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# Photo-Identification Analysis of Bottlenose Dolphins, *Tursiops truncatus*, off Lewes Delaware

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## ABSTRACT

The dolphin dorsal fin is analogous to that of a human fingerprint. Photo-identification of Bottlenose dolphins, *Tursiops truncatus*, during 2017-2018 off Lewes, Delaware resulted in 223 uniquely identified individuals composed in a catalog. Within the same year, 29% (n=65) of these individuals were re-sighted and 13% (n=28) individuals within consecutive years. The sighting frequency of individuals ranged from 1-6 encounters overall. The catalog was compared to dolphins from a local study area, Cape May, New Jersey and resulted in an 18% (n=41) overlap. The analysis and a social network was completed using computational softwares R, Python and Tableau. Further development of this catalog in Delaware with combination of data collection on ecotourism vessels and dedicated boat-based surveys will improve the understanding of habitat utilization, social structure, migration, and movement patterns within the Northern Migratory Stock of coastal Bottlenose dolphins. This project was completed with funding awarded from the Stockton Graduate Distinguished Research Fellowship.

## INTRODUCTION

- The Northern Migratory Stock population of Bottlenose dolphins, both inshore and offshore occupy the Delaware waters of the Atlantic Ocean and Delaware Bay. They travel as far North as New York in the warm water months and as far South as North Carolina in the cold water months (NSFC, 2018).
- Photo-identification is an established technique for studying free-ranging dolphins by the natural markings on their dorsal fin. It can be used to study population abundance, migration, reproduction biology and social networks of a species (Wey, 2007).
- Before this study, minimal photo-identification research has been conducted off Lewes, Delaware.

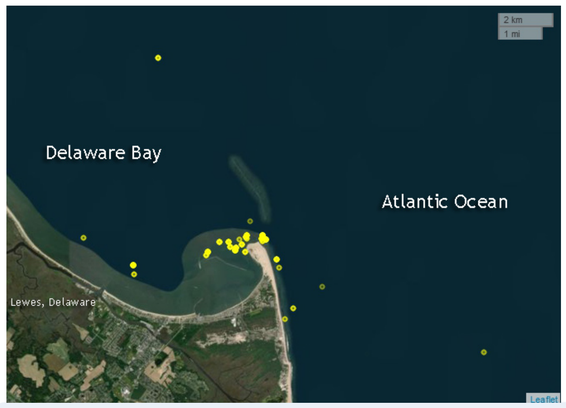


**Fig. 1.** Study Area. Catalogued dolphin sightings from 2017-2018 off Lewes, Delaware.

## MATERIALS AND METHODS

- Data collection occurred on the *Keena Dale III*, owned and operated by Fisherman's Wharf in Lewes, Delaware during ecotourism whale and dolphin watches.
- A sighting or dolphin group was defined as individuals within close proximity or 100m of each other, engaged in similar behavior and traveling in the same direction.
- In addition to weather and sea conditions, the following parameters were recorded within a sighting: Start and end time, latitude, and longitude (Garmin GPSmap 78), water temperature, depth, estimated pod size, behaviors, calves or juveniles present and the direction traveling. Photographs were attempted for both the right and left dorsal of each individual (Nikon D3300).
- From 2017-2018, a total of 6,139 photos were sorted to create a catalog.
- Data analysis was completed using computational softwares, R, Python and Tableau. A social network was created using the library package, NetworkX, with Python.

## RESULTS

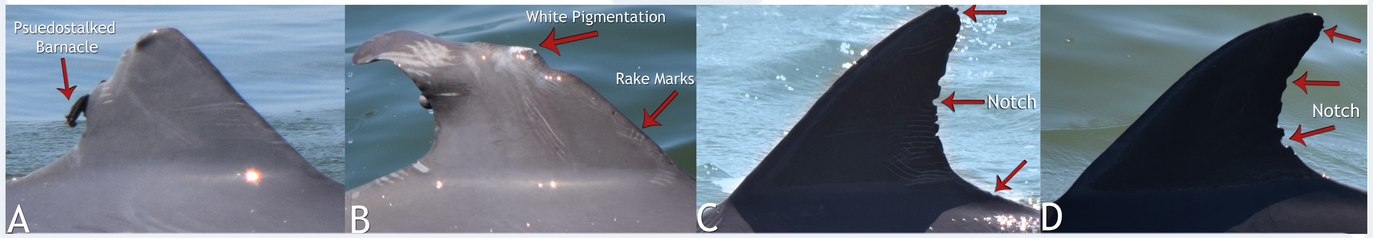


**Fig. 2**. Dolphins are identified by unique natural markings: Mutilations or disfigured fins (A & B), white pigmentation (B), and notches on the trailing edge of the dorsal fin (C & D). Psuedostalked barnacles and rake marks commonly accompany dorsal fins (A & B). Figure 2A - Tt18, Figure 2B- Tt8, Figure 2C - Tt71, Figure 2D - Tt116

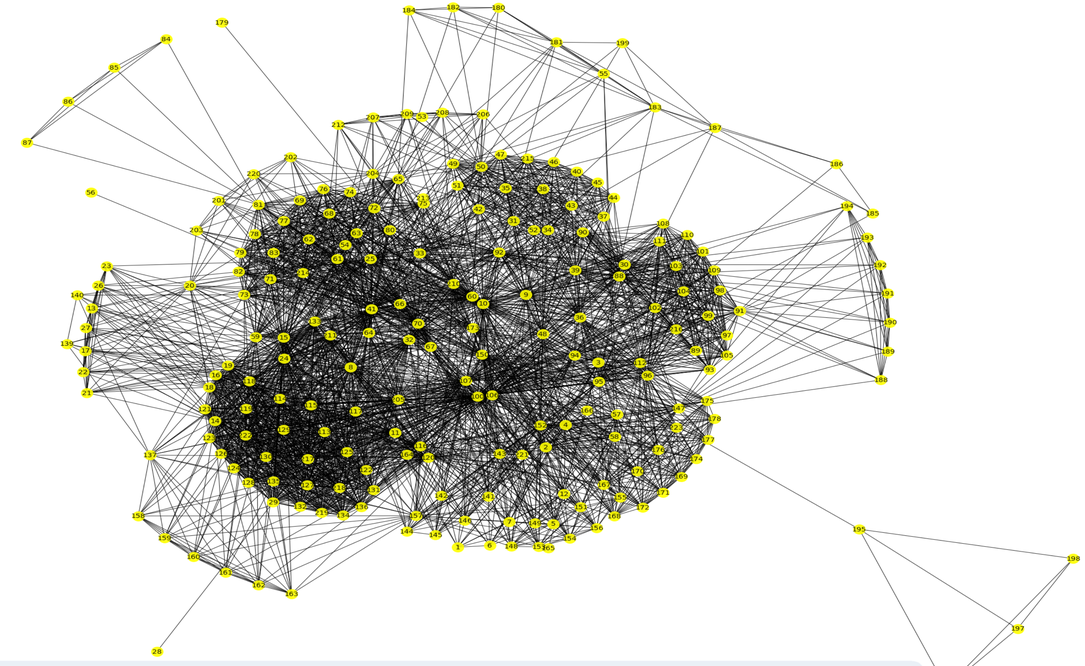

**Fig. 3.** A social network of 221 individual Bottlenose dolphins. The nodes represent each individual and the links indicate encounters with other individuals.


**Fig. 4.** Two unidentifiable individuals displaying a high abundance of stalked barnacles from 2017 (Figure 4A) and 2018 (Figure 4B)


**Fig. 5.** The majority of dolphin observations (63%) occurred at the tip of Cape Henlopen State Park in Delaware.

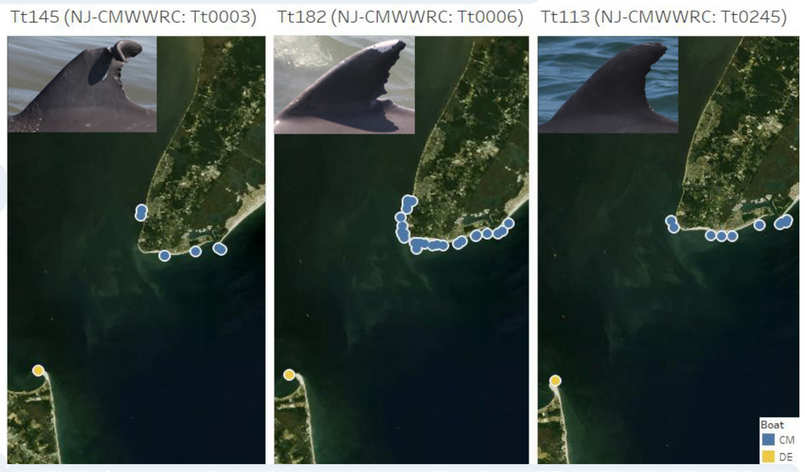


**Fig. 6.** Observations of 3 individuals out of 41 total off both Lewes, DE and Cape May NJ in 2018.

## DISCUSSION

- Data collection occurred on a total of 28 trips over 20 days within 2017-2018 over 765.1 kilometers.
- 223 uniquely identified individual dolphins were composed in a catalog using their natural markings (Figure 2). Within the same year, 29% (n=65) of these individuals were re-sighted and 13% (n=28) individuals within consecutive years. The sighting frequency of individuals ranged from 1-6 encounters overall.
- Two individuals from the catalog were not included in the social network. Delaware is composed of both inshore and offshore ecotypes; the two individuals that were not included in the social network may be within the offshore ecotype that did not occur with an inshore coastal group. The average clustering coefficient was 0.84, indicating high clustering, a possible result of a fission-fusion society. Tt10, Tt41, and Tt8 were the highest nodes for following algorithms; Page rank, Degree, Betweenness and Closeness centralities (Figure 3).
- Two sightings consisted of the offshore ecotype and were accompanied by a high abundance of psuedostalked barnacles and displayed random travel, sporadic movement, and quick group surfacing followed by a longer dive (Figure 4).
- There was an 18% (n=41) overlap with NJ-CMWWRC catalog; including freezebranded individuals, and kypothic scoliosis abnormalities. Travel between Cape May, NJ and Lewes, DE occurred in less than 24 hours with some individuals (Figure 6).

## FUTURE DIRECTIONS

- Comparison of the Lewes, Delaware catalog within OBIS-SEAMAP in the Mid-Atlantic Bottlenose Dolphin Catalog (MABDC) may reveal additional matches to other study areas.
- The combination of data collection with the ecotourism vessels, operated by Fisherman's Wharf and Cape May Whale Watch and Research Center, as well as dedicated or systematic boat-based surveys concentrating at the tip of Cape Henlopen State Park (Figure 5) will expand our knowledge of migration, movement, social structure, of the Northern Migratory Stock.

## REFERENCES

- Northeast Fisheries Science Center. "Common Bottlenose Dolphin (Tursiops truncatus truncatus): Western North Atlantic Northern Migratory Coastal Stock." NOAA Fisheries, April 2018, goo.gl/pFDoWB
- Wey, Tina, et al. "Social Network Analysis of Animal Behaviour: a Promising Tool for the Study of Sociality." Animal Behaviour, Academic Press, 26 Dec. 2007.

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