Master's Thesis Opportunity n. 3: Mediterranean coastal lagoons food web reconstruction through integrated meta-analysis of literature data.

Topic

Trophic food webs in Mediterranean coastal lagoons: comparing diet reconstruction methods and their implications on food web analysis.

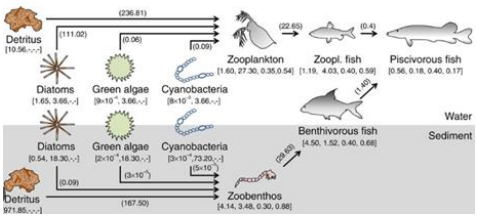
Project:

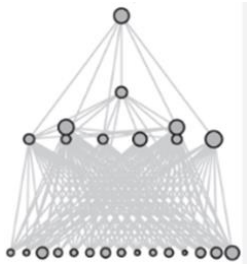
The Research is framed within the Project "WebDNA – Food Web Reconstruction through Environmental Dna Analysis" – Leverhulme Trust foundation, March 2025-March 2028.

Background

Food webs connect organisms through consumer-resource interactions, and their structure and dynamics vary as the composition and relative abundance of species change in response to environmental factors. Among aquatic ecosystems, Mediterranean coastal lagoons experience remarkable seasonality, that determine variations in species assemblages and food web structure, which are also shaped by the migratory patterns of various life stages of marine species that find food and shelter in the lagoon environment, and the importance of benthic primary producers in these shallow habitats. Increasingly frequent disturbances – such as climate warming, extreme weather events, over-exploitation, or pollution – will alter biodiversity, disrupting trophic interactions and energy flows, and affect ecosystem services in these transitional environments (e.g. carbon storage, food production, nutrient cycling, recreation).

Monitoring changes in food webs is a key step towards understanding the trajectories of these ecosystems, and their response to environmental change. In this context, reconstructing food webs through meta-analysis of literature data represents a key approach to overcome the complexity of field data collection, while integrating information derived from different trophic ecology methods such as gut content analysis, stable isotopes, and diet metabarcoding. Trophic interactions from multiple studies can be compiled and then used to reconstruct food webs using network theory and food web metrics. There analyses allow the comparison of food webs derived from different methods, across multiple study sites, allowing for the evaluation of how methodological choices influence the characterization of trophic interactions and overall network structure.





Objectives

The aim of this thesis is to reconstruct trophic interactions in Mediterranean coastal lagoons based on data derived from a quantitative meta-analysis of studies with a specific focus on comparing different

diet reconstruction methods (e.g. stomach content analysis, stable isotopes, metabarcoding) and evaluating how these influence the resulting food web structure.

Specific objectives include:
a) Integrative Meta-Analysis, aimed at developing a framework for synthesizing and comparing literature data on species diet and trophic interactions from different methodological approaches.
b) Datasets will be compiled, considering trophic interactions among taxa (e.g. fish and benthic macroinvertebrates), based on different diet reconstruction methods.
c) The resulting databases will be used to reconstruct food webs, and comparing their structure using selected food web metrics.

Expected Outcomes

1. A robust assessment of current knowledge on trophic interactions in transitional environments, highlighting potential, methodological limitations, and research gaps in the context of Mediterranean lagoon trophic ecology.
2. Comprehensive datasets of Med lagoons ecological features, anthropogenic pressures, trophic webs descriptors, and of diet details.
3. Food webs structure for different lagoon typologies, under different environmental conditions.

Candidate Profile

We are looking for a motivated master's student with a background in Ecology and Biology. Interest in trophic ecology and food web analysis. Willingness to work with literature data and perform statistical and network analysis in R. Basic knowledge of R is preferred.

Start: May 2025

Duration: approx. 8 months
Location: Activities will be carried out at the Laboratorio di Ecologia Sperimentale e Acquacoltura (LESA) – Dipartimento di Biologia, **Supervisor:** Prof. Eleonora Ciccotti
Co-supervisor: Dr Chiara Leone

Interested candidates are invited to send a short motivation letter to:
ciccotti@uniroma2.it and chiara.leone@uniroma2.it