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Report on foraging behavior and conflicts of the Araguaia River dolphin in Goiás and Mato Grosso, Brazil

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All predators adapt their foraging behavior to exploit a variety of prey in diverse environments (Shearer et al., 2022). In gregarious, long-lived, large-brained species, these adapted behaviors can permeate across generations and become a cultural tradition (Laland & Janik, 2006; Whitehead & Rendell, 2015).

Dolphins are particularly prolific in examples of adaptations of foraging behaviors. Since the 1990s Leatherwood & Reeves (1990) have drawn attention to the fact that bottlenose dolphins adapt their feeding strategies to take advantage of human activities, including predicting the next phases of fishing operations based on the sounds of on-board machines. These interactions usually assume a commensal bias, taking advantage of organisms discarded or attracted by fishing vessels (*e.g.*, Corkeron et al., 1990; Bonizzoni et al., 2022). There are also so-called positive interactions between dolphins and artisanal fishers with mutual benefits (Simões-Lopes et al., 1998; Cantor et al., 2023). Some behaviors involve risks for dolphins, such as deliberate strandings of orcas when hunting sea lions (McInnes et al., 2020; Black et al., 2023) or strandings of bottlenose dolphins when hunting fish (Jiménez & Alava, 2015). These voluntary stranding behaviors must be learned and trained, and often become regional traditions passed down through generations.

Here we report a foraging behavior of the little-known Araguaia River dolphin (*Inia araguaiaensis*), that inhabits the Tocantins-Araguaia Basin in Brazil (Araújo & da Silva, 2014; Hrbek et al., 2014). These behaviors were observed during the dry season (which lasts from April to September) between the municipalities of Luiz Alves (13°12'43" S, 50°34'54" W) and Bandeirantes (13°41'02" S, 50°48'25" W), in the state of Goiás, and the municipality of Barra do Garças (15°53'37" S, 52°15'17" W), in the state of Mato Grosso, Brazil (Fig. 1).

Araguaia River dolphins swim along sandbars and riverbanks, corralling schools of fish in extremely shallow waters. During our observations, animals stand in line with apparently two to four dolphins, one behind the other, and undulate their body, touching their belly to the bottom. Suddenly, they swerve and launch themselves towards the bank, running aground with more than half a body out of the water over their bellies (Fig. 2). Almost completely out of the water, dolphins try to catch fish and wave their body again in a returning motion. Unlike the case of bottlenose dolphins in the salt marsh, where animals beach on their right flank, reinforcing the hypothesis of laterality (Hoese, 1971; Rigley, 1983), the Araguaia River dolphins observed here use both flippers to maneuver and keep their belly on the bottom. When they decide to return to the water, they turn their bodies in a quick and precise movement (Fig. 3).

This behavior is locally known as "estouro do boto" (dolphin burst) and was observed in three occasions, with the time of observation lasting between 50 minutes to 1 hour and 30 minutes. During our observations, more than one prey species (*e.g.*, *Prochilodus* spp., *Leporinus* spp., and *Brycon* spp.) were seen involved in this capture strategy. Realizing that Araguaia River dolphins group their prey against the shore and are, therefore, a clue for the presence of fish schools, recreational fishers have sought the same location where dolphins are. On 14 July 2022, we observed a group of four dolphins foraging with this behavior. We started observing the group by 7:30h, and the dolphins remained foraging by 8:50h, totalizing 1 hour and 20 minutes of observed behavior. At this moment, recreational fishing boats approached and berthed around the sandbars where dolphins were. As more boats approached (we counted 12 boats), animals left the area (Fig. 4a). On the other two occasions (23 July 2021 and 12 July 2022), animals were observed foraging with this behavior for 50 minutes and for 1 hour and 30 minutes, respectively. In both cases, the dolphins remained in the area even as a few boats arrived (Fig. 4b). This overlap among fishers and dolphins can lead to

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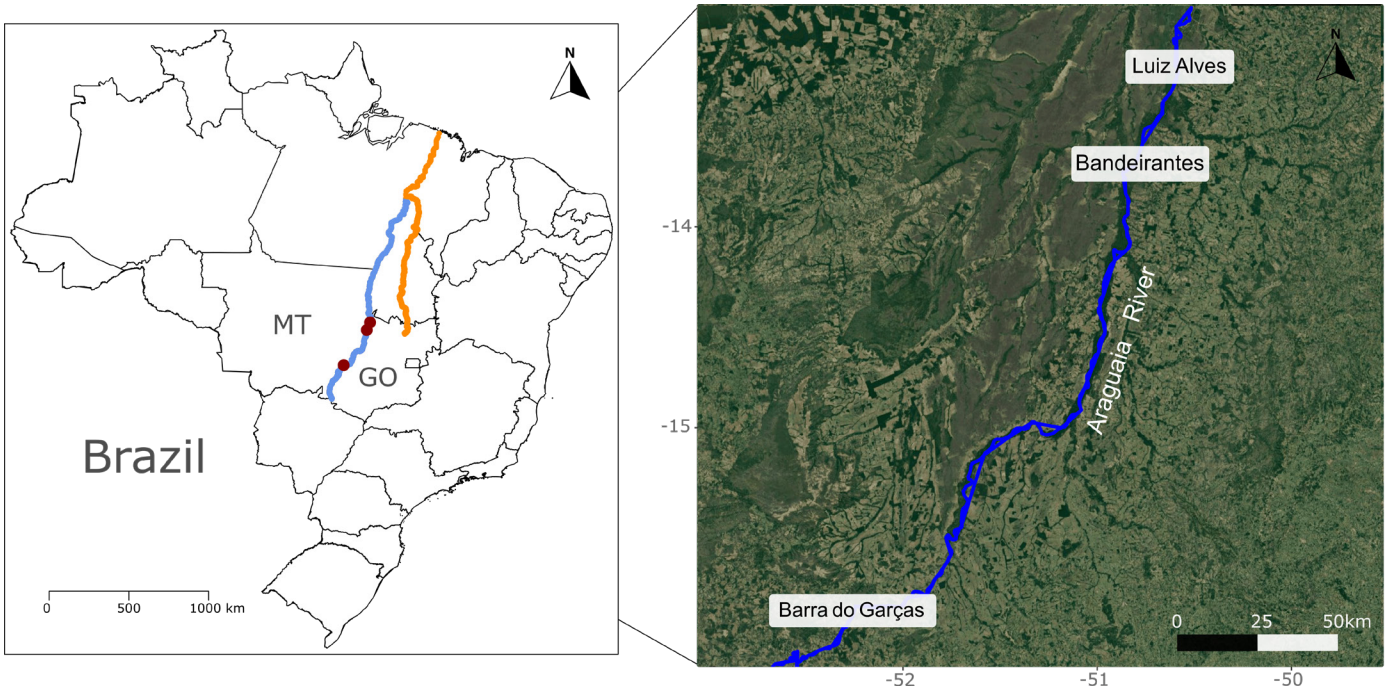

Figure 1. Location of the Araguaia River (blue), the Tocantins River (orange) and the sites where the behavior was recorded (red): the Luiz Alves (13º12'43" S, 50º34'54" W) and Bandeirantes (13º41'02" S, 50º48'25" W) municipalities in Goiás state (GO); and the municipality of Barra do Garças (15º53'37".84" S, 52º15'17" W) in Mato Grosso state (MT), Brazil.

Figure 2. Voluntary beaching behavior of the Araguaia river dolphins to capture their prey in Barra do Garças, Mato Grosso state, Brazil (15º53'37" S, 52º15'17" W) (G1 MT 2019).

Figure 3. Araguaia River dolphins returning to the riverbed after voluntary beaching behavior to capture their prey in Barra do Garças, Mato Grosso state, Brazil (15º53'37" S, 52º15'17" W) (G1 MT 2019).

conflicts such as collisions (Van Waerebeek et al., 2007; Zappes et al., 2013; Schoeman et al., 2020), mutilations of propellers (Byard et al., 2013), exposition to noise pollution (Weilgart, 2007), interactions with lines and hooks (Gilman et al., 2006), and can lead to reduction in feeding intake rates and affect dolphin population survival (Forney et al., 2017; Tenan et al., 2020).

In fact, these conflicts are already occurring. Despite the existence of a national law (Law No. 7.643 of 18 December 1987) to protect cetacean species from being caught and harassed, these animals still face harmful interactions and retaliatory actions. Fishers reported that dolphins interfere with fishing by attacking baits and, occasionally, the caught fish. On these occasions, fishers' responses include the use of slingshot, gunshots, and firecrackers against dolphins. There are also documented records of dolphins bycaught on hooks (Fig. 5).

Additionally, during the recreational fishing season (May - Sep) – which encompasses times when sandbanks are exposed –, the region has an intensive occupation that includes boats, jet skis, and touristic cabanas that are provisionally built in the sandbanks to serve as dormitory and restaurants (Fig. 6).

Apparently, river dolphins in the Amazon (*Inia* spp.) are more versatile than originally thought. This gains importance when mentioning historical cases in the literature as the described positive interactions of the Amazon River dolphins (*Inia geoffrensis*) with artisanal fishers (Lamb, 1954). This versatility may partly explain the successes of the various evolutionary branches of the Amazon River dolphins (*Inia geoffrensis*) in the different surrounding watersheds. Although this behavior was previously known, it is still underreported in the scientific literature, not sufficiently documented or systematically investigated. Information such as the individual composition of groups engaging in this behavior, its prevalence along the entire Araguaia River dolphin distribution, and possible variations in animals' behavior require further investigation. Assessing this information will allow to draw a better picture to understand if such behavior may be an adapted behavior typical of a restricted group of animals and if it can be conceived as social learning that could forge a cultural tradition. To the best of our knowledge, the behavior described here has been reported very briefly in the scientific literature and there has been no in-depth investigation of its scope nor of its capture efficiency, which also deserves to be better studied.

It is important to reinforce that these observations were made by the authors and should not be generalized, as the study area is restricted, and the animals may behave differently in other regions or even in different seasons. In fact, these observations should serve as a guide and a call for further investigations to

Figure 4. Recreational fishing boats approaching the sandbank where Araguaia River dolphins were foraging (a) and animals left the area. On another occasion, dolphins remained foraging with boats and tourists behind the sandbank (b). Events were recorded in Luiz Alves (13º12'43" S, 50º34'54" W) and Bandeirantes (13º41'02.15" S, 50º48'25" W), in the state of Goiás, Brazil.

Figure 5. Frames of videos available on Youtube that document a calf and an adult Araguaia River dolphin bycaught on hooks in the Araguaia River, state of Goiás, Brazil, in separated occasions. Links to videos and the faces were omitted to protect user privacy (Di Minin et al., 2021).

deepen the understanding of behavioral aspects and better assess any ongoing conflicts.

The reported conflicts highlight the importance of continuous support and expansion of ongoing conservation and educational initiatives in the region, such as the Rede pela Conservação do Boto-do-Araguaia (REBOTO, *Network for Araguaia River Dolphin Conservation*) and the *Araguaia Vivo* project, to mitigate potential conflicts involving the Araguaia River dolphin. The presence of enforcement by the Secretaria de Meio Ambiente e Desenvolvimento Sustentável do Estado de Goiás (SEMAD, *State Secretariat for Environment and Sustainable Development of Goiás*) during peak tourist seasons is also a critical step toward managing these human-wildlife interactions.

An integrated approach combining research, policy, and local tourism management would help reduce both intentional and unintentional harm to the Araguaia River dolphin (Araújo & da Silva, 2014; Brum et al., 2021). For long-term effectiveness, these initiatives would benefit from strengthened public policies that support the sustainable regulation of sport fishing and tourism activities, ensuring that the increasing pressures in the region are effectively addressed.

Figure 6. Occupation of Araguaia River and sandbanks in Luiz Alves (13º12'43" S, 50º34'54" W), Goiás, Brazil, from boats, jet skis, and touristic cabanas during the recreational fishing season (May-Sep 2022).

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