POPULATION STATUS OF THE BOLIVIAN RIVER DOLPHIN (*Inia boliviensis* D'ORBIGNY 1834) IN TRIBUTARIES OF THE ITÉNEZ RIVER (BOLIVIAN AMAZON)

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ESTADO DE LAS POBLACIONES DEL DELFIN BOLIVIANO (*Inia boliviensis* D'ORBIGNY 1834) EN TRIBUTARIOS DEL RÍO ITÉNEZ (AMAZONÍA BOLIVIANA)

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ESTADO DAS POPULAÇÕES DO BOTO (*Inia boliviensis* D'ORBIGNY 1834) EM TRIBUTÁRIOS DO RIO ITÉNEZ (AMAZÔNIA BOLIVIANA)

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SUMMARY

The Bolivian river dolphin (*Inia boliviensis*) was recently recognized as a species, geographically separated from *Inia geoffrensis* by rapids in the Madera River. The species is restricted to the Iténez*, Yata and Mamoré watersheds. More or less 95% of its distribution range overlaps with Bolivian territory, the remaining part with Brazil. Overall, the species is poorly studied, with an important information gap on its distribution and abundance in the Iténez river basin. As a first step towards the development of conservation strategies in this basin, habitat preferences and current population status are being assessed. The aim of the present study was to determine the population status of the river dolphin in the San Martin and Blanco rivers, two tributaries of the Iténez River. During the end of the high water season, 81.6 km were surveyed in the San Martin River and 66 km in the Blanco River. The average size of the observed groups was 2.4 (± 2.1) in the San Martin River and 3.0 (± 2.0) in the Blanco River. The relative abundances were 0.7 and 1.4 individuals/km respectively. In the San Martín River, there was a significant preference for river confluences. Hypotheses are put forward to explain observed differences in relative abundance between the two rivers.

*The Iténez river is known as Guaporé river in Brasil

RESUMEN

El delfín boliviano (*Inia boliviensis*) ha sido reconocido recientemente como una especie geográficamente separada de *I. geoffrensis* por rápidos y cachuelas en la cuenca del río Madera. La especie está restringida a las subcuencas de los ríos Iténez, Yata y Mamoré. Aproximadamente 95% del rango de distribución se sobrepone con territorio boliviano, el resto se sobrepone con territorio brasilero. La especie es poco conocida, y en particular existe un vacío de información sobre su distribución y abundancia en la cuenca Iténez. Como primer paso hacia la elaboración de estrategias de conservación para la especie en esta cuenca, las preferencias de hábitat y estado de las poblaciones están siendo evaluadas. El objetivo del presente estudio es determinar el estado de las poblaciones de *I. boliviensis* en los ríos San Martín y Blanco, ambos tributarios del río Iténez. Durante la época de aguas altas, 81.6 km han sido muestreados en el río San Martín y 66 km en el río Blanco. El tamaño promedio de los grupos fue de 2.4 (± 2.1) en el rio San Martin y de 3.0 (± 2.0) en el río Blanco. La abundancia relativa fue de 0.7 y 1.4 individuos/km,

respectivamente. En el río San Martín, el bufeo tuvo una preferencia notoria por la confluencia entre ríos. Se presentan hipótesis que pueden explicar las diferencias observadas entre los dos ríos.

RESUMO

O boto da Bolívia (*Inia boliviensis*) foi reconhecido recentemente como uma espécie geograficamente isolada da I. geoffrensis pelas corredeiras da bacia do rio Madeira. A espécie é restrita às bacias dos rios Iténez**, Yata e Mamoré. Aproximadamente 95% da área de distribuição encontram-se na Bolívia, e apenas o restante está em território brasileiro. A espécie é pouco conhecida e, em particular, existe um vazio de informação sobre sua distribuição e abundância na bacia do Iténez. Como primeiro passo para o desenvolvimento de estratégias de conservação para a espécie nesta bacia, preferências de habitat e a situação das populações estão sendo avaliadas. O objetivo deste estudo é determinar o estado das populações de I. boliviensis nos rios San Martín e Blanco, ambos afluentes do rio Iténez. Durante a época de águas altas, foram amostrados 81,6 km no rio San Martin e 66 km no rio Blanco. O tamanho médio dos grupos foi de 2,4 (± 2,1) no Rio San Martin e 3,0 (± 2,0) no Rio Blanco. A abundância relativa foi de 0,7 e 1,4 indivíduos/km, respectivamente. No rio San Martín, o boto teve uma notável preferência pela confluência de rios. São apresentadas hipóteses que podem explicar as diferenças observadas entre os dois rios.

**Iténez e denominado rio Guaporé no Brasil

INTRODUCTION

Cetaceans are widely spread all around the world in different types of aquatic habitat, and occur under a wide range of climatic conditions. Some species inhabit freshwater ecosystems, and amongst these, the species belonging to the genus *Inia* are considered as "obligate river dolphins" (Trujillo, 2000). This genus is widely distributed in the Amazon and Orinoco basins of South America (Trujillo, 2000). The species *Inia geoffrensis* was traditionally divided in three subspecies which are separated geographically: *I. g. humboldtiana* (Orinoco basin), *I. g. geoffrensis* and *I. g. boliviensis* (Amazon basin).

Recent molecular studies (Banguera-Hinestroza *et al*., 2002; Ruiz-Garcia *et al*., 2007; Ruiz-García *et al*., 2008) have shown that the river dolphin found in Bolivia is in fact a genetically different species, geographically isolated by rapids and waterfalls in the Madera river basin (border area between Brazil and Bolivia). This species, *Inia boliviensis,* has a restricted distribution range in the Bolivian Amazon, only occurring in the Iténez, Mamoré and Yata river basins. Dolphins were also reported in the lower Beni river (below the Cachuela Esperanza rapid) and in the Abuná river, however, Tavera *et al*. (in press) state that it is not clear to which of the two species these individuals belong. It is considered to be one of the least studied species of mammals in Bolivia (Aliaga-Rossel, 2002). Its total population size was estimated to be considerable smaller than the size of *I. geoffrensis* populations due to its restricted distribution range (Tavera *et al*., in press).

Inia geoffrensis is catalogued by the IUCN under the "Data Deficient" category (IUCN, 2010) and is listed in the Appendix II of the CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora) (CITES, 2008). No mention is made of *I. boliviensis* by UICN or CITES. In Bolivia, *I. boliviensis* hunting is forbidden by D.S. 22641 (8th of November 1990) and D.S. 25458 (21th of July 1999). In 2008, it was declared natural heritage of the department of Beni (R.P. 25858, Department of Beni). Recently, it received the status of "Vulnerable" in the Red List of Vertebrates of Bolivia (Aliaga-Rossel, 2009).

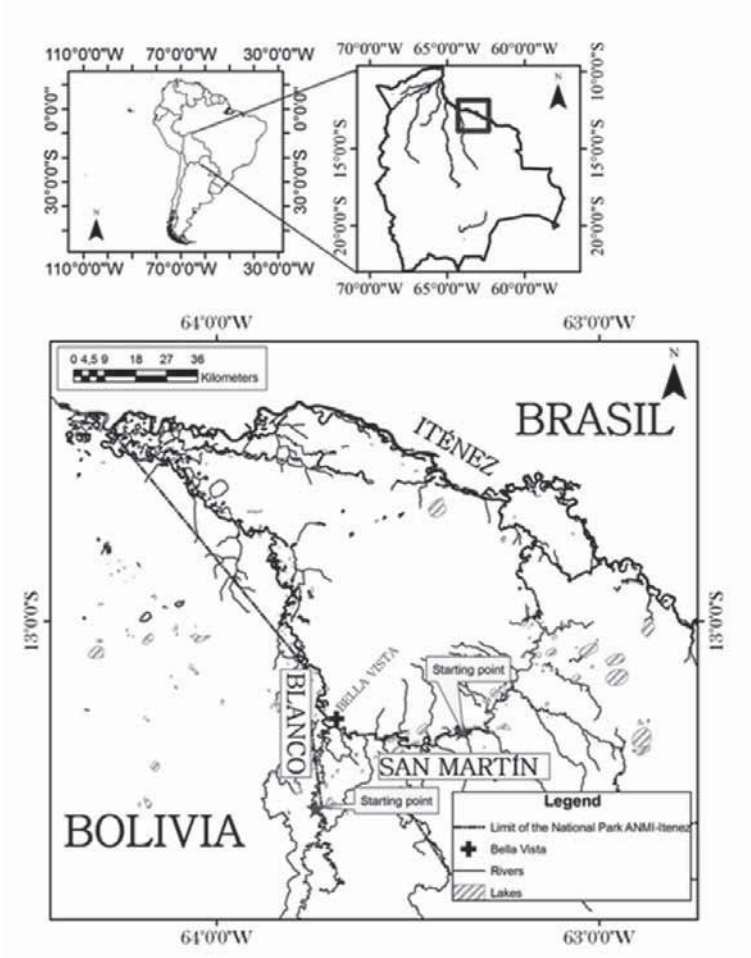

Figure 1. Map of the study area, showing the river transects in the Blanco and San Martin rivers in the Departmental Park – ANMI Iténez, Bolivia

The recognition of *Inia boliviensis* as a separate species increased the interest of the scientific community and the necessity for the development of species-specific conservation strategies.

However, for an effective management and conservation of the species, information is needed about their abundance and the natural and human factors that are affecting their abundance over time. The populations in the Mamoré watershed are relatively well studied (Aliaga-Rossel, 2002, 2003; Aliaga-Rossel *et al*. 2006), however, there exists an important information gap on its population status in the eastern part of its distribution range. The objective of the present study is to fill this gap, assessing the habitat preferences and current population status of *Inia boliviensis* in two rivers belonging to the Iténez watershed in Bolivia.

METHODS

The study was conducted in the San Martin and Blanco Rivers, whose lower stretches drain the Departmental Park and Natural Area for Integrated Management Iténez (PD-ANMI Iténez,

Beni, Bolivia). This protected area is located between 10º30' and 13º00'S, and between 64º00' y 69º00'W (Fig. 1). The major vegetal formations present in the PD-ANMI Iténez are the inundated floodplain forests, the Amazonian ("tierra firme") rainforest of the Precambrian Shield and the lowland savannas (Ten *et al*., 2001). The PD-ANMI Iténez overlaps entirely with the Iténez river basin and has a surface area of 186 460 km^2. The mean temperature fluctuates between 24° to 27°C, while the annual rainfall is between 1500 and 2000 mm per year.

The Blanco River is a white water river transporting a moderate load of suspended and dissolved solids, which explains the light brown colour, low transparency and close-to-neutral pH. This river drains the alluvial lowlands of Beni. The San Martin River, on the other hand, is a clear water river with high transparency (on average 2.7 m) and low load of suspended and dissolved solids, draining the Precambrian Shield (Navarro & Maldonado, 2002).

The surveys were conducted at the end of the high water season in June and July 2006 and lasted 4 weeks. Because the rivers on average were less than 100 m wide (Blanco river 33.9 m; San Martin river 56.6 m), strip transects were carried out, travelling downstream. Based on the methodology of Aliaga-Rossel (2002), dolphin abundance was estimated through sightings made from a wooden boat propelled by rowing, with an observer standing on the bows and someone rowing the stern. The boat speed was 5-7 km/hrs. Transects were conducted between 08:00 and 17:15 hrs, under optimal light and visibility conditions. The boat headed in the middle of river and the observer in the bow of the boat located river dolphins using binoculars. Each time a river dolphin or dolphin groups were detected, the boat stopped and the observer registered the number of individuals and geographical location. In the case of acoustical records, visual confirmation was necessary to record the sighting, as recommended by McGuire & Winemiller (1998). Observation height was approximately 1.5 m (standing height of observer), making the data difficult to compare with other studies, in which usually platforms were used at least 3 m above the water level. The same methodology was used in both rivers, making the data comparable between the two rivers visited.

We distinguished 3 habitat types: the main river course, dead river arms and confluences. Dead river arms (locally called "bahías") are oxbow lakes permanently connected with the main river channel. By definition, confluences include the river mouth as well as river stretches 100 m downstream and 100 m upstream of the river mouth. The same term is used for the intersection of rivers and dead river arms. Streams are defined as water courses less than 20 m wide, and have their origin in the forest or savannas, transporting clear waters.

The Blanco and San Martin rivers were characterized through registration of physical parameters (maximum depth, total width, water transparency), which were measured every two km in rivers. The main average and average of the maximums of all physical parameters were calculated. In addition, the river sinuosity was evaluated by the Index of sinuosity (Is = longitude of the river/longitude of the valley). Kruskall-Wallis analyses were used to analyze for significant differences between the two rivers. When a dolphin or a group of dolphins was observed the same parameters were taken on the point of first observation. In dead river arms the same parameters were measured at least in two different points and at each point where river dolphins were observed. Anthropogenic disturbance was measured as number of boats and fishing nets encountered during the river transects.

In total, 147.6 km were surveyed in the two watersheds. In the San Martin watershed, 62.4 km were surveyed in the main river channel (not including confluences), 15.2 km in dead

river arms and 0.4 km in streams. The survey distance in confluences was 3,6 km (3.0 km in river-dead arm confluences and 0.2 km in river-stream confluences). The survey distance in the Blanco River was 66 km. The river surface (km^2) was calculated by multiplying survey distance by mean width; river volume (km^3) was calculated by multiplying survey distance, mean maximum depth and the mean width. The relative distance of each habitat type was calculated as survey distance in each habitat divided by the total survey distance. The total surface of the river transect sampled in the San Martín River was 4.62 km^2, whereas the corresponding surface in the Blanco River was 2.24 km^2. These surfaces corresponded to water volumes of 0.04 km^3 in the San Martin River and 0.01 km^3 in the Blanco River, respectively. The index of dolphin abundance was calculated as ind./km, ind./km^2 and ind./km^3.

Spearman Rank Correlation was used to explore the relationship between group size and physical parameters. When the correlation indicated significant differences, a regression analysis was performed to determine the percentage of variability explained by the physical variable. Chi-square analysis was applied to analyze the preference of habitats by the river dolphin.

RESULTS

On average, the San Martin main river channel was significantly deeper and wider than the Blanco River. Transparency was also significantly higher in the San Martín River (Table 1).
In the Blanco River the sinuosity was 2.64 and in the San Martin 1.74 over the 66 km surveyed in the main channel of both rivers.

The Blanco River presented a density of 0.075 canoes/km and three fishing nets were found along the survey. In the San Martin River, 0.17 canoes were registered each km. These data show the low level of human disturbance in both rivers, which are mainly visited by local artisanal fishermen.
A total of 55 individuals were observed in the San Martin river (including main channel, confluences and dead river arms), and 94 individuals in the Blanco river. These data correspond with relative densities of 0.7 and 1.4 ind./km (Table 2). When densities were calculated per surface area or by volume, the number of dolphins per unit in the Blanco River is 3.5, resp. 6.8, times higher than in the San Martín River.

Twenty four groups of river dolphins were recorded in the San Martin River. Average group size (number of individuals per sighting) was 2.4 (±2.1). The predominant aggregation consisted of 2 individuals, observed in 40% of the sightings (Fig. 2). The largest group consisted of 7 dolphins and was observed in bahía "Las Pozas" (Fig. 3). In the Blanco River, 31 groups were sighted, representing 94 dolphins. The average size of the groups was 3.0 (±2.0), whereas the largest group consisted of 10 river dolphins. 12.7% of the observed individuals in the San Martin river were solitary, whereas in the Blanco River only 8.5% were solitary (Fig. 2). There was no significant relationship between, respectively, river depth, width, water transparency of both rivers and the group size of river dolphins (Spearman Rank Correlation; $p > 0.1$).

Table 1. Physical characteristics of the river transects sampled in the San Martin and Blanco rivers

	Rio Blanco (N=34)	Rio San Martin (N=34)	Kruskall-Wallis H (N=68)	p-value
Average maximum depth (m)	5.7 (± 1.9)	8.2 (± 2.3)	18.0	<0.0001
Average transparency (m)	0.5 (± 0.1)	2.7 (± 0.4)	50.9	<0.0001
Average width (m)	33.9 (± 8.5)	56.6 (± 18.0)	35.6	<0.0001

Table 2. Relative abundance of river dolphins of the Blanco and San Martin rivers

River	Transect length (km)	Number of dolphins	dolphins/km	dolphins/km²	dolphins/km³
Blanco	66.0	94	1.4	41.9	9400
San Martin	81.6	55	0.7	11.9	1375

There was a highly significant difference in habitat occupied by dolphins in the San Martin river (N = 5, $\aleph^2$ = 20.8; df = 4; p < 0.0001) (Fig. 3). Table 3 shows the total number and the percentage of dolphins encountered in each habitat type. Most of the individuals (50.9%) used the main channel in the San Martín. However, the density of dolphins in confluences was higher than in the main river channel.

River dolphins were observed in 5 of the 12 visited dead river arms (Sin Nombre I, Las Pozas, La Poza, Capuchin and La Asunta) (Table 4). In total, 16 river dolphins were observed, and group size ranged from 1 to 7 individuals (average per dead river arm: 3.2 ± 2.2). The physical characteristics (depth, width, transparency) of the dead arms did not influence significantly the group size of the river dolphins (Spearman Rank Correlation; $p > 0.01$).

DISCUSSION

The Blanco and San Martin River represent very different habitats for the Bolivian river dolphin. The Blanco River is a meandering river with little incidence of associated lakes. It has a narrow and deep channel, with high river banks of a high slope, covered almost completely with herbaceous riparian vegetation; there are hardly beaches during the dry season. Though it is not a typical white water river (Navarro & Maldonado, 2002), because of not draining the Andes mountains, it has a relatively high load of suspended and dissolved solids, low transparency and high conductivity and it is supposed to be more productive than the

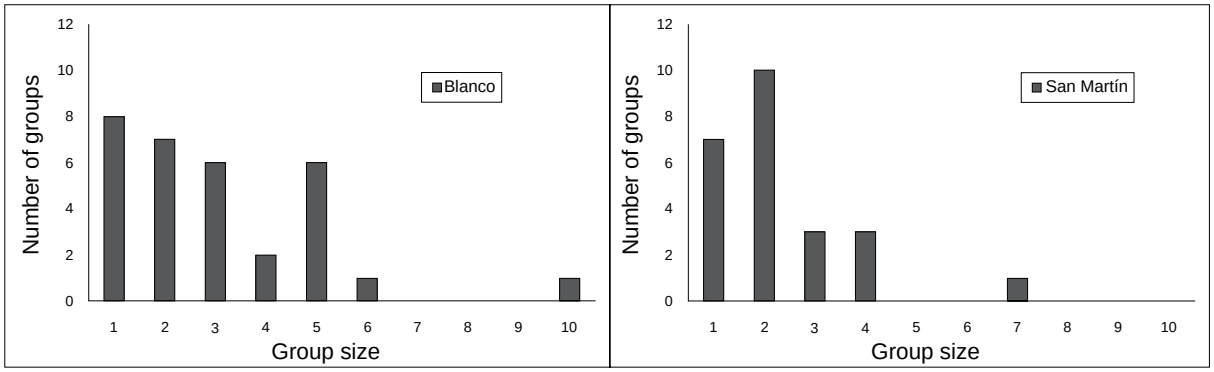

Figure 2. Frequency of occurrence of groups of river dolphin of different group sizes in the rivers San Martin and Blanco in June-July, 2006

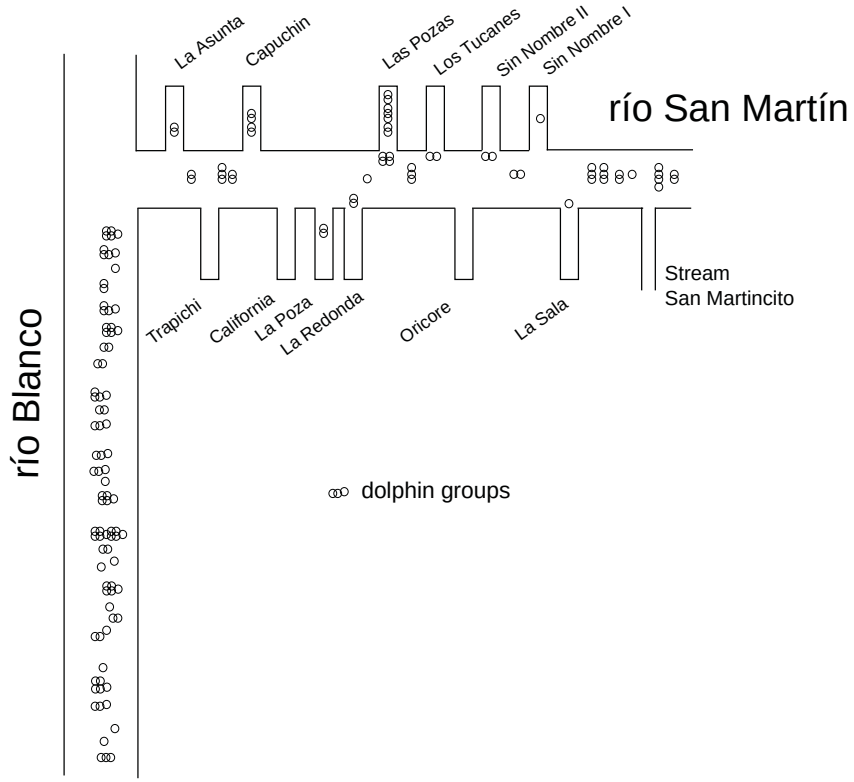

Figure 3. Representation of habitat use by the Bolivian river dolphin *Inia boliviensis* in the San Martín and Blanco River.

San Martin river (Navarro & Maldonado, 2002).

On the other hand, the San Martin River is considered as a clear water river, with high transparency and low load of suspended solids. It is characterized by a high structural heterogeneity: it has a wide floodplain, spacious beaches, numerous dead river arms and a high number of smaller water bodies temporally forming part of the larger floodplain (Navarro & Maldonado, 2002; Zambrana, 2007). In contrast with the Blanco river, the San Martin is characterized by floating and emergent macrophytes.

Both the Blanco and the San Martin River are well preserved and not much disturbed by human activities. Although there was evidence of farms, livestock, fisheries activities and fire impact in both rivers, human disturbance is thought to be low. The number of boats found during the survey

Table 3. Habitat use by the river dolphin in the San Martin River in June-July 2006

Habitat type	Distance sampled (km)	Relative distance (%)	Number of dolphins	Density (dolphins/km)	% of dolphins in each habitat
Main channel	62.4	76.9	28	0.4	50.9
Dead river arms	15.2	18.6	16	1.1	29.1
Streams	0.4	0.5	0	0.0	0.0
Confluences river-dead river arms	3.0	3.7	11	3.6	20
Confluence river-stream	0.2	0.2	0	0.0	0.0

Table 4. Physical parameters in the sighting points of dolphins in dead river arms along the river San Martin (June-July, 2006)

Dead river arm	Length (km)	Average depth (m)	Width (m)	Transparency (m)	Total No. of dolphins	Groups of dolphins
Oricore	0.5	5.7	25	3.0	0	0
California	0.9	47	53	3.3	0	0
Trapichi	0.5	4.2	27	2.8	0	0
La Sala	4.0	5.8	60	3.4	0	0
Sin nombre I	1.8	4.8	20	2.7	1	1
Sin nombre II	1.1	5.1	100	2.7	0	0
Los Tucanes	1.4	5.1	90	3.7	0	0
Las Pozas	0.7	4.4	110	3.0	7	1
La Redonda	2.0	4.6	45	3.2	0	0
La Poza	0.9	4.3	57	2.7	2	1
Capuchin	1.1	5.6	80	2.6	4	1
La Asunta	0.25	4.1	25	2.5	2	1
TOTAL					16	5

is not a very reliable indicator of overall human presence, but gives a general idea of the low human pressure. There are no indications of kills of freshwater dolphins and we assume that the local population structure and density is similar to natural conditions.

This study explored the importance of some of the factors that might influence the distribution and relative abundance of river dolphins, such as river depth, river width and water transparency. The encounter rate of river dolphins was higher in the shallow and narrow Blanco River than in the San Martin River. Within each river, river depth and width did not seem to affect the group size of river dolphins. These data suggest that the river dolphin not necessarily selects deeper stretches in the river, as was expected. Its microhabitat selection probably depends more on local food availability, in this case of small-sized fish, than on physical factors such as depth.

Water transparency may influence dolphin abundance in a variety of ways. The vision of river dolphins is apparently weak (Mass *et al*., 1989; Cassens *et al*., 2000), however can distinguish large objects at a short distance even in turbid water (Mass *et al*., 1989). In these waters, prey are mainly echolocated (Cassens *et al*., 2000). Therefore, we may assume that fish prey are easily located both in clear waters and in the highly turbid waters of the Amazon white water rivers that drain the Andes (Alliaga *et al*., 2006). At the same time, prey may be able to observe more easily hunting dolphins in clear water, and thus may have more possibilities to escape from predation. The data in the present study suggest that a low transparency river (Blanco) has more dolphins than a clear water river (San Martín). Aliaga-Rossel (2006) recorded in Bolivian Amazon rivers relative abundances of 1.6 ind./km (Mamoré), 5.8 ind./km (Tijamuchi), 2.9 ind./km (Apere), 2.4 ind./km (Yacuma) and 2.6 ind./km (Rapulo), respectively. Among these, the Mamoré is a river with very high turbidity all around the year, whereas the latter four are rivers with mixed waters, the turbidity varying along the year. All these recorded densities are higher than the density recorded in the San Martín river (0.7 ind./km), but are also slightly higher than the density recorded in the Blanco River, which suggests that there are many other variables (such as river and floodplain size) that can influence dolphin abundance. Tavera *et al*. (2010) presented some apparently contradictory results: they registered higher encounter rates in the Iténez River (clear water) than in the Mamoré River (white water) but argued that a high fraction of the Mamoré population may be found in floodplain

lakes, which were not surveyed. This latter study shows that more detailed distribution data will be needed before being able to test hypothesis on the influence of water transparency and other variables on dolphin abundance.

Water transparency may also be related to other factors that can influence dolphin abundance. Pouilly *et al*. (2010), for example, argued that sensorial predators such as Siluriformes are more abundant in turbid waters, and visual predators such as Characiformes, more abundant in clear waters, in concordance with the PTM (Piscivory-Transparency-Morphometry) Model of Rodriguez & Lewis (1997). The main food items of freshwater dolphins belong to the latter group (Da Silva & Best, 1982; Da Silva 1983; Best 1984; Da Silva 1994), so clear water rivers may be more suitable in terms of availability of prey belonging to this group.

Some factors not measured during the present study, such as food availability, may exert a strong influence on relative dolphin abundance. Differences in productivity between different rivers may affect total food availability (Furch, 1997) and may explain the relative abundance of dolphins in different water bodies. Both McGuire & Winemiller (1998) and Aliaga-Rossel (2003) suggested that food availability is an important habitat component for river dolphins. White water river systems are considered to be more productive than clear water systems (Furch, 1997), and this factor might influence dolphin abundance patterns in the area. Pouilly & Camacho (2010) studied the fish fauna in the Blanco and San Martin river and came to the conclusion that there were significant differences in fish community composition, mainly controlled by water transparency, however they did not find clear-cut differences in abundance as measured by capture per unit effort, and stated that their data are not conclusive as to which of the two systems would have higher secondary productivity. The Blanco river does not have an extensive floodplain and does not drain the Andes mountains, and therefore its primary productivity may be considerably lower than the "typical" white water rivers in the Bolivian central Amazon.

The high relative abundance of dolphins in river confluences and in dead river arms, both being considered by local fishermen as areas of high fish abundance, supports the hypothesis on a close relation between food availability and dolphin abundance.

Trujillo & Diezgranados (2002) indicated that during the high water season, *Inia* disperse in the flooded forest, where observation is more difficult. Though during the present survey, water had already retreated from the floodplain, this factor may have reduced encounters in the San Martin river basin. Salinas (2007) found dolphin densities of 0.77 ind./km in the San Martín river during the low water season, slightly higher than the present data, showing that there might have been a slight underestimation of total population size during the high water season. In addition, McGuire &

Table 5. Size of river dolphin groups in surveys conducted in Bolivian Amazon rivers (Aliaga-Rossel, 2006)

River	Maximum group size	Mean group size
Mamoré	11	2.1 (±1.3)
Tijamuchi	14	3.3 (±3.0)
Apere	5	2.3 (±1.0)
Yacuma	3	1.8 (±0.8)
Rapulo	3	2.0 (±0.8)

Winemiller (1998) indicated that sightings of dolphins are more common in a large heterogeneous habitat, and this pattern could be explained by the great diversity and density of fish, or other benefits provided by a complex habitat structure.

Trujillo (2000) indicated that the reason of grouping is because it increases the opportunity for hunting, mating and avoiding predators. Being part of a group implicates some costs but also provides benefits. McGuire and Winemiller (1998) indicated that, normally, river dolphins are solitary or swim in pairs, although occasionally groups of 20-35 individuals were observed. In Bolivia, Aliaga-Rossel (2006) encountered group ranges between 1 and 14 individuals in the Mamoré river and its tributaries (Table 5). In the present study, the average group size in the San Martin River was 2.4 (± 1.5) and group size ranged between 1 and 7 individuals, and in the Blanco River the average size was 3.2 (± 2.3), whereas group size ranged between 1 and 10 dolphins (Table 5). These data show a weak and non significant tendency towards larger group sizes in large white-water rivers, however more distribution data are needed to confirm this tendency.

The aquatic environments studied are strongly influenced by seasonal changes in water level (Navarro & Maldonado, 2002). Being the San Martin River a tributary of the Blanco River, it is possible that there occurs population interchange between both rivers in different seasons. At high water, the San Martin River offered a variety of habitats available for river dolphin: the main river course, death river arms, confluences and, eventually, the inundated floodplain. During low water, habitat availability is probably lower, dead river arms and streams becoming inaccessible (Salinas, 2006). Possibly, the density of dolphins in the San Martín river is determined by food and habitat availability during the low water season and not during the high water season. In the confluence of the Blanco and San Martin rivers two dolphin groups were encountered (of resp. 10 and 5 individuals) (unpublished data). Interchange between the two rivers may occur, thus optimizing seasonal habitat and food availability.

This research is a first step towards improving our knowledge of the Bolivian river dolphin (*Inia boliviensis*) in the eastern part of its distribution range (Iténez river basin). McGuire and Winemiller (1998) emphasized the lack of information about the habitat requirements and population dynamics of river dolphins in South America. The Iténez river basin, characterized by clear water rivers draining the Precambrian Shield, might be an excellent location to study the factors that influence dolphin distribution patterns.

Lack of information hinders the development and implementation of strategies for conservation of freshwater dolphins (Leatherwood & Reeves, 1997). According to McGuire & Winemiller (1998), the best way for a long-term protection is through the strengthening and protection of national parks, although it is not clear whether this strategy would be enough for long-term protection. In Bolivia, a relatively small percentage of the dolphins is living within protected areas (Tavera *et al*., 2010) and the protection of these areas probably is not sufficient to protect the species in a definitive way. However, protected areas such as the PD ANMI Iténez may play an important role because the local populations probably are not affected by humans. They also represent unique habitats to study and understand the requirements of this species.

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REFERENCES

Aliaga-Rossel E. 2002. Distribution and abundance of the river dolphin (*Inia geoffrensis*) in the Tijamuchi River, Beni, Bolivia. Aquatic Mammals, 28 (3): 312-323.

Aliaga-Rossel E. 2003. Situación actual del delfín de río (*Inia geoffrensis*) en Bolivia. Ecología de Bolivia, 38 (2): 167-177.

Aliaga-Rossel E., McGuire T.L. & Hamilton H. 2006. Distribution and encounter rates of the river dolphin (*Inia geoffrensis boliviensis*) in the central Bolivian Amazon. Journal for Cetacean Research & Management 8 (1): 87–92.

Aliaga-Rossel E. 2009. *Inia boliviensis*. p. 534-535. En: Ministerio de Medio Ambiente y Agua. Libro Rojo de la fauna silvestre de vertebrados de Bolivia. La Paz, Bolivia.

Banguera-Hinestroza E., Cardenas H., Ruíz-García M., Marmontel M., Galtán E., Vázquez R. & García-Vallejo F. 2002. Molecular identification of evolutionarily significant units in the Amazon River Dolphin *Inia* sp. (Cetacea: Iniidae). The Journal of Heredity, 93 (5): 312-322.

Best R.C. 1984. The aquatic mammals and reptiles of the Amazon. p. 371-412. In: Sioli H. (Ed.) The Amazon. Limnology and landscape ecology of a mighty tropical river and its basins. Dr. W. Junk Publisher, Dordrecht, 763 p.

Best, R.C. & Da Silva V. 1993. *Inia geoffrensis*. Mammalian species, 426: 1-8

Cassens I., Vicario S., Waddell V.G., Balchowsky H., Van Belle D., Ding W., Fan C., Lal Mohan R.S., Simões-Lopes, P.C., Bastida R., Meyer A., Stanhope M.J. & Milinkovitch M.C. 2000. Independent adaptation to riverine habitats allowed survival of ancient cetacean lineages. Proceedings of the National Academy of Sciences of the USA, 97 (21): 11343-11347.

CITES. 2008. Apéndices I, II y III. Convención sobre el comercio internacional de especies amenazadas de fauna y flora silvestres. www.cites.org

Da Silva V.M.F. 1983. Ecologia alimentar dos golginhos da Amazonia. M.Sc. thesis, University of Amazonas, Manaus, Brasil, 118 p.

Da Silva V.M.F. 1994. Aspects of the biology of the Amazonian dolphins Genus *Inia* and *Sotalia fluviatilis*. Ph.D. Dissertation, University of Cambridge, Cambridge. 327 p.

Furch K. 1997. Chemistry of várzea and igapó soils and nutrient inventory of their floodplain forest. P. 47-62. In: Junk W.J. (Ed.) The central Amazon floodplain: Ecology of a pulsing system. Ecological Studies, 126.

IUCN. 2010. IUCN Red List of Threatened Species. Version 2010.1 www.iucnredlist.org downloaded on 24 March 2010

Leaterwood S. & Reeves R. 1997. Conservación de los delfines de río, *Inia geoffrensis* y *Sotalia fluviatilis*, en la Amazonía peruana, p. 289-299.

Mass A. & Supin A. 1997. Distribution of ganglion cells in the retina of an Amazon river dolphin Inia geoffrensis. Aquatic Mammals, 15 (2): 49-56.

McGuire T. & Winemiller K. 1998. Occurrence patterns, habitat association, and potential prey of the river dolphin, *Inia geoffrensis*, in the Cianoruco River, Venezuela. Biotropica 30 (4): 625-638.

Navarro G. & Maldonado M. 2002. Geografía ecológica de Bolivia. Vegetación y ambientes acuáticos. Primera edición. Ed. Centro de Ecología Simón I. Patiño. Cochabamba-Bolivia. 719 p.

Poully, M. & Rodriguez, M.A. 2004. Determinism of fish assemblage structure in neotropical floodplain lakes : influence of international and landscape lake conditions. Proceedings of the Second International Simposyum on the Managament of Large Rivers for Fisheries (LARS 2) Volume II. RAP Publication/17. pp 243-265.

Rodriguez M. & Lewis W. 1997. Structure of fish assemblages along environmental gradients in floodplain lakes of the Orinoco River. Ecological Monographs, 67 (1): 109-128.

Ruíz-García M., Murillo A., Corrales C., Romero-Aleán R. & Álvarez-Prada D. 2007. Genética de poblaciones amazónicas: la historia evolutiva del jaguar, ocelote, delfín rosado, mono lanudo y piurí, reconstruida a partir de sus genes. Animal Biodiversity and Conservation, 30 (2): 115-130.

Ruíz-García M., Caballero S., Martínez-Agüero M. & Shostell J.M. 2008. Molecular differentiation among *Inia geoffrensis* and *Inia boliviensis* (Iniidae, Cetacea) by means of nuclear intron sequences. p. 1-29. In: Koven, V.T. (Ed.). Population Genetics Research Progress. Nova Science Publishers.

Salinas, A. 2007. Distribución y Estado Poblacional del delfín de río (*Inia boliviensis*) en el río San Martín y Blanco (cuenca del río Iténez). Tesis para optar el grado de Licenciatura. pp. 95. Cochabamba-Bolivia.

Tavera G., Van Damme P.A., Crespo A., Aliaga E. & Salinas A. 2010. Distribution and conservation status

of the Bolivian river dolphin *Inia boliviensis* (d' Orbigny 1832). p. 99-122. In: Trujillo F., Crespo E., Van Damme P.A. & Usma J.S. (Eds.). The action plan for southamerican river dolphins 2010-2020. WWF, Fundación OMACHA, WDS, WDCS, Solamac. Bogotá D.C. Colombia, 249 p.

Ten S., Liceaga I. & Gonzales M. 2001. Reserva Inmovilizada de Iténez: Primer listado de Vertebrados. Trinidad. Revista Boliviana Ecología y Conservación Ambiental, 10: 81-110.

Trujillo F. 2000. Habitat use and social behavior of the freshwater dolphin *Inia geoffrensis* (DE BLAINVILLE 1817) in the Amazone and Orinoco basins. A thesis submitted for the degree of Doctor of Philosophy at the University of Aberdeen, Scotland. p.168

Trujillo F & Diezgranados C. 2002. Delfines de río en la Amazonia y Orinoquia: Ecología y Conservación. Fundación Omacha. p. 43.

Zambrana V. 2007. Distribución y estado poblacional de la londra (*Pteronura brasiliensis*) en los ríos Blanco y San Martín (Cuenca del río Iténez). Tesis de Licenciatura. San Simón University, Cochabamba, Bolivia. 76 p.