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First giant otter distribution survey in the southeast of Roraima, Brazil, with notes on the OSG Guidelines for a Standardization of Survey Methods

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Despite covering more than three quarters of the range of the giant otter [*Pteronura brasiliensis* (Zimmermann 1780)], Brazil still possesses very limited information on the distribution of the species. For this reason, according to the Otter Specialist Group (OSG)'s Range-Wide Distribution Survey Strategy, investigations should concentrate on large transects over the Brazilian Amazon basin and in existing work areas (Groenendijk *et al.*, 2005). In this note we present the results of the first giant otter distribution survey in the southeast corner of the Brazilian state of Roraima (01°04'S, 61°36'W), an area that has remained hitherto virtually unexplored. Located at the border with the state of Amazonas, it includes the Xixuaú Creek, which was the site of a number of studies on the ecology and biology of the species (Rosas *et al.*, 1999; Evangelista, 2004; Evangelista and Rosas, 2011*a*, *b*; Tosi and Evangelista, 2011). The territory is covered with dense ombrophilus forest, crossed by black-water and white-water rivers. It is home to less than a thousand traditional inhabitants, who mainly live off fishing, hunting, small-scale agriculture and extraction of non-timber forest products. The yearly rainfall is about 2000mm; the low-water season lasts from October to March, the water level rising up to 10m during the flooded season. Situated in the Negro River basin, the region comprises the lower section of the Jauaperi River, the lower section of the Branco River and a short stretch of the Negro River itself (Figure 1). The Jauaperi River is a black-water tributary of the Negro River and marks the border between the states of Amazonas and Roraima. Like most of the rivers of the region it is covered with large expanses of tall *igapó*, a term applied to forests seasonally flooded by black-water and nutrient-poor rivers (Prance, 1979). The Branco River is the most important tributary of the Negro River and is considered a main biogeographical barrier for wildlife (Naka *et al.*, 2006). The banks of the lower Branco River are covered by *várzea*, typical forest seasonally flooded by white-water rivers, which are rich in suspended sediments and have a muddy appearance (Prance, 1979). Geochemical analyses indicate that the Branco River is chemically and sedimentologically intermediate between black-water and white-water rivers, representing an exception among the homogeneous black-water group of rivers that forms the Negro River basin (Küchler *et al.*, 2000; Albert and Reis, 2011).

Our distribution survey followed the guidelines for a standardisation of survey methods as recommended by the IUCN/SSC OSG (Groenendijk *et al.*, 2005). In order to increase the probability of detection of giant otter presence, the survey was conducted at the end of the dry season (February-March), when water level is low and the species is restricted to permanent watercourses. Referring to the UTM grid, the survey was planned to cover two squares of 100x100km and three quadrants of 50x50km. In order to provide a more detailed level of information, it also encompassed six sub-quadrants of 25x25km. For the selection of the site to be surveyed in each sub-quadrant we made use of the local knowledge; when it occurred in the proximity of a community, we visited and informed the community leaders about the intent of the survey, requesting permission to visit the area. Navigation on the main rivers was done using a local boat whereas we paddled canoes to explore giant otters' feeding creeks and side channels, consistently maintaining a traveling speed below 10km/hour. At the selected site we

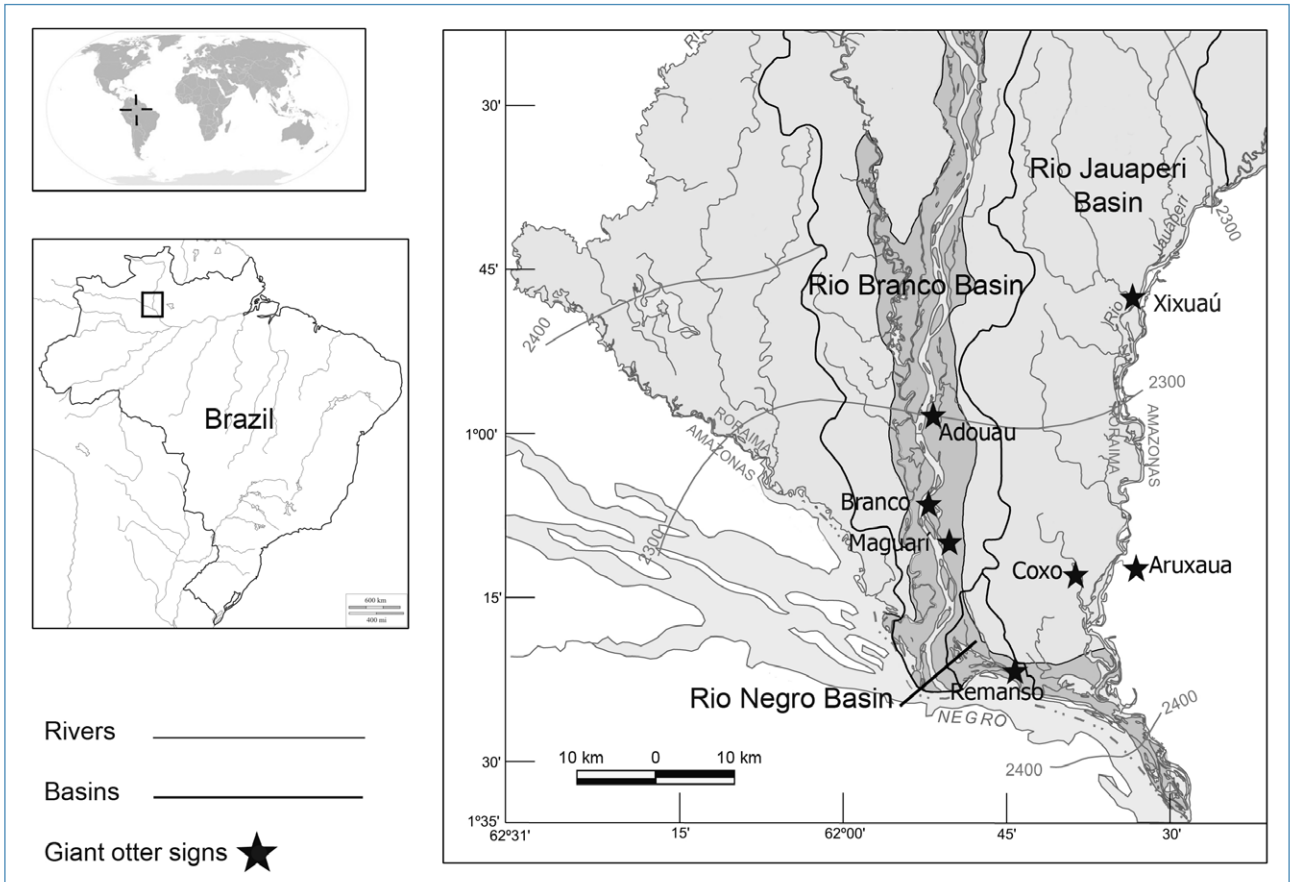

Figure 1. Map of the southeast corner of Roraima, indicating the limits of the hydrographic basins of the Branco, Negro, and Jauaperi rivers, and the signs of giant otter presence registered during the survey

actively searched for direct and indirect signs of giant otters, applying the stop-at-first-sign method, that is, halting the survey at the first sign that unquestionably indicated the presence of the species. The location of any clear indicator of giant otter presence was recorded with a GPS (UTM, WGS 84). The expedition focused on three different river basins. In the Jauaperi River basin we navigated and explored the lower part of the river, from the village of Xixuaú to its mouth; on the left margin of the river we surveyed the Aruxaua Creek, and on the right margin the Coxo Stream, after visiting its community. In the Negro River basin we navigated the Paranã da Floresta side channel, visited the village of Remanso, and surveyed its watercourse. In the Branco River basin we explored the left margin of the river, from its mouth to north of the Adouau Island; we stopped at the village of Cota and surveyed the Maguarí Stream and the Adouau side channel. In total, two black-water rivers (Jauaperi, Negro), one white-water river (Branco), one white-water side channel and five black-water streams were navigated during two weeks, totaling a travel distance of 380km. The survey revealed the presence of giant otters in all the basins investigated. All the sub-quadrants were identified as positive (Table 1; Figure 1), 50% of the recorded signs being sightings of individuals (n = 3) and 50% being indirect signs such as campsites, dens or tracks (n = 3). The maximum stop-at-first-sign distance registered was 5km. The presence of three cubs, about five months old, was recorded once (Xixuaú). While traveling towards the selected sites one otter group was recorded on the Branco River (Table 1; Figure 1) but no indirect signs of presence were observed.

In order to increase the effectiveness and improve the organization of future surveys, Groenendijk *et al.* (2005) recommend conducting field-testing of the survey methodology standards and guidelines. We tested some features of the Standard Field Survey Techniques for the Giant Otter (SFST-GO), which proved to be accurate and effective. Using the *Keys to identify and age campsites and dens*, a non-expert surveyor, who received basic training before participating in the survey, was able to recognize and age all the giant otter signs encountered, with the exception of scratch walls that were not recognized as a clear sign of presence of the species. The Standard Distribution Survey Method for Giant Otter (SDSM-GO) seems appropriate to the conditions in which we have applied it. It proved to be time- and cost-effective, allowing the investigation of a large area (two squares of 100x100km) in a relatively short time

Table 1. Detailed findings reported as from *Appendix 4/D. Results/findings* (Groenendijk *et al.*, 2005). Site: selected site; Rating: 1 = positive, 2 = negative; Distance: from start-point to first sign; Kinds of proof: 1 = Finding living animal, 2 = Finding dead animal, 3 = Observation of living animal, 4 = Footprints/Tracks, 5 = Campsite, 9 = Reproduction/cubs, 10 = Den; Nº observed: total number of proofs; UTM Easting, Northing: GPS position; Documentary evidence: 1 = Living specimen, 2 = Complete carcass, 3 = Fur (of carcass), 4 = Skull (of carcass), 5 = Photo/Video, 6 = Cast/drawing of track, 7 = Scat/spraint, 9 = Other: 10 = No evidence.

Site	Rating	Distance (km)	Kind of proof	N° observed	UTM Easting	UTM Northing	Documentary evidence
Xixuaú	1	0	1, 9	5	660482.59 mE	9911502.92 mS	5
Aruxaua	1	2	5	1	658749.97 mE	9865300.44 mS	5
Coxo	1	2	5	1	651902.51 mE	9865549.11 mS	5
Remanso	1	2	1	5	640151.79 mE	9848842.62 mS	5
Maguarí	1	2	4	1	628327.95 mE	9871697.62 mS	10
Adouau	1	5	10, 5, 1	1, 1, 7	627263.79 mE	9891766.29 mS	10
Branco	1	n.r.	1	5	625527.59 mE	9877914.58 mS	10

The Branco sighting indicates a casual record; the distance was not registered (n.r.) for it did not occur within a selected site

(two weeks) and engaging limited personnel (two researchers plus three local guides). However, the standard survey distance of 20km appeared to be unnecessarily long. This result agrees closely with that found by Lasso in Peru (Groenendijk and Hajek, 2004) and, in accordance with her recommendation, it is likely that also in our area a reduction of the survey distance would not affect the species encounter probability. Nonetheless, due to the large geographical scale and the heterogeneous environment of the giant otter distribution range, we do not recommend any variation without further field-testing in different habitats and under different giant otter densities. For a range-wide distribution survey, the standard methodology recommends the use of the UTM grid and the selection of a number of sites within a square of 100x100km. We suggest that these sites are selected on the basis of traditional local knowledge in order to avoid wrong conclusions, which would lead to equivocal conservation and policy decisions.

During the expedition we registered the presence of a number of commercial fishing boats, both along the Jauaperi (n = 5) and the Branco rivers (n = 2). Along with the hunting of river turtles, commercial fishing represents the most important threat to wildlife and people of the region for it puts the locals directly in conflict with commercial interests from neighbouring cities. Legally prohibited during the low-water season, we found that it is commonly practiced, even on the Jauaperi River, where it has been banned since 2006 (law nº 99, of 26 April 2006). We also registered sport fishing activity on the Branco River (n=2), where local agencies are selling *catch-and-release* trips, carried out with noisy speedboats, hence introducing high impact tourism to the region. The environmental integrity of the southeast corner of Roraima is currently threatened at different levels. The increase of human density is linked to a state-sponsored colonization program in forested areas (Naka *et al.*, 2006). Not far from the surveyed area, large pastures dominate the landscape. Besides potential habitat degradation, the future of giant otters in the region could also be threatened by local perception of the species. Meeting with local communities, we found widespread prejudice against giant otters, which are accused of interfering with fisheries and considered a factor in the reduction of available fish stocks.

The southeast corner of Roraima has recently been recognized as a protected area under Brazilian law, marking a possible step forward for protection of its biodiversity. Named *Lower Rio Branco Area of Environmental Protection* (APA-BRB), the state protected area measures 15000km^2 (law nº 714, of 21 May 2009). Within the Brazilian National System of Protected Areas[1] protected areas are divided into two main categories: areas of integral protection and areas for sustainable use, where the harvest of natural resources for commercial purposes is allowed. Among the latter, state units (*e.g.* areas of environmental protection APA) are the most fragile in terms of conservation since their models allow extensive economic and demographic use (Azevedo-Ramos *et al.*, 2006). The future of the region and the long-term survival of the giant otters largely depend on the APA-BRB's management plan, which must be elaborated in the near future by a council composed of local inhabitants, organizations and governmental institutions. From a conservation perspective,

[1]SNUC - National System of Protected Areas (2000) Presidência da República, Casa Civil, Law no 9.985, of 18 July 2000. Available at http://www.planalto.gov.br/ccivil_03/leis/L9985.htm Consulted on 20 March 2012

this plan should help managers prolong the conditions for coexistence between human and wildlife as well as to anticipate new threats to the ecosystem. We suggest that the management plan takes into account the ecosystem services provided by apex predators, whose important roles in sustaining biodiversity have been demonstrated in both aquatic and terrestrial ecosystems across a wide geographical range (Ritchie and Johnson, 2009). As apex predators, the giant otters help maintain the health of the fish population and may play an important role in regulating the whole ecosystem (Davenport, 2008; Duplaix *et al*., 2014). In conclusion we recommend rigorous cost-benefit analyses before performing any economic activities within the APA-BRB boundaries, as well as preventing potential conflicts with the local fishermen through the implementation of environmental programs and the design of possible areas for exclusive use by giant otters as already suggested by Carrera-Ubidia (2007).

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