Better Understanding Watercraft Collision Mortalities in the Florida West Indian Manatee (2010-2018)

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Introduction

The Florida West Indian manatee (Trichechus manatus) recently became a threatened species after being endangered for decades (U.S. Fish and Wildlife Service 2017). Despite being taken off endangered status, the Florida Fish and Wildlife Conservation Commission (FWC) still recovers an increased number of manatee carcasses every five years, the most common mortality among these being watercraft collision mortalities since the 1970s (Ackerman *et al.* 1995; FWRI 2020). The FWC continues to collect data from recovered manatee carcasses in Florida to better understand common causes of death for the Florida West Indian manatee population. Although manatee protection efforts have been ongoing for decades now, evaluating the efficiency of these efforts has proven problematic (Calleson 2014). Determining whether sex, month or county have a dependent relationship with watercraft collision mortalities was done in the hope that it could help re-stabilize the manatee population by identifying which variables to target when improving upon manatee protection efforts.

Methods

Data was originally collected across the state of Florida by the Fish and Wildlife Research Institute (FWRI) field staff who constitute the research division of the FWC. Coordinates where manatee carcasses were recovered was recorded by FWRI field staff and verified by GIS FWRI staff. Alongside coordinates, the date that manatee carcasses were recovered, and a unique five-digit ID were recorded to verify that each sample was independent from one another. Data has been collected by FWRI staff from 1974 to 2018 with a sample size of 11940. This raw data was modified to create a subset of data suitable for statistical analysis. Modified data examined samples from the years 2010-2018 with a sample size of 2021. Modified data also excluded samples containing counties with sample sizes smaller than n=30, unidentified manatee carcasses, and perinatal mortalities in order to achieve more accurate and precise results.

Three chi-square tests were used to statistically analyze whether watercraft collision mortality in manatees was dependent on sex (whether a male or female manatee carcass was recovered), month (time of the year a manatee carcass was recovered) or county (counties in Florida where manatee carcasses were recovered). Watercraft collision mortality had two levels, Y or N, indicating the mortality was or was not watercraft collision related. Data was modified to change month from a discrete variable to a categorical variable in order to conduct a chi-square test (i.e. January instead of 1). Results were taken from statistical analyses conducted on the program JMP.

Results

- There was not a significant relationship between sex and watercraft collision mortality ($\chi^2 = 0.066$, p-value = 0.7975; Fig. 1).
- There was a significant relationship between month and watercraft collision mortality ($\chi^2 = 517.242$, p-value < 0.0001; Fig. 2). Month had the greatest frequency during the summer months of June, July and August.
- There was a significant relationship between county and watercraft collision mortality ($\chi^2 = 113.417$, p-value < 0.0001; Fig. 3). Watercraft collision mortality was examined across 12 counties with the greatest frequencies in Lee County, Brevard County and Volusia County.

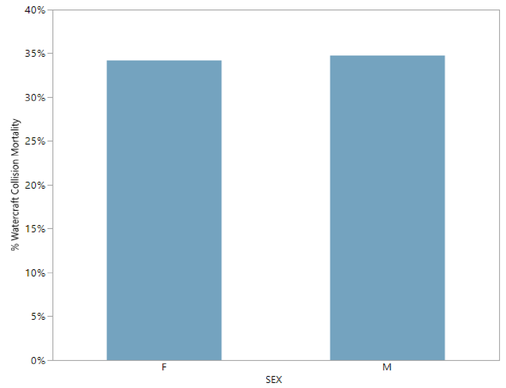

Figure 1. Comparing the relationship between sex and mortality type from recovered manatee carcasses (2010-2018). Sex: Male = M (n = 1033), Female = F (n = 988). Mortality type: Watercraft collision mortality = Y (n = 697), Non-watercraft collision mortality = N (n = 1324).

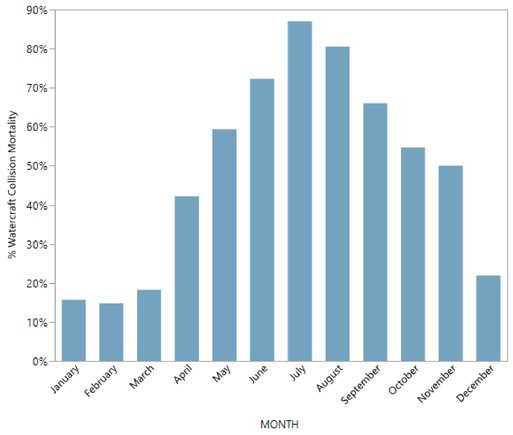

Figure 2. Comparing the relationship between month and mortality type from recovered manatee carcasses (2010-2018). Month: January (n = 420), February (n = 311), March (n = 328), April (n = 154), May (n = 128), June (n = 119), July (n = 100), August (n = 72), September (n = 53), October (n = 53), November (n = 96), December (n = 187). Mortality type: Watercraft collision mortality = Y (n = 697), Non-watercraft collision mortality = N (n = 1324).

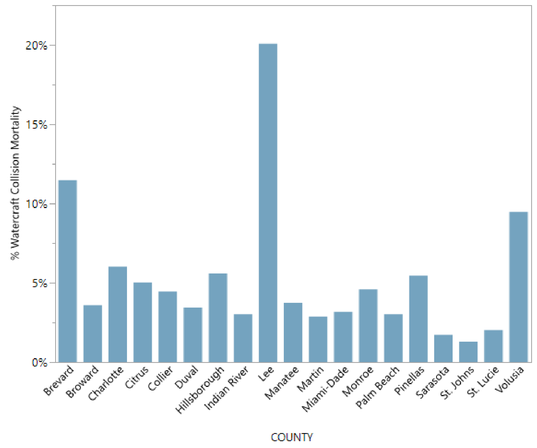

Figure 3. Comparing the relationship between county and mortality type from recovered manatee carcasses (2010-2018). County: Brevard (n = 322), Broward (n = 57), Charlotte (n = 106), Collier (n = 120), Duval (n = 66), Hillsborough (n = 80), Indian River (n = 75), Lee (n = 521), Manatee (n = 59), Martin (n = 49), Miami-Dade (n = 48), Monroe (n = 61), Palm Beach (n = 48), Pinellas (n = 66), Sarasota (n = 68), St. Johns (n = 31), St. Lucie (n = 47), Volusia (n = 115). Mortality type: Watercraft collision mortality = Y (n = 697), Non-watercraft collision mortality = N (n = 1324).

Conclusions

Sex and watercraft collision mortality did not have a significant relationship with one another so neither male or female manatees were more susceptible to be involved in a watercraft collision mortality. Manatees do not show obvious signs of sexual dimorphism, so results were reasonable since male and female manatees do not have any noticeable morphological differences (Mesnick 2018).

County and watercraft collision mortality had a significant relationship with one another, indicating that manatees were more susceptible to be involved in a watercraft collision mortality depending on the county they inhabited. Large bodies of water that manatees inhabited could have contributed to high watercraft collision mortality rates in certain counties, such as the Indian River Lagoon (IRL), whose main body of water resides in Brevard and Volusia county. Despite increased awareness, and the establishment of manatee protection zones, boat traffic in large bodies of water such as the IRL continues to directly and indirectly cause marine animal disturbance, injuries, and mortality (Bechdel 2009). Increased resources to produce stricter boating law enforcement in Lee, Brevard and Volusia county could be implemented to decrease high watercraft collision mortality rates since boating compliance increases with the presence of law enforcement (Gorzelany 2004).

Month and watercraft collision mortality had a significant relationship with one another, indicating that watercraft collision mortality had a higher frequency during the summer months of June, July and August. As of 2014, 56% of tourists in Florida visited during the spring and summer with beach/waterfront activities accounting for 41% of domestic tourists' choice for visiting Florida (Harrington 2017). The increase in watercraft collision mortalities during the summer was likely attributable to this tourism.

The patterns reflected when comparing county and month to watercraft collision mortality gives an idea of when and where to implement manatee protection efforts to maximize their efficiency. Continuing to collect data on recovered manatee carcasses is crucial for future studies to develop new methods to determine the effectiveness of manatee protection efforts and how to improve their efficiency. Future research, law enforcement and local communities need to work together so that the manatee population in Florida can continue to properly re-stabilize.

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