

**BEHAVIORAL PATTERNS AND USE OF AREA BY THE BOTO, *SOTALIA*
GUIANENSIS, IN PIPA BEACH, TIBAU DO SUL CITY, RIO GRANDE DO NORTE,
 BRAZIL.**

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Abstract

This paper aims to describe and characterize the behavior of the Boto *Sotalia guianensis* in Rio Grande do Norte's South littoral, Brazil. The data was collected between 1999 and 2003 in the bays of Curral and Madeiro, both located in Pipa Beach, Tibau do Sul city. Twenty-three distinct behavior patterns were registered, divided in 4 categories, all verified in the two bays: aerial activity, displacement, socialization and foraging. The size of the groups varied from 2 to 19 with an average of 4.2 individuals per group, composed, in their most, by adults and immature ones, with cubs observed throughout the year. In both bays the most common activity was the foraging, followed by the aerial activity. In relation to the differences about the use of the area, the foraging was registered more frequently in Curral bay. It was possible to catalogue 34 individuals through photo identification, as well as investigate the fidelity level and residence pattern description of these animals to the area of study. The behavioral information collected throughout this period suggests that the *Sotalia guianensis* presents a flexible behavioral repertoire, with expressive aerial activity and that both bays are very important to the species preservation, since foraging was the behavioral pattern most registered in the areas and that immature ones are frequently seen in the locals of study.

Resumo

O presente trabalho teve como objetivo descrever e caracterizar o comportamento do boto *Sotalia guianensis* no litoral sul do Estado do Rio Grande do Norte, Brasil. Os dados foram obtidos entre 1999 e 2003 nas enseadas do Curral e Madeiro, localizadas na Praia de Pipa, município de Tibau do Sul. Foram registrados 23 padrões comportamentais distintos, divididos em 4 categorias, todos verificados nas duas enseadas: atividade aérea, deslocamento, socialização e forrageio. O tamanho dos grupos variou entre 2 e 19, com média de 4.2 indivíduos, formados em sua maioria por adultos e imaturos, com filhotes observados ao longo do ano. Em ambas as enseadas a atividade mais comum foi o forrageio, seguida da atividade aérea. Com relação às diferenças no uso de área, o forrageio foi registrado em maior frequência na enseada do Curral. Foi possível também realizar a catalogação de 34 indivíduos através da foto-identificação, bem como a investigação do

grau de fidelidade e descrição dos padrões de residência destes animais à área de estudo. As informações comportamentais obtidas ao longo desse período sugerem que o *Sotalia guianensis* apresenta um repertório comportamental flexível, com atividade aérea expressiva e que as duas enseadas são de grande importância para a conservação da espécie, tendo em vista que o forrageio foi o padrão comportamental mais registrado nas áreas e que imaturos são vistos com frequência nos locais de estudo.

Introduction

The number of studies involving cetaceans has increased in the past few years emphasizing, mainly, the complex behavior patterns of the inter-specific relations and social organization of different species of dolphins and whales. Although it is difficult to observe them in their natural habitat, there are viable techniques to do so, with alternative methodologies to the sampling of the behavior of cetacean inside a variety of available conditions (Mann, 2000).

Along Rio Grande do Norte's littoral there is the presence of *Sotalia guianensis* that is observed during all year. Inside the bays the animals can be seen alone or, most frequently, in small groups. The size of the groups vary between 2 and 19, the average of animals per groups was of 4.2 individuals (Spinelli, 2004), most of them adults and immature, with cubs observed throughout the year. For these locations, the species *S. guianensis* was observed performing a wide behavioral repertoire, different from what Andrade *et al.* (1987) pointed out in Baía da Guanabara – RJ and Hetzel and Lodi (1993) had as a species of low activity on the surface.

This study aims to describe the behavior as well as the use of fidelity areas and patterns and residence of the boto, *S. guianensis*, in the south littoral of Rio Grande do Norte, Northeast of Brazil.

Materials and Methods

Study Area

The studies were done in two bays, (6° 13' 41, 3" S; 35° 03' 36, 6" W) and Madeiro (06° 13' 23,9" S; 35° 04' 14,8" W), located in Pipa beach, Tibau do Sul city – RN. The bays have their bottoms composed by sandstone, reaching maximum depth of 7 meters, surrounded by cliffs whose height is around 30 meters, characterizing a region sheltered by winds and coast currents, what favor the stability of these parameters.

Ethogram

To describe the behavioral repertoire of the boto, *S. guianensis*, some observations were done on the animals in their natural habitat during the day. The study was conducted between August 1999 and August 2001, totalizing 634 hours of sampling effort and 450, 7 hours of effective effort.

Data was collected by observers who were located in a steady point at the top of the cliff of each bay, from where it was possible to completely see the respective areas, recording all behavioral events of the present estuary dolphins in the bays through *Ad libitum* method (Altman, 1974).

The ethogram was based only on behavioral events accomplished in the water surface or right below it (Slooten, 1994). Each event observed was named, described, represented by a sketch and, through the context in which it happened, indicated to one of the behavioral categories.

Use of the Area

To characterize the use of the bays by the boto, the frequency of the same categories of the behavior was registered by the use of the same procedures described above for the data collection in the ethogram elaboration. The observations were processed from April 2000 to March 2001, totaling 336 hours of sampling effort to Curral and 348 hours to Madeiro.

The data was analyzed to determine behavior frequency variations between areas and categories. In all analysis a Kruskal-Wallis non parametrical test was used with significance level of 95%.

Residence Pattern

To determine the residence and fidelity pattern of the boto in Curral bay, a photo identification technique and a photographic catalogue analysis produced in the period between October 2002 and December 2003 were used.

With the help of two Reflex 35mm photographic cameras whose obturator speed varied from 1/1000s to 1/4000s, zoom lens from 80 to 300mm and ASA 400 films, the photographic registers were done from three different platforms: a small wooden boat with a propeller anchored at the entrance or at the middle of the bay, tourist boats that sail between Madeiro and Curral bays and adjacent areas and on land (beach), taking 564 photos (total effort) from which 160 were used (effective effort).

The photographic registers focused on the presence of natural marks and the shape of the dorsal fin, being catalogued and compared to those already existent through a computer program called Presto! Mr. Photo 1.5 ©, which allows images overlap, making it possible, then, to distinguish photos with similar marks.

The residence patterns adopted in this work were divided in three groups: Residents (common individuals – re-sighted for 8 or more months – and frequent – from 6 to 7 months -); Seasonal Residents (occasional individuals – re-sighted from 3 to 5 months) and Transients (rare individuals – re-sighted between 1 to 2 months – or that have not been sighted again) (Quintana-Rizzo & Wells, 2001; Zolman, 2002).

Results

Ethogram

The observations allowed us to distinguish twenty-three behavioral acts that were grouped in four behavior categories: (a) aerial activity, (b) displacement, (c) socialization and (d) foraging (Table 1).

Use of the Area

The frequency of foraging register was superior to both bays with 59% of the registers, followed by the category of aerial activities (29%) and socialization (11%), being verified significant difference only for the foraging (Kruskal-Wallis $p < 0.05$) (Table 2).

Residence Pattern

We have reached a total of 34 animals that were photo identified for the study area. From these, 20.58% were re-sighted at least once after being inserted in the catalogue; 38.23% were identified only and 41.17% were not re-sighted. Among these individuals, 47.06% ($n = 16$) were considered rare, 2.94% ($n = 1$) occasional, 2.94% ($n = 1$) frequent, 5.88% ($n = 2$) common and the rest 41.18% ($n = 14$) were not re-sighted. From this data it was possible to indicate that 8.82% ($n = 3$) individuals were considered resident animals, 2.94% ($n = 1$) seasonal residents and 88.24% ($n = 30$) transients.

Discussion

The *S. guianensis* descriptions always referred to the species as a very timid and little expressive one (Hetzl and Lodi, 1993; da Silva and Best, 1996). As opposed to these characterizations, it was possible to verify that the population of Pipa beach presents a diversified and intense repertoire of activities performed on the surface, mainly in what refers to the expression of aerial activities, displacement, foraging and socialization. Some hypotheses are suggested to try to explain possible aerial behavior functions: to get rid of parasites or commensal (Perrin and Gilkpatrick 1994); communicative function (Norris and Dohl, 1980; Wursig and Wursig, 1980; Whitehead, 1985) and aggressive contexts. This study considers that the aerial activities are influenced by oceanographical factors, sizes and wave frequency conditioned by wind speed as well as socialization and/or aggressiveness contexts. Displacement patterns, on the other hand, were associated to the movements inside the bays, varying according to the activity in which the dolphins were engaged at.

Having in mind the great participation of immature individuals in the socialization episodes, this activity seems to be connected to the context of games. As it was discussed by Spinelli *et al.* (2002) about the same regions, the games in aquatic mammals is similar to the ones in terrestrial mammals, having an adaptative function that prepares the individual to an adult life and to the challenges that are present in the moment of their development.

Finally, the foraging presents itself as one of the predominant categories of behavior in different populations of *Sotalia* dolphins, like in Paraty, Rio de Janeiro (Lodi, 2003) and in Cananéia, São Paulo, both in the southeast of Brazil (Geise *et al.*, 1999). The same was evidenced to the *S. fluviatilis* populations in the Amazon Basin (da Silva and Best, 1996). In Pipa's case the highest frequency of the animals' foraging behavior can be associated to oceanographical and ecological characteristics of the bays, such as depth, flow regime and nutrients' input that favor the concentration of catches used in the botos' diets.

The photo-identification data allowed us to verify different residence patterns of the botos in Pipa. The resident individuals formed a small part of the observed animals in the area, while the greatest part of animals was categorized as transient. Similar to what was observed in other species of dolphins (Wilson *et al.*, 1997), this condition is part of a stratification of the habitat use by *S. guianensis* in the area studied.

In this case, there are individuals that realize both temporary movements and periodical return to the area, like dolphins that use the area in an opportunistic way. The spatial and temporal variation of environmental conditions, reproduction and feeding success have been indicated as factors that contribute to the fidelity of use of a determined area by dolphins (Santos *et al.*, 2001).

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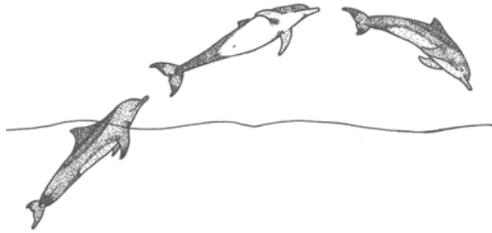
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Table 1 – Description of the categories and behavioral acts performed by the boto, *Sotalia guianensis*, in the region of Pipa, Tibau do Sul, RN.

(a) Aerial Activity: characterized as a category composed by stereotyped behavior in which the animals expose totally or partially their bodies above the water surface, except in displacements, in which the animals only emerged to breath and in the aerial attack that is used to capture their catches.

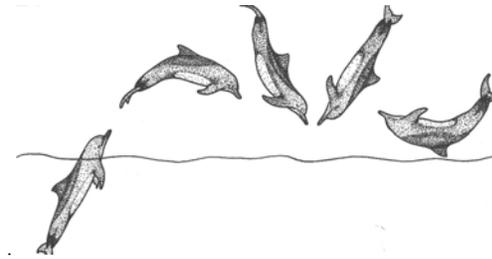
Total Jump: it is characterized by the body's total exposition, above the the water surface. The return to the water can be given with the ventral, dorsal or lateral region of the body.

Partial Jump: the body's exposition is not totally observed above the water surface. The return to the water can be given with the ventral, dorsal or lateral region of the body.



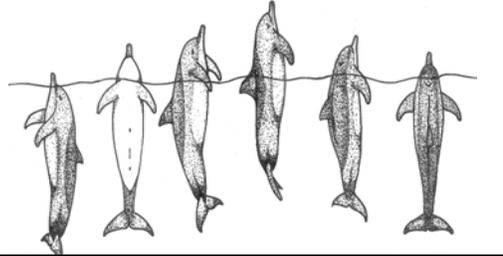
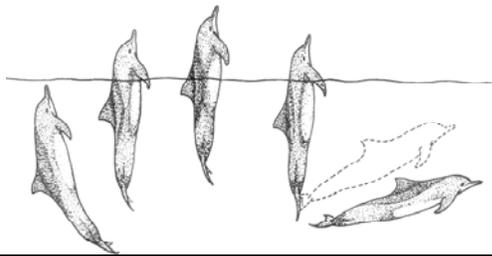
Somersault: a variation of the total jump in which the animal performs a spin around its own axis, returning to the water with the ventral or lateral region of its body.

Caudal: the caudal behavior is characterized by the exposition and sustentation of the peduncle and the caudal fin above the water surface for some seconds.

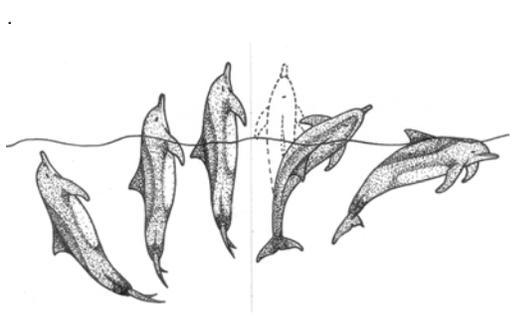


Periscope: the animal emerges vertically, creating a 90° angle in relation to the water surface, showing its pectoral fin and part of its ventral region, diving afterwards

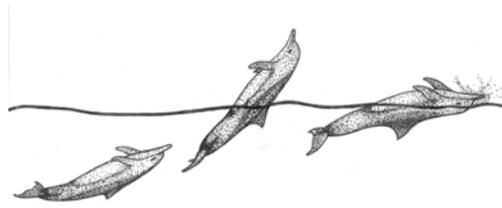
Periscope with a spin: the animal emerges vertically, creating a 90° angle in relation to the water surface, however, spinning around its own axis.



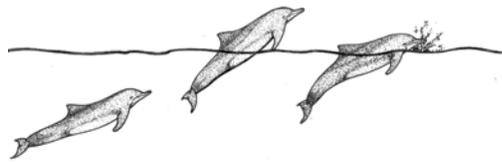
Periscope with a fall: another variation for the periscope, similar to the ones above mentioned, differing by the return to the water like letting the body fall.



Dorsal Head Slam: the animal emerges perpendicularly, leaving part of its body above the water surface, returning with a slam with the dorsal and melon region.



Inverse Head Slam: the animal emerges perpendicularly, leaving half of its body above the water surface, returning with a slam with the region of the jaw.

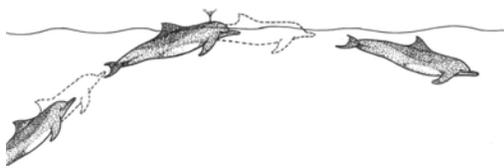


Caudal Slam: the animal swims slowly in the water surface, dorsally or ventrally positioned, rising its peduncle and caudal fin so it can slam the water surface.

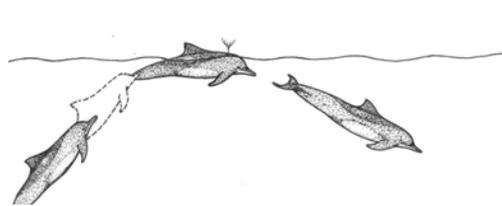


(b) Displacement: characterized when the animals were seen going from a point to another inside the bay, keeping a steady direction, altering dives with fast ascents to the water surface to breath. The body of the animal vaulting in this action determines the speed of the displacement.

Slow: swimming with body's open vaulting during the emersion



Fast: swimming with body's closed vaulting during emersion.



In speed: swimming with consecutive partial jumps (sliding).



Dive: the dive sequence is the same of the slow and fast displacements, differing by the sight of the animal's whole body, from beak to caudal fin. The animal's body, when diving, is positioned at a 45° or 90° angle.



Porpoising: characterized by a sequence of total jumps next to the water surface.

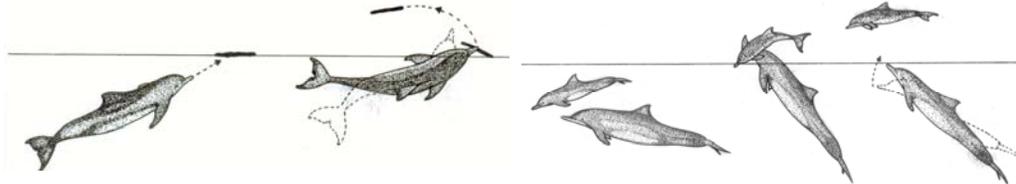
Torpedo: swimming next to the surface with dorsal positioning without intervals to breath.



(c) Socialization: characterized when the animals were observed in groups formed by adult and immature animals in the surface and performing physical contacts through agonistic activities, games, mating and milking.

Games with objects: to throw objects with the mouth or carry them in their pectoral or dorsal fins.

Cub's Impulse: an animal is propelled outside the water by another, using the beak.



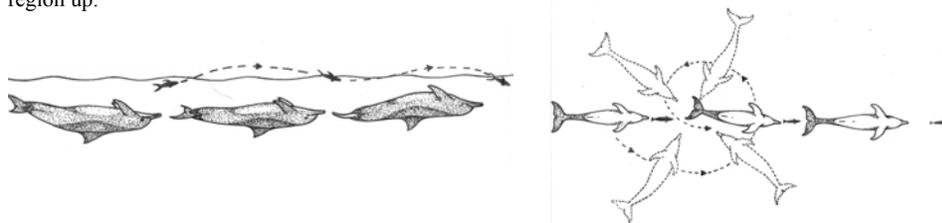
Surf: the animal uses the waves to move itself.



(d) Foraging: it is characterized by chasing the catch in the water surface, being it usually captured and eaten, being composed by four phases.

Chase: displacement in speed, close to the water surface, with the animal swimming with its ventral region up.

360° Spin: During the chase the animal positioned with the ventral region up performs a 360° spin.



Attack: end of the chase, in which the animal captures its catch in the water surface or in the air with its mouth

Consumption: after the capture, the catch is thrown to the air or in the water surface, sometimes, being re-captured and swallowed afterwards.

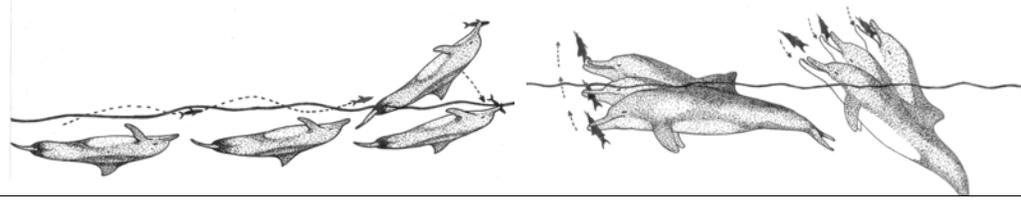


Table 2 – Frequency of the behavior categories observed in the Curral and Madeiro bays for twelve months.

Behavior categories	Curral	Madeiro	total
Aerial activity	232 - 25.6%	318 - 34.1%	550 - 29%
Socialization	61 - 7%	136 - 14.6%	197 - 11%
Foraging	612 - 67.6%	479 - 51.3%	1091 - 59%
total	905	933	1838