TIEE

Teaching Issues and Experiments in Ecology - Volume 20, June 2024

Reorganisation following disturbance: multi trait-based methods in R

Introduction

In this practical, we will use a multi trait-based approach to determine how communities are impacted by a disturbance event. Morphological and ecological traits can be used to understand species in terms of their roles in an ecosystem and interaction with the environment and other species. You should already be familiar with the concept of species diversity (how many species there are). In this practical, we will focus on trait-based 'functional' diversity (what species might actually be doing).

The ecological communities in question are coral reef fish assemblages found on reefs around Lizard Island, located on the northern Great Barrier Reef. The disturbance event is the prolonged heat wave—extreme temperatures experienced in 2016 that triggered mass coral bleaching (Hughes 2017).

Over the practical, we will use the statistical programming tool R to calculate multi trait-based indices of 'functional' diversity and to examine how fish assemblages changed from before to after the coral bleaching event. The trait-based diversity indices are produced using multivariate statistical methods. Multivariate analysis is useful because it allows you to detect patterns in several variables (e.g., multiple species) at once, and reduce a large complex dataset into a smaller number of components. Once calculated, you will compare the trait-based diversity indices before and after the coral bleaching event. After these practical computer sessions, you will produce a scientific poster summarizing these findings, and present your poster to your peers at a student symposium. This is a 3-part practical:

Part 1 – Getting to know the dataset and the ecosystem

Part 2 – Building the multi-trait space to measure trait-based diversity

Part 3 – Analysing the trait-based diversity indices and presenting your data

Over the course of the practical you will learn about trait-based methods, a tool that is increasingly used in the field of community ecology. You will learn about the impact that climate change has on coral reefs using a real-life dataset and you will gain practice in handling, summarizing, and visualizing data in R. The practical handouts form a complete standalone guide to the work: if you follow the instructions, you will be able to produce the results that you will present in your poster.

Assessed elements

This practical will contribute to 50% of the overall module mark. The practical will be assessed based on your production and presentation of an individual scientific poster:

a) Presentation of poster at the student symposium (15% of total module mark)
b) Quality of submitted poster content (35% of total module mark)

Logistics

During this practical you will be assigned to a group. Each group will focus on a different habitat in the dataset, and you will choose particular species observed in that habitat for an additional part of your analyses. This way, at the poster session, you can learn from your peers. You can choose to work individually or in your habitat group – this is up to you.

After each practical session, are a list of tasks that you will need to do in preparation for the next practical. The expectation is that you spend time in between practicals doing this preparation and making sure you have understood what was covered in the sessions.

During the practical part 3, we will go over how to make an effective scientific poster.

Make sure you know the practical times, dates, locations, and the poster assignment deadline and student symposium date.

Key reading

Background on the disturbance event and ecosystem of focus

Hughes et al. 2017. Global warming and recurrent mass bleaching of corals. Nature 543:373-377. https://doi.org/10.1038/nature21707

Paper on which the practical is based and dataset sourced

Richardson et al. 2018. Mass coral bleaching causes biotic homogenization of reef fish assemblages. Global Change Biology 24: 3117-3129. https://doi.org/10.1111/gcb.14119. Available free of charge and without subscription here: https://doi.org/10.25903/5b57c26b0beb7 (Chapter 4).

Paper outlining methods employed to build a functional space to calculate functional richness – just read to understand generally, don't worry about the details just yet

Magneville et al. 2022. mFD: an R package to compute and illustrate the multiple facets of functional diversity. Ecography 2022:https://doi.org/10.1111/ecog.05904

Any questions, just ask – that is why we are here!