

## ***A NORTHERN RECORD OF PANTROPICAL SPOTTED DOLPHINS (*Stenella attenuata*) IN SOUTHWEST ATLANTIC OCEAN***

Um registro mais setentrional de golfinhos-pintados-pantropicais (*Stenella attenuata*) no Atlântico Sul Ocidental

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### **ABSTRACT**

Pantropical spotted dolphins, *Stenella attenuata*, are found across all tropical and subtropical oceans around the world, but their distribution is poorly known in the Southwestern Atlantic Ocean (SWA). A group of approximately 10 *S. attenuata* individuals was sighted in deep (~3,000 m), warm (~27.5 °C) and oligotrophic waters, near oceanic banks off northeastern Brazil (02°04'16.68" S and 038°08'28.26" W). This sighting constitute a new record of the northern distribution of *S. attenuata* in SWA. More survey efforts must be carried out to investigate cetaceans distribution along the Brazilian coast, especially in offshore waters.

**Keywords:** marine mammals, cetaceans, Atlantic Ocean, Northeastern Brazil, oceanic banks.

### **RESUMO**

Golfinhos-pintados-pantropicais, *Stenella attenuata*, são encontrados em todos os oceanos tropicais e subtropicais do mundo, mas sua distribuição no Atlântico Sul Ocidental (ASO) é pouco conhecida. Um grupo de aproximadamente 10 indivíduos de *S. attenuata* foi avistado em águas profundas (c. 3.000 m), quentes (c. 27,5 °C) e oligotróficas, próximas a bancos oceânicos do Nordeste do Brasil (02°04'16.68" S e 038°08'28.26" W). Esse avistamento representa um novo registro para a distribuição mais setentrional de *S. attenuata* no ASO. Maiores esforços para investigar a distribuição de cetáceos ao longo da costa brasileira precisam ser realizados, especialmente em águas oceânicas.

**Palavras-chave:** mamíferos marinhos, cetáceos, Oceano Atlântico, Nordeste brasileiro, bancos oceânicos.

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## INTRODUCTION

Pantropical spotted dolphins, *Stenella attenuata* (Gray, 1946), are found across all tropical and subtropical oceans around the world, where different populations have been described (Perrin, 1975; 2001). Although its distribution is generally restricted to pelagic tropical zones (e.g. *S. attenuata attenuata* and two informally named subspecies: *S. attenuata* subspecies A, found in the eastern Pacific, and *S. attenuata* subspecies B, surrounding Hawaiian Islands), a coastal form (*S. attenuata graffmani*) is also recognized for the Eastern Tropical Pacific (hereafter, ETP) (Perrin, 1975; Jefferson *et al.*, 1993; Rice, 1998).

This species is well documented in the Pacific Ocean, where ETP offshore populations suffered substantial losses as a result of bycatch by purse-seine fishing vessels targeting yellowfin tuna (*Thunnus albacares* (Bonnotterre, 1788) (Gerrodette *et al.*, 2012; Scott *et al.*, 2012; Lennert-Cody *et al.*, 2016). Even though these dolphin stocks appear to be recovering at a slower rate than expected after the implementation of measures to reduce their mortality in fishing nets (Wade *et al.*, 2007; Kellar *et al.*, 2013), *S. attenuata* has been listed as 'Least Concern' by the International Union for Conservation of Nature since 2008 (Kiszka & Braulik, 2018).

In contrast to the ETP populations, the geographical range of pantropical spotted dolphins in the Atlantic Ocean is poorly known (Mignicci-Giannoni *et al.*, 2003), especially in the Southwestern region (hereafter, SWA) (Moreno *et al.*, 2005; Amaral *et al.*, 2015). The species latitudinal distribution in SWA seems to be limited to Brazilian waters, since previous records south of 23°S are questionable and confirmed reports come solely from Rio de Janeiro state (Moreno *et al.*, 2005), whereas other studies had documented its northernmost occurrences in Pará (Siciliano *et al.*, 2008) or Maranhão states (Costa *et al.*, 2017).

The present work reports a new record of the northern distribution of *S. attenuata* in SWA, in Brazilian offshore waters.

## MATERIAL AND METHODS

Between 10<sup>th</sup> and 12<sup>th</sup> of June 2019, public agents from the Brazilian Navy, Federal Policy and the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA aboard the offshore patrol ship Macau (hereafter, NPa Macau) inspected fishing boats along Ceará state coastal waters and oceanic banks (up to c. 140nm from the coast).

Toward the end of a patrolling day, dolphins were opportunistically sighted and filmed with a 12-megapixel smartphone camera, able to record 4K videos at 30 frames per second. After a first visual recognition, the video footage was carefully examined and compared to relevant references on cetacean identification (Perrin *et al.*, 1987; Perrin, 2001, 2018) to assure the species had not been misidentified to assure the species had not been misidentified.

Geographic coordinates were taken from the vessel's GPS system (datum WGS84), while chlorophyll a concentration at a minimum depth (Chl-a) was obtained from Bio-ORACLE (Oceans Rasters for Analysis of Climate and Environment, available at <http://www.bio-oracle.org/explore-data.php>) (Tyberghein *et al.*, 2012; Assis *et al.*, 2017), bathymetric data were gathered from the U.S. Bathymetric and Fishing Maps (NOAA, 2019) and sea surface temperature (SST) and salinity (SSS) data obtained from PIRATA (Prediction and Research Moored Array in the Tropical Atlantic) buoy plots (NOAA, 2020),

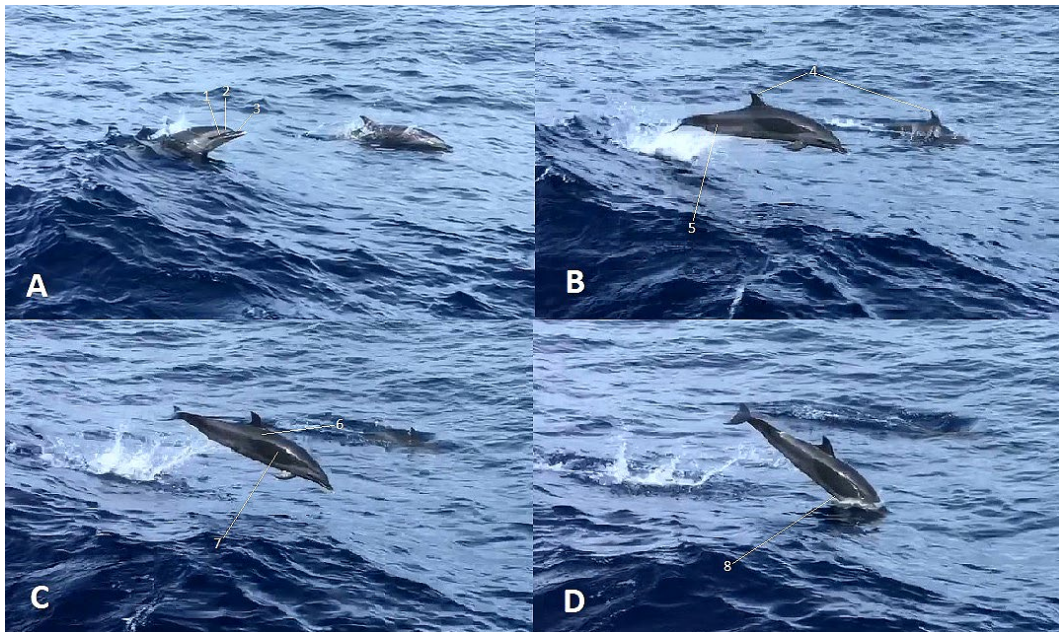
since biological and oceanographic parameters should be collected to investigate environmental features that influence the habitat and distribution of dolphins (Moreno *et al.*, 2005). PIRATA Station 0°/35°W was chosen as reference as it was the closest buoy to the site where the dolphins were observed (c. 423 km/228nm distant).

## RESULTS

On 11<sup>th</sup> of June 2019, at 04:05 p.m. (UTC-3, BRT), a group of pantropical spotted dolphins (c. 10 individuals, no calves sighted) was observed in oceanic waters off Ceará state (02°04'16.68" S and 038°08'28.26" W).

In spite of the light spotting patterns of the observed individuals and the indiscernible flipper stripe, the other species characteristics enabled the precise identification of *S. attenuata* (Figure 1).

Figure 1 – Footage frames of *S. attenuata* sighted off Ceará State, Brazil (A-D), showing distinguishable characteristics of the species (1 – dark grey band encircling the eye continues forward to the apex of the melon; 2 – melon separated from the long thin beak by a distinct crease; 3 – distinct white beak tip; 4 – narrow, falcate and pointed at the tip dorsal fin; 5 – peduncle divided into dark upper and light lower portions; 6 – no spinal blaze sweeping up into the dorsal cape; 7 – dark dorsal cape, narrow on the head and sweeping low on the flank in front of the dorsal fin; 8 – grey lower side of the belly, where spots were more perceptible)

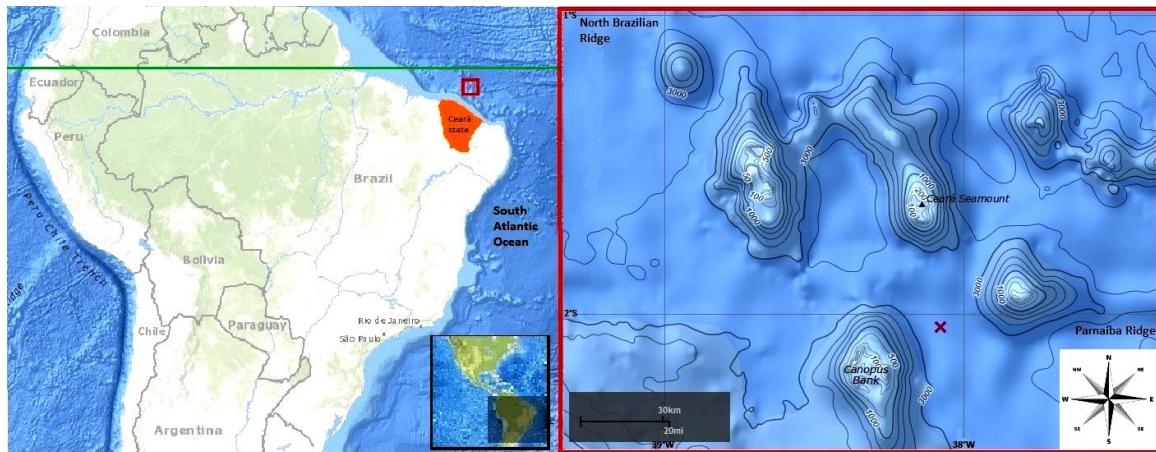


These dolphins swam for about 8 minutes along the same course as the NPa Macau (210° heading), at c. 3,000 m deep, in the vicinity of the Canopus Bank, in the southeastern portion of the North Brazilian Submerged Seamount Chain (Figure 2). At that time, the vessel was traveling at a speed of 11km/h (6nm), when some of the dolphins moved beside it and crossed its bow, while other individuals leaped slightly away from the ship.

The day was overcast, in an area where mean Chl-a concentration is 0.004 mg/m<sup>3</sup> (ranging from a minimum of 0.001 – 0.151 mg/m<sup>3</sup> to a maximum of 0.004 – 0.488 mg/m<sup>3</sup>, depending on the region of the oceanic banks), whereas SST and SSS were 26.3 °C and 35,85, respectively, at that time of the day.



Figure 2 – Location of pantropical spotted dolphins record off Brazilian coast, where green line represents the Equator. The bathymetric map of the oceanic banks near Ceará state (red frame) presents the exact sighting position of *S. attenuata* (red cross)



## DISCUSSION

The scarcity of sightings of cetaceans in SWA is due to a combination of factors, including the limited cetacean-oriented survey efforts in deep waters along the Brazilian coast (Di Tullio *et al.*, 2016; Rocha *et al.*, 2019). Hence, most of the studies concerning the occurrence of such marine mammals in this area is based on a few localized records of strandings, accidental captures and opportunistic sightings (Rocha *et al.*, 2019) and, so, the report of new occurrences, mainly in offshore waters, is extremely valuable to understand the distribution of cetacean species in this region.

Although all *Stenella* dolphins are currently well characterized, due to previous taxonomic uncertainties caused by similarities of external color pattern among some species and the overlap in their ranges, many records have remained unidentified or even been misidentified (Moreno *et al.*, 2005). Pantropical spotted dolphins, for instance, can be confused with other long-beaked species, especially with the Atlantic spotted dolphin, *Stenella frontalis* (Cuvier, 1829), which is found only in the Atlantic Ocean (Perrin *et al.*, 1987; Jefferson *et al.*, 1993; Rice, 1998).

Nevertheless, *S. attenuata* and *S. frontalis* present a parapatric distribution along the eastern coast of South America. While the former occurs in waters beyond the slope, the latter is more often observed over the continental shelf (Amaral *et al.*, 2015; Di Tullio *et al.*, 2016) – despite a possible intersection area of the two species off the southeastern Brazilian coast (Moreno *et al.*, 2005). Additionally, pantropical spotted dolphins can be differentiated from Atlantic spotted dolphins by the absence of a spinal blaze sweeping up into the dorsal cape and the presence of a clear division of the peduncle into dark upper and light lower portions (Perrin *et al.*, 1987; Perrin, 2001; Mignicci-Giannoni *et al.*, 2003; Lodi & Borobia, 2013).

Flipper stripe and spotting patterns in *S. attenuata* are known to be highly variable with age, sex and also geographically (Perrin *et al.*, 1987; Perrin, 2001). While specimens from the US Atlantic coast, Gulf of Mexico, coasts of Central and South America and also of West Africa have medium to heavy spotting, individuals from offshore Northwestern Atlantic and Southwestern Caribbean have fewer if any spots (Perrin *et al.*, 1987; Mignicci-Giannoni *et al.*, 2003). Thus, the unnoticeable flipper stripe and light spotting patterns here reported can be a typical feature of the offshore population from the northernmost SWA.

As dolphin habitats appear to be a function of the variables influencing the aggregation of their preys (e.g. sea-floor relief, diffuse attenuation, Chl-a, SST, SSS and depth), these parameters affect the occurrence of prey species and, consequently, limit their distribution (Moreno *et al.*, 2005; Amaral *et al.*, 2015; Barragán-Barrera *et al.*, 2019).

At the oceanic banks in the southeastern portion of the North Brazilian Ridge, the high SST (c. 27.5 °C) with narrow temperature range (c. 2.5 °C) and deep waters (around 3,000 m), make those areas highly suitable for the occurrence of *S. attenuata* (Amaral *et al.*, 2015; Di Tullio *et al.*, 2016). Indeed, the current sighting confirmed the ecological niche modeling presented by Amaral *et al.* (2015) and corroborate with the statement regarding the occurrence of pantropical spotted dolphins mainly in Northeastern Brazil, typically in small groups (up to 25 individuals), beyond the continental shelf break, in deep (850-4,900 m) and warm (26-28 °C) waters (Moreno *et al.*, 2005).

Although the oceanic banks off the Ceará coast present low Chl-a concentrations, they are recognized by local fishermen as economically important fishing areas (Bezerra, 2013) and may be attractive to *S. attenuata*, which feed on a wide variety of epipelagic and mesopelagic preys (Perrin, 2001). The confirmed occurrence of *S. attenuata* in areas of lower primary productivity corroborate with the results of ecological niche modeling of *Stenella* dolphins in the Caribbean Sea and SWA (Amaral *et al.*, 2015; Barragán-Barrera *et al.*, 2019).

More than 20 different cetacean species have been recorded within the coastal and offshore waters of Ceará state (Alves Júnior *et al.*, 1996; Martins *et al.*, 2004; Meirelles & Furtado Neto, 2004; Meirelles *et al.*, 2009, 2010, 2011; Ribeiro *et al.*, 2011; Cypriano-Souza *et al.*, 2016), including unpublished strandings of *S. attenuata* reported by Associação de Pesquisa e Preservação de Ecossistemas Aquáticos – Aquasis (Negrão & Carvalho, pers. comm.). Thus, the sighting of pantropical spotted dolphins in this region was not unexpected, since this species is mostly sighted off northeastern South America (Moreno *et al.*, 2005), where the environmental requirements for the occurrence of the species are present (Amaral *et al.*, 2015). Probably, the reason why this species is scarcely recorded in north and northeastern Brazil is due to a lack of dedicated research efforts, especially in offshore waters at low latitudes in SWA (Amaral *et al.*, 2015).

Costa *et al.* (2017) reported two stranded specimens of *S. attenuata* in Maranhão and Piauí states (between 2°50' S and 2°40' S), but, unfortunately, Siciliano *et al.* (2008) did not provide the precise location where pantropical spotted dolphins were sighted off northeastern Pará state and, thus, as this latter state is crossed by the Equator, it is not clear whether that sighting event occurred in the Southern or Northern Hemisphere. Therefore, considering just these two latter references as information sources of the northern distribution of the species in Brazil, it is possible that the present sighting of *S. attenuata* represents the northernmost published record of the species in SWA. However, if unpublished sightings of pantropical spotted dolphins available at the Sistema de Apoio ao Monitoramento de Mamíferos Marinhos (SIMMAM) (<http://simmam.acad.univali.br/site>) are taken into account, this report constitute just a new record of the northern distribution of *S. attenuata* in SWA.

Further studies in offshore waters along the Brazilian coast are essential for a better understanding of cetacean ecology and to confirm species distribution represented in coarse-scale maps, which are mostly represented by generalizations based on cumulative knowledge about their distribution over time, and, more recently, predicted through ecological modeling (Amaral *et al.*, 2015; Rocha *et al.*, 2019). Such surveys would not only

provide a more complete description of the distribution pattern of *Stenella* dolphins in SWA but also might fulfill gaps on the occurrence of certain still unreported species in sites where they are suitable to be found, technically supporting ecosystem-based conservation initiatives in the region (IWC, 2016; Soares & Lucas, 2018; Giglio *et al.*, 2018).

In addition, it is worth noting that although *S. attenuata* do not seem to be as threatened by *T. albacares* fishery in northeast Brazil (where the great majority of the tuna fishery carried out, known as 'associated school fishery', uses pole and line, handlines and trawling as fishing methods (Silva *et al.*, 2019)) as they are in other parts of the world where purse-seine are the prevailing tuna fisheries, hooked marine mammals have been recorded either in longline or handline fishing gears worldwide (Passadore *et al.*, 2015; Werner *et al.*, 2015; Anderson *et al.*, 2020). Indeed, negative interactions between associated school tuna fishery and other cetacean species off Northeastern Brazilian coast were already observed: the decrease of landings and low profits caused by false killer whales (*Pseudorca crassidens* (Gray, 1846)) preying upon the targeted species (Silva *et al.*, 2016). So, potential impacts of tuna fisheries on pantropical spotted dolphins populations from SWA shall also be investigated.

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