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# CONFLICTS BETWEEN HUMANS AND GIANT OTTERS (*PTERONURA BRASILIENSIS*) IN AMANÁ RESERVE, BRAZILIAN AMAZONIA<sup>1</sup>

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## Introduction

Mammals using inland and coastal waters frequently interact with humans, as they often share habitats and explore similar resources (REEVES *et al.*, 2002). As a result, aquatic mammals are susceptible to anthropic changes and disturbances that may negatively influence their distribution and maintenance (ROCHA-CAMPOS *et al.*, 2010; ANDRADE *et al.*, 2011; ROCHA-CAMPOS and GUSMÃO-CÂMARA, 2011). *Pteronura brasiliensis* (Zimmermann 1780), popularly known as *ariranha* in Portuguese, *lobo de río* in Spanish, or giant river otter in English, is an example of semi-aquatic mammal that is sensitive to human impacts.

Giant river otters are one of the largest freshwater carnivores in South America, and the largest among the subfamily Lutrinae (DUPLAIX, 1980; CARTER and ROSAS, 1997). Adults can reach nearly 1.8 m in total length, and 30 kg in weight, with males slightly larger than females (DUPLAIX, 1980). Endemic to South America, the giant river otter is restricted to aquatic ecosystems in tropical forests and wetlands up to 300 m a.s.l. (CARTER and ROSAS, 1997; SCHENCK, 1999). They form cohesive family groups, usually with 3-12 individuals, composed by one reproductive couple and several young from different generations (DUPLAIX, 1980; SCHWEIZER, 1992; CARTER and ROSAS, 1997; STAIB, 2005). They feed mainly on fish, usually captured in shallow waters

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(DUPLAIX, 1980; SCHWEIZER, 1992; ROSAS *et al.*, 1999), but can complement their diet with crustaceans, amphibians, reptiles, birds and other mammals (LAIDLER, 1984; CARTER and ROSAS, 1997). The areas used by giant river otters are vulnerable to water level oscillations and pulses, directly influencing the resources the animals use. During low water season, individuals use main rivers, which retain larger water surfaces and food availability. Conversely, during high water periods, animals may have to move to higher places, due to the flooding of dens or campsites. Since their diet is mainly piscivorous, giant river otters may change areas, following seasonal fish migrations (DUPLAIX, 1980).

As a primarily terrestrial species adapted to forage in the water, giant river otters are susceptible to changes that occur in both environments. Because giant river otters explore a restricted area, close to river and lake margins (e.g. LIMA *et al.*, 2012), frequently with easy access to humans, they are vulnerable to hunting (FOSTER-TURLEY *et al.*, 1990). Since giant river otters occupy the highest trophic level, they are among the first species to disappear when the environment is altered or contaminated (FOSTER-TURLEY *et al.*, 1990; PARERA, 1996).

Their vulnerability to human impacts together with an intensive hunting pressure in the past century led giant river otters to a worrisome conservation status (CARTER and ROSAS, 1997; DUPLAIX *et al.*, 2008). The species is classified by the IUCN as endangered (A3cd) due to its small populations, restricted occurrence areas, and local extinctions recorded along its historical geographic range (DUPLAIX *et al.*, 2008). In Brazil, the species is considered under extinction risk in an imminent future (IBAMA, 2001; MACHADO *et al.*, 2008; ICMBio, 2010).

It is believed that the Brazilian Amazonia and some areas in the Pantanal harbor stable populations of giant river otters, possibly under recovery (MACHADO *et al.*, 2008; LEUCHTENBERGER and MOURÃO, 2008). In those regions, protected areas are important instruments to conserve populations of giant river otters, shielding the species from the human pressures and favoring population recovery in natural environments, and, thus, increasing its chances of survival (ICMBio, 2010). One example is the Amanã Sustainable Development Reserve in the state of Amazonas, where giant river otters were sporadically spotted upstream of the Amanã Lake in early 2000, after approximately 30 years of absence in the region and two years after the creation of the reserve. Studies in the region suggest that the species is recolonizing areas where it previously occurred, i.e. its historical areas of occurrence (MARMONTEL and CALVIMONTES, 2004; Lima *et al.*, 2014).

The identification of current and potential threats to giant river otters was pointed out as a priority for the implementation of conservation strategies at local and regional levels (FOSTER-TURLEY *et al.*, 1990; IBAMA, 2001; DUPLAIX *et al.*, 2008; MACHADO *et al.*, 2008). Hence, in the present study, we intend to advance the knowledge on threats to giant river otters in the Brazilian Amazonia, more specifically in the Amanã Reserve. A special emphasis was given to the characterization of negative human impacts resulting from the growth in human and animal populations and from the recolonization of historical areas of occurrence by giant river otters in the reserve. We aimed at assessing

whether these interferences could compromise the maintenance of the giant river otter population in the area.

## Materials and methods

**Study area** – The present study was carried out in the surroundings of the Amanã Lake (Figure 1), within the Amanã Reserve (IUCN Category VI), one of the largest protected areas of tropical forest in South America. Amanã is located in the central region of the state of Amazonas, in the interfluvium of the rivers Negro and Japurá (1°35'43"S - 3°16'13"S; 62°44'10"W - 65°23'36"W), and harbors areas of floodable forest, *igapó*, *terra firme*, and *campinarana* (AMAZONAS, 1998; AYRES *et al.*, 2005).

The reserve occupies an area with extensive pristine forest with low human density and high wildlife richness. Approximately 520 tree species, 330 bird species, over 300 fish species, and 69 species of terrestrial mammals were recorded in the neighboring Mamirauá Reserve (MAGURRAN and QUEIROZ, 2010). Less than 3% of Amanã is used by residents for the extraction of natural resources, and other parts are designated for scientific and conservation purposes (AYRES *et al.*, 2005).

According to Alencar (2006), the Amanã Lake played an important role in the process of human occupation in the region, because it was used as an access to the rivers Negro and Japurá. The human occupation history in Amanã dates back to the early twentieth century, when migrants from the rivers Juruá, Jutai, and Japurá established themselves in the region, aiming at the economical exploration of the natural resources available upstream of the lake (see ALENCAR, 2006, for further information on the human presence in the area). Through the streams (*igarapés*) located in the lake's headwaters it was possible to access areas with non-timber and wildlife products. Production in the region was based until the 1970s on plant extraction and commercial hunting, mainly for the trade of animal skin, including otters (*Lontra longicaudis* and *P. brasiliensis*) and jaguars (*Panthera onca*). Fishing was performed only between crop seasons and some families cultivated manioc (*Manihot esculenta* Crantz) for consumption and occasional trade (ALENCAR, 2006).

The population of the Amanã Reserve in 2011 was ca. 3,600 residents and users, distributed in 84 localities and 612 residences (<http://www.mamiraua.org.br/pt-br/reservas/amana/>). Some families live in isolated houses, but participate in the nearest community (ALENCAR, 2006). The human population living near the headwaters of the Amanã Lake during the study comprised 374 residents.

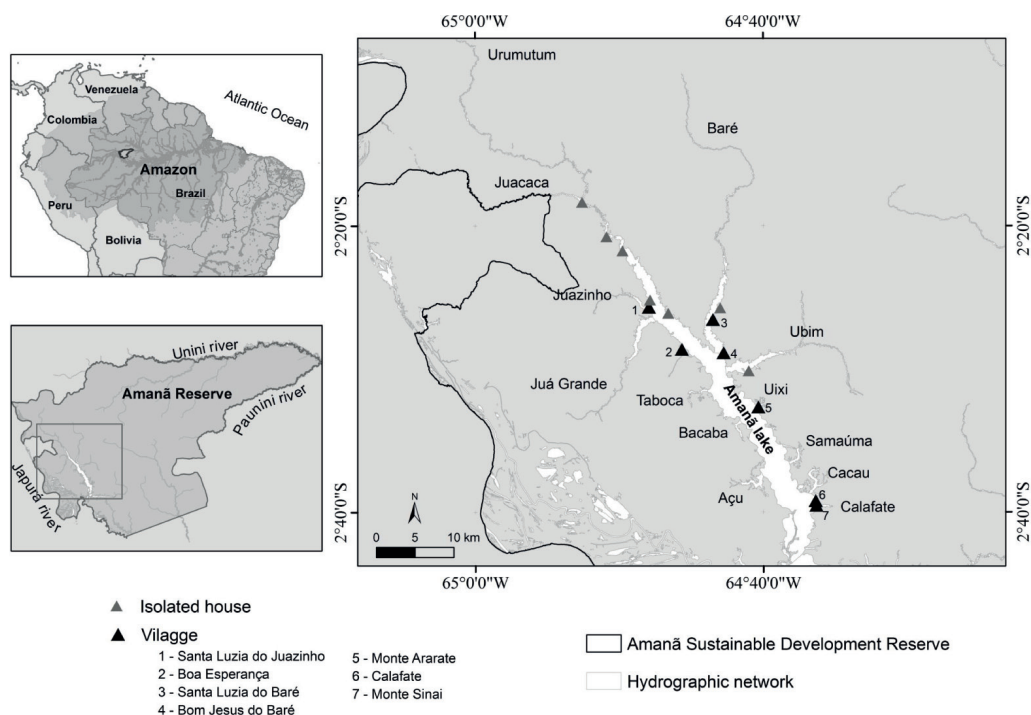


Figure 1. General view of sites occupied by humans in the surroundings of the Amanã Lake, within the Amanã Sustainable Development Reserve, Amazonas state, Brazil.

*Sampling procedures* – Forty field sessions were carried out, between October 2004 and September 2008, searching for records of otters in the basin of the Amanã Lake. A total of 18,181 km along 13 water bodies were surveyed in 465 days of fieldwork. For a detailed description of the survey techniques used to sample and record giant river otters see Lima *et al.* (2012) and Lima *et al.* (2014). During surveys, we established direct and continuous contact with the local residents and through informal conversations 16 residents interested in contributing to the study were identified, which became co-investigators, and collected information on negative human interactions with giant river otters, such as hunting.

Based on the information provided by our co-investigators, the residents that interacted negatively with giant river otters were contacted and encouraged to report their experiences. During the reports, the conversation was guided to obtain some information on (1) perception of residents towards giant river otters, (2) level of knowledge about the species, (3) past and current hunting, (4) events of interaction with fishing activities, and (5) other types of negative interactions (e.g. CHIZZOTI, 2000).

A direct search for residents with information on negative interactions with giant river otters was also carried out. These people were identified during occasional encounters and, from the first approach on, we used snowball sampling (BERNARD, 2005), i.e., the interviewee could indicate other people with possible useful informa-

tion. In addition to potentially negative human impacts reported, we tried to record all events of possible human interference with giant river otters in the region, including direct signs or recent hunting (e.g. pelts or skulls, or traps), or indirect threats, like habitat loss due to the conversion of once pristine areas into human-modified areas. This information was used, together with the localities pointed out as conflict sites, to map critical areas for the species. The information obtained was organized and analyzed qualitatively, considering all contributions provided by the interviewees, without exclusions.

The data were ordered in a temporal sequence, for a better analysis of the information: year I - October 2004 to September 2005, year II - October 2005 to September 2006, year III - October 2006 to September 2007, and year IV - October 2007 to September 2008. Records of human interference were also pooled according to sampling year. The location of each record was georeferenced and plotted in shapefiles of the study area, and overlapped in 1-km<sup>2</sup> grids placed on top of the watercourses that form the Amanã Lake, in order to better estimate the maximum distances between records (e.g. SEA OTTER RECOVERY TEAM, 2003; GROENENDIJK *et al.*, 2005; Figure 3).

## Results

Based on our own observations during the survey for giant otters along the rivers, the number, frequency, and spatial distribution of negative interactions between humans and giant river otters varied among years. In year I, the species was recorded along three rivers and negative interactions were recorded in the streams Urumutum (3 records) and Baré (1 record - Figures 2 and 3). In year II, the species expanded the area used to the headwaters of Amanã Lake and three negative interactions were recorded along Urumutum and two along Baré. In year III, only one negative interaction was recorded in Urumutum. In year IV, negative interactions were recorded along Urumutum, Juazinho and Juacaca streams (1 record each). Urumutum and Baré streams were hotspots of negative interactions (Figures 2 and 3).

Based on the interviews, reports from 83 local residents on sightings of giant river otters or negative interactions between humans and otters were obtained. This sample represented 22% of the 374 human residents living near the headwaters of the Amanã Lake during the study. Five negative interactions were reported: entanglement of giant river otters in fishing nets, damages in gillnets, killing of otters due to fear of attack or curiosity, change in the pattern of habitat use, and removal of cubs. The map of records of giant river otters upstream of the Amanã Lake during the study suggests that there are 14 areas where these negative interferences occur (Figure 2).

All encounters between interviewees and otters occurred during movements in the watercourses that lead to extractivism areas or crops used by local residents, or even in areas close to these sites. The highest incidence of negative interactions occurred near areas occupied by humans either close to community organizations, where there is higher human population density, or in the vicinity of isolated residences located in *igarapés* upstream of the Amanã Lake (Figures 2 and 3).

Among the residents that reported encounters with giant river otters, 28% ( $n = 23$ ) affirmed that they recognized the animal as a giant river otter. During the reports, it was observed that these interviewees had knowledge about the behavioral patterns of giant river otters and the ecological requirements that determine their presence in a watercourse. This familiarity results from the experience (direct or by family members) obtained through hunting wildlife (39%,  $n = 9$ ), including giant river otters, for animal skin trade in the last century (61%,  $n = 14$ ).

For the other interviewees (72%,  $n = 60$ ), the giant river otter is a poorly known species. The first sightings were made by 78% ( $n = 47$ ) of the residents after the recolonization of the streams located in the headwaters of the Amanã Lake by giant river otters. According to the reports, this occupation apparently occurred in the late 1990s and early 2000s.

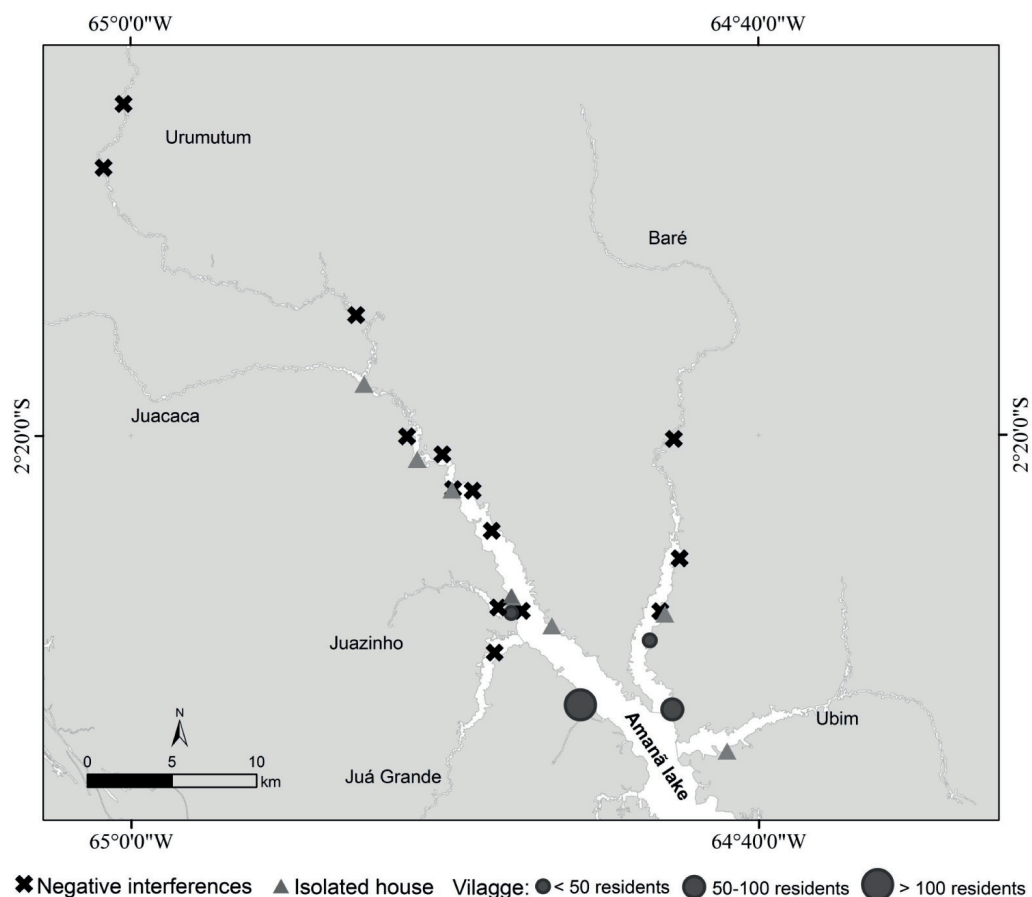


Figure 2. Sites around the Amanã lake, within the Amanã Sustainable Development Reserve, Amazonas state, Brazil, with negative interactions between humans and giant river otters (*Pteronura brasiliensis*), monitored between October 2004 and September 2008.



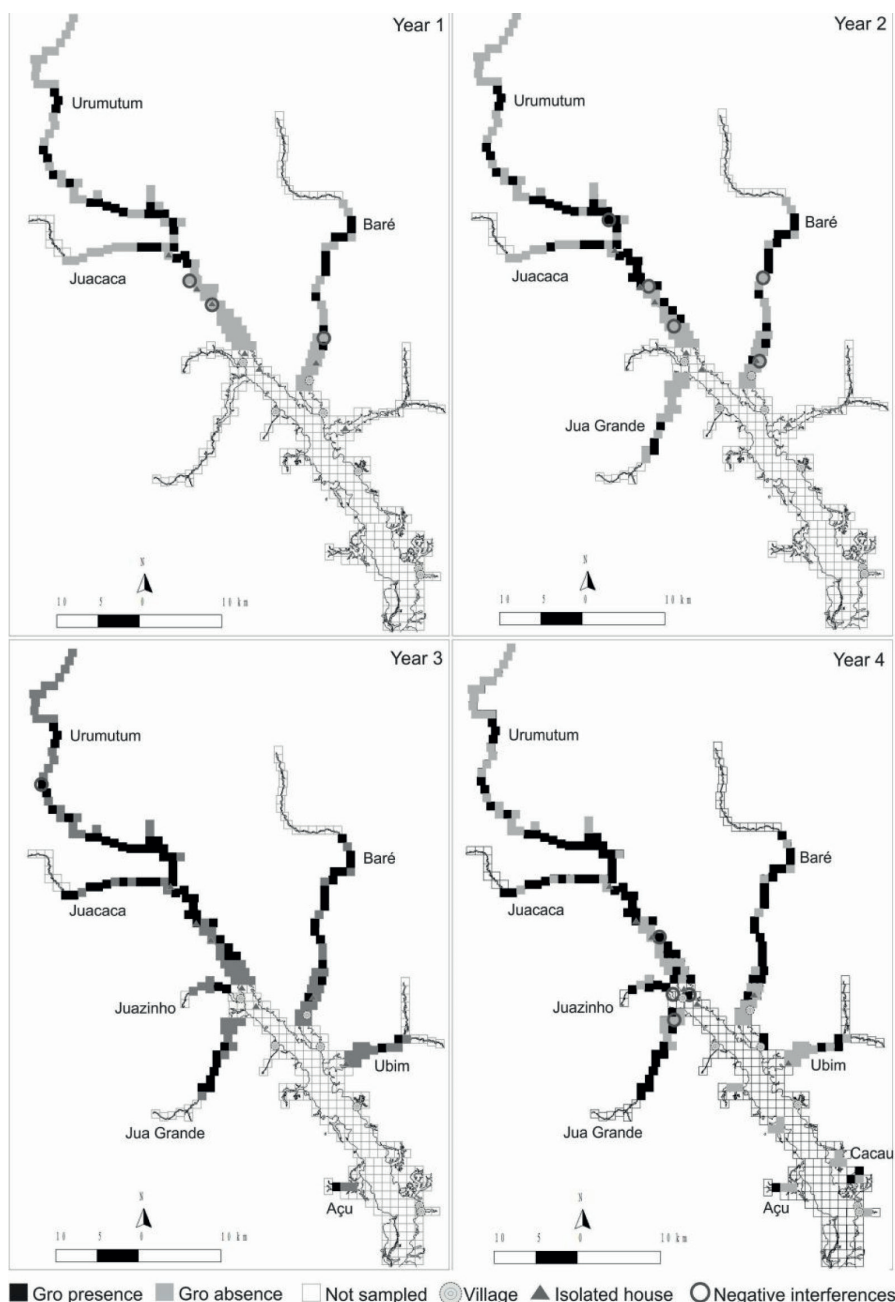


Figure 3. Monitoring of the presence of giant river otters (*Pteronura brasiliensis*) and negative interference with humans, recorded around the Amanã lake, Amanã Sustainable Development Reserve, Amazonas state, Brazil, between October 2004 (year 1) and September 2008 (year 4). Grid cells = 1 km<sup>2</sup> each; black cells = presence of animal groups; gray cells = sites sampled but with no groups; empty cells = not sampled; empty circles = sites with negative interferences detected.



Residents with less familiarity with giant river otters ( $n = 60$ ) shared the perception that these animals are aggressive and “courageous”, and have an investigatory behavior and elaborate vocalizations interpreted as an attack alert. To avoid a presumed attack and the proximity of giant river otters from boats, these people reported that they frequently used firearms or threw fishing devices (harpoon, spear, and arrow) at the animals. For 85% of the interviewees this procedure aimed at scaring away the otters. Nine residents used firearms to kill giant river otters, but only two confirmed the death.

All residents interviewed affirmed that the watercourses around the Amanã Lake have been recolonized by giant river otters and that this re-occupation was caused by a fast increase in otter populations. This recovery has been negatively perceived by residents, since they believe that otters compete with them for fish, and so may reduce fish availability in the region. In addition to the perception that giant river otters compete with humans for food, it was unanimously believed that fish disappear from watercourses explored by giant river otters. These residents avoided placing gillnets in sites with recent vestiges of giant river otters. The residents living on the margins of the streams Urumutum and Juazinho ( $n = 30$ , 36% of the reports) regarded the presence of giant river otters as unwanted in the region due to current and potential damages caused by these animals.

Giant river otters were regarded not only as competitors, but also as responsible for damaging gillnets while trying to get the fish caught in them. Twenty-eight per cent of the residents ( $n = 23$ ) reported damages in nets, mainly in those made of 0.30-mm and 0.40-mm nylon thread, which are used by the local population to capture species such as *Semaprochilodus* spp., locally known as *jaraquis*, *pacus* (*Mylossoma* spp.), and *matrinxãs* (*Brycon* spp.). For this reason, seven residents shot giant river otters when they were spotted trying to remove fish from nets. These shots resulted in the death of two individuals. As an alternative to avoid constant damage to the nets, the residents affirmed that they alternate fishing sites with those least used by giant river otters.

Information about two events of accidental death resulting from entanglement were received, and a report of a giant river otter entanglement with posterior release of the animal still alive. The three records involved males; of which one adult and one cub were found by owners of the nets at an early stage of decomposition. In the case of lethal entanglement, gillnets were made of polyamide thread type 210/24 and 210/36. This type of mesh is used in the region mainly to capture fish like the *tambaqui* (*Colossoma macropomum*).

Eleven areas altered by local residents to cultivate manioc on the margins of watercourses used by giant river otters were recorded. These crops are established by slash-and-burn; in two cases this practice altered the patterns of use by two giant river otter groups. According to the land owners, there were refuges used by giant river otters before the vegetation was cut, but the animals abandoned the area after it was altered.

The maintenance of wild animals in captivity is one of the most common practices among the local residents. After the reappearance of giant river otters in the watercourses, 23% ( $n = 19$ ) of the residents that had already interacted with the species were interested in removing cubs from their habitat and keeping them as pets; 26% ( $n = 5$ ) of the residents reported capture attempts without success. One intentional capture was

recorded in the region, favored by the low level of the watercourses, which restricted the home range of the giant river otter group to the main riverbed. Two days after capturing the cub, the residents agreed to give it back to its group, after a successful intervention by our research group.

Local residents (11%,  $n = 9$ ) showed interest in obtaining giant river otter skins to decorate their residences or in killing otters just out of curiosity 'to know how they look like' (13%,  $n = 11$ ); two animals were killed for this reason. The perception that after the establishment of a dense population of giant river otters a 'management plan' for skin trade could be implemented were recorded in 14% of the reports ( $n = 12$ ). According to interviewees, in this scenario, legalized hunting would be encouraged as an economical alternative for local communities, and would exert a control on the otter population, minimizing the damages caused by these animals.

Local residents frequently transport domestic animals on their boats when they head to areas of hunting, fishing, plant extractivism or agriculture. Out of 107 encounters with residents heading to extractivism areas, in 36% ( $n = 39$ ) dogs were observed onboard.

## Discussion

This study points out that the recent reoccupation of the Amanã Lake by giant river otters (see LIMA *et al.*, 2014), a historical area of occurrence of this species in Amazonia, was followed by an increase in negative interactions between these animals and humans that live in the area. These negative interactions include an increase in the number of casual encounters between otters and humans during fishing, humans trying to scare away the otters, entanglement followed by death in gillnets, conversion of environments used by otters into crop fields, capture of cubs, and increase in the possibility of transmission of zoonoses from domestic animals to giant river otters (see ICMBio, 2010).

Threats to the giant river otter population in the watercourses upstream of the Amanã Lake followed, in general, the same pattern observed in other areas, like Suriname and the Western Brazilian Amazonia (DUPLAIX *et al.*, 2008; ROSAS-RIBEIRO *et al.*, 2011). The records of negative interactions with giant river otters were mainly associated with an overlap in the areas used by humans and giant river otters, and such growing overlap in ecological requirements between carnivorous mammals and humans is one major cause of negative interactions (e.g. TREVES and KARANTH, 2003). Indeed, Carter and Rosas (1997) reported that one of the greatest threats to the species is human population growth, which may lead to an increase in the number of riverine communities and, hence, to habitat changes. The human impacts identified in the present study must be regarded as threats and may compromise the long-term maintenance and recolonization of giant river otters around the lake.

Local residents reported that giant river otters frequently damage gillnets in an attempt to remove fish, which causes economic loss and a negative attitude towards otters. Similar reports were also obtained in studies with emphasis on the interaction of giant river otters with fishing activity (GÓMEZ and JORGENSEN, 1999; ROOPSIND, 2002; ROSAS *et al.*, 2003; VARGAS and MARMONTEL, 2007; ROSAS-RIBEIRO *et al.*, 2011).

In addition, residents attributed their attempts to kill giant river otters to fear of being attacked on their boats. Likewise Staib and Schenck (1994), who described entanglement followed by death of giant river otters in nets of commercial fishermen, our study shows that subsistence fishing was also responsible for otter mortality. The difference between those types of fisheries may lie in the frequency of occurrence and the extension of the nets used, but both should be considered in the identification of threats to giant river otters.

It was observed that river margins, key-areas for giant river otters, are being converted into annual crops (locally known as *roças*), contributing to change the availability of areas once used as dens, campsites or resting sites by the animals (see LIMA *et al.*, 2012). This interference results mainly from the use of slash-and-burn for the implementation of crops. Carter and Rosas (1997) identified this practice as one of the threats to giant river otters, because the low quality of nutrients in Amazonian soils associated with rudimentary agriculture practices are responsible for a high turnover in the areas used for subsistence agriculture, with the constant opening of new areas.

The transportation of domestic animals together with local residents to areas of agriculture and extractivism has put these animals closer to populations of giant river otters in the region. Giant river otter populations are specially threatened by diseases transmitted by domestic animals in riverine communities, such as parvovirus and canine distemper (SCHENCK, 1999). The spread of diseases may easily occur due to the social behavior of giant river otters and their ability to move long distances, particularly solitary animals searching for sites to establish their territories (SCHENCK, 1999). Although these zoonoses have not been confirmed in the region of the Amanã Lake, they may be disseminated by contaminated animals that share areas with giant river otters.

Giant river otters are poorly known by local residents, which resulted in the death of individuals of this species motivated by fear, curiosity, and interference in fishing activities. Although only a few kills were confirmed, it is recognized that collateral death caused by hunting may also be significant (Peres, 2000). It is important to take into account that several otters injured during killing attempts may not be located by residents and that dependent cubs usually die from starvation after losing their mother (CARTER and ROSAS, 1997).

As a consequence of the increase in the frequency of sightings of giant river otters by residents, the local population showed interest in returning to old habits, such as the capture and maintenance of giant river otter cubs as pets. In addition, there is a misunderstanding that the increase in the otter population qualifies this animal as a target species for a 'management plan' based on hunting for skin trade, with the additional benefit of population control. Such a thought probably results from well-succeeded experiences of sustainable management of the *pirarucu* (*Arapaima gigas*) in the Mamirauá Reserve, adjacent to Amanã, whose profits are converted into material goods that improve the life quality of the residents (see VIANA *et al.*, 2007). However, as an endangered species, with low populations, and listed in the Appendix II of CITES, giant river otters did not qualify for initiatives aiming at their commercial use. The local situation of giant otters in Amanã requires a better diffusion on the requirements a species must have before being considered for commercial use.

A way to conciliate the expectation of income by the local population with the purposes of the reserve could be the exploration of giant river otters as a touristic attraction. The giant river otter is a charismatic species, with a successful example of ecotourism in Peru (SCHENCK and STAIB, 2001). However, it is necessary to consider the disperse use of habitats by otters, mobility of groups, and rarity of direct sightings, even during the dry season in the region.

We believe that the growth in populations of giant river otters and their subsequent contact with humans in the surroundings of the Amanã Lake will lead to an increase in negative interactions, with negative consequences for a species that, even increasing its local population, is still endangered. The mitigation and monitoring of the threats identified in the present study are very important for the conservation of giant river otters in the region. Measures for the prevention and control of these threats must be included in the management plan of the Amanã Reserve. Without these initiatives, the recolonization of an historical area of occurrence of giant river otters in the Brazilian Amazonia, even within a legally protected area, may represent a dead end for the species.

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# CONFLICTS BETWEEN HUMANS AND GIANT OTTERS (*PTERONURA BRASILIENSIS*) IN AMANÃ RESERVE, BRAZILIAN AMAZONIA

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**Abstract:** Commercial hunting was determinant in the disappearance of giant river otters along areas of historical occurrence in the Brazilian Amazonia. After approximately 30 years of absence, giant otters were spotted in the Amanã Lake in 2000, after the creation of the Amanã Reserve. Four years of field surveys were carried out to confirm the presence of giant river otters in the area and to assess local threats to the species. Information on the human impact on this otter population was compiled based on 83 interviews with residents. Areas of overlap used by both otters and humans resulted in negative interactions. The identified threats included: perception of otters as competitors for subsistence fisheries; conversion of natural areas into annual crops; removal of cubs to be raised as pets; and potential disease transmission from domestic animals. Mitigation and monitoring of these threats are paramount for the maintenance of giant river otters in the area.

**Keywords:** Brazil, fishing conflicts, flooded forest, Lutrinae, sustainable-use reserves.

**Resumo:** A caça comercial foi determinante para o desaparecimento de ariranhas em áreas de sua ocorrência histórica na Amazônia brasileira. Depois de cerca de trinta anos de ausência, ariranhas foram avistadas no lago Amanã em 2000, após a criação da Reserva Amanã. Ao longo de quatro anos foram conduzidas expedições a campo com o objetivo de confirmar e quantificar a presença de ariranhas e avaliar ameaças locais. Informações acerca do impacto humano sobre essa população foram compiladas a partir de entrevistas com 83 moradores. Áreas de sobreposição utilizadas tanto pela ariranha quanto pelo homem resultaram em interações negativas. As ameaças identificadas incluem: percepção dos moradores locais em relação à espécie como concorrentes da pesca de subsistência, conversão de áreas naturais em culturas anuais, remoção de filhotes para manutenção como animais de estimação e potencial transmissão de doenças por animais domésticos. Mitigação e monitoramento dessas ameaças são de extrema importância para a manutenção das ariranhas na área.

**Palavras-chave:** conflitos de pesca, floresta alagada, Lutrinae, Reserva de Desenvolvimento Sustentável, Brasil.

**Resumen:** La caza comercial fue determinante para la desaparición del lobo de río a lo largo de su área de ocupación histórica en la Amazonía brasilera. Después de casi 30 años de ausencia, lobos de río fueron observados en el Lago Amanã en el año 2000, después del establecimiento de la Reserva Amanã. Nuestro equipo desarrolló un estudio de campo de cuatro años con el objetivo de confirmar y cuantificar la presencia de la especie y de levantar las amenazas locales. Informaciones acerca del impacto humano sobre esta población fueron compiladas a partir de entrevistas con 83 habitantes. Áreas de superposición usadas por el lobo de río y el hombre resultan en interacciones negativas. Las amenazas identificadas incluyen: (1) percepción de los lobos de río como competidores en la pesca de subsistencia; (2) conversión de áreas naturales en áreas de cultivos anuales; (3) retiro de crías para ser criadas como mascota; (4) transmisión potencial de enfermedades por animales domésticos. La mitigación y el monitoreo de esas amenazas son de suma importancia para la conservación del lobo de río en la región.

Palabras-clave: conflictos pesqueros, bosques inundados, Lutrinae, Reservas de Desarrollo Sostenible, Brasil.

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