Investigating Correlations Between Sea Turtles and Their Major Threats

Casner Pernice

PSM in Environmental Sciences

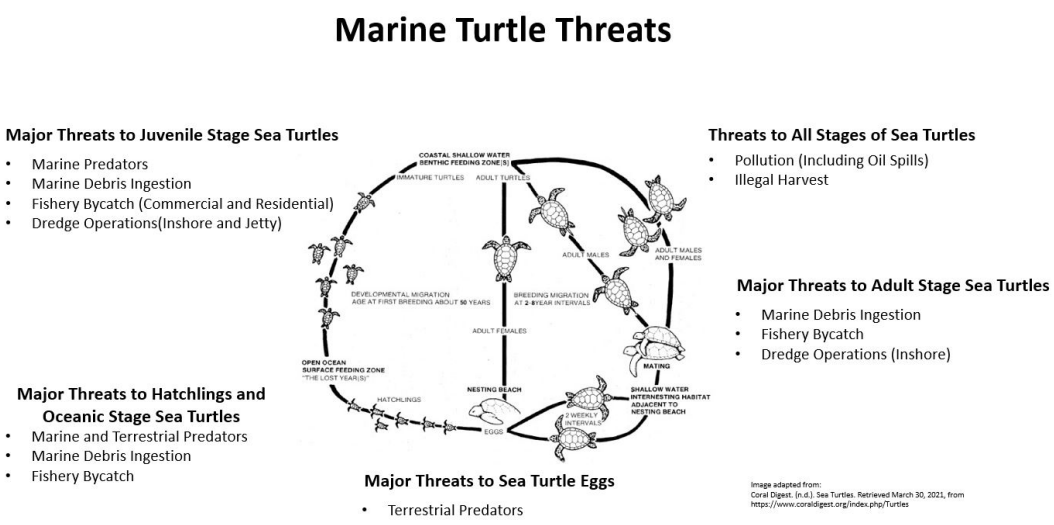
Executive Summary

March, 2021

During my internship with the National Parks Service and the Student Conservation Association, I worked with various sea turtle species present on Padre Island National Seashore (PINS). Located on North Padre Island in Texas, the longest undeveloped barrier island in the world, PINS is home to many critical endemic species. Among these species is the Kemp's Ridley sea turtle which is endangered and listed as Convention on International Trade in Endangered Species (CITES) Appendix I. This turtle is one of the flagship species for PINS and is slowly making its recovery after the historic population low in the 1980's.

Throughout their lifecycle, the sea turtles in the Gulf of Mexico face threats from many different sources, shown in Figure 1. Marine debris ingestion, fisheries interactions, and pollution are among the major threats that these critical species face, contributing directly to turtle strandings in the Gulf.

Figure 1: Major Threats Affecting Marine Turtles



To determine potential correlations between an increase in strandings and the threats to the sea turtle population, data were gathered on marine debris, shrimp fishery interactions, and plastics production. These data were sourced from the Ocean Conservancy Inter-Coastal Cleanup (ICC), Amendment 17b of the Gulf of Mexico Shrimp Fishery Management Plan, and EPA plastic packaging production data. In addition to these sources, I used nesting and population data from the 2015 5-Year Review: Summary and Evaluation of the Kemp's Ridley Sea Turtle and stranding data from the Sea Turtle Stranding and Salvage Network. Using the Pearson Correlation method, the correlations between sea turtle strandings and their major threats were examined to determine the type and strength of their relationships.

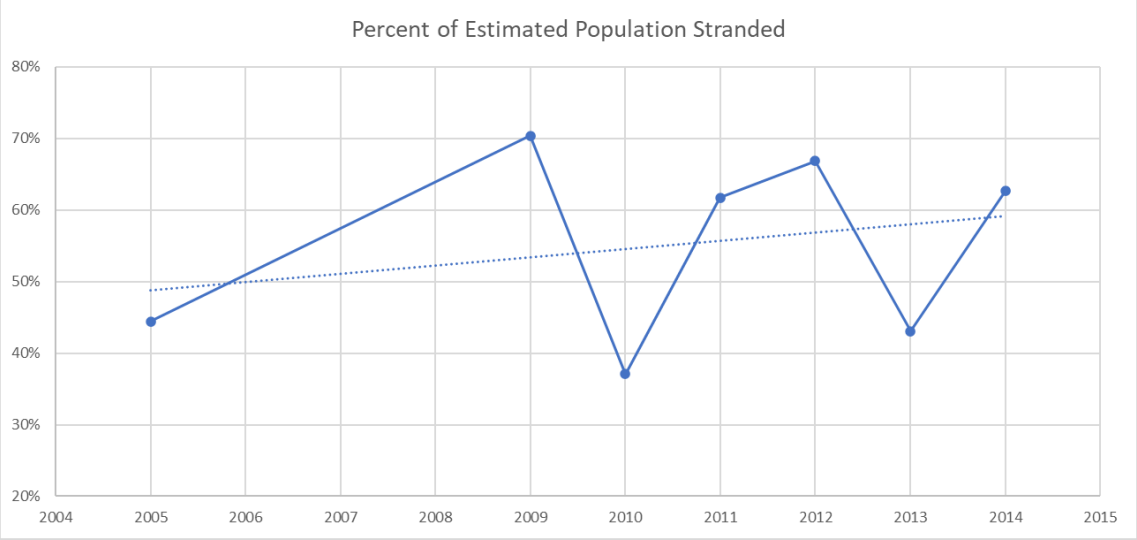
The relationship between the marine debris data and the turtle strandings showed a moderate positive correlation with a statistically significant result. However, due to temporal and spatial data limitations, the correlation between marine debris and sea turtle strandings is inconclusive. If data were to be improved using consistent reporting methods, these correlations could be revisited to provide a more holistic view of the turtle population and the relationship to marine debris. Additionally, improvements in data accessibility would provide a more refined dataset, which would be useful in determining human-turtle interactions and mortality caused by debris.

The relationship between strandings in Texas and Gulf shrimp fishery landings is negatively and weakly correlated due to the decline in the shrimping industry and is not statistically significant. Although the shrimp fishery causes turtle mortality through their operations in the Gulf, the data used is unable to be correlated to an increase in turtle strandings.

The correlation between the number of observed Kemp's Ridley nests in both Texas and Mexico and turtle strandings are moderately to strongly correlated. These correlations are statistically significant, showing that as the population grows, so will the number of strandings.

With the major threats analyzed, the largest population impact was observed following the Deep Water Horizon oil spill in 2010. Mortality of the Kemp's Ridley sea turtle immediately rose by 40 additional Kemp's Ridley strandings, or 35%, in 2010. In 2011, impacts were seen on other sea turtle species, with a doubling of strandings from the previous year. Of the other threats examined, shrimp fishery data do not appear to be correlated with an increase in strandings, while the ICC data collection methods for marine debris need to be improved before conclusions can be made. The only correlation that was found was between turtle nesting data and turtle strandings, indicating that turtle strandings increase with turtle population growth. This correlation is distinctly visible when turtle strandings are compared to estimated population on a percentage basis, as in Figure 2. Whether this is due to environmental carrying capacity of a migratory species or increased human-turtle interactions is grounds for additional study.

Figure 2: Percent of Estimated Population Stranded



Cited:

Coral Digest. (n.d.). Sea Turtles. Retrieved March 30, 2021, from https://www.coraldigest.org/index.php/Turtles

EPA. (2021). Containers and packaging: Product-specific data. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific-data#PlasticC&P.

NOAA. (1970, January 1). Bi-national recovery plan for the Kemp's Ridley turtle (Lepidochelys kempii). https://repository.library.noaa.gov/view/noaa/4368.

NOAA. (2015, July). Kemp's Ridley Sea Turtle 5-Year Review: Summary and Evaluation. https://repository.library.noaa.gov. https://repository.library.noaa.gov/view/noaa/17048.

NOAA. (2018). Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters, Final Amendment 17B.

Ocean Conservancy. (2020). Cleanup Reports. Retrieved March 30, 2021, from https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/annual-data-release/

Southeast Fisheries Science Center, 2020: Marine turtle stranding data- Sea Turtle Stranding and Salvage Network (STSSN) from 2000-01-01 to 2019-12-31. NOAA National Centers for Environmental Information, https://www.fisheries.noaa.gov/inport/item/27318.