



Distribution and conservation status of giant otter *Pteronura brasiliensis* in the Pantanal wetland, Brazil

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Abstract: The giant otter (*Pteronura brasiliensis*) is listed as vulnerable in Brazil, is included in Appendix I of CITES and is classified as endangered by the IUCN. In Brazil, few viable populations persist outside the Amazon basin and the Pantanal wetland. Furthermore, there is limited information on the distribution and abundance of the existing populations. The aim of this study was to estimate the abundance of giant otters in the Pantanal wetland and to discuss the conservation status of this population. From July 2000 to November 2011 we conducted surveys throughout the Pantanal to detect the occurrence of giant otters by the observations of active dens and latrines and the direct visualization of the otters. We also monitored giant otter population in five rivers, which allowed us to obtain information on number of individuals, group size and linear density. The species was found to occur in almost every river stretch within the Pantanal wetland, as well as in several aquatic habitat types, indicating a remarkable recovery since the over-hunting during the 1960s. The population of giant otter in the Pantanal may reach 3969 (SD = 1103) individuals, based on our estimated number of individual per kilometer of rivers and creeks (0.54 ± 0.15), over a total of about 7350km of rivers and secondary channels occurring in the Pantanal. These results indicate that the Pantanal is an important area to preserve the giant otter and its habitat, despite the many threats that the species still faces in the region, such as increased vessel traffic, pollution and siltation, as well as disruption of the hydrological characteristics due to the construction of dams and river-bed sedimentation.

Resumo: A ariranha *Pteronura brasiliensis* é listada como vulnerável no Brasil, está incluída no apêndice I da CITES e é classificada como em perigo de extinção pela IUCN. No Brasil, poucas populações viáveis persistem fora da Bacia Amazônica e do Pantanal. Além disso, há limitadas informações sobre a distribuição e abundância das populações existentes. O objetivo deste estudo foi estimar a abundância de ariranhas no Pantanal e discutir o status de conservação dessa população. De julho de 2000 a novembro de 2011 nós conduzimos levantamentos ao longo do Pantanal para detectar a ocorrência de ariranhas através de observações de tocas e latrinas ativas e da visualização direta da espécie. Nós também monitoramos populações de ariranhas em cinco rios, o que permitiu acessar informações sobre número de indivíduos, tamanho de grupo e densidade linear. A espécie foi encontrada ocorrendo em quase todos os trechos de rio monitorados no Pantanal, como também em muitos tipos de habitats aquáticos, indicando uma notável recuperação desde a sobre-caça durante a década de 1960. A população de ariranhas no Pantanal pode chegar a 3969 (SD = 1103) indivíduos, de acordo com o número estimado de indivíduos por quilômetro de rios e riachos ($0,54 \pm 0,15$), em um total de cerca de 7350km de rios e canais secundários ocorrendo no Pantanal. Estes resultados indicam que o Pantanal é uma das mais importantes áreas para preservar ariranhas e seus habitats, apesar de que a espécie enfrenta muitas ameaças na região, como o aumento da navegação, poluição e assoreamento, como também a descaracterização hidrológica devido a construções de barragens e sedimentação das cabeceiras dos rios.

Introduction

The giant otter (*Pteronura brasiliensis*) is the largest living river otter, and its occurrence originally included Suriname, central-south Venezuela, southern and eastern Colombia, western Ecuador, eastern Peru, central-north and eastern Bolivia, northern Argentina, almost all of Paraguay, Uruguay and Brazil (except the semi-arid region of *caatinga*, in the northeastern part) (Cabrera, 1957; Chehébar, 1990; Mason, 1990; Nowak, 1991; Emmons, 1999). The species is listed as vulnerable in Brazil (Chiarello *et al.*, 2008), is included in the Appendix I of CITES, and is classified as endangered by the IUCN¹. Hunting to supply the international fur trade was the major cause of decline of giant otter populations from vast areas of its historical range (Duplaix, 1980; Chehébar, 1990; Carter and Rosas, 1997; Emmons, 1999). Other causes of decline have been reported. These included hunting as a result of conflicts between fisherman communities and otters (Thornback and Jenkins, 1982; Emmons, 1999), vessel traffic (Duplaix, 1980) and pollution. In addition, Gutleb *et al.* (1997) suggested that mercury pollution from gold mining might have negative effects on otters in Peru. These authors found high levels of methylmercury and total mercury in fish as well as in feces of giant otter from Manu National Park. This pollutant was a major problem in river otter populations in Europe and North America (Wren, 1985), and may therefore have contributed to the decline of giant otters in the Brazilian Amazonia (Fonseca *et al.*, 1994). In the Brazilian Pantanal, contamination with mercury has already been reported in giant otter (Fonseca *et al.*, 2005).

In the 1980s, the remaining overall giant otter population was estimated at 1000 to 3000 individuals in the wild (Brecht-Munn and Munn, 1988). However, Carter and Rosas (1997) suggested that these numbers are underestimates, based on information from Schweizer (1992) for the southern portion of the Pantanal wetland, Brazil. Nowadays, few viable populations persist outside the Pantanal and the Amazonian regions (Chehébar, 1990), which is supported by recent surveys conducted in the Brazilian Amazon (Lima *et al.*, 2013; Rosas *et al.*, 2007), Pantanal² (Ribas, 2004; Leuchtenberger, 2012) and Araguaia River (see http://www.araguaia.org/cantao/Projeto_Ariranha_2.html).

In the Pantanal, the giant otter was subjected to intensive hunting until the end of 1960s and early 1970s, when the species became commercially extinct in the region. However,

as caiman poachers remained active in the Pantanal until the early 1990s (Mourão *et al.*, 1996), some level of giant otter hunting persisted as well. Thus, pelts of giant otters were sporadically found together with caiman skins confiscated from poachers (W.M. Tomas, pers. obs). This process could have driven the giant otter population far below the commercial extinction limit. Few populations persisted in the floodplains although they seem to have recovered over the decades (Schweizer, 1992). However, there is no evaluation of the present abundance and distribution of the species, except for Schweizer (1992), who mapped giant otter populations along the mid stretch of the Negro River, in Mato Grosso do Sul State, Brazil. Tomas *et al.* (2011) argued that giant otter populations in the Pantanal seem to be widespread throughout the floodplain, as the occurrence records are widely distributed in the region.

Here we present updated information on giant otter occurrence and estimates of population size throughout Pantanal floodplains, and discuss the conservation status of the species in the region.

Study area

The Pantanal wetland is located in the central portion of South America, where it occupies about one third of the Paraguay River basin³. It comprises approximately 140000km² in Brazil (Silva and Abdon, 1998), and a smaller extension into Paraguay and Bolivia. Remarkable characteristics of this floodplain are its low elevation³, the slight gradient of declivity⁴, the alternation of periods of flooding and drought^{5,6}, a high annual amplitude of the temperature cycle, a strongly seasonal pattern of precipitation⁷ and a high interannual variation in flooding intensity⁶, which are known to strongly affect some water-dependent species (Tomas *et al.*, 2001; Mourão *et al.*, 2010).

Flooding, as well as topographic and edaphic factors, affects the vegetation, which occurs as diversified mosaics of forest, aquatic and open habitats (Prance and Schaller, 1982;

³Godoi Filho, J.D. (1986) Aspectos geológicos do Pantanal Mato-Grossense e de sua área de influência. Pages 63-76 in *Anais, I Simpósio sobre recursos naturais e sócio-econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

⁴Alfonsi, R.R., and Camargo, M.B.P. (1986) Condições climáticas para a região do Pantanal Mato-Grossense. Pages 29-42 in *Anais, I Simpósio sobre recursos naturais e sócio-econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

⁵Adámoli, J. (1986) A dinâmica das inundações no Pantanal. Pages 51-61 in *Anais, I Simpósio sobre recursos naturais e sócio-econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

⁶Carvalho, N.O. (1986) Hidrologia da Bacia do Alto Paraguai. Pages 43-49 in *Anais, I Simpósio sobre recursos naturais e sócio-econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

⁷Tarifa, J.R. (1986) O sistema climático do Pantanal. Da compreensão do sistema à definição de prioridades de pesquisa climatológica. Pages 9-27 in *Anais, Simpósio Sobre Recursos Naturais e Sócio-Econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

¹Duplaix, N., Waldemarin, H.F., Groenendijk, J., Evangelista, E., Munis, M., Velasco, M. and Botello, J.C. (2008) *Pteronura brasiliensis*. in IUCN 2010. *IUCN Red List of Threatened Species*. Version 2010.4. Available online at <www.iucnredlist.org>. Consulted on 13 December 2010.

²Tomas, W.M., Borges, P.A.L., Rocha, H.J.F., Sá-Filho, R., Kutchenski-Júnior, F. and Udry, T.V. (2000). Potencial dos rios Aquidauana e Miranda, no Pantanal de Mato Grosso do Sul, para a conservação da ariranha (*Pteronura brasiliensis*). Page 12 in *Resumos, III Simpósio sobre recursos naturais e sócio-econômicos do Pantanal: os desafios do novo milênio*, 27-30 November 2000, Embrapa Pantanal, Corumbá, MS, Brazil. Available at <http://www.cpap.embrapa.br/agencia/congresso/Bioticos/TOMAS-073.pdf>. Consulted on 17 November 2014

Ratter *et al.*, 1988; Prado *et al.*, 1992; Silva *et al.*, 1997; Schessl, 1999). The Pantanal flora and fauna are influenced by the surrounding biogeographic provinces: Cerrado, Amazonia, Chaco and the Atlantic Forest^{8,9}.

Professional fishermen use almost all the river stretches included in the survey. They are often small groups equipped both with relatively large boats containing freezers and smaller boats that allow more mobility. Some rustic hotels, ranches and camps dedicated to sport fishing provide the facilities to support the growing tourism in the region.

Sources of pollution are evident in the area surveyed. The urban sewage from several cities surrounding the Pantanal is still lacking treatment plants, and is mostly released in the rivers. Sediment deposits originating from erosion upstream in the surrounding plateaus are present in almost all rivers within the Pantanal wetland, and are one of the most threatening factors affecting the Pantanal ecosystems (Harris *et al.*, 2005; Tomas *et al.*, 2009).

Material and methods

Surveys were conducted in the Pantanal from July 2000 to November 2011, using kayaks, boats, four-wheel-drive vehicles and horses to reach rivers and other aquatic habitats as widespread as possible in the floodplain. All active giant otter dens we were able to find were documented and their geographic position was recorded with GPS. The signs used to characterize activity were the well-delineated sliding strips connecting the dens to the water with presence of recent tracks of giant otter, recently used latrines associated to the dens, and the presence of the otters using the observed den. All giant otters observed during the field expeditions were recorded, and we also gathered information on giant otter occurrence by interviewing field biologists and other research staff working in the Pantanal. These data were used to map the occurrence of giant otters throughout the Pantanal. We also recorded the number of individuals in each group at five river stretches (see Tomas *et al.*, 2000; Ribas, 2004; Leuchtenberger, 2012), which allowed us to assess the population status in these areas by providing information on the average giant otter group size, as well as the average spacing among giant otter groups. The length of each surveyed river stretch, as well as the average giant otter group size, number of otters per kilometer, and distance between groups, were used to estimate the linear abundance of the species (number of kilometers per group and number of individuals per kilometer). A conservative number of giant otters living in the Pantanal was obtained using the

average number of groups and individuals per kilometer of river, which was multiplied by the total length of rivers and secondary channels within the floodplain.

Results

Fifty-seven active dens were recorded along a 324km stretch of the Aquidauana and Miranda rivers included in the single survey conducted in 2000 using kayaks, with an average of one den per 5.7 kilometer of river. Thirty giant otter groups were found, with a total of 90 individuals. The giant otter population inhabiting an extension of 75.8km of the Vermelho River and a stretch of the Miranda River (from 19°36'48"S 56°46'41"W to 19°34'43"S 57°02'17"W) was monitored between 2002 and 2007 (Ribas, 2004; Leuchtenberger and Mourão, 2008). In 2009 and 2010, the marginal population of giant otters living in natural and artificial water bodies around the 78-km long Estrada Parque Pantanal Sul Highway (from 19°13'48"S 57°27'33"W to 19°36'43"S 57°02'09"W) was monitored (Ribas *et al.*, 2012). In 2003, 29 active dens and 11 isolated latrines were recorded in a 23km stretch of the Riozinho Creek, in the northern Pantanal (from 16°30'27"S 56°15'14"W to 16°34'52"S 56°21'48"W) (Ribas, 2004). During this time, two groups and a solitary individual were identified; one group was composed of five adults and the other of seven adults and four cubs. From 2009 to 2011, 76 active dens and 26 isolated latrines were recorded on a stretch of 36km along the Negro River (from 19°35'20"S 56°05'36"W to 19°35'13"S 56°17'16"W). During this survey, 51 giant otters were identified composing nine groups. Table 1 presents a summary of the average group size, number of giant otters per kilometer of river stretch, and number of kilometers per giant otter groups in these five survey areas, as well as average estimates for the Pantanal.

Giant otters were recorded in almost every river in the Pantanal (Figure 1). We surveyed a total of 7350km of rivers and other river-like important drainage systems in the floodplain (*corixos*). Based on the average group size and distance between groups in five surveyed river stretches, we estimate that the giant otter population in the Pantanal may reach 3969 ± 1103 individuals. The estimated number of groups is 553 and, considering that in each group there is one reproductive pair (Duplaix, 1980; Carter and Rosas, 1997; but see also Ribas, 2012), we estimated that the effective population size (the number of breeding individuals) (Wright, 1931) for giant otters in the Pantanal is around 1100 individuals.

Discussion

The information obtained in these surveys indicates that the Pantanal wetland shelters a relatively large giant otter population. This may be considered a conservative estimate since it is known that giant otters also occupy marginal ponds and oxbow lakes (Duplaix, 1980; Laidler, 1984; Ribas *et*

⁸Adámoli, J. (1982) O Pantanal e suas relações fitogeográficas com os Cerrados. Discussão sobre o conceito de "Complexo do Pantanal". Pages 109-119 in *Anais, XXXII Congresso Nacional de Botânica*, 21-31 January 1981, Sociedade Brasileira de Botânica, Teresina, PI, Brazil.

⁹Brown Jr, K.S. (1986) Zoogeografia da região do Pantanal Matogrossense. Pages 137-182 in *Anais, I Simpósio sobre recursos naturais e sócio-econômicos do Pantanal*, 28 November-4 December 1984, Departamento de Difusão e Tecnologia, EMBRAPA, Corumbá, MS, Brazil.

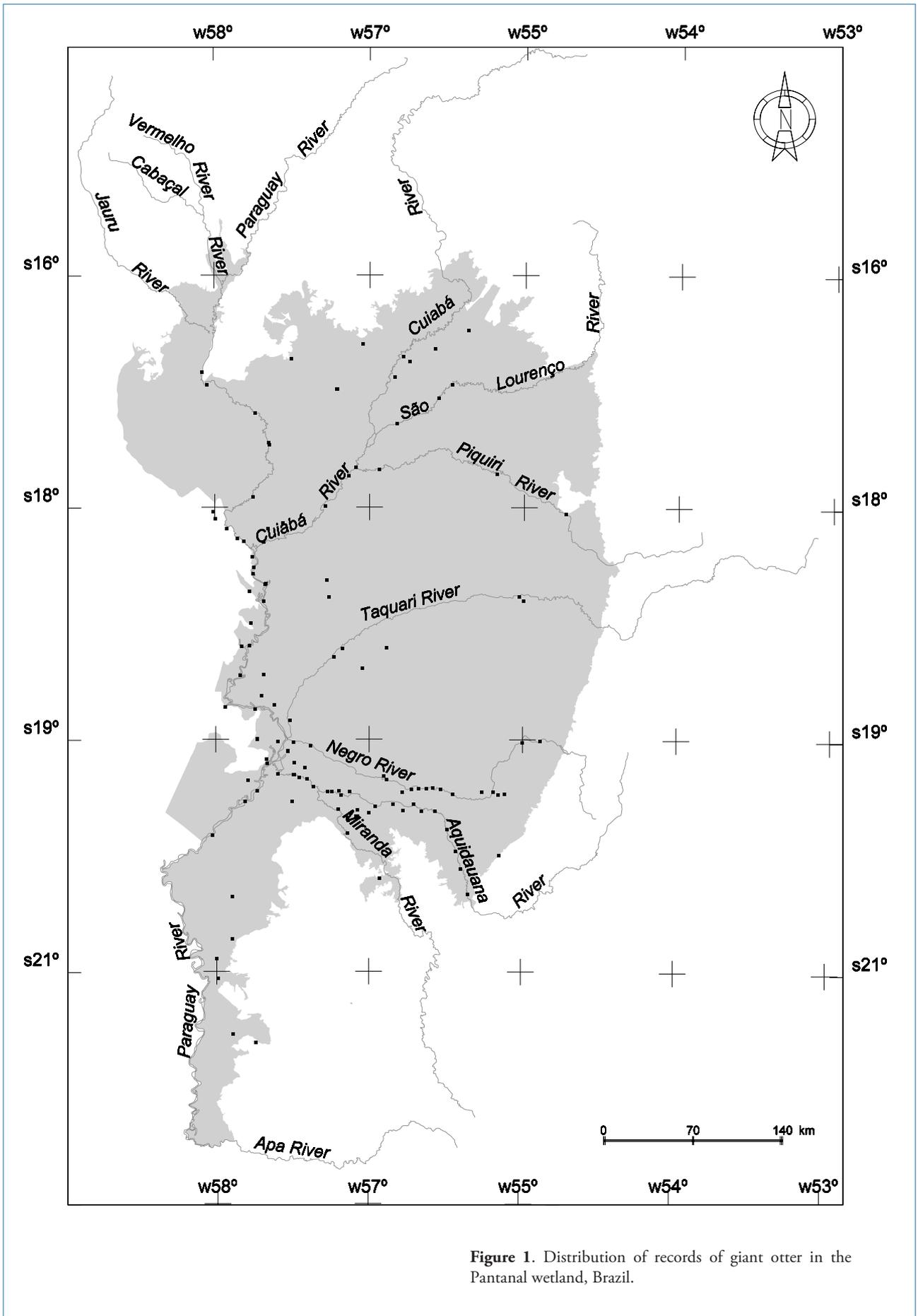


Figure 1. Distribution of records of giant otter in the Pantanal wetland, Brazil.

Table 1. Group size, number of individuals per kilometer and number of kilometers per giant otter (*Pteronura brasiliensis*) group along five river stretches in the Pantanal wetland, surveyed from 2000 to 2011.

Site/habitat	Length (km)	Group size	Individual/km	Km/group
Aquidauana River	324.0	3.0 ± 0.2	0.30	10.8
Vermelho/Miranda River	75.8	6.0 ± 3.0	0.48	13.0
EPP Highway	78.0	4.3 ± 2.3	0.17	26.0
Riozinho Channel	23.0	6.0 ± 1.0	0.74	11.5
Negro River	36.0	4.7 ± 2.1	1.00	5.10
Average ± 1SD		4.8 ± 0.57	0.54 ± 0.15	13.3 ± 3.50

al., 2012; Leuchtenberger *et al.*, 2013), which were scarcely monitored in this study due to logistical and technical reasons. The rivers are the main giant otter habitat in the Pantanal, as many lakes do not seem to support giant otter groups for much of the time. These lakes tend to be shallow and the water level drops greatly during the dry season, often disconnecting them from the river. In the Amazon region, in contrast, lakes are often deep oxbows connected to the rivers most of the time, and represent the prime giant otter habitat (Staib, 2005).

In the lower Aquidauana River, Schweizer (1992) found almost no signs of giant otters in a similar survey during the late 1960s. Therefore, our surveys in this river indicate a substantial expansion of the population in the region. In the area surrounding the Morro do Azeite region, in the lower Miranda River, Schweizer (1992) found no sign of the species in 1968, after two weeks of investigation that included the Vermelho River. However, recent studies suggest that this population is now near carrying capacity since the linear density of individuals per kilometer of river has remained constant since 2002 (Leuchtenberger and Mourão, 2008; Ribas *et al.*, 2012). As suggested by our present results, the giant otter population from Pantanal has experienced a remarkable recovery. Two factors appear to have contributed to the recovery of this population: the discontinuation of the commercial hunting and a sequence of annual cycles of high floods, which began in 1974 and lasted until the mid 1990s. The sequence of years of higher flooding may have supplied the otters with greater habitat and resource availability, as well as with protection in areas of difficult human access.

The average number of giant otters per kilometer found in our surveys ($n = 0.54 \pm 0.15$) is intermediate if compared with the estimates reported by Duplaix (1980) in Suriname (2 inds/km), Laidler (1984) in Guiana (0.2 ind./km), and Evangelista and Rosas (2011) in the Xixuaú Reserve, Brazil (1 ind./km). The results presented here suggest that the Pantanal is a very important stronghold for the conservation of giant otter populations, since their occurrence seems to be widespread along the main rivers in the floodplain. The species is often considered one of the rarest aquatic mustelids in the world, but

our results indicate that they can occur in higher numbers than previously believed, at least on a regional level, when habitat integrity is preserved and when human pressure is low.

The high possibility of observing giant otters in the Pantanal suggests a considerable potential for tourism, which could be directed to the conservation of the species. However, this type of activity must be developed cautiously, as it can result in negative effects for the otter populations. Duplaix (1980) hypothesizes that disturbances originated from the movement of boats, construction of bridges and expansion of urban areas contributed to the disappearance of the giant otter from places where it was formerly abundant, although this hypothesis has not been tested yet. Thus, the utilization of the giant otter as a tourist attraction should be in accordance with the behavior and biology of the species. Environmental education campaigns are also needed to provide information about the giant otter's ecological role to avoid the conflict between giant otters and fishermen. In the study area we found that local fisherman believe that giant otters are increasing their numbers and are already competing with humans for fish. Apparently, this situation presents little threat to the otter population in areas used for commercial fishing in Pantanal¹⁰. Commercial fishing in the Pantanal is practiced in an artisanal manner, without the use of fishing nets, and the products are destined mostly for local consumption. This situation represents a very different scenario when compared with regions of intense, industrial-scale fishing, such as in many regions of the Amazon basin.

Few protected areas contain suitable habitats in sufficient quantity to support large populations of the species (Coelho, 2013). In our study area, the mosaic of private and governmental conservation areas protects giant otter populations only marginally, since the design of areas to preserve a species along linear habitats is difficult and it is often not taken into account. Thus, the conservation of giant otter populations in

¹⁰Zucco, C.A. and Tomas, W.M. (2004) Diagnóstico do conflito entre pescadores profissionais artesanais e as populações de jacaré (*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 Pantanal, Corumbá, MS, Brazil.

the Pantanal should rely on the maintenance of habitat quality, including the control of pollution and siltation, as well as the avoidance of projects that could lead to alterations in the flood pulse in the Pantanal wetland, such as hydroelectric dams and waterways.

Monitoring the main populations is one of the aspects listed as a necessary action for the conservation of the species in Brazil¹¹. Unfortunately, little has been done to meet the guidelines of this plan regarding the giant otter. Monitoring population trends is a complex task, and perhaps a suitable alternative is to monitor its distribution rather than try to use population size repeatedly for a long period of time. In the Pantanal, this strategy may be applicable, as the species seems to be continuously distributed and, perhaps, one suitable strategy is to monitor distribution based on a watershed approach instead of using large grids (Groenendijk *et al.*, 2005).

The outcomes of our surveys strongly indicate that the giant otter population in the Pantanal is larger than previously expected, widely distributed, and likely to be viable in a long-term perspective. However, habitat disturbance, pollution and the difficulties in establishing protected areas to fully preserve viable populations of the species may jeopardize the giant otter populations in Pantanal wetlands. Thus, sustainable watershed management strategies should be sought in order to keep the Pantanal as a suitable region for this species.

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¹¹ICMBio/MMA (2010) *Sumário Executivo do Plano de Ação Nacional para Conservação da Ariranha*. Available online at <http://www.icmbio.gov.br/portal/images/stories/docs-plano-de-acao/pan-ariranha/sumario_ariranhass_lontras.pdf>. Consulted on 10 April 2012.

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