



Aggregative behavior of blackfin tuna (*Thunnus atlanticus*) following a fishing boat in the southwestern tropical Atlantic Ocean

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ABSTRACT

The blackfin tuna (*Thunnus atlanticus*) is a small epipelagic species restricted to the western and central Atlantic Ocean that has aggregative behavior, living in large schools usually associated with other tunas and commonly caught near moored Fish Aggregating Devices (FAD) or natural floating objects. This work offers the first report of a blackfin tuna school following a fishing boat serving as a drifting FAD in the southwestern tropical Atlantic Ocean, which occurred during the tagging campaign for the Atlantic Ocean Tropical Tuna Tagging Program (AOTTP) in May 2019. The blackfin tuna school followed the boat for approximately 190 nautical miles during almost 60 hours. The school remained close to surface when the boat was in motion but moved to deeper waters (60 m) in those few moments when the boat remained drifting. Along with the tagging activities, which occurred mainly in the morning, we caught 17 blackfin tunas with size ranging from 46 to 58 cm fork length (FL) (mean \pm SD: 52.47 \pm 3.35 cm FL) and weight ranged from 2.3 to 4.04 kg (3.2 \pm 0.5 kg).

Keywords: Tuna behavior, Associated schools, Fishing boats, FADs

The blackfin tuna (*Thunnus atlanticus*) is a small epipelagic species restricted to the western and central Atlantic Ocean, occurring from Massachusetts, in the United States (US) (40° N), to southern Brazil (31° S), with records in the Saint Peter and Saint Paul Archipelago (0°55'N - 29°W) (Collete and Nauen, 1983; Freire et al., 2005; Bezerra et al., 2011). This species supports both

commercial and recreational fisheries in Latin America and the Caribbean and is caught using pole-and-line, trolling, and handline methods (Taquet et al., 2000; Freire et al., 2005).

The blackfin tuna has an aggregative behavior, living in large schools usually associated with other tunas, such as the skipjack (*Katsuwonus pelamis*), and is commonly caught near moored Fish Aggregating Devices (FAD) or natural floating objects (Collete and Nauen, 1983; Taquet et al., 2000). However, there are no previous reports of the association of the blackfin tuna with drifting FADs or aggregated near fishing boats.

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The tuna species has associative behavior and aggregate around any floating object in the ocean, which could be natural (i.e., marine debris, logs, and dead animals) or artificial, such as the case of FADs, which are intentionally deployed by fishers to increase their production (Dagorn et al., 2000). Based on this knowledge, fishers began to use their fishing boats as FADs. The first report of this method came from the northeastern Atlantic off Senegal (Hallier and Molina, 2000; Fonteneau and Diouf, 1994). In the beginning of the 2000s, this type of fishery came to southern Brazil, which became locally denominated as “associated school fishery” (Schroeder and Castello, 2007), and subsequently spread to the northeast region, becoming the main Brazilian tuna capture technique in terms of production (Silva et al., 2018).

This work offers the first report of the blackfin tuna aggregative behavior following a fishing boat serving as a drifting FAD in the southwestern tropical Atlantic Ocean.

The event occurred during the campaign for the Atlantic Ocean Tropical Tuna Tagging Program (AOTTP) in the western tropical Atlantic in May 2019. The boat first approached the area near the Pilot Research Moored Array in the Tropical Atlantic (PIRATA) data buoy to get a school from another fishing boat composed mainly of bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*), and skipjack tuna (*K. pelamis*), which were the main target species of the program. The tagging activities were carried out on a 45-ft wooden fishing boat and the tunas were caught by handline and pole-and-line, both equipped with silicone lures.

The tagging activities began after receiving the school from the other boat, which is a common practice in the associated school fishery (Silva et al., 2018). However, as the tagging rate was very low, the skipper of the mission decided to move towards the ocean banks off northeastern Brazil in an attempt to increase the school size and tagging rate. Upon arriving at the site, the mission encountered a school of blackfin tuna, which promptly joined the school that was already following the boat. The skipper and crew decided to return to the vicinity of the data buoy and the blackfin tuna school followed the boat along this course, in which some tagging

activities were carried out, resulting in the capture of some individuals, which were taken to the laboratory for measurements of fork length (FL) and weight on a digital scale.

The school followed the boat for approximately 190 nautical miles towards the data buoy during nearly 60 hours (Figures 1 and 2). Cruising speed ranged from 5 to 6 knots, decreasing to 2.5 knots during tagging activities for the target species. The school remained close to surface when the boat was in motion but moved to deeper waters (60 m) in those few moments when the boat remained drifting. Along with the tagging activities, which occurred mainly in the morning, 17 blackfin tunas were caught. Size ranged from 46 to 58 cm FL (mean \pm SD: 52.47 \pm 3.35 cm FL) and weight ranged from 2.3 to 4.04 kg (3.2 \pm 0.5 kg). When the boat arrived at the vicinity of the data buoy, the blackfin tuna school dissipated within a few hours. However, some blackfin tunas were still caught along with bigeye tuna using drop lines in deeper waters (120 m) at night.

The aggregative behavior of tunas to fishing boats remains poorly understood, including the blackfin tuna, for which no information is available. Dagorn et al. (2001) reported the behavior of three yellowfin tuna aggregated to a scientific vessel during ultrasonic telemetry experiments, with tracking ranging from 11 to 91 hours. Schroeder and Castello (2007) reported a tuna identifiable by a scar that followed the fishing boat for eight days in the associated school fisheries in southern Brazil but the authors did not record the distance travelled. The only previous report of blackfin tuna behavior came from studies using pop-up satellite archival tags (PSATs) in the Gulf of Mexico (Fenton et al., 2015), in which the authors, despite using a light-based geolocation approach, reported a maximum straight-line distance travelled of 97.5 km, which corresponds to 52.6 nautical miles, nearly 27% the distance reported in the present study.

Therefore, this is the first report of a blackfin tuna school following a fishing boat for such a great distance. We recommend further studies for a better understanding of this behavior using tools such as acoustic telemetry, PSATs, aerial surveys, underwater videos, and hydroacoustic.

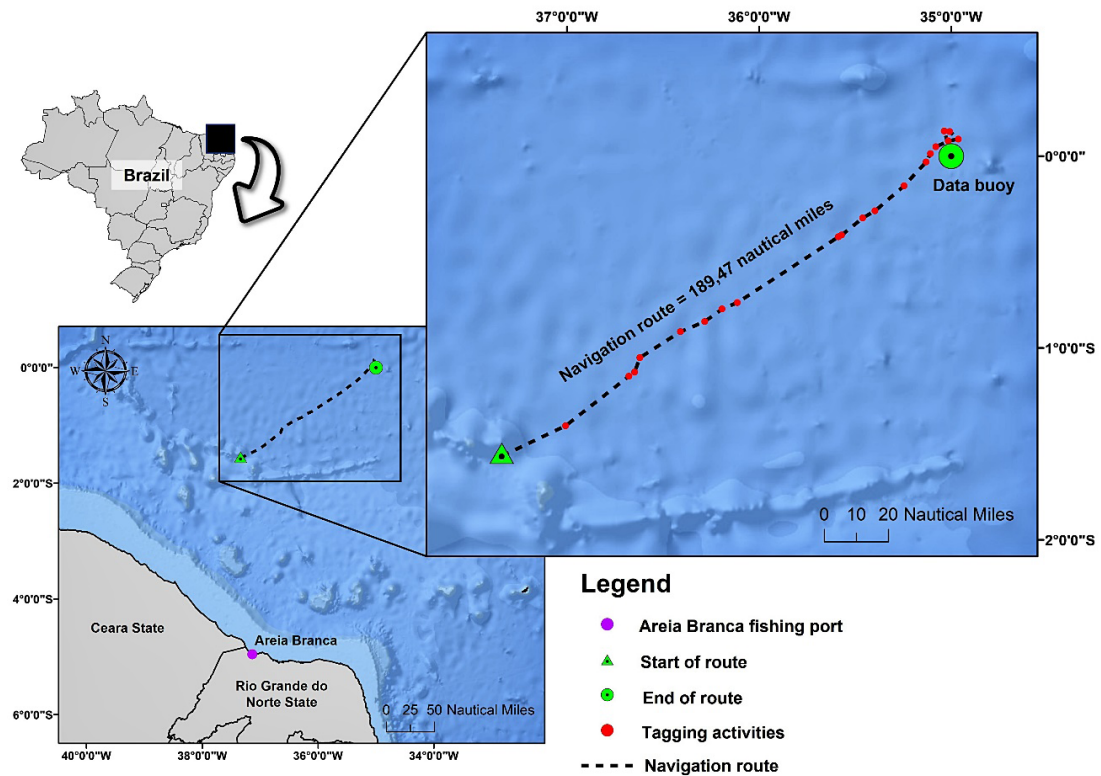


Figure 1. Map of western Atlantic showing route followed by school of blackfin tuna.



Figure 2. School of blackfin tuna following the fishing boat during the AOTTP activities in southwestern Atlantic Ocean.

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AUTHOR CONTRIBUTIONS

G. B. S.: Conceptualization; Data Acquisition; Methodology; Visualization; Writing – original draft; Writing – review & editing.

P.V.N.A.: Visualization; Writing – original draft; Writing – review & editing.

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