NOTE FROM THE EDITOR

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Dear Friends, Colleagues and Otter Enthusiasts!

I hope that those of you who live in the northern hemisphere can enjoy some vacation with family and friends in the nature. I have seen that some of my friends in the south have snow. Wherever you are – I hope that we all can do some small steps to contribute to maintain biodiversity.

We open now the issue 40/3 in 2023 and in fact even issue 40/4 is already full. Lots of interesting stuff in the pipeline. We will see whether this will be the first year with a fifth issue but most likely will manuscripts that are just under review rather make it into issue 41/1 in early 2024.

Having more issues also means that more persons receive requests for reviews and the number of translations is also increasing. So, all in all the whole system has more work.

More issues and manuscripts also mean that Lesley has more work. She is correcting language issues that made it through reviews and proofprints and as always crosschecks the references in the text and the list of references. Lesley, thank you so much for all your time and efforts and heart blood to make this journal an increasing success.

ARTICLE

KNOWLEDGE AND PERCEPTION OF THE NEOTROPICAL OTTER (*Lontra longicaudis annectens)* AMONG FISHERMEN IN THE CHAMPAYÁN LAGOON SYSTEM, ALTAMIRA, TAMAULIPAS, MEXICO

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ABSTRACT: Not enough research has been conducted on the distribution and population density of the Neotropical otter (*Lontra longicaudis annectens*) in the state of Tamaulipas. Today, the inhabitants of villages near the Champayán Lagoon System have empirical knowledge of the biodiversity in adjacent areas from experiences in their daily activities. A study was conducted through 35 interviews about the knowledge and perception of the Neotropical otter applied in seven fishermen villages in the Champayán Lagoon System, Altamira, Tamaulipas. Interviews revealed that all of the interviewed fishermen reported knowing the Neotropical otter and having observed it at different spots across the lagoon system. It is reported that the otter is a social species that has been observed in pairs and with offspring. Fishermen mention that otters feed mainly on native and exotic fish and

others preys as well as crustaceans, reptiles, and poultry. There is an interaction between fishermen and otters, where the latter steals fish from fishing nets; however, this does not represent an economic loss for fishermen. The 91.4% of fishermen interviewed reported having directly interacted with an otter, and 97.1% mentioned that they had never threatened or disturbed an otter, since they consider it a charismatic species. Only 5.7% mention the otter as a species of great importance for the lagoon system. This work highlighted the need to continue this research applying ethnobiology methodologies to work with local communities, as a first strategy to promote the conservation of the Neotropical otter and to carry out to long-term studies on the interaction of fishermen with otters when their populations may be threatened.

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INTRODUCTION

The Neotropical otter, *Lontra longicaudis annectens* (Major, 1897), is a semi-aquatic mammal belonging to the family Mustelidae (Gallo-Reynoso, 1989; De Almeida and Ramos Pereira, 2017; Rheingantz et al., 2017) that is closely linked to freshwater (Gallo-Reynoso,1989) and associated marine environments such as lakes, rivers, swamps, coastal islands, and lagoons located in dry and wet forests (Carvalho-Junior et al., 2012).

In Mexico, the subfamily Lutrinae comprises three species: "sea otter" (*Enhydra lutris* Linnaeus, 1758), "North American river otter or Nearctic otter" (*Lontra canadensis* Scheber, 1776), and "Neotropical river otter" or "long-tailed otter" (*Lontra longicaudis annectens* (Major, 1897) (Gallo-Reynoso and Casariego, 2005; Gallo Reynoso et al., 2019); the latter is widely distributed in the Americas, from northwest Mexico to South America (Gallo-Reynoso, 1989; De Almeida and Ramos Pereira, 2017; Rheingantz et al., 2017). In Mexico, this species is distributed from southern Tamaulipas bordering the Gulf of Mexico and part of the Mexican Caribbean in the Atlantic slope, and from the northern parts of Chihuahua and Sonora to the border with Guatemala on the Pacific slope (Gallo-Reynoso, 1997; Aranda, 2000).

The Neotropical otter is listed in the Near-Threatened category on the Red List of the International Union for the Conservation of Nature (*Rheingantz et al.,* 2021), as Endangered of Extinction in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2021), and as Threatened in the Mexican Official Standard NOM-059-SEMARNAT-2010 (SEMARNAT, 2010). To increase the knowledge and to contribute to *L. longicaudis* conservation is essential to conduct studies to determine the current distribution and human perceptions of Neotropical otter (Gallo-Reynoso, 1989, 1996, 2008; Macías-Sánchez and Aranda, 1999).

The lower part of the Guayalejo–Tamesí River basin in Tamaulipas forms a lagoon system of great hydrological, ecological, and social importance in the southern region of the state (Vera, 2004). This area is characterized by high availability of fishes, vegetation, and shelter (logs, roots), which make a suitable habitat for the Neotropical otter (Mayagoitia-González et al., 2013).

Ethno-biological studies have shown that local human populations possess a deep knowledge of the natural resources, including biological resources used by them or with which they interact (Souto et al., 2011; Alves and Rosa, 2013). These local populations are frequently involved in biodiversity monitoring (Harvey et al., 2003; Mejía-Correa,

2014), also called participatory monitoring (Evans and Guariguata, 2008) and could be the first step to integer natural resources political management with conservation strategies (Braga and Schiavetii, 2013). Some works have led to this type of study on the Neotropical otter, for example, Gallo-Reynoso (1989) conducted interviews with inhabitants of Sierra Madre del Sur to know about some aspects related to Neotropical otters. Macías-Sánchez (2003) also used interviews in adults and children to know about the relationship between humans and otters, and their biological and ecological aspects in central Veracruz, México. Vázquez-Maldonado et al. (2021) also conducted interviews with inhabitants of the Laguna de Términos, to find out the perception of the species in the area. These interviews with fishermen may be the first step to know about the relationships with the Neotropical otter in the Champayán Lagoon System. Local people have extensive knowledge of the natural environment and that is a potential habitat for the Neotropical otter. The lack of studies in the southern part of the state has made it impossible to know the role of the species in the ecosystem.

We conducted a study based on semi-structured interviews with fishermen living in villages located adjacent to the Champayán Lagoon System in the municipality of Altamira, Tamaulipas, with the aim to collect information on the knowledge and perception of local inhabitants about the biological and ecological aspects of the Neotropical otter, as well as on the distribution of the species in this area and its interaction with fishermen.

MATERIALS AND METHODS

Study area

The Champayán Lagoon System is a freshwater body fed by the Guayalejo-Tamesi River with an area of approximately 213 km², a length of 38.4 km, and an average width of 5.6 km. The average depth recorded in the 2013-2016 surveys was 1.5 m, with a maximum depth of 5.9 m. The Champayán Lagoon System holds abundant vegetation (CONAGUA, 2012). This complex hydraulic network is used as a means of communication by fishing populations (Rolón-Aguilar et al., 2015). It also is the main source of water for domestic and industrial uses in the regional urban areas of Altamira, Ciudad Madero, and Tampico municipalities (Fig. 1; SEDUMA, 2015). The local wetland vegetation consists mainly of the southern cattail *Typha domingensis* that grows in the lagoon banks, and a transition area covered by the shrub *Mimosa pigra*; both species are also found in islets within the lagoons. *Ceratophyllum demersum* is a submerged aquatic species also present, along with extensive areas covered by populations of water hyacinth *Pontederia crassipes* and a narrow strip of riparian vegetation. These banks also harbor patches of trees including Humboldt's willow *Salix humboldtiana*, ahuehuete *Taxodium mucronatum*, rosy trumpet tree *Tabebuia rosea*, ceiba *Ceiba pentandra*, and ear pod tree *Enterolobium cyclocarpum* (CONAGUA, 2012).

Dredging operations in the channels and the lagoon are regularly conducted to maintain an optimal water level at the entrance of the Altamira water treatment plants (Ulloa et al., 2018). The environmental services provided by this lagoon system to society include direct benefits such as the supply of drinking water and food through aquaculture and fisheries, and other services such as recreational activities (SEDUMA, 2015; Ulloa et al., 2018).

The predominant climate is warm sub-humid with rainfall in summer. The mean annual temperature exceeds 22 °C throughout the year; the highest temperatures are recorded from May to September, ranging between 25 °C and 28 °C, and occasionally exceeding 40 °C. The rainy season usually occurs from June to October, with an annual

average of 1,043 mm. September is the rainiest month with an average of 250 mm, and the driest season spans from November to May. January and February are the driest months with an average of 21.1 mm and 28.0 mm respectively. These temperature and precipitation conditions produce a warm and humid summer and a dry and cold winter (SEDUMA, 2015).

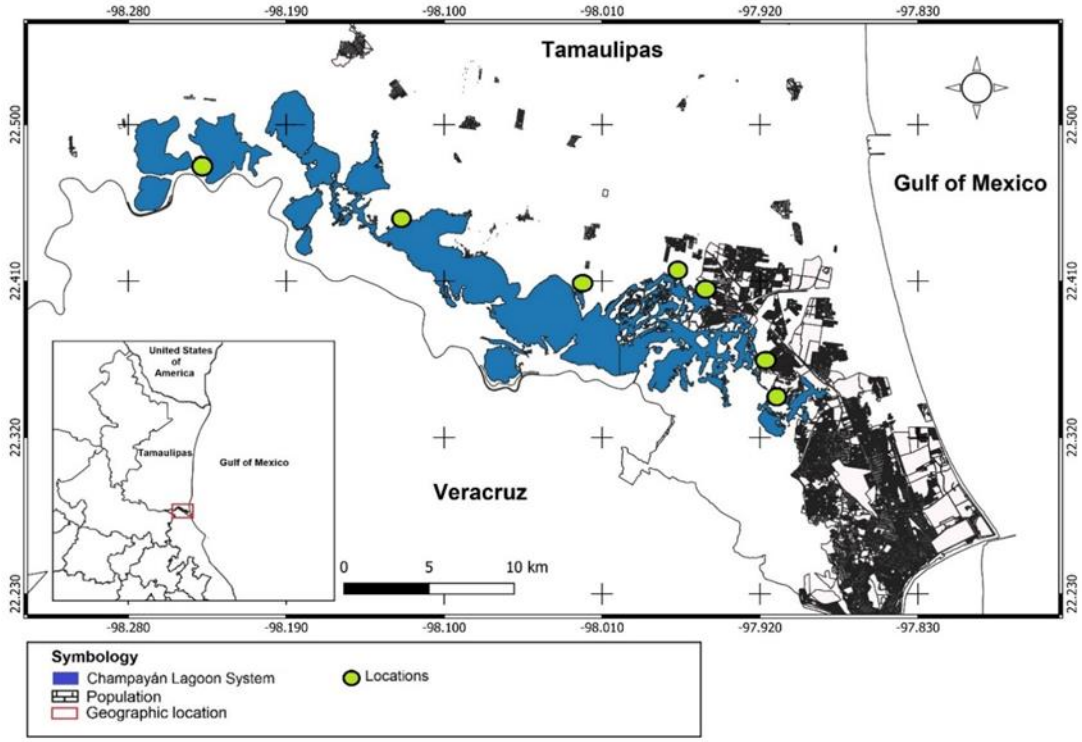

Figure 1. Location of the Champayán Lagoon System, Altamira, Tamaulipas, Mexico.

Data collection and analysis

Thirty-five interviews were conducted in different locations around the Champayán Lagoon System in Altamira, Tamaulipas, during November and December 2020 (Table 1).

Table 1. Localities and number of interviews conducted in fishing populations located adjacent to the Champayán Lagoon System, Altamira, Tamaulipas.

Locality	Number of interviews
Vega de Esteros	3
Monte Alto	5
Zona Centro	5
El Repecho	4
Tres de Mayo	4
Mata del Abra	7
Vuelta de las Yeguas	7
Total	35

The interviews, data gathering, and fieldwork took place over 31 kilometers on the margins of the lagoon. Semi-structured interviews and informal talks were conducted with fishermen, mainly involving adult men and women living in villages along the lagoon. Interviews were based on the questionnaire arranged by Gallo-Reynoso (1989) and Macías-Sánchez (2003) to gather information on the knowledge and perception of respondents about the Neotropical otter in the Sierra Madre del Sur

and the central zone of Veracruz, respectively. The interview consisted of 38 questions organized into four sections: 1. General information of the respondent (sex, age, education level, and socioeconomic status); 2. Respondent's expertise as a fisherman in the area, so that they gain confidence with us and provide reliable information about otters; 3. Biological and ecological aspects of the otter; and 4. Threats, regulations, and conservation of the species.

The data gathered from interviewed fishermen were qualitatively processed for analysis, we classified the answers according to the interview sections and presented the percentages obtained respectively. Additionally, we made a map with the distribution of the Neotropical otter in the Champayán Lagoon System based on the information from interviews in each locality.

RESULTS

The people interviewed (n=35) were between 30 and 60 years old and had lived in the area for more than 10 years. In six localities: Vega de Esteros, Monte Alto, Zona Centro, El Repecho, Tres de Mayo, and Mata del Abra, an 80% (n=28) of the interviewed persons were male. In a single town, Vuelta de las Yeguas, a 20% (n=7) of the respondents were female. Their responses evidenced that interviewed people were familiar and have had direct encounters with Neotropical otters. Fishing is the main economic activity for all the interviewed people, either full-time or on a seasonal basis, this activity has given them the opportunity to gain knowledge about the Neotropical otter, locally known as "*perro de agua*" ("aquatic dog").

Distribution of the Neotropical otter

All the respondents mentioned that the Neotropical otter is distributed throughout the Champayán Lagoon System, from Vega de Esteros to Vuelta de las Yeguas. Most otters have been sighted in the canals that crosses vegetation patches and that connect with the Tamesí River, which are used for trading between villages. The localities El Repecho, Tres de Mayo, and Mata del Abra have reported a lower frequency of otter sightings, while sightings of Neotropical otters are more frequent in Vega de Esteros, Monte Alto, Zona Centro, and Vuelta de las Yeguas (Fig. 2).

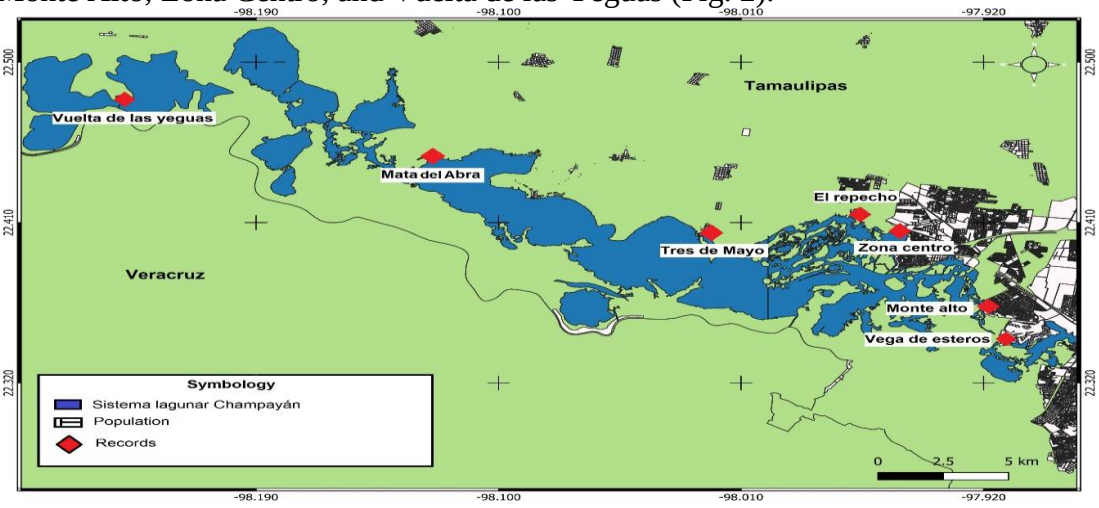

Figure 2. Distribution of the Neotropical otter in the Champayán Lagoon System, Altamira, Tamaulipas, Mexico.

Feeding habits

94.2% (n=33) of respondents mention that they observed otter feeding preferentially on introduced fish such as tilapia (*Oreochromis spp*.) and carp (*Cyprinus carpio*), which are considered the major components of its diet in the area. The respondents observed otters stealing fish trapped in fishing nets and related observations of fish with otter bite marks. As a second food source, 17.1% (n= 6) of respondents mentioned the black bass (*Micropterus salmoides*) and the pearl scale cichlid or lowland cichlid (*Herichthys carpintis*).

Only 14.2% (n=5) of the surveyed fishermen mention the consumption of other taxa in the diet of the Neotropical otter, such as prawns, turtle eggs, and poultry. These records come from direct observations by fishermen on otters preying on and consuming wild and domestic animals. The respondents mentioned that domestic animals are easy prey for otters because there are poultry hatcheries in houses near the lagoon shores. Also, 17.1% (n=6) of the fishermen describe the crocodile (*Crocodylus moreletii*) as a potential predator of the Neotropical otter, and one of them described that there are currently less otters and more crocodiles, while the otters were dominant years ago.

Reproductive Behavior

The 28.5% (n=10) of the respondents mentioned that the breeding season of the Neotropical otter occurs in spring and summer, the interviewed fishermen had observed adult females with offspring in those seasons, and also by the sounds produced by offspring, that are they listen among aquatic vegetation. Regarding the number of offspring per female, 2.8% (n=1) of fishermen have observed an adult female accompanied by four to five pups; 5.7% (n=2), with three to four young; 11.4% (n=4), with two young; and 2.8% (n=1), with a single pup. The fishermen, describe otters as aggressive animals during the breeding season, mainly when boats come very close to their dens. Two fishermen mentioned that an otter nearly attacked them, and another described that an otter climbed onto their boat to attack him.

Activity and Sighting Frequency

Neotropical otters are most frequently observed by the 62.8% (n=22) of the fishermen, during spring, summer, and part of autumn (April to October), when the water level in the lagoon system is high and fish abundance increases, they also mention that otters are observed mainly when more fish are available in the lagoon. Otters can be seen all year round as 31.4% (n=11) of fishermen commented, and being less frequently observed in winter, as only 2.8% (n=1) mention otter sightings in winter.

However, 91.4% (n= 32) of otter records are related to direct sightings of otters swimming, feeding, or interacting with fishermen in the proximity of boats; only 8.5% (n= 3) of the interviewed fishermen have observed spraints among aquatic vegetation on floating islets.

Regarding the activity period of otters, 88.5% (n=31) interviewed fishermen mentioned that Neotropical otters are most active in the morning and in the afternoon, with the greatest activity observed in the early morning hours (07:00 to 09:00 h), while others 11.4% (n=4) comment that otters are active until noon. Literature reports describe that the Neotropical otter is active during twilight hours, feeding mainly in the afternoon. Regarding direct observations, 54.2% (n=19) of fishermen reported having observed otters stealing fish from fishing gear placed by them. Other reported activities of otters include swimming and diving 40.0% (n=14), with the head slightly protruding

above the water surface and then immersing in search for food. Other fishermen 5.7% (n=2) reported having interacted with otters swimming on one side of their boats (Fig. 3).

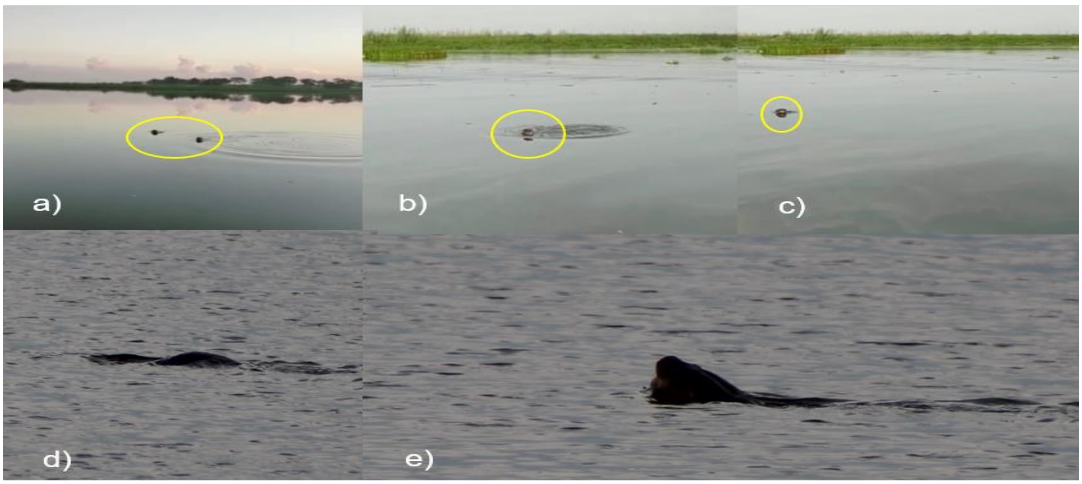

Figure 3. Otters observed in two different locations within the Champayán Lagoon System. a), b), and c) correspond to the locality of Monte Alto; d), and e), to the Central Zone.

Group Composition, Habitat, and Indirect Evidence

Fishermen interviewed describe otters as social animals frequently observed in groups of two or three individuals, with occasional observations of solitary individuals. However, 57.1% (n=20) of fishermen have frequently observed otters in pairs, describing them as "couples". Fishermen in the Champayán Lagoon System describe that the Neotropical otter prefers to swim in water 1 m to 2 m deep, and the lagoon maintains this depth level most of the year. Sightings of otters become less frequent in the dry season when the water level is below 1 m depth. This might be due to the fact that there are fewer fish available for both, fishermen and otters; an alternative explanation is that boats cannot go fishing because the water level is too shallow, thus there are fewer observations of otters.

Otters had been rarely seen on the lagoon banks, as described by 91.4% (n=32) of the fishermen, they also say that otters prefer floating islets of vegetation (named *cabezales* by fishermen). These floating islets include plants such as the cattail (*Typha domingensis*), reed (*Phragmites australis*), and water hyacinth (*Pontederia crassipes*), forming networks of islets interconnected through channels. The 5.7% (n=2) fishermen stated that otters have dens and breeding nests in these sites. Dens are described as structures built between cattail plants, formed by stems, and bent branches to which otters can access through underwater tunnels. Fishermen have observed traces of otter spraints on the vegetation in floating islets, and only one fisherman mentioned otter spraints on the shore of the lagoon system.

Anthropogenic Threats

The relationship between Neotropical otters and fishermen is unavoidable since both feed on almost the same resources. Otters tend to forage for food in easily accessible sources, in this case, fish caught by fishing gear and nets set by fishermen. A 5.7% (n=2) said that occasionally, this has caused the death of some otters when they get entangled in the net. A fisherman mentioned the sale of a young otter, but this was an isolated case that has not been reported again. The 97.1% (n=34) of fishermen stated

that they have never threatened or disturbed otters and, conversely, they protect both otters and their environment.

Importance and Conservation

Concerning its ecological importance, 8.5% (n=3) of fishermen highlighted its relevance as a predator living in its natural habitat. Fishermen also mentioned not having hunted otters; on the contrary, when coming across a nearby otter, they only watch it because they stand out for being charismatic organisms. Indeed, 40% (n=14) of the interviewed fishermen indicate that when otters are spotted stealing fish from fishing gear, they just scare them away. Only 5.7% (n=2) of the respondents mentioned being aware of regulations protecting the Neotropical otter; the vast majority are not familiar with any protection measures but are convinced that killing otters is detrimental to the environment.

DISCUSSION

Interactions between humans and otters are well known at all seven fishing locations and have not been documented before. This turns out to be crucial information for designing an efficient effort to conserve the otters in the Champayán Lagoon System. Otters are threatened according to the official norm NOM-059-SEMARNAT-2010 (SEMARNAT, 2010), and in international laws, almost threatened, according to the International Union for Nature Conservation (Rheingantz et al., 2021). In Appendix I of the International Convention on Wild Flora and Fauna (CITES, 2021), they are classed as threatened. This study sought knowledge about, perception of, and experiences of fishermen with Neotropical otters, especially in regard to daily fishing.

The presence of otters is well documented in the southern part of Tamaulipas (Gallo-Reynoso, 1997), the latest records are found in Vega Escondida, recently named a protected natural area in Tampico City (Mayagoitia-González et al., 2013), including the body of water near to Champayán Lagoon System. Fishermen mention the presence of otters to the north and south of the Champayán Lagoon System, their presence in the south of Tamaulipas could be influenced by riparian vegetation cover (CONAGUA, 2012; Mayagoitia-González et al., 2013), as well as the availability of refuge and food, and fish with a length from 0-20 cm that are more available in channels that connect the lagoons with the Tamesí River, where commercial fishing is great (Mayagoitia-González et al., 2013) as well in the trade water-way between localities (Rolón-Aguilar et al., 2015).

Neotropical otter feeding habits from Neotropical otter sprain analyzes in the Champayán Lagoon System are based on exotic (commercial) and native fish, and various other taxa (mollusks, crustaceans, insects, amphibians, birds, and mammals), this is similar to the results found by Rangel-Aguilar and Gallo-Reynoso (2013), Carvalho-Junior et al. (2013), Grajales-García et al. (2019) and Vázquez- Maldonado and Delgado-Estrella (2022). In the Champayán Lagoon System and other water bodies in southern Tamaulipas, the swamp crocodile (*Crocodylus moreletii*) is an important player inside the ecosystem (Cedillo-Leal et al., 2011), and is probably a predator of Neotropical otter, due to an overpopulation of crocodiles and a decline in the otter population according to the fishermen interviewed.

The reproductive season of Neotropical otters is associated with otter territoriality as mentioned by fishermen: spring and summer (dry season) is when they observe reproductive behavior, according to Gallo-Reynoso (1989). Winter and Spring are the reproductive seasons with higher birth rates, due to the lower river water, but it can occur at any time of the year (Parera, 1996). Interviewed people mention that the number of pups is variable, with sightings of one to five pups, two pups being the most

common. Larivière (1999) affirms that two to three pups is usual for the species, although it can be from one to five pups, and usually is two pups (Reid, 1997).

The highest frequency of direct otter sightings was highly associated with fish abundance and availability to both fishermen and otters, occurring in spring, summer and fall. And less frequent during winter. Fishermen rarely observe spraints (Santiago-Plata et al., 2013) by the dirt road to La Veleta, in Campeche State, but report more frequent footprints and sightings during the rainy season (June-October) than in the dry season (March-May), which contrasts with the observations reported by González-Christen et al. (2013) in the Catemaco Lagoon, Veracruz State, where the abundance of otter's records increases after the rainy season at the beginning of the dry season (November to January). Similarly, Duque-Dávila et al. (2013) reported a higher number of otters in the dry season and a lower number in the rainy season in Río Grande, Biosphere Reserve of Tehuacán-Cuicatlán, Oaxaca State.

The daily activity of the otters and the activity of the fishermen coincide early in the morning (07:00-09:00 am). It is known that the Neotropical otter displays crepuscular habits, having greater foraging activity at dusk and dawn. However, it is known to adopt more nocturnal habits in areas with greater human activity (Wilson and Mittermeier, 2009; Rheingantz et al., 2016; Gallo-Reynoso et al., 2019).

Otters are described as elusive and social animal by fishermen, with groups of one to three individuals, two being the most common. This coincides with that described by Aranda (2000), where the behavior of the Neotropical otter is described as mainly solitary, but it can be observed in pairs and in family groups. Orozco (1998) records that 64% of the otters seen in Río Hondo, Quintana Roo were solitary; Vázquez-Maldonado et al. (2021) in Laguna de Términos Campeche, reported that 56 to 73% of sightings were of solitary individuals, although groups of two and three individuals have been observed, mostly females with cubs. Localities such as Atasta (79%) and Palizada (62%) are the places where groups have been observed most frequently.

Fishermen report that vegetation has an important influence on the behavior and daily life of the species, floating islands being used as shelter sites dens; they are mainly composed of herbaceous plants, bushes and aquatic plants with riparian and aquatic vegetation prevailing (CONAGUA, 2012). This agrees with the findings of several authors in which the presence of otter is highly associated with vegetation cover (García and Quintana, 2005; Arellano-Nicolás et al., 2012); such habitat is composed of dense forests, rapid flow of water and associated riparian vegetation in lentic environments (Aceituno et al., 2015).

Regarding human - otter conflict, the information collected suggests that these events are isolated and sporadic, and there is no major threat to the otters. Fish stealing from nets is a behavior that does not cause any large economic loses according to several fishermen. This might be due to the increase in availability of prey in areas where there are human activities; nevertheless, a bad perception of the otter's presence might in future generate conflict between fishermen and otters (Hernández-Romero et al., 2018). Such interactions should be thoroughly evaluated with long term studies when the otter populations might be threatened (Andrade et al., 2019).

Hernández-Romero et al. (2018) describe a conflict between trout farmers and Neotropical otters in Tonalaco, Veracruz, where a negative perception of otters has caused hunting to eliminate the threat to their fish. Barbieri et al. (2012) analyzed the perception of otters in two fishing localities in Brazil: in Tramandaí, the fishing activities affected were less, while in Imbé, where the effect of otters on fish is greater, the fishermen had a greater negative perception about otters.

Otters are not generally seen as a problematic species for fisherman in the Champayán Lagoon System, since otters are a charismatic species. A large number of interviewed persons showed a positive attitude towards the existence of laws that protect otters. We also detected some ecological awareness: when we asked for some reasons to protect otters, a large majority highlighted their importance as predators and that they are part of the environment. The fishing communities in the Champayán Lagoon System have extensive empirical knowledge of the surrounding environment, which is a potential habitat for otters. Based on this type of knowledge, there are multiple ethno-biological studies in other parts of the world carried out with fishermen and their contact with a wide a range of organisms (Begossi et al., 2016). In developing countries, where there is a great need for data and resources, collecting empirical local ecological knowledge to expand our understanding of the environment has been a relevant issue (Berkström et al., 2019) and the use of tools such as interviews and questionnaires have been used to assess possible damage and loss of biodiversity related to species under some degree of threat. This can represent a first step to integrate political management of natural resources and conservation strategies together with the response from local communities (Braga and Schiavetii, 2013).

CONCLUSIONS

The Neotropical otter is a well-known species to fishermen in all fishing localities of the Champayán Lagoon System, Altamira, Tamaulipas, where it is distributed through most of the lagoon complex; there is, however, a lack of knowledge about the status of its population. Sightings were reported at all surveyed locations, and respondents described frequent interactions between fishermen and otters. Otters have been observed to feed on fish caught in fishing nets, this being their main source of food; apparently, this behavior was been developed by otters a long time ago. The fishermen mentioned that this feeding behavior of the otters does not cause problems for their fishing activities, and their presence does not generate economic losses. However, it can be dangerous for otters, as they occasionally become entangled in the nets and die. Otter sightings have been incidental as fishermen carry out their activities; however, they mentioned that these sightings have become less and less frequent in this lagoon system. The fishermen have a deep empirical knowledge about the biological and ecological aspects of the Neotropical otter, describing it as a friendly species that does not represent any danger to them. Consequently, they try to protect it and know that otters are an important element of the lagoon´s ecosystem.

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RESUME

CONNAISSANCE ET PERCEPTION DE LA LOUTRE A LONGUE QUEUE (*Lontra longicaudis annectens*) PAR LES PÊCHEURS DANS LE SYSTÈME LAGUNAIRE DE CHAMPAYÁN, ALTAMIRA, TAMAULIPAS, MEXIQUE

La recherche sur la distribution et la densité de population de la loutre à longue queue *(Lontra longicaudis annectens*) n'est pas assez documentée dans l'état de Tamaulipas. Aujourd'hui, les habitants des villages proches du système lagunaire de Champayán ont une connaissance empirique de la biodiversité dans les zones adjacentes à partir d'expériences dans leurs activités quotidiennes. Une étude comportant 35 entretiens a été menée sur la connaissance et la perception de la loutre à longue queue appliquée à sept villages de pêcheurs du système lagunaire de Champayán, Altamira, Tamaulipas. Les entretiens ont révélé que tous les pêcheurs interrogés ont déclaré connaître la loutre à longue queue et l'avoir observée à différents endroits du système lagunaire. Il est

rapporté que la loutre est une espèce sociale qui a été observée en couple et avec sa progéniture. Les pêcheurs mentionnent que les loutres se nourrissent principalement de poissons indigènes et exotiques et d'autres proies ainsi que de crustacés, de reptiles et de volailles. Il existe une interaction entre pêcheurs et loutres, ces dernières volant du poisson dans les filets de pêche ; cependant, cela ne représente pas une perte économique pour les pêcheurs. Certains pêcheurs interrogés (8,5%) ont déclaré avoir interagi directement avec une loutre, et 97,1% mentionnent n'avoir jamais menacé ou dérangé une loutre, car ils la considèrent comme une espèce charismatique. Seuls 5,7% mentionnent la loutre comme une espèce de grande importance pour le système lagunaire. Ce travail a mis en évidence la nécessité de poursuivre cette recherche en appliquant des méthodologies ethno-biologiques visant à travailler avec les communautés locales, comme première stratégie afin de promouvoir la conservation de la loutre à longue queue et de mener à bien des études à long terme sur l'interaction entre pêcheurs et loutres lorsque leurs populations peuvent être menacées.

RESUMEN

CONOCIMIENTO Y PERCEPCIÓN SOBRE LA NUTRIA NEOTROPICAL (*Lontra longicaudis annectens)* POR PESCADORES EN EL SISTEMA LAGUNAR CHAMPAYÁN, ALTAMIRA, TAMAULIPAS, MÉXICO

Son insuficientes las investigaciones realizadas sobre la distribución y densidad poblacional de la nutria neotropical (*Lontra longicaudis annectens*) en el estado de Tamaulipas. Actualmente, los habitantes de los poblados cercanos al Sistema Lagunar Champayán poseen un conocimiento empírico de la biodiversidad en las zonas adyacentes a partir de las experiencias vividas en sus actividades cotidianas. En siete poblados de pescadores del Sistema Lagunar Champayán, Altamira, Tamaulipas se realizó un estudio sobre el conocimiento y percepción de la nutria neotropical a través de 35 entrevistas. Las entrevistas revelaron que todos los pescadores encustados conocen a la nutria neotropical y mencionan haberla observado en diferentes puntos del sistema lagunar. Ellos informan que la nutria es una especie social que ha sido observada en parejas y con crías. Los pescadores mencionan que las nutrias se alimentan principalmente de peces nativos y exóticos y de otras presas como de crustáceos, reptiles y aves de corral. Existe una interacción entre pescadores y nutrias, donde estas últimas roban pescado de las redes de pesca; sin embargo, esto no representa una pérdida económica para los pescadores. El 91.4% de los pescadores entrevistados registraron haber interactuado directamente con una nutria, y el 97.1% mencionan que nunca han amenazado o molestado a una nutria, ya que la consideran una especie carismática. Sólo el 5.7% menciona a la nutria como una especie de gran importancia para el sistema lagunar. Este trabajo resaltó la necesidad de continuar esta investigación aplicando metodologías de etnobiología para trabajar con las comunidades locales, como una primera estrategia para promover la conservación de la nutria neotropical y realizar a largo plazo estudios sobre la interacción de los pescadores con las nutrias cuando sus poblaciones puedan estar amenazadas.

R E P O R T

NEW CONFIRMED RECORDS OF THE GIANT OTTER (*Pteronura brasiliensis*, GMELIN, 1788) IN ARGENTINA

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Abstract: Here, we report two independent and confirmed observations of solitary giant otters (*Pteronura brasiliensis*) recorded in December 2021 and September 2022 in Argentina. The former observation, a male first seen in El Impenetrable National Park in May 2021, was recorded in Buenos Aires province, which lies outside the historical distribution known for giant otters. The latter observation, an adult of unknown sex, was recorded in the Iberá Park, Corrientes province, where giant otter vanished more than 30 years ago. These records highlight the urgency for management strategies directed to enhance the recovery of giant otter populations in their historical range.
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Keywords: distribution range, Lutrinae, reintroduction, South America, wildlife conservation.

INTRODUCTION

Giant otters (*Pteronura brasiliensis*) are globally endangered and regionally extinct in Argentina (Di Martino et al., 2019), where the last confirmed record of the

species dates from 1986 (Chebez and Bertonatti, 1994). Afterwards and until 2010, a handful of observations, always of solitary individuals, have been reported in the northeastern region of the country but all these records lacked supporting evidence like signs (i.e., tracks and scats) and images. However, in May 2021 an adult male was first observed, then photographed, while swimming in a pond formed by old meanders of the Bermejo River in El Impenetrable National Park (EINP) in the Chaco region (Leuchtenberger et al., 2021). Further monitoring using camera traps found no evidence of other accompanying giant otters. No other report of a giant otter has been published for Argentina since then. Here, we present two new and confirmed observations of solitary giant otters in Argentina.

MATERIAL AND METHODS

The first individual was recorded in the Pampas region, Buenos Aires province, near Villa Roch (Fig. 1). Here, land use is characterized by intensive cattle ranching and farming (Fig. 2). Small- to medium-sized lagoons (up to 300 to 400 hectares) and artificial channels, some of which connect with the La Plata River, can be found in the area. At this latitude (-36.2766°S) the La Plata River meets the Atlantic Ocean, resulting in brackish waters. This location lies outside the known historic distribution of the species.

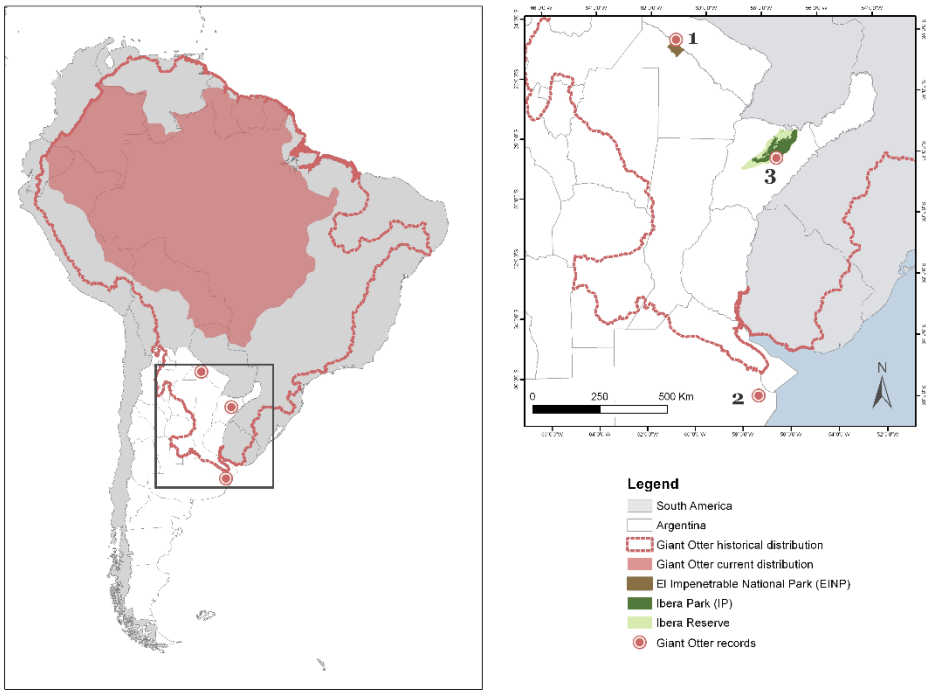

Figure 1. Map presenting the locations where giant otters were recorded in Argentina between May 2021 and September 2022: 1 – former location (Leuchtenberger et al., 2021) of the solitary male in El Impenetrable National Park; 2 – record of the same male in Villa Roch locality in Buenos Aires province; 3 - photographic record of a solitary giant otter in the Iberá Park, Corrientes, Argentina. The blue line shows the possible path followed by the solitary male between records 1 and 2 (limits of current and historical distribution range were developed by the committee of the Brazilian Action Plan for Giant Otters' conservation).

Figure 2. Representative picture of Buenos Aires province landscape where a giant otter male was recorded in December 2021 by a farmer.

The second individual was recorded in Ibera Park (IP), Corrientes province. This park, a complex of protected areas including the Iberá National Park and the Iberá Provincial Park (both IUCN Category II), encompasses 756,000 ha (Fig. 1) and conserves an extensive wetland characterized by swamps, bogs, lagoons, streams, grasslands, and patches of forests (Fig. 3). This location lies inside the known historic distribution of the species (Beccaceci and Waller, 2000), although giant otters vanished from Corrientes more than 30 years ago (Beccaceci et al., 1995).

Figure 3. Representative picture of the Iberá Park landscape where a solitary giant otter of unknown sex was recorded by a camera trap in September 2022.

RESULTS

The first individual was filmed and photographed with a smartphone by a farmer on December 1st and 2nd 2021, near Villa Roch, a town located in the Buenos Aires province (36.4836°S, 57.4170°W, 4 m above sea level). Photos and videos were sent in November 2022 to one of the authors (SD), who, in January 2023, visited the area and interviewed the farmer. According to the farmer's account, the giant otter was first seen on Dec 1st 2021 during daylight. This individual was observed first running in the field and then lying down in a small patch of forest, where it stayed until the next day. The farmer speculated that the otter might have reached her property using irrigation canals that drain from the Río de la Plata to her farm.

Subsequent analysis of the otter's throat marks revealed that they were identical to those observed in the solitary male spotted in May 2021 at EINP and surrounding area (Fig. 4). In November 21st, 2021 fresh signs were observed for the last time in the EINP area (eg. tracks, scats), but we didn't get any photographic record of the animal. If these signs observed in November, 2021 at EINP correspond to the same solitary male observed in December, 2021 in Villa Roch, then this individual must have travelled over 2000 km, along the Bermejo, Paraná and La Plata rivers and artificial Canal Number 1, in only 10 days. Previous photographic records of this individual, after its first sighting in May 2021 at EINP, suggest that the maximum distance that it may have traveled was 200 km in, at most, 2 days.

Figure 4. Photographic records presenting the throat pattern of the solitary giant otter male registered by: (left) a camera trap in the El Impenetrable National Park; and (right) by a stream in the Villa Roch locality, Buenos Aires province (right), Argentina. The arrows show the similarity of the shape of the white patch on the throat of both records.

The second individual, an adult giant otter of unknown sex (Fig. 5), was photographed on September 2nd, 2022, at 10:40 by one of the 28 camera traps (Browning Strike Force) that we deploy every year in an area of IP. This camera, located in the area known as Eulogio (28.5812°S, 57.2484°W, 88 m above sea level), took, in a period of 6 seconds, four photographs. Following this finding, we increased the number of camera traps in the area. However, we registered neither this nor other individuals to date. Similarly, and despite intensive searches, we found neither tracks nor scats in the location where the giant otter was photographed.

Figure 5. Photographic record of a solitary giant otter by camera trap located in the Iberá Park, Corrientes Province, Argentina.

DISCUSSION

Here we presented the southernmost observation of a giant otter ever recorded and the first record for the Buenos Aires province. Moreover, the distance travelled by this individual represented the longest dispersal movement known for the species to date. This observation questions available information about the historical distribution of the species (Di Martino et al., 2019), and forces specialists to increase efforts to understand how early Spanish settlers might have affected southern populations of giant otters.

We also reported a second confirmed record of a giant otter in Argentina within an interval of 16 months (Leuchtenberger et al., 2021) and after 36 years of the last confirmed observation in the country (Chebez and Bertonatti, 1994). Like the individual observed first in EINP and then in Buenos Aires province, the origin of the giant otter photographed in IP is unknown, perhaps a migrant from a population in Paraguay being the most plausible, albeit untested, explanation.

Regardless of their origin, the presence of these individuals in Argentina highlights the importance of (1) establishing protected areas such as EINP and IP to conserve suitable habitat and maintaining corridors for dispersing giant otters from stronghold populations, (2) maintaining and increasing survey efforts to detect isolated individuals and even relict populations and (3) conservation translocation actions, whenever possible, to improve the recovery of the species to its indigenous range. Furthermore, the translocation of isolated individuals to current founding nuclei of giant otters, such as those that are being stablished by the Giant Otter Reintroduction Program at EINP and IP (Zamboni et al., 2018) could reinforce the establishment of a viable population (IUCN/SSC, 2013).

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RESUME

NOUVEAUX ENREGISTREMENTS CONFIRMÉS DE LOUTRE GÉANTE (*Pteronura brasiliensis*, GMELIN, 1788) EN ARGENTINE

Nous rapportons ici deux observations indépendantes et confirmées de loutre géante solitaire (*Pteronura brasiliensis*) enregistrées en décembre 2021 et septembre 2022 en Argentine. La première observation, un mâle vu pour la première fois dans le parc national d'El Impenetrable en mai 2021, a été enregistrée dans la province de Buenos Aires, qui se situe en dehors de la répartition historique connue des loutres géantes. La deuxième observation, un adulte de sexe inconnu, a été enregistrée dans le parc Iberá, province de Corrientes, où la loutre géante a disparu il y a plus de 30 ans. Ces enregistrements soulignent l'urgence de stratégies de gestion visant à améliorer le rétablissement des populations de loutres géantes dans leur aire de répartition historique.

RESUMEN

NUEVOS REGISTROS CONFIRMADOS DE NUTRIA GIGANTE (*Pteronura brasiliensis,* GMELIN, 1788) EN ARGENTINA

Aquí, informamos dos observaciones independientes y confirmadas de nutrias gigantes (*Pteronura brasiliensis)* solitarias, registradas en Diciembre de 2021 y Septiembre de 2022 en Argentina. La primer observación, un macho que había sido visto en el Parque Nacional El Impenetrable en Mayo de 2021, fue registrada en la provincia de Buenos Aires, que está fuera de la distribución histórica conocida de la nutria gigante. La segunda observación, un adulto de sexo desconocido, fue registrada en el Parque Iberá, provincia de Corrientes, donde la nutria gigante desapareció hace más de 30 años. Éstos registros destacan la urgencia de tener estrategias de manejo dirigidas a reforzar la recuperación de las poblaciones de nutria gigante en su área de distribución histórica.

R E P O R T

NEW RECORDS FOR THE MARINE POPULATION OF SOUTHERN RIVER OTTER *Lontra provocax*: CONFIRMING *HUILLÍN* PRESENCE ON MITRE PENINSULA, TIERRA DEL FUEGO, ARGENTINA

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Abstract: The southern river otter (*Lontra provocax*), known as *huillín* in Spanish, is an endangered otter that is endemic to Patagonia. Argentina has two populations separated by 1,500 km: a freshwater one in northern Patagonia, and a coastal marine one in Tierra del Fuego province. This last population was categorized as critically endangered, and until now only presents two stable subpopulations inside protected areas (Tierra del Fuego National Park and Staten Island Provincial Reserve). Several sporadic records of this species were known for Mitre Peninsula (Tierra del Fuego), a difficult area to access. The goal of this study was to evaluate the status of the southern river otter on Mitre Peninsula. In 2018, 2021, 2022 and 2023, we systematically surveyed the southern coasts of this area (the only with suitable habitat), looking for otter presence through signs (e.g., spraints, tracks, dens). Additionally, camera traps were set in areas with high activity. We found new records and also confirm a stable presence of the species in the area. Camera trap records also confirm presence throughout the year and the first known confirmation of reproduction. Additionally, introduced species, like American mink (*Neogale vison*) and free-range dogs (*Canis lupus familiaris*) were identified, which are potential threats to the otter. We believe that this evidence of huillín presence on Mitre Peninsula implies there is a stable subpopulation, which would also mean that Mitre Peninsula represents a potential biological corridor between Staten Island and the rest of the archipelago.
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INTRODUCTION

The southern river otter (*Lontra provocax*), also called *huillín* in Spanish, is a semiaquatic carnivore that is endemic to Argentine and Chilean Patagonia (Chehébar, 1985; Kruuk, 2006). It is one of the otter species with most restricted range in the world (Chehébar et al., 1986) and inhabits both freshwater river and lake shores in northern Patagonia and marine coasts along the channels and fjords of southern Patagonia (Sepúlveda et al., 2015; 2019). In general, this species uses natural cavities between rocks, tree trunks or shrubs in areas with high vegetation cover to establish it dens, resting places, latrines, etc. (Valenzuela et al., 2013).

During the last century, this species was hunted for its fur leading to a severe decline of its populations and driving this otter to its present endangered status (Sielfeld and Castilla, 1999; Cassini et al., 2010). Moreover, despite a ban on hunting, to date

the species has not recovered, mainly because it continues to be threatened by degradation, fragmentation and loss of riparian and coastal habitats, unplanned urbanizations, unregulated human activities, and interaction with invasive introduced carnivores, such as feral dogs (*Canis lupus familiaris*) and American mink (*Neogale vison*) (Valenzuela et al., 2012; Valenzuela, 2019; Sepúlveda et al., 2019; Barbe et al., 2023; Claverie et al., 2023). For these reasons, currently the southern river otter is categorized as Endangered internationally (Sepúlveda et al., 2015) and in Argentina (Valenzuela et al., 2019). In particular, in 2019 the Argentine Society for the Study of Mammals (*SAREM* in Spanish) together with the Argentine Ministry of Environment, and following the IUCN rules to categorize species conservation status at a regional level, classified the Argentine coastal marine population of southern river otters as Critically Endangered, estimating that only 50 individuals remain in the Argentine portion of Tierra del Fuego (Valenzuela et al., 2019).

The southern river otter's distribution in Argentina represents the extremes of the species' global distribution, with two populations separated for more than 1,500 km: a freshwater population in Nahuel Huapi National Park in northern Patagonia, and a coastal marine population in the Argentine portion of the Tierra del Fuego Archipelago (Chehébar, 1985; Centrón et al., 2008; Valenzuela et al., 2013). This latter population has two relatively stable sub-populations in Tierra del Fuego National Park (TFNP; Schiavini and Bugnest, 1994; Malmierca et al., 2006; Rocha and Valenzuela, 2015) and Staten Island Provincial Reserve (Valenzuela et al., 2017). Historical data suggest that the species was present all along the Beagle Channel and on Mitre Peninsula (MP) (Valenzuela et al., 2019). During a preliminary field trip to the MP's Aguirre Bay, performed in 2016, an otter spraint was found (Valenzuela et al., 2021), evidencing the need for further research. However, no systematic survey for otter presence has been performed on MP until now, mainly due to it being an isolated and logistically complicated area to visit and work in. Yet, MP was recognized as a priority area for otter research and conservation by both the *Binational (Argentina-Chile) Meeting for Conservation of Southern River Otter* (Valenzuela, 2019) and the *Global Otter Strategy* (Sepulveda et al., 2019). Additionally, this area represents a potential biological corridor that connects the otters of Staten Island (southeast extreme of the world-wide range of this species) with the rest of its distribution.

In this publication, we present the results of the first systematic prospection for southern river otter on Mitre Peninsula, performed during 2018, 2021, 2022 and 2023, providing new otter records for the area.

STUDY AREA

Mitre Peninsula constitutes the eastern extreme of the Tierra del Fuego Island (between 54°30'–55°03'S and 65°06'–66°44' O; Fig. 1). The climate of this region is characterized by two main seasons: a long cold winter and a short cool summer (Tuhkanen et al., 1989). The vegetation along the peninsula's southern coast is dominated by *Nothofagus* trees (Pisano, 1977). Its southern coast also is characterized by the presence of cliffs, formed by the Andes Mountain Range, which plunge into the sea, unlike the northern coast, which is made up mainly of low-slope bays (Isla, 1994).

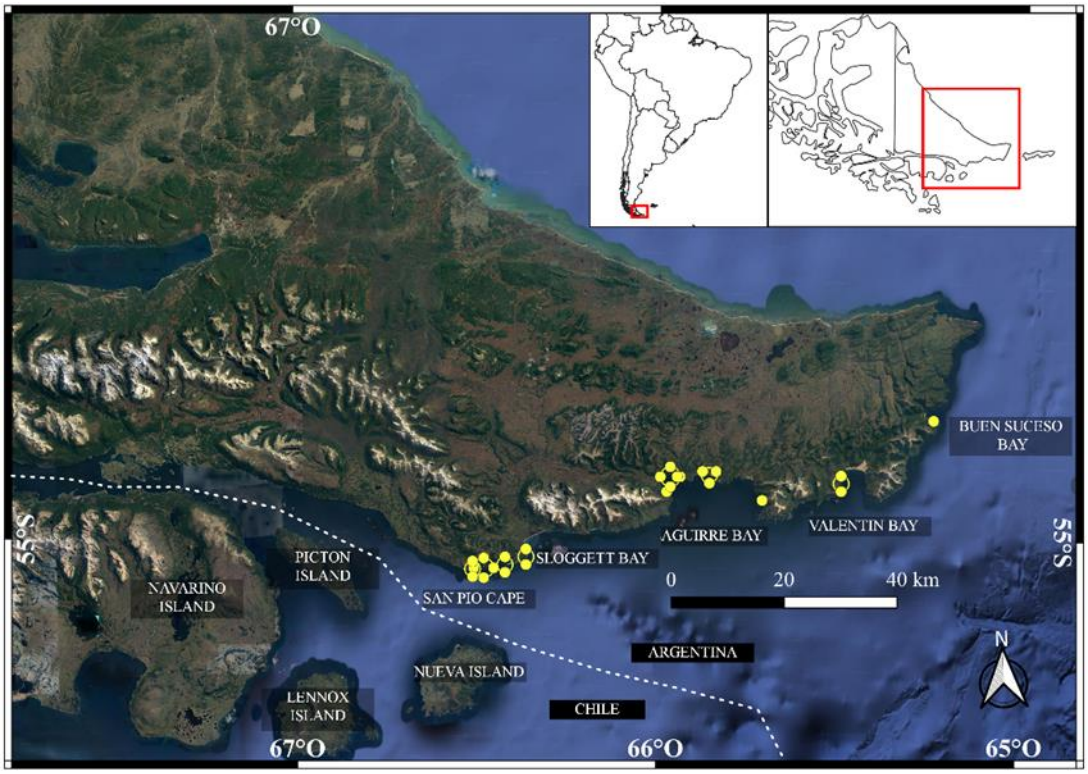

Figure 1. Map of Mitre Peninsula showing the sites with confirmed southern river otter (*Lontra provocax*) presence (yellow dots)

METHODOLOGY

Based on the southern river otter habitat suitability model for Tierra del Fuego presented by Valenzuela et al. (2013) and using satellite images (Google Earth Pro 7.3.4), a total of 130 km of coastline were considered apt for otters, taking into account inherent environmental characteristics like vegetation, slope, orientation, etc. Based on presence of suitable habitat and logistical feasibility, a total of 71 km of the coastline were surveyed by foot between the summer seasons of 2018, 2021, 2022 and 2023, including all main bays in the area (Sloggett, Aguirre, Valentín and Buen Suceso), San Pio Cape and associated exposed coasts (Fig. 1). This sampling effort represents 54% of the coastline described as suitable, and it is comparable, or even exceeds, the efforts carried out for otter research in both Patagonia and Europe (Chehebar, 1985; Bonesi and Macdonald, 2004; Fasola et al., 2009). In each sector, otter signs, such as spraints, tracks, latrines or dens, were recorded. Additionally, in three sites with high otter activity (large amount of scats and/or recognizable dens), digital sensor motion camera traps with non-invasive black flash (Bushnell Trophy Cam HD) were set (Fig. 2). Cameras were active continuously, taking one photo and one video for 15 seconds upon being triggered (and a period of at least one hour between triggering events).

RESULTS

Numerous signs of southern river otter were found in all sites surveyed (Sloggett, Aguirre, Valentín, Buen Suceso Bays and San Pio Cape), which confirms the presence of the species along the PM's southern coasts (Fig. 1). A total of 124 spraints were found, distributed as follows by site: 60 in San Pio Cape, 37 in Aguirre Bay, 22 in Sloggett Bay, four in Valentín Bay and one in Buen Suceso Bay. Depending on the level of activity, the camera traps were placed, two in Aguirre Bay, and one in Sloggett Bay (Fig. 2). Cameras registered 503 records of the species, detecting its presence all

year long, and also documenting reproduction activity in both sites, with eight different records of juveniles in the dens. Also, an individual was sighted near San Pio Cape during the last survey in 2023 (Fig. 2). In addition to spraints, the cameras and other sign evidence, we documented invasive introduced American mink (*Neogale vison*) and free-range dogs (*Canis lupus familiaris*) in the entire study area.

Figure 2. Field work at sites with activity of southern river otter (*Lontra provocax*). A) Spraint in Buen Suceso Bay. B) Authors setting a camera trap in Sloggett Bay. C) Camera trap placed in Hall Cape, in Aguirre Bay. D) Individual recorded in the camera trap from Sloggett Bay. E) Individual sighted at San Pio Cape (Photo by Rodriguez Mariano)

DISCUSSION

These results represent the first systematic survey of southern river otters on MP. To our knowledge this study involved the first use of camera traps in the area, as well. A relatively stable otter presence was observed throughout the year and between years, and there was documentation of reproductive events. These results imply that there is an established subpopulation of otters on MP that should be taken into account in future research, management and conservation decisions regarding this species. However, despite being isolated, this population does not escape the general threats to otter conservation, such as invasive introduced mink and dogs and unregulated human activities (Valenzuela et al., 2019). On the other hand, our results also support the hypothesis that MP is a potential biological corridor between the Staten Island subpopulation and the rest of the distribution. Additionally, the higher activity in San Pio Cape and Sloggett Bay highlights the importance of this sector. This area is located adjacent to several channels between the Chilean islands of Navarino, Picton, Nueva and Lennox, suggesting a possible connection with these areas from the south of Navarino Island, and both subpopulations of the Argentine Beagle Channel in the south of Tierra del Fuego Island, TFNP and MP. Furthermore, individuals from San Pio Cape and MP eventually connect the rest of these subpopulations with the most extreme

eastern portion of this species range on Staten Island. In general, these results highlight the important value of MP for the southern river otter, which was recently declared a provincial natural monument (Provincial Law #1346) and also reinforces the need to include this species in decision-making and the future management plan of the recently passed law that declares MP as Provincial Natural Protected Area. Further research is needed to understand the situation of the species in MP, including long-term monitoring, studies of habitat use, estimations of relative abundance, quantification of diet and genetic analysis, etc. This information will be important to develop effective conservation strategies taking into account the critical situation of the southern river otter in Argentina generally and Tierra del Fuego specifically.

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RESUME

NOUVEAUX ENREGISTREMENTS DE LA POPULATION MARINE DE LOUTRE DU CHILI *Lontra provocax* : CONFIRMATION DE LA PRÉSENCE DE L'« HUILLÍN » SUR LA PÉNINSULE DE MITRE, TIERRA DEL FUEGO, EN ARGENTINE

La loutre du Chili (*Lontra provocax*), connue sous le nom de l'Huillín en espagnol, est une espèce de loutre en voie de disparition endémique en Patagonie. L'Argentine compte deux populations séparées de 1.500 km : l'une d'eau douce dans le nord de la Patagonie et l'autre marine, côtière dans la province de Tierra del Fuego. Cette dernière population a été classée en danger critique d'extinction et ne présente jusqu'à présent que deux sous-populations stables à l'intérieur des aires protégées (parc national Tierra del Fuego et réserve provinciale de l'île de Staten). Plusieurs signalements sporadiques de cette espèce étaient connus dans la péninsule de Mitre (Tierra del Fuego), une région difficile d'accès. Le but de cette étude était d'évaluer la situation de la loutre du Chili dans la péninsule de Mitre. En 2018, 2021, 2022 et 2023, nous avons parcouru de manière systématique les côtes sud de la région (la seule ayant un habitat correct) et avons recherché des indices de présence de loutres (par exemple : épreintes, pistes, tanières). De plus, des pièges photographiques ont été installés dans des zones à forte activité. Nous avons réalisé de nouveaux enregistrements et confirmons également la présence durable de l'espèce dans la région. Les enregistrements de pièges photographiques confirment aussi la présence tout au long de l'année et la première

confirmation connue de reproduction. Par ailleurs, des espèces introduites, comme le vison d'Amérique (*Neogale vison*) et les chiens errants (*Canis lupus familiaris*) qui ont été identifiés, constituent des menaces potentielles pour la loutre. Nous pensons que cette preuve de la présence de l'Huillín dans la péninsule de Mitre implique la présence d'une sous-population stable, ce qui signifierait également que la péninsule de Mitre représente un corridor biologique potentiel entre l'île de Staten et le reste de l'archipel.

RESUMEN

NUEVOS REGISTROS PARA LA POBLACIÓN MARINA DE HUILLÍN (*Lontra* provocax): CONFIRMANDO LA PRESENCIA DE ESTA NUTRIA EN PENÍNSULA MITRE, TIERRA DEL FUEGO, ARGENTINA.

El huillín (*Lontra provocax*), una nutria endémica de Patagonia en peligro de extinción, presenta en Argentina dos poblaciones separadas por 1.500 km: una dulceacuícola en Patagonia norte, y una costera en la provincia de Tierra del Fuego (TDF). Esta última fue categorizada como en peligro crítico, y hasta ahora sólo presentaba dos subpoblaciones estables en áreas protegidas (Parque Nacional Tierra del Fuego y la Reserva Provincial Isla de los Estados). Varios registros esporádicos de esta especie habían sido reportados en Península Mitre (TDF), un área de díficl acceso. El objetivo de este estudio fue evaluar el estado de los individuos de huillín en Península Mitre. En 2018, 2021, 2022 y 2023, muestreamos sistemáticamente las costas sur de esta área (las únicas con hábitat adecuado), en búsqueda de signos que confirmaran la presencia de la nutria (e.g., fecas, huellas, madrigueras). Además, se colocaron cámaras trampa en las áreas con mayor nivel de actividad. Se confirmaron nuevos registros y también la presencia estable de la especie en esta área. Las cámaras también confirmaron la presencia a lo largo de todo el año y las primeras actividad reproductivas. También se identificaron especies introducidas como el visón americano (*Neogale vison*) y perros asilvestrados (*Canis lupus familiaris*), las cuales son amenazas potenciales para la nutria. Consideramos que esta evidencia de presencia de huillín en Península Mitre demuestra la existencia de una subpoblación estable, lo cual implica que esta área representaría un potencial corredor biológico entre Isla de los Estados y el resto del archipiélago.

R E P O R T

MORTALITY OF *Lontra felina* (Molina, 1782) IN CHILE (2009-2022) BASED ON REPORTS

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Abstract: This note reports 58 dead marine otters along the coast of North and central Chile during 2009-2022. The data was retrieved from a database of the Chilean National Service for Fisheries and Aquaculture (SERNAPESCA) and from observations of the authors. The main part of the otter mortality reports occurred in the Valparaíso region, which in turn would be consequence of a major effort to report mortality events by volunteers and scientists here. Seventeen (29%) cases of otter mortality were identified whereby interaction with thermal power plants cooled by seawater, attack of dogs, and interaction with small-scale fisheries are the main causes of mortality. But the cause of almost all the deaths remains unknown.

Citation: Correa, R. and Pizarro, J. (2023). Mortality of *Lontra felina* (Molina, 1782) in Chile (2009-2022) based on Reports. *IUCN Otter Spec. Group Bull.* 40 (3): 145 - 151
Keywords: Mortality, by-catch, habitat, invasive species

INTRODUCTION

The marine otter *Lontra felina* (Molina, 1782) is distributed mainly along the rocky shore of Peru and Chile and being classified as an Endangered species at global level (Mangel et al., 2022). Currently the species well-known as "chungungo" is legally protected in Chile as a hydrobiological resource according with the Decree N°430 from 31 January 2023 (Ministerio de Economía Fomento y Reconstrucción, 2023). Also, *L. felina* was recently classified in Chile as Endangered A4ce category (Ministerio del Medio Ambiente, 2023).

Habitat fragmentation, attack by dogs, entanglement in small-scale fishing gear as well as pollution are the main threats to the marine otter in Chile (Sielfeld and Castilla, 1999; Medina-Vogel et al., 2007; Duplaix and Savage, 2018). However, few instances of deaths as a consequence of these causes are documented (Rozzi and Torres-Mura, 1990; Pizarro, 2008; Mangel et al., 2011; Cursach et al., 2012; Pizarro et al., 2022).

Mortality events of *L. felina* in Chile during 2009-2022 are presented in this work using mainly the database of the National Service of Fishing and Aquaculture of Chile (SERNAPESCA by its acronym in Spanish).

MATERIALS AND METHODS

Study area

The study covers the regions of Arica y Parinacota, Tarapacá, Antofagasta, Atacama, Coquimbo, Valparaíso, Bio-Bio, and Los Ríos y Los Lagos. All localities from the analyzed database correspond to the Humboldtian, Chile Central and Araucarian ecoregions of the Warm-temperate Southeastern Pacific Province (Spalding et al., 2007).

Methods

The database of stranded marine fauna from the National Service of Fishing and Aquaculture of Chile for the period 2009-2022 (SERNAPESCA, 2023) was used to obtain data on live and dead marine otters. The database was filtered using the metadata species = *Lontra felina* and searching information about sex of the specimen, date and locality of the event and cause of the death. In this way, a new database of reports on dead marine otters in Chile (2009-2022) was built, which can be downloaded from https://figshare.com/s/f61e67db869a7e508b51. In addition, the authors searched for some cases not registered in the SERNAPESCA database, and then those reports were incorporated into the new database. The reports not registered by SERNAPESCA were supported by two reports of necropsies and photographs. Finally, mortality cases of anthropogenic origin were identified using the data shown in the SERNAPESCA database as well the results of necropsies and observations of the authors. The database of SERNAPESCA contains reports verified by the officials of this agency and therefore included in the data sheet as observations of each mortality event. Observations by the authors were verified with photographs as well as the two necropsy reports (Table 1).

RESULTS

We found 58 reported cases of dead marine otters in Chile during 2009-2022. 48 (83%) cases were finding out in the database of SERNAPESCA, as well as nine (16%) additional cases based in archives of the authors and one documented in a court ruling (Supreme Court of Justice of Chile, 2019). Valparaíso was the region of Chile with most reports of dead marine otters between 2009 and 2022 (Fig. 1).

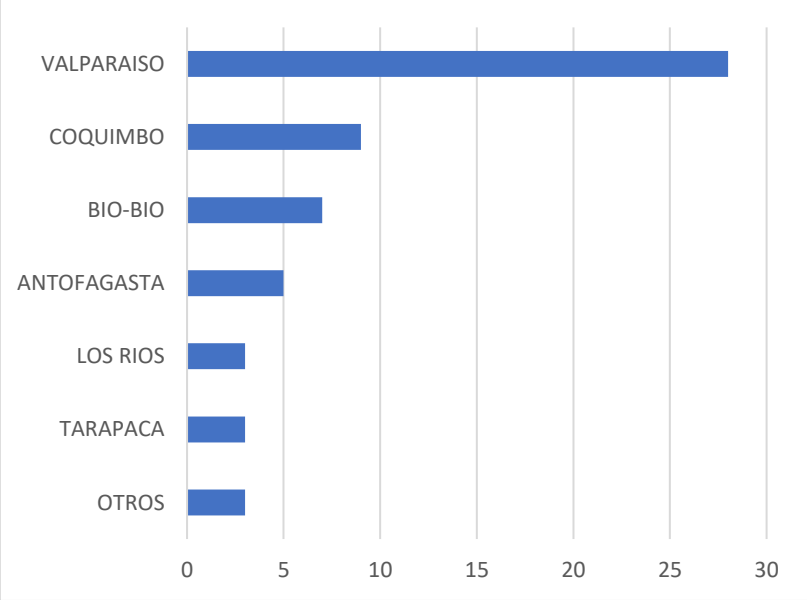

Figure 1. Reported dead marine otters by region in Chile (2009-2022).

There is evidence of anthropogenic causes of the death of marine otters in at least seventeen cases. However, there is no information available on the cause of death from the other 41 reported cases (Table 1).

Another result of interest is that the months with more deaths reported are January, February, and June. Likewise, the reports of dead marine otters have increased in the last years, from one report in 2009 to 16 cases in 2022.

Table 1. Mortality events of *Lontra felina* by anthropic source. Chile (2013-2022).

N°	Dead Animals	Locality/Coordinates	Date	Cause/Source
1.	One individual. No sex identified0	Yachting beach, Algarrobo, Valparaíso Region. 33°21´43.9¨S 71°40´19.5¨W	24 January 2013	Crushed by boat (SERNAPESCA, 2023).
2.	One male individual.	San Vicente small-scale fishing town, Talcahuano, Bio-Bio Region. 36°43´33.8¨S 73°07´59.25¨W	31 May 2013	Otter crushed, presumably by boat (SERNAPESCA, 2023).
3.	One individual. No sex identified	Quintero Bay, Valparaíso Region. 32°45´58.4¨S 71°29´31¨W	24 September 2014	Died impregnated by oil after oil spill (Supreme Court of Justice of Chile, 2019).
4.	One cub without sex identification	Puchuncaví, Valparaíso Region. 32°44´43.3¨S 71°29´18¨W	31 December 2016	Attack of dogs (Ricardo Correa, Fig. 2)
5.	One male individual.	Coquimbo, Coquimbo Region. 29°57´8.15¨S 71°20´7.94¨W	3 October 2017	Road-kill (SERNAPESCA, 2023)
6.	One individual. No sex identified.	Maitencillo beach, Valparaíso Region. 32°39´19.15¨S 71°26´35.4¨W	12 June 2018	Attacked by dog (SERNAPESCA, 2023).
7.	One male individual.	AES-Gener thermal power station, Las Ventanas, Valparaíso Region. 32°44´57.5¨S 71°29´17.7¨W	5 September 2018	Died by asphyxia within power station (Necropsy report translation by Ricardo Correa, 2023a)
8.	One pup without sex identification.	Quintero Bay Valparaíso Region. 32°44´38.8¨S 71°29´28¨W	5 March 2019	Entangled in fishing gear (Ricardo Correa, Fig. 3)
9.	One individual. No sex identified.	La Rinconada, Antofagasta Región. 23°28´0.48¨S 70°27´45.68¨W	12 June 2019	Crushed by boat (SERNAPESCA, 2023).
10.	One male individual.	Small-scale fishing village of Tongoy. Coquimbo Region. 30°15´22.9¨ S 71°29´´58.13¨W	27 February 2020	Died in crustacean trap (SERNAPESCA, 2023).
11.	One female individual.	Las Conchitas beach, Puchuncaví, Valparaíso Region. 32°44´9¨S 71°30´00¨W	11 June 2020	Attack of dog (Necropsy report translation by Ricardo Correa, 2023b).
12.	One individual. No sex identified.	Playa Grande, Valdivia, Los Ríos Region. 39°51´41.15¨S 73°23´38.21¨W	30 October 2020	Died in crustacean trap (SERNAPESCA, 2023).
13.	One individual. No sex identified.	AES-Gener thermal power station, Tocopilla, Antofagasta Region. 22°05´41¨S 70°12´38¨W	24 November 2020	Trapped at power station (SERNAPESCA, 2023).

14.	One individual. No sex identified.	El Apolillado, La Higuera, Coquimbo Region. 29°12´29.6¨S 71°29´38.08¨W	28 May 2021	Entangled in artisanal fishing gear (SERNAPESCA, 2023).
15.	One individual. No sex identified.	AES-Gener thermal power station, Tocopilla, Antofagasta Region. 22°05´43¨S 70°12´38¨W	12 September 2021	Wounded by propeller at power station (SERNAPESCA, 2023).
16.	One male individual.	Antofagasta, Antofagasta Region. 23°30´24¨S 70°25´26¨W	20 June 2022	Attacked by dog (SERNAPESCA, 2023).
17.	One individual. No sex identified.	AES-Gener thermal power station, Puchuncaví, Valparaíso Region. 32°44´S 71°29´W	24 July 2022	Died at power station (SERNAPESCA, 2023).

Figure 2. Dead cub otter due to attack of dogs. Puchuncaví, Valparaiso, Chile 31 December 2016.

Figure 3. Entangled cub in fishing gear. Quintero Bay, Valparaíso, Chile. 5 March 2019.

DISCUSSION

Most dead otters were found in the Valparaíso region. Valparaíso and other regions such as Coquimbo and Atacama are within the ecoregion Chile Central, which is characterized by being a transitional zone between the very productive Humboldtian and the coldest Araucanian ecoregion, but is impacted by coastal pollution from industries and ports as well (Sullivan Sealey and Bustamante, 1999). Currently, the Valparaíso region is the second largest urban agglomeration in Chile and its coastal population has increased at an average rate of 25% during the last three decades, an extreme urbanization process, and has several tourism facilities, industrial plants and the three most important ports in the country: Valparaíso, San Antonio and Port Quintero-Ventanas (Rangel-Buitrago et al., 2018).

Although only four cases of dead otters were found at power stations, the Chilean Institute for Fisheries Development (IFOP by its acronym in Spanish) indicates that it is a threat for marine otters in Chile (IFOP, 2016). Thermal power stations are considered a threat to marine otters because these animals could die when attempt to enter the plants, suffering asphyxia in the suction ducts or wounds produced by propellers that suck seawater. Cases of interaction of otters with these plants have been reported in Tocopilla, Antofagasta Region and in Puchuncaví, Valparaíso.

In the SERNAPESCA database, it also appears that some marine otters died entangled in fishing gear, such as fishing nets and crustacean traps (Table 1). This situation is recurrent in Peru, where individuals died by asphyxia when they are entangled in artisanal fishing nets (Pizarro, 2008). Marine otters crushed by boats could be a consequence of the opportunistic foraging of the species over fish discards obtained at the small fishing villages wherein they currently arrive to feed and live (Cursach et al., 2012; Badilla and George-Nascimento, 2009).

Another mortality cause reported is the attack of dogs on marine otters (Table 1), which confirms how serious this threat for the otters is in Chile, as has also been mentioned by other authors (Cursach et al., 2012; Sepúlveda et al., 2014). The deaths caused by dogs recorded in this study occurred on open beaches, disturbed by human presence and where marine otters are exposed to attack by dogs (Medina-Vogel et al., 2008). The only reported death of an otter due to road-kill did not occur on a highway as happens in Europe with the Eurasian otter (Kruuk and Conroy, 1991), but within a port because marine otters live mainly on coastal and their refuges are associated with the availability of food and the protection of their dens against the waves, which can be near fishing towns or ports (Medina-Vogel et al., 2007).

CONCLUSIONS

The cause of death for marine otters is unknown in most cases. Deaths of anthropogenic origin were identified for only seventeen marine otters. It is probable that a greater number of interactions with otters and a greater effort to report otter mortality events may be the reasons why Valparaíso is the region of Chile with most reports of dead marine otters in Chile during the last 13 years. Furthermore, interaction with power stations cooled by seawater, attack by dogs and incidental death during small-scale fishing activities are the main human-made mortality causes identified in the present work.

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RESUME

MORTALITÉ DE *Lontra felina* (Molina, 1782) AU CHILI (2009-2022) SUR BASE DES RAPPORTS

Cette note fait état de 58 loutres marines mortes le long de la côte du nord et du centre du Chili entre 2009 et 2022. Les données ont été extraites d'une base de données du Service National Chilien de la Pêche et de l'Aquaculture (SERNAPESCA) et les observations des auteurs. La majeure partie des rapports de mortalité de loutres a eu lieu dans la région de Valparaíso, ce qui serait une conséquence d'un effort majeur destiné à signaler les faits de mortalité par des volontaires et des scientifiques locaux. Les principales causes de mortalité, soit dix-sept loutres identifiées (29%), sont liées aux centrales thermiques refroidies par eau de mer, à l'attaque de chiens et à la pêche artisanale. Cependant, la cause de la majorité des décès reste inconnue.

RESUMEN

MORTALIDAD DE *Lontra felina* (Molina, 1782) EN CHILE (2009-2022) EN BASE A REPORTES

Ésta nota reporta 58 nutrias marinas muertas a lo largo de la costa de Chile Norte y Central, durante 2009-2022. Los datos fueron extraídos de una base de datos del Servicio Nacional de Pesca y Acuicultura de Chile (SERNAPESCA) y de observaciones de los autores. La parte principal de los reportes la mortalidad de nutrias ocurrió en la región de Valparaíso, lo que a su vez sería consecuencia de un importante esfuerzo para reportar los eventos de mortalidad por parte de voluntarios y científicos allí. Fueron identificados diecisiete casos (29%) de mortalidad de nutrias en los que las principales causas de la mortalidad fueron interacción con plantas térmicas de energía con enfriamiento mediante agua de mar, ataque por perros, e interacción con pesquerías de pequeña escala. Pero la causa de casi todas las muertes permanece desconocida.

R E P O R T

SIGHTING AND SIGNS OF THE SMALL-CLAWED OTTER (*Aonyx cinereus* ILLIGER, 1815) IN CILIWUNG RIVER, INDONESIA

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Abstract: The small-clawed otter (*Aonyx cinereus*) is classified as vulnerable on the IUCN Red List and has recently been upgraded to Appendix I on CITES due to significant population reduction and commercial trade. Despite increasing conservation efforts for otters worldwide, land conversion, waste, pesticides, and poaching pose significant threats to otter populations. Previous studies have identified the presence and habitat characteristics of *Aonyx cinereus* in various regions of Indonesia. However, more research still needs to be done on the Ciliwung River species. The field observation was carried out from August to October 2022; with most fieldwork happening in the rainy season, there are better times to sample otter markings. Spraints and latrine sites were the most commonly reported signs of otter presence. Two direct sightings of otters were made during the survey, one of a group of eight otters at Ciliwung Bridge and another of two otters searching for food along the riverbank at Blue Bridge. We confirmed the presence of otters in this area through visual encounters, sign surveys, and direct sightings. The proximity of *Aonyx cinereus* to settlements in the Jabodetabek region makes this species vulnerable to hunting. It is essential to preserve the Ciliwung River so that it may be passed on to future generations.
Citation: Oktaliza, A., Abidin, M.A., Puspitasari, P., Geraldhi, K., Syah, W. and Andriyanto (2023). Sighting and Signs of the Small-Clawed Otter (*Aonyx cinereus* Illiger, 1815)in Ciliwung River, Indonesia. *IUCN Otter Spec. Group Bull.* **40** (3): 151 - 164
Keywords: Habitat characteristics, field observation, conservation, protected species

INTRODUCTION

The small-clawed otter (*Aonyx cinereus*) has recently been elevated to Appendix I on the CITES due to commercial trade and is currently listed as vulnerable (VU) on

the IUCN Red List due to a significant population decline. Otter conservation efforts are growing globally, but they are still threatened by things like poaching, pesticides, waste, and land conversion. It is believed that all four of Indonesia's otter species are in decline because of habitat loss, pollution, conflicts with human, and poaching. However, there is a dearth of research and information on the status and habitat characteristics of *A. cinereus*.

Previous research has established the presence of *A. cinereus* and its habitat characteristics in a number of Indonesian provinces, including West Aceh, West Sumatra, West Java, and Eastern Java. However, little is known about the *A. cinereus* in the Ciliwung River, and this knowledge gap represents a significant gap in Indonesian otter research. Despite the absence of *A. cinereus* from the IUCN's distribution map for the Ciliwung River, anecdotal evidence from nearby communities and river-conservation networks indicates that otters are still relatively common in the region.

The conservation issue of otters is getting more attention now. Land conversion, waste, pesticides, and trading are the major threats to otters worldwide (Foster-Turley and Santiapillai, 1990). There needs to be more information on wild otter populations in Indonesia. Still, we believe that all four species are in decline due to increasing loss and degradation of suitable habitat, impacts from environmental pollution, human-otter conflicts, and poaching for trade (Gomez and Shepherd, 2018). The importance of this study is highlighted by paucity of information on *A. cinereus*, particulary in the Ciliwung River watershed. There is need for current data on the presence and habitat characteristics of *A. cinereus* in the Ciliwung River Segment 4, Depok, West Java. Previous studies have been done in other regions of Indonesia. Small-clawed otters are endangered in the Jabodetabek region because of the widespread desire to keep and trade them, as shown by social media posts. As a result, the goal of this study is to close the information gap and offer current knowledge on *A. cinereus* in the Ciliwung River, which is essential for efficient conservation and management measures to safeguard this imperiled species.

There is still a lack of research or literature that discusses *A. cinereus* (Allen et al., 2019) in Indonesia. Several previous studies of small-clawed otter detected the presence and habitat characteristics of *A. cinereus* based on tracks, spraints, food scraps, latrine sites, and sliding sites. *A. cinereus* were found on the rice field, swamps, nipah/rumbia forest, and riverside in West Aceh (Ujong Nga, Samatiga), West Sumatra (Padang Pariaman), and West Java (Halimun National Park) (Melisch et al., 1996; Aadrean et al., 2010; Abdullah and Rasyid, 2015; Aadrean and Usio, 2017), and Eastern Java (Wonorejo Mangroves) (Rihadini et al., 2022). Feeding location, inventory of prey animals, and diet composition of *A. cinereus* from rice fields in Padang Pariaman were also studied (Aadrean et al., 2011; Andeska et al., 2021).

According to the IUCN distribution map, the small-clawed otter (*A. cinereus*) has yet to be found in the Ciliwung River, Indonesia (Wright et al., 2015). Nonetheless, according to data collected from Ciliwung River communities with active nature enthusiasts who reside near the Ciliwung River as part of a river-conservation network and social media, there are still relatively large numbers of otters visible.

The lack of knowledge regarding the small-clawed otter is one of the reasons why this research is vital, especially in the Ciliwung River watershed. Several previous studies have been conducted in Indonesia, such as Melisch et al. (1994), Aadrean and Usio (2017), Aadrean and Usio (2020), Andeska et al. (2021), Dirgantara et al. (2021), and Rihadini et al. (2022). Specifically, to get the most up-to-date information regarding the small-clawed otter's presence, particularly in the Ciliwung River Segment 4, Depok,

West Java. With the strong interest of keepers and the wide coverage of the buying and selling of small-claw otters in the Special Region of Jakarta and surrounding cities (Jabodetabek) on social media, this will be a threat to the survival of this species.

Jabodetabek short for Jakarta-Bogor-Depok-Tangerang-Bekasi, is a metropolitan area in Indonesia that consists of the national capital city Jakarta, and four surrounding cities: Bogor, Depok, Tangerang, and Bekasi. With a population of over 30 million people, Jabodetabek is one of the most populous urban areas in the world.

THE STATUS OF SMALL CLAWED OTTER IN INDONESIA

As an indicator species, otters are regarded as ambassadors of freshwater ecosystems (Mason and MacDonald, 1986). Otters are wetland wildlife species that enrich Indonesian biodiversity, which is a source of national pride (Fig. 1). Otters are very important in safeguarding a balanced ecosystem in river watersheds, and can also act as indicators of wetland habitat conditions.

Figure 1. Otter, commonly referred to in Bahasa (Indonesian Language) and local language as Berang-berang, Lingsang, Sero, or Regul, became an Indonesian postage stamp in the 1956 edition.

In Indonesia, *Aonyx cinereus* does not include protected animals based on Regulation of the Minister of Environment and Forestry Number P.20/MENLHK/SETJEN/KUM.1/6/2018. *Lutrogale perspicillata* has a conservation status in the IUCN is vulnerable, CITES is Appendix I, and is included in the list of protected animals in Indonesia. In fact, the Ciliwung River watershed is a non-conservation region, so an otter conservation effort is necessary in one of Jabodetabek's river watersheds, as well as basic information about the presence of otters in Jabodetabek.

STUDY AREA

The Ciliwung River is the major river that flows through the Special Region of Jakarta (Fig. 2). It is also the main river in the Ciliwung watershed, which is around 390 km2 and includes Jakarta and three satellite cities: Bogor District, Bogor City, and Depok City. The Ciliwung Riparian Area has a settlement occupancy rate of 9.53% in the upstream, 16.02% in the middle stream, and 89.72% in the downstream (Noviandi et al., 2016). Land use changes are inevitable, and the residential, industrial, office, and commercial uses in the Ciliwung watershed increased throughout the period 2010–2014

(Arifasihati and Kaswanto 2016; Permatasari et al. 2017). It contributes significantly to water pollution and expands impermeable terrain, hence increasing runoff and water discharge (Remondi et al. 2016). Aside from that, land use influences riparian habitat fragmentation, low input organic material, and plant variety, including ground vegetation (Moffatt et al. 2004).

This river faces the problem of changes in land cover as a result of the occupation of developed land along the river's riparian zone, which can worsen the impact of flooding farther downstream. As a transition zone between terrestrial and aquatic ecosystems, the riparian zone will lose its ecological function, particularly the conservation functions of biodiversity, water retention, and water absorption, if it is occupied by developed land.

On the basis of administrative area boundaries, the Ministry of Environment and Forestry of the Republic of Indonesia divides the Ciliwung River into six segments, one for each local government. The fourth segment of the Ciliwung River flows through two provinces, namely West Java Province and Special Capital Region of Jakarta. The fourth segment of the Ciliwung River extends for 24 kilometers through Depok City.

This research is conducted on the banks of Ciliwung River Segment 4. In a landscape dominated by human-altered regions, we evaluated the effect of diverse habitat types on the occupancy and intensity of habitat use by river otters along the Ciliwung River. Segment 4 of the Ciliwung River watershed is dominated by bamboo woods. Compared to the devastation wrought by industrialization, the densely growing bamboo forests along the riverbanks have become a haven for wildlife, particularly otters.

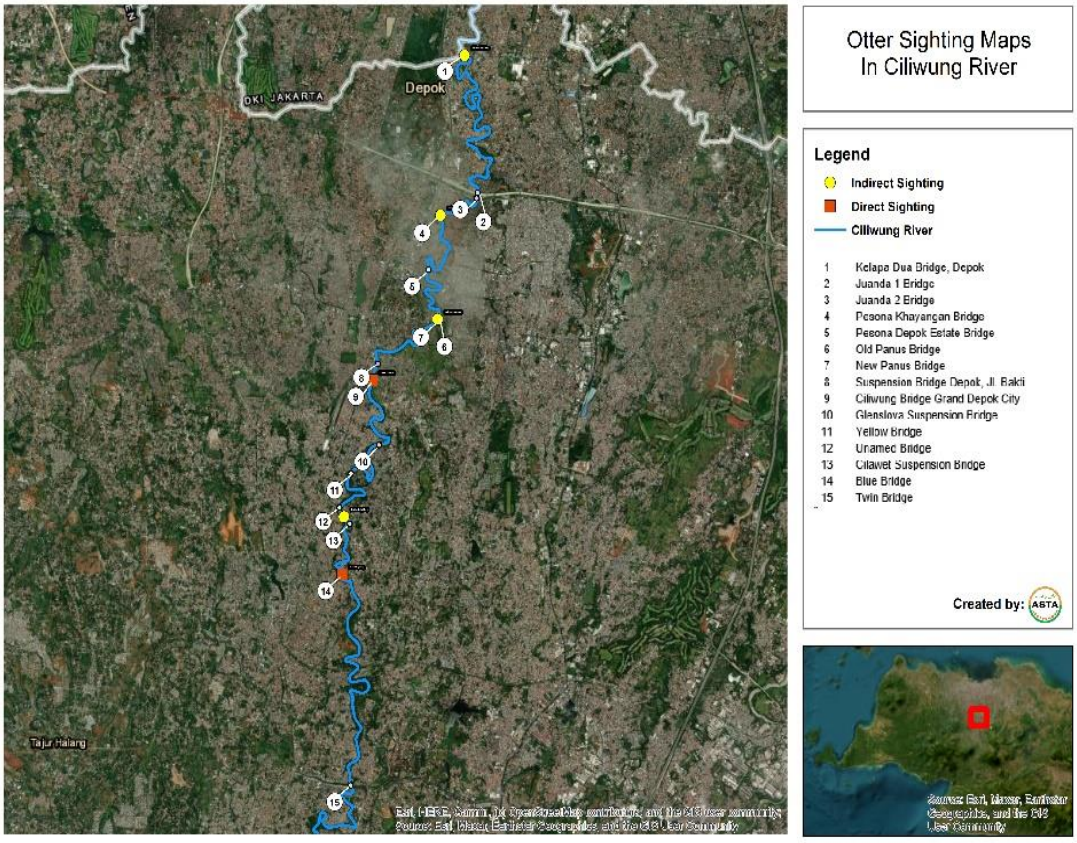

Figure 2. Locations of study area and records of the small-clawed otters in the Ciliwung River Segment 4.

The vegetation near the Ciliwung watershed has been converted into settlements for the local citizens, causing damage to the ecosystem there (Saridewi et al., 2014), including otters. According to the IUCN Red List species distribution map (https://www.iucnredlist.org/species/44166/164580923), the Ciliwung River is home to a population of *Lutrogale perspicillata* but not *Aonyx cinereus* (Wright et al., 2015). The position of *Aonyx cinereus* in Indonesia, which is not listed on the list of protected species, captivates the interests of otter keepers and hunters, therefore increasing the danger to their survival.

MATERIAL AND METHODS

To check for the existence of otters, we closely collaborate with environmentalist communities that are widely dispersed in the Ciliwung River watershed. Informal conversations with the locals also serve as a reference for determining potential locations.

With local communities, volunteers, and environmentalist communities along the Ciliwung watershed, the survey was conducted using an interview and questionnaire based on a checklist (El Alami et al., 2020). Combined with those data, a field survey (monitoring) was conducted as far as 24 km of the Ciliwung River Segment 4 by walking. We confirmed the presence of otters in this area through visual encounters, sign surveys, and direct sightings.

In a landscape dominated by human-altered areas, we studied the impact of diverse habitat types on the occupancy and intensity of habitat use by river otters along Ciliwung River Segment 4 along the river. The standard otter monitoring method was used (Reuther et al. 2000). At each location, a maximum distance of 600 m was searched along the river watershed for spraints and tracks of otters. As soon as otter signs were found, the search was stopped, and the site was confirmed as positive. If no otter signs were found, then the site was recorded as negative. Binocular, infrared monocular, and DSLR cameras have been utilised. In actuality, we recorded fresh or old spraints, latrines, grooming sites, footprints, and otter dens (Mason & Macdonald, 1986).

Figure 3. Habitat of the small-clawed otter in Ciliwung River, West Java, Indonesia (a) under the bridge, (b) dominated with bamboo.

The observation began at the bridge along Ciliwung River Segment 4 (Fig. 3, Table 1). At each site, the total number of spraints and tracks found under the bridge and along the bank was recorded. There were two reasons for choosing the bridges: the

ease of approaching the river and the longevity of otter signs under the bridge cover (Macdonald and Mason 1988). All bridges were monitored during survey periods (August-October 2022), which were aimed to be as short as possible. For all surveys, the area under each monitoring bridge was checked for otter spraint on both sides of the river, and the encountered spraint was classified into three categories of freshness: (A) fresh spraint: still wet, intact shape, characteristic smell, color not yet faded; (B) spraint of intermediate freshness: dry but not yet dissociated and color not yet lost; (C) old spraint: dry, dissociated, and color faded (Schenekar, 2022).

Table 1. List of bridges on Segment 4 of the Ciliwung River.

No	Bridges	Coordinates
1	Kelapa Dua Bridge, Depok	-6.354531376133077, 106.83598517885292
2	Juanda 1 Bridge	-6.378683216827473, 106.839191873313
3	Juanda 2 Bridge	-6.379617062735045, 106.8389756386668
4	Pesona Khayangan Bridge	-6.382781260949938, 106.83157617648835
5	Pesona Depok Estate Bridge	-6.39210357398909, 106.8296048737849
6	Old Panus Bridge	-6.400520935458336, 106.83157610978641
7	New Panus Bridge	-6.401031376602222, 106.83133605147745
8	Suspension Bridge Depok, Jl. Bakti	-6.408602751281296, 106.8197367756546
9	Ciliwung Bridge Grand Depok City	-6.41139064617847, 106.81863001332651
10	Glenslova Suspension Bridge	-6.422751373447414, 106.81995841205328
11	Yellow Bridge	-6.427740248548856, 106.81452464216945
12	Unnamed Bridge	-6.433705267702588, 106.81227592432221
13	Cilawet Suspension Bridge	-6.436531871229537, 106.81428886045323
14	Blue Bridge	-6.445377108424671, 106.81277815442608
15	Twin Bridge	-6.482260935708482, 106.81450612116083

RESULTS

In general, the search for otter signs in wet areas such as the Ciliwung River can be focussed on the adjacent dry ground, as they are key resting, nesting, grooming, and latrine site for all otters resident in the Ciliwung River.

The otter's small-clawed footprints are particularly distinct, with lengthy middle toes on the forelegs and no claw impressions (Fig. 4). Small-clawed otters leave smaller footprints than smooth-clawed otters. In contrast to the otter's traces, the fur is smooth and typically features claw marks and occasionally even clearly visible webs. We recorded the coordinates of direct sightings, otter footprints, and otter spraints using the Locus Map application on the Xiaomi Redmi 10s smartphone.

Figure 4. Footprints of otters observed along the bank

The field sampling was carried out from August to October 2022 with most fieldwork happening in the rainy season. Spraints and latrine sites are the most commonly reported signs of otter presence. Informal social interviews were conducted during the survey to gather information about otters in the territories they respect (Fig. 7). To confirm their identity, respondents are shown photos of the otters. Photographics records of its tracks (Fig. 4), spraints (Fig. 5), food scraps, latrine sites, dens (Fig. 6), and sliding sites were collected from along the Ciliwung river bank.

Figure 5. (a) Spraints of otters found at Ciliwung River, West Java, Indonesia, (b) contained fish bones and spines

Figure 6. Rock cavities used as dens by small-clawed otters

Figure 7. Interviews with local people and fishermen along the Ciliwung River regarding the possible presence of the small-clawed otter.

The first otter sighting occurred on 10 October 2022 at Ciliwung Bridge in Grand Depok City (-6.41139064617847, 106.81863001332647) through direct observation and documentation using a monocular IR camera (Fig. 8). At 1:30 AM, the appearance of the otters was noted. The eight otters who suddenly appeared were members of a family. Shortly after the rain stopped falling at the observation position, the family appeared. Through an infrared monocular, a video of the otter from the initial discovery was captured. The distance at which the otter was captured on camera (about 100 meters) makes its appearance less distinct.

Figure 8. An infrared camera records the eyes of two otters during the night. Photo © Wildan Syah

The second encounter happened on October 14, 2022 at Blue Bridge (6.445377108424671, 106.81277815442608) and was documented using a Nikon Coolpix P900 camera. The documentation has two otters (Fig. 9). The two otters were searching for food along the riverbank. At that time, it was 10:00 a.m., and the area surrounding the observation point was bustling with people crossing the bridge and passing the observation point. This documentation was captured at approximately 50 m from the otters. Additionally, photographs and video recordings were taken during the activity.

DISCUSSION

The Ciliwung River, especially segment 4 that passes through Depok City, has good vegetation with various types of tree stands such as Loa, Breadfruit, Banyan, Benda, and Bamboo species (Fig. 3). The most important thing is that the Ciliwung River still provides adequate carrying capacity for the survival of the otter, because the availability of feed in the form if fish is still quite abundant.

Informal social interviews were conducted during the survey to collect information about otters in their respective regions. To confirm their identification, participants were shown photographs of otters. Locals and fishermen lacked a precise

understanding of the ecology and behaviour of otters. Their description of the otters are filled with myths and beliefs. The majority of otter activity occurs at night and during crepuscular hours (dawn and dusk), according to the interviewees.

Figure 9. Two small-clawed otters photographed on the Blue Bridge were observed hunting and eating *Hemibagrus* sp. in Ciliwung River. Photos © Averroes Oktaliza

The finding of locations for sliding and grooming sites alows us to assume that they are grooming themselves on the rocks. Typically, when the river water recedes, rocks that are currently submerged can be exposed. It will be intriguing to find out what the situation will be like when the river level rises again due to rain. The otters may be forced to relocate to higher ground, where they may be able to build dens and find places to sliding and grooming sites (Fig. 6).

This can be attributed to the abundance of otter-friendly nesting sites along the river's banks, where numerous rocks are present. Another possible explanation is that otters do not need dens in such habitat because there is so much empty space, such as a cave between rocks, that they use as dens.

Dual sightings of *Aonyx cinereus* in Ciliwung River Segment 4 and numerous additional observations (latrine sites, footprints, sprains, and slide sites) in August and October 2022 indicate the presence of this species in the Jabodetabek region. However, according to the IUCN Redlist, which was last updated on February 19, 2020, *Aonyx cinereus* does not yet exist in that area (Fig. 10).

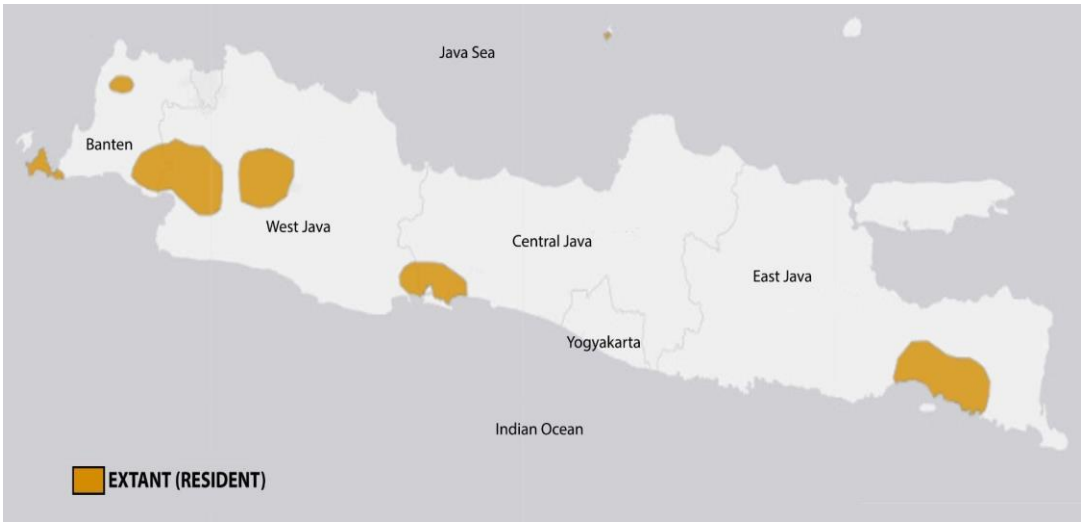

Figure 10. Distribution map of the Asian small-clawed otter referring to the IUCN (International Union for Conservation of Nature) 2015. *Aonyx cinereus*. The IUCN Red List of Threatened Species. Version 2022-2

The disparity between these results is due to the absence of assessments conducted in the Java Island region or in Indonesia as a whole. This is evident from the few studies conducted in Indonesia on *Aonyx cinereus* (Dirgantara et al., 2021).

Maps of species distribution are important for estimating extinction risk and planning conservation efforts. Here, we attempt to perform a study that aims to contribute data on the distribution of *Aonyx cinereus* on the Java Island, as well as to map the distribution of the species and assess their conservation status in accordance with the IUCN Red List's rules and criteria.

The distribution of the species *A. cinereus* in the Ciliwung River is particularly unknown. There is a need for more monitoring and tougher supervision of this otter species, particularly to prevent its extinction by improving the effectiveness of national legislative mechanisms. As a region with high biodiversity, the region around Ciliwung is essential in establishing the viability of this function.

Aonyx cinereus and *Lutrogale perspicillata* are the two kinds of otters found on Java Island (Wright et al., 2015). However, *Aonyx cinereus* dominated our findings in segment 4 of the Ciliwung River in our study. As we all know, the Ciliwung River is not a trash-free river, but rather one that is overflowing with trash. When the rainy season arrives in Jakarta, various places are susceptible to flooding. Due to the garbage-clogged overflow of the Ciliwung River, which caused it to flood.

Small-clawed otter are adapted to live near human populations and migrate through the canal network. It was observed that otters are not habituated to human presence. Being nocturnal, most activity is observed at night in the filed areas. They are also found crossing roads in certain areas.

Tracks could be assumed as their activities occur, spraints served as a territory mark for *A. cinereus*, scraps were an indication of their prey hunting, and latrine sites could be used as a form of communication between species. The existence of *A. cinereus* activity in the region was also supported by the assertions of locals that certain locations served as *A. cinereus*'s playground. During nighttime observation, the voice of *A. cinereus* was also audible at the site.

The tracks of *A. cinereus* sometimes were found together with spraints. Latrines in Ciliwung watershed were distinguished by the abundance of human waste. A latrine site was discovered close to a field, in an area with no other vegetation but grass. There were differences in the vegetation between the two latrine sites, but both were

discovered on dry soil rather than mud. In some of fresh and intermediate spraint, we discovered fish bones, snail, shell fragments, feathers, and fabric fibres (Fig. 5).

Nonetheless, trash does not prevent otters from inhabiting the Ciliwung River. It's not just a garbage problem; passing automobiles across the river does not prevent otters from adapting to their environment to the point where they become accustomed to vehicles passing near their habitat.

In addition to the poor quality of otter habitat in the Ciliwung River, the greatest threat to the small-clawed otter population is poaching for the pet trade (Aadrean, 2013; Gomez et al., 2019). The close proximity of *Aonyx cinereus* to settlements in the Jabodetabek region makes this species vulnerable to hunting, thereby threatening its survival in the wild. To discourage the hunting and trading of otters in the country, stringent punishments must be legislated and enforced, along with the protection of *Aonyx cinereus* and three other otter species in Indonesia.

With the observation of *Aonyx cinereus* in Ciliwung River Segment 4, we hope that the local community and government would boost their priority on river sustainability, whether it is cleanliness or development in the Ciliwung watershed, so that the survival of these animals in their habitat can be maintained.

This huge territory, which includes the Ciliwung River and the 13 rivers that flow through Jakarta and the surrounding metropolis, may be an important refuge for the small-clawed otter. Urgently required are follow-up and systematic surveys to collect data on otter population size, threats, and conservation strategy. It is essential to preserve the Ciliwung River so that it may be passed on to future generations. Therefore, it is anticipated that all sectors of society would contribute to maintaining the river clean.

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RESUME

OBSERVATION ET INDICES DE PRESENCE DE LA LOUTRE CENDREE (*Aonyx cinereus* ILLIGER, 1815) DANS LA RIVIÈRE CILIWUNG, EN INDONÉSIE

La loutre cendrée (*Aonyx cinereus*) est classée comme vulnérable sur la Liste rouge de l'UICN et a récemment été reprise à l'Annexe I de la CITES en raison d'une réduction importante de la population et du commerce. Malgré les efforts croissants de conservation des loutres dans le monde, la conversion des terres, les déchets, les pesticides et le braconnage constituent des menaces importantes pour les populations de loutres. Des études antérieures ont identifié la présence et les caractéristiques de l'habitat d'*Aonyx cinereus* dans diverses régions d'Indonésie. Cependant, des recherches supplémentaires doivent encore être menées sur les espèces de la rivière Ciliwung. L'observation de terrain a été réalisée d'août à octobre 2022 ; la plupart des travaux sur le terrain ont eu lieu durant la saison des pluies, alors qu'il existe de meilleures périodes pour échantillonner les indices de présence de loutre. Les épreintes et les latrines étaient les indices de présence de loutre les plus fréquemment signalés. Deux observations directes de loutres ont été faites au cours de l'enquête, l'une d'un groupe de huit loutres à Ciliwung Bridge et l'autre de deux loutres cherchant de la nourriture le long de la berge à Blue Bridge. Nous avons confirmé la présence de loutres dans cette zone par des rencontres visuelles, des indices de présence et des observations directes. La proximité d'*Aonyx cinereus* des villages de la région de Jabodetabek rend cette espèce

vulnérable à la chasse. Il est essentiel de préserver la rivière Ciliwung afin qu'elle puisse être transmise aux générations futures.

RESUMEN

AVISTAJE Y SIGNOS DE LA NUTRIA DE UÑAS PEQUEÑAS ASIÁTICA (*Aonyx cinereus* ILLIGER, 1815) EN EL RÍO CILIWUNG, INDONESIA

La nutria de uñas pequeñas asiática (*Aonyx cinereus)* está clasificada como vulnerable en la Lista Roja de UICN, y ha sido recientemente subida al Apéndice I del CITES debido a su significativa reducción poblacional, y el tráfico comercial. A pesar del aumento en los esfuerzos de conservación de nutrias en todo el mundo, la conversión de la tierra, los desechos, los pesticidas, y la caza ilegal son amenazas significativas para las poblaciones de nutrias. Estudios previos han identificado la presencia y características del hábitat de *Aonyx cinereus* en varias regiones de Indonesia. Sin embargo, aún se necesita más investigación sobre las especies del Río Ciliwung. La observación de terreno fue llevada a cabo entre Agosto y Octubre de 2022; la mayor parte del trabajo de campo se hizo en la estación lluviosa, siendo que hay mejores períodos para muestrear marcas y signos de nutria. Los signos más comúnmente reportados fueron las fecas y los sitios de letrina. Se hicieron dos observaciones directas de nutrias durante el relevamiento, una de un grupo de ocho nutrias en el Puente Ciliwung y otra de dos nutrias buscando alimento a lo largo de las orillas del río en el Puente Azul (Blue Bridge). Confirmamos la presencia de nutrias en éste área a través de encuentros visuales, relevamientos de signos, y avistajes directos. La proximidad de *Aonyx cinereus* a asentamientos humanos en la región de Jabodetabek hace que ésta especie sea vulnerable a la caza. Es esencial preservar el Río Ciliwung, para que pueda pasar a las futuras generaciones.

R E P O R T

EFFECTS OF HABITAT VARIABLES ON THE DISTRIBUTION OF SMOOTH-COATED OTTERS (*Lutrogale perspicillata*) ALONG THE KAURIALA BRANCH OF THE KARNALI RIVER, NEPAL

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Abstract: The Smooth-coated Otter (Lutrogale perspicillata) (SCO) is a semi-aquatic, top predator and a biological indicator of freshwater environments. We assessed the distribution of SCO and its relation to habitat variables in the Kauriala branch of the Karnali River. We searched for evidence of SCO in plots of 100m x 10m in the middle of each of 70 transects of 1 km, on both sides of the river, on a 39km stretch of river. Signs of ocupancy were observed in stretches where the river width ranged from 50 m to 300 m, but river width was negatively associated with probability of occurrence of SCO. Observed signs of SCO were maximal in areas of shrub cover and sandy substrate. Human activity is considered to be the most pressing threat, followed by grazing, stone extraction, fishing and construction activities. Formulation and implementation of a SCO conservation action plan should be prepared to protect the species in the Karnali River.
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Key words: Smooth-coated Otter, habitat, otter distribution, threats

INTRODUCTION

Smooth-coated Otter (*Lutrogale perspicillata*) (SCO) are semi-aquatic, top chain predator, piscivorous mammals belonging to the family Mustelidae of order Carnivora (Mason and Macdonald, 1986; Houghton, 1987; Nawab and Hussain, 2012b; Khan et al., 2014; Wai et al., 2020). They are social mammals and live in groups to defend territory and and capture prey (Thierry et al., 2021), and are opportunistic feeders (Rajani et al., 2019). Habitat degradation, habitat inadequacy and other human-caused disturbances are a few of the limiting factors determining the abundance of otters (Mason, 1995; de Silva, 2011). The distribution of SCO is little studied in Nepal (Kafle, 2009; Awasthi and Yoxon, 2018), which presents a conservation challenge to conservationists and policymakers alike (Khan et al., 2014).

The SCO is one of three otter species present in Nepal. The two other species are the Eurasian otter (*Lutra lutra*), and the Small-clawed otter (*Aonyx cinereus*), although the latter was last documented in the 19th century (Hodgson 1840). The declining population of SCO (de Silva et al., 2016) qualifies it as vulnerable on the IUCN Red List of Threatened Species (Khoo et al, 2023), and it is listed on Appendix I of CITES (CITES, 2022). The SCO has undergone rapid population decline in Nepal (Jnawali et al., 2011). The SCO is protected by the Aquatic Life Protection Act, 2002, but has yet to be listed as a protected species under the National Park and Wildlife Protection Act, 1973.

SCOs in Nepal were first reported by Hodgson (1840). Later on, Houghton (1987) reported on the distribution of SCOs in the Narayani River, the Karnali River and the Mahakali Rivers (Acharya, 2006; BPP, 1995; Evans et al., 1985) and more recently they were reported from the Koshi River after long ambiguity about their presence in the river (Mishra et al., 2022). The species is reported from the Annapurna Conservation Area, Makalu Barun National Park, Bardiya National Park, Chitwan National Park, Shuklaphanta National Park, and Kailali and Kanchanpur districts (Suwal and Verheugt, 1995). SCO habitat use reports vary greatly and range from riverine forests, through rice fields, freshwater wetlands, lakes and rivers to mangrove (Acharya and Lamsal, 2010; Dias et al., 2022). SCO distribution in relation to habitat variables are little studied in Nepal. Within the Karnali River system, SCO studies have been carried out in the eastern branch of the Karnali River, with only limiting studies in western Karnali branch - Kauriala. This study reports on the presence and distribution of SCOs in the Kauriala, the western branch of the Karnali River, along with distribution relation to habitat variables. The findings of this study will be useful in developing a conservation strategy for the Smooth-coated otter in Nepal.

STUDY AREA

The Karnali River, originating from Tibet, China, is snow-fed perennial river and the longest river of Nepal. When it reaches the lowland in Nepal, the river splits into two channels/branches: the Kauriala is the western channel, with relatively less water volume than the main channel in the east (Fig. 1). The study was conducted along a 39 km stretch of the Kauriala River, ranging from 119 m to 170 m above sea level, (28.41680556° N, 81.02777778° E to 28.63966° N, 81.2797073° E). The Karnali river serves as a political boundary between the Kailali District and the Bardia District in the lowlands of Nepal. In the study area, the river runs for about 10 km through the buffer zone area of Bardiya National Park. The annual average temperature of the study area is 24.6 °C and it receives an annual average rainfall of 1822.6 mm. The Karnali River has floodplain and forest as its dominant land type, and boulders, gravel, sand, silt and clay are the soil types (CBS, 2019). The study area has tropical vegetation, mainly comprising *Shorea robusta*, *Acacia catechu*, *Dalbergia sissoo*, *Mallotus nudiflorus*, *Syzygium cumini*, *Lantana camara*, *Calamus acanthospathus*, *Typha angustifolia*, *Phragmitis* sp., and *Saccharum spontaneum*.

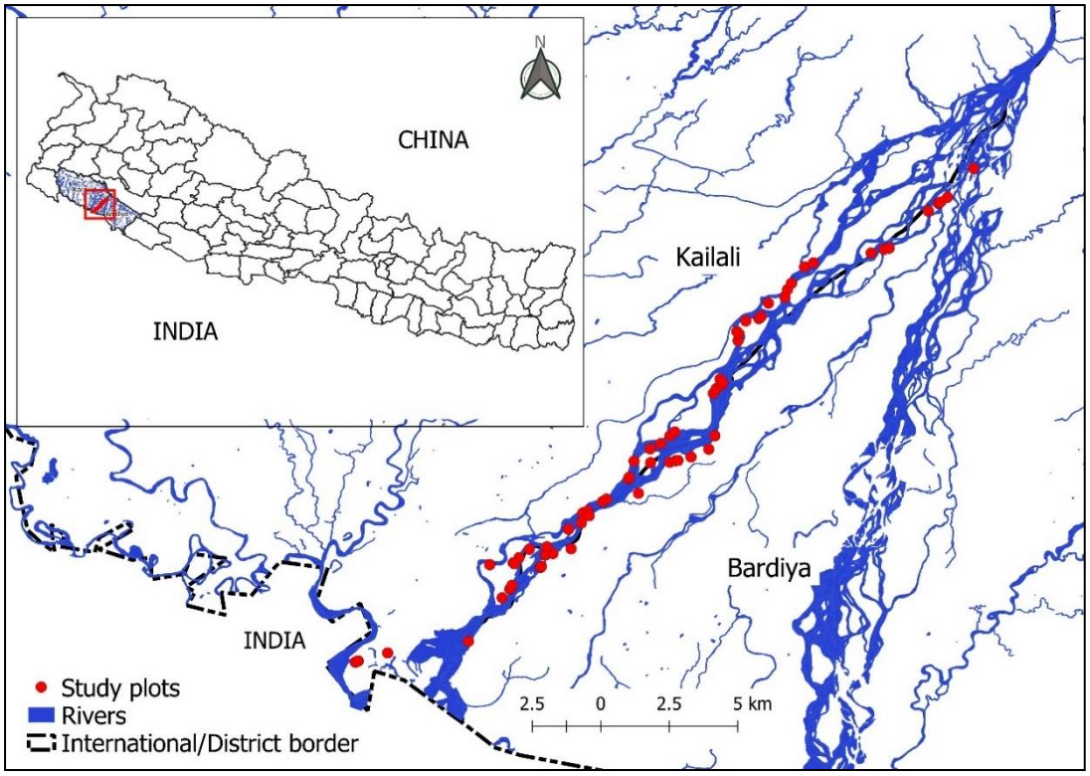

Figure 1. Study site

METHODS AND ANALYSIS

A reconnaissance field visit along the Kauriala River- western branch of Karnali River was carried in October 2019 for a general idea of study area, to finalize the study design and to confirm the presence of otters in the study area so the study could be conducted.

Based on this, a 39 km stretch study area was selected where detailed field study was carried in Jan-Feb of 2020. The study was carried by walking along transects, looking on both banks of the river. A total of 70 transects of 1 km along the 39 km river stretch were laid , and a plot of 100 m × 10 m was placed in the middle of each transect (Anoop and Hussain, 2004; Chettri and Savage, 2014; Nawab and Hussain, 2012a); this was examined for signs of occupancy, i.e. scat, track and dens (Acharya and Lamsal, 2010).

Within the plots, habitat variables were studied: substrate type, vegetation type, escape distance, proximity to road and settlement, river width, braided bars (temporary islands) , disturbance intensity (high = sites of stone or sand extraction and less proximity (distance) to settlement <100 m ; moderate = sites of low human activity and medium proximity to settlement 100 m to 500 m ; low = sites of no or limited human activity and high proximity to settlement >500 m), disturbance type (grazing, frequency of human activity, sand and boulder extraction, presence of feral dogs, fishing) - habitat characteristics defined in Khan et al., 2014 and Jha, 2018. Occupancy signs (tracks, scats and grooming sites) were confirmed following an identification guide by de Silva (2016).

A distribution map of SCO was plotted using Arc GIS version 10.8. A Chi-square test of association was done to assess an association between habitat variables and the presence of Smooth-coated Otters. Logistic regression with Poisson error structure was used to assess the association between habitat variables and evidence of the SCO presence. All statistical analysis was done in R (R Core Team, 2016).

RESULTS AND DISCUSSION

Smooth-coated Otter Occupancy Signs and Distribution

In 70 sampling plots (32 in Bardia District and 38 in Kailali District), occupancy signs were observed in 14 plots (Fig. 2). Tracks (Fig 3A) were observed most frequently (14 plots), followed by scat in 2 plots (Fig 3B), grooming sign (1 plot) and a den (one plot). The occupancy signs were mostly observed on sandy substrate (7 plots), sandy/stone substrate (3 plots), muddy substrate (2 plots) and loamy substrate (2 plots). The distribution of occupancy is 20% of total sampled plots, similar to findings of Hussain and Choudhury (1997).

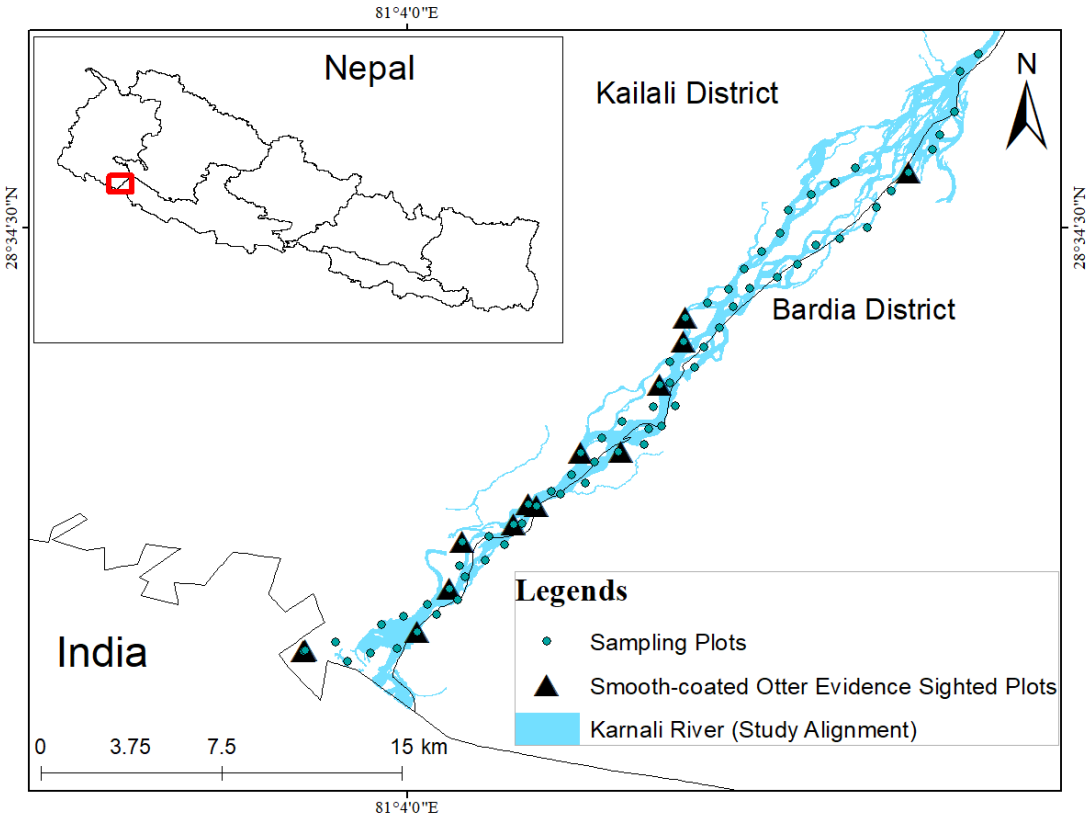

Figure 2. Habitat occupancy map of study area with sign of SCO.

Figure 3. Observed otter track (A) and scat (B) during field study

Association of Habitat Variables with SCO Occupancy Signs

Plots with occupancy signs of SCO were observed where river widths ranged from 50 m to 300 m. The presence of the SCO evidence was recorded in the Narayani River with width of the river ranging from 22.8 m to 276.45 m (Acharya et al., 2010). The probability of occurrence of SCO was negatively associated width of the river (Fig.

5). The studies from Anoop and Hussain (2004), Khan et al., (2014), Narasimmarajan et al., (2021) and Jayasurya et al., (2023) also had negative correlation of SCO evidence with the river width.

A den site was observed outside the sampling plot along the transect that was at distance of 1.4 m from the river bank. Den sites and scats were observed as far as 12.5 m from the water edge (Hussain and Choudhury, 1997).

Occupancy signs of SCO were observed most often where there was shrub cover (*Saccharum* sp., *Lantana camara*), followed by under tree cover (*Dalbergia sissoo*) and then in grass cover (*Cynodon* sp.). Signs were observed in areas without vegetation as well (Fig. 4). In the Sind Province of Pakistan, otter sign was documented more on riverbanks thickly vegetated with *Typha* sp., *Saccharum* sp., and *Phragmites* sp., and/or *Prosopos juliflora*, *Tamarix* sp., and farmland (Khan et al., 2009). Forest and bank vegetation provides otters with feeding opportunities, as well as a place for foraging, resting and holts (Jha, 2018). Most of the otter signs were recorded in vegetated areas (n=5), followed by floodplains (n=4), gabion walls (n=3) and agriculture land (n=2). Signs of six individuals were observed 50 m from settlements or roads, while signs of two individuals were observed within 50-100 m, 100-250 m, 250-500 m and 500-1000 m from settlements and roads. Out of 14 plots with SCO sign, nine plots had less than 5 m escape distance to vegetative cover, three within 5-10 m and two in 10-25 m (Fig. 6, Fig. 7).

The substrate used by SCO were both coarse grained (sand and gravel) and fine grained (clay and silt). However, a higher number of signs (P<0.001) were observed in coarse grained sediments (n=53) compared to fine grained sediments (n=17), that has also been reported in earlier research (Anoop and Hussain, 2004; Acharya and Lamsal, 2010; Acharya, 2017; Bashyal and Yadav, 2020; Hussain and Choudhary, 1997).

The study showed evidence of SCO presence more frequently on sandy substrate with sufficient escape cover and short escape distance (distance of vegetation from occupancy signs to different types of covers). Other studies have shown that Smooth-coated Otters prefer sandy substrate for grooming and sprainting (Anoop and Hussain, 2004; Acharya and Lamsal, 2010; Acharya, 2017; Bashyal and Yadav, 2020). Also, studies by Chettri and Savage (2014) and Khan et al. (2014) have shown a statistically positive relationship between sandy substrate and otter-based activities.

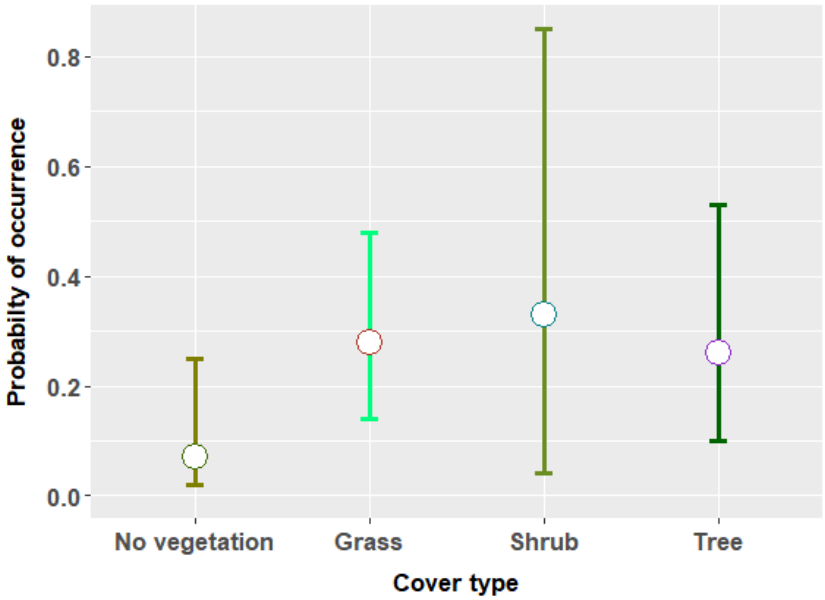

Figure 4. Occurrence of SCO in different river cover types

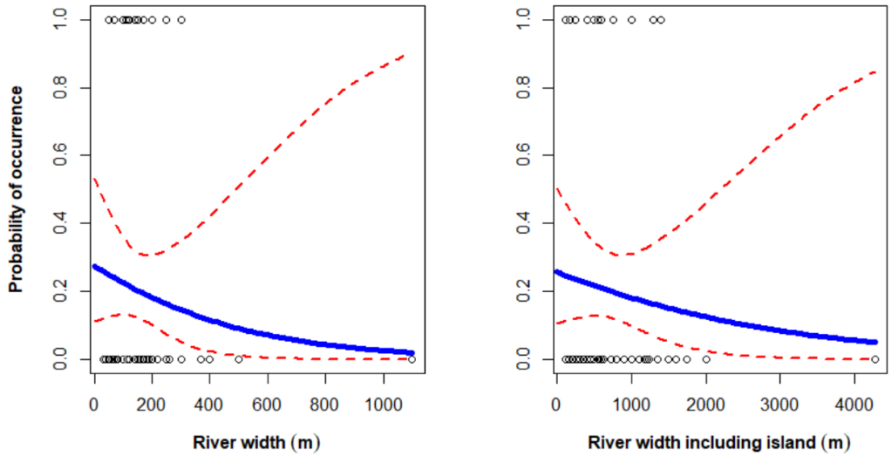

Figure 5. Occurrence of SCO along different river widths

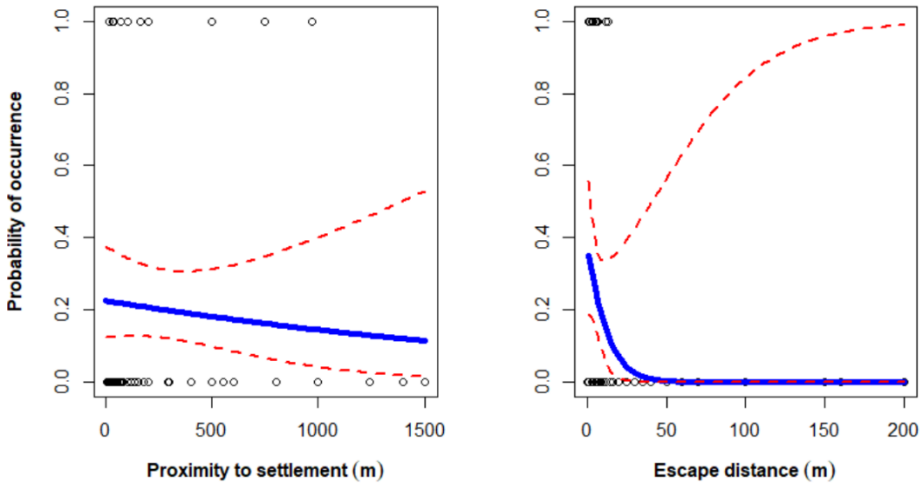

Figure 6. Occurrence of SCO along proximity to settlement and escape distance

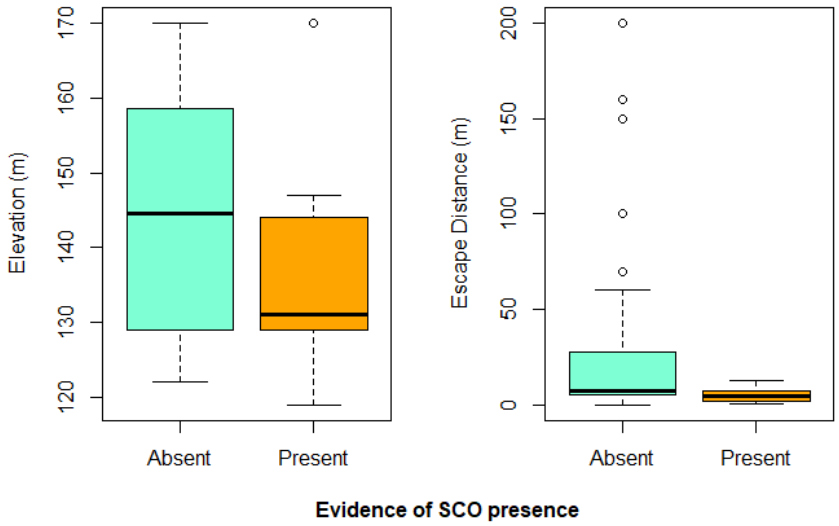

Figure 7. Elevation and escape distance variation with otter abundance

Habitat Disturbance

Human activity is the most pressing problem for SCOs in the study area, followed by grazing, stone extraction, fishing and construction activities (Fig. 8). Ongoing construction works and stone extraction was the most active disturbance type. Livestock grazing and the presence of feral dogs were also potential disturbances. Otter sign been shown to be scarce in disturbed sites (Ali et al., 2010; Nawab and Hussain, 2012a; Chettri and Savage, 2014).

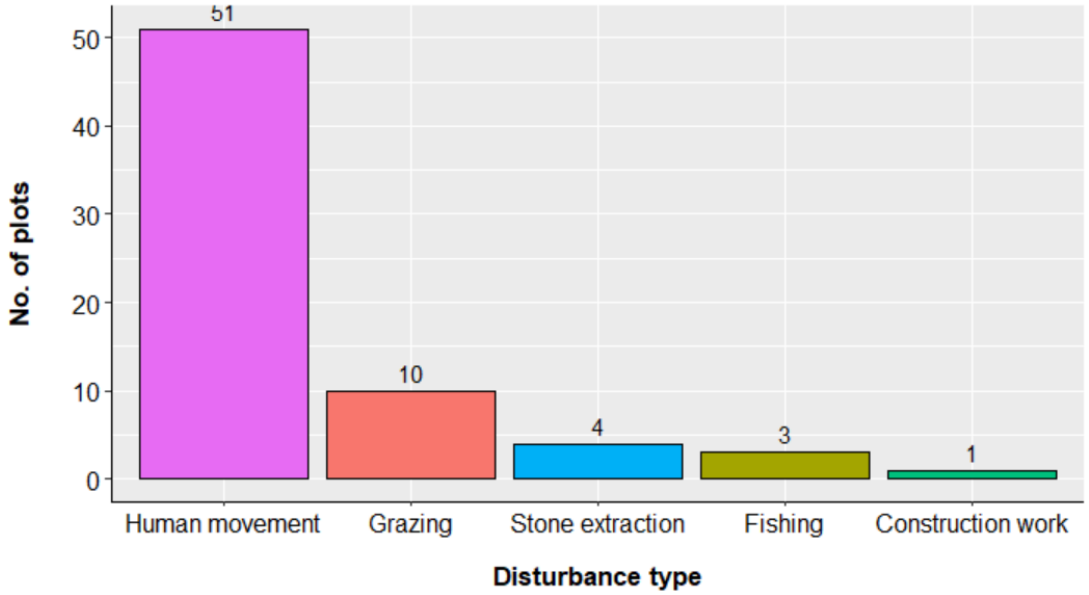

Figure 8. Major disturbances observed in SCO habitat

CONCLUSION

SCO presence in the study area was associated with bank vegetation and human activities, including more otter sign where there was more bank vegetation cover. This could relate to ease of escape from human activities and other land-based threats into land and water. Human activities in the study area need to be mitigated to foster SCO presence. Since otter sign has been found relatively more in vegetated areas with shrub cover, ongoing concretization, gabion wall formation and sand and gravel extraction can be taken as being threatening agents for SCOs. Thus, public awareness, regular monitoring of SCOs and conservation initiations are suggested actions in the Karnali Watershed.

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RESUME

EFFETS DES VARIABLES DE L'HABITAT SUR LA DISTRIBUTION DE LA LOUTRE À PELADE LISSE (*Lutrogale perspicillata*) LE LONG DU BRAS KAURIALA DE LA RIVIÈRE KARNALI, AU NÉPAL

La loutre à pelage lisse (*Lutrogale perspicillata)* (LPL) est un prédateur supérieur semi-aquatique et un indicateur biologique des milieux d'eau douce. Nous avons évalué la distribution de la LPL et sa relation avec les variables d'habitat dans le bras Kauriala de la rivière Karnali. Des preuves de la présence de la LPL ont été recherchées sur les deux berges le long d'un tronçon de rivière de 39 km comprenant 70 transects de 1 km où des parcelles de 100 m × 10 m ont été définies au milieu du transect. Des indices de présence ont été observés sur les tronçons où la largeur de la rivière varie de 50 à 300 m. Cependant, la largeur de la rivière induisait une probabilité négative d'occurrence

de la LPL. Les indices de présence observés de LPL étaient maximaux dans les zones de couverture arbustive et de substrat sablonneux. Les mouvements humains sont considérés comme la menace la plus pressante, suivis par le pâturage, l'extraction de pierre, la pêche et les activités de construction. Un plan d'action de conservation de la LPL devrait être rédigé et mis en œuvre afin de protéger les espèces de la rivière Karnali.

RESUMEN

EFECTOS DE LAS VARIABLES DE HÁBITAT EN LA DISTRIBUCIÓN DE LA NUTRIA LISA (*Lutrogale perspicillata*) A LO LARGO DE LA RAMA KAURIALA DEL RÍO KARNALI, NEPAL

La Nutria Lisa (*Lutrogale perspicillata*) (NL) es un predador tope semi-acuático, y un indicador biológico en ambientes de agua dulce. Evaluamos la distribución de NL y su relación con las variables de hábitat en la rama Kauriala del Río Karnali. Buscamos evidencias de NL en ambas orillas a lo largo de un tramo de 39 km de río, con 70 transectas de 1 km, disponiendo cuadrantes de 100 m x 10 m en el medio de la transecta. Observamos signos de ocupación en tramos en los que el ancho del río variaba entre 50 m y 300 m, pero el ancho del río se asociaba negativamente con la probabilidad de ocurrencia de NL. Los signos observados de NL fueron máximos en áreas con cobertura de arbustos y sustrato arenoso. El movimiento de personas fue considerada la amenaza que ejerce más presión, seguido por el pastoreo, la extracción de rocas, la pesca, y las actividades de construcción. Se debería preparar un plan de acción para la conservación de la NL, para proteger a la especie en el Río Karnali.

सार

खैरो ओट (*Lutrogale perspicillata*) एक अर्ध-जलीय, शीर्ष शिकारी र जलीय पारिस्थितिकिय प्रणालीको जैविक सूचक हो । हामीले कर्णाली नदीको कौरियाला शाखामा खैरो ओटको वास-स्थान बारे अध्य्यन गऱ्यौं । हामीले कर्णाली नदीको ३९ कि.मि. को दुवै तटमा प्रत्येक १ कि.मि. को ट्रान्जेक्ट (Transect) को मध्य विन्दुमा एउटा १०० × १० मि. को प्लट (Plot) बनाएर जम्मा ७० वटा ट्रान्जेक्ट सर्वेक्षण गरेको थियौ । ओटले नदीको चौडाइ ५० मिटर देखि ३०० मिटर सम्म रहेको क्षेत्रहरूमा अधिक उपयोग गरेको पाईयो, तर नदीको चौडाइसँग खैरो ओटको उपस्थितिको सम्भावनासँग नकारात्मक सम्बन्ध देखियो। खैरो ओट स-साना बुट्यानहरु भएको र बलौटे माटो भएको क्षेत्रहरूमा बढी देखियो । त्यस क्षेत्रमा मानव गतिविधि सबै भन्दा ठूलो खतरा भएको देखियो , त्यसपछि चरन, ढुङ्गा उत्खनन, माछा मार्ने र भौतिक निर्माण जस्ता गतिविधिहरूले पनि ओटको वास-स्थानमा असर गरेको देखियो । यो अध्ययनले कर्णाली नदीमा रहेका प्रजातिको संरक्षणकालागि प्रजाति संरक्षण कार्य योजना तर्जुमा र कार्यान्वयन गर्नुपर्छ भन्ने निष्कर्ष प्रस्तुत गर्दछ ।