

## Short Note

# Rough-Toothed Dolphins (*Steno bredanensis*) Along Southeastern Brazil: Report of an Anomalous Pigmented Juvenile and Description of Social and Feeding Behaviors

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Rough-toothed dolphins (*Steno bredanensis*; G. Cuvier in Lesson, 1828) are robust, with a long beak, a conical head, a prominent and slightly falcate dorsal fin, and unusually large flippers. Adults can reach 2.65 m long and weigh up to 155 kg. They are typically identified by the narrow, dark gray dorsal cape between the head and the dorsal fin. Their sides are light gray, and their belly, lower jaw, and lips are white (Bastida et al., 2007; Jefferson et al., 2008). Anomalous colorations, classified as albinism, leucism, melanism, or piebaldism, are considered rare in wild cetacean populations, including *S. bredanensis*. There is currently only one record of a white rough-toothed dolphin calf photographed off the Gabon coast (De Boer, 2010). Rough-toothed dolphins occur from tropical to warm temperate waters in the Pacific, Atlantic, and Indian Oceans, generally in deep waters, but they are also found in coastal shallow waters off Brazil, Honduras, and the United States (Jefferson et al., 2008; West et al., 2011). This species is classified by the International Union for Conservation of Nature as “Data Deficient” due to a lack of information about its population size and mortality rates (Bastida et al., 2007). *S. bredanensis* are rather sociable and curious cetaceans, characterized by intricate relationships among conspecifics, which includes elaborate feeding cooperation and epimelletic behavior (Lodi, 1992; Addink & Smeenk, 2001; Moura et al., 2009). Although widely distributed in the coastal and offshore waters of Brazil (e.g., Ott & Danilewicz, 1996; Flores & Ximenez, 1997; Wedekin et al., 2014; Costa et al., 2017), detailed

descriptions of the social and feeding behaviors of *S. bredanensis* are rare (Lodi & Hetzel, 1999). Thus, the purpose of this note is to increase the available data on *S. bredanensis* group behavior by presenting recent field observations.

The Archipelago of Ilhabela, located along southeastern Brazil, is a coastal, large, and important touristic island, located approximately 20 nmi from Ubatuba, situated in the mainland in the northern coast of São Paulo state. These waters offer habitat for several cetacean species, with regular sightings of the Bryde’s whale (*Balaenoptera brydei*), dwarf minke whale (*B. acutorostrata*), humpback whale (*Megaptera novaeangliae*), killer whale (*Orcinus orca*), Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*), rough-toothed dolphin, common dolphin (*Delphinus delphis*), Guiana dolphin (*Sotalia guianensis*), and franciscana dolphin (*Pontoporia blainvillei*) (Souza et al., 2009; Santos et al., 2010). Sea surface temperature in the waters off the northern coast of São Paulo range from 19° to 29°C. This region is influenced by the warm oligotrophic waters of the Brazil Current and by the cold, nutrient-rich waters of the South Atlantic Central Water (SACW, or ACAS in Portuguese) (Rossi-Wongtschowski & Madureira, 2006). Due to their enhanced biological relevance, these waters were declared an Environment Protection Area in 2008 named APA Marinha do Litoral Norte de São Paulo. It comprises 145,101,081 ha of protected marine waters (Assembleia Legislativa do Estado de São Paulo, 2008).

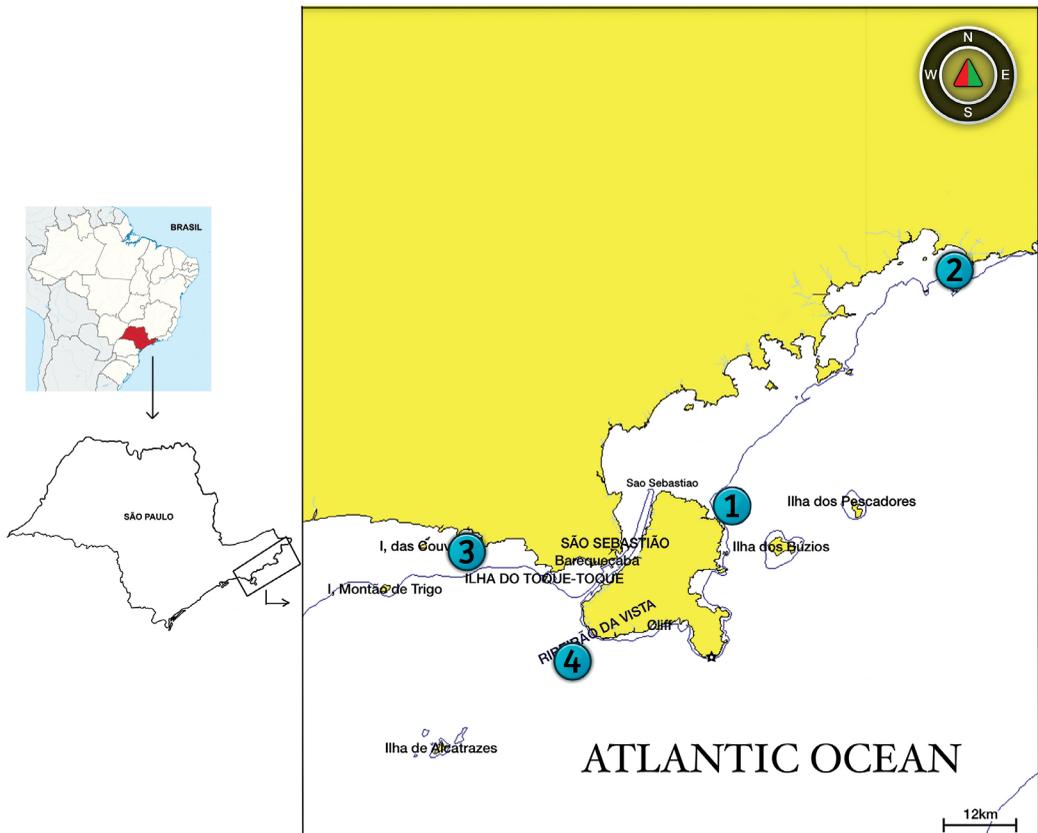
Cetacean sighting cruises have been carried out by the Project Baleia à Vista (PROBAV) monthly on the coast of the Archipelago of Ilhabela and São Sebastião (northern São Paulo state on the southern Brazilian coast) since 2005. PROBAV is a citizen science project focused on creating cetacean conservation awareness in this important cetacean area. A total of 70 cruises were conducted in 2017, with 14 sightings of whales (Bryde's and humpback) and 12 sightings of dolphin groups (killer whales and Guiana, rough-toothed, franciscana, bottlenose, Atlantic spotted, and common dolphins).

Herein, we report on sightings of rough-toothed dolphins made during PROBAV summer 2018 cruises (Figure 1). Data from each sighting are provided in Table 1. For each sighting, we recorded navigation heading (route) and dolphin position as well as sea current speed using a Raymarine Chartplotter/GPS. Depth and sea surface water temperature were recorded by a Raymarine Sonar. The pictures were taken using

a Nikon D500 (300-mm lens FX) and a Nikon D 750 (80-400-mm lens), with a high speed of 1/1250 fps and openings varying between f/4 and f/8 due to the amount of light and direction.

### Sighting #1

On 9 December 2017, a pod of 25 to 30 rough-toothed dolphins was spotted 0.5 nmi from Ponta Grossa off Ilhabela. The group was swimming in a calm, 1-m sea. The average wind speed was 5 kts, gusting to 11 kts. Water depth was approximately 20 m, and seawater temperature was around 23°C. Local current velocity was estimated at 2 kts eastward. The observation period was from 1301 to 1352 h. The pod was swimming synchronously, split in subgroups of two to five dolphins, surfacing together to breathe (Figure 2). They were moving slowly (1 to 2 kts) in circles, changing suddenly to a reverse direction, and then slowly heading to the open sea in an E-SE direction. Eventually, one dolphin left the group,



**Figure 1.** Map indicating the locations of the four sightings of rough-toothed dolphins (*Steno bredanensis*): (1) Ponta Grossa (Ilhabela), (2) Ponta da Pinguaba (Ubatuba), (3) Boiçucanga beach (São Sebastião), and (4) 3.5 nmi southwest of Ilhabela

**Table 1.** Data from four sightings of rough-toothed dolphins (*Steno bredanensis*) off northern coast of São Paulo state, Brazil, from December 2017 to March 2018

Sighting #	Date	Latitude/longitude	Platform	Approach distance
1	9 December 2017	S 23 46.281 W 045 13.763	Motorboat <i>Ballerina</i> (Ferretti 16.2 m)	50-100 m
2	4 January 2018	S 23 22.978 W 044 51.030	Motorboat <i>Ballerina</i> (Ferretti 16.2 m)	50-100 m
3	1 March 2018	S 23 48.853 W 045 38.437	Motorboat <i>Kavala I</i> (9.8 m)	50-100 m
4	10 March 2018	S 23 57.730 W 045 30.314	Motorboat <i>Ballerina</i> (Ferretti 16.2 m)	50-100 m



**Figure 2.** Subgroup of four rough-toothed dolphins with one leucistic juvenile among them, swimming coordinately at Ponta Grossa, Ilhabela, on 9 December 2017 (Photo by J. Cardoso)



**Figure 3.** A rough-toothed dolphin holding a huge mullet (*Mugil curema*) in its mouth off Ubatuba (Picinguaba) on 4 January 2018 (Photo by J. Cardoso)

swimming at a higher speed (6 to 8 kts), moving away and then returning after a while. Behavior of tail-slapping was observed for some individuals when they approached the boat at 20 m distance but apparently did not influence the behavior of the other dolphins. At other times, two dolphins stayed still and together in a depth of 1.0 to 1.5 m, with one of them in an inverted position (belly up) as if they were copulating. The subgroups were scattered in an area of 600 m during their circular navigation. In 50 min, they only moved 0.5 km from the initial position.

### Sighting #2

On 4 January 2018, at 1.0 nmi off Ponta da Picinguaba on the Ubatuba coast, 20 to 25 rough-toothed dolphins were swimming in a calm sea, with 0.5 m wavelength, with no winds, local depths between 12 and 15 m, and seawater temperature at 26.5°C. The observation period was from 1330 to 1430 h. In this sighting, the pod was also split in subgroups of three to five individuals that were

swimming at low speed and floating at the surface. After 20 to 30 min, they moved 300 to 400 m away from the original location and started chasing fish from multiple species such as mullets (*Mugil* sp.), “bicudas” or Guachanche barracuda (*Sphyræna guacacho*), and bluefishes (*Pomatomus saltatrix*). They caught the fish by holding them in their mouths. Sometimes the dolphins submerged and swam with the fish in their mouths or they breached, releasing the fish and catching it again. One of the dolphins held a large mullet (2 to 3 kg) in its mouth and then head-shook it quickly to behead the fish (Figure 3). The beheaded and partially eaten fish was later recovered floating.

### Sighting #3

On 1 March 2018, a pod of 30 to 40 rough-toothed dolphins was seen swimming near the surface along Boiçucanga beach on the São Sebastião coast in a calm sea, in depths of 17 m, and with a seawater temperature of 29°C. The group was observed from 1400 to 1530 h. The group was

divided in subgroups of 10 to 12 individuals swimming slowly in circles below the sea surface, diving periodically, and surfacing to breathe. They alternated this swimming behavior with fast attacks on unidentified schools of 2 to 3 kg fish.

#### Sighting #4

On 10 March 2018, aboard the boat *Ballerina*, a group of approximately 40 rough-toothed dolphins was sighted 3.5 nmi southwest of Ilhabela in calm waters, at 37 m depth, with a water temperature of 27°C. This pod was actively chasing Atlantic needlefish (*Strongylura marina*) and mullets during the 1130 to 1220 h observation period. The group was involved in foraging behaviors such as group attacks on surface and subsurface fishes, leaping and tail-slapping when approaching the fish school (Figure 4). The subsurface attacks involved a high speed chase. On several occasions, one dolphin caught a fish and threw it in the air to be caught by other dolphins as was recorded in one attack on an Atlantic needlefish (Figure 5).

#### Comparison of Observed Behavior with Previous Reports

Rough-toothed dolphins in Brazil have been reported traveling in pods of approximately 50 individuals divided in subgroups of three to 10 (Lodi & Hetzel, 1998). De Boer (2010) also described the behavior of rough-toothed dolphins swimming in synchrony and changing direction as one of them tail-slaps to command the action. This behavior of synchronized swimming in circles, diving coordinately, and changing direction when the tail-slaps occur has been described as cooperative foraging for this species (Lodi & Hetzel, 1999; Pitman & Stinchcom, 2002). Dolphins may also



**Figure 4.** A rough-toothed dolphin exhibiting tail-slapping behavior off Ilhabela (Ponta da Sela) on 10 March 2018 (Photo by J. Cardoso)



**Figure 5.** A rough-toothed dolphin chasing an Atlantic needlefish (*Strongylura marina*) off Ilhabela (Ponta da Sela) on 10 March 2018 (Photo by J. Cardoso)

stun or debilitate fish prey with the slaps of noisy leaps (as well as with tail-slaps). Tail-slapping was observed twice: in Sighting #1, probably as a social behavior; and in Sighting #4 during cooperative foraging activities, displaying the same behavior as described by Lodi & Hetzel (1999).

The individual and group attacks observed in Sighting #2 were also observed in the coastal waters of the Central Pacific Ocean by Ortega-Ortiz et al. (2014), where prey herding behavior was additionally performed by dolphins swimming in circles and using bubbles to catch fishes such as the black skipjack tuna (*Euthynnus lineatus*), the dolphinfish (*Coryphaena hippurus*), the Californian needlefish (*Strongylura exilis*), and the gafftopsail pompano (*Trachinotus rhodopus*). Benoit-Bird & Au (2009), using a multibeam echosounder, observed the foraging behavior of spinner dolphins (*Stenella longirostris*) in Hawaii, where they cooperate in groups, herding the prey to increase its density and maximize their feeding success rates. Holding the prey (“mullet”) in the mouth, head-shaking them, and beheading them were also behaviors observed in Ilha Grande Bay by Lodi & Hetzel (1999).

Attacks of rough-toothed dolphins on schools of squid were observed by Souza et al. (2009) in the Alcatrazes Archipelago on the northern coast of São Paulo when the dolphins were in interspecific competition with largehead hairtail (*Trichiurus lepturus*) for the same prey. Other records of multispecific feeding behavior of *S. bredanensis* were cited by Olmos et al. (2013) involving Wilson’s storm-petrels (*Oceanites oceanicus*), and by Lodi & Hetzel (1999) involving bottlenose dolphins, magnificent frigate birds (*Fregata magnificens*), and brown boobies (*Sula leucogaster*). Alternating subsurface diving with swimming at high speed during group attacks, as observed in Sightings #3 and #4, were also recorded as feeding behavior of

rough-toothed dolphins in Ilha Grande Bay, along with leaping and tail-slapping (Lodi & Hetzel, 1999).

Food items retrieved from stranded or incidentally caught specimens and additional field observation of feeding behavior in rough-toothed dolphins recorded along the southeastern and northeastern Brazilian coast include largehead hairtail (Lodi & Hetzel, 1999; Di Benedetto et al., 2001; Secco et al., 2010), castin leatherjack (*Oligoplites saliens*; Olmos et al., 2013), mullet (*Mugil curema*), sardine (*Sardinella* sp.), ballyhoo halfbeak (*Hemiramphus brasiliensis*), sharksucker (*Echeneis naucrates*; Wedekin et al., 2004), Atlantic needlefish, and squids (*Loligo plei* and *L. sanpaulensis*) (Lodi & Hetzel, 1999; Santos & Haimovici, 2001; Melo, 2010; Lodi et al., 2012). Gurjão et al. (2004) found six beheaded fishes in the stomach of a dead, stranded rough-toothed dolphin on the coast of Ceará state, Brazil. He also found one fish from the Sciaenidae family and 54 eye lenses in a second examined carcass. Our observations confirm the mullet, and add the Atlantic needlefish, guachanche barracuda, and bluefishes as items in the diet of free-ranging rough-toothed dolphins in coastal São Paulo state waters.

Besides rough-toothed dolphins' feeding behavior, an anomalously white juvenile was recorded during Sighting #1 displaying a whitish/light grey coloration, slightly showing the characteristic dorsal cape. The eyes, forehead, dorsal fin, and rostrum were darker than the rest of its body (Figures 2 & 6A).

The “Beluguinha,” or “little white whale” as it was called by the observer team, displayed the same feeding behavior as the other dolphins. It also swam slowly, eventually speeding away from the group and then returning to swim in close association with the adults. It was escorted by the same adult, presumably his mother, as confirmed by the photographic analyses of the escort's dorsal fin marks (Figure 6).

Anomalous pigmented cetacean records are uncommon. Individuals in several species have been documented with albino, piebald, leucistic, and melanistic patterns. *Albinism* refers to the total lack of melanin, while *leucism* refers to partial lack, though the individual's eye coloration remains dark. *Piebald* individuals show black and white/light grey patches in some parts of their bodies. *Melanism* occurs when there is an abnormal increase of melanin in the animals' skin. In cetaceans, leucism has been recorded among 21 species (Fertl & Rosel, 2009). The body pigmentation pattern we observed suggests a case of leucism; however, as pointed out by Toledo et al. (2018), it is necessary to analyze tissue samples to determine if the insufficient melanin is due to



**Figure 6.** Leucistic rough-toothed dolphin juvenile in the company of the same escort in two consecutive shots (A and B) off Ilhabela (Ponta Grossa) on 9 December 2017 (Photos by J. Cardoso)

the heritable condition that results in leucism or albinism.

In 2009, the first record of an all-white rough-toothed dolphin was confirmed in the southern Gulf of Guinea on the west coast of Africa. It was a calf in a pod of at least 50 individuals; thus, it was not possible to determine if it was an albino or a leucistic individual. The calf was escorted by an adult, swimming in the echelon position, indicating a mother–calf pair (De Boer, 2010). In Brazil, there are records for anomalously pigmented cetaceans for franciscana, Guiana, and Atlantic spotted dolphins (Lodi & Borobia, 2013; Cremer et al., 2014; Toledo et al., 2018).

In the photo-identification catalogue of the Laboratório de Biologia da Conservação de Mamíferos Aquáticos, Instituto Oceanográfico, Universidade de São Paulo (LABCMA, IO-USP), there were 18 piebald dorsal fins recorded among 71 individually photo-identified rough-toothed dolphins from nearby shore waters (LABCMA, 2017). This gives a figure of approximately 25% of light grey dorsal fins or hypopigmented rough-toothed dolphins which could be a phenotypic characteristic of this population inhabiting the northern São Paulo coast. Alves et al. (2017)

described seven sightings of anomalously pigmented *D. delphis* and *S. frontalis* recorded off Madeira Island between 2014 and 2016. These authors emphasize that despite inherent limitations of this condition, adult dolphins observed off Madeira confirmed that some anomalously pigmented individuals can live for a long time in the wild. In addition, they highlighted the value of sharing photographs via social media forums.

Leucism and albinism can affect the survival of the individuals by making them prone to skin cancer and sunburn. It may also affect their thermoregulation processes and expose them to predators due to the lack of countershading (Fertl & Rosel, 2009). Therefore, sightings of such rare conditions should be tracked and reported whenever possible.

Our findings are the first record for an anomalously white pigmented *Steno bredanensis* in Brazilian waters. In addition, comparing photographs of previously catalogued individuals in the area can suggest a prevailing phenotypic pattern of hypopigmented rough-toothed dolphins occurring off the northern coast of São Paulo state. Certainly, further investigation of the prevalence of such anomalous coloration in a coastal population of rough-toothed dolphins in southeastern Brazil would be essential for evaluating their health status. Besides the record on an anomalously pigmented juvenile *S. bredanensis*, the presented information on social and feeding behavior is a significant contribution to the use of a coastal protected marine area, adding valuable information to this yet poorly known species.

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