

BIO470 Assignment 1

USING R TO EXPLORE REEF FISH BIOMASS AND WOLF-MOOSE POPULATION DYNAMICS

1 Objectives

This assignment is designed to get users comfortable using R. For this assignment **R** or **RStudio** may be used. **RStudio** is simply a more user friendly (i.e. GUI setup) way to implement the **R** language. The questions in this assignment are designed to test a number of objectives:

- Using R as a fancy calculator
- How to call data into R
- Data types
- How to manipulate data frames
- Extracting basic information from data
- Plotting

The CRED data are estimates of the biomass (grams/m²) of four trophic groups (Pisc = piscivores, Herb = herbivores, LowCarn = benthic carnivores, Planktivore = planktivores) at islands in the Northwest Hawaiian archipelago (NWHI), the Main Hawaiian Islands (MHI), and Pacific Remote Island Areas (PRIAs). Data were collected by stationary point counts (SPC) of reef fish > 20g, and there are environmental predictor variables for the sea surface temperature (mean annual, SST), productivity (mean annual, chlorophyll a), and the log10 human population size at each island. The variable 'state' indicates if the island is populated (disturbed) or unpopulated (remote). Read Williams et al. (2010) Differences in reef fish assemblages between populated and remote reefs spanning multiple archipelagos across the central and western Pacific (Journal of Marine Biology, 2011) for extra details on the dataset (on the website).

The Isle Royale dataset describes the demography of moose and wolves on Isle Royale on Lake Superior (<http://www.isleroyalewolf.org/data/data/home.html>). The data are a time series of species population estimates, moose mortality and recruitment rates, and wolf predation rates. See the short powerpoint on the website for more details on the data.

2 Completing the assignment

This assignment will be marked out of 100 points, and is worth 10% of your final grade. To receive a grade on the assignment, you must turn in an **R script** that includes the answers to each question. Code for plots should be written in the script, and the plots themselves sent as separate pdf files. See the 'exampleanswers.R' on the website for an idea of how to complete

the assignment. There are a number of resources available for completing this assignment and learning R - use the tutorial PDFs and the online links to help you with your coding (google "how to....in R" if you're stuck!).

3 Exercises

We will be using the Isle Royale data on wolf-moose dynamics, and a new version of the NOAA CRED reef fish dataset.

1. Keep your code well commented and structured throughout the script (10 pt)
2. Create some objects in your workspace (10 pt total)
 - (a) Create a sequence of numbers from 1 to 100, increasing by 10 each time. Save this sequence as 'seq.a' to your workspace. (2 pt)
 - (b) Store three objects, such that 'a' is equal to 10, 'b' is equal to 22, and 'c' is equal to 40. (2 pt)
 - (c) Remove object 'c' from your workspace. (2 pt)
 - (d) What is a factor? (2 pt)
 - (e) How would you change a factor to a number? (2 pt)
3. Explore the CRED dataset (10 pt total)
 - (a) Print the first six records (2 pt)
 - (b) How many columns and rows are in the data frame? (2 pt)
 - (c) What are the names of the variables in the data set? (2 pt)
 - (d) What types of variables (e.g. numeric, factor) are included in the data? (2 pt)
 - (e) What is the range of biomass values in the full dataset? (2 pt)
4. Export data for the PRIA islands only - save as a csv file in your working directory. (5 pt)
5. Calculate some statistics on the CRED dataset (20 pt total)
 - (a) What is the mean and variance of the biomass of each trophic group? (5 pt)
 - (b) What is the standard deviation of the productivity at the disturbed islands? (5 pt)
 - (c) How much piscivore biomass is there as a proportion of the total reef fish biomass? (in the full dataset) (5 pt)
 - (d) Which island has the highest biomass of herbivores? (5 pt)
6. Explore the drivers of piscivore biomass (20 pt total)

- (a) Report the slope of the relationship between piscivore biomass and productivity? (5 pt)
 - (b) Make a multi-panel plot (4x4) of the relationships between 1) piscivore and 2) herbivore biomass with productivity and SST (10 pt)
 - (c) Add a linear regression line to each plot, and annotate your plot with the slope of the relationship and the associated significance figure (P value). (5 pt)
7. How do moose and wolf populations change over time? Using the Isle Royale dataset, recreate the figure below. (25 pt)

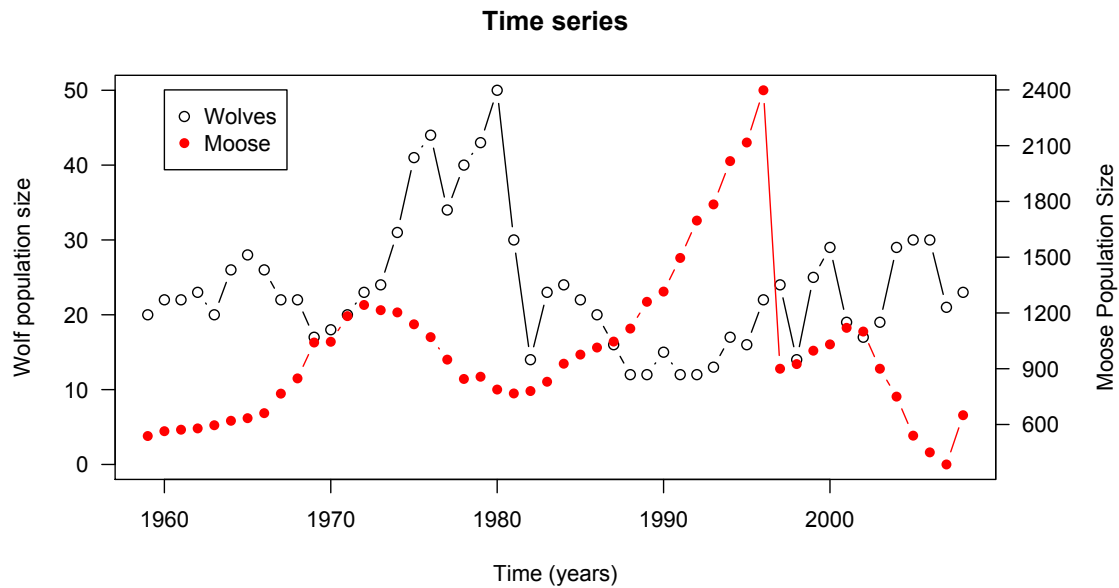


Figure 1: Isle Royale time series