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Behaviors of the Solitary Neotropical Otter (*Lontra longicaudis*) in Communal Latrines

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Abstract

Latrines are important sites for intraspecific olfactory communication in mammals, especially for solitary or widely distributed species. Communal latrines give visitors access to information about other visitors, notably conspecific chemical cues, even in their absence. Chemical communication has evolved to allow information transfer among individuals that, due to other ecological constraints, do not co-occur in time. Latrines can be difficult to find and monitor but provide useful information about the behavioral ecology of otters. The aim of this study was to describe the behaviors of Neotropical otters (*Lontra longicaudis*, Olfers, 1818) in two communal latrines using video-camera traps. A total of 1,651 one-minute footage of otters visiting the latrines were used to elaborate an ethogram that included individuals (1) passing by, (2) rubbing, (3) scent marking, (4) scratching, (5) in vigilance, (6) smelling, (7) defecating, (8) urinating, (9) digging, (10) self-grooming, and (11) interacting with others. These results suggest that latrines are not only used by Neotropical otters to deposit feces and urine but that they also play a role in intraspecific communication. We suggest that *L. longicaudis* latrines function as information centers where individuals can monitor the location and activities of potential sexual partners and/or competitors.

Key Words: behavior, ethogram, video-camera trap, latrines, Neotropical otter, *Lontra longicaudis*, mammals

Introduction

Chemical signals mediate encounters among solitary individuals that are separated by space and time. Repeated animal visits to specific locations promote interactions with other individuals (Danchin et al., 2004). Many animals concentrate their signals where other individuals regularly deposit their chemical marks (e.g., scent, feces, urine). These locations are referred to as latrines (Gorman, 1980; Brown & Macdonald, 1985). The use of latrines is particularly common in small and medium-sized carnivorous mammals such as the solitary honey badger (*Mellivora capensis*; Begg et al., 2003) and the social meerkat (*Suricata suricatta*; Jordan et al., 2007).

In social species, latrines may be more common at territorial boundaries to prevent individuals from other groups from entering an area that already has owners (Gorman & Mills, 1984; Kilshaw et al., 2009). Chemical signaling in latrines can have dual function: (1) preventing intruders in the central area of a territorial pair/group and/or (2) as centers for information exchange among individuals from different pairs/groups to reduce marking efforts and to maximize the likelihood of information gain about the conspecifics in a given region (Jordan et al., 2007; Darden et al., 2008; Eppley et al., 2016). In general, the marking sites are selected to enhance signal detection by receivers (Roberts & Gosling, 2001).

Latrines play an important role in olfactory communication in several species (Brown & Macdonald, 1985). Mammals often depend on olfactory cues present in feces, urine, and other secretions to exchange information with

conspecifics (Vehrencamp & Bradbury, 1998; Wyatt, 2014). Among carnivores, olfactory signals generally play a key role in intraspecific communication (Beauchamp et al., 1976; Gorman, 1980; Brown & Johnston, 1983; Kranz, 1996; Molteno et al., 1998). In different species and under different ecological conditions, chemical signals found in feces, urine, and anal mucus can serve as reliable indicators of an individual's sex or reproductive status (Brown & Macdonald, 1985), as well as in maintaining the social organization of the group (Jorgenson et al., 1978; Brown, 1979; Macdonald, 1985; Gese & Ruff, 1997; Sillero-Zubiri & Macdonald, 1998).

Smells in the latrine can persist in the environment for a long time, with the potential to reach a wide audience (Muller-Schwarze, 2006; Wyatt, 2014) without the need for face-to-face interaction between individuals to communicate (Darden et al., 2008; Wronski et al., 2013). Consequently, latrines can function as information centers between social groups or between individuals of solitary species that are dispersed in their habitat (Darden et al., 2008; Eppley et al., 2016). In this context, latrines can help coordinate social and reproductive behavior by allowing conspecifics to monitor the activity and condition of potential mates and rivals (Sneddon, 1991; Rostain et al., 2004; Wronski et al., 2006; Darden et al., 2008).

The latrine behavior of otters includes marking places along the coast of water courses (Testa et al., 1994; Bowyer et al., 1995; Kruuk & Conroy, 1996) where they deposit feces and urine in addition to secretions from anal glands (Ben-David et al., 1998). Although the social function in the otter latrine sites is still not clearly understood (e.g., marking to establish social dominance, marking territorial ownership, etc.), evidence of otters removing another's feces suggest competition among individuals (Testa et al., 1994; Bowyer et al., 1995; Ben-David et al., 1998; Kruuk, 2006; I. C. Laurentino, pers. obs.). To the best of our knowledge, there is no published information about the behavior of Neotropical otters (*Lontra longicaudis*, Olfers, 1818) in latrines.

The distribution of *L. longicaudis* latrines along rivers depends on habitat variables. In Rio Grande do Norte, Neotropical otters show preferences for sloping, shallow, and vegetated locations. In this region, latrines are usually found on riverbanks, in areas of difficult access that are protected by the vegetation cover of the Atlantic Forest (Laurentino et al., 2020). The frequency of use of latrines in Rio Grande do Norte varies according to the level of the rivers and their location, and they can be active for long periods (Laurentino et al., 2020). *L. longicaudis* latrines are also used as a food source for other vertebrates (Laurentino et al., 2019) in their natural habitat. The objective of this study is to describe the behaviors of wild Neotropical otters in their latrines.

Methods

Fieldwork was carried out in the municipality of Nísia Floresta, Rio Grande do Norte, Brazil (Figure 1). The research was authorized by ICMBio 32910-12 and the Animal Ethics Committee 151.002/2019. Two latrines frequently used by Neotropical otters were selected for this study: one by the Campo de Santana River (5º 58' 23.89" S, 35° 11' 46.08" W) and the other by the Boa Cica River (6º 05' 29.92" S, 35° 08' 01.31" W).

The monitoring effort was carried out from 2016 to 2020. The latrines were monitored continuously using video-camera traps with motion sensors (Bushnell Trail Camera DL 001; Bushnell Outdoor Products, Overland Park, KS, USA). It was not possible to identify individuals since Neotropical otters do not show apparent individual visual markings that allow for identity recognition. Any footage that contained any visible otter behavior was selected for further inspection. Two analysts (ICL and RTMS) described and classified each behavior recorded by the video-camera traps separately to build the ethogram. The selected footage at the latrines could contain otters engaged in a single behavioral state but also engaged in sequences of behaviors. When Neotropical otters were engaged in a single behavioral state, the number of occurrences of each behavior was used to compare their frequencies in the latrines. Sequences of multiple behavioral states (i.e., behavioral sequences) were identified, and the percent chance of passing from a given behavioral state to another was calculated to elaborate a flow chart of behavioral paths at the latrines.

Results

Out of a total of 2,486 min of video recordings, 1,651 min contained footage of Neotropical otters. The otters' behaviors were classified into eleven different types which are described in the ethogram (Table 1).

Often, only the Neotropical otter's wet tail was recorded after the animal came from the river and moved up to the riverbank. Otters spend little time in the latrine. Rarely does an individual spend more than 7 s in the area. Considering the total amount of footage with otters in sight (100%), 61% of the footage showed otters engaged in a single behavioral state. Figure 2 shows the number of records in which the otters were engaged in a single behavioral state at the latrine. Almost 15% of the time, otters were filmed performing a single

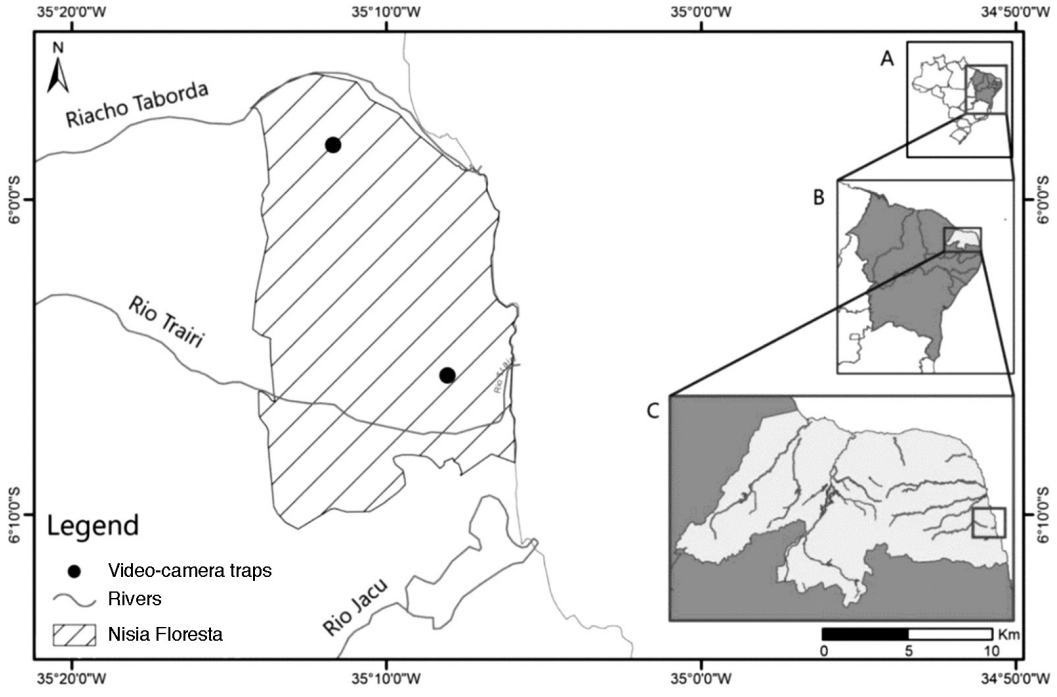


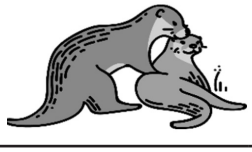
Figure 1. Approximate location of the latrines by the Campo de Santana and Boa Cica Rivers, located in the municipality of Nísia Floresta: (A) map of Brazil, (B) northeastern region of Brazil, and (C) State of Rio Grande do Norte.

behavior at the latrine; they were just passing by. The next most frequent observation was otters interacting with each other (13%), defecating (12%), or scent marking (11%).

Figure 3 shows a flow chart representing the behavioral sequences and the percentage of the time that one behavior is followed by another within those sequences. Almost 40% of the footage with Neotropical otters contained behavioral sequences (i.e., it was possible to observe otters performing more than one behavior while visiting the latrine). As soon as otters arrived at the latrine, they all smelled it. Then, most of the time (86% of the occurrences), they rubbed their bodies in it and dug before depositing their own droppings (i.e., defecating, urinating, and/or scent marking) and leaving the latrine. Defecation often occurred on top of another's droppings, usually within the same week. During another less frequent behavioral sequence path, otters followed smelling the latrine with scent marking (14%), which was then always followed by scratching before otters left the latrines. It is important to note that all otters that were observed in latrines engaged in this sequence (smelling–scent marking–scratching) were identified as males since testicles were visible while scent marking and scratching. Note that the sequence "smelling–scent marking–scratching" was only observed in individuals identified by visible testicles as males (indicated by ♂) before leaving the latrine. In more detail, males were observed following four behavioral sequences: (1) smelling, scent marking, scratching, and leaving latrine; (2) smelling, rubbing, digging, scent marking, scratching, and leaving latrine; (3) smelling, rubbing, digging, and leaving latrine; and (4) smelling, rubbing, digging, defecating and/or urinating, and leaving latrine. Complementarily, females and unidentified subjects follow two observed sequences: (1) smelling, rubbing, digging, and leaving latrine; and (2) smelling, rubbing, digging, defecating and/or urinating, and leaving latrine.

Neotropical otters were also registered passing by, in vigilance, grooming themselves, and interacting with conspecifics at the latrines (Table 1). Sometimes two or three individuals were seen in the footage close to each other, most of the time an adult and a smaller individual, which we presume to be females accompanied by their young. In a few instances, two equally large individuals were recorded interacting and engaging in physical contact that appeared to be aggressive. Unfortunately, we were unable to determine the

Table 1. Ethogram of Neotropical otters (*Lontra longicaudis*) in communal latrines. On the left, we present the behavior names and their visual representations. *N* = numbers of records for each behavioral state filmed when a single behavior was recorded. Descriptions of each behavioral state are in the right column.

Behavior		*N*	Description
Passing by		242	Otters arrive at the latrine from the river, passing through the latrine and returning to the river without carrying out any other behavior on the site (i.e., otters just move from one side to the other within the latrine area).
Rubbing		132	Otters lie on the ground and rub their whole body in the latrine, especially the head and neck.
Scent marking		189	Otters elevate their hind legs, lift their tails, and urinate on a vertical post while wagging their tails. This behavior was observed only in adult males (testicles visible). This behavior has been also described by Rostain et al. (2004) in North American river otters (*Lontra canadensis*).
Scratching		101	Otters support their bodies on their tails and scratch wood or the ground with their claws (mostly from their front legs and sometimes with claws from their hind legs). This behavior was observed only in adult males (testicles visible) and was performed on thicker tree trunks and branches of trees.
In vigilance		107	Otters stop other behaviors, raise their heads and neck, and look around in all directions. They remain vigilant for a few seconds as they turn their heads from side to side.
Smelling		145	Otters lower their bodies down to the ground of the latrine, smelling the droppings of others. This behavior occurs with the ventral or dorsal part of the otter's body on the ground.
Defecating		201	Otters come from the river, stop to defecate, and then leave, not performing any other type of behavior.
Urinating		102	Otters come from the river, stop to urinate, and then leave, not performing any other type of behavior.
Digging		108	Otters dig up the ground while lying in the latrine. This was performed especially when otters rubbed against existing droppings from other individuals and when there were fallen leaves on top of the latrine.
Self-grooming		102	Otters lie down in the latrine, licking or cleaning their hair. This behavior may or may not occur on top of droppings. The individual rubs and licks different parts of its body. This behavior also occurred after the otter shook off the water when coming from the river.
Interacting with others		222	Interactions occurred when more than one otter was registered in the latrine area at the same time. These social interactions occur more frequently between females and their offspring (sometimes accompanied by vocalizations). Interactions involving physical contact were also recorded. These interactions appear to be aggressive (agonistic) and could be interpreted as a fight between two individuals.

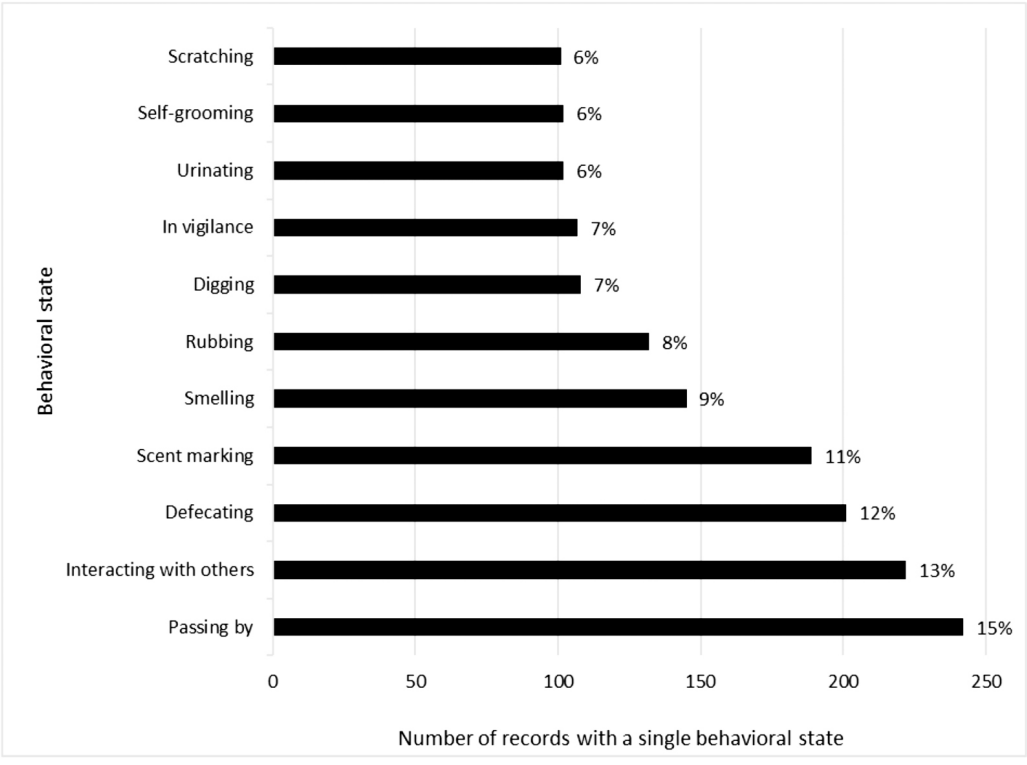


Figure 2. Histogram of the number of records in which Neotropical otters (*Lontra longicaudis*) were engaged in a single behavioral state in their communal latrines

sex of the individuals engaged in this "fighting" behavior.

Discussion

Our video-camera trap effort in *L. longicaudis* latrines resulted in 2,486 min of video, most of which contained images of the target species, though approximately one third of those records contained other species. Latrines are built by a single species but can be used by several other ones. Laurentino et al. (2019) identified nine species of mammals, birds, and reptiles that triggered video-camera traps in *L. longicaudis* latrines. This study additionally identified broad-snouted caiman (*Caiman latirostris*), capybara (*Hydrochoerus hydrochaeris*), southern tamandua (*Tamandua tetradactyla*), black-rumped agouti (*Dasyprocta prymnolopha*), and the Paraguay green racer snake (*Philodryas nattereri*) in our study sites. Interspecific information can be potentially exchanged by several interacting species at communal latrines (Laurentino et al., 2019).

The remaining 1,651 min of footage contained Neotropical otter behaviors that are described in Table 1. Based on our results, we can say that *L. longicaudis* latrines are not used only as places to deposit feces, urine, and other secretions. In fact, when otters were not just passing by (most frequent observation of single behaviors at latrines), the second most frequent single behavior observed at latrines was social interaction. They spent time searching or engaged in social bonding at these communal use places. This surprising result suggests that latrines, besides being places to leave chemical cues about itself and acquire (chemical) information about other individuals that have visited the site, are places to physically encounter conspecifics for this solitary species. In our results, we observed the presence of some groups of otters, with up to three individuals, between the months of December and May (spring to autumn), between 1800 h and midnight. Carvalho-Junior (2007) indicates that Neotropical otters can be solitary or form a basic social group; and the group, depending on the time of year, typically consists of an adult female and her offspring (up to three young). Parera's (1996) study also describes only groups formed by females accompanied by their young.

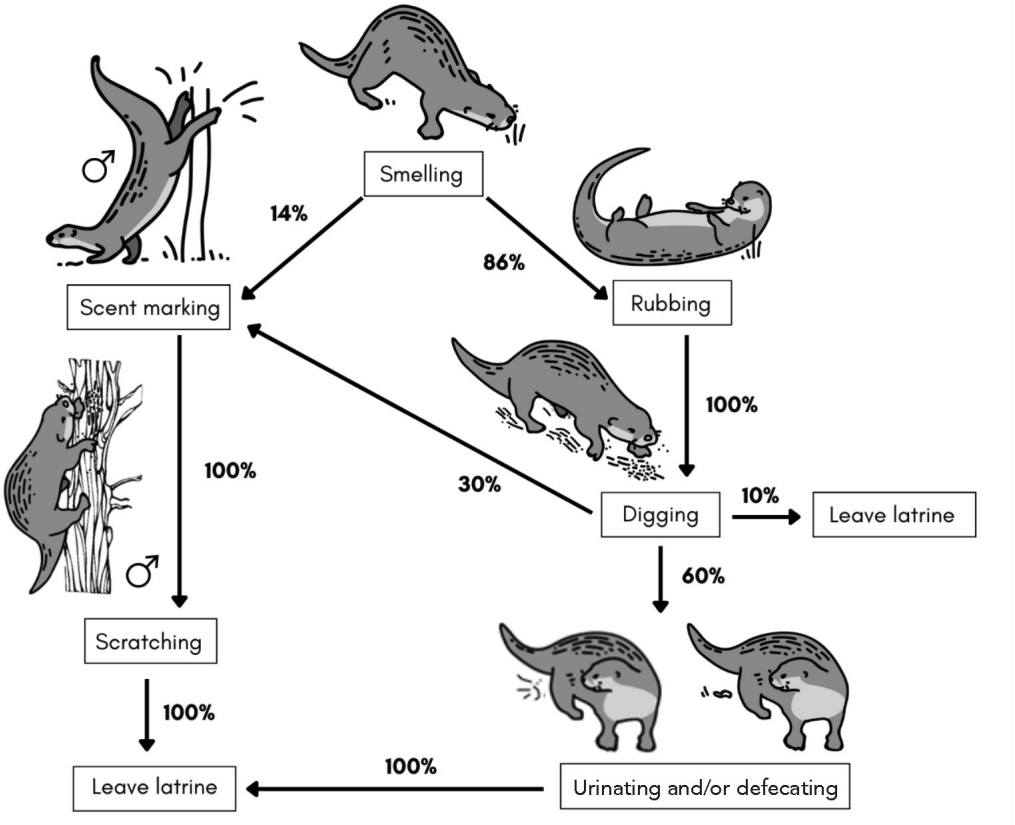


Figure 3. Flow chart of behavioral sequences observed in communal latrines of Neotropical otters. The arrows departing from each behavior point to other behaviors that occur in a sequence before otters leave the latrine. The percentages show how often the behavior is followed by another.

The use of a communal latrine (i.e., the repeated use of a specific defecation site) is described for several other mammals, facilitating the social bond through olfactory communication (Begg et al., 2003; Dröscher & Kappeler, 2014). Many species not only defecate, but also often urinate and deposit hormonal information. North American river otters (*Lontra canadensis*) also use latrines not only for depositing feces, urine, and anal mucus (Bowyer et al., 1995; Rostain, 2000; Ben-David et al., 2005) but as a form of communication and to carry out social interactions among conspecifics (Rostain et al., 2004). In the latrines of river otters, solitary individuals can gather information about the presence of close individuals and may even decide to join a group or detect highly connected or familiar individuals (Barocas et al., 2016).

In many cases, latrines can be a site for exchanging other types of signal in addition to olfactory communication (Dröscher & Kappeler, 2014). In fact, our results show that visual signals, such as scratches, are left on the ground, trunks, and logs of the latrine site. In our study, male otters also showed behavioral sequences that included smelling, scent marking, and scratching, sometimes after digging the ground. Scratching and digging leave visual markings in the latrines. Fadel (2008) elaborated an ethogram of Neotropical otters in captivity and observed that "rubbing" can serve to maintain the hair or to demarcate territory. Roque et al. (2012) observed two captive males and classified their behaviors as "territorial behaviors"—smelling, scent marking, and digging—which suggests that even in captivity, these behavioral states are associated with males leaving multimodal signals (chemical and visual). Such signals could facilitate reproductive encounters and be used as potential territory holding displays among

males, possibly avoiding unnecessary agonistic interactions.

Neotropical otters were observed in vigilance raising their heads and necks and looking around in all directions while in the latrines; however, in captivity, Fadel (2008) describes Neotropical otters supporting and raising their full body by the tail and hind legs during vigilance. We speculate that the lack of potential danger in captivity allows them to make themselves more conspicuous than individuals in the wild. Another term for this behavior is "alertness," and it is also performed by rats and mice. These animals often elevate their heads and forelegs to assume a vertical posture of alertness to make a risk assessment of the environment. Therefore, the "in vigilance" state is considered a defensive behavior used to assess the environment by looking for escape options and estimating potential predators' positions (Guimarães-Costa et al., 2007).

Based on the Neotropical otter behaviors captured in latrines, it is possible to develop new hypotheses about their behavior. We only observed the sequence "smelling–scent marking–scratching" in males with visible testicles. According to Teixeira et al. (2008), the anal mucus of Neotropical otters can carry information about gender and whether the female is in heat, pregnant, or with young. The *L. longicaudis* latrines are used as a social information center—an adequate place to investigate sociality and communication. Neotropical otters maintain communication with other individuals of the same species by means of scent marks and pheromones, even when spatially apart, using latrines in environments with easy access to water such as sand banks and slopes. These scent markings would be unlikely to be made directly in the water because the chemical substances would be quickly carried away and diluted by the current of the rivers (MacDonald & Mason, 1994). Our results suggest that in the social behavior of Neotropical otters, latrines may function as sites for exchanging information about the presence and possible reproductive status of conspecifics. In addition, we postulate that latrines may also serve as likely meeting places, both for agonistic interactions and for social activities.

The use of video-camera traps to study the behavior of Neotropical otters has an important caveat. The movement and temperature sensors are not able to detect the otters' body heat when they are first coming out from the river, and often there is a lag to record these animals until their bodies are heated ashore. It was not possible to obtain records of the species in and out of the water, considering that the cameras work with temperature sensors, so the behaviors that occur in the water close to the latrine are unknown. The video cameras do not cover the entire latrine as it only has a 90º view; therefore, the records are dependent on the location of the otter in the area where the video camera is positioned.

Finally, we recommend actions that aim to preserve not only the species, but also the latrines and their surroundings. This approach includes the rivers and their riparian forest as integrative parts of efficient conservation strategies for the species. It is also necessary to obtain more information about individual behavioral patterns, discriminating the behavior of adult males, juveniles, females, and young otters. Genetic studies are also needed to assess the level of diversity and population connectivity between the latrines, which may also allow sexing of those individuals that visit the same latrines.

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