Foraging behaviors of common bottlenose dolphins *Tursiops truncatus* in the salt marsh estuary near Savannah, Georgia, USA

**Abstract**

Common bottlenose dolphins *Tursiops truncatus* have a variety of foraging behaviors, and locations of foraging are often related to tide and habitat. The purpose of this study was to identify types of foraging behaviors of dolphins near Savannah, Georgia, USA and determine which behaviors were related to depth, creek width, and tidal stage. We conducted surveys from south of the Savannah River to north Ossabaw Sound in Georgia from April 2009 to August 2009. The most frequently observed foraging behaviors were deep diving and begging occurring in 58 and 53 sightings (out of 242 sightings), respectively. Using multivariate GAM analyses, we found that foraging behaviors were significantly correlated to depth, creek width, and tidal stage. Headstands (p = 0.009), hard stops (p = 0.016), headstands (p = 0.001), hard stops (p = 0.004), mudbank whacking (p= 0.001), herd/circling (p= 0.024), and strand feeding (p = 0.064) were significantly correlated with shallow or small creeks. Sightings with kerplunking (p = 0.031), mudbank whacking (p = 0.001), strand feeding (p = 0.003), and herd/circling (p = 0.008) were significantly correlated with low tide. Small tidal creeks, where a variety of behaviors were observed, have lower water volume and physical barriers which could be beneficial to the dolphin in capturing prey. Strand feeding events had group sizes of 1-4 dolphins observed on the mudbank, with 2 dolphins strand feeding more frequently. The results of this study demonstrated a diverse array of foraging behaviors, and foraging correlations to specific habitats may provide insight into the resource partitioning of resident dolphins within estuaries.

**Introduction**

Several types of foraging behavior of bottlenose dolphins have been studied in South Carolina and described around mid-coastal Georgia; these include tail slapping, circle swimming bouts, and strand feeding (Hoese, 1971; Rigley et al., 1981). The estuarine habitat near Savannah, Georgia consists of salt marshes with branching creeks. Many of the smaller creeks are nearly depleted of water twice per day at low tide. This environment would likely influence dolphin foraging behaviors, yet the relationship of strand feeding and other foraging behaviors to environmental variables has not been determined.

**Methods**

Boat based surveys conducted from April - August 2009 collecting location, photographs of individuals, depth, creek width, group size, and foraging behaviors (Table 1). Analysis: Calculated total number of foraging behaviors by sighting and events. Multivariate Generalized Additive Models (GAMs)

**Results**

- Kerplunking, strand feeding, mudbank whacking, and herding/circling were all correlated with low tide.
- Deep diving was correlated to larger creeks and rivers and was not observed in small creeks. Strand feeding and herding/circling were abundant in small creeks.
- Hard stops and headstands were correlated with shallow water; whereas, deep diving was correlated with mid-range depths. Mudbank whacking was correlated with shallow and deep depths.
- Deep diving was correlated with mid-range group sizes of bottlenose dolphins; whereas, begging was correlated with large group sizes.

**Conclusion**

This study identifies previously unknown foraging behaviors of bottlenose dolphins near Savannah, GA and describes behaviors not previously described in the literature, such as headstands, hard stops, and mudbank whacking.

Why are so many behaviors correlated with low tide, small creeks, and shallow depths? At high tide fish use the marsh as refuge, but fish are concentrated in the small creeks at low tide. Dolphins would need less time to search and capture prey at low tide. In addition, low tide prey are more accessible to the dolphins and specialized foraging behaviors, such as strand feeding, may occur.

Preservation of the entire salt marsh estuary is vital since dolphins utilize different habitat characteristics of the estuary for foraging.

**Table 1:** The occurrence of foraging behaviors of bottlenose dolphins *Tursiops truncatus* observed near Savannah, Georgia. Behaviors are organized by the number of sightings the behavior occurred and the number of times the behavior was observed (events).

**Foraging Behavior**

- **Deep Diving:** (p > 0.05) selected from all of the following actions: lifted tail flukes out of the water; dove for long periods (> 1 min); surfaced at random with no clear directional pattern (i.e., surface intervals were not in a straight line); and surfaced successively less than 100 m apart.
- **Begging:** (p > 0.05) approached within 10 m of the boat with head-up and chin out of the water in the direction of the boat, or dolphin(s) surfaced within 2 m of the boat with the ventral surface of the body facing the boat (modified from Samuels and Bejder, 2004; Finn et al., 2008).
- **Mudbank Whacking:** (p > 0.05) traveled at the water surface with the dolphin(s) thrusted toward the shore and created a large splash.
- **Kerplunking:** (p > 0.05) lifted out of the water and then thrusted down quickly into the water, which created a "kerplunk" sound and a 1-2 m high splash (Nowacka, 1999; Connor et al., 2000).
- **Hard Stop:** (p > 0.05) traveled about 1 m from shore at a slow speed (estimate 1-2 m/s); then, the dolphin raised its caudal peduncle out of the water and kept its fluke underwater. This behavior caused an immediate stop in the forward movement of the dolphin. Often, the water around the dolphin was stranded up with mud.
- **Strand Feeding:** (p > 0.05) created a wave that temporarily stranded the dolphin(s) and fish on the mudbank.
- **Herd/Circling:** (p > 0.05) a group of dolphins traveled within 1 m of each other and suddenly increased speed (estimate 3.5 m/s) in the same direction or in circles.
- **Headstand:** (p > 0.05) was vertical in the water column with the flukes out of the water. The dolphin held this position for a time of at least 2 seconds. Often, water around the dolphin was stranded up with mud.
- **Begging:** (p > 0.05) approached within 10 m of the boat with head-up and chin out of the water in the direction of the boat, or dolphin(s) surfaced within 2 m of the boat with the ventral surface of the body facing the boat (modified from Samuels and Bejder, 2004; Finn et al., 2008).
- **Crab Pot:** (p > 0.05) approached within 10 m of the boat with head-up and chin out of the water in the direction of the boat, or dolphin(s) surfaced within 2 m of the boat with the ventral surface of the body facing the boat (modified from Samuels and Bejder, 2004; Finn et al., 2008).
- **Provisioning:** (p > 0.05) approached within 10 m of the boat with head-up and chin out of the water in the direction of the boat, or dolphin(s) surfaced within 2 m of the boat with the ventral surface of the body facing the boat (modified from Samuels and Bejder, 2004; Finn et al., 2008).

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**References**