

# Movements of the rough-toothed dolphin (*Steno bredanensis*) in Rio de Janeiro State, south-eastern Brazil

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*To verify the movements of the rough-toothed dolphin (Steno bredanensis) on the coast of Rio de Janeiro State, south-eastern Brazil, we performed a photo-identification comparison between the catalogued individuals of Rio de Janeiro City (22°54'10"S–43°12'27"W) (N = 30) during August and September 2011 and the Cabo Frio region (22°52'46"S–42°01'07"W) (N = 41) during March and August 2011. Two photo-identified individuals from Rio de Janeiro City were resighted in the Cabo Frio region, approximately 119.7 km east of the original Rio de Janeiro sighting and two other individuals identified in the Cabo Frio region were resighted in the Rio de Janeiro City area, approximately 117.0 km west of the original sighting. This study reports the first information about the movements of the species in Brazil within these coastal areas.*

**Keywords:** *Steno bredanensis*, resightings, displacements, Rio de Janeiro State, south-eastern Brazil

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## INTRODUCTION

The rough-toothed dolphin, *Steno bredanensis* (Lesson, 1828), is a tropical to subtropical species and generally inhabits deep oceanic waters between 40°N and 35°S (Perrin, 2009). However, in certain areas (e.g. Brazil (Lodi & Hetzel, 1998 and references therein; Lodi & Hetzel, 1999), Honduras (Kuczaj & Yeater, 2007) and Mauritania (Addink & Smeenk, 2001)) the species occurs in shallower coastal waters.

Rough-toothed dolphins are widely distributed in all three major oceans, but the literature on *S. bredanensis* includes many comments indicating that little is known about their distribution and ecology (e.g. Jefferson, 2002; Baird *et al.*, 2008).

In Brazil, the northern and southern limits of the species are reported as Pará State (geographical coordinates unknown) (Siciliano *et al.*, 2008) and 60 km south of the Tramandaí River mouth, Rio Grande do Sul State (30°29'S–50°20'W) (Ott & Danilewicz, 1996), respectively. This information may indicate that *S. bredanensis* is widely distributed in coastal waters. However, few records of the species in oceanic waters in depths between 1500 and 2500 m are also available (Ramos *et al.*, 2010).

The available information on this species remains scarce and is limited to opportunistic and occasional records of sightings (e.g. Ramos *et al.*, 2010), strandings (e.g. Meirelles *et al.*, 2009), biological data on the diet (e.g. Di Benedetto *et al.*,

2001), age and growth (Siciliano *et al.*, 2007) and parasitic fauna (e.g. Carvalho *et al.*, 2010). Records of feeding (Lodi & Hetzel, 1999), epimeletic (Lodi, 1992) and interspecific behaviours (Wedekin *et al.*, 2004), fisheries interaction (e.g. Lodi & Capistrano, 1990), plastic debris ingestion (Meirelles & Barros, 2007) and persistent organic pollutants (e.g. Yogui *et al.*, 2010) are available as well.

The aim of this study is to describe the movements of *S. bredanensis* in the coastal waters of Rio de Janeiro State by reporting the results of photo-identification comparisons between the catalogued individuals of the Cabo Frio and the Rio de Janeiro City regions.

## MATERIALS AND METHODS

### Study area

The Cabo Frio coast (22°57'58"S–42°01'40"W) is marked by a change in the shoreline from north–south to a south–west–north–east orientation and exhibits a steep slope (De Leo & Pires-Vanin, 2006). The occurrence of two water masses is strongly influenced by the wind regime. The Brazil Current (BC) is a warm, resource-depleted surface water mass. The South Atlantic Central Water (SACW) is a deeper, relatively cold and nutrient-rich water mass influenced by the prevailing dominant east–north–east winds. This combination of features produces upwelling conditions (Carbonel, 1998). The area that we sampled in this study included the inner region of Forte Beach (22°53'59"S–42°01'01"W), which includes

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water depths of approximately 5–30 m (Nautical Chart No. 150501: Diretoria de Hidrografia e Navegação da Marinha do Brasil). In general, the Rio de Janeiro City coast ( $22^{\circ}54'10''\text{S}$ – $43^{\circ}12'27''\text{W}$ ) is influenced by the heavily polluted waters of Guanabara Bay and by the hydrological dynamics of the BC and the SACW. The SACW occurring in this region is derived from the Cabo Frio upwelling (Carbonel & Galeão, 2007). The area sampled by this study included the coastline of Rio de Janeiro between the entrance of Guanabara Bay ( $22^{\circ}58'16''\text{S}$ – $43^{\circ}09'25''\text{W}$ ) and Ipanema Beach ( $22^{\circ}59'50''\text{S}$ – $43^{\circ}12'27''\text{W}$ ). This coastline exhibits depths varying from 5–40 m (Nautical Chart No. 1620: Diretoria de Hidrografia e Navegação da Marinha do Brasil).

## Field procedures

Sightings of *S. bredanensis* on the Rio de Janeiro coast were made opportunistically during the common bottlenose dolphin (*Tursiops truncatus*) population dynamics research project. The photographs taken on the Rio de Janeiro coast were obtained from a 9.3 m vessel with an outboard engine. Data on sightings on the Cabo Frio coast were gathered through the long-beaked common dolphin (*Delphinus capensis*) bioacoustics and social organization project. Photographs were taken from a 6.5 m vessel with an outboard engine. The height from which the photographs were taken was approximately 1.5 m.

The photographs were taken with Canon EOS 40D digital cameras, both equipped with 70–300 mm lenses (Rio de Janeiro and Cabo Frio). Photographs were taken in 2011 during four sightings (two in Rio de Janeiro and two in Cabo Frio).

## Data analysis

Rough-toothed dolphins exhibited distinct features suitable for individual identification, such as notch patterns on the dorsal fin and distinct scratches (Mayr & Ritter, 2005). Only well-focused images with sufficient light and little blurring were considered for the analysis and creation of a photo-id catalogue for each locality. The procedures in Espécie *et al.* (2010) were followed. In the laboratory, the photographs from both catalogues were compared using Darwin software (Digital Analysis and Recognition of Whale Images on a Network: <http://darwin.eckerd.edu/>).

## RESULTS AND DISCUSSION

Photographs were obtained for 30 and 41 individuals identified at Rio de Janeiro and Cabo Frio, respectively. Two photo-identified individuals sighted on the Rio de Janeiro coast (RJ#004 and #005) on 18 August 2011 were resighted at Cabo Frio (CF#022 and #040, respectively) on 26 August

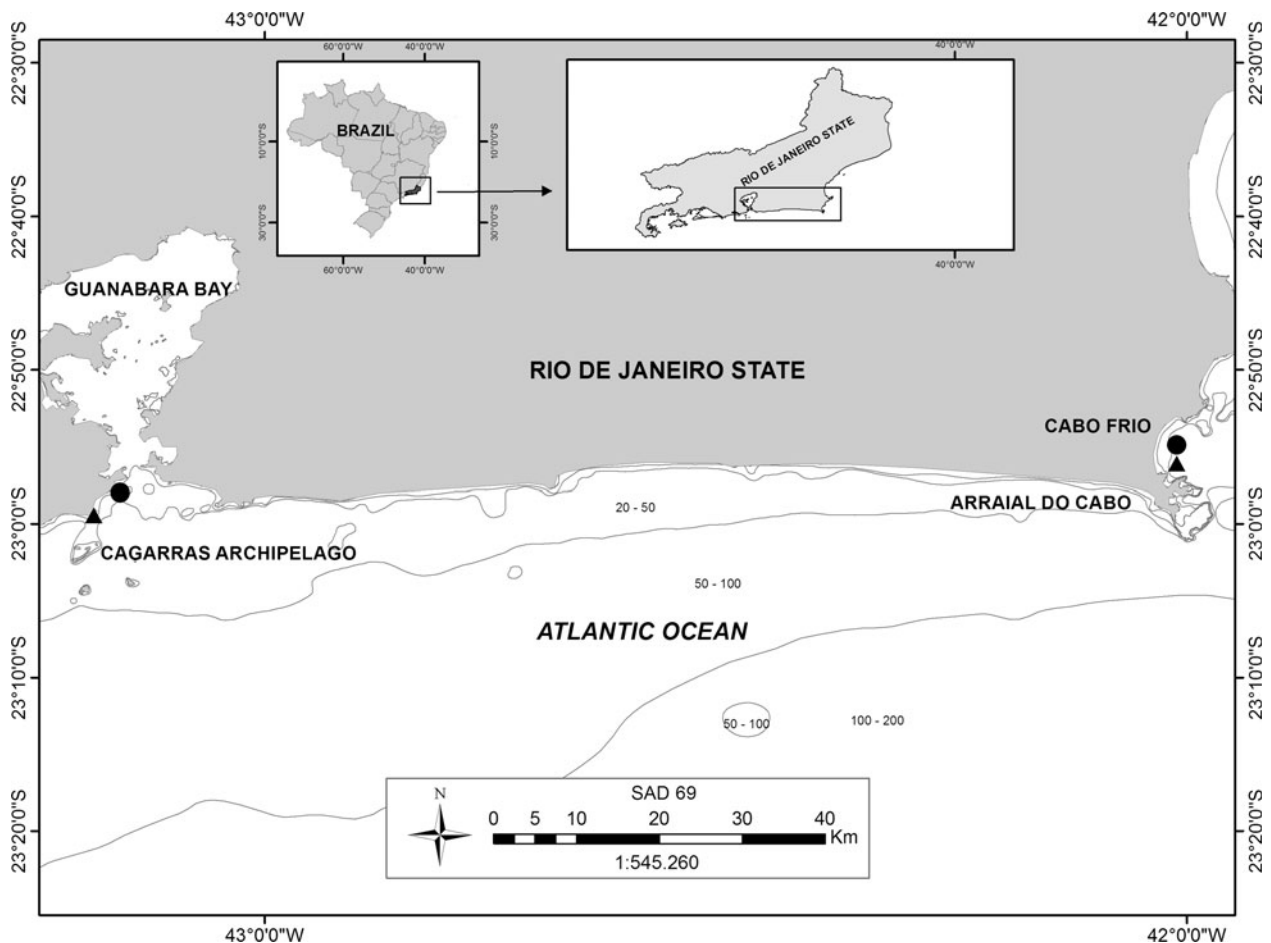


Fig. 1. Resightings of rough-toothed dolphins (*Steno bredanensis*) along the Rio de Janeiro State coast, Brazil. ▲, RJ#004/CF #022 and RJ#005/CF#040; ●, RJ#012/CF #028 and RJ#016/CF#035.

**Table 1.** Sightings and resightings of *Steno bredanensis* off Rio de Janeiro State between August and September 2011.

	Identification code							
	RJ#004 CF#022		RJ#005 CF#040		RJ#012 CF#028		RJ#016 CF#035	
Date	18 August	26 August	18 August	26 August	16 September	26 August	16 September	26 August
Site	Copacabana Beach	Forte Beach	Copacabana Beach	Forte Beach	Leme Beach	Forte Beach	Leme Beach	Forte Beach
Distance from coast (m)	300	2000	300	2000	300	2000	300	2000
Group size	15	15	15	15	30	15	30	15
Mean depth (m)	10	25	10	20	20	19	20	10
Surface temperature of water (°C)	23	23	23	23	22	23	22	23

2011 at a linear distance of approximately 119.7 km east of the initial sighting. Two other photo-identified individuals sighted on the Cabo Frio coast (CF#028 and #035) on 26 August 2011 were resighted at Rio de Janeiro (RJ#012 and #016, respectively) on 16 September 2011 at a linear distance of approximately 117.0 km west of the initial sighting (Figure 1; Table 1).

Although the Cabo Frio coast is influenced by upwelling phenomena, the process is not homogeneously distributed. The influence of upwelling at the site where we have observed *S. bredanensis* (Forte Beach) is relatively less prominent (Carbonel, 1998). The site shares geographical and oceanographical similarities with Rio de Janeiro. Our data showed that dolphins were sighted in similar depths and at similar temperatures (Table 1) in both areas.

On 26 August 2011 at Cabo Frio and on 19 September 2011 at Rio de Janeiro, we could observe rough-toothed dolphins feeding on mullet (*Mugil curema*) and cutlass fish (*Trichiurus lepturus*), respectively. These species of fishes have been previously described in the diet of the rough-toothed dolphins (Lodi & Hetzel, 1999; Di Benedetto *et al.*, 2001). They are widely distributed along the Brazilian coast (Carvalho Filho, 1999). This may suggest that the dolphins travel between the two areas because they offer similar food resources.

Our data on the group sizes in both areas (Table 1) were consistent with the known patterning of social groupings of *S. bredanensis* in other regions, e.g. Mauritania (10–12: Addink & Smeenk, 2001), the Canary Islands (10–>50: Ritter, 2002), French Polynesia (1–35: Gannier & West, 2005), Honduras (5–30: Kuczaj & Yeater, 2007), Hawaiian Archipelago (2–90: Baird *et al.*, 2008), and Brazil (1–>50: Lodi & Hetzel, 1998; Ramos *et al.*, 2010).

The ongoing project in the Cabo Frio region resighted three of the 41 photo-identified individuals. CF#003, 012 and 014 were sighted for the first time on 19 March 2011 and resighted on 26 August 2011. These observations suggest a possible instance of site fidelity. The three individuals resighted in the Cabo Frio region were not observed in the Rio de Janeiro region. Resightings of photo-identified dolphins in the Canary Islands (Mayr & Ritter, 2005), Honduras (Kuczaj & Yeater, 2007) and the Hawaiian Archipelago (Baird *et al.*, 2008) indicated that individual rough-toothed dolphins are residents in these areas and exhibit site fidelity.

In the main Hawaiian waters, the distances between the resighting locations of individuals off Kaua'i/Ni'ihau were not statistically greater than the straight-line distances between the resighting locations off Hawaii. Individuals were found to move from Kaua'i to Hawai'i after an interval of 309 days. The straight-line distance of 480 km between

sighting locations is the greatest travel distance reported for the species (Baird *et al.*, 2008).

In view of these findings, the distance between the two clusters of sightings in our study appears to fall well within the range reported for individual rough-toothed dolphins. This note reports the first information about the movements of the species in Brazilian coastal areas. Clearly, additional survey effort in the areas between Rio de Janeiro City and the Arraial do Cabo regions is needed to better understand the site fidelity and home range of this species in the coastal waters of Rio de Janeiro State.

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