

Short Note

Epimeletic Behavior of Guiana Dolphins (*Sotalia guianensis*) Towards a Calf Supposedly Killed by a Motorboat in Brazil

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Epimeletic behavior, or care-giving behavior, is a term originally used by Scott (1958) to describe animal behavior that involves the giving of care or attention. If the care or attention is directed by an adult towards a young animal (usually mother and calf), it is termed *nurturant*. If directed by adults to distressed adults, it is termed *succorant* (Caldwell & Caldwell, 1966).

In cetaceans, the assistance usually consists of a healthy animal or animals swimming alongside an incapacitated group member, helping it to stay at the surface or taking it away from an apparent source of danger (Norris & Prescott, 1961). Descriptions of cetacean epimeletic behavior are more common for Odontoceti, especially delphinids (Caldwell & Caldwell, 1966; Félix, 1994; Fertl & Schiro, 1994). Helping dead dolphins to stay at the surface has rarely been observed in the wild; but in captive conditions, there are many records of such events (Félix, 1994). Epimeletic behavior can be directed to individuals of the same or different species. Interspecific epimeletic behavior performed by dolphins has been described towards *Tursiops truncatus*–*Lagenorhynchus obliquidens* (Brown & Norris, 1956), *T. truncatus*–*Delphinus delphis* (Essapian, 1962), and *Globicephala macrorhynchus*–*L. obliquidens* (Caldwell et al., 1963). Intraspecific epimeletic behavior usually involves adults and dead calves (Cockcroft & Sauer, 1990; Lodi, 1992; Félix, 1994; Fertl & Schiro, 1994; Santos et al., 2000; Cremer et al., 2006; Moura et al., 2008).

The Guiana dolphin (*Sotalia guianensis*; Van Bénédén, 1864) is a small delphinid found in the western Atlantic Ocean of South and Central America, from southern Brazil (27° 35' S, 48° 35' W) to Nicaragua (14° 35' N, 83° 14' W). The species occurs in estuaries, bays, and other protected shallow coastal waters, but it has been recorded as far as 70 km from the coast in water 40 m deep (Rossi-Santos et al., 2006). Due to its coastal distribution, the species is very susceptible to incidental mortality in fishing gear and vessel strikes, direct killing for human consumption or use as bait, religious purposes, and health issues resulting from exposure to contaminants (Alves et al., 2010; ICMBio, 2011; Alonso et al., 2015). Despite being categorized as “Data Deficient” by the International Union for Conservation of Nature (IUCN) (Secchi et al., 2012), the Guiana dolphin is categorized as “Vulnerable” for conservation purposes in Brazil (Ministerio do Meio Ambiente [Ministry of the Environment] [MMA], 2014). Herein, we present and describe video footage of epimeletic behavior in *S. guianensis* resulting from a fatal interaction between a dolphin and a boat in Brazil (see video footage on the “Supplemental Materials” page of the *Aquatic Mammals* website: www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=10&Itemid=147).

The observation was recorded at Curral Beach (6° 13' S, 35° 05' W) in Pipa Bay, Rio Grande do Norte State, northeastern Brazil. This bay is surrounded by cliffs and is called Dolphin Bay

because it hosts a resident population of dolphins in its turbid, calm, and shallow waters (with a maximum of 7 m deep). Within the bay, groups of Guiana dolphins are frequently sighted year-round, which has led to an increase in boat-based dolphin-watching activities, particularly commercial (Tosi & Ferreira, 2008). The bay is currently part of a Marine Protected Area, the Tibau do Sul Coastal Fauna Reserve (REFAUTS; Lunardi & Ferreira, 2013), dedicated to the protection of the dolphins.

Previous studies show that Dolphin Bay is an important site for *S. guianensis*, where animals are seen exhibiting a complex behavioral repertoire with 30 events distributed in four states: (1) resting, (2) travelling, (3) feeding, and (4) socializing (Nascimento et al., 2008; Tosi & Ferreira, 2008; Lunardi, 2011). Other studies have shown that Guiana dolphins have a high degree of site fidelity (Paro, 2010) and are genotypically distinct to other areas in Brazil (Cunha et al., 2005).

Video footage was recorded from a motorboat positioned ca. 25 to 30 m away from the focal dolphin group. The focal group method (Altmann, 1974) was used to record behavioral states and events. Three size classes were adopted: (1) adult, (2) juvenile, and (3) calf (about $\frac{3}{4}$ and $\frac{1}{2}$ of the body length of an adult animal, respectively).

At 0900 h on 11 June 2011, a dolphin-watching boatman noticed a speedboat passing over a group of dolphins and then observed an adult dolphin trying to lift a calf above the surface. Immediately, the boatman contacted us and began to record the dolphins' behavior on video until our arrival. The following events are described from a 40-min uninterrupted video, recorded between 0923 and 1003 h (see video highlights).

The first sighting of the calf in the video was at 63 s when it appeared floating belly-up. Next, we observed successive attempts of the presumed mother to lift the calf to the surface using its rostrum, its back, and sometimes its tail. The calf was sinking and without movement; therefore, we assume it was dead. The group consisted of the mother-calf pair, another adult, and a juvenile, which remained in proximity throughout the video footage. At that time, the intervals between breaths of the presumed mother were less than 20 s. The other adult and the juvenile dolphin were close by (~5 m), swimming in circles around the mother and injured calf pair. All three animals maintained the position and the epimeletic behavioral state even with the approach of other dolphin-watching motorboats. Dolphin activity decreased after 21 min, while the breathing intervals became longer (30 s), and the frequency and the intensity of the adult's attempt to lift the dead calf decreased (the presumed mother was apparently exhausted). In the meantime, the other

dolphins exhibited other social displays such as head-slapping, tail-slapping, and spy-hopping. At 36 min, a larger boat with about 25 people aboard (a schooner with a 6 cc diesel engine) approached very close to the mother-calf (< 15 m), but the mother kept exhibiting epimeletic behavior until the dolphins were out of sight at 38 min.

When our team arrived at the location, the focal group was about 100 m from the boat and joined other Guiana dolphins, forming a larger group of 10 individuals with no sign of the dead calf. During the next 2 d, surveys of the shoreline were done to look for the carcass of the calf which was never recovered; therefore, the cause of death was not established.

Cetacean epimeletic behavior can last a few hours (Lodi, 1992; Santos et al., 2000; Cremer et al., 2006) to a number of days (Wells, 1991; Moura et al., 2008). However, extreme cases have been recorded; for example, Tayler & Saayman (1972) reported a captive female bottlenose dolphin (*Tursiops truncatus*) carrying her dead calf in her mouth for 5 d before relinquishing the carcass in a state of advanced decomposition. Cockcroft & Sauer (1990) described an event involving wild bottlenose dolphins in South Africa, which lasted only 20 min.

Care-giving behavior by cetaceans has been recorded more often in well-studied species, especially those in captivity such as *T. truncatus*. However, it is not possible to say that the epimeletic behavior is necessarily more common in these species due to the large distribution and limited observation periods of cetacean groups in the wild (Félix, 1994). Furthermore, it is presumed that this behavior always involves mother-calf pairs. Carrying a dead body, even in calm waters, represents considerable energetic cost. The adult struggles to maintain the calf at the surface, which suggests a strong affective bond, reflecting a well-developed sense of protection towards the calf (Félix, 1994). Connor & Smolker (1990), studying primates, suggested that epimeletic behavior may have evolutionary adaptive consequences, especially when the animals are genetically related. In the case presented herein, the parental relationship with the calf and the closest adult was not verified, but we can assume that the adult that tried to lift the dead body to the surface was its mother. The other two dolphins just swam close by but did not touch the calf.

This is the second record of epimeletic behavior for Guiana dolphin. A previous case was reported in Cananéia estuarine waters (25° 01' S, 47° 58' W) in southeastern Brazil in 1995 (Santos et al., 2000). In that case, a dead calf was carried for about 2 h by an adult Guiana dolphin, probably its mother. The authors retrieved the carcass

from the water for analysis, but the cause of death could not be determined. According to the boatman's information, a boat collided with the dolphin group at high speed. Ferreira et al. (2005) investigated the negative impacts associated with dolphin-watching activity in Pipa Bay and suggested the creation of the Tibau do Sul Coastal Fauna Reserve to control the number and speed of dolphin-watching boats. These simple mitigating actions worked well at first (Tosi & Ferreira, 2008), but, unfortunately, in the absence of a management plan and effective control in the following years, negative impacts of cetacean observation activities in the area of the Guiana dolphin population have been verified (Lunardi, 2011). Lunardi (2011) showed that such impacts include behavioral and budget changes in the presence of vessels and a decrease in the effectiveness of prey capture, among others.

Brazilian guidelines for cetacean approach by boats were established by Federal Law 7643 on 18 December 1987 and by Decree 117 (1996) altered by Decree 24 (2002), which forbids boats from interrupting or intentionally altering the course of movement of any cetacean species' group or penetrating such groups, dispersing the individuals. Clearly, such regulatory rules have not been observed in the instance described herein, but we cannot assess if the incident was intentional.

The interactions described herein provide direct evidence for nurturant behavior in Guiana dolphin groups. As noted by Cockcroft & Sauer (1990), such behavior has clear implications for the survival of possibly genetically related dolphins within specific groups and exemplifies the complexity of the behavioral traits present in cetaceans.

Moreover, the evidence of negative interactions between dolphins and the growing dolphin-watching activity (more and more tourists come to Pipa every year) highlights the need for continuous enforcement and improvement of boat traffic regulatory measures allied to a long-term monitoring of dolphins' behavior (Tosi & Ferreira, 2008). Currently, there is a council composed of different sectors of the society created to deliberate and promote actions aimed at the preservation of the REFAUTS. Among the main objectives of this council is the establishment of a management plan, including codes of conduct and control rules for the dolphin-watching activities (e.g., limiting speed, approach distance, and numbers of boats) to avoid additional instances of harassment and injury.

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Literature Cited

- Alonso, M. B., Feo, M. L., Corcellas, C., Gago-Ferrero, P., Bertozzi, C. P., Marigo, J., . . . Barceló, D. (2015). Toxic heritage: Maternal transfer of pyrethroid insecticides and sunscreen agents in dolphins from Brazil. *Environmental Pollution*, 207, 391-402. <https://doi.org/10.1016/j.envpol.2015.09.039>
- Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour*, 49(3), 227-266. <https://doi.org/10.1163/156853974X00534>
- Alves, R. R. N., Campos, B. A. T. P., Toledo, G. A. C., Mourão, J. S., Barboza, R. R. D., & Souto, M. S. W. (2010). Traditional uses and conservation of dolphins in Brazil. In A. G. Pearce & L. M. Correa (Eds.), *Dolphins: Anatomy, behavior and threats* (pp. 183-195). New York: Nova Science Publishers.
- Brown, D. H., & Norris, K. S. (1956). Observations of captive and wild cetaceans. *Journal of Mammalogy*, 37(3), 311-326. <https://doi.org/10.2307/1376730>
- Caldwell, M. C., & Caldwell, D. K. (1966). Epimeletic (care-giving) behavior in Cetacea. In K. S. Norris (Ed.), *Whales, dolphins and porpoises* (pp. 755-789). Berkeley: University of California Press.
- Caldwell, M. C., Brown, D. H., & Caldwell, D. K. (1963). Intergeneric behavior by a captive Pacific pilot whale. *Los Angeles County Museum, Contributions in Science*, 70, 1-2.
- Cockcroft, V. G., & Sauer, W. (1990). Observed and inferred epimeletic (nurturant) behaviour in bottlenose dolphins. *Aquatic Mammals*, 16(1), 31-32.
- Connor, R. C., & Smolker, R. A. (1990). Quantitative description of a rare behavioral event: A bottlenose dolphin's behavior toward her deceased offspring. In S. Leatherwood & R. R. Reeves (Eds.), *The bottlenose dolphin* (pp. 355-360). New York: Academic Press. <https://doi.org/10.1016/B978-0-12-440280-5.50023-8>
- Cremer, M. J., Hardt, F. A. S., & Tonello, A. J., Jr. (2006). Evidence of epimeletic behavior involving a *Pontoporia blainvillei* calf (Cetacea, Pontoporidae). *Biotemas*, 19, 83-86.
- Cunha, H. A., Da Silva, V. M. F., Lailson-Brito, J., Jr., Santos, P. C. O., Martin, A. R., . . . Solé-Cava, A. M. (2005). Riverine and marine ecotypes of *Sotalia* dolphins are different species. *Marine Biology*, 48(2), 449-457. <https://doi.org/10.1007/s00227-005-0078-2>
- Essapian, F. S. (1962). Courtship in captive saddle-backed porpoises, *Delphinus delphis*, L. 1758. *Zeitschrift für Säugetierkunde*, 27, 211-217.
- Félix, F. (1994). A case of epimeletic behaviour in a wild bottlenose dolphin *Tursiops truncatus* in the Gulf of

- Guayaquil, Ecuador. *Investigations on Cetacea*, 25, 227-234.
- Fertl, D. C., & Schiro, A. (1994). Carrying of dead calves by free-ranging Texas bottlenose dolphins (*Tursiops truncatus*). *Aquatic Mammals*, 20(1), 53-56.
- Ferreira, R. G., Santos, E., Jr., Pansard, K., & Ananias, S. (2005). *Reserva de Fauna Costeira de Tibau do Sul – Em defesa de um turismo sustentável no município* [Tibau do Sul Coastal Fauna Reserve: In defense of sustainable tourism] (*Relatório oficial apresentado as Secretarias de Meio Ambiente Federal, Estadual e Municipal* [Official report presented to the Federal, State and Municipal Secretariats of the Environment]). 45 pp.
- ICMBio. (2011). *Plano de ação nacional para a conservação dos mamíferos aquáticos: pequenos cetáceos* [National action plan for the conservation of aquatic mammals: Small cetaceans]. Brasília: Instituto Chico Mendes de Conservação da Biodiversidade.
- Lodi, L. (1992). Epimeletic behavior of free-ranging rough-toothed dolphins, *Steno bredanensis*, from Brazil. *Marine Mammal Science*, 8, 284-287. <https://doi.org/10.1111/j.1748-7692.1992.tb00410.x>
- Lunardi, D. G. (2011). Comportamento social de botos-cinza, *Sotalia guianensis*, na praia de Pipa, RN, Brasil: Dinâmica, sequência, sincronia e respostas ao turismo de observação [Social behavior of boto-cinza, *Sotalia guianensis*, in Pipa beach, RN, Brazil: Dynamics, sequence, synchrony and responses to dolphin-watching tourism] (Master's thesis). Universidade Federal do Rio Grande do Norte, Brazil.
- Lunardi, D. G., & Ferreira, R. G. (2013). Group composition influences on behavioral sequence patterns of the Guiana dolphin *Sotalia guianensis*. *Journal of Ethology*, 31(1), 49-53. <https://doi.org/10.1007/s10164-012-0347-8>
- Ministerio do Meio Ambiente [Ministry of the Environment] (MMA). (2014). *Sotalia guianensis*. In *Lista das espécies da fauna Brasileira ameaçada de extinção* [List of Brazilian fauna species threatened with extinction]. Retrieved from icmbio.gov.br
- Moura, J. F., Rodrigues, E. S., & Siciliano, S. (2008). Epimeletic behaviour in rough-toothed dolphins (*Steno bredanensis*) on the east coast of Rio de Janeiro State, Brazil. *Marine Biodiversity Records*, 2, 12. <https://doi.org/10.1017/S1755267208000122>.
- Nascimento, L. F. D., Medeiros, P. I. A. P., & Yamamoto, M. E. (2008). Descrição do comportamento de superfície do boto-cinza, *Sotalia guianensis*, na praia de Pipa-RN [Description of surface behavior of boto-cinza, *Sotalia guianensis*, in Pipa beach, RN]. *Psicologia: Reflexão e Crítica*, 21(3), 509-517. <https://doi.org/10.1590/S0102-79722008000300020>
- Norris, K. S., & Prescott, J. H. (1961). *Observations of Pacific cetaceans of California and Mexican waters*. Berkeley: University of California Press.
- Paro, A. D. (2010). *Estimativa populacional e uso do habitat do boto-cinza (Sotalia guianensis) no litoral sul do Rio Grande do Norte* [Population estimate and habitat use of boto-cinza (*Sotalia guianensis*) on the southern coast of Rio Grande do Norte] (Master's dissertation). Universidade Federal do Rio Grande do Norte, Brazil.
- Rossi-Santos, M., Wedekin, L. L., & Sousa-Lima, R. S. (2006). Distribution and habitat use of small cetaceans off Abrolhos Bank, eastern Brazil. *Latin American Journal of Aquatic Mammals*, 5, 23-28. <https://doi.org/10.5597/lajam00088>
- Santos, M. C. O., Rosso, S., Siciliano, S., Zerbini, N. A., Zampiroli, E., Vicente, A., & Alvarenga, F. (2000). Behavioral observations of the marine tucuxi dolphin (*Sotalia fluviatilis*) in São Paulo estuarine waters, south-eastern Brazil. *Aquatic Mammals*, 26(3), 260-267.
- Scott, J. P. (1958). Social behaviour of domestic goats and sheep: A comparative study. *Animal Behavior*, 6(3), 247. [https://doi.org/10.1016/0003-3472\(58\)90070-8](https://doi.org/10.1016/0003-3472(58)90070-8)
- Secchi, E. (2012). *Sotalia guianensis*. In International Union for Conservation of Nature (Ed.), *IUCN red list of threatened species*. Retrieved from iucnredlist.org
- Taylor, C. K., & Saayman, G. S. (1972). The social organization and behavior of dolphins (*Tursiops aduncus*) and baboons (*Papio ursinus*): Some comparisons and assessments. *Annals of the Cape Provincial Museums (Natural History)*, 9, 11-49.
- Tosi, C. H., & Ferreira, R. G. (2008). Behavior of estuarine dolphin, *Sotalia guianensis* (Cetacea, Delphinidae), in controlled boat traffic situation at southern coast of Rio Grande do Norte, Brazil. *Biodiversity Conservation*, 18, 67-78. <https://doi.org/10.1007/s10531-008-9435-z>
- Wells, R. S. (1991). Bringing up baby. *National History*, 100(8), 56-62.