Introduction

Many are interested in the conservation of Bald Eagles (Haliaeetus leucocephalus) since they are known as charismatic birds, are the national bird of the United States, and have been on the brink of extinction in the recent past. The state of Maine has paid close attention to Bald Eagle conservation since 1962 when the National Audubon Society initiated Bald Eagle monitoring in Maine and five other populations. Since then, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has worked towards re-establishing a self-sustaining population of Bald Eagles across Maine. Despite increasing numbers of nests and fledglings each year, there is no evidence that eagles can increase or sustain their numbers without special attention to the habitats they require and close monitoring of population growth and decline. As part of this effort in eagle monitoring, data for over 200 mortality cases had been collected over the past 25 years by the MDIFW, but has yet to be analyzed. This project analyzes this data set in a spatial way to tackle the following questions:

- What are common causes of eagle mortality in Maine and where exactly are they occurring?
- Are there trends in mortality factors based on location?
- Are mortalities generally natural occurrences or associated with human disturbance?
- Do places with high density population also have high density of eagle mortalities?
- Which kinds of disturbances might cause the most mortality? Is it roads, power lines, or hunting?

Descriptive Attributes

Causes of Eagle Mortality

Methods

Latitude and longitude coordinates of locations where eagle carcasses were found were plotted in the state of Maine. Next mortality counts by district were calculated and symbolized by color gradient (Figure 1). Density of eagle mortality was calculated and displayed using kernel density. To analyze whether human population affects eagle mortality, population density of Maine residents was symbolized using a census tract layer and was overlaid with densities of eagle mortality (Figure 2). Conservation lands were spatially joined with eagle mortality data to calculate the number of mortalities that occurred within 500m of a road, indicating that a vehicle collision might have been the cause of death (Figure 5). Line density of Maine roads was also calculated and symbolized by color gradient (Figure 4). To analyze the effect of roads on eagle mortality, buffer zones around roads were created and spatially joined with eagle mortality data to determine if mortalities occurred more often in non-conserved versus conserved lands (Figure 4). To analyze the effect of roads on eagle mortality, buffer zones around roads were created and spatially joined with eagle mortality data to calculate the number of mortalities that occurred within 500m of a road, indicating that a vehicle collision might have been the cause of death (Figure 5). Line density of Maine roads was also calculated and overlaid with eagle mortality density, to see if regions with higher road density overlapped with regions of high eagle mortality (Figure 3).

Results

Blunt trauma by vehicle collision, electrocution, and lead poisoning were identified as the most common causes of Eagle mortality in this sample (Figure 1). Carcasses were found most of often in the spring months (March, April, May, June). 60% of carcasses were adults, 30% immature, and 10% Nestlings. Areas with higher human population densities overlapped with areas of higher eagle mortality densities (Figure 2). Mortalities usually occurred in areas that were non-protected conservation lands (Figure 4). Areas with high road density also have high incidences of eagle mortality (Figure 3). 178 mortalities occurred within 500m of the road (Figure 5).

Conclusions and Further Research

From this analysis it is clear that human disturbance likely plays a role in Bald Eagle mortality since high densities of mortalities were found in areas with high human population and high densities of roads. There was however a large bias in this analysis since in areas with high population, eagles are more readily discovered. More thorough surveys for eagle mortalities in uninhabited areas would decrease the amount of bias in the data. There is more mortality data from MIFWS available; however, there are no coordinates for these carcasses. With a larger sample size, it would be interesting to analyze mortalities more specifically by cause of death. For example is there a specific body of water that is heavily fished and causing mortalities by fish hook ingestion that should be more closely regulated? Are mortalities caused by lead poisoning nearby hunting sites where eagles may have scavenged game and ingested lead pellet? Are electrocutions commonly occurring in the same locations, indicating that a specific power line is disrupting flight routes or in areas suitable for nesting? Although this project is a great start in analyzing eagle mortality data in Maine, analysis of a larger sample size data could yield more trends valuable to Bald Eagle conservation.