

Northern Range of Transient *Tursiops truncatus* Observed in Northern Outer Banks during the Spring Season

Julia Jacobs and Jessica Taylor

Background

Bottlenose dolphins (*Tursiops truncatus*) are found within tropical and temperate waters throughout the world (Leatherwood and Reeves 1990). Their habitat includes inshore coastal, continental shelf, and oceanic waters. Bottlenose dolphins tolerate oceanic as well as brackish water and can therefore be found in estuaries, sounds, bays, and other coastal areas (Hayes et al. 2017). Individuals can exhibit, seasonal, long-term, and-transient residency patterns. Multiple factors may influence the residency (Barco et al. 1999; Mason and Taylor 2016; Zolman 2002).

Many bottlenose dolphins obtain distinguishing nicks and notches on their dorsal fin that make individuals unique. Using a technique called photo-identification, individual dorsal fins are photographed, providing insight into population dynamics. The Outer Banks Center for Dolphin Research conducts a long-term photo-identification monitoring study on the dolphins in the Roanoke Sound in North Carolina. This study allows researchers to monitor the population trends, individual identities, health, movement patterns, and habitat use of dolphins in the Roanoke Sound in a non-invasive manner. The Mid-Atlantic Bottlenose Dolphins Catalog compiles the multiple photo-id efforts along the east coast into one comparable source for the purpose of understanding stock structure (Urian et al. 1999).

Eighteen distinct stocks of bottlenose dolphins are recognized in the Northwestern Atlantic Ocean (Waring et al. 2016). Many of these stocks do have overlapping ranges, but they are treated as separate groups in order to successfully conserve and manage the bottlenose dolphin populations. There are four different stocks that occur off coastal North Carolina: the Northern North Carolina Estuarine System (NNCES), the Southern North Carolina Estuarine System (SNCS), the Western North Atlantic Northern Migratory Stock (NMS), and the Western North Atlantic Southern Migratory Stock (SMS) (Hayes et al. 2017). This study focuses on individuals that comprise the NNCES stock. The habitat for this stock is split between the ocean and the sound (Hayes et al. 2017). Gorgone et al. (2014) estimated the current stock size to range between 823 and 873 dolphins. The NNCES ranges from Beaufort, NC to southern VA during the summer months, using primarily estuarine waters. During the winter, individuals

move out to the coastal waters, typically within 3 km of shore, ranging between the New River and Cape Hatteras (Hayes et al. 2017).

The purpose of this study is to investigate the northern range of transient individuals observed by the OBXCDR in the spring season by comparing dorsal fin images to northern study sites that contribute to the MABDC. Matches found will contribute to further delineating the northernmost range of the Northern North Carolina Estuarine System Stock.

Methods

Field Surveys

The surveys were conducted throughout the Roanoke Sound, a body of water in the Outer Banks that separates Roanoke Island and Nags Head (Figure 1). The Roanoke sound is a brackish body of water with an average depth of 3.5 feet with a dredged out channel that ranges from 10-12 feet deep. The surveys were conducted south to the Oregon Inlet. The OBXCDR conducted both dedicated and opportunistic surveys in Roanoke Sound.

Dedicated transect surveys were conducted from May 2008 through October 2013 aboard a 16 or 17 foot outboard boat. Photo-identification data was collected using standardized photo-identification techniques (Wursig and Wursig 1977). The surveys followed predetermined track lines and photo-id images were taken of any dolphins sighted. In addition to photos, sighting data, including GPS locations, group size estimates, activity state, water temperature, and salinity were recorded. All dedicated transect surveys were conducted under a NMFS General Authorization Permits LOC-13416 and LOC-17988 awarded to J. Taylor.

Opportunistic data was collected while on board the Nags Head Dolphin Watch throughout the Roanoke Sound. The Nags Head Dolphin Watch was comprised of two pontoon boats, approximately 30 and 36 feet in length. Photo-id and data collection were conducted when dolphins were sighted on these boat, but they did not follow transect lines.

Seasons were defined by water temperature as follows: Spring (March-May), Summer (June-August), Fall (September-November), and Winter (December-February). Although survey effort was attempted year-round, the majority of surveys occurred from May through October.

Photo Processing and Catalog Comparison

FinBase was used to process the photos and sighting data collected during surveys (Adams et. al 2006). The photos were sorted and cropped to contain a single dorsal fin in each image. The images were then graded for photo quality. The fins were then matched to the local catalog and all matches were verified by a second individual to minimize errors. The updated catalog was sent to the Mid-Atlantic Bottlenose Dolphin Catalog (MABDC).

Good quality high and average distinctive fins were selected for analysis. Transient individuals were defined as less frequently seen based upon Taylor et al. (2017). From this sample, dolphins observed during the spring season were selected to compare to the MABDC. This project compared 26 high or average distinct dolphins sighted in the spring season to dolphins in three northern catalogs (Figure 2).

In the MABDC, filters were applied to compare to only the highly distinct (D1 and D2) individuals as well as the high quality (Q1 and Q2) images (Figure 2). Individuals were compared to dolphins observed in Virginia (VA-HDR), Maryland (MD-PCDP), and New Jersey (CMWWRC).

Results

Field Effort

Fifty-seven dedicated and eighty-six opportunistic surveys were conducted between 2008 and 2013 (Figure 3a). The number of opportunistic versus dedicated surveys conducted each year fluctuated depending on weather. A total of 18 surveys were conducted during the spring season with spring surveys mainly occurring in May (n=15) across years (Figure 3b).

Matching Effort

Twenty-six transient good quality distinctive individuals were observed during the spring season in Roanoke Sound, and selected from the OBXCDR catalog to compare to the northern MABDC catalogs. Two confirmed matches were made between the OBXCDR catalog and the northern catalogs (Figure 4). One match was made to the Norfolk Virginia catalog (HDR) and the other match was made to the Chesapeake Maryland Catalog (MD-PCDP). There were no confirmed matches between the New Jersey catalog (CMWWRC) and the OBXCDR sample.

Discussion

The results do suggest that there is a limit to the Northern North Carolina Estuarine System Stock's northern range. There are multiple reasons that could explain the lack of matches between the catalogs. One such reason could be that this study examined a small sample of dolphins and in specific regions. There were also incidents that in which there were many years between the photos being compared. Fins may change over time; in order to mitigate potentially overlooking matches of changed fins, consistency in photo-identification effort should be maintained across years.

A similar study is currently underway examining dolphins observed in the autumn; preliminary results are very similar in that only two dolphins in the OBXCDR catalog were matched to the same northern catalogs.

Finally, our study examined a very far range. There may be individuals who travel that far north, but the majority of the population's range does not extend that far. The results of this study further support the current documented northern range of the Northern North Carolina Estuarine Stock System.

Further studies could compare the peak summer dolphins in the Roanoke Sound to those in the northern catalogs since the typical migration pattern supports the dolphins going further north in the summertime and south in the winter. There could also be a larger number of individuals compared from OBXCDR catalog to the northern catalogs in order to reduce biased results from the smaller dataset.

Figures

Figure 1. Study Area for Outer Banks Center for Dolphin Research

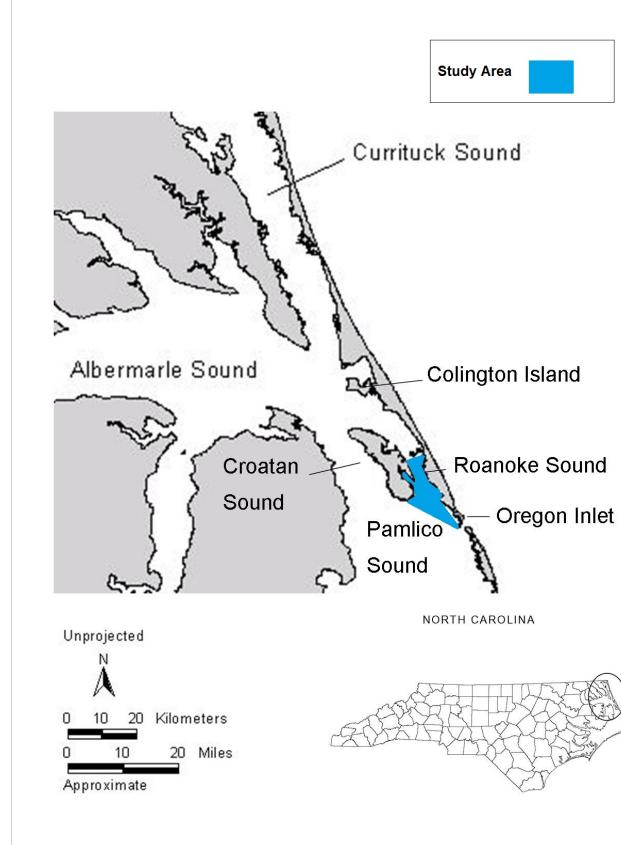


Figure 2. Comparison catalogs

Catalog Location	Organization	Complete catalog size	Q1, Q2, D1 and D2 Individuals	Collection Period	Number of matches
Roanoke Sound, NC	OBXCDR	922	26	2007- 2018	NA
Norfolk, VA	HDR	442	138	2012-2013	1
Potomac / Chesapeake, MD	PCDP	193	86	2014-2015	1
Cape May, NJ	CMWWRC	333	221	2011-2018	0

Figure 3a. Dedicated and Opportunistic Field Effort in Roanoke Sound

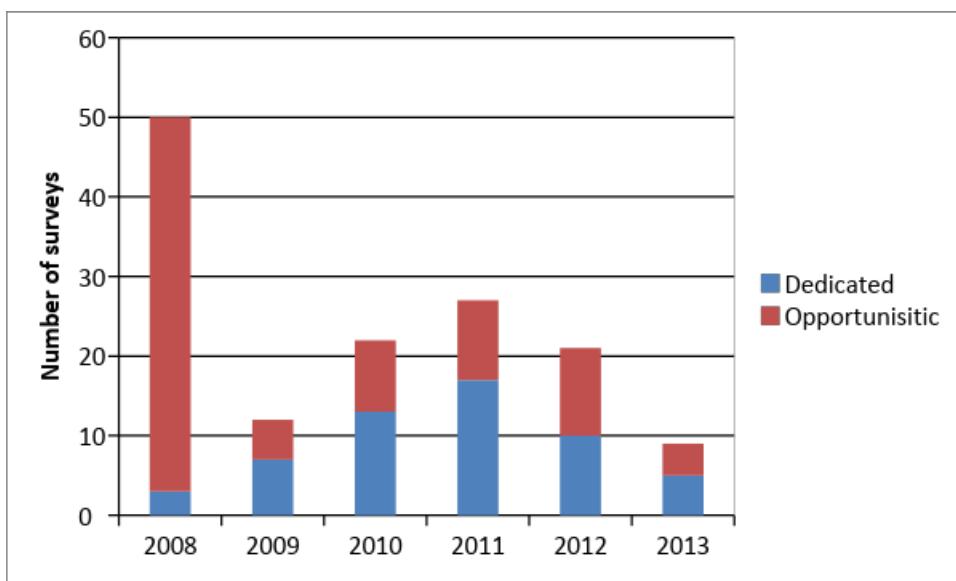
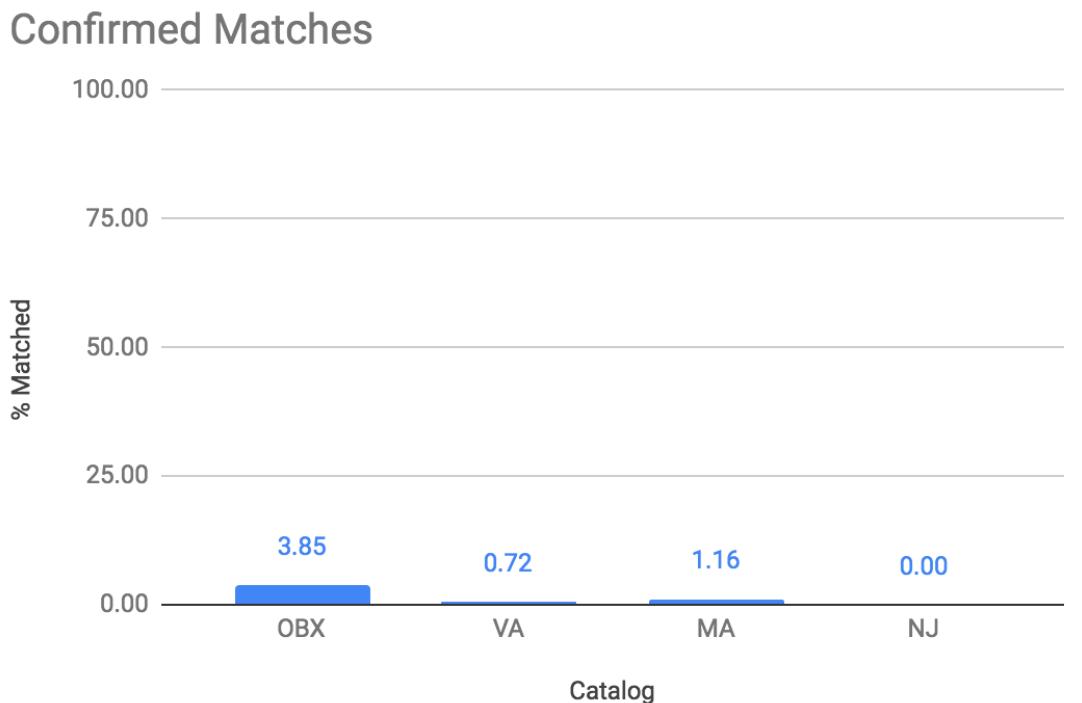


Figure 3b. Monthly Spring Survey Effort 2008-2013



Figure 4. Percent Matches



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