

Seasonal Exchange of Bottlenose Dolphins
Occurring in Beaufort and the Outer Banks of North
Carolina

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Introduction

Bottlenose dolphin, (*Tursiops truncatus*), populations can be found worldwide (Louis 2014). North-West Atlantic populations of bottlenose dolphins are split into two distinct ecotypes; coastal and pelagic (Louis 2014). Populations can include individuals that display short term seasonal residency (Toth-Brown 2007), year round residency (Wells 1991), and transience (Defran and Weller 1999). The type of residency is dependent on numerous factors including food availability, predators, suitable habitat, and environmental conditions like water quality, salinity and temperature (Campbell et al 2002).

Bottlenose dolphins in the United States are managed by The National Marine Fisheries Service (NMFS) as stocks, with each stock containing dolphins that can produce viable offspring and are functioning elements in their ecosystem. The dolphins found in the Roanoke Sound are considered to be part of the Northern North Carolina Estuarine System Stock (NNCESS) which is estimated to have up to 900 inhabitants that will range as far south as Beaufort, NC and can be as far as 1 km offshore during the warmer summer months (Waring et al. 2012). It is believed that in the cooler winter months the dolphins move out of the estuarine waters and can be found up to 3 km offshore and can be found between Cape Hatteras and the New River (Waring et al. 2012). When the dolphins are wintering in Beaufort there is a possible overlap of the NNCESS and the Northern and Southern Migratory Stocks in Beaufort (Waring et al. 2013) Due to the overlap of these stocks and the seasonal movements between

Beaufort and the Roanoke Sound, understanding the extent of the mixing is important for the appropriate management of the stocks

The Outer Banks Center for Dolphins Research (OBXCDR) has been conducting a long-term monitoring study of bottlenose dolphins in the Roanoke Sound since 2008, and has identified over 650 individual dolphins in the area. The local population of dolphins can be found in the sound April through November and exhibit seasonal migratory and transient patterns of site fidelity (Taylor et al. 2014).

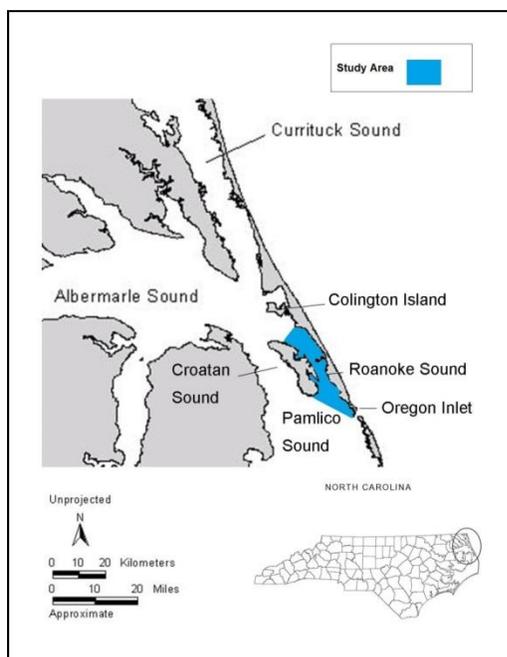
. Through photo-identification and the use of the Mid-Atlantic Bottlenose Dolphin Catalog (MABDC) we are able to document individuals that are found as residents of both Beaufort and the Roanoke Sound populations. The MABDC was created in 1997 in order to help catalog and organize dorsal fin images from various researchers along the Eastern Coast of the United States. The MABDC currently is made up of 19 catalogs, 20 contributors and over 11,000 dorsal fin images (Urian 2014). Photo-identification is a type of mark and recapture study; it is the most economical and extensively used method to monitor bottlenose dolphin species (Weir et al 2008). The identification process is dependent on clear images of natural markings on the dorsal fins of the cetaceans.

Methods

The study area is located in the Roanoke Sound of the Outer Banks, the study area is approximately 41 square miles from the northern tip of Roanoke Island to south of the Oregon Inlet (Figure 1). The Roanoke sound separates Nags Head and Roanoke

Island, and is an important area for recreational and commercial fishing and water sports. The average depth of the Roanoke sound excluding the dredged channel which is part of the intercostal waterway is around three and a half feet and is made up of shallow seagrass beds, and numerous sandbars.

Figure 1: Roanoke Sound Study Area



The Outer Banks Center for Dolphin Research regularly conducts both dedicated and opportunistic photo-identification surveys on bottlenose dolphins within the area of interest. Exploratory surveys were conducted in the southernmost area of the study site during October 2007, from June 2008 - August 2008, February 2009, May 2009-October 2009, May 2010-October 2010, and May 2011-October 2011. Non exploratory surveys were conducted at least once per month in the study area. In November of

2011, a standardized transect route was created to cover the entire area of interest. Surveys were conducted from a 16' or 17' outboard vessel in the study area, with the exception of May and July 2013. The transect lines used were made in the program MapSource and uploaded to a GPS unit. Once a group of dolphins was sighted, the group's location was marked on the GPS unit and the dolphins were slowly approached in order to not affect their natural behavior. Photographs of the dorsal fins of each dolphin were obtained using standard photo-identification techniques. In addition to the GPS location of the group of dolphins, date, time, activity state, observed behaviors, and environmental conditions such as salinity, water temperature, and wind speed were obtained and recorded for each individual sighting. The sighting ended if any of the three following events happened: the dolphins exhibited avoidance behaviors or were lost, the maximum allotment of one hour for the sighting was reached according to the General Authorization permit under which the surveys were conducted or every dorsal fin had been photographed in the group. After the sighting was concluded the research vessel returned to the transect line and continued the transect route until completion or until another group of dolphins were spotted.

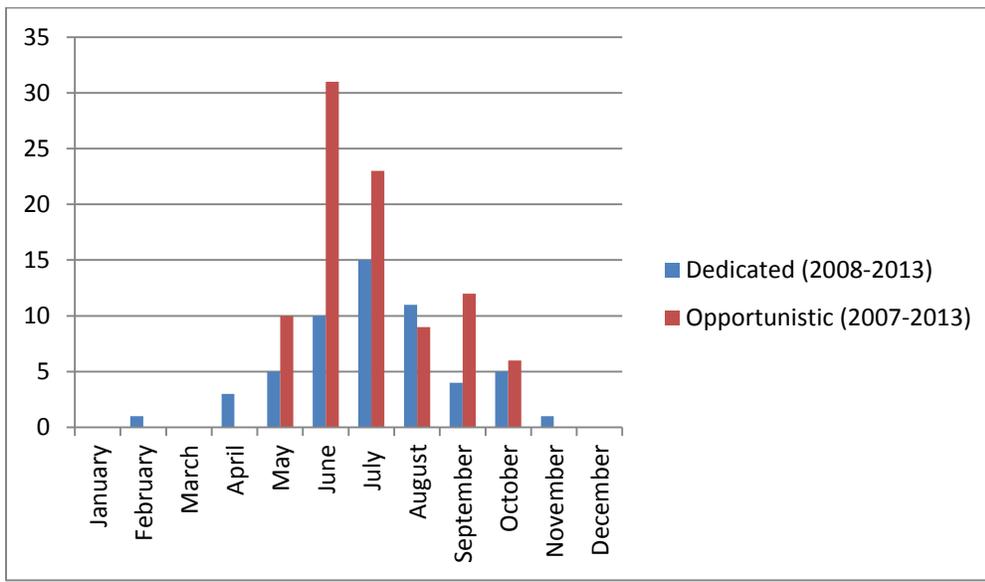
The opportunistic data was collected from May 2008-October 2013 aboard the Nags Head Dolphin Watch. The tours occurred within the study area but did not follow a set transect line. The collection of data and survey methods were similar to the dedicated survey methods, and differed in the route taken to locate dolphins, approaching the group, and they had a shorter maximum sighting time. After locating a group of dolphins the captain followed the NMFS Recommended Viewing Guidelines for bottlenose dolphins, these guidelines limited the maximum viewing time to half an hour.

The program FinBase (Adams et al. 2006) was used in the processing of the data sheets, and photo-identification images. The images collected from every dedicated survey and random opportunistic surveys were sorted, graded for photo quality, and then matched to the OBXCDR photo-identification catalog. The OBXCDR catalog includes dorsal fins from October 2007 – October 2013, and consisted of both dedicated and opportunistic surveys in the Roanoke Sound. After a researcher believed they found a match in the catalog a second researcher verified the match. The sighting data collected from that survey was linked to the images of that dolphin. The data was then sent to Kim Urian, DUML, in order for it to be added to the MABDC. Images that were considered poor quality, or fins without any markings or distinguishing characteristics were not included in the analysis. Any images that were considered good images of distinctive fins (N=202) were matched to the Duke Marine Lab catalog within the MABDC. If there was believed to be a match by the OBXCDR researcher, the match must be verified by Kim Urian the curator of that catalog, a second OBXCDR researcher and the regional catalog contributor.

A table was created for every individual that had been matched (Table 1). This table included gender (if determined), the first sighting date of that animal and the total number of sightings in the Outer Banks. The gender of the animal was considered a female if she was sighted three or more times consistently with a dependent calf, the individual was considered a male if it was seen surfacing beside another adult dolphin three times consistently and was believed to be part of a male pair. There was a larger survey effort during the summer months (Figure 2). The seasons are based on water

temperature and are considered as Fall (September through November), Spring (April and May), and Summer (June through August).

Figure 2: Survey Effort



Results

I was not able to complete the matching of the dorsal fins to the Beaufort, NC (NC-DUML-UNCW) catalog a number of fins were able to be matched. Approximately 9 % (N=19) of the distinctive individuals (N=213) in the OBXCDR catalog with good quality dorsal fins were found to be matches to the NC-DUML-UNCW catalog. There is a very good chance that there will be more matches found between the two catalogs in future studies . Out of the 19 dolphins matched we were able to determine their sex; 9 male and 9 female dolphins were found to be matches to the DUML catalog (Table 1). The male dolphins matched had the largest number of sightings with an average of 32

sightings, the females had a much smaller average of 12 sightings. This difference in averages could be attributed to the males in the table being seen in a group together.

Table 1: Information on Matches Found

| Alias | Number of Sightings | NC-DUML catalog # | MABDC ID | Sex | 1st Sighting Date |
|--------------------|---------------------|-------------------|----------|---------|-------------------|
| Skylar (FB418) | 39 | 15117 | 8726 | M | 10/7/2007 |
| Rake | 37 | 73840 | 14693 | M | 6/14/2008 |
| MALLON | 36 | 91010 | 15045 | M | 6/5/2008 |
| Onion | 33 | 20050 | 14057 | M | 10/7/2007 |
| Sprite | 32 | 81540 | 14887 | M | 10/7/2007 |
| Rainbow (FB 416) | 29 | 15115 | 8786 | M | 6/17/2008 |
| Sequoia | 29 | 13964 | 8953 | M | 6/5/2008 |
| Pinchers(deceased) | 28 | 14314 | 8719 | M | 10/7/2007 |
| FB457 | 28 | YES | 15133 | F | 6/24/2008 |
| FB708 | 26 | 15147 | 8952 | M | 7/29/2008 |
| Fatlip | 20 | 81510 | 14884 | F | 7/19/2008 |
| Artemis | 16 | 81650 | 14892 | F | 10/7/2007 |
| FB717 | 15 | 15156 | 8730 | F | 10/13/2007 |
| Knobby Top | 13 | 72560 | 14629 | F | 10/7/2007 |
| FB459 | 9 | fb 459 | 15135 | F | 7/1/2008 |
| Wicked | 3 | 63360 | 14423 | Unknown | 7/1/2008 |
| Virginia | 2 | 390 | 11441 | F | 8/21/2011 |
| FB401 | 2 | 323 | 8857 | F | 6/20/2008 |
| FB405 | 1 | 15106 | 8729 | F | 10/13/2007 |

Future Directions

It is imperative for obtaining accurate matches that the MABDC catalogs be updated regularly. When matching to outdated catalogs there can be matches that go unfound, due to the dorsal fins having an increased number of markings or newer markings that are not documented in the older photo. Future studies should continue the matching of the NC-DUML-UNCW catalog to the OBXCDR catalog to find more matches between

the sites, in order to further examine the site fidelity of the individuals in North Carolina to determine if they show seasonal home range preferences, or if they use full extent of their home range year round.

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