EEB313 Group K Mid Project Update

Xuehai Zou, Eula Bui, Yao-Chi Yang, Ariane Lin

Hypothesis:

Original: Male and female juvenile North American red squirrels *Tamiasciurus hudsonicus* differ in their likelihood of acquiring a territory and surviving their first winter.

Adjusted: Male and female juvenile North American red squirrels *Tamiasciurus hudsonicus* differ in their likelihood of acquiring a territory and sex is the biggest factor that affects whether they can acquire a territory.

We changed from our original hypothesis to an adjusted one because the article already explored the relationship between sex and survival rate. Therefore, we needed to identify an aspect not covered in the article. We found that the relationship between other factors (such as differences in predators, prey, foraging behavior, resource allocation, growth rate, and density) and territory acquisition has not been studied.

This led us to come up with two predictions:

- Prediction 1: One sex (male or female) might have a higher likelihood of acquiring a territory.
- Prediction 2: The likelihood of acquiring a territory might be affected by differences in predators, prey, foraging, resource allocation, growth rate, and density.

Data Description:

Our dataset comes from a long-term study of wild North American red squirrels (*Tamiasciurus hudsonicus*) in Yukon, Canada. The data was originally collected to study survival, reproduction, and population changes in squirrels, with information gathered over 27 years through trapping, observations, and environmental measurements. Data is also collected from other studies. For example, white spruce cone availability, annual indexes of cones produced on a consistent subset of trees in each study area, is acquired from a study by LaMontagne, Peters, and Boutin. Abundance data for predators and their alternate prey is obtained from population monitoring in the research region. The dataset includes variables such as sex, growth rate (*growth*), standardized birth timing (*Std. BD*), food availability (*z.cones*), predator metrics (*Std. lynx* and *Std. muste*), temperature (*z.temp*), and territory acquisition status (*owner*). Other variables in the dataset include *individual ID*, *litter ID*, *year*, *grid location*, *survival status after 200 days (survived_200d)* are not included in our analysis. While it was designed to explore survival and fitness, we are focusing on how sex influences the likelihood of territory acquisition and whether it is the most important factor in acquiring a territory. To prepare the data, we selected relevant

variables (*sex, owner, growth, Std. BD, Std. lynx*, *Std. muste, z.cones, z.density* and *z.temp*), standardized continuous variables to improve comparability, and *owner* was encoded as a binary variable. Additionally, we excluded incomplete records to ensure data quality.

Analysis Plan:

For Prediction 1, we will conduct a logistic regression to assess the likelihood of acquiring a territory as a function of sex, treating the acquisition of a territory *(owner)* as the binary outcome variable. The assumptions of the model will be validated by checking the independence of observations and conducting a log-likelihood ratio test to assess the results and test the hypothesis. For Prediction 2, we will conduct a logistic regression with multiple predictors, such as predator abundance *(Std. lynx)*, growth rate *(growth)*, resource availability *(z.cones)*, population density *(z.density)*, and temperature *(z.temp)*, along with potential interactions like those between predators and prey availability. The model will be validated using a log-likelihood ratio test and the Akaike information criterion. Visualizations like density plots will be created to understand variable distributions and relationships.