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New records of Neotropical otter, *Lontra annectens*, in Arroyo Romerillos and Santa Catarina River, Acaxochitlán, Hidalgo, México

Nuevos registros de nutria neotropical, *Lontra annectens*, en el arroyo Romerillos y en el río Santa Catarina, Acaxochitlán, Hidalgo, México

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There are scarce published records of Neotropical otter (*Lontra annectens*) for the state of Hidalgo, México. This work expands the knowledge of its distribution in the state. Fieldwork consisted of the evaluation of 2 sites in search of evidence of the presence of the species: Arroyo Romerillos and Santa Catarina River. Records were obtained through evidence observed during walks along both streams; indirect evidence was identified based on specialized literature and corroborated in the field. The first record in Arroyo Romerillos was an otter spraint found on a rock. Three records were observed in the Santa Catarina River: the first was an otter individual observed entering in the water; the second, a feeding site with crayfish remains (*Procambarus* sp.) on a rock; the third was a den next to the river where offspring sprains were found. This work highlights the importance of continuing to study the species using direct and indirect sampling methods to know the ecological aspects of the habitat of otters and the state of conservation of these water bodies in the state of Hidalgo to help on the generation of conservation strategies for the Neotropical otter and its habitat.

Key words: Conservation strategies; ecological aspects; Hidalgo State; indirect evidence; new records.

Hay pocos registros publicados sobre la nutria neotropical (*Lontra annectens*) para el estado de Hidalgo. Este trabajo amplía el conocimiento de su distribución en el estado. El trabajo de campo consistió en la evaluación de 2 sitios en busca de evidencias de la presencia de la especie: Arroyo Romerillos y Río Santa Catarina. Para la obtención de los registros se hicieron recorridos a pie, a lo largo de ambos caudales; las evidencias indirectas fueron identificadas siguiendo literatura especializada y corroboradas en campo. El primer registro en el Arroyo Romerillos fue una hez encontrada sobre una roca. En el Río Santa Catarina se encontraron 3 registros: el primero la observación de un individuo entrando al agua, el segundo un comedero con restos de acamaya (*Procambarus* sp.) sobre una roca, el tercero fue una madriguera junto al río con heces de cría. Este trabajo destaca la importancia de continuar con la prospección de la especie por medio de métodos de muestreo directos e indirectos, para conocer aspectos ecológicos del hábitat de las nutrias, además de conocer el estado de conservación de estos cuerpos de agua en el estado de Hidalgo, con la finalidad de aportar información que permita generar estrategias para la conservación de la especie y su hábitat.

Palabras clave: Aspectos ecológicos; estado de Hidalgo; estrategias de conservación; evidencias indirectas; nuevos registros.

The Neotropical otter, *Lontra annectens* (de Ferran *et al.* 2024), is extensively distributed in México. It is found in the states of Sonora and Chihuahua in the northwest, and from Tamaulipas in the northeast; from these states south to central and southern México, where its distribution forms 2 branches: one comprising Tabasco, Campeche, Yucatán, and Quintana Roo in the Yucatán Peninsula, and the other covers Oaxaca and Chiapas in the southwest (Gallo-Reynoso 1997; Aranda-Sánchez 2012; Gallo-Reynoso and Meiners 2018; Corona-Figueroa *et al.* 2022; Ortega-Padilla *et al.* 2022). It thrives in mountainous areas with temperate forests, sub-deciduous tropical forests, medium and high tropical forests, and in plains, marshes, and coastal areas, in habitats associated with water bodies (Gallo-Reynoso 1997; Guerrero-Flores *et al.* 2013; Vezzosi *et al.* 2013; Botero-Botero *et al.* 2017; Cid-Mora *et al.* 2018; Mariano-Mendoza *et al.* 2022). The characteristics of these areas and the physiography of the water body (presence of pools, rapids, and shelters, among others), perennial streams with availability and abundance of prey that support the food requirements of *L. annectens*, and other environmental factors such as shaded portions of rivers and temperate water, influence the occupation of riparian habitats by otters (Gallo-Reynoso *et al.* 2019); however, other factors such as high levels of pollutants in their habitat limit their presence (López-Martín *et al.* 1998; Hon *et al.* 2010; Ruíz-Olmo *et al.* 2011; Ramos-Rosas *et al.* 2012; Gallo-Reynoso *et al.* 2019; Vázquez-Maldonado and Delgado-Estrella 2022).

There is one record of Neotropical otter (*L. annectens*) for the state of Hidalgo, found in the boundaries of the municipalities of Calnali and Xochicoatlán (Aguilar-López *et al.* 2015), there is an unpublished record in Toctitlán, municipality of Tlanchinol (iNaturalista 2020), and sightings of the species have been reported in social networks and local newspapers (El Sol de Hidalgo 2022; Rivera 2023). This situation can be attributed to the topographic complexity of the state, which limits access to study areas. This complexity leads to environmental heterogeneity, including several potential habitats suitable for the species when considering the extensive rainwater catchment areas and the complex hydrography in the state associated with the Sierra Madre Oriental located in the eastern part of the state of Hidalgo.

This work expands the known distribution of the Neotropical otter in Hidalgo. In recent years, the water bodies in Hidalgo have been affected by pollution related to solid waste and urban wastewater discharges (probably polluted) that adversely affect the species consumed by otters, other wild species that also thrive in riparian habitats, and the different ecosystem services provided to society (Arreguín-Cortés *et al.* 2010; CNDH 2018). It is worth mentioning that *L. annectens* is an appealing species for society, possibly facilitating its denomination as an umbrella species for the inclusion of communities in conservation actions of local water bodies (Botello *et al.* 2006; Vázquez-Maldonado *et al.* 2021). Despite its wide distribution in México, the Neotropical otter is categorized as "Threatened" (NOM-059-SEMARNAT-2010; DOF 2019) and as "Near Threatened" species at the international level (International Union for Conservation of Nature, IUCN; Rheingantz *et al.* 2021).

The study area is located in the municipality of Acaxochitlán, limited by the municipalities of Metepec, Tulancingo de Bravo, and Cuautepec de Hinojosa in the state of Hidalgo, and by the municipalities of Honey, Pahuatlán, Naupan, Huauchinango, and Ahuazotepec in the state of Puebla (Figure 1).

Fieldwork consisted of the evaluation of 2 sites in search of evidence of the presence of Neotropical otter on September 21, 2023. Records were obtained through evidence observed during walks along both streams in search of direct (sightings) and indirect evidence found on rocks, trunks, herbs, muddy and sandy areas (tracks, spraints, feeding sites, anal-gland gels, shelters, and dens). The first walk lasted 1 hr and covered approximately 200 m of both banks of Arroyo Romerillos (20° 13' 28.93" N, 98° 11' 40.21" W; Figure 1b). The second walk lasted 2 hr, traveling approximately 1,000 m of both banks of the Santa Catarina River (20° 15' 33.41" N, 98° 11' 6.72" W; Figure 1b). Indirect evidence was identified following specialized literature (Aranda-Sánchez 2012) and corroborated in the field by the co-authors.

Site 1. Arroyo Romerillos. The local climate is C (fm), humid temperate with summer rainfall. Mean annual precipitation is 1,200 mm, mean annual temperature is 15.4 °C, at an elevation of 2,140 m (García 2004; CONABIO 2008). Arroyo Romerillos is a creek that runs 6.5 km from the Santa Ana Tzacuala dam and heads north, converging with the Santa Catarina River that flows until it merges with the Chachahuantla River (SEMARNAT 2015). It is a stream with transparent, cold water to the touch, with a waterfall of approximately 10 m high made up of rocks of pyroclastic origin (basalts) that falls to a tree shaded pool; the stream runs through countless small watercourses that gradually merge into a single one. The herbaceous substrate that grows on the riverbanks consists mainly of grasses, ferns, and moss, with a cool and humid environment. Pine-oak forests and mountain cloud forests characterize the habitat. This site is located next to a dirt road that connects San Miguel Rescate in the state of Hidalgo with Honey in the state of Puebla.

Site 2. Santa Catarina River. Its local climate is C (f), humid temperate with precipitation all year. Mean annual precipitation is 1,450 mm, mean annual temperature is 15.8 °C, at an elevation of 1,655 m (García 2004; CONABIO 2008). The area is covered by shade of large trees (~20 m high), the river flows stumbled, and includes shaded pools and large rocks of pyroclastic origin (basalts and tuffs) along the riverbank and within the river. The water is cold to the touch and semi-transparent.

At both sites, a well-preserved herbaceous and shrub substratum abounds, with riparian vegetation consisting of trees such as clethra (*Clethra macrophylla*), madrone (*Arbutus xalapensis*), alder (*Alnus acuminata*), wild cherry (*Prunus*

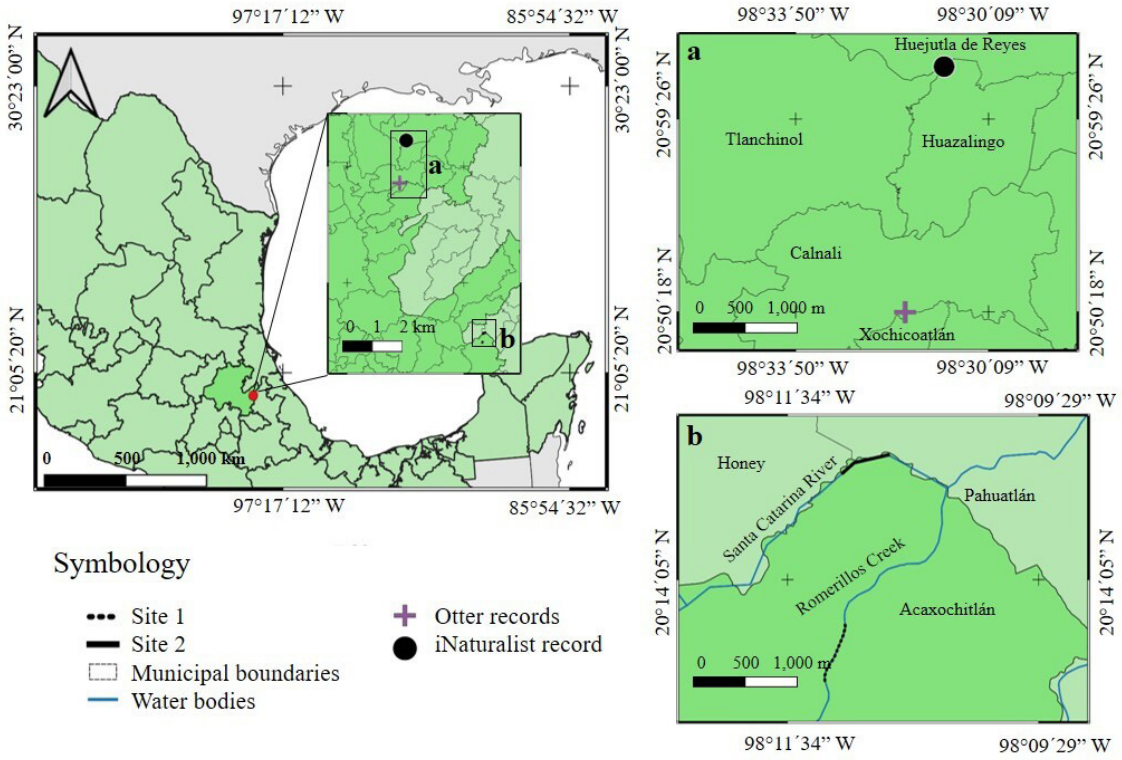

Figure 1. Study area. a) Previous records for the state of Hidalgo; b) the sections of streams walked are marked: the dotted black line corresponds to Site 1 (Arroyo Romerillos) and the solid black line marks Site 2 (Santa Catarina River).

serotina), 2 willow species (*Salix* spp.), 5 pine species (*Pinus* spp.), and 7 oak species (*Quercus* spp.; ASRFPT-WFC 2017). We observed several "fauna paths" crossing the area. Forest management activities are developed in the area and consist in planting pine seedlings (ASRFPT-WFC 2017).

Site 1. Arroyo Romerillos. The first record of the presence of *L. annectens* consisted of a spraint found on a rock containing remains of fish, crustaceans, and insects. This record was located approximately 10 m from the mainstream at 2,139 m (20° 13' 28.93" N, 98° 11' 40.21" W). No other spraints or tracks were observed on the site (Table 1; Figure 2a). We confirmed the presence of crayfish of the genus *Procambarus* sp. (J. L. Villalobos-Hiriart, pers. comm.) on the lower part of the stream after the cascade; this species is potential prey for otters on the site.

Site 2. Santa Catarina River. Three records of Neotropical otter were found. The first was the observation of an individual entering the water from a large willow trunk in the middle of the riverbed and close to the bridge leading to Santa Catarina town. The second record was a feeder on a rock next to the river, where remains of crayfish (*Procambarus* sp.) were found at 1,639 m (20° 15' 33.41" N, 98° 11' 6.72" W; Table 1; Figure 2b). The third record was noted at the entrance to a den adjacent to the river, under a group of large rock blocks, where spraints of Neotropical otter offspring were identified at 1,647 m (20° 15' 30.63" N, 98° 11' 11.79" W; Table 1; Figures 2 c-d). In addition, we found muddy slides where otters enter or leave the water, shelters, and feeding sites.

We recorded other wild mammals in both areas by their tracks, raccoon (*Procyon lotor*), Deppe's squirrel (*Sciurus deppei*), white-nosed coati (*Nasua narica*), gray fox (*Urocyon cinereoargenteus*), species that have been previously recorded in the area together with Mexican hairy porcupine (*Coendou mexicanus*), and margay (*Leopardus wiedii*) by Lira-Torres *et al.* (2014).

Although widely studied in México, no historical publications exist on Neotropical otter occurrence in faunal studies of the state of Hidalgo. Some potential sites for the distribution of the species are mentioned in part for the Huasteca Hidalguense in Molango (Gallo-Reynoso 1989). There is a recent, indirect record of tracks and spraints in

Table 1. Records of *Lontra annectens* in 2 sites located in the municipality of Acaxochitlán, state of Hidalgo, México.

Direct evidence	Indirect evidence	Site 1 Arroyo Romerillos	Site 2 Santa Catarina River
Sighting		---	An adult individual
---	Spraint	On a rock	Inside a den (pup)
---	Feeding site	---	Remains (crayfish)
---	Den	---	Of a pup, underneath rocky blocks
---	Resting den	---	Ferns *Campyloneurum* sp.
---	Potential prey	Crayfish *Procambarus* sp.	Crayfish *Procambarus* sp.

the Chachala River in an evergreen tropical forest at an elevation of 400 m (20° 52′ 46.02″ N, 98° 32′ 20.7″ W; Aguilar-López *et al.* 2015). The latest one is a record near Huejutla found in iNaturalista (2020).

Our records are restricted only to the highlands and Huasteca regions; although these are insufficient to determine the distribution of *L. annectens* in the state, they serve to expand its known distribution. The state of Hidalgo has several habitats, ranging from the Mezquital Valley semi-desert zone, the temperate-humid forests of the Sierra Gorda and Sierra Oriental region, to the tropical lowlands of the Huasteca. Some of them are potential habitats for the species (Gallo- Reynoso 1997; Guerrero-Flores *et al.* 2013; Cid-Mora *et al.* 2018; Mariano-Mendoza *et al.* 2022). The scarce documentation and the new records obtained in this study on the presence of Neotropical otter in the state indicates that a thorough search for its presence has not been conducted, likely due to difficult access to areas of potential presence.

The records of Neotropical otter in 2 sites in the municipality of Acaxochitlán by direct observation of an individual plus indirect evidence (spraints, feeding sites, dens, shelters, and slides) represent the first records of the species in the pine-oak and mountain cloud forests in the Hidalgo Eastern Sierra. The observational record of the otter individual is important since the crepuscular behavior of the

Figure 2. Site 1: Arroyo Romerillos, a) Neotropical otter spraint; Site 2: Santa Catarina River; b) remains of a crayfish eaten on a rock; c) entrance to an otter den, and d) Neotropical otter spraint inside the den.

species limits its study and detection (Gallo-Reynoso *et al.* 2019), the otter was observed in broad daylight in a shaded area. Our record of an active den is also important as it indicates that the species has suitable conditions to reproduce in this habitat. Therefore, it is crucial to continue to survey in search of the species and determine the state of conservation of the rivers in the state of Hidalgo.

Factors that determine the presence or absence of Neotropical otter in the sampling sites include the degree of vegetation cover, the level of anthropization, the state of conservation of water bodies, and prey availability (Rheingantz *et al.* 2017; Gallo-Reynoso *et al.* 2019). Additionally, water resources are increasingly in demand by the human population and are polluted by wastewater (Arreguín-Cortés *et al.* 2010; CNDH 2018).

This work highlights the importance of continuing to explore the species through indirect sampling methods to know the feeding habits, reproductive season, relative abundance, and other aspects of the ecology of otters, in addition to knowing the state of conservation of rivers in the state of Hidalgo. All this will provide information that allows the generation of conservation strategies for the Neotropical otter and the habitats in which it is located.

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