

<http://dx.doi.org/10.5597/lajam00151>

REPORT OF THE WORKING GROUP ON DISTRIBUTION, HABITAT CHARACTERISTICS AND PREFERENCES, AND GROUP SIZE

VERA M. F. DA SILVA^{1*}, DANIELA FETTUCCIA¹, EDERSON DA S. RODRIGUES², HOLLY EDWARDS³,
IGNACIO B. MORENO⁴, JAILSON FULGENCIO DE MOURA⁵, LEONARDO L. WEDEKIN⁶, MARIEL BAZZALO⁷,
NEUSA RENATA EMIN-LIMA⁵, NÍVIA A. S. CARMO⁸, SALVATORE SICILIANO⁵ AND VICTOR UTRERAS B.⁹

Introduction

The genus *Sotalia* includes two species: *Sotalia guianensis* distributed along the coast of Brazil, northern South America, and throughout the Caribbean Sea up to Honduras in Central America (Flores and da Silva, 2009), and *Sotalia fluviatilis*, confined to the rivers of the Amazon River basin. Although widely distributed in the Amazon basin and familiar wherever it occurs, *S. fluviatilis* (known as *tucuxi* in the Brazilian Amazon) is poorly studied. Due to its speed and small size as well as the turbidity or opacity of most Amazonian rivers, studies of the *tucuxi* are rare and few attempts have been made to quantify its habitat preference and ecology (da Silva and Best, 1994; Martin *et al.*, 2004). On the other hand, due to its coastal distribution, occurrence in bays and estuaries, larger body size and behaviour, and a high level of fisheries interaction, *S. guianensis* is better known than its fluvial congener. However, the available information on the distribution, habitat characteristics and habitat use, as well as group size and group structure of these dolphins is not well known and most of studies are concentrated where the species is more abundant and of easy access.

Distribution

The known northernmost limit of the distribution of *S. guianensis* is in central Honduras (Central America) at La Mosquitia (14°00'N; 83°20'W) (Edwards and Schnell, 2001). The species also occurs in northern Nicaragua (Carr and Bonde, 2000); in the Gandoca-Manzanillo Wildlife Refuge in Costa Rica (Rodríguez-Fonseca and Cubero-Pardo, 2001;

Acevedo-Gutiérrez *et al.*, 2005; May-Collado and Gamboa-Poveda, 2006¹⁰) and along the Caribbean coast from Panama to Venezuela (Bossenecker, 1978). In Venezuela *S. guianensis* is found in the Gulf of Venezuela and Maracaibo Lake System, a mixed environment with both fresh and salt water (Boher *et al.*, 1995) (Figure 1). This dolphin is also found well inside the Orinoco River as far as Estado Bolívar and Apure near the mouth of Suapure River, 800km upstream from the mouth of the Orinoco River (Boher *et al.*, 1995; Bolaños-Jiménez, 1998¹¹), but the taxonomic status of these dolphins remains uncertain as to whether they are *S. guianensis* or *S. fluviatilis*. In the Caribbean Sea *S. guianensis* is found at the Gulf of Morrosquillo in Colombia (García and Trujillo, 2004; Dussán-Duque *et al.*, 2006¹²); Venezuela (Bolaños-Jiménez, 1998¹¹; Ramírez-Carroz, 2005); Guyana (William, 1928; Herald, 1967); Suriname (van Bénédén, 1864; Husson, 1978) and French Guiana (van Waerebeek, 1990). A single record is known from Trinidad and Tobago (van Bree, 1975).

In Brazil, *S. guianensis* occurs from the Oiapoque in northern Amapá State (4°12'N; 51°34'W) (Beltrán-Pedrerros, 1998; S. Siciliano, pers. comm; V.M.F. da Silva, unpublished data) to Baía Norte in Florianópolis, Santa Catarina State (27°35'S; 48°34'W) (Simões-Lopes, 1988). *S. guianensis* is commonly found inside the Baía de Marajó as far as Camará (00°47'17"S; 48°32'21"W; S. Siciliano and N.R. Emin-Lima, pers. comm.). *Sotalia* is common in the Amazon estuary, however the species has not yet been determined. In this particular area, the boundaries between fresh and saltwater influence, as well as the limits of the co-occurrence of the two species is unknown.

¹ Laboratório de Mamíferos Aquáticos, Instituto Nacional de Pesquisas da Amazônia, P.O. Box 478, 69011-790 Manaus, AM, Brazil

² Faculdade da Região dos Lagos, RJ, Brazil

³ Florida Fish and Wildlife Conservation Commission, FL, USA

⁴ Grupo de Estudo de Mamíferos Aquáticos do Rio Grande do Sul, RS, Brasil

⁵ Fundação Oswaldo Cruz, RJ, Brasil

⁶ Instituto Baleia Jubarte, BA, Brasil

⁷ Universidad de Buenos Aires, Argentina

⁸ Museu Paraense Emilio Goeldi, Belém, PA, Brasil

⁹ Wildlife Conservation Society-Ecuador Program, Ecuador

* Corresponding author, e-mail: tucuxi@inpa.gov.br

¹⁰ MAY-COLLADO, L. AND GAMBOA-POVEDA, M. (2006) *Insights on the biology of Sotalia guianensis at Mandoca-Manzanillo. Costa Rica: Residence, habitat use, acoustics and reactions to anthropogenic noise.* Page 36 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a026>

¹¹ BOLAÑOS-JIMÉNEZ, J. (1998) *Registro de avistamientos de delfines de agua dulce de Venezuela, Subproyecto Región Zulía, 1995-1998.* Informe Técnico MINAMB-ONDB-DGF-DF IT/411, MINAMB, Caracas.

¹² DUSSÁN-DUQUE, S., WELLS, R.S. AND BASSOS-HULL, K. (2006) *Distribución, uso de habitat y abundancia de Sotalia guianensis en el Golfo de Morrosquillo, Colombia.* Page 15 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a005>

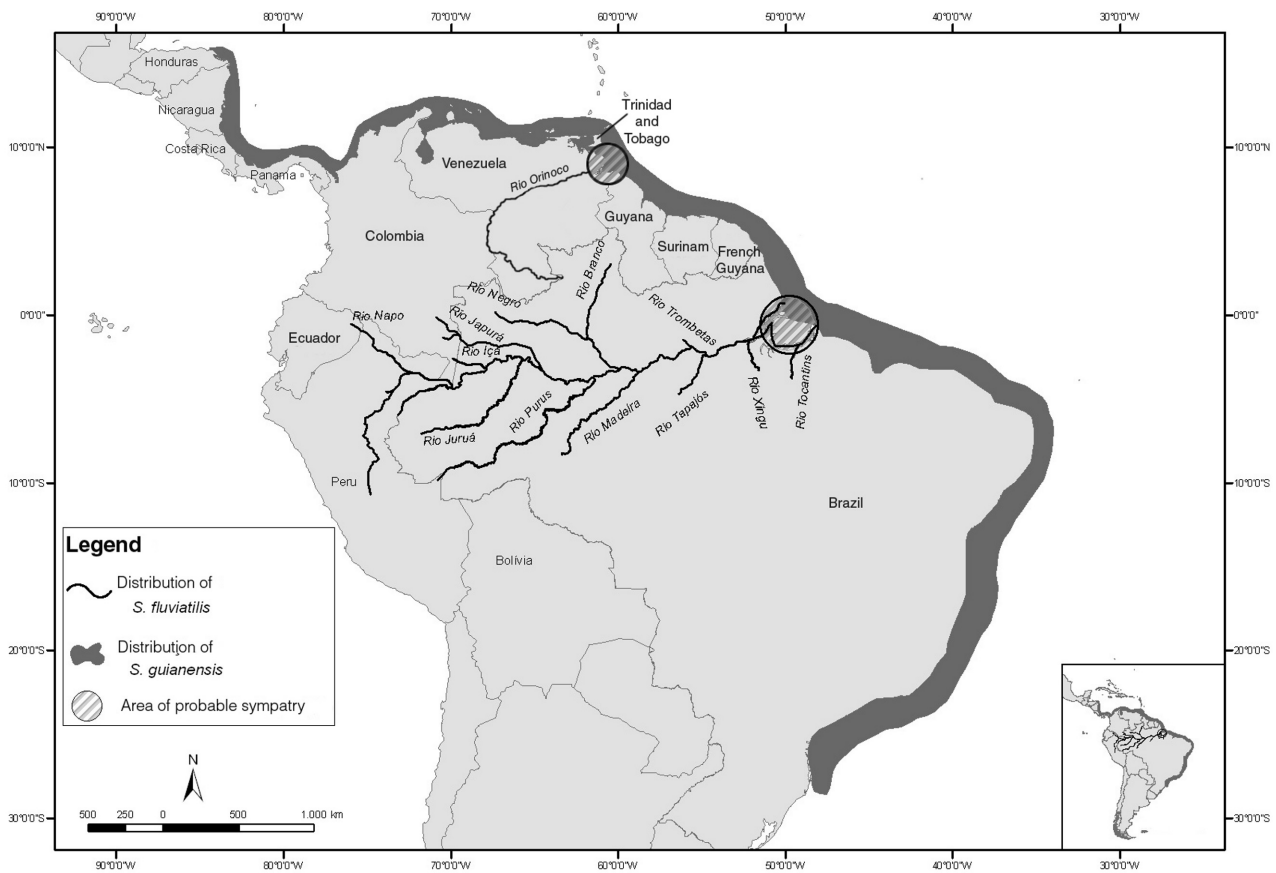


Figure 1. Map depicting the geographic distribution of *Sotalia guianensis* along the coast of South and Central America (dark gray shading) and *Sotalia fluviatilis* throughout the Amazon River Basin (black line). The area of potential overlap between the two species in the Amazon and Orinoco estuaries is also shown (crosshatching).

The distribution of *S. guianensis* is mostly continuous throughout its range (Figure 1). There is no evidence of large discontinuity, although in some areas it is rarely seen or absent. Furthermore, many parts of its range have never been surveyed.

S. fluviatilis has been recorded in the main rivers of the Amazon basin and their tributaries, lakes and channels (da Silva and Best, 1994; Vidal *et al.*, 1997; Leatherwood *et al.*, 2000; Zapata-Ríos and Utreras, 2004; Zapata-Ríos *et al.*, 2006¹³). It occurs in all the rivers of the north and south margin of the Amazon/Solimões River, including Japurá-Caquetá, Iça-Putumayo, Napo and Marañón basins (Figure 1).

The westernmost distribution of the species is in Ecuador, near the base of the Andean mountains, ca. 200m above sea level, in the Morona River (2°S45'32''S, 77°34'49''W; Zapata-Ríos and Utreras, 2004).

In Brazil, the freshwater species of *Sotalia* occurs in all of the Amazon tributaries, associated lakes and larger channels (paranãs) along the main channel of the Amazon River from its mouth to the border area with Peru and Colombia. It has also been recorded on the following rivers and its tributaries: Pará, Lower Tocantins, Lower Xingú, Lower Tapajós, Lower Madeira, Purús, Juruá, Javari, Içá, Tocantins, Japurá, Negro, Branco, Nhamundá, Lower Trombetas, Lower Uatumã, Maicuru, Paru, and Jari (da Silva, 1994; da Silva and Best, 1994).

In Colombia, records of *S. fluviatilis* exist for the following rivers: main course of the Amazon-Marañón, as well as the Putumayo, Caquetá, Tigre, Loreto Yacu, Atacuarí, and Amacayacu Rivers, including the lakes Tarapoto, El Correo, and Caballo Cocha situated at the border of Peru with Colombia (da Silva and Best, 1996;

¹³ ZAPATA-RÍOS, G., UTRERAS, V. AND SUÁREZ, E.R. (2006) Preliminary assessment of *tucuxi* (*Sotalia fluviatilis*) distribution along a disturbance gradient in Ecuadorian Amazonia. Page 16 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, Workshop on Research and Conservation of the genus *Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a006>

Trujillo, 1992; Trujillo, 1994; Trujillo and Beltrán, 1995; Vidal *et al.*, 1997; Dussán-Duque *et al.*, 2006¹²), as well as the Napo, Mazon, Nanay, Momon, Tamshiyacu and Tahuayo (Kasuya and Kajihara, 1974).

In Ecuador, the species was recorded in the Putumayo River and in the Napo River basin, in the following rivers: Gueppi, Cuyabeno, Aguarico, Pañayacu, Lagartococha, Tiputini, Yasuní and Lake Jatuncocha. It is also found in the Pastaza River and in the rivers of the Morona Basin as Mangosiza, Cushuimi, Cangaiame, Makuma, Wichimi and Morona (Zapata-Rios and Utreras, 2004).

In Peru the distribution includes the following rivers: Amazonas, Marañon, Yanayaquillo, Atun Caño, Yanayacu, Pucate, Pacaya, Samiria, Tanshiyaco, Tahuayo, Huaysi, Yapara, Nauta Caño, Tapiche and Ucayali; and for the lakes San Pablo de Tipishca, Atun Cocha and Tipishca del Samiria, as well as Napo, Tigre, Mazon, Nanay, and Momon rivers, among others (da Silva and Best, 1996; Leatherwood *et al.*, 2000; McGuire, 2006¹⁴).

Falls and rapids in several tributaries of the Amazon River basin represent barriers for this species (da Silva and Best, 1996; Herrando-Pérez *et al.*, 2006¹⁵). The main barriers within the Amazon are: (1) Madeira River, the Santo Antonio and Teotônio falls just above Porto Velho; (2) Tapajós River, approximately 200km from its mouth; (3) Xingú River, the Belo Monte rapids below Altamira; (4) on the Tocantins River, the Tucuruí Dam, has cut the river off from its estuary since 1988, although the rapids that were flooded by the reservoir had probably served as a barrier for *S. fluviatilis* before the dam's construction; (5) on the Rio Negro, there is a series of rapids beginning at Tapuruquara, about 900m upstream, while the first major barrier is located 1200km upstream; (6) the Trombetas River has rocky riverbeds and several falls, the first major one being Cachoeira Porteira, which is located about 260km from its mouth. A previous record of the species in Formoso River, a tributary of the Araguaia River (Tocantins State) (Borobia *et al.*, 1991; Record N° 254) it has actually been confirmed as a specimen originally captured in the Tapajós River (V.M.F. da Silva, INPA, unpublished data). Caballero *et al.* (2007) also present a report of genetic material extracted from bones attributed to an animal from the Formoso River. However, recent surveys performed at different times of the year along a 700km stretch between Aragarças (15°53'31.9"S;

52°14'41.3"W) and the south end of Bananal Island (12°50'27.7"S; 50°33'39.2"W) did not succeed in locating this species (Carneiro, 2002; Amaral, 2002; Araújo, 2010; C.C. Araújo and V.M.F. da Silva, unpublished data). A study of *Inia geoffrensis* in the Lago dos Tigres, about 50km from Aruanã (15°14'28"S, 51°09'38"W) also did not record the presence of *Sotalia* (Araújo, 2007). No *Sotalia* were sighted on surveys between the north end of Bananal Island, down 120km to Caviara River, during February, March, April and November 2001 or along a 530km stretch of the middle course of Araguaia River, in May and September 2010 (C.C. Araújo and V.M.F. da Silva, unpublished data). Additionally, several reports from expeditions to different parts of the Araguaia and Tocantins Rivers over the past decade did not result in a single encounter (V.M.F. da Silva, unpublished data; N.A.S Carmo, pers. comm.), strongly indicating that *Sotalia* does not occur in the Araguaia or the Tocantins Rivers basins above Tucuruí Dam.

S. fluviatilis does not occur in the rivers of Bolivia or above the falls of the Madeira River. It also does not occur above the stretch of rapids and falls on the upper Rio Negro in Brazil, thus creating a seemingly impassable barrier to the upper parts of the Orinoco River (Mead and Koehnken, 1991; da Silva and Best, 1994). Therefore, the status of *Sotalia* in the Orinoco Basin is still to be ascertained, whether they likely isolated from the Amazon populations and therefore with important implications for conservation or whether the mouth of Orinoco River may constitute an area of possible sympatry. In the Caquetá River *S. fluviatilis* is limited by the rapids of Córdoba (1°8'10"S, 69°39'52"W).

Habitat Characteristics

S. guianensis is found in coastal habitats such as bays, estuaries and open coasts (Borobia *et al.*, 1991). Apparently the species is limited to depths of 50m (Fernandes, 2005). However, most sightings were recorded in water less than 25m deep (Bossenecker, 1978; Cremer, 2000; Di Benedetto *et al.*, 2001; Edwards and Schnell, 2001; Flores, 2003; Lodi, 2003a; Azevedo *et al.*, 2007; Santos and Rosso, 2007). *S. guianensis* is found as far as 36km offshore in Abrolhos Bank, an extension of the continental shelf with warm and shallow waters (Borobia *et al.*, 1991; Rossi-Santos *et al.*, 2006). Most sightings, however, are coastal (Borobia *et al.*, 1991;

¹⁴McGUIRE, T.L. (2006) *Ecology and conservation status of Riverine Tucuxi (Sotalia fluviatilis) in the Pacaya-Samiria Reserve, Peru*. Page 17 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a007>

¹⁵HERRANDO-PÉREZ, S., GÓMEZ, C., TRUJILLO, F., DIAZGRANADOS, M.C. AND PORTOCARRERO, M. (2006) *Distribución y uso de habitat del delfin de rio Sotalia fluviatilis en la Amazonia colombiana: un análisis de 15 años*. Page 13 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a003>

Carr and Bonde, 2000; Edwards and Schnell, 2001; Di Benedetto *et al.*, 2001; Santos, 2004; Fernandes, 2005; Rossi-Santos *et al.*, 2006¹⁶; Bazzalo *et al.*, 2008).

The occurrence of the species is strongly associated with the presence of mangroves and estuarine regions (Borobia *et al.*, 1991; Zanelatto, 2001; Santos, 2010). The different types of coastal habitats where *S. guianensis* is found include mangrove, dunes, sandy beaches, rocky shores, or a combination of these features, and areas with irregular sea floor relief, and steep and flat bottoms (Cremer, 2000; Bonin, 2001; Lodi, 2003a; Wedekin, 2007; Rossi-Santos *et al.*, 2006¹⁶).

The marine coastal and estuarine waters that *S. guianensis* normally inhabits are turbid (*e.g.* Flores, 2003). Water temperatures vary from 13° to 32°C (Edwards and Schnell, 2001; Flores, 2003) respectively at the southern and northern ends of their range. The coastal habitat where the species occurs is subject to intense human activities such as fishing, boat traffic, oil exploration and urban development. *S. guianensis* can be found from salty coastal waters to inner estuarine and freshwater (Cremer, 2000; Bonin, 2001; Lodi, 2003a; Wedekin, 2007; Santos and Rosso, 2007).

S. fluviatilis occurs in all types of freshwater types: white, black and clear water. The water temperatures in the Amazon vary little throughout the year. In Ecuador, during seasonal river water fluctuations, the water temperature ranges from 24° to 32°C (Utreras, 1996). The same variation was recorded in the Purus River, Brazil (Silva *et al.*, 2008). The temperature of white waters along the year is 29±1°C, while in black waters the average is of the order of 30° to 31°C (Sioli, 1985). This species occurs well inside the Amazon tributaries and associated lakes, in large streams, around islands, and in small channels (Vidal *et al.*, 1997; Martin *et al.*, 2004). Habitats in which *S. fluviatilis* is found include margins of the rivers with river banks, muddy and sand beaches, flooded forest or *igapó*, floating vegetation, bays, inlets, confluences and meeting of waters (Martin *et al.*, 2004; McGuire, 2006¹⁴; Faustino and da Silva, 2006). The extension of the occurrence of *S. fluviatilis* in the Amazon River estuary is not well known.

Habitat Preference

Habitat preference of *S. guianensis* has been determined analysing parameters that included primarily temperature, water depth, salinity, distance from the coast, sea floor relief, and sea floor substrate. The species commonly aggregates in the mouths of estuaries and bays (Edwards and Schnell, 2001; Filla, 2004; Dussán-Duque *et al.*, 2006¹²; Silva and Firmino, 2006¹⁷; Flach *et al.*, 2008; Rossi-Santos *et al.*, 2006¹⁶). The results indicate that *S. guianensis* prefers areas less than 5km from the shore (Cremer, 2000; Bonin, 2001; Edwards and Schell, 2001; Lodi, 2003a; Fernandes, 2005; Rossi-Santos *et al.*, 2006; Souza *et al.*, 2006¹⁸; Wedekin, 2007; Bazzalo *et al.*, 2008) and water depths from 2 to 10m, steeply sloping areas, areas with high sea floor relief (Cremer, 2000; Bonin, 2001; Wedekin, 2007), and areas with muddy bottoms (Lodi, 2003a; Santos, 2010). In the case of *S. fluviatilis*, strong seasonal variation of water levels in the Amazon River basin provides a broad diversity of habitats. This diversity provides *S. fluviatilis* with a choice among different habitat types based on abundance of prey and physical features of the area (da Silva and Best, 1994; Junk and da Silva, 1997; Martin and da Silva, 2004). Tucuxi are associated with areas of deeper water and open channels. In the Pacaya-Samiria Reserve in Peru, they were not found in rivers less than 3m deep or, 1.8m in lakes (Leatherwood *et al.*, 2000; McGuire, 2006¹⁴). In the floodplains of the central Amazon, *S. fluviatilis* does not occur in areas with dense floating vegetation. This species shows preference to areas with diminished current and where two channels join, but do not favor the most common type of habitat: mud banks and flooded forest margins. The most preferred habitat type was the least common: the confluence of waters (Magnusson *et al.*, 1980; da Silva, 1994; Martin *et al.*, 2004; Faustino and da Silva, 2006). In the Colombian Amazon, during the low-water season, *S. fluviatilis* prefers the main river channels around islands and confluences; during high-water season, the animals also occupy lakes and smaller tributaries, but do not enter the flooded forest (Herrando-Pérez *et al.*, 2006¹⁵). Most research has found that *S. fluviatilis* aggregates in areas of confluences and meeting of waters (Magnusson *et al.*, 1980; Martin *et al.*, 2004; Zapata-Rios and Utreras, 2004; Herrando-Pérez *et al.*, 2006¹⁵).

¹⁶ ROSSI-SANTOS, M., WEDEKIN, L. AND MONTERO-FILHO, E.L.A. (2006) *Influência de padrões do uso de habitat e variáveis ambientais na ecologia de Sotalia guianensis no Estuário do Rio Caravelas, estado da Bahia, Brasil*. Page 49 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a039>

¹⁷ SILVA, F.J.L. AND FIRMINO, A.S.L. (2006) *Habitat use, annual and daily circarhythm activity of the boto Sotalia guianensis in Rio Grande do Norte, Northeast Brasil*. Page 57 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a047>

¹⁸ SOUZA, S.P., WINK, M. AND SILES, S. (2006) *Ocorrência de Sotalia fluviatilis (Gervais, 1853) no litoral norte do Estado de São Paulo, Brasil*. Page 53 in Siciliano, S., Borobia, M., Barros, N.B., Marques, F., Trujillo, F. and Flores, P.A.C. (Eds), Book of Abstracts, *Workshop on Research and Conservation of the genus Sotalia*, 19-23 June 2006, Armação dos Búzios, Rio de Janeiro, Brazil. *Latin American Journal of Aquatic Mammals* 8(1-2) (supplement). <http://dx.doi.org/10.5597/lajam00147.a043>

Group Size

S. guianensis. Group size is generally small, ranging from 1 to 15 individuals (Araújo *et al.*, 2001; Edwards and Schnell, 2001; Azevedo *et al.*, 2005; Daura Jorge *et al.*, 2005; Rossi-Santos *et al.*, 2006¹⁶; Pansard *et al.*, 2006¹⁹; Santos and Rosso, 2007). However, larger aggregations up to 450 dolphins have recorded inside bays in Rio de Janeiro State: Ilha Grande (23°05' and 23°14'S; 44°05'W and 44°23'W) with 450 individuals (Lodi and Hetzel, 1998); in Baía de Paraty (23°18'S; 44°30'W) ca.100 individuals (Lodi, 2003b), and in Baía de Sepetiba (22°35'S; 44°03'W) with 200 individuals (Simão *et al.*, 2000). In Bahia State, a group of 140 individuals was observed in Baía de Todos os Santos (Reis *et al.*, 2006²⁰); in Santa Catarina State, at Baía Norte (27°23'S-27°35'S, 48°33'W-48°30'W), groups larger than 50 individuals were frequently recorded (Flores, 1999; Daura-Jorge *et al.*, 2005). In the Paranaguá estuarine complex group sizes varied from 2 to 90 individuals (Santos *et al.*, 2010), while in a nearby estuary groups were recorded with 2 to 60 individuals (Santos and Rosso, 2007). In Baía de Marapanim (0°41'S, 47°36'W), Pará State, groups of 1 to 60 individuals were sighted (Emin-Lima *et al.*, 2006²¹). There is no information on the habitat preferences, group size and other population parameter for *S. guianensis* on the coastal areas of north of South America and Caribbean.

The group size of *S. fluviatilis* varies throughout its distribution, ranging from 1 to 6 individuals (Vidal *et al.*, 1997; Martin and da Silva, 2004; Faustino and da Silva, 2006). In Colombia, larger aggregations, ca. 60 tucuxis, were recorded in confluences of rivers and around islands (Vidal *et al.*, 1997; Herrando-Pérez *et al.*, 2006¹⁵). In the central Amazon, group size ranges from 1 to 6 individuals, with a mean of 2.24 (n = 504, da Silva and Best, 1996; Martin *et al.*, 2004). In confluences and meeting of waters larger aggregations up to 20 individuals are common (V.M.F. da Silva, unpublished data). In Ecuador the average group size is 3 (n = 28) with a range of 1 to 10 (Zapata-Rios and Utreras, 2004; V. Utreras, unpublished data). In the Pacaya-Samiria Reserve in Peru, group size was most often singles individuals or pairs, although groups as large as 13 were observed (Leatherwood *et al.*, 2000; McGuire, 2006¹⁴).

Future research recommendations

As a result of the Workshop, several general research recommendations are put forward herewith:

Sotalia guianensis

1) Confirm the northern limit of the occurrence of *S. guianensis*. Conduct research to obtain more information on the distribution and occurrence of the species in the northern part of its range in other countries of Central America and Mexico. It is possible that the range of *S.*

guianensis may extend to the Gulf of Mexico, including the Yucatan Peninsula. It also may occur in Belize although yet there are no records.

2) Collect biological data from carcasses, compile photos, and direct observations inside Baía de Guajará and Baía de Marajó, located at the Amazon estuary to help determine which *Sotalia* species occur in the area and their potential respective boundaries.

3) Identify the limits of the distribution of *Sotalia* upstream in rivers of the Orinoco Basin and determine which *Sotalia* species occur in the area and their potential respective boundaries.

4) Expand the scale of research conducted to date to include larger areas with different coastal habitats.

5) Identify populations or stocks along *S. guianensis* distribution range using different techniques and methodologies.

Sotalia fluviatilis.

1) Identify the occurrence boundaries of *S. fluviatilis* along the Amazon estuary.

2) Standardize surveys methods to monitor population trends in a variety of areas within different river basins and countries.

3) Assess daily, seasonal and long-term movements.

4) Further assess home range and habitat preferences.

5) Monitor population dynamics and trends.

6) Identify populations and assess the level of genetic differences between populations from different river basins.

Acknowledgements

The authors would like to thank the organisers and all participants of the workshop for their hard work and significant discussions and contributions on the status and research on *Sotalia*. Thanks to Carlos Olavarría, Monica Borobia and an anonymous researcher for reviewing this report.

References

- ACEVEDO-GUTIÉRREZ, A., DI BERARDINIS, A., LARKIN, S. AND FORESTELL, K.L.A.P. (2005). Social interactions between tucuxis and bottlenose dolphins in Gandoca-Manzanillo, Costa Rica. *Latin American Journal of Aquatic Mammals* 4(1): 49-54. <http://dx.doi.org/10.5597/lajam00069>
- AMARAL, E.S.R. (2002) *Identificação da espécie de boto Inia geoffrensis como parte da fauna aquática do rio Araguaia*. B.Sc. Thesis. Universidade Católica de Goiás. Goiânia, Brazil, 25 pp.
- ARAÚJO, C.C. (2007) *Influência do tráfego de embarcações sobre o comportamento do boto Inia geoffrensis no Lago dos Tigres, Britânia, Goiás*. B.Sc.Thesis. Universidade Federal de Goiás Goiânia, Brazil. 43 pp.
- ARAÚJO, C.C. (2010). *Distribuição e estimativas populacionais do boto Inia geoffrensis (De Blainville, 1817) (Iniidae) no médio rio Araguaia (Brasil Central)*. M.Sc. Thesis. INPA/ BADPI. Manaus, AM, Brazil, 69 pp.

- ARAÚJO, J.P., PASSAVANTE, J.Z.O., AND SOUTO, A.S. (2001) Behavior of the estuarine dolphin, *Sotalia guianensis*, at Dolphin Bay-Pipa-Rio Grande do Norte, Brazil. *Tropical Oceanography* 29(2): 13-23.
- AZEVEDO, A.F., VIANA, S.C., OLIVEIRA, A.M. AND VAN SLUYS, M. (2005) Group characteristics of marine tucuxis (*Sotalia fluviatilis*) (Cetacea: Delphinidae) in Guanabara Bay, south-eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom* 85(1): 209-212. <http://dx.doi.org/10.1017/S0025315405011082h>
- AZEVEDO, A.F., OLIVEIRA, A.M., VIANA, S.C. AND VAN SLUYS, M. (2007) Habitat use by marine tucuxis (*Sotalia guianensis*) (Cetacea: Delphinidae) in Guanabara Bay, south-eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom* 87(1): 201-205. <http://dx.doi.org/10.1017/S0025315407054422>
- BAZZALO, M., FLORES, P.A.C. AND PEREIRA, M.G. (2008) Uso de hábitat y principales comportamientos del delfín gris (*Sotalia guianensis*, van Bénédén, 1864) en la Bahía Norte, Estado de Santa Catarina, Brasil. *Mastozoología Neotropical* 15(1): 9-22.
- BELTRÁN-PEDREROS, S. (1998) *Captura accidental de Sotalia fluviatilis* (Gervais, 1853) na pescaria artesanal do Estuário Amazônico. M.Sc. Thesis. Instituto Nacional de Pesquisas da Amazônia, Manaus. AM. Brazil, 100 pp.
- BOHER, S., BOLAÑOS, J. AND COVA, L.J. (1995) Sobre un avistamiento del delfín estuarino o bufete (*Sotalia fluviatilis*) en el Orinoco Medio. *Acta Científica Venezolana* 46: 217-218.
- BONIN, C.A. (2001) Utilização de habitat pelo boto-cinza *Sotalia fluviatilis guianensis* (Cetacea: Delphinidae), na porção norte do Complexo Estuarino da Baía de Paranaguá, PR. M.Sc. Thesis. Universidade Federal do Paraná. Curitiba, PR, Brasil. 106 pp.
- BOROBIA, M., SICILIANO, S., LODI, L. AND HOEK, W. (1991) Distribution of the South American dolphin *Sotalia fluviatilis*. *Canadian Journal of Zoology* 69(4): 1025-1039. <http://dx.doi.org/10.1139/z91-148>
- BOSENNECKER, P. G. (1978) The capture and care of *Sotalia guianensis*. *Aquatic Mammals* 6(1): 13-17.
- CABALLERO, S., TRUJILLO, F., VIANNA, J.A., BARRIOS-GAR RIDO, H., MONTIEL, M.G., BELTRÁN-PEDREROS, S., MARMONTEL, M., SANTOS, M. C. DE O., ROSSI-SANTOS, M., SANTOS, F.R. AND BAKER, C.S. (2007). Taxonomic status of the genus *Sotalia*: species level ranking for 'tucuxi' (*Sotalia fluviatilis*) and 'costero' dolphins (*Sotalia guianensis*). *Marine Mammal Science* 23(2): 358-386. <http://dx.doi.org/10.1111/j.1748-7692.2007.00110.x>
- CARNEIRO, L.X. (2002) *Estimativa de abundância do boto Inia geoffrensis no médio Araguaia*. B.Sc. Thesis. Universidade Católica de Goiás. Goiânia, Brazil. 25 pp.
- CARR, T. AND BONDE, R.K. (2000) Tucuxi (*Sotalia fluviatilis*) occurs in Nicaragua, 800km north of its previously known range. *Marine Mammal Science* 16(2): 447-452. <http://dx.doi.org/10.1111/j.1748-7692.2000.tb00936.x>
- CREMER, M. (2000) *Ecologia e conservação do golfinho Sotalia fluviatilis guianensis* (Cetacea: Delphinidae) na Baía de Babitonga, litoral norte de Santa Catarina. M.Sc. Thesis. Universidade Federal de São Carlos. São Carlos, Brazil. 226 pp.
- DA SILVA, V.M.F. (1994) *Aspects of the Biology of the Amazonian Dolphins of Genus Inia and Sotalia fluviatilis*. Ph.D. Thesis. University of Cambridge, England. 327 pp.
- DA SILVA, V.M.F. AND BEST, R.C. (1994) Tucuxi, *Sotalia fluviatilis* (Gervais), 1853. Pages 43-69 in RIDGWAY, S.H. AND HARRISON, R.J. (Eds) *Handbook of Marine Mammals*. Academic Press, London, UK.
- DA SILVA, V.M.F. AND BEST, R.C. (1996) *Sotalia fluviatilis* Gervais, 1866. *Mammalian Species* (527): 1-7. <http://dx.doi.org/10.2307/3504117>
- DAURA-JORGE, F.G., WEDEKIN, L.L., PIACENTINI, V.Q. AND SIMÕES-LOPES, P.C. (2005) Seasonal and daily patterns of group size, cohesion and activity of the estuarine dolphin, *Sotalia guianensis* (P.J. van Bénédén) (Cetacea, Delphinidae), in southern Brazil. *Revista Brasileira de Zoologia* 22(4): 1014-1021.
- DI BENEDITTO, A.P.M., RAMOS, R.M.A. AND LIMA, N.R.W. (2001) Sightings of *Pontoporia blainvillei* (Gervais e D'Orbigny, 1844) and *Sotalia fluviatilis* (Gervais, 1853) (Cetacea) in South-eastern Brazil. *Brazilian Archives of Biology and Technology* 44(3): 291-296. <http://dx.doi.org/10.1590/S1516-89132001000300011>
- EDWARDS, H. AND SCHNELL, G. (2001) Status and ecology of *Sotalia fluviatilis* in the Cayos Misquitos Reserve, Nicaragua. *Marine Mammal Science* 17(3): 445-472. <http://dx.doi.org/10.1111/j.1748-7692.2001.tb00998.x>
- FAUSTINO, C. AND DA SILVA, V.M.F. (2006) Seasonal use of Amazon floodplains by the tucuxi *Sotalia fluviatilis* (Gervais 1853), in the Central Amazon, Brazil. *Latin American Journal of Aquatic Mammals* 5(2): 95-104. <http://dx.doi.org/10.5597/lajam00100>
- FERNANDES, T. (2005) *Distribuição potencial de cetáceos no norte do Estado do Rio de Janeiro, através de informações advindas de pescadores*. M.Sc. Thesis. Universidade Estadual do Norte Fluminense. Brazil. 59 pp.
- FILLA, G. F. (2004) *Estimativa da densidade populacional e estrutura de agrupamento do boto-cinza Sotalia guianensis* (Cetacea: Delphinidae) na Baía de Guaratuba e na porção norte do complexo estuarino da Baía de Paranaguá, PR. M.Sc. Thesis. Universidade Federal do Paraná. Curitiba, Brazil. 67 pp.
- FLACH, L., FLACH, P.A. AND CHIARELLO, A.G. (2008) Aspects of behavioral ecology of *Sotalia guianensis* in Sepetiba Bay, southeast Brazil. *Marine Mammal Science* 24(3): 503-515. <http://dx.doi.org/10.1111/j.1748-7692.2008.00198.x>
- FLORES, P.A.C. (1999) Preliminary results of a photo identification study of the marine tucuxi, *Sotalia fluviatilis*, in Southern Brazil. *Marine Mammal Science* 15(3): 840-847. <http://dx.doi.org/10.1111/j.1748-7692.1999.tb00846.x>
- FLORES, P.A.C. (2003). *Ecology of the marine tucuxi dolphin (Sotalia fluviatilis) in southern Brazil*. Ph.D. Thesis. Pontificia Universidade Católica do Rio Grande do Sul. Porto Alegre, Brazil. 140 pp.
- FLORES, P.A.C. AND DA SILVA V.M.F. (2009) Tucuxi and Guiana Dolphin - *Sotalia fluviatilis* and *S. guianensis*. Pages 1188-1191 in PERRIN, W.F., WÜRSIG, B. AND THEWISSEN, J.G.M. (Eds) *Encyclopedia of Marine Mammals*. 2nd ed. Academic Press, Amsterdam, Netherlands.
- GARCÍA, C. AND TRUJILLO, F. (2004) Preliminary observations on habitat use patterns of the marine tucuxis, *Sotalia fluviatilis*, in Cispatá Bay, Colombian Caribbean coast. *Latin American Journal of Aquatic Mammals* 3(1): 53-60. <http://dx.doi.org/10.5597/lajam00048>
- HERALD, E.S. (1967) Bouto and tookuchee-Amazon dolphins. *Pacific Discovery* 20: 2-9.
- HUSSON, A.M. (1978) *The Mammals of Surinam*. E.J. Brill, Leiden, The Netherlands. 569 pp.

- JUNK, W.J. AND DA SILVA, V.M.F. (1997). Mammals, reptiles and amphibians. *Ecological Studies* 126: 409-417.
- KASUYA, T. AND KAJIHARA, T. (1974). Dolphins in Amazon and Orinoco rivers. *Report of Scientific Expedition on the La Plata and Amazon Dolphins*: 7-11.
- LEATHERWOOD, J.S., REEVES, R.R., WURSIG, B. AND SHEARN, D. (2000) Habitat preferences of river dolphins in the Peruvian Amazon. Pages 131-144 in Reeves, R.R., Smith, B.D. and Kasuya, T. (Eds) *Biology and conservation of freshwater cetaceans in Asia*. Occasional Paper of the IUCN Species Survival Commission No. 23. IUCN, Gland, Switzerland and Cambridge, UK. 152 pp.
- LODI, L. (2003a). Seleção e uso de hábitat pelo boto-cinza, *Sotalia guianensis* (van Bénèden, 1864) (Cetacea, Delphinidae), na Baía de Parati, Estado do Rio de Janeiro. *Bioikos* 17(1-2): 5-20.
- LODI, L. (2003b) Tamanho e composição de grupo dos botos-cinza, *Sotalia guianensis* (van Bénèden, 1864) (Cetacea, Delphinidae), na baía de Parati, Rio de Janeiro, Brasil. *Atlântica* 25(2): 135-146.
- LODI, L. AND HETZEL, B. (1998) Grandes agregações do boto-cinza (*Sotalia fluviatilis*) na Baía da Ilha Grande, Rio de Janeiro. *Bioikos* 12(2): 26-30.
- MAGNUSSON, W.E., BEST, R.C. AND DA SILVA, V.M.F. (1980) Numbers and behaviour of Amazonian dolphins, *Inia geoffrensis* and *Sotalia fluviatilis fluviatilis*, in the Rio Solimões, Brasil. *Aquatic Mammals* 8(1): 27-32.
- MARTIN, A.R. AND DA SILVA, V.M.F. (2004) River dolphins and flooded forest: seasonal habitat use and sexual segregation of botos (*Inia geoffrensis*) in an extreme cetacean environment. *Journal of Zoology* 263(3): 295-305. <http://dx.doi.org/10.1017/S095283690400528X>
- MARTIN, A.R., DA SILVA, V.M.F. AND SALMON, D.L. (2004) Riverine habitat preferences of botos (*Inia geoffrensis*) and tucuxis (*Sotalia fluviatilis*) in the Central Amazon. *Marine Mammal Science* 20(2): 189-200. <http://dx.doi.org/10.1111/j.1748-7692.2004.tb01150.x>
- MEAD, R.H. AND KOEHNKEN, L. (1991) Distribution of the river dolphin, tonina *Inia geoffrensis* in the Orinoco River basin of Venezuela and Colombia. *Interciencia* 16(6): 300-358.
- RAMIREZ-CARROZ, S. (2005) *Bases ecológicas para la conservación del delfín estuarino Sotalia fluviatilis en el Golfo de Venezuela*. M.Sc. Thesis. Universidad Nacional Experimental de los Llanos Occidentales 'Ezequiel Zamora'. Guanare, Venezuela. 118 pp.
- RODRÍGUEZ-FONSECA, J. AND CUBERO-PARDO, P. (2001) Marine mammal strandings in Costa Rica 1966-1999. *Revista de Biología Tropical* 49(2): 135-143.
- SANTOS, M.C.O. (2004) *Uso de área e organização social do boto-tucuxi marinho, Sotalia fluviatilis (Cetacea, Delphinidae), no estuário de Cananéia, SP*. Ph.D. Thesis. Universidade de São Paulo. São Paulo, Brasil. 265 pp.
- SANTOS, M.C.O. AND ROSSO, S. (2007) Ecological aspects of marine tucuxi dolphins (*Sotalia guianensis*) based on group size and composition in the Cananéia estuary, Southeastern Brazil. *Latin American Journal of Aquatic Mammals* 6(1): 71-82. <http://dx.doi.org/10.5597/lajam00110>
- SANTOS, M.C.O. (2010) Guiana dolphins (*Sotalia guianensis*) displaying beach hunting behavior in the Cananéia Estuary, Brazil: social context and conservation issues. *Brazilian Journal of Oceanography* 58(2): 143-152. <http://dx.doi.org/10.1590/S1679-87592010000200005>
- SANTOS, M.C.O., OSHIMA, J.E.F.; PACÍFICO, E.S. AND DA SILVA, E. (2010) Group size and composition of Guiana dolphins (*Sotalia guianensis*) (Van Bénèden, 1864) in the Paranaguá Estuarine Complex, Brazil. *Brazilian Journal of Biology* 70(1): 111-120. <http://dx.doi.org/10.1590/S1519-69842010000100015>
- SILVA, A.E.P., ANGELIS, C.F., MACHADO, L.A.T. AND WAICHAMAN, A.V. (2008) Influência da precipitação na qualidade da água do Rio Purus. *Acta Amazonica* 38(4): 733-742. <http://dx.doi.org/10.1590/S0044-59672008000400017>
- SIMÃO, S.M., PIZZORNO, J.L.A., PERRY, V. N. AND SICILIANO, S. (2000) Aplicação da técnica de fotoidentificação do boto-cinza *Sotalia fluviatilis*, (Cetacea, Delphinidae) da Baía de Sepetiba. *Floresta e Ambiente Seropédica* 7(1): 31-39.
- SIMÕES-LOPES, P.C. (1988) Ocorrência de uma população de *Sotalia fluviatilis* (Gervais, 1853) (Cetacea, Delphinidae) no limite sul de sua distribuição, Santa Catarina, Brasil. *Biotemas* 1(1): 57-62.
- SIOLL, H. (1985) *Amazônia Fundamentos da Ecologia da maior região de Florestas Tropicais*. Ed Vozes Ltda. Petrópolis, Rio de Janeiro.
- TRUJILLO, F. (1992) *Estimación poblacional de las especies dulceacuicolas de delfines Inia geoffrensis (de Blainville, 1817) y Sotalia fluviatilis (Gervais and Deville, 1853) en el sistema lacustre de Tarapoto y El Correo, Amazonia colombiana*. M.Sc. Thesis. Fundación Universidad de Bogotá Jorge Tadeo Lozano. Santafé de Bogotá, Colombia. 240 pp.
- TRUJILLO, T. (1994) The use of photoidentification to study the Amazon River dolphin, *Inia geoffrensis*, in the Colombian Amazon. *Marine Mammal Science* 10(3): 348-353.
- TRUJILLO, F. AND BELTRÁN, S. (1995) *Patrones de uso del habitat, comportamiento y mortalidad dirigida e incidental de Inia geoffrensis y Sotalia fluviatilis en el Amazonas colombiano*. C.I.C. Fundación Universidad de Bogotá Jorge Tadeo Lozano. Santafé de Bogotá, Colombia. 117 pp.
- UTRERAS, V. (1996) *Estimación de la Abundancia, Aspectos Ecológicos y Etológicos del Delfín Amazónico Inia geoffrensis geoffrensis (Cetacea:Delphinidae) en el Río Lagartococha, Amazonía Ecuatoriana*. B.Sc. Thesis. Pontificia Universidad Católica del Ecuador. Quito, Ecuador.
- VAN BÉNÉDÉN, E. (1864) Sur un dauphin nouveau et un ziphiode rare. *Memoires de l'Académie Royale de Belgique* 41: 2-44.
- VAN BREE, P. J. (1975) Preliminary list of the cetaceans of the southern Caribbean. *Studies on the Fauna of Curacao and other Caribbean Islands* 48: 79-87.
- VAN WAEREBEEK, (1990) Preliminary notes on the existence of a dolphin by-catch off French Guiana. *Aquatic Mammals* 16(2): 71-72.
- VIDAL, O., BARLOW, J., HURTADO, L.A., TORRE, J., CENDON, P. AND OJEDA, Z. (1997) Distribution and abundance of the Amazon River dolphin (*Inia geoffrensis*) and the tucuxi (*Sotalia fluviatilis*) in the upper Amazon River. *Marine Mammal Science* 13(3): 427-445. <http://dx.doi.org/10.1111/j.1748-7692.1997.tb00650.x>
- WEDEKIN, L.L. (2007) *Preferência de habitat pelo boto-cinza, Sotalia guianensis (Cetacea, Delphinidae) em diferentes escalas espaciais na costa sul do Brasil*. M.Sc. Thesis. Universidade Federal do Paraná. Curitiba, Brasil. 80 pp.

WILLIAM, S.H. (1928) A river dolphin from Kartabo, Bartica District, Brithish Guiana. *Zoologica* 7: 105-128.

ZANELATTO, R.C. (2001) *Diet do boto-cinza Sotalia fluviatilis (Cetacea, Delphinidae) no Complexo estuarino da baía de Paranaguá e sua relação com a ictiofauna estuarina*. M.Sc. Thesis.

Universidade Federal do Paraná, Curitiba, Brasil.

ZAPATA-RIOS, G. AND UTRERAS, V. (2004) Notes on the distribution of tucuxi, *Sotalia fluviatilis* (Cetacea: Delphinidae), in Ecuadorian Amazonia. *Latin American Journal of Aquatic Mammals* 3(1): 85-87. <http://dx.doi.org/10.5597/lajam00054>

*Received 8 November 2010. Accepted 21 January 2011.
Managed by Marcos Santos.*