Long-term passive acoustics as a means to understand spatial and temporal patterns of Atlantic bottlenose dolphins (Tursiops truncatus)

Alyssa D. Marian¹; Eric W. Montie²; and Agnieszka Monczak²

¹GPMB, University of Charleston, SC; ²Dept. of Natural Sciences, University of South Carolina Beaufort, Bluffton, SC

Introduction
Along the east coast of the United States, the Atlantic bottlenose dolphin, Tursiops truncatus is widely distributed from New York to Florida (Duffield et al., 1983; Bills and Keith, 2012). There are five major coastal stocks found in estuarine and near-shore waters that are known to contain migratory and resident animals (Hayes et al., 2018). Previous long-term, photo-identification studies have described various communities of resident estuarine animals, as well as seasonal, migratory animals within the South Carolina/Georgia Coastal Stock (Wang et al., 1994; Gubbins, 2002; Zolman et al., 2002; Speakman et al., 2006). However, spatial patterns and temporal movements of these migratory animals are not yet fully understood. Current sampling methods include aerial or boat-based visual surveys and passive acoustics, both of which have advantages and disadvantages (Melling et al., 2007; Hayes et al., 2018). Bottlenose dolphins are quite vocal, producing a variety of signals (e.g. echolocation clicks, burst-pulses, and whistles) that can be detected using passive acoustics (Caldwell, 1968; Cook et al., 2014). The goal of the current study is to combine visual surveys and passive acoustics to create a more powerful dataset to better understand resident and migratory bottlenose dolphins in the May River estuary, SC. Passive acoustic data may provide important information regarding the migratory movements of the South Carolina / Georgia Coastal Stock and the Southern Migratory Coastal Stock in relation to climate variability. The current study will use six years of passive acoustic data (i.e., 2013 – 2018) and four years of visual survey data (i.e., 2015 – 2018) of the May River estuary, SC.

Objectives
1. Identify patterns in dolphin vocalizations and spatial, temporal, environmental, and anthropogenic factors that may influence acoustic behavior.
2. Determine resident and migratory dolphins and their spatial and temporal patterns in the May River.
3. Determine relationships between vocalizations and dolphins sighted within the detectable ranges of the acoustic recorders.
4. Assuming that the migrant stock movement into the May River can be identified, multiple years of acoustic data will be analyzed to determine the timing of its arrival and departure and factors that may influence this migration.

Methods

Visual Surveys
Bimonthly visual surveys of the entire May River are conducted. All dolphin group/individual sightings include location, time, abundance, environmental conditions, water quality, and behavior. If possible, photos of dorsal fins are captured. The computer program Darwin is used to identify individuals and catalogue each sighting.

Acoustic Monitoring
Stations 4M, 19M, and 34M were used only for 2013-2014. Stations 9M, 14M, and 37M have been used from 2013 to present. They are equipped with 2 HOBO loggers to measure temp and depth and are set to record for 2 min every 20 min. Each 2 min file is manually analyzed using Adobe Audition CS5.5 software. Whistles, echolocations, and burst pulses are individually counted in each file.

Preliminary Data

Figure 4. Spectrograms produced from Adobe Audition. Spectrograms are reviewed using a spectral resolution of 2048 and a 10 s time window. Vocalizations are placed in one of 3 categories: whistles (top), echolocation (middle), and burst pulses (bottom).

Figure 5. Daily count of vocalizations at 37M for 2014 (A), 2015 (B), and 2016 (C). Each year there was a general increase in the total number of vocalizations in the spring and late fall which may indicate the arrival and departure of the migratory stock.

Figure 6. Heat map showing individual sighting counts for 2015-2016. This can be used to distinguish residents and migrants. Residents are sighted in all 4 seasons of the year and migrants are sighted in only 1 or 2 seasons of the year (Gubbins, 2002).

Future Goals
2. Continue with bimonthly visual dolphin surveys through 2018.
3. Begin combining both acoustic and visual data sets.

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References

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