**ESM 212, Spring 2023**

**Exercise #3**

**Estimating small mammal and reptile population size using Mark-Recapture**

The purpose of this exercise is to reinforce the course field trip and readings estimating animal population size using the closed-population mark-recapture method. Please read the instructions carefully. You can insert your answers into this document and then upload to gauchospace. Please note: this is meant to be useful and interesting, not to simply make work for you. Please let me know if you have any questions or if the instructions are not clear and I will try to clarify asap.

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Your Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Methods**

Over the course of this week, we simulated a mark-recapture study of small mammals at Coal Oil Point, sampling for two consecutive nights on a regular trapping grid. Individuals would have been marked with ear tags to be able to identify recaptures.

For the sake of this exercise, we will use a subset of the data from MacDonald et al. 2018 *Ecosphere*, as the class case study data are not sufficient to make population estimates. We will assume that the populations were closed: no births, deaths, immigration, or emigration, which is reasonable given the short timeframe of the sampling and the localized area in which sampling took place. In this case, three consecutive trapping nights were used to distinguish population sizes between burned and unburned plots in Los Padres National Forest following the 2013 White Fire.

In this analysis we will use a Huggins closed population model, making the simplest assumptions about capture and recapture probabilities (e.g. they are equal and do not differ based on age, sex, prior capture history, etc.)

The data can be found in csv files in the exercise folder (FYI, no *N. fuscipes* were trapped in the burned plots, so there is no data file for this):

Questions:

1a) What is the estimated population size of *Peromyscus* mice inside and outside the burn area (this is done in the r script for you)? (Use the Huggins closed population function in the R package ‘mra’).

1b) Repeat 1a for *Neotoma fuscipes* (woodrats) and *Sceloporus occidentalis* (fence lizards).

2a) Use a t-test to compare population estimates for *Peromyscus* mice between the burned and unburned plots (this is done for you in the r script).

2b) Repeat 2a for *Neotoma fuscipes* (woodrats) and *Sceloporus occidentalis* (fence lizards).

3) From what you have learned about mark-recapture and animal behavior, briefly discuss the main sources of uncertainty in such a mark-recapture survey and how you might change our method (sampling or modeling approach) to reduce these uncertainties.