

Lab 9: Exploring the population dynamics of wintering bald eagles through long-term data (50 pts.)

Modified from: Julie Beckstead, Alexandra N. Lagasse, and Scott R. Robinson. 2011. *Teaching Issues and Experiments in Ecology*. Volume 7.

Introduction

This data set explores factors affecting the population numbers of bald eagles (*Haliaeetus leucocephalus*) surrounding Lake Coeur d'Alene, Idaho. The bald eagle is a large bird of prey that demands our attention by its physical features, its history of near extinction, and its dynamic population seen today.

Background Information:

The population trend of the bald eagle during the past 70 years provides a history with several important lessons. After World War II, the insecticide, dichlorodiphenyl-trichloroethane (DDT), was allowed for widespread agricultural use. Despite its effectiveness in killing insect pests on crops, the chemical accumulated in the body tissues of bald eagles (through biomagnification), making the birds unhealthy and causing them to lay thin-shelled eggs that broke as soon as the parents sat on them to begin incubation. The numbers of bald eagles in the contiguous United States, which were already declining due to hunting, plummeted as a result. The bald eagle was listed as endangered under the Endangered Species Act of 1973, and this protection, combined with the national ban of DDT in 1972, is credited with leading to the recovery of these magnificent birds.

Bald eagle numbers not only vary over historical time, but they also vary across the landscape with changes in the seasons. Like many birds, most bald eagles migrate in the winter in search of food. The primary food source for bald eagles is fish, and the eagles need open water to access the fish, which in many locations consists of spawning salmon at the shallow edges of lakes and streams. Once the lakes and streams freeze over, the eagles have to use an alternative food source (i.e., carrion such as dead deer or elk) or go elsewhere. Bald eagles will also feed on ducks, although not as frequently as fish. During the migration the eagles follow a route with several stopovers at lakes and streams along a southward corridor. The bald eagles travel individually, and although a given eagle may spend only a week or two at a stopover, collectively the eagles may be present for several months. Although the birds travel as individuals, once at a stopover, they will roost together in the evening (i.e., location where eagles gather to sleep for the night) and perch together in the same or adjacent trees.

Because of its endangered status in the early 1970s, several agencies and biologists initiated long-term surveys. Some of the surveys are ongoing nationwide surveys, such as the Midwinter Bald Eagle Survey, and others are local surveys such as the data set that is the focus of this activity. Since 1974, just two years after the ban on DDT, the Bureau of Land Management in Northern Idaho has counted migrating bald eagles every winter.

Instructions

Read the background information and look over the data available. As you explore, make notes about the factors influencing bald eagle numbers that interest you. Select one of those factors to investigate. For example, this could be a question relating to weather and eagle numbers or how human activities have affected eagle numbers (see Fig. 1 for a map of where the surveys took place).

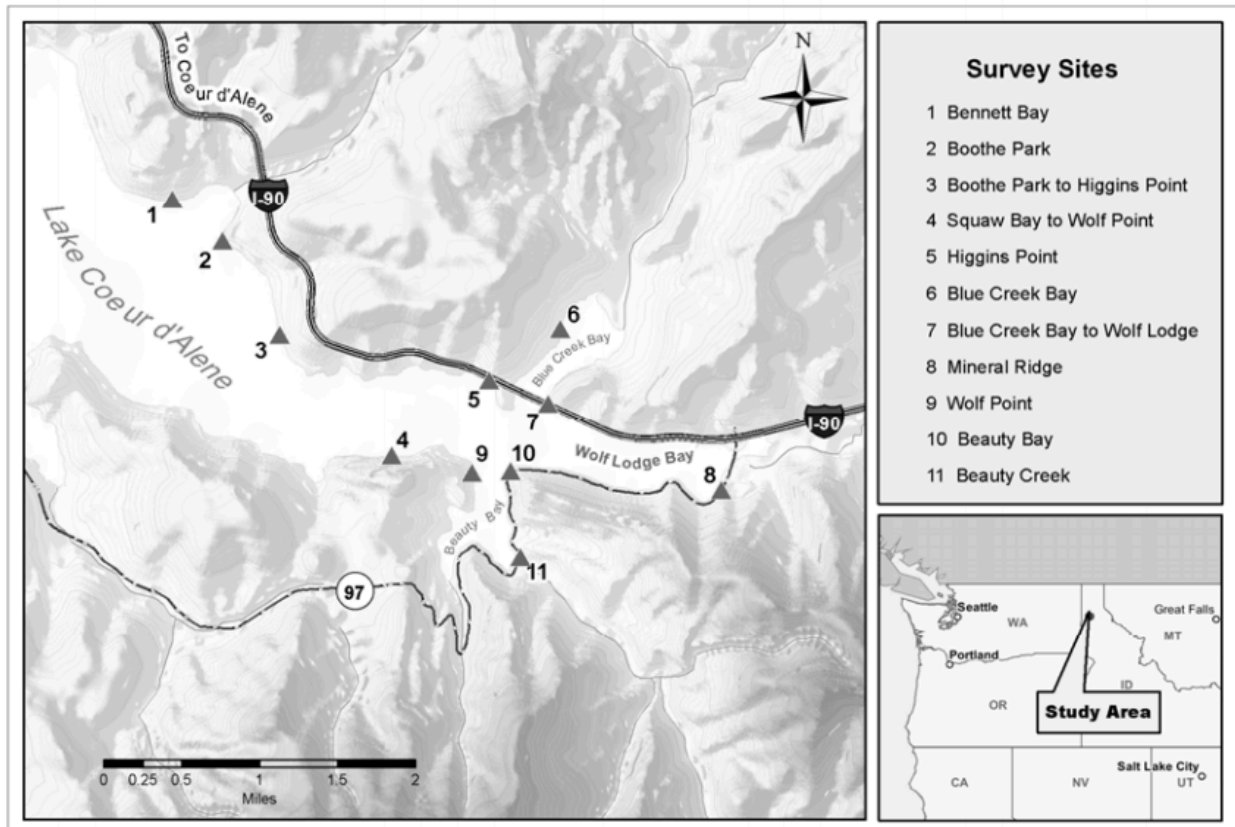


Figure 1: Map of the study area in the Pacific Northwest (United States) and the bald eagle winter survey sites along Lake Coeur d'Alene, Idaho.

1. Develop a hypothesis

Work with 1-2 others to develop a hypothesis you would like to test using eagle data provided. What are the predictions of your hypothesis? How will you test it? What data will you need? Are the data continuous or categorical? This will influence how you write your hypothesis and how you will be able to test it.

2. Analyze your data

Make a plan of how you will deal with missing data. Are any missing data absent due to bias? Or is it likely that there is bias in the missing data (do you expect the missing data to be systematically lower or higher than the reported data)? If it is unlikely that there is

a bias in what data are missing, it is fairly reasonable to ignore them. However, you should still mention the fact that they were missing in your discussion section. Make sure you are following good statistical practices and checking to make sure the data meet the assumptions of the test you are using. If they do not, try transforming them.

3. Write up a summary of what you found

This will be due 24 hours before the start of next week's lab.

Introduction

Briefly explain your hypothesis and why you thought it would be interesting to test.

Materials and Methods

Explain what data you used and how you analyzed it. Make sure to cite the source of your data.

Results and Discussion

Report the results of your analysis and explain your findings. Include 1-3 figures that summarize your findings, making sure to clearly label the axes and explain what each figure shows in its caption. Did your results support your hypothesis, or did you reject your hypothesis (it's ok if you did—that's part of science!)? Explain what your results mean in the broader context of ecology. Cite at least two peer-reviewed papers in your discussion to support your ideas. A bibliography is listed below to help you get started finding appropriate papers.

Questions to consider for your discussion section:

1. What physical changes could have occurred at the survey sites surrounding Lake Coeur d'Alene over the time scale of the survey that might have an impact on the data? Would these changes affect your conclusions?
2. Would patterns of abundance be the same for immature and adult bald eagles?
3. What factors did you choose to analyze and why?
4. Given the results of your analyses, what would you predict for the bald eagle population in the near future? Can you propose some alternative hypotheses for your project or some follow-up related hypotheses to test?

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