

BIO470 Spring 2015 Assignment 2

DIVERSITY PATTERNS IN PACIFIC CORAL REEF FISH COMMUNITIES

DUE 14:30 MONDAY 23rd MARCH. Email your R script and PDFs of any plots to **jame-spwr@uvic.ca**

1 Objectives

This assignment tests your ability to carry out a research project, using R from start to finish. This assignment will cover:

- Loading and cleaning data
- Manipulating data into a form suitable for analysis
- Writing a function to calculate a species diversity index
- Using multiple regression to examine diversity drivers
- Making a relevant and informative plot.

The CRED data are counts of coral reef fishes from four trophic groups (Pisc = piscivores, Herb = herbivores, LowCarn = benthic carnivores, Planktivore = planktivores) at islands in the Main Hawaiian Islands (MHI), Marianas Archipelago (MARIAN), 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), and productivity (mean annual, chlorophyll a) at each island. Islands are coded as "DISTURBED" for populated and "REMOTE" for unpopulated. As with Assignment 1, 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).

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 a single **R script** that includes the answers to each question and the code you used for any calculations, plots and statistics. 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!). In each question, there are multiple ways of getting the correct answer. Use whichever you feel comfortable with - but **there are marks for efficient/quick coding in this assignment.**

3 Exercises

Make sure you download the updated CRED dataset (CRED_diversity_assignment2.csv).

1. Keep your code well commented and structured throughout the script (5 pt)
2. Keep your code efficient and quick - try and minimise the number of objects you create in your workspace (within reason), and use functions (e.g. aggregate) rather than subsetting objects to work with the data. (10 pt)
3. **Loading and cleaning data** (10 pt total)
 - (a) Load in the dataset. Examine each variable and clean the necessary variables (e.g. NAs, spelling mistakes, different datasets...) (8 pt)
 - (b) Export the clean data frame as a csv file (2 pt)
4. **Manipulating the data:** the dataset is unsuitable for analysis in its current form. Manipulate the dataset before analysis. (10 pt total)
 - (a) Arrange the data so that you have the total counts of each species, at each island. Keep (or add in) the explanatory variables in the new data frame (5 pt)
 - (b) Use the xtabs() function to create a community matrix table of species counts by island (5 pt)
5. **Explore the dataset:** calculate some statistics on the CRED dataset (use the total counts data frame, not the community matrix table) (10 pt total)
 - (a) How many individual fish are in the dataset? (2 pt)
 - (b) How many species are in the dataset, for each trophic group? (2 pt)
 - (c) What is the correlation coefficient between productivity and SST at the MHI islands? (2 pt)
 - (d) How many islands were sampled in 2010? (2 pt)
 - (e) What is the most abundant species at Baker? (2 pt)
6. **Calculate a species diversity index:** Write a function that calculates Pielou's evenness (using the vegan package, check the examples in the diversity() function for Pielou's equation) (5 pt)
7. **Estimate coral reef fish diversity:** using the community matrix table, calculate Pielou's evenness of the reef fish community (20 pt total)
 - (a) Calculate Pielou's evenness for each island and save as an object (5 pt)
 - (b) Add the explanatory variables to the Pielou's evenness data frame (5 pt)
 - (c) Create boxplots of Pielou's evenness for each island, year, and state (3 separate plots) (10 pt)

8. **Using multiple regression:** examine the drivers of Pielou's evenness with a multiple linear regression model (10 pt total)
- (a) Run a multiple linear regression to examine the drivers of Pielou's evenness (no interactions) (5 pt)
 - (b) Write a short description of the results of the regression (slopes, significance values, R^2) How does SST influence evenness? How does productivity influence evenness? Use the statistics you've run to support your answer. (5 pt)
9. **Plotting:** create a publication quality figure (multi-panel) that shows the change in Pielou's evenness with 1) productivity and 2) across each region. Choose whichever plot type you think is most appropriate for each relationship - use colour, legends and labels to fully describe the data. Marks will be given for creativity here - remember that you want to use the plot design to clearly translate the results of your model to the reader of your figure. (20 pt total)