that illegal hunting for the pelt trade is also a serious problem in Nepal. Otters are being killed by trapping the animal using several nets, chasing the animal to exhaustion and shooting (**Fitchett, 2013**).

### *Water pollution and loss of prey*

Different chemical fertilisers and pesticides are increasingly used by farmers to increase crop production. These toxins have run off towards water bodies and been absorbed by aquatic fauna. Pesticides are also used in fishing bait as well. The high concentration of organic matter and chemicals in effluents has killed fish and destroyed the plant life they depend on. The contamination of freshwater ecosystems with harmful chemicals can put otters at risk due to the adverse effects on their physiology.

### *Hunting and predation by other wild animals*

Fishpond owners have considered otters as a threat to fish farming as otters consume fish out of their ponds at night. To overcome this problem, otters used to be hunted using domestic dogs in buffer zone areas. There are records of killing of otters for their pelt, meat and for the uterus that is thought to have medicinal value, but the effects of hunting on their populations remains unknown (**IUCN Nepal 2004; DNPWC, 2019**).

## *Perceptions of local community members*

Table 1 shows the characteristics of the respondents, e.g. gender, age, etc. Of the 90 respondents, all reported having seen otters and were aware of otter signs such as spraints, tracks and dens.

***Table 1. Characteristics of respondents***

| **Respondents characteristics** | **Percentage (%)** | | | | | |
|---|---|---|---|---|---|---|
| Sex | Male | | Female | | | |
| | 67.8 | | 32.2 | | | |
| Age | (18-35) years | (36-49) years | (50 and above) years | | | |
| | 25.6 | 40 | 34.4 | | | |
| Occupation | Agriculture | Service | Housewife | Student | Teacher | Businessman |
| | 35.6 | 23.3 | 26.7 | 6.7 | 2.2 | 5.6 |
| Caste | Brahmin | Chhetry | Tharu | Dalit | Others | |
| | 21.1 | 25.6 | 47.8 | 4.4 | 1.1 | |
| Education | Illiterate | Primary | Secondary | Higher education | | |
| | 53.3 | 32.2 | 10.1 | 4.4 | | |

81.1% of respondents had seen otters in streams, 3.3% had seen otters in a paddy area, 10% had seen otters in the lake area, and 5.6% had seen an otter in other areas (Figure 7).

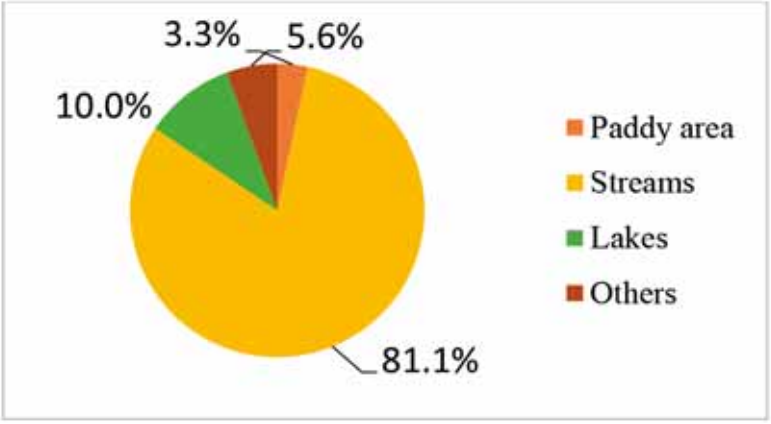


***Figure 7. Perceived otter presence by area***

A majority (61.6%) believed that otters are declining in the area and (39.9%) had no idea of the trend (Figure 8).

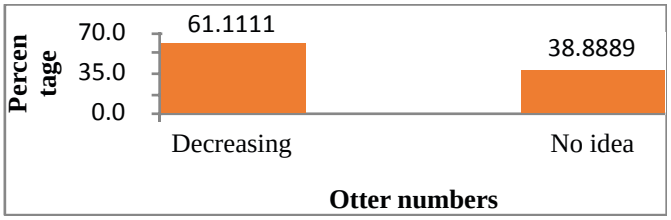


***Figure 8. Perceived trend in otter population***

Most respondents (85.6%) believe that habitat degradation is the main threat to otters swhile 14.4% believed that predation by other wild animals could be another important threat (Figure 9).

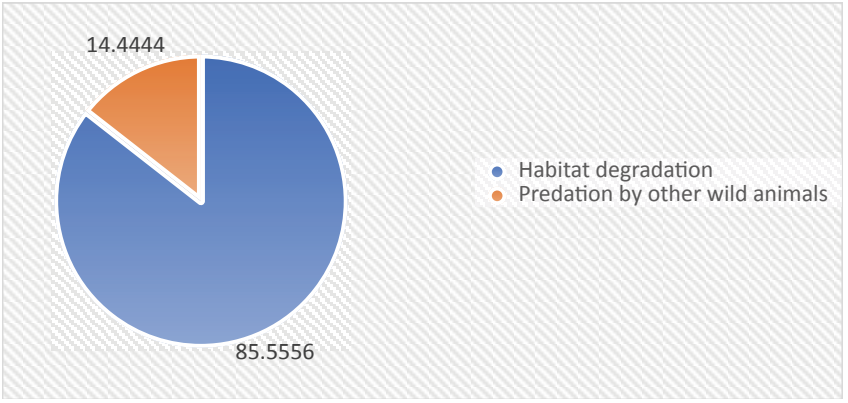


***Figure 9. Perceived threats to otters***

Of the respondents, 52.2% believe that deforestation is the main cause of habitat degradation and 47.8% believe that water pollution is the main cause (Figure 10).

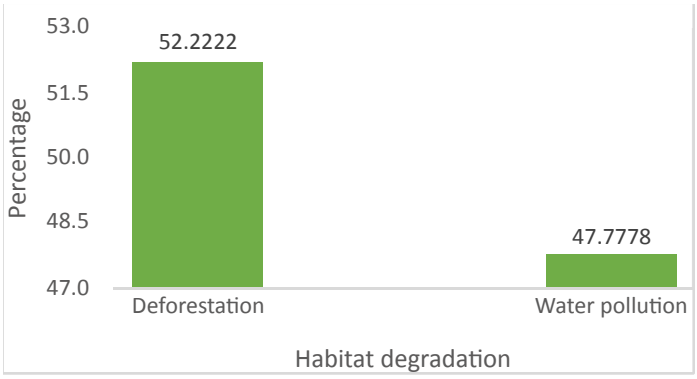


***Figure 10. Causes of habitat degradation***

Many respondents (60%) believe that climate change has affected the otter population and 40% of respondents have no idea about it (Figure 11).

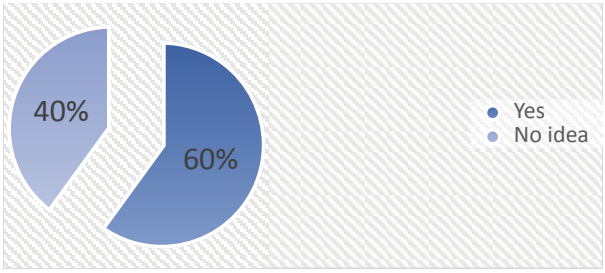


***Figure 11. Climate change effect on otter population***

Many respondents (65.6%) believe that otters are hunted for fur, 4.4% believe that otters are being hunted for meat, 18.9% believe that the otters being hunted for medicine, and 11.1% had no any idea about it (Figure 12).

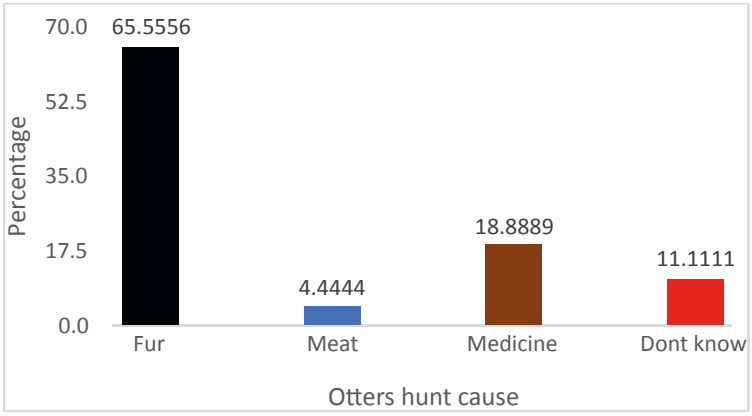


***Figure 12. Causes of otter hunting***

Community members were asked about the possible conservation measures that could be applied for otter conservation and they offered multiple options that can be effective. 68.9% of the respondents said that there should be an awareness

programme describing otters, including their habitat preference and desirable prey (Figure 13), and that nearby communities, Park staff, and tour guides can play a vital role in the conservation of otters. Also, 31.1% respondents suggested the formation of an otter conservation area considering the habitat required for the otter. Park officials and game scouts noted that poaching of otters has not been recorded or understood in the area.

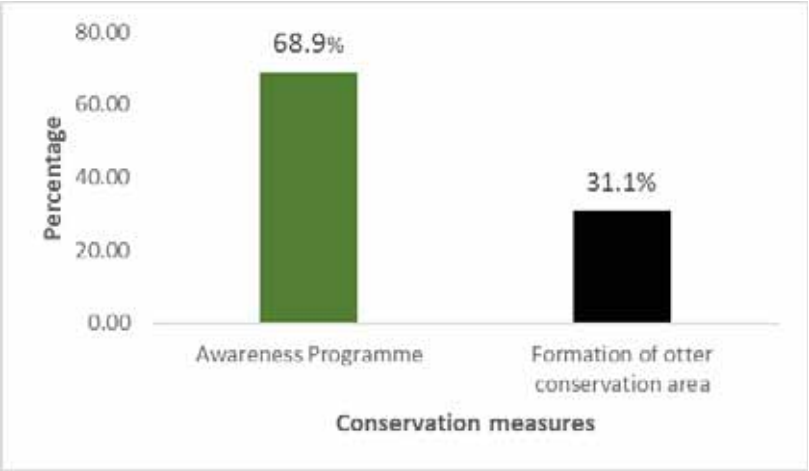


***Figure 13: Otter conservation measures***

## CONCLUSIONS

There appears to be a healthy population of otters in the ShNP, although habitat destruction, water pollution, and loss of wetland continue to threaten them. During the field visits to the rivers and lakes, it was evident that there was a lot of water hyacinth covering this water surface. Some of the lakes, like Rani Lake and Ghumauna Lake, are almost dried up. This has also created threats to otters in the Park. However, most local people are aware of otters in the area and their ecological importance and support their conservation. But still there is a further need to ensure regular monitoring of existing otter habitats by strengthening the capacities of local community members to help generate a database of the population status of otters. The National Parks and Wildlife Conservation Act of 1973 prohibits possession without a permit of 27 mammal species, but no otter species are included in the Act. Notwithstanding Nepal's role as a leader in wildlife conservation in Asia, illegal trade in wildlife is prevalent and remains difficult to control.

For better conservation, research about otters, their ecological behaviours, distribution, and factors affecting their distribution need to be carried out in all potential areas of Shuklaphanta National Park. Research and findings related to otters are to be taken into consideration while developing Park strategies and management plans for otter conservation. Providing this critical information to decision-makers in influential bodies, at national and international levels, will help to

promote the development of an otter conservation programme. Human induced threats such as tree logging, livestock grazing, and fishing should be regulated. Conservation education and awareness programmes relating to otters, and their ecological behaviours, are needed to be conducted at local level.

## Acknowledgments

We thank the anonymous reviewers and editors. Special thanks to those rural people and Park staff who shared their knowledge with us without hesitation. The Academician Workstation of Guiyang University, Guizhou Province ([2019]5605); The Regional First-class Discipline Construction of Guizhou Province to GYU ([2017]85); Provincial Key and Special Subject of Guizhou Province–Ecology (ZDXK[2015]11); The Training Project for High-Level Innovative Talents in Guizhou Province (2016 [4020]).

## Disclosure

No potential conflict of interest was reported by the authors.

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# RECENT RECORDS OF THE ENDANGERED HAIRY-NOSED OTTER (L*utra sumatrana*) IN SELANGOR, MALAYSIA

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**Abstract**

*Four species of otters are found in Malaysia: smooth-coated* (Lutrogale perspicillata), *Eurasian* (Lutra lutra), *Asian small-clawed (*Aonyx cinereus*), and hairy-nosed* (Lutra sumatrana). *The hairy-nosed otter is well known as the rarest otter species in the world, and is confined to Southeast Asia. Thought to be extinct in Malaysia, it was re-discovered in Sabah during 2010 and there have been more records and sightings in the last few years. However, the conservation of otters is often overshadowed by other larger and more charismatic species. Therefore, this study focuses on the hairy-nosed otter and reports on two recent records along the coastal and sub-coastal habitats of Selangor state. The first is camera trap footage of a single individual in the Kuala Selangor Nature Park, which is an area of mangrove, mudflat, artificial tidal lagoon and secondary forest. The second was a roadkill on the fringe of a peat swamp forest reserve and agricultural area dominated by paddy fields at Sungai Besar, Sabak Bernam district. Roadkill has been added to a list of main threats faced by Asian otters, such as wetland degradation, pollution, otter–human conflict, and illegal trading for pets. Therefore, extensive and comprehensive study is urgently needed to assess the status, distribution, and habitat use of the hairy-nosed otter along this stretch of coastal and sub-coastal habitats. The research results will be important in advocating the conservation actions for the hairy-nosed otter in the whole of Malaysia.*

***Keywords:*** *Hairy-nosed otter; camera trap; coastal; sub-coastal; roadkill; distribution; habitat use*

## INTRODUCTION

The Mustelidae represents the largest family in the Order Carnivora. This group is well known for its diversity and within the group is the Lutrinae, the otters. This is the only group that exhibits the characteristic of being entirely dependent on wetlands but also using terrestrial habitats. There are 13 extant otter species which include totally marine species, freshwater species, and some that use both habitats. Otters have been well known to play important ecological roles in the wetland ecosystem and contribute benefits to the surrounding communities. Hence, otters have been perceived as the ambassador of wetland conservation. Even though it has

this vital reputation, the otter is still facing serious threats such as wetland degradation, pollution, otter–human conflict, and illegal trade for pets.

Southeast Asia is home to four otter species, namely the smooth-coated otter (*Lutrogale perspicillata*), Asian small-clawed otter (*Aonyx cinereus)* – both listed as "Vulnerable" (**de Silva et al., 2015; Wright et al., 2015**) – Eurasian otter (*Lutra lutra)* – listed as "Near threatened" (**Roos et al., 2015)**, and hairy-nosed otter (*Lutra sumatrana)* listed as "Endangered" (**Aadrean et al., 2015**). The first two species mentioned are found throughout Asian regions and are widely distributed in Southeast Asia. The Eurasian otter has the widest distribution across the world, even into Europe and North Africa. The hairy-nosed otter is considered to be among the most unique, rarest otter species in the world and endemic to Southeast Asia (**International Otter Survival Fund, 2021**). The first three Asian otter species are listed in Appendix I of CITES but the hairy-nosed otter is listed in Appendix II (Convention on International Trade in Endangered Species of Wild Fauna and Flora, n.d.). Overall, research studies and conservation work of Asian otter species are still largely unexplored.

The hairy-nosed otter has a body length of around 1.3m in length and weighs around 7 to 8kg (**Wright, Olsson and Kanchanasaka, 2008**). It is distinguished from the other sympatric Asian otter species through its distinctly hairy rhinarium, as the other species have a hairless rhinarium. This is hard to distinguish in the wild unless you are able get very close to the otter and capture a clear picture of the rhinarium or can see a captive animal or road kill. Otherwise, hairy-nosed otters can be easily recognised from the obvious whitish lips, chin, and throat.

The range countries of the hairy-nosed otter are Cambodia, Indonesia, Malaysia, Thailand, and Vietnam (**Aadrean et al., 2015**). Based on the **PERHILITAN** (**2017**), the status of this species in peninsular Malaysia remains as "Endangered" due to its rarity and lack of studies. The Asian small-clawed otter is listed as "Near Threatened" and smooth-coated otter as "Least Concern" and both of these species are more commonly found in Malaysia. As the Eurasian otter has not been confirmed for a very long period of time it has been removed from the list. All otter species in Malaysia are considered to be "Totally Protected" based on the Wildlife Conservation Act 2010 which is enforced in the Peninsular Malaysia region; the laws in Sabah state (the Wildlife Conservation Enactment 1997) and Sarawak state (Wild Life Protection Ordinance 1998) only list the otters as "Protected" and a license can be issued to hunt, kill, keep, sell, or eat.

In Malaysia, the hairy-nosed otter was thought to be extinct until a single living individual was documented through a camera trap in the Deramakot Forest Reserve in Sabaha in 2010 (**Walker, 2010**). This was followed by more records being confirmed in a few sites distributed across the whole country. Likewise, historical data compiled by **Sasaki et al.** (**2009**) had concluded the presence of hairy-nosed

otters across a few states in Malaysia (Malacca, Perak, Selangor, Johor, Sabah, and Sarawak) based on museums and institutions specimens. **Abdul-Patah et al.** (**2020**) managed to map out the most recent distribution of hairy-nosed otters in Peninsular Malaysia based on the e-DNA technique with a total of seven localities across five states, including Kelantan which before this had no records. Hairy-nosed otters were thought to use mainly flooded habitats and peat swamp forests (**Sebastian, 1995**). Surprisingly, more general camera trapping studies and reported sightings have unveiled different types of habitats that can be inhabited by the species (**Baker, 2013; Salahshour, 2016; Ishigami et al., 2017; *Borneo Post*, 2020**).

The hairy-nosed otter is known as *Memerang Hidung Berbulu* in the local language of Peninsular Malaysia. Most of the local communities are able to recognise the "otter" but are unable to differentiate species due to the similarities in terms of physical appearances and the difficulty to get near for a clearer view as otters are sensitive and highly cautious. Conservation of otters in Malaysia is often overshadowed by the other larger and more charismatic species. In addition, the coastal and sub-coastal habitats which have not gained the same attention like tropical rainforests, have been highlighted as the priority habitats for research in smooth-coated otter and Asian small-clawed otter in Malaysia (**Foster-Turley, 1992**). Otters in coastal areas are more prone to the threat of otter–human conflict due to the expansion of aquaculture farms. With such important habitat for the survival of otters, documentation of otters along the coastline is very limited. During a terrestrial mammal survey in 2018 in the Kuala Selangor Nature Park (KSNP,) situated along the coastline of Selangor, a single individual hairy-nosed otter was captured through a camera trap. More recently, on 29 January 2020, a roadkill hairy-nosed otter was reported and the specimen was taken for further identification.

## DETAILS OF THE RECORD IN KUALA SELANGOR

KSNP (GPS location: 3.3390°N, 101.2448°E) is situated along the coastline North-Central Selangor Coast, or NCSC (GPS coordinate from 3.8444°N, 101.8152°E to 2.9762°N, 101.2811°E). It is an Important Bird and Biodiversity Area (IBA MY11) and is about 28,000 hectares, stretching for 110km between the Klang Islands in the south to Sungai Bernam in the North. KSNP is the first Park in Malaysia to be managed by an NGO, the Malaysian Nature Society (MNS). The Park serves as an educational centre focusing on the mangrove ecosystem. The size of the Park is 296 hectares and it consists of different habitats, which are the mangrove forest, secondary forest, artificial tidal lagoon, freshwater canals, and mudflats.

In 2018, MNS conducted Ramsar BioBlitz Seminar to support the submission of the Ramsar Information Sheet to the government. Before the seminar, a number of research activities were conducted to update the wildlife checklist in the Park.

Thirty-seven camera traps were set up around the Park from May to August 2018 in order to obtain information on medium–large-sized mammal species.

As a result, the camera traps successfully captured footage of two species of otters, namely the smooth-coated otter and Asian small-clawed otter, around the lagoon. On 6 June 2018, at 8:56am, footage of a single individual of otter was captured through one of the camera traps in the Park at the location shown in Figure 1.

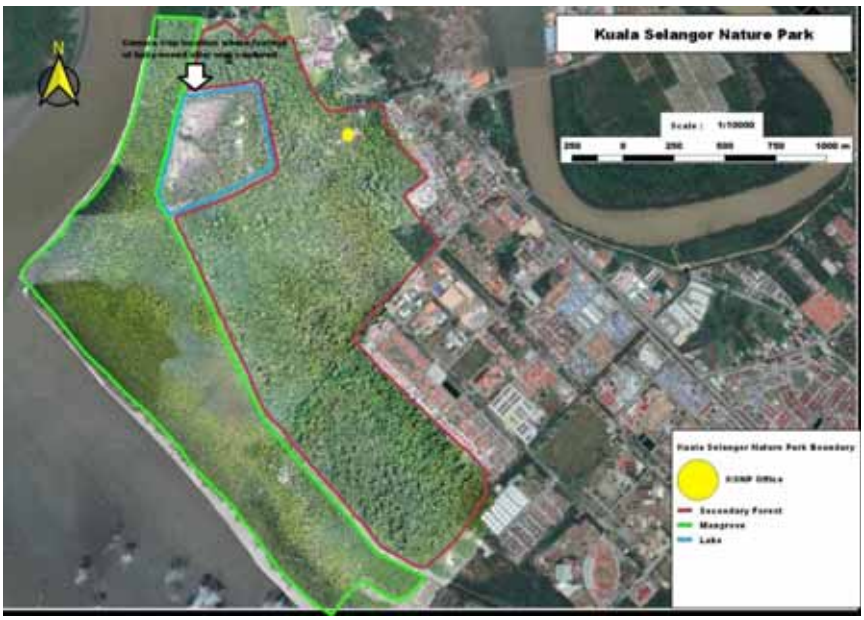


***Figure 1. Map of KSNP and the camera trap location (as shown in white arrow) where the footage of the hairy-nosed otter was captured.***

In the footage, the otter only appeared for two seconds before it moved towards the right and out of the camera range. The otter was facing backwards before it disappeared to the right but based on the body size it was confirmed to be among the larger sized species. However, we were unable to identify the actual species based on head shape. A close examination was made by play and pause click during the video and at the very last second before it disappeared to the right, the side of the head was visible and there is a faint blurred white marking on the chin (Figure 2). The video was sent to the IUCN/SSC Otter Specialist Group and presented as a poster during the Fourteenth International Otter Congress 2019. It was then that the otter was identified by the experts as a hairy-nosed otter. Additionally, there are a few records of hairy-nosed otters in coastal habitats to support the possibility of this research result **Latifiana and Pickles, 2013; Heng et al., 2016; Huda et al., 2019**).

***Figure 2. A screenshot photo of the footage of hairy-nosed otter captured by the camera trap in KSNP.***

## DETAILS OF THE RECORD IN SABAK BERNAM

On the morning of 29 January 2020, one of the local people who is a member of a community group called "Friends of Raja Musa Peat Swamp Forest" sent a picture showing a roadkill of an otter. The location of the roadkill otter is shown in Figure 3 (red pin), where on the right side of the location is the fringe of the Sungai Karang Forest Reserve, part of the North Selangor Peat Swamp Forest (NSPSF) and on the left is agriculture land, mostly dominated by paddy fields. Another roadkill of a hairy-nosed otter around the same area was reported by **Tan** (**2015**).


***Figure 3. The location of the roadkill hairy-nosed otter recorded in our study and a map showing the locations of the KSNP and North Selangor Peat Swamp Forest.***

Figure 4 shows the roadkill otter and the distinct features of hairy-nosed otters – white lips and chin – can clearly be seen. The carcass was later collected and a close examination was conducted. The time of death of the otter was assumed to be around midnight of the same day. The identification was further confirmed through the hairy rhinarium (Figure 5), white lips and chin (Figure 6) and flattened head shaped (Figure 7). The whole body length was measured at 88.9cm and it was thus assumed to be a sub-adult animal.

***Figure 4. The roadkill hairy-nosed otter recorded in our study held by the author. © Alifah/ MNS***


***Figure 5. Nose part of the roadkill hairy-nosed otter recorded in our study showing the hairy rhinarium***

***Figure 6. The underpart of the roadkill hairy-nosed otter recorded in our study showing the white lips and chin. © Raffi Ismail/ MNS***

***Figure 7. The side of the head part of the roadkill hairy-nosed otter recorded in our study showing the flattened head. © Raffi Ismail/ MNS***

## CONCLUSION

The present study has confirmed the first discovery of the hairy-nosed otter in the KSNP and its coexistence with the other two Malaysian otter species. The presence of permanent latrine and grooming sites with both smooth-coated otters and Asian small-clawed otters constantly visiting the sites, shows that such a small park can play a vital role for the survival of the otter species in Selangor. One of the immediate major threats that was shown based on our study is the roadkill issue, as two individuals of hairy-nosed otter had become victims around the same area. In fact the KSNP and NSPSF are located near to each other along the coastline. Hence, extensive and comprehensive study is urgently needed to assess the status, distribution, and habitat use of the hairy-nosed otter along this stretch of coastal and sub-coastal habitats. The research results will be important in advocating conservation actions for the hairy-nosed otter throughout Malaysia.

### Acknowledgements

We would like to thank the Department of Wildlife and National Parks (DWP) Peninsular Malaysia for granting permission to conduct the wildlife research. Also thanks to Dr. Pazil Abdul Patah from DWNP who serves as our local collaborator, and Maichal Isthyben Sawairnathan the Park Manager of KSNP, in granting permission to conduct research in the Park. We would also like to thank Faeez for his contribution in reporting the roadkill record. In addition, we are thankful to Nicole Duplaix, Katrina Fernandez, Hiroshi Sasaki, Md Nor Shukor, and Reza Lubis for confirmation of the species identification.

### Disclosure Statement

No potential conflict of interest was reported by the author.

## Author Biography

WOO CHEE YOONG is working as a Wildlife Conservation Officer in the Malaysian Nature Society (MNS). He has past experience of camera trapping in the final-year project of his degree study and has assisted various wildlife conservation projects with MNS such as hornbill and waterbird. Currently he is leading the MNS Otter Project focusing on the coastal and urban wild otters through ecological research, communities, and multi-stakeholder work, documenting otter–human conflict, education, and public awareness. He graduated from the Universiti Malaysia Sarawak with a degree in Animal Resource Science and Management. Currently He is carrying out his MSc study in Sunway University with research into the distribution of three sympatric otter species across different land use types along the Selangor coastline, Peninsular Malaysia.

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Printed by Strath Print, Isle of Skye tel: 01471 822 555 www.strathprint.co.uk