

REPORT

RELATIVE ABUNDANCE AND HABITAT USE OF THE NEOTROPICAL OTTER (*Lontra annectens*) IN THE CUICHAT RIVER, CENTRAL MÉXICO

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(Received 30th May 2025, accepted 18th July 2025)

Abstract: The eastern-central region of Mexico has very few reports on the presence of the northern neotropical otter (*Lontra annectens*). In this work, we determined the relative abundance and habitat use of *L. annectens* in the Cuichat River in Cuetzalan, Puebla. We followed a 16 km river branch that we traveled once a month from September 2012 to February 2013. In each descent, we identified sites with otter presence, signs of presence such as faeces, latrines, tracks, feeding places, and dens. We estimated the density of usage of latrines along the river. We analyzed seven habitat variables that were evaluated using a χ^2 analysis for habitat use. We obtained 31 sites with otter presence, with a relative abundance of 0.32 otters/km. When anthropogenic activity was absent, we found that otters were more active and occupied more shelters regardless of whether the site presented steeper slopes or abundant tree cover. Knowing the variables preferred by otters will allow us to make informed decisions to generate conservation programs related to the species in the Cuichat River, which can be applied to other areas occupied by the species.

Citation : Moreno Barrera, P., Ramírez-Bravo, O.E., Hernández-Romero, P., and Garabana Quintana, B. (2025). Relative Abundance and Habitat Use of the Neotropical Otter (*Lontra annectens*) in the Cuichat River, Central México. *IUCN Otter Spec. Group Bull.* 42 (4): 186 - 193

Keywords: Cuetzalan, distribution, conservation, Mustelid, Puebla.

INTRODUCTION

One approach to habitat conservation is to utilize existing carnivores as flagship species to promote habitat protection, leveraging their specific requirements and position as top predators (Sergio et al., 2008). However, there is little information available on the ecological variables that affect them (Eizirik et al., 2001) and their dispersal capabilities (Waser et al., 2001), making planning conservation and management programs difficult.

This is the case of the neotropical otter (*L. annectens*), a species for which there is a surprising lack of ecological information before the fragmentation of its habitat (Macías-Sánchez and Aranda 1999). Another important situation is that new genetic evidence split the neotropical otter into two species, the formerly denominated *L. longicaudis* and the newest denomination of *L. annectens* (De Ferran et al. 2024), therefore, studies on *L. longicaudis annectens* must be adapted to fit the new classification.

Furthermore, modeling *L. annectens* distribution at the catchment level is difficult due to the need for precise information on the characteristics of the river. Several studies have determined the distribution of the ecologically similar species *Lontra canadensis* in Mexican rivers depends low slopes and riparian vegetation availability (Carrillo-Rubio and Lafón, 2004; Cirelli, 2005; Gallo-Reynoso et al., 2019), the presence of slopes (Carrillo-Rubio and Lafón, 2004; Hernández-Romero, 2011), and the amount of dissolved oxygen, and water quality (Macías-Sánchez, 2003). Thus, otter density seems to be related to habitat productivity (Guerrero et al, 2013), and abundance of prey (Gallo-Reynoso et al., 2019); varying from 0.34 otters per km in semi-arid habitats (Gallo-Reynoso, 1996) to 2.45 otters per km and 6.26 otters per km in tropical areas (Macías-Sánchez, 2003). Due to these factors, the species is considered a reliable bioindicator for habitat quality modifications that could negatively impact its persistence and density in a given river (Owen, 1971; Malanson, 2009; Duque-Dávila et al., 2013).

Since this species is widely distributed in Mexico, it is necessary to produce information on the different habitats where it can be found. This is a priority in highly threatened habitats, such as the mountainous cloud forest, which has a restricted distribution in the country and has been drastically reduced (Challenger and Caballero, 1998). In addition, it is necessary to determine the factors that affect its presence in this habitat as it can serve as a reference for other similar areas. The Eastern Central Mexico presents this opportunity, as it has fragments of the cloud forests habitat, and the otter is present in several of these areas. Our main objective is to understand the otter ecology and distribution in these areas to improve conservation and management programs for the species, using as an example the basin of the Cuichat River.

METHODS

Study Area

The Cuichat River is found in the municipality of Cuetzalan del Progreso, State of Puebla, in Eastern Central Mexico. The municipality has a semi-warm-subhumid climate, rainfall is present throughout the year, with the highest precipitation values at the national level, exceeding 4,000 mm of annual average (Vázquez, 1990). The river is 16 kilometers long and has a maximum height of 1,012 masl, descending to 157 masl (INEGI, 2009) (Fig. 1).

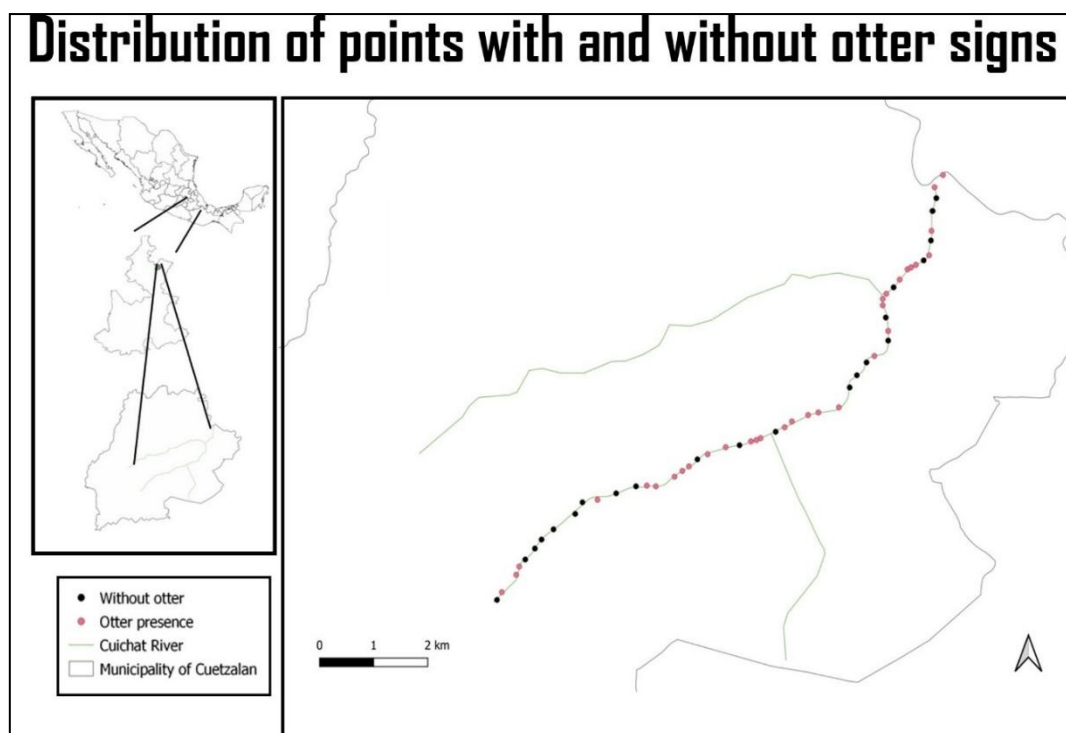


Figure 1. Study area in Cuetzalan, Puebla, Mexico. Sites with and without signs of neotropical otter, *Lontra annectens*, along the Cuichat River.

Fieldwork

We conducted a total of six field trips with a duration of six days each, per month, from September 2012 to February 2013, getting a total of 36 days at the end of the study. When weather conditions allowed, we covered as much of the 16 km area along the river as possible over the six days. Weather patterns were important since during the rains the terrain becomes unstable, and the level of the river increases greatly, making it dangerous for researchers. Also it has to be clear that there is a seasonal bias that has to be addressed, changes on the level of the river due to the rain may wash away otter tracks or completely force otters to move to other sites, as sites like shelters may flood; so future research should consider these factors.

During the field trips of January and February we walked the whole river, in November and December we covered 12 km, and during September and October, we only covered 8 km due to river conditions due to the rainy season. During each trip, we looked for *L. annectens* sites by identifying their presence through faeces, latrines, footprints, feeders, and probable burrows using Aranda's (2000) field guide. Burrows are cavities near water formed by rocks or by tree roots. usually, otter burrows have two entrances, one from the water and the other from dryland; to completely define them as occupied by otters should have some faeces inside (Macías-Sánchez, 2003). Feeders are sites where otters usually feed, and it is possible to find remains of eaten prey and otter faeces. Latrines are sites with the presence of faeces as well as other secretions like urine; these sites are used by otters to mark territory and as a means of communication (Gallo-Reynoso et al, 2019).

We recorded environmental variables within a radius of 25 m at each site since most monitoring projects by CONANP (Commission on Protected Natural Areas) record variables using these measures; this way, data can be comparable to similar studies by CONANP. While looking for and recording the presence of otter tracks at sites during the six-day field trip. In cases of sites with more than one sign, a circumference that englobed all signs was considered as a reference to measuring the

variables within a 25 m radius. In the study area, human activities consisted of livestock production and agriculture, which are common around the river. We also registered indications of urbanization (presence of roads, crop fields, livestock, and houses), which were measured by their presence/absence within the established 25 m radius, as a preliminary evaluation of human impact on otter populations in the Cuichat river, as further studies are required in the future.

Habitat Characteristics

We determined habitat use by describing seven environmental variables: 1) Vegetation type (arboreal, shrubby, mixed, null), 2) Riverbed characteristics (sandy, stony, rocky), 3) shelter availability, 4) anthropogenic activity (presence, absence), 5) trail location (in the middle of the river, in the shore), 6) riverbank characteristics (slope, sandy shore, stony shore, rocky shore) and 7) Channel characteristics (high-deep zone, medium-high depth zone, medium-low depth zone, low-depth zone). Vegetation type is among the most important characteristic, since it directly influences otter habitat preferences (Mayor-Victoria and Botero-Botero, 2010), in “observed sites” which were those with otter signs (faeces, footprint, burrow), and in “expected sites” which were sites obtained by setting and numbering squares along the river and using a random number generator with Microsoft Excel 2010 to select some of this squares. If any of these random sites for habitat characterization fell near an otter site, it was moved 50 m downstream, obtaining a total of 53 sites; the number was just based on the maximum number of points that could be established along the river, avoiding sites with previously confirmed otter presence. We compared results for both sites using a χ^2 analysis (Hernández-Romero, 2011). In case there was a significant difference, we used a Bonferroni confidence interval test with a 95% confidence to determine differences among values. We selected the Bonferroni analysis since not all variables were measurable, and it is a recommended confidence interval for comparing availability and usage (Byers et al., 1984). Furthermore, it helped to make our results comparable with previously published data.

RESULTS

We found 31 sites with otter signs along the 16 km traveled of the Cuichat River, with 25 sites presenting one or more faeces and 6 sites with footprints. The highest number of tracks was obtained on the riverbank at the lower altitudes of 157 masl. The lowest presence of tracks was found at higher altitudes of 1,012 masl (Figure 1).

The results showed there are significant differences between the expected and observed values of all variables (Table 1). Bonferroni intervals explained that the species prefers areas with low slopes, pools, rocky beds, good tree cover, high shelter availability, and little anthropogenic activity.

The expected values presented in Table 1, obtained from sites without signs of otters, serve as a control for comparison with the sites that exhibit signs of otters.

Table 1. Variables used to evaluate *L. annectens* habitat preferences.

Characteristic	Points with signs	Points without signs	Observed rate of use	Rate without use	Bonferroni intervals	Use rate	Selection
Riverside							
Slope	14	9	0.67	0.43	0.18, 0.72	U>E	+
Sandy	4	1	0.19	0.41	-0.05, 0.31	U<E	-
Stony	1	9	0.05	0.14	-0.06, 0.13	U=E	n.s.
Rocky	12	3	0.10	0.05	0.12, 0.65	U>E	+
Channel							
Pond	13	6	0.42	13	0.27, 0.15	U>E	+
Riffle	9	4	0.29	9	0.55, 0.09	U<E	-
Backwater	9	12	0.29	9	0.27, 0.09	U>E	+
Riverbed							
Sandy	9	6	0.26	0.27	0.09, 0.43	U=E	n.s.
Stony	5	9	0.16	0.41	0.02, 0.30	U>E	+
Rocky	17	7	0.26	0.32	0.39, 0.77	U=E	n.s.
Vegetation							
Timberline	16	7	0.52	0.32	0.29, 0.74	U>E	+
Shrub	2	4	0.06	0.18	-0.05, 0.17	U<E	-
Mixed	12	10	0.39	0.45	0.17, 0.61	U=E	n.s.
Nonexistent	1	1	0.03	0.45	-0.05, 0.11	U<E	-
Burrow							
Availability	21	11	0.68	0.41	0.47, 0.89	U>E	+
Absence	10	11	0.32	0.59	0.11, 0.53	U<E	-
Anthropogenic Disturbance							
Disrupted	17	16	0.55	0.73	0.32, 0.77	U>E	+
Preserved	14	6	0.45	0.27	0.23, 0.68	U<E	-

Expected values results, the first column indicates the variables, the second column shows the number of observed signs, the third column shows the expected number of signs, the fourth column presents the observed rate of use (how common is for otters to use the site), the fifth column presents the expected rates of use, the sixth column represents the Bonferroni interval for the rate of use, then a Bonferroni analysis was required when the values of the observed rate of use and expected rate of use differed, the seventh column represents if use “U” differ from the expected use “E”, the eight column shows selection, this determines the chance of finding an otter on the site (“+” is a higher chance than expected, “-” is a lower than expected chance usually because those are sites that otters avoid, and “n.s.” represents that the difference to the expected chance is not significant).

DISCUSSION

This study in mountain cloud forests can help identify priority conservation zones throughout this ecosystem. The obtained results are like those obtained through other sampling methods, such as photo-trapping, the most widely used technique for population and habitat use studies of otters in other regions of Mexico (Gallo-Reynoso et al. 2019).

The results on habitat use show that despite differences in habitat, the characteristics sought by the species are like those previously recorded in other sites. An example of this is the use of large rocks on the banks of rivers as latrines (Mayor-Victoria and Botero-Botero, 2010), the use of slopes as resting, shelter, and breeding sites (Cirelli, 2005; Hernández-Romero, 2011). Similarly, there was a preference for sites with rocky banks because they are associated with pools and deep areas of the river, indicating a higher probability of prey availability, mainly during the dry season (Gallo-Reynoso, 1996; Cirelli 2005; Hernández-Romero, 2011). In addition, we observed that, as in other areas, the otter prefers areas with extensive vegetation cover (Gallo-Reynoso 1996; Calmé and Sanvicente, 2009), although the species seems to prefer shrubs rather than dense tree populations.

Regarding human presence, other studies have shown that it is not a factor that affects the presence of the otters (López-Martín et al., 1998; Briones-Salas et al., 2008), but only when it is low intensity of use of common areas. However, sewage discharge and garbage deposits can cause otters to move to sites with better water quality (Gallo-Reynoso, 1996; Macías-Sánchez, 2003; Hernández-Romero 2011). As has been observed with otter tracks have been found in areas without human activities, although some sites with slight human presence reported higher densities of otters than completely undisturbed areas, showing that possible anthropogenic activity may benefit otter populations slightly, being an interesting contrast to what previous studies report. However, it is necessary to determine the effects of human activity on otters' presence. Still, the results obtained helped us determine some key preferences in the habitat for neotropical otters: preferred vegetation coverage, presence of slopes and large rocks and none or slight human presence

Ethics Statement: We applied indirect methods, so no permits were required; however, we followed the ethical and legal standards in Mexico, including asking for permission from local authorities.

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Degree Thesis, Facultad de Filosofía y letras. Colegio de Geografía. UNAM. México.
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RÉSUMÉ : ABONDANCE RELATIVE ET UTILISATION DE L'HABITAT DE LA LOUTRE NÉOTROPICALE (*LONTRA ANNECTENS*) DANS LA RIVIÈRE CUICHAT, AU CENTRE DU MEXIQUE

La région Centre Est du Mexique possède très peu de données sur la présence de la loutre néotropicale du nord (*Lontra annectens*). Dans ce travail, nous avons déterminé l'abondance relative et l'utilisation de l'habitat de *L. annectens* le long de la rivière Cuichat à Cuetzalan, dans l'État de Puebla. Nous avons parcouru un bras de rivière de 16 km que nous avons prospecté une fois par mois de septembre 2012 à février 2013. À chaque descente, nous avons identifié des lieux de présence de loutres, ainsi que des indices de présence tels que des épreintes, des latrines, des traces, des aires d'alimentation et des catiches. Nous avons estimé la densité d'utilisation des latrines le long de la rivière. Nous avons analysé sept variables d'habitat, qui ont été évaluées par une analyse du χ^2 de l'utilisation de l'habitat. Nous avons obtenu 31 sites de présence de loutres, avec une abondance relative de 0,32 loutre/km. En l'absence d'activité anthropique, nous avons constaté que les loutres étaient plus actives et occupaient davantage d'abris, liés à la présence de pentes raides ou à un couvert forestier abondant. Connaître les variables de prédilection des loutres nous permettra de prendre des décisions judicieuses afin de générer des programmes de conservation liés à l'espèce de la rivière Cuichat. Ces programmes pourront être appliqués à d'autres zones occupées par l'espèce.

RESUMEN: ABUNDANCIA RELATIVA Y USO DE HÁBITAT DE LA NUTRIA NEOTROPICAL (*LONTRA ANNECTENS*) EN EL RÍO CUICHAT, EN EL CENTRO DE MÉXICO

La zona centro-oriental de México presenta muy pocos reportes de presencia de nutria neotropical (*Lontra annectens*). En este estudio, determinamos la abundancia relativa y uso de hábitat de *L. annectens* en el Río Cuichat en Cuetzalan, Puebla. Recorrimos un brazo del río de 16 km de largo una vez al mes durante el periodo de septiembre 2012 a febrero 2013. En cada descenso identificamos sitios con presencia de nutrias, como lo son heces fecales, letrinas, rastros, alimentadores y madrigueras. Estimamos la densidad de uso de letrinas a lo largo del río. Analizamos siete variables de hábitat que fueron evaluadas usando análisis χ^2 para uso de hábitat. Obtuvimos 31 sitios con presencia de nutria, con una abundancia relativa de 0.32 nutrias/km. Cuando hubo ausencia de actividad antropogénica, descubrimos que las nutrias son más activas y ocupan más madrigueras, independientemente de si el sitio presentaba pendientes pronunciadas o cobertura abundante de árboles. Conocer las variables preferidas por las nutrias, nos permitirá tomar decisiones mejor informadas para generar programas de conservación para la especie en el Río Cuichat, qué pueda ser aplicado a su vez a otras áreas ocupadas por esta especie.