Project 4: Investigating flight response of Pacific Brant to helicopters at Izembek Lagoon, Alaska

Project description

Izembek Lagoon, an estuary in Alaska, is a very important staging area for Pacific brant, a small migratory goose. Each fall, nearly the entire Pacific Flyway population of 130,000 brant flies to Izembek Lagoon and feeds on eelgrass to accumulate fat reserves for nonstop transoceanic migration to wintering areas as distant as Mexico. In the past 10 years, offshore drilling activities in this area have increased and, as a result, the air traffic in and out of the nearby Cold Bay airport has also increased. There has been a concern that this inreased air traffic could affect the brant by disturbing them from their feeding and resting activities, which in turn could result in reduced energy intake and buildup. This may increase the mortality rates during their migratory journey. Because of these concerns, a study was conducted to investigate the flight response of brant to overflights of large helicopters. Response was measured on flocks during experimental overflights of large helicopters flown at varying altitudes and lateral (perpendicular) distances from the flocks. Results of this study will be used to guide the development of new FAA guidelines for airports near Izembek Lagoon. You will use these data to answer the following questions:

1. What is the effect of helicopter altitude on the flight response of Pacific brant?
2. What is the effect of helicopter lateral distance on the flight response of Pacific brant?
3. What recommendations can you provide in terms of air traffic near flocks of Pacific brant?

Background information

During the fall season, Izembek Lagoon, Alaska and adjacent estuaries support greater than 90% of the Pacific black brant (*Branta bernicla nigricans*) population. Izembek Lagooon was designated a wetland of international importance in 1985 because it supports large numbers of geese and other waterbirds. Aircraft and other human activities are continuing to increase in and near Izembek Lagoon. Brant and other geese are sentitive to aircraft and other human disturbances during fall migration. Human disturbance can disrupt feeding activities of geese, displace birds from feeding areas, and potentially affect energy reserves that are important for migration and over-winter survival of waterfowl. The current FAA minimum altitude standard for flying over Izembek Lagoon is 2000 feet.

In this study, overflights of two large helicopters with similar noise ranges, the Bell 205 and a Sikorsky HH-3F Coast Guard helicopter, were flown following established routes and altitudes. These two aircraft are commonly used in the area and would be expected to have the highest disturbance effects on brant. Flight-lines were aligned perpendicular or parallel to the shoreline of Izembek Lagoon to simulate local flight patterns. Data presented are for these experimental aircraft overflights (hereafter called overflights) at Izembek Lagoon and were used to assess the effects of altitude of the aircraft and lateral (perpendicular) distance from the birds on the behavioral response of brant. Lateral distance was determined from maps, which included the flight path of the aircraft and the location of the center of each flock. The behavioral response of brant flocks to overflights was recorded from blinds at various locations along the shoreline of the lagoon. Flock size was determined by visual estimation from the blinds. A flock was defined as a spatially distinct group of birds. In some cases flock members were dispersed over a 1km area, and an arbitrary subdivision of the flock was selected for observation.

The altitude for the aircraft was randomly assigned for each flight to one of nine discrete levels (measured in 100 meters): 0.91, 1.52, 3.05,4.57, 6.10, 6.71, 7.62, 9.14, 12.19. For the purposes of your analyses, you may wish to classify altitude into three categories: < 3 , 3-6, and >6 . You may also find it useful to consider four classes of lateral distance: <10, 10-19, 20-29, and >30.

Getting started in R

You can use the following R command to read the dataset into R:

```
project4.dat = read.table(file="project4.txt", col.names = c("observ", "altitude", "lateral", "flight"))
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The data set contains the following variables:

CODE	DESCRIPTION
observ	Number code for the flock observed
altitude	Altitude of the helicopter (100 meters)
lateral	Lateral distance of the helicopter to the flock (100 meters)
flight	Indicator of flight response (1=yes, 0=no)

You are acting as an agent asked to provide a written and oral report to the director of the Cold Bay airport and to local and state wildlife officials concerning the impact of helicopter traffic on Pacific brant.

Your written report must include:

- A title page
- A table of contents
- An introduction to the problem being considered, using appropriate scientific language where reasonable
- Clear statement of the specific questions of interest
- Presentation of relevant graphical summaries
- Presentation of relevant numerical summaries
- Descriptions of methods used in the analysis, along with addressing diagnostics to check for validity of conditions (e.g. QQ-plots, residual plots, etc.)
- Use of at least one statistical test, with proper statement of the test and a conclusion based on a p-value
- Use of at least one estimator, together with an assessment of uncertainty in the estimator (e.g. a confidence interval)
- Conclusions and recommendations written from the point of view of the agent and appropriate for the target audience

Your recorded presentation should be 8–12 minutes long (don’t take this literally), and should summarize your written report. Essentially, your recorded presentation should make clear what your conclusions and recommendations are, and should support them with a summary of the analyses and discussion of your methods.