



Giant otter (*Pteronura brasiliensis*) distribution, relative abundance and conservation in northwestern Bolivia

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Abstract: At the end of the last century northwestern Bolivia was prioritized for further study in a national evaluation of the endangered giant otter (*Pteronura brasiliensis*). In this paper we present a decade of efforts to investigate and systematize data regarding the distribution and relative abundance of giant otters in this wilderness region including 435 distribution points generated from direct observations, confirmed giant otter signs, and interviews with park guards and local people from indigenous communities. We also sampled 1318.6km of river and stream along the Tuichi, Hondo, Arana, Machariapo, Upper Madidi, Enatahua and Heath rivers and their adjacent oxbow lakes in the Madidi National Park, as well as the Undumo and Tequeje rivers in the Tacana Indigenous Territory, and the lower and mid Madidi River and 42.14km² of immediately adjacent oxbow lakes. Relative abundance was variable across the region ranging between 0.02 and 0.18 individual/km sampled in streams and rivers, and our data reveals a particularly important giant otter population along the Madidi River much of which remains unprotected. Our data and local reports point towards a possible population recovery within the Madidi and Pilon Lajas protected areas of the region over the last decade. In total we counted 271 animals, identifying 109 individuals through video and photographic throat pattern evidence. We argue that this previously undocumented population is of particular conservation importance due to its connectivity with the well-documented but currently threatened populations of neighboring southeastern Peru. Together northwestern Bolivia and southeastern Peru represent one of the most important conservation strongholds for this species.

Resumen: Al final del último siglo en una evaluación nacional el noroeste de Bolivia fue identificado como un sitio importante para estudios futuros sobre la amenazada nutria gigante o londra (*Pteronura brasiliensis*). En este artículo presentamos una década de esfuerzo para investigar y sistematizar datos respecto la distribución y abundancia relativa de la londra en este área silvestre incluyendo 435 puntos de distribución generados de observaciones directas, señas confirmadas, y entrevistas con guarda parques y gente local de comunidades indígenas. Adicionalmente hemos muestreado 1318,6km de río y arroyo en los ríos Tuichi, Hondo, Arana, Machariapo, Alto Madidi, Enatahua y Heath y sus lagos adyacentes dentro y alrededor del Parque Nacional y Área Natural de Manejo Integrado Madidi, además de los ríos Undumo y Tequeje en la Tierra Comunitaria Tacana, y también las secciones medias y bajas del Río Madidi y 42.14km² de sus lagunas meandricas adyacentes. La abundancia relativa fue variable entre los sitios muestreados con valores entre 0,02 y 0,18 individuo/km en arroyos y ríos, y los datos revelan la importancia del Río Madidi y además sugiere una posible recuperación de poblaciones dentro de las áreas protegidas de Madidi y Pilon Lajas en la última década. En total hemos contado 271 animales, identificando 109 individuos a través de evidencia de filmación y fotografía sobre los patrones de las manchas gulares. Consideramos que este población anteriormente no-documentada es de particular importancia por su conectividad con la población bien documentada pero amenazada en el sureste de Perú. Juntos el noroeste de Bolivia y el sureste de Peru representan una población baluarte para esta carismática y amenazada especie.

Introduction

The giant otter (*Pteronura brasiliensis*) is found from the Llanos of Venezuela to northern Argentina, although it is extinct in Uruguay (Duplaix, 2008; but see Buschiazzi *et al.*, 2014). In Bolivia it is found between 100 to 350masl in the tropical forests and grasslands of the Amazon, Cerrado and Pantanal (Eisenberg, 1989; Redford and Eisenberg, 1992; Carter and Rosas, 1997; Zambrana *et al.*, 2009; Tarifa *et al.*, 2010), inhabiting different aquatic systems such as white, black and clear water rivers, oxbow lakes and streams (Van Damme *et al.*, 2002; Ayala and Wallace, 2009; Zambrana *et al.*, 2009, Tarifa *et al.*, 2010).

The giant otter is one of the largest specialist piscivores of the Neotropics, measuring up to 2m and weighing between 22-34kg. It is brown with a characteristic white throat pattern that facilitates individual identification (Duplaix, 1980; Anderson, 1997; Carter *et al.*, 1999; Groenendijk *et al.*, 2005; Zambrana *et al.*, 2009; Tarifa *et al.*, 2010). Giant otters are considered excellent indicators of the health of aquatic ecosystems because of their large home ranges and high sensitivity to human activities¹ (Duplaix, 1980; Staib and Schenck, 1994). Giant otters are opportunistic predators, focusing mainly on fish captured on the borders of rivers and lakes (Duplaix, 1980; Carter and Rosas, 1997; Emmons and Feer, 1997; Damasceno, 2004; Velasco, 2004; Becerra-Cardona, 2006; Feuillet and De Thoisy, 2009).

Giant otters are one of the most threatened large mammals of the Neotropics because of a drastic population reduction between the 1940s and 1970s due to pelt hunting^{2,3} (Foster-Turley *et al.*, 1990; Schenck, 1999; Isola, 2000). In Bolivia giant otters are considered endangered (Tarifa and Aguirre, 2009) as they are across their range¹, because of reduced populations found in remote areas, habitat loss and fragmentation, mercury contamination of water and persecution from fishermen due to perceived reduction in fish stocks⁴ (Días Fonseca *et al.*, 2004; Zambrana *et al.*, 2009; Lima *et al.*, 2012). As such this species is in urgent need of ecological and natural history studies. This paper presents current information on the distribution and relative abundance of the giant otter in northwestern Bolivia, an area previously identified as a priority for studies to document populations (Van Damme *et al.*, 2002).

Methods

Distribution Assessment

To describe giant otter distribution in northwestern Bolivia within the framework of a national scale effort for medium to large sized mammals⁵ we systematized historical records for giant otter by examining published literature and the grey unpublished documents of five key libraries for mammals in Bolivia⁵. We also recorded giant otter observations and signs across fifteen years of field research in the Greater Madidi-Tambopata Landscape.

In addition, between 2001 and 2014 we conducted interviews with park guards across the three national protected areas about target wildlife presence, including giant otter, using enlarged satellite images on a 1km² grid map of the region. Similarly, we conducted wildlife presence interviews using the same maps with 16 communities in the two Tacana Indigenous Territories of northern La Paz. We then georeferenced all available distribution points and produced a GIS database of giant otter records.

Relative Abundance Study Areas

Between 2004 and 2014 we conducted eight relative abundance surveys for giant otters within Madidi National Park (upper Madidi River, upper Heath River, Tuichi River), the Tacana Indigenous Territory (Undumo and Tequeje streams) and other areas (lower and mid Madidi River) (Figure 1). Survey sites were all Amazonian and fell mainly within the Sub-Andean Amazonian and Pre-Andean Amazonian Forest ecoregions, except the Tequeje-Undumo site within the Pre-Andean Amazonian Forest and Inundated Moxos Savanna ecoregions, and the Heath site within the Pando Amazonian Forest and Inundated Moxos Savanna ecoregions (Ibisch *et al.*, 2003). Details of the habitat types across these ecoregions are provided elsewhere⁶ (Araujo-Murakami *et al.*, 2005; De La Quintana, 2005; Fuentes, 2005; Paniagua-Zambrana, 2005; Cabrera and Wallace, 2007).

Across survey sites we employed a mixture of the recently standardized methodologies developed for giant otters (Groenendijk *et al.*, 2005; Van Damme and Wallace, 2005). At all sites we registered giant otter signs when encountered (Groenendijk *et al.*, 2005), as well as registering and attempting to photograph or film all giant otter individuals or groups encountered (Groenendijk *et al.*, 2005; Van Damme and Wallace, 2005). At two sites, Undumo and Tequeje, we repeatedly attempted to film or photograph the entire resident population (Groenendijk *et al.*, 2005).

To estimate giant otter relative abundance we conducted surveys in boats (inflatable and dugout canoe boats), at a

¹Duplaix, N. (2002) *Giant Otter Final Report*. WWF-Guianas Rapid River Bio-assessment and Giant Otter Conservation Project. 118 pp.

²Groenendijk, J. (1998) *A Review of the Distribution and Conservation Status of the Giant Otter (Pteronura brasiliensis), with Special Emphasis on the Guyana Shield Region*. Netherlands Committee for IUCN, Amsterdam. 55 pp.

³Duplaix, N., Waldemarin, H.F., Groenendijk, J., Evangelista, E., Munis, M., Velasco, M. and Botello, J.C. (2008) *Pteronura brasiliensis*. In *IUCN Red List of Threatened Species*. Version 2011.2. Available online at <www.iucnredlist.org>. Consulted on 27 March 2012

⁴Zucco, C.A. and Tomás, W. (2004) Diagnóstico do conflito entre os pescadores profissionais artesanais e as populações de jacarés (*Caiman yacare*) e ariranhas (*Pteronura brasiliensis*) no Pantanal. Page 7 in *Anais, IV Simpósio sobre Recursos Naturais e Sócio-econômicos do Pantanal*, 23-26 November 2004, EMBRAPA, Corumbá, Brazil. 34 pp.

⁵Wallace, R.B., Lopez-Strauss, H., Mercado, N. and Porcel, Z.R. (2013) *Base de Datos Nacional sobre la Distribución de los Mamíferos Medianos y Grandes de Bolivia*. DVD Interactivo. Wildlife Conservation Society, La Paz, Bolivia.

⁶Zenteno, F. (2010) *Análisis y caracterización de la vegetación en la cuenca del río Madidi (Norte de La Paz, Bolivia) 2da Fase*. Informe Técnico, Wildlife Conservation Society, La Paz, Bolivia. 48 pp.

velocity of approximately 3-4km/h along rivers, streams and oxbow lakes. Surveys were conducted by four wildlife experienced observers (two researchers and two local guides) between 07:30-18:30h. We registered direct observations and giant otter sign such as footprints, scats, latrines and holts or dens and recorded the following data for each record: site name, date, hour, geographic coordinates, site description, record type total number of observed individuals, group structure, activity, the behavioral reaction of the giant otters and notes.

Upon encountering giant otters we attempted to photograph and film all individuals of the group for as long as possible, especially when periscoping, from a distance of 20-30m using a SONY Handycam TM Digital Video Camera with a 12x and 480x digital optical zoom. Subsequently the footage was analyzed using Ulead VideoStudio 10TM retrieving photographic images of each individual record and identifying individuals using the distinctive white throat markings.

Results

Distribution

In total we gathered 435 giant otter distribution points across the landscape (Figure 1). These records date back

historically to 1995 and have an altitudinal range between 169m and 356masl. The majority of distribution points were dens and latrines (n = 130; 29.9%), questionnaire-based local reports (n = 119; 27.4%), direct observations (n = 89; 20.4%), and footprints (n = 83; 19.1%). Scats made up the rest of the records (n = 14; 3.2%).

Giant otters were reported through interviews with local indigenous people and park guards along the Asunta and Toromonas rivers in the Tacana II Indigenous Territory, and similar interview records were subsequently confirmed with regular sightings on the Madidi and Heath rivers within the Madidi national protected area, the Undumo and Tequeje rivers within the Tacana I Indigenous Territory, and along large portions of the middle and lower sections of the Madidi River that are found outside national protected areas or indigenous territories (Figure 1).

Occasional sightings have also confirmed the presence of small groups of giant otter on the Tuichi, Hondo and Quiquibey rivers within Madidi and Pilon Lajas national protected areas (Table 1). Reported sightings on the Quendeque River within Madidi National Park from park guards, as well as indigenous community interview records

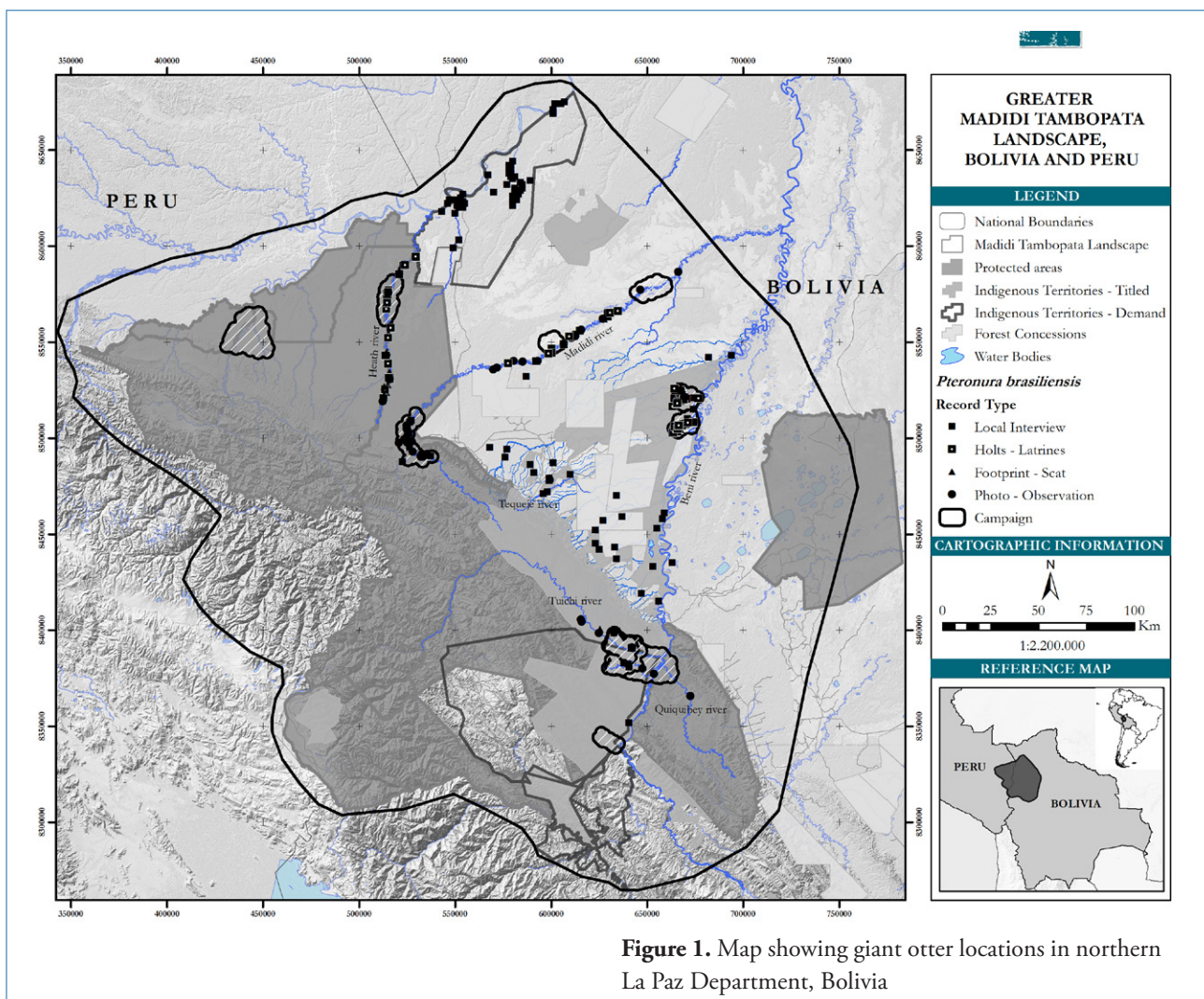


Table 1. Casual observations of giant otters in northern La Paz Department, Bolivia

Observer	Year	Management Unit	River	Habitat	# Individuals	Coordinates
Guido Ayala	2002	Madidi National Park	Tuichi	Stream	1	14°33'20"S, 67°40'48"W
Boris Rios	2003	Madidi National Park	Beni	River	1	14°40'31"S, 67°34'26"W
Fortunato Espinoza	2003	Madidi National Park	Hondo	River	1	14°39'1"S, 67°37'44"W
Guido Ayala	2006	Madidi National Park	Tuichi	River	2	14°29'4"S, 67°50'33"W
Benito Cuili and Tito Lipa	2008	Madidi National Park	Tuichi	Oxbow	1 1	14°25'52"S, 67°55'32"W 14°25'18"S, 67°55'43"W
Guido Ayala and Maria Viscarra	2009	Unprotected area	Madidi	River	3	12°51'60"S, 67°39'5"W
Jesus Martinez	2009	Unprotected area	Madidi	Oxbow	11	12°46'53"S, 67°28'10"W
Erika Alandia	2011	Pilon Lajas Biosphere Reserve	Quiquibey	Lake	4	14°46'47"S, 67°23'51"W
Maria Viscarra and Juan Gonzalez	2011	Madidi National Park	Alto Heath	River	3	13°23'49"S, 68°53'9"W
Guido Ayala and Maria Viscarra	2013	Unprotected area	Madidi	River	3	12°58'56"S, 67°47'21"W
Herminio Ticona and Esteban Canare	2013	Unprotected area	Madidi	Stream	5	13°21'4"S, 68°20'3"W
Guido Ayala & Juan Gonzalez	2014	Madidi National Park	Hondo	River	8	14°38'51"S, 67°47'29"W
Juan Gonzales and Edson Gonzales	2014	Tacana Indigenous Territory	Undumo	Stream	14	13°22'36"S, 67°22'8"W

along a series of minor rivers and streams between San Buenaventura and Ixiamas that flow off the last of the Andean foothills require further investigation.

Relative Abundance

Relative abundance surveys covered 1318.6km of rivers and streams and 42.14km² of oxbow lakes, and counted a total of 271 giant otter identifying 109 individuals of which 38 (34.8%) were registered in rivers and streams and 71 (65.2%) in oxbow lakes. Giant otter relative abundance in northern La Paz varied between 0.02 and 0.18 ind./km, with the highest abundance at the upper Madidi site and the lowest in the Tacana Indigenous Territory. The upper Madidi site was surveyed in 2004 and 2011, and giant otter relative abundance was similar across both surveys (0.18 ind./km in 2004 and 0.16 ind./km in 2011). We were also able to calculate a density of 2.7 inds/km² in oxbow lakes across the mid and lower Madidi sites (Table 2).

Giant otter encounters (n = 59) were most frequent between 08:00-12:00h and then again between 14:00-15:00h, after which activity declined (Figure 2). Giant otter group size ranged from solitary animals to groups of up to 11 individuals. Mean observed group size in streams and rivers was 3.6 ± 2.1 individuals, and mean observed group size in oxbow lakes was 5.5 ± 1.7 individuals. In 18.9% of

encounters giant otter groups included juveniles, with up to three juveniles in a group.

Additional direct observations at different sites across the region (n = 25) were not related to standard relative abundance surveys and represented a total of at least 58 individuals (Table 1). These individuals combined with the 109 individually identified animals during relative abundance surveys suggest a minimum population of 167 individuals across the northern La Paz region.

Discussion

This study clearly establishes that a previously suspected (Van Damme *et al.*, 2002) resident population of giant otters is present along the rivers and oxbow lakes of northern La Paz Department, Bolivia, especially the Madidi River that accounts for 66.2% of the minimum population estimate (90 of 167 individuals). Combining information on confirmed giant otter distribution and the location of more intensive relative abundance surveys reported herein it is important to stress that 167 individuals is a minimum population estimate because large sections of the Bolivian side of the Heath River were not surveyed nor was the upper mid section of the Madidi River which has a very high density of oxbow lakes representing prime giant otter habitat. Similarly, although local interviews and observations confirm the presence of

Table 2. Giant otter relative abundance in northern La Paz Department, Bolivia

Author	Year	Management Unit	Rivers	Habitat	Survey Distance	Groups/ Individuals	Population Abundance	Individuals Identified
Ayala and Wallace	2004	Madidi National Park	Upper Madidi	River, Stream	168.4km	10 groups/30 inds	0.18 ind./km	10
Jurado	2006	Tacana Indigenous Territory	Undumo Tequeje	Stream	227.2km 379.2km	5 groups/5 inds 13 groups/31 inds	0.02 ind./km 0.08 ind./km	1 10
Jurado	2007	Tacana Indigenous Territory	Undumo Tequeje	Stream	120.3km 178.8km	0 2 groups/5 inds	0 0.03 ind./km	0 5 (2n + 3r)
Ayala and Viscarra	2008	Madidi National Park	Tuichi	River	28.2km	0	0	0
Ayala and Viscarra	2009	Unprotected Area	Mid and lower Madidi	Oxbow	23.91km ²	12 groups/66 inds	2.7 inds/km ²	66
Ayala and Viscarra	2011	Madidi National Park	Upper Madidi Upper Heath	River, Stream	172km 44.5km	9 groups/27 inds 1 group/3 inds	0.16 ind./km 0.07 ind./km	11 (9n + 2r) 3
Ayala and Viscarra	2013	Unprotected Area	Mid and lower Madidi	Oxbow	18.22km ²	3 group/16 inds	0.88 ind./km ²	16 (5n + 11r)

n=New individuals; r=Recaptured individuals are those individuals identified and then subsequently registered at another location or date. Recaptured individuals were not quantified within the total animals identified, as they were quantified when they were registered for the first time.

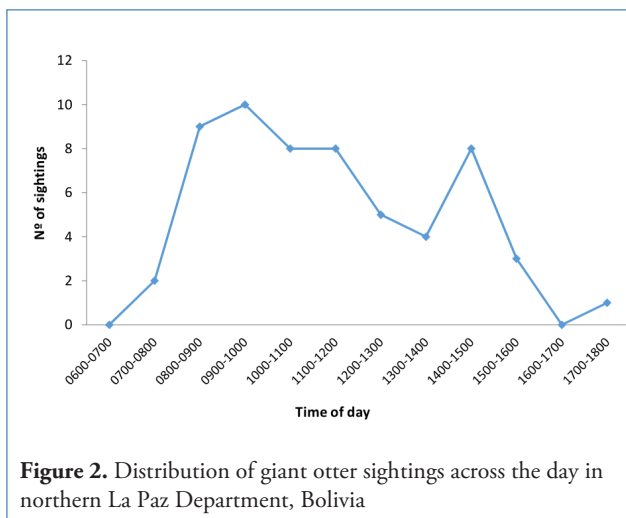


Figure 2. Distribution of giant otter sightings across the day in northern La Paz Department, Bolivia

giant otters on the Asunta, Moa and Toromonas rivers of the Tacana II Indigenous Territory that are tributaries of the Madre de Dios River, as yet no relative abundance or counts exist on these rivers. No information regarding giant otters or other wildlife exists for additional rivers further north in the department such as the Manurimi and Manupare.

Giant otters are also present in immediate portions of both neighboring departments: Beni and Pando. Very few giant otter records exist in southwestern Beni (Tarifa *et al.*, 2010), however recent observations suggest resident populations on the Negro River and Chuto Lake within and around the Tacana III Indigenous Territory in the Reyes Municipality⁷. In Pando giant otters are present within the Manuripi national protected area (Reserva Nacional de Vida

Silvestre Amazónica Manuripi), which borders onto the Madre de Dios River (Tarifa *et al.*, 2010) and giant otter population surveys are an urgent management priority for the park⁸. As such it seems likely that our minimum estimate of 167 giant otters individuals for northwestern Bolivia will increase, perhaps to as many as 200 animals, in the near future, once additional rivers and lakes in La Paz Department are surveyed, as well as connected populations in the Beni and Pando departments.

Critically, this Bolivian population is also connected to an already documented and well-known giant otter population in the Madre de Dios region of southern Peru⁹ (Schenck, 1999) that is currently declining and estimated at around 117 individuals⁹. Population declines in southern Peru are thought to be primarily due to intensive and illegal gold mining along the Malinowski River and surrounding area⁹. Taken together, the Bolivian and Peruvian populations represent at least 281 individuals (117 in Peru plus 167 minus 3 = 164 in Bolivia to avoid double counting Heath River values) with as yet unsurveyed areas in both countries likely to increase this number to perhaps as many as 350 animals. As such this transboundary area represents an important regional stronghold population for the giant otter in Latin America given that current global population estimates stand at 1000-

⁷H. Aranibar, pers. comm., 2012; M. Gonzales, pers. comm., 2014

⁸J.C. Gomez, pers. comm., 2010; V. Zambrana, pers. comm., 2012

⁹Silva, L. (2010) *Monitoreo de lobo de río Pteronura brasiliensis en Madre de Dios, Perú*. Presentation at the I Curso de Capacitación Binacional en Monitoreo de Especies y Actividades Humanas a Nivel Paisaje. SERNAP, SERNANP, WCS. Rurrenabaque, Bolivia.

5000 individuals¹. At the same time the rather low total population estimate for this stronghold emphasizes why giant otters remain endangered across their range¹. Recent estimates of minimum viable population size for vertebrates offer broad target recommendations of between 2000 and 5000 individuals (Traill *et al.*, 2010), and even more traditional estimates of 500 animals for population viability (Franklin, 1980) indicate the vulnerability of this giant otter population, unfortunately a problem for populations across their range.

Giant otters have been especially vulnerable because of their large size, group living and conspicuous behavior, habitat preferences along major thoroughfares in Latin America, perceived conflict with local fishermen, and, historically at least, the high quality and value of their pelts. In southern Peru giant otters are threatened from significant illegal gold mining with apparent population declines documented. In Bolivia our information suggests a more optimistic outlook with anecdotal information perhaps suggesting the beginning of a recovery for populations that were once abundant along the Tuichi, Hondo and Quiquibey rivers within Madidi National Park¹⁰; indeed, our observations of a group of seven giant otters in the Hondo River in September 2014 is the first observation of a group on this river. Meanwhile a healthy and important population is still present along the Madidi River, although 2013 informal interviews with fishermen on this river suggest that giant otters are perceived as competition and may be persecuted if fishing and logging intensifies along this river.

In any case, giant otters are a classic 'landscape species' (Sanderson *et al.*, 2002; Coppolillo *et al.*, 2004) requiring landscape-scale efforts in order to conserve biologically significant populations. Indeed, the giant otter is recognized as a landscape species in the transboundary Greater Madidi-Tambopata Landscape¹¹ that includes five continuous national protected areas as its core: Apolobamba, Madidi and Pilon Lajas in Bolivia and Bahujaja Sonene and Tambopata in Peru. Further efforts should be made in order to coordinate research and conservation efforts for giant otters across Bolivia and Peru. In this light, in late 2010, both national protected area agencies, SERNAP in Bolivia and SERNANP in Peru, as well as park guards from six national protected areas (the five aforementioned and Manuripi in Bolivia) agreed a set of ten wildlife species, including *Pteronura*, that required landscape scale coordinated presence-absence monitoring efforts from protected area personnel¹². Monitoring efforts for the ten wildlife species have been underway since the beginning of 2012 in five of the six protected areas.

Information from park guards, combined with interviews with local people across the region and subsequently targeted field surveys in unknown rivers such as Asunta, Toromonas, Manuripi, Manurimi, and Manupare, as well as repeated surveys at priority sites such as the Madidi and Heath rivers will improve baseline and monitoring information for this stronghold giant otter population.

In the meantime, communication and outreach efforts must increase in order to inform the local, national and international public about the regional and national importance of this stronghold giant otter population, their conservation status, and ongoing and planned efforts towards their conservation. In this light, the decision of the Consejo Indígena del Pueblo Tacana that represents Tacana indigenous communities in the Tacana I and II indigenous territories to afford protected status to giant otters within their territories is an encouraging development¹³. Similarly, the creation of the Ixiamas Municipal Reserve to protect both sides of the upper Madidi River that lies partially within the Madidi National Park is another positive development. However, in the future it will also be important to work with the Ixiamas Municipality and the La Paz prefecture to develop strategies to protect the river and oxbow lake habitats of the upper mid, mid and lower sections of the Madidi River.

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¹⁰L. Ocampo, pers. comm., 2005

¹¹Wallace, R.B., Siles, T.M., Kuroiwa, A., Reinaga, A., Domic, E. and Mercado, A. (2016) *Planificación para Conservación a Nivel Paisaje, Volumen 1: Planificación Espacial. Memorias de los Tres Talleres de Planificación Binacional sobre Conservación a Nivel Paisaje en el Gran Paisaje Madidi-Tambopata en Bolivia y Perú*. Wildlife Conservation Society. La Paz, Bolivia.

¹²SERNAP, SERNANP and WCS (2012) *Curso de Capacitación Binacional en Monitoreo de Especies y Actividades Humanas a Nivel Paisaje*. SERNAP, SERNANP & WCS, La Paz, Bolivia.

¹³CIPTA (2008) *Reglamento de Acceso, Uso y Aprovechamiento de los Recursos Naturales Renovables del Territorio Indígena Tacana*. Consejo Indígena del Pueblo Tacana (CIPTA), La Paz, Bolivia.

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