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# Presence of Neotropical otter, *Lontra longicaudis annectens,* on Champotón River Banks, Campeche

# Presencia de nutria neotropical, *Lontra longicaudis annectens,* en la ribera del río Champotón, Campeche

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Given the extensive territory inhabited by the Neotropical otter, in addition to knowing the ecological importance of this species, one annual monitoring was carried out along the Champotón River banks after 22 years of the only documented record in the study area. The aim was to confirm the presence of the Neotropical otter, *Lontra longicaudis annectens.* We navigated 30 km of the Champotón River aboard a vessel during 3 climatic seasons ("*nortes*" of 2019; dry and rainy seasons of 2020). Direct and indirect evidences of the presence of otters were recorded and properly georeferenced. Additionally, the water temperature and salinity in these sites were recorded. The recorded temperature was 30 ºC ± 3 °C, and salinity ranged between 0 ppm and 8 ppm. A total of 33 indirect evidences were recorded, including feeders and feces: 22 in the "*nortes*" season (2019), 5 in the dry season, and 6 in the rainy season (2020), plus one sighting in the 2019 "*nortes*" season. The indirect evidences analyzed confirmed the otter feeding habits based on the local crustaceans and fishes. The environmental and feeding conditions, in addition to the Champotón River flora and fauna, were favorable for the presence of *L. l. annectens*, just over 2 decades after its first record in the study area; however, attention should be paid to anthropic affectations.

**Key words:** Anthropic effects; Campeche; feces; feeding; Neotropical otter.

Derivado del extenso territorio en el que habita la nutria neotropical, además de conocer la importancia ecológica de esta especie, se realizó un monitoreo durante un año en la ribera del río Champotón después de 22 años del único registro documentado en el área de estudio con la finalidad de confirmar la presencia de la nutria neotropical *Lontra longicaudis annectens.* Durante 3 temporadas climáticas (nortes de 2019, secas y lluvias de 2020) se realizaron recorridos a bordo de una embarcación a lo largo de los 30 km navegables del río Champotón. Se colectaron evidencias directas e indirectas de la presencia de nutrias debidamente georreferenciadas. Adicionalmente se registró la temperatura y la salinidad del agua de estos sitios. La temperatura registrada fue de 30 ± 3 °C y la salinidad de 0-8 ppm. Se recolectaron 33 evidencias indirectas tales como comederos y heces: 22 en la temporada de nortes (2019), 5 en la temporada de secas y 6 en temporada de lluvias (2020), además de un avistamiento en la temporada de nortes (2019). Se analizaron las evidencias indirectas, confirmando los hábitos de alimentación basados en crustáceos y peces de la zona. Las condiciones ambientales, de alimentación, flora y fauna del río Champotón, fueron propicias para confirmar la presencia de *L. l. annectens*, a poco más de 2 décadas de su primer registro en el área de estudio; sin embargo, se debe poner atención a las afectaciones antrópicas.

**Palabras claves:** Alimentación; Campeche; efectos antrópicos; heces**;** nutria neotropical.



The Neotropical otter (*Lontra longicaudis annectens*) is a mustelid considered a key species because of its ecological functions within ecosystems (Miller *et al.* 1999). At the continental level, it is widely distributed from northern México to northern Argentina (Arellano *et al.* 2012). Given the current conservation difficulties from the drastic alteration of ecosystems due to the constant impact of anthropic activities on habitats, this species is protected in México by the General Law of Wildlife. The Neotropical otter is listed as Threatened in the standard NOM-059-ECOL-2010 (SEMARNAT 2010). In addition, it is listed in the Red List of Threatened Species of the International Union for the Conservation of Nature (IUCN; Rheingantz *et al.* 2021) and Appendix I of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES 2018). The pollution of tributaries, habitat destruction, and altered land uses have been the main causes affecting the species. This has caused its displacement and even its eradication in historical distribution areas that no longer provide optimal conditions for its survival (Soler 2002). Other anthropogenic pressures that have influenced the decline of populations of this species are mining activities, pollution, livestock raising, urban expansion, and hydroelectric networks (Rheingantz *et al.* 2021).

In México, the Neotropical otter is distributed throughout the south to Morelos, and its distribution reaches

the south of Tamaulipas on the Gulf of México slope and the north of Sonora and Chihuahua on the Pacific slope (Gallo-Reynoso and Meiners 2018). An important aspect of Neotropical otters is that in environments impacted by pollutants such as heavy metals and pesticides, there is a noticeable lack of direct and indirect evidence of the presence of Neotropical otters. Therefore, this species is considered an indicator of the conservation quality of sites (Gallo-Reynoso and Meiners 2018).

Systematic studies of the species have been conducted in the state of Campeche, such as those of Gallo-Reynoso (1997) in the Candelaria, San Pedro, Chumpan, and Samaria rivers. Guzmán-Soriano *et al.* (2013) recorded 2 skulls, 1 found in the Calakmul Biosphere Reserve and the other in the Venustiano Carranza River, in the state of Campeche. Santiago-Plata *et al.* (2013) on the road La Veleta (almost on the state border between Campeche and Tabasco) and Vázquez-Maldonado *et al.* (2021) recorded the presence of Neotropical otters in the state of Campeche. In 2022, 2 works were carried out in lagoons adjacent to the Palizada River, Campeche: "La Lagartera" lagoon (Mariano-Mendoza *et al.* 2022) and "La Sangría" lagoon (Vázquez-Maldonado and Delgado-Estrella 2022). Meanwhile, in the Champotón River, the information available regards a single record reported by Gallo-Reynoso in April 1986, observing 3 traces 3 km east of the Champotón town. This work aimed to expand the previous information, confirm the presence of this species in this tributary, and determine its food preferences to analyze the conservation issues facing the Neotropical otter.

The Champotón River is located in the central part of the state of Campeche (Figure 1); it originates near the San Juan Carpizo town, with a maximum elevation of 120 m, and runs across 48 km until its mouth to the Gulf of México. Its total area is 649 km$^2$, and its average depth is 4 m (Posada-Vanegas *et al.* 2013). Due to the local relief and climate, the riparian vegetation is composed of medium semi-evergreen and sub-deciduous forests, low semi-evergreen thorny forest, and mangroves composed of *Rhizophora mangrove*, *Avicennia germinans,* and *Laguncularia racemosa*. Crustaceans consumed by Neotropical otter as food include decapods, palemonids, and amphipods; for example, *Mayaweckelia yucatanensis* and *Creaseria morleyi* (INEGI 2016).

We traveled along the riverbank on an outboard motorboat, covering approximately 30 km long during the 3 climatic seasons in the region: "*nortes*" (cold-front) season of 2019 (October to January), and dry (February to May) and rainy (June to September) seasons of 2020 (Ramos-Miranda *et al.* 2006). During the surveys, we reviewed mainly trunks and mangrove trees to record indirect evidences of the presence of the Neotropical otter: feces, latrines, feeders, footprints, exudates (gelatinous excretions of the anal glands indicating the reproductive status); places that allowed walking were searched for burrows. The materials found (feces and feeders) were sampled manually using self-sealing bags with airtight closure. All the evidence was georeferenced with a GPSMAP 78s GARMIN (Taiwan), and the following characteristics of the area were recorded: surface water temperature (Seahawk manual thermosounder; Taiwan), salinity (ATAGO refractometer; U.S.A.), and presence of anthropic activities (livestock raising, agriculture, logging, fires, presence of garbage). Each indirect evidence (latrine feces, feeder, exudate, and burrow) was photographed with a Nikon DMC-LS80 digital camera. Subsequently, the percentage of occurrence (PO) on the Champotón River banks was analyzed to evaluate its representativeness by season using the modified formula for feeding habits of Macías-Sánchez and Aranda (1999):

$$PA = \frac{f_i}{ft}(100)$$

Where *fi* is the number of records of indirect evidence "*i*", and *ft* is the total number of records considering all types of indirect evidence.

Feces were analyzed using the method by Santiago-Plata *et al.* (2013) modified by Vázquez-Maldonado *et al.* (2021). This consisted of washing and drying the collected samples. Non-digestible components were identified using a stereo microscope (Iroscope model ES-24PLIT). Biomass was calculated from the dry weight of the remains; once the sample was separated, it was weighed on an electronic scale (Ohaus PA214, China).

Crustacean species were identified based on specialized literature: Guzmán and Sánchez (1992), Álvarez *et al.* (2014), and García and Ramírez (2015).

On the other hand, the feeding habits of the Neotropical otter were determined by calculating the percentage of occurrence (PO) with the formula:

$$PA = \frac{f_i}{ft}(100)$$

Where *fi* is the number of feces containing the prey category "*i*", and *ft* is the total number of records of all prey categories in all feces (Macías-Sánchez and Aranda 1999).

The location and spatial distribution of indirect evidences of the Neotropical otter (feces, latrines, exudates, and feeders) by climatic season were recorded using the program Qgis version 2.0, which produced the respective spatial distribution maps.

During the 2019 "*nortes*" season, the mean surface water temperature was 33.70 °C, and salinity was 7.91 ppm. In the 2020 rainy season, mean surface water temperature was 30.25 °C, and salinity was 0. Besides, the 2020 dry season recorded a mean surface water temperature of 33.50 °C and salinity of 6 ppm.

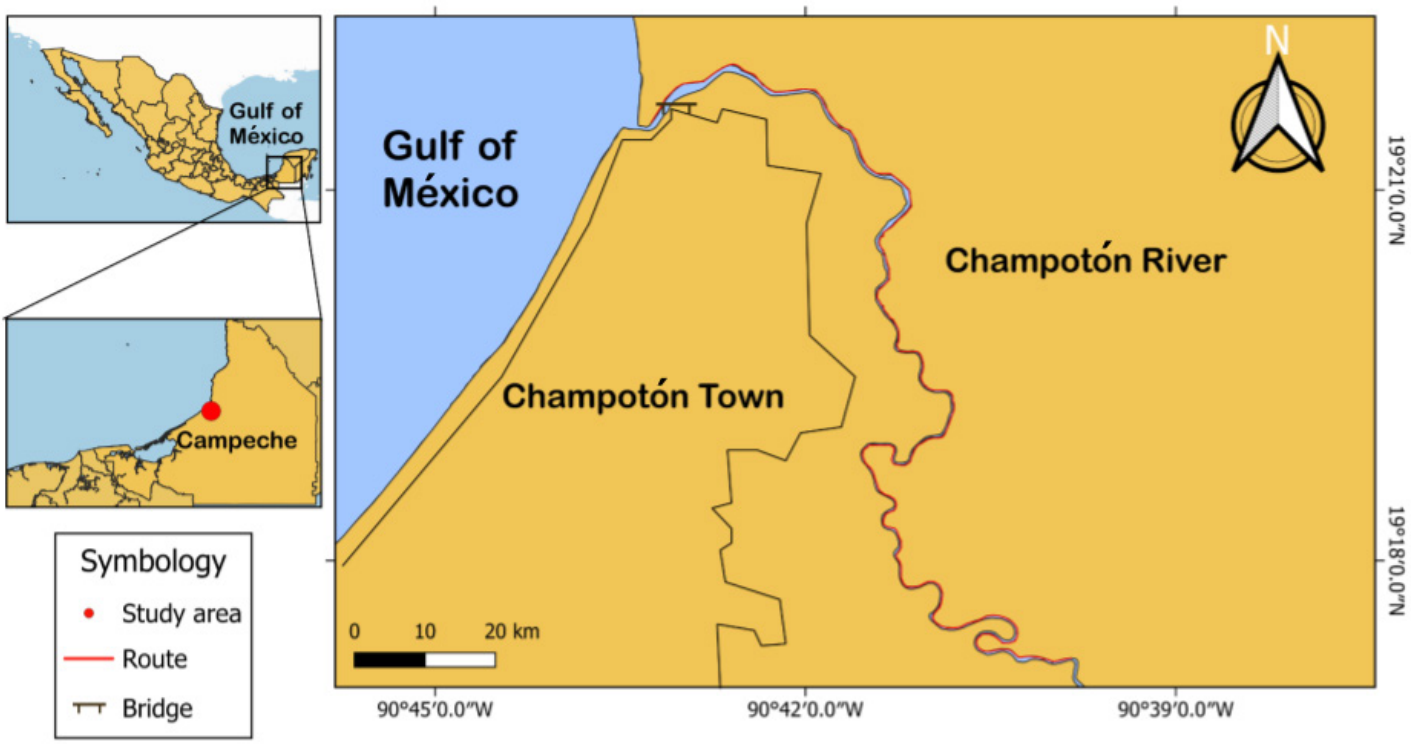


**Figure 1**. Location of the study area in Champotón River, Campeche, México.

We obtained 33 records of indirect evidence of the presence of *L. l. annectens* along the Champotón River banks (22 in the "*nortes*" season, 6 in the rainy season, and 5 in the dry season). Of these, 16 corresponded to feces, 12 to feeders, 2 to latrines, 3 to exudates (gelatinous excretions from the anal glands), and 1 sighting. In the latter, an individual was observed sunbathing on a dead tree trunk in the 2019 "*nortes*" season; this otter could not be photographed because it ran away, but its location was recorded (see the map in Figure 2a). Differences in the ecosystem between seasons were observed during the period studied, reflected as variations in the number of direct and indirect evidences in the study area by season. Besides, in the dry and rainy seasons of 2020, a greater impact of anthropic activities was observed, such as livestock farming, cane fishing, deforestation, fires, and agriculture carried out by villagers living near the river (Figure 2b, 2c).

Regarding the percentage of occurrence of indirect otter traces, a higher incidence was recorded in the "*nortes*" season (68 %), followed by the rainy season (17 %), and the lowest in the dry season (15 %). Concerning non-digestible remains in feces and feeders, crustaceans showed the highest percentage of occurrence (PO) in the 3 seasons (80 %), followed by a minor presence of fish remains (12 %) and mollusks (8 %). The main crustacean species consumed by otters in the study area belong to 3 genera (*Uca* sp., *Sesarma* sp., and *Callinectes* sp.). The genus *Uca* had the highest biomass (60.04 g), followed by *Sesarma* (21.73 g), and *Callinectes* (14.36 g). These 3 genera were recorded in the 3 climatic seasons. Also were found remains of fish spines and scales, which were scarce compared to crustaceans; as no structures allowing their identification were found, we only recorded their consumption. The presence of mollusks was also recorded; however, the very small fragments of exoskeletons (shells) found were unsuitable for identification.

The presence of *L. longicaudis* on the Champotón River banks was confirmed with a sighting and the record of 3 anal excretions (exudates), which indicate the reproductive stage of the species, in the 2019 "*nortes*" season. Similarly, several indirect evidences confirm the presence of this species in the study area.

The distribution of indirect traces of Neotropical otter in the study area in the 3 climatic seasons was analyzed, revealing that the presence of the species may also be influenced by seasonal variations in resource availability. This is consistent with the observations for *L. longicaudis* reported by Arellano *et al.* (2012) in Tlacotalpan, Veracruz; Grajales-García *et al.* (2019) in the coastal area of Tuxpan, Veracruz, and Vázquez-Maldonado and Delgado-Estrella (2022) in La Sangría lagoon, Ciudad del Carmen, Campeche, México. Our findings also agree with those reported by Carrasquilla and Trujillo (2004) for the giant river otter of the Amazon River (*Pteronura brasiliensis*), who stated that annual variations in the hydrological regime and prey availability are among the drivers of the spatial distribution of otters.

The area studied in the present work is composed of habitats and physicochemical parameters similar to those in the areas where the Neotropical otter thrives, described by Gallo-Reynoso in this same region (1991). That is, the species can adapt to live in areas of forests (mountain cloud forest, tropical sub-deciduous forest), mangroves, and

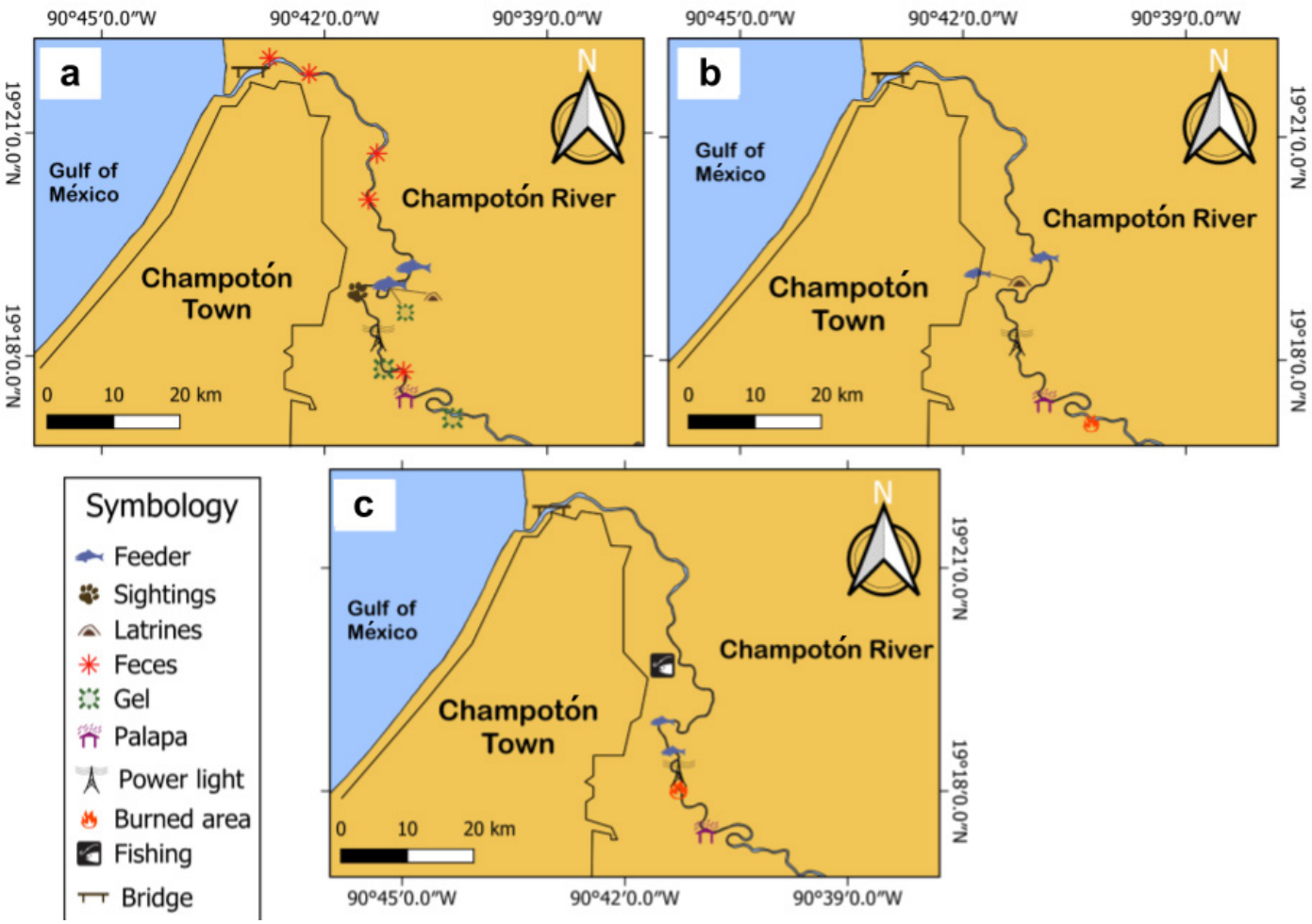


**Figure 2.** Record of indirect and direct evidences of the presence of the Neotropical otter (*Lontra longicaudis annectens*), as well as of anthropic activities, by climatic season in the Champotón River, Campeche. a) "*nortes*" season (2019), b) dry season (2020), c) rainy season (2020).

low deciduous forests with well-defined climatic seasons, in addition to brackish and even completely saline water ecosystems. The Champotón River comprises medium subdeciduous and semi-evergreen forests, low thorny semi-evergreen forests, and mangroves, presenting well-defined climatic seasons and influenced by brackish water. These features make Champotón River a suitable habitat for *L. longicaudis,* as documented in the present study.

Different anthropic activities were observed on the Champotón River banks during the study period. These differ in each climatic season as the resources provided by the river are used: the approach of cattle to the river bank, incidence of fishing boats, agri-food crops on the river margins, logging, and, in particular, induced fires in the dry season. These were reflected in the low incidence of direct and indirect evidences reflecting the sporadic use of this site by Neotropical otters, confirming the reports of Gallo-Reynoso and Meiners (2018), and highlighting that anthropic activities influence the presence of the species.

With regard to the diet of Neotropical otter (*L. longicaudis*) in this area, crustaceans were the most abundant prey in their diet, followed by fishes, although in a low proportion. These results are similar to those recorded by Macías-Sánchez and Aranda (1999), Macías-Sánchez (2003), Botello *et al.* (2006), Ramírez-Bravo (2010), Duque-Dávila *et al.* (2013), and Grajales- García *et al.* (2019), but differ from the reports by Gallo-Reynoso (1986, 1991, 1996), Parera (1993), Parera (1993), Cruz-García *et al.* (2017), Barrientos *et al.* (2018), Juárez-Sánchez *et al.* (2019), Mariano-Mendoza *et al.* (2022), and Vázquez-Maldonado and Delgado-Estrella (2022), who mention that fishes are the most important prey in their study areas. Several authors (Gallo-Reynoso 1991, 1996; Macías-Sánchez and Aranda 1999; Arellanes-Licea and Briones-Salas 2003; Díaz-Gallardo *et al.* 2007; Santiago-Plata *et al.* 2013; Grajales-García *et al.* 2019; García-Silva *et al.* 2021) indicate that otters are generalist carnivores that feed preferentially on abundant and slow species. Accordingly, *L. longicaudis* has been defined as a generalist species feeding on any potential food available. The incidence of the prey group with the highest percentage of occurrence (PO) in the samples supports the idea that crustaceans (*Uca* sp., *Sesarma* sp., and *Callinectes* sp.) were the most available prey in the area. Rheingantz *et al.* (2017) note that flexibility in feeding patterns of the Neotropical otter may contribute to explaining the wide distribution of the species, as it depends on the broad range of conditions in the aquatic systems where it thrives.

This work, a follow-up of the study by Gallo-Reynoso (1997), confirms the presence of this species in the Champotón River, Campeche, after approximately 2 decades. For this reason, we consider it important to continue with studies in the region, preferably addressing the current condition of the native carcinofauna and ichthyofauna, as well as the population dynamics and abundance of the Neotropical otter, to gain a deeper insight into the biological and ecological aspects of its population in this region. Based on the observations made, we also recommend conducting environmental education workshops targeting the local inhabitants. This activity would contribute to conserving the otter and mitigating any ecosystem disruptions in general. Additionally, these workshops would inform municipal and state environmental institutions aimed at setting plans for the monitoring and conservation of the Neotropical otter in the Champotón River.

The environmental conditions of the Champotón River (physicochemical, flora, and fauna) allowed us to confirm the presence of the Neotropical otter since the analysis of indirect and direct evidences is consistent with the observations recorded in other studies. However, the various anthropic activities in human settlements on the Champotón River banks could be drivers of the low presence of *L. longicaudis annectens* during the 3 climatic seasons covered by our research work. The prey consumed by *L. longicaudis* included mainly crustaceans and a low percentage of fish; crustaceans were represented by the genera *Uca* sp., *Sesarma* sp., and *Callinectes* sp.

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