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Short Note

Rostrum Contact Behaviors by the Guiana Dolphin (*Sotalia guianensis*) in Ilhéus, Brazil

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Dolphins exchange information via contact behaviors, vocalizations, and postures (Dudzinski et al., 2009a). Contact behaviors have been extensively described for a few species—for example, caressing in spinner dolphins (*Stenella longirostris*; Johnson & Norris, 1994), rubbing in Atlantic spotted dolphins (*S. frontalis*; Dudzinski, 1998), petting in bottlenose dolphins (*Tursiops* sp.; Mann & Smuts, 1998, 1999) and Atlantic spotted dolphins (Dudzinski, 1998), contact swimming in bottlenose dolphins (*T. aduncus*; Connor et al., 2006), and flipper rubbing in Indo-Pacific bottlenose dolphins (*T. aduncus*; Sakai et al., 2006; Dudzinski et al., 2010, 2012) and Atlantic spotted dolphins (Dudzinski et al., 2009b). The definitions of most of these behaviors emphasize contact between pectoral fins, contact of other body parts between two animals, and pectoral fin contact with the body parts of another animal (see Sakai et al., 2006, for a review).

In some cases, the general context of their occurrence was specified; simple body-to-body contact was frequently observed during play bouts in Atlantic spotted dolphins, while flipper rubbing was an affiliative behavior in Indo-Pacific bottlenose dolphins (Dudzinski, 1998; Sakai et al., 2006). Paulos et al. (2008) showed that Atlantic spotted dolphins exhibited some specific contact behaviors (e.g., touch with rostrum) after joining a group or before departure, while other tactile actions were performed before the departure of individual in Indo-Pacific bottlenose dolphins (e.g., touch with pectoral fin). The results of a recent study indicate that bottlenose dolphins also produce a variety of sounds that may inform a partner about their interest in a pectoral fin contact interaction (Evans-Wilent & Dudzinski, 2013).

The Guiana dolphins (*Sotalia guianensis*) are a small coastal species considered vulnerable in Brazilian waters according to International Union for Conservation of Nature (IUCN) criteria (Instituto Chico Mendes de Conservação da Biodiversidade [ICMBio], 2014). They usually form groups of one to 15 dolphins, but aggregations of up to 450 individuals have been reported (Da Silva et al., 2010). Their social network is composed of a few strong and many weak ties (Cantor et al., 2012). Contact behaviors have been poorly described for Guiana dolphins because this coastal species mostly frequents waters with low visibility (Izidoro & Le Pendu, 2012a), limiting observation below the surface. However, one study reported rostrum contact between infants of Guiana dolphins, and it has been suggested that this and other touching behaviors between infants may occur in affiliative or playful contexts (Monteiro-Filho et al., 2008).

Play has been reported in several Brazilian Guiana dolphin populations (e.g., Cananeia: Geise et al., 1999; Pipa beach: Spinelli et al., 2002; "Dolphin Bay": Souto et al., 2006; Ilhéus: Izidoro & Le Pendu, 2012b). None of these studies provided a detailed description of contact and rubbing events during play bouts, although Spinelli et al. (2002) observed frequent physical contact during social play at Pipa beach. Playful behaviors in this species are characterized by a lack of apparent function and excessive repetition, intensity, or frequency (adapted from Spinelli et al., 2002). Previously, we described the play behaviors performed by Guiana dolphins in Ilhéus (Izidoro & Le Pendu, 2012b). Herein, we provide a description of the occurrences of rub with rostrum and reciprocal nuzzle—two surface contact behaviors involving the rostrum performed by Guiana dolphins in Ilhéus, Brazil—and discuss their possible functions.

The dolphins were observed at the edge of a breakwater of 2.3 km length in the Port of Ilhéus (14º 47' S, 39º 02' W), along the south coast of Bahia, Brazil. This location was chosen due to favorable conditions that facilitated monitoring the behavior of these dolphins (Izidoro & Le Pendu, 2012a): they remain at this location almost every day (Reis, 2004) and spend long periods near the edge of the breakwater (Santos et al., 2013).

Data were collected only in Beaufort Sea states of 0 to 3 from September 2007 to August 2008, yielding a total of 548.3 h of monitoring. Data were collected 12 d/mo during 4-h observation sessions between 0700 and 1730 h. The monitored area was measured with a theodolite (Santos et al., 2013) and was a circular area with a radius of 300 m (321,700 m^2). When observing dolphins within this area, we were able to determine visually three age classes: (1) infants (grey-pinkish color and up to ⅔ of the size of an adult), (2) juveniles (grey back and more than ⅔ of the size of an adult), and (3) adults (Randi et al., 2008; Izidoro & Le Pendu, 2012b). When the age of an individual remained uncertain, he was classified as undetermined. To facilitate the visual determination of age classes, data were collected only during good weather conditions, and binoculars were used to determine age class when needed. Furthermore, 80% of the groups in the area were composed of only two to five dolphins (Izidoro & Le Pendu, 2012a); groups remained at a median distance of 110 m from the land-based point of observation (Santos, 2010), and sometimes as close as 10 m from the shore.

A group was defined as two or more dolphins moving in the same direction and often engaged in the same activity (adapted from Shane, 1990). We noted the time that dolphins departed from or joined a group, the total number of dolphins in a group, the number of individuals engaged in a play bout, and the age class of each animal. We considered the dolphin(s) as having departed or joined a group when the number of animals in a group changed for at least 10 min.

Behavioral data were collected using an all occurrence sampling protocol (Altmann, 1974). Every play bout occurring during monitoring sessions at the surface in this circular study area was recorded as well as the time of its occurrence. A play bout was composed of single or

Figure 1. Photographs of rub with rostrum events (above to face side and below to dorsal fin) performed by Guiana dolphins (*Sotalia guianensis*) in Ilhéus (Photos by Flavia B. Izidoro)

successive play events, each sequential event being performed by one or several individuals at not more than a 10-s interval after the preceding play event (Mackey et al., 2014). Play events were grouped into six categories: (1) play with object, (2) play with prey, (3) aerial play, (4) surfing play, (5) social play, and (6) impulsion play. The social play category included social locomotor play and contact play (see Izidoro & Le Pendu, 2012b, for a detailed description). An animal performed a contact play when he used his rostrum to touch any part of another individual's body (Izidoro & Le Pendu, 2012b). Two contact play events were observed: (1) rub with rostrum and (2) reciprocal nuzzle. A rub with rostrum event occurred when an animal used his rostrum to touch and then rub any part of the body of another individual. A reciprocal nuzzle, as defined by Dudzinski (1996) and Paulos et al. (2008), was recorded when two or more individuals rubbed their rostrums against each other's bodies. The body part of the receiver of a rub with rostrum varied from the head to the back and pectoral fins or fluke (Figure 1) but was never documented at the genital region when a dolphin was ventral up at the water surface. The receiver usually remained still while being rubbed or turned to offer another body part to the initiator.

For this study, we investigated if these two rostrum contact events were play events. We examined the age class of the initiators and receivers and analyzed if rostrum contact events were preceded and/or followed by other play events. An exact binomial test of goodness-of-fit was used to examine whether the initiators of reciprocal nuzzles reflected the proportion of juveniles and adults documented during monitoring (no infant was observed performing a reciprocal nuzzle). Individuals of unidentified age class were not included in the exact binomial test.

Dolphins were present during 122 of the 137 sampling days and for 52.4% of the sampling time; we observed 56 singletons and 425 groups in the area (Izidoro & Le Pendu, 2012a). Groups were usually composed of two ($N = 192$) or three individuals ($N = 105$), and rarely more than six ($N = 13$). We documented 116 infants, 335 juveniles, 443 adults, and 512 individuals of undetermined age classes. We observed 2,794 play events, including 1,288 social play events (see Izidoro & Le Pendu, 2012b, for further details).

The rostrum was recorded to be involved in 31 occurrences of surface contact behaviors (rub with rostrum: $N = 4$ and reciprocal nuzzle events: $N = 27$) during 15 different sampling days. The rub with rostrum events were not preceded or followed by another play event; also, 13 of the 27 reciprocal nuzzles were not preceded or followed by another play event. Reciprocal nuzzles were observed in

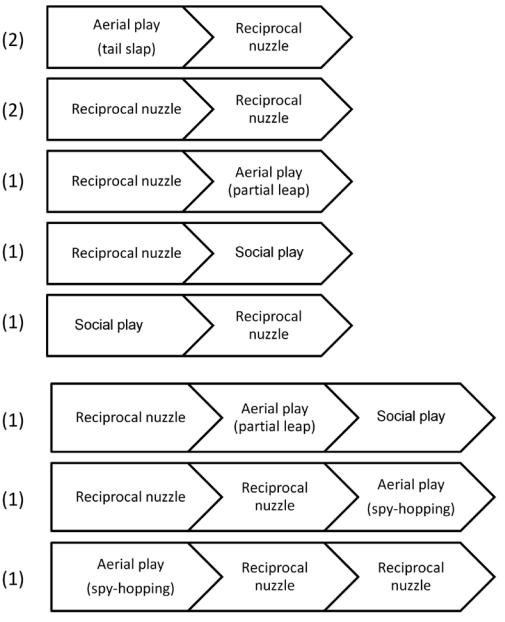

Figure 2. Play bouts (i.e., sequence of events) including reciprocal nuzzle(s) performed by Guiana dolphins in Ilhéus; the number of bouts is indicated in parentheses.

10 play events: seven bouts included two behavior events each, while three bouts included three behavior events each (Figure 2). Aerial or social play preceded or followed a reciprocal nuzzle in eight bouts, whereas two bouts involved only an exchange of reciprocal nuzzles (Figure 2). When performed twice during a bout, the second reciprocal nuzzle was always performed by the same individual that performed the first one.

Rub with rostrum events were initiated by one infant toward an unidentified age class individual, by a juvenile towards an infant and by two unidentified age class individuals towards a juvenile and an adult. A reciprocal nuzzle was generally performed by a pair ($N = 24$ events) but occasionally by four ($N = 1$), five ($N = 1$), or seven ($N = 1$) dolphins in a group (Table 1). We determined the age class of 34 initiators of reciprocal nuzzles. The observed number of juveniles ($N = 27$) and adults ($N = 7$) differed significantly from the number of juveniles ($N = 335$) and adults ($N = 443$) documented during monitoring (exact binomial test of goodness-of-fit, $p = 0.00031$). Juveniles initiated 3.86 more reciprocal nuzzles than adults. When considering all play events, juveniles performed 1.52 more play behaviors than adults (juveniles: $N = 1,056$ and adults: $N = 697$; Izidoro & Le Pendu, 2012b).

Table 1. Description of bouts, including one or more reciprocal nuzzles: number of events per bout, number of initiators, number of reciprocal nuzzles, and number of individuals of each age class initiating reciprocal nuzzles in these bouts

Events per bout	Number of initiators	Number of bouts	Number of reciprocal nuzzles	Juveniles	Adults	Undetermined
1	2	11	11	10	2	10
1	4	1	1	1	3	
1	7	1	1	3	2	2
2	2	6	8	7		5
2	5	1	1			5
3	5	3	5	6		
Total		23	27	27	7	22

No specific context was associated with rub with rostrum events since we only observed this contact behavior four times. Nonetheless, one rub with rostrum event occurred 1 min after a joining event and another occurred during the minute preceding the departure event. Atlantic spotted and Indo-Pacific bottlenose dolphins frequently touch other dolphins before leaving and after joining a group or after being touched (Paulos et al., 2008). Atlantic spotted dolphins touch other individuals with their rostrum significantly more than expected before leaving and after joining a group (Paulos et al., 2008). None of the rub with rostrum events performed by Guiana dolphins was immediately followed by another contact behavior observable at the surface. Reciprocal nuzzles were frequently immediately followed by another that was always performed by the same individual that performed the first reciprocal nuzzle, but they never did so more than one lag after the first. In spotted and Indo-Pacific bottlenose dolphins, touch with rostrum (i.e., touch not followed by a rub) and reciprocal nuzzle events occur significantly more often than expected by chance within three behavior events performed before or after another touch behavior (Paulos et al., 2008). Such differences may be related to different observational conditions between the two studies: we recorded contact behaviors only at the surface, while Paulos et al. (2008) examined successive events sequentially from data collected under water. Alternatively, these differences might be related to species differences; however, additional data are required to address this possibility.

Rub with rostrum and reciprocal nuzzle events may help to remove parasites and dead skin as suggested for pectoral fin rubbing by bottlenose dolphins (Connor et al., 2006; Sakai et al., 2006). Nonetheless, we never observed macroscopic parasites, sloughing skin, or skin diseases as reported in other populations (Van Bressem et al., 2009), either with binoculars, the naked eye, or within the many high-resolution photographs taken during photo-identification sessions. Carvalho et al. (2010) did not identify any parasite on the skin for 21 Guiana dolphins rescued off the northeastern coast of Brazil. In addition, no animal was observed rubbing on the rocks and concrete stones used for construction of the breakwater for the possible removal of macroscopic parasites. We would probably have detected such rubbing events despite the low water visibility because the depth is shallow near the breakwater and the neighboring seabed is muddy with no rocks.

The primary function of contact by rostrum touches or rubs is probably not hygienic as was also concluded for contacts with fluke and rostrum (Dudzinski et al., 2012), and contact behaviors in Indo-Pacific bottlenose dolphins (Sakai et al., 2006; Dudzinski et al., 2009b), bottlenose dolphins (Tamaki et al., 2006; Dudzinski et al., 2010), and Atlantic spotted dolphins (Dudzinski et al., 2009b). Thus, the most plausible explanations of the contact interactions documented in our study are a socio-sexual or a play function.

Contact behaviors are often interpreted as having a socio-sexual function when oriented to a dolphin's ventral (Johnson & Norris, 1994) or genital regions (Dudzinski, 1996). Genital buzzes in bottlenose dolphins (Herzing, 1996) and rostrum to genital contact in Atlantic spotted dolphins (Dudzinski, 1998) are behaviors considered sexual. Rostrum contact behaviors performed by Guiana dolphins at the surface did not seem to reflect a sexual context as none of the observed rostrum contact events was oriented towards the genital region. Thus, our observations do not support a possible sexual function of rostrum contact events in this population.

Juvenile Guiana dolphins play significantly more than adults in the population of Ilhéus (Izidoro & Le Pendu, 2012b). Spinelli et al. (2002) also considered that play is mainly performed by juveniles in this species, although they often observed adults engaged in play activity in groups with immatures and did not consider groups only

composed of adults in their analyses of play. Play behavior has been observed in both immature and adults dolphins, although infants and juveniles usually play more than adults (Paulos et al., 2010; Kuczaj & Eskelinen, 2014). Bottlenose dolphin calves initiate an increasing percentage of social play bouts during their first year (Mackey et al., 2014). According to the surplus resource model (Burghardt, 1999), protection of youngsters against the threat of predators would be guaranteed by parental care that supports younger individuals by providing them with food. This would allow the young ones to play more frequently.

Guiana dolphins performing reciprocal nuzzles were mainly juveniles, similar to Paulos et al.'s (2008) observations of Atlantic spotted and bottlenose dolphins. Although our observations focused on play behaviors, we suggest the reciprocal nuzzle is a play behavior for the following reasons. First, juveniles of this population play significantly more than adults (Izidoro & Le Pendu, 2012b). Second, a reciprocal nuzzle was frequently preceded or followed by other play events or another reciprocal nuzzle in a bout. Third, in our observations, it is not a courtship behavior since we did not document any adult dyads engaged in reciprocal nuzzles. Lastly, no other obvious function for this behavior could be identified during our observations. Such lack of obvious function is a characteristic of play behaviors in this (Spinelli et al, 2002) and other species (Martin & Caro, 1985).

Rub with rostrum and reciprocal nuzzle are two rostrum contact events performed by Guiana dolphins at the surface. Rub with rostrum was rare and not performed in a sequence of play events. Conversely, reciprocal nuzzle was frequently performed by juveniles and preceded or followed by other play events, suggesting that it is a play behavior. The study of contact behaviors in Guiana dolphins is only possible in a few locations where the dolphins stay a sufficient amount of time for an observer to document these rare surface events. Despite these difficulties, we need to understand better the social behavior of the Guiana dolphin to manage this coastal species, which is susceptible to numerous anthropogenic threats (Azevedo et al, 2009; ICMBio, 2014). Further land-based observations should allow for verification as to whether rub with rostrum and reciprocal nuzzle are associated with departure or joining events and should confirm that a reciprocal nuzzle is mainly a play behavior. Photo-identification and acoustic recording of individuals engaged in such interaction also will provide valuable information for understanding the context and function of contact behaviors in Guiana dolphins.

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Literature Cited

Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour*, *49*, 227-267. http://dx.doi.org/10.1163/156853974X00534

Azevedo, A. F., Lailson-Brito, J., Dorneles, P. R., van Sluys, M., Cunha, H. A., & Fragoso, A. B. L. (2009). Human-induced injuries to marine tucuxis (*Sotalia guianensis*) (Cetacea: Delphinidae) in Brazil. *Marine Biodiversity Records*, *2*, 2004-2008. http://dx.doi.org/10.1017/S1755267208000262

Burghardt, G. M. (1999). The conceptions of play and the evolution of animal minds. *Evolution and Cognition*, *5*(2), 115-123.

Carvalho, V. L., Bevilaqua, C. M. L., Iñiguez, A. M., Mathews-Cascon, H., Ribeiro, F. B., Pessoa, L. M. B., . . . de Lima Silva, F. J. (2010). Metazoan parasites of cetaceans off the northeastern coast of Brazil. *Veterinary Parasitology*, *173*(1-2), 116-122. http://dx.doi.org/10.1016/j.vetpar.2010.06.023

Cantor, M., Wedekin, L. L., Guimarães, P. R., Daura-Jorge, F. G., Rossi-Santos, M. R., & Simões-Lopes, P. C. (2012). Disentangling social networks from spatiotemporal dynamics: The temporal structure of a dolphin society. *Animal Behaviour*, *84*(3), 641-651. http://dx.doi.org/10.1016/j.anbehav.2012.06.019

Connor, R. C., Mann, J., & Watson-Capps, J. (2006). A sex-specific affiliative contact behavior in Indian Ocean bottlenose dolphins, *Tursiops* sp. *Ethology*, *112*(7), 631-638. http://dx.doi.org/10.1111/j.1439-0310.2006.01203.x

Da Silva, V. M. F., Fettuccia, D., Rodrigues, E. S., Edwards, H. H., Moreno, I. B., Moura, J. F., . . . Utreras B., V. (2010). Report of the working group on distribution, habitat characteristics and preferences, and group size. *Latin American Journal of Aquatic Mammals*, *8*(1-2), 31-38. http://dx.doi.org/10.5597/lajam00151

Dudzinski, K. M. (1996). *Communication and behavior in the Atlantic spotted dolphin (*Stenella frontalis*): Relationships between vocal and behavioral activities* (Doctoral dissertation). Texas A & M University, College Station.

Dudzinski, K. M. (1998). Contact behavior and signal exchange in Atlantic spotted dolphins (*Stenella frontalis*). *Aquatic Mammals*, *24*(3), 129-142.

Dudzinski, K. M., Douaze, E., & Thomas, J. (2009a). Communication in marine mammals. In W. F. Perrin, B. Würsig, & J. G. M. Thewissen (Eds.), *Encyclopedia of marine mammals* (2nd ed., pp. 260-268). London: Elsevier. http://dx.doi.org/10.1016/B978-0-12-373553-9.00064-X

Dudzinski, K. M., Gregg, J. D., Paulos, R. D., & Kuczaj II, S. A. (2010). A comparison of pectoral fin contact behaviour for three distinct dolphin populations. *Behavioural Processes*, *84*(2), 559-567. http://dx.doi.org/10.1016/j.beproc.2010.02.013

Dudzinski, K. M., Gregg, J. D., Ribic, C. A., & Kuczaj II, S. A. (2009b). A comparison of pectoral fin contact between two different wild dolphin populations. *Behavioural Processes*, *80*(2), 182-190. http://dx.doi.org/10.1016/j.beproc.2008.11.011

Dudzinski, K. M., Gregg, J. D., Melillo-Sweeting, K., Seay, B., Levengood, A., & Kuczaj II, S. A. (2012). Tactile contact exchanges between dolphins: Self-rubbing versus inter-individual contact in three species from three geographies. *International Journal of Comparative Psychology*, *25*, 21-43.

Evans-Wilent, J., & Dudzinski, K. M. (2013). Vocalizations associated with pectoral fin contact in bottlenose dolphins (*Tursiops truncatus*). *Behavioural Processes*, *100*, 74-81. http://dx.doi.org/10.1016/j.beproc.2013.07.025

Geise, L., Gomes, N., & Cerqueira, R. (1999). Behaviour, habitat use and population size of *Sotalia fluviatilis* (Gervais, 1853) (Cetacea, Delphinidae) in the Cananéia estuary region, São Paulo, Brazil. *Brazilian Journal of Biology*, *59*(2), 183-194. http://dx.doi.org/10.1590/s0034-71081999000200002

Herzing, D. L. (1996). Vocalizations and associated underwater behavior of free-ranging Atlantic spotted dolphins, *Stenella frontalis*, and bottlenose dolphins, *Tursiops truncatus*. *Aquatic Mammals*, *22*(2), 61-79.

Instituto Chico Mendes de Conservação da Biodiversidade [ICMBio]. (2014). *Sotalia guianensis*. Retrieved from www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/6152-especie-6152.html

Izidoro, F. B., & Le Pendu, Y. (2012a). Estuarine dolphins (*Sotalia guianensis*) (Van Bénéden, 1864) (Cetacea: Delphinidae) in Porto de Ilhéus, Brazil: Group characterisation and response to ships. *North-Western Journal of Zoology*, *8*(2), 232-240.

Izidoro, F. B., & Le Pendu, Y. (2012b). Estuarine dolphins (*Sotalia guianensis*, Cetacea, Delphinidae) play at Porto de Ilhéus harbor, Bahia, Brazil. *Pan-American Journal of Aquatic Sciences*, *7*(1), 27-36.

Johnson, C., & Norris, K. (1994). Social behavior. In K. Norris, B. Würsig, R. Wells, & M. Würsig (Eds.), *The Hawaiian spinner dolphin* (pp. 243-286). Berkeley: University of California Press.

Kuczaj II, S. A., & Eskelinen, H. C. (2014). Why do dolphins play? *Animal Behavior and Cognition*, *1*(2), 113-127. http://dx.doi.org/10.12966/abc.05.03.2014

Mackey, A. D., Makecha, R. N., & Kuczaj II, S. A. (2014). The development of social play in bottlenose dolphins (*Tursiops truncatus*). *Animal Behavior and Cognition*, *1*(1), 19-35. http://dx.doi.org/10.12966/abc.02.02.2014

Mann, J., & Smuts, B. B. (1998). Natal attraction: Allomaternal care and mother-infant separations in wild bottlenose dolphins. *Animal Behaviour*, *55*, 1097-1113. http://dx.doi.org/10.1006/anbe.1997.0637

Mann, J., & Smuts, B. B. (1999). Behavioral development in wild bottlenose dolphin newborns (*Tursiops* sp.). *Behaviour*, *136*, 529-566. http://dx.doi.org/10.1163/156853999501469

Martin, P., & Caro, T. (1985). On the functions of play and its role in behavioral development. *Advances in the Study of Animal Behavior*, *15*, 59-103. http://dx.doi.org/10.1016/S0065-3454(08)60487-8

Monteiro-Filho, E. L. A., Neto, M. M. S., & Domit, C. (2008). Comportamento de infantes [Behavior of infants]. In *Biologia, ecologia e conservação do boto-cinza* (pp. 127-137). São Paulo: Câmara Brasileira do Livro.

Paulos, R. D., Dudzinski, K. M., & Kuczaj II, S. A. (2008). The role of touch in select social interactions of Atlantic spotted dolphin (*Stenella frontalis*) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). *Journal of Ethology*, *26*(1), 153-164. http://dx.doi.org/10.1007/s10164-007-0047-y

Paulos, R. D., Trone, M., & Kuczaj II, S. A. (2010). Play in wild and captive cetaceans. *International Journal of Comparative Psychology*, *23*, 701-722.

Randi, M. A. F., Rassolin, P., Rosas, F. C. W., & Monteiro-Filho, E. L. A. (2008). Padrão de cor de pele [Skin color pattern]. In E. L. A. Monteiro-Filho & K. D. K. A. Monteiro (Eds.), *Biologia, ecologia e conservação do boto-cinza* [Biology, ecology, and conservation of the estuarine dolphin] (pp. 11-16). São Paulo: Câmara Brasileira do Livro.

Reis, M. d. S. S. dos. (2004). Ecologia comportamental do boto *Sotalia guianensis* no porto de Ilhéus [Behavioral ecology of the boto *Sotalia guianensis* at Port of Ilhéus]. In *I Workshop do Nordeste de Pesquisa e Conservação de* Sotalia fluviatilis (pp. 51-59). Mossoró: Edições UERN.

Sakai, M., Hishii, T., Takeda, S., & Kohshima, S. (2006). Flipper rubbing behaviors in wild bottlenose dolphins (*Tursiops aduncus*). *Marine Mammal Science*, *22*(4), 966-978. http://dx.doi.org/10.1111/j.1748-7692.2006.00082.x

Santos, M. S. (2010). *Sazonalidade e interação com embarcação do boto-cinza,* Sotalia guianensis*, (Cetacea: Delphinidae) no Porto do Malhado, Ilhéus, Bahia-Brasil* [Seasonality and interaction with boats of the estuarine dolphin, *Sotalia guianensis* (Cetacea: Delphinidae) in the Port of Malhado, Ilhéus, Bahia-Brazil] (Master's thesis). Universidade Estadual de Santa Cruz, Ilhéus,

Brazil. Retrieved from http://nbcgib.uesc.br/ppgsat/files/PPGSAT/Defesas%202010/Mariana_Soares_Santos.pdf

Santos, M. S., Schiavetti, A., & Alvarez, M. R. (2013). Surface patterns of *Sotalia guianensis* (Cetacea: Delphinidae) in the presence of boats in Port of Malhado, Ilhéus, Bahia, Brazil. *Latin American Journal of Aquatic Research*, *41*(1), 80-88. http://dx.doi.org/10.3856/vol41-issue1-fulltext-6

Shane, S. H. (1990). Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In S. Leatherwood & R. Reeves (Eds.), *The bottlenose dolphin* (pp. 245-265). San Diego: Academic Press. http://dx.doi.org/10.1016/b978-0-12-440280-5.50016-0

Souto, A. D. S., Araújo, J. P. de, Geise, L., & de Araújo, M. E. (2006). The surface behavior of the estuarine dolphin in Baía dos Golfinhos, RN, Brazil: A field and comparative study. *Zoociências*, *8*(2), 183-192.

Spinelli, L. H. P., Nascimento, L. F. do, & Yamamoto, M. E. (2002). Identificação e descrição da brincadeira em uma espécie pouco estudada, o botocinza (*Sotalia fluviatilis*) em seu ambiente natural [Identification and description of play in a scarcely studied species, the tucuxi (*Sotalia fluviatilis*) in a field site]. *Estudos de Psicologia*, *7*(1), 165-171. http://dx.doi.org/10.1590/S1413-294X2002000100017

Tamaki, N., Morisaka, T., & Taki, M. (2006). Does body contact contribute towards repairing relationships? The association between flipper-rubbing and aggressive behavior in captive bottlenose dolphins. *Behavioural Processes*, *73*(2), 209-215. http://dx.doi.org/10.1016/j.beproc.2006.05.010

Van Bressem, M., César, M., Santos, M. C. de O., Emi, J., Oshima, D. F., & Oshima, J. E. D. F. (2009). Skin diseases in Guiana dolphins (*Sotalia guianensis*) from the Paranaguá estuary, Brazil: A possible indicator of a compromised marine environment. *Marine Environmental Research*, *67*(2), 63-68. http://dx.doi.org/10.1016/j.marenvres.2008.11.002