Marine Ecological Modelling
Global Climate Change

Course Overview

Jorge Assis, PhD // theMarineDataScientist, jmassis@ualg.pt
2020, Centre of Marine Sciences, University of Algarve

Scope

Interactions and potential **impacts of global climate changes on different levels of marine biodiversity**.

Hands-on oriented, with a strong **component on biodiversity and climate data acquisition, management and visualisation, as well as on ecological modelling** using state of the art mechanistic and correlative approaches.

Goals

Get to know the foundations of **ecological niche theory**;

Develop skills on **marine macroecology**, **climate data acquisition**, **management** and **visualisation**;

Develop skills on **mechanistic and correlative ecological modelling**;

Understand the strengths of niche modelling and the develop skills for proper **model transferability across space and time**;

Week 1-4

S01. Course overview

S02. Principles of Geographic Information Systems

S03. Ecological niches and geographic distributions

S04. Climate oscillations and distributional shifts of marine biodiversity

S05. Biological and environmental data for macroecology

S06. Principles of Ecological Niche Modelling

S07. Potential applications of ENM

S08. Model fitting and transferability in space and time

S09. Bringing realism to ENM

Week 5

Individual research study addressing a topic in the context of ecological modelling and global climate change.

[**Presentations discussing study possibilities** 5 + 10 minutes]

Week 6-9

S10. Evaluating predictive performance and setting decision thresholds

S11. The diversity of algorithms of ENM and ensembles

S12. Improving transferability of ENM

S13. Exploring niche evolution and speciation mechanisms

S14. Dissemination of results

Week 10

Individual study addressing a topic in the context of ecological modelling and global climate change.

[**Final Presentations** 10 + 10 minutes]

Evaluation

Each student needs to write an **individual** report (**research study**) addressing the interactions OR impact of global climate changes (past OR future) in one of the different levels of biodiversity. This can be:

(1) identifying the main environmental drivers shaping distributions;

(2) predicting present distributional ranges;

(3) projecting future range shifts;

(4) predicting marine invasion processes, etc.

Formulate a relevant research ecological question

>> what will be the consequences of future climate to *Zostera noltii*?

Students must formulate an hypothesis, based on the general theories presented in the lectures or from literature

>> increasing emissions of greenhouse gases will produce more severe range shifts to *Zostera noltii*.

Build a conceptual model to address the question in their system

>> model the ecological niche of *Zostera noltii* and predict its distribution for the present and for future climate conditions.

Read literature in a systematic, quantitative way, to collect, assess the evidence for the different components of their model and hypotheses, and formulate conclusions and recommendations

Evaluation

Individual research study

[Week 05] Presentation / Discussion : 5 + 10 min (10% grade)

[Week 10] Presentation : 10 + 5 min (20% grade)

[Week 14] Report (15pp without references, paper format; 60% grade)

[Week 14] Documented R markdown script as supplementary information of the final report (10% grade)

Mid-term Exam

[~Week 10] Multiple choice + up to 4 essay questions, 90 min; > 9.5

** **Final grade = (Exam x 0.3) + (Individual research x 0.7)**

Class room

Mondays [15:30-18:30]

C1 0.29.1

- Theory [up to 50m]
- Break [10m]
- Hands-on [50m]
- Relax [...]

Resources

https://github.com/jorgeassis

Sessions (PPTs), Data, Scrips, challengeSolutions, codeRecipes
literature.md (Interesting and mandatory reads per session)

Time for additional questions

[Mondays 10:00 to 12:00] Room 2.67 Building 7

[Fridays 15:00 to 17:00] jmassis@ualg.pt