

Master's Thesis Opportunity n. 4: Application of Labelling Techniques and Machine Learning for the Early Detection of Blue Crab Zoeae in Mediterranean Coastal Lagoons.

Topic

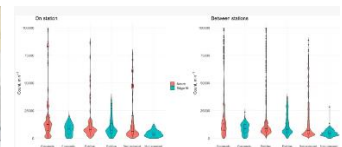
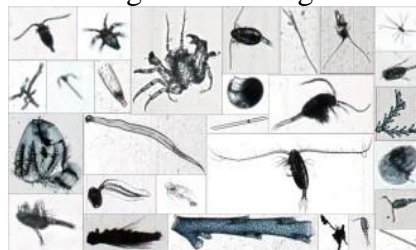
Development of an early detection system of larval recruitment of *Callinectes sapidus* in Mediterranean coastal lagoons, based on Labelling and Machine Learning techniques.

Project:

The Research is framed within the Project “ZoeAI” – Regione Lazio Codice Intervento 116101 – Azione 1 – Obiettivo Specifico 1.6 – PN FEAMPA 2021/2027., February 2025-February 2026

Background

The blue crab, *Callinectes sapidus*, is an invasive species widely established across several Mediterranean coastal ecosystems, including Italian lagoons. Its presence is associated with significant ecological impacts, including predation on native species, alteration of trophic webs, and Understanding the factors regulating larval recruitment and juvenile settlement in transitional environments, such as lagoon-sea interfaces, is crucial for the development of early recognition systems of the larval stages of the blue crab, and hence to predict the species' spread dynamics in coastal lagoons, in order to support effective management strategies.



Objectives

The main goal of the thesis is the development of a system for the early detection of Blue Crab (*C. sapidus*) during recruitment and colonization at the larval stage (zoea) in coastal lagoons. The work will integrate field work with lab work, combined with image analysis and machine learning.

Specific objectives include:

- a) Development of an automated system to collect plankton images in two coastal lagoons of Central Italy, and for the automated classification of planktonic species with particular attention to blue crab zoeae, also taking into account the role of environmental drivers of larval recruitment to the lagoon (sampling calendar, sampling stations in each lagoon).

- b) Collection of high-quality annotated dataset build by labelling techniques, and development of models for the detection, recognition and count of *C. sapidus* (blue crab) zoeae within complex planktonic samples.
- c) Training and validation of machine learning models and artificial intelligence techniques applied to automatic image recognition, to early detect *C. sapidus* zoeae in the lagoons

Expected Outcomes

1. Tool for the automatic collection on field of images of planktonic species
2. Labelling techniques for the creation of a high-quality dataset of images,
3. Models for the detection, recognition and count of blue crab zoeae, based on the use of machine learning and artificial intelligence.
4. Integrated automated tool for early monitoring of the blue crab in coastal lagoons.

Candidate Profile

We are looking for a motivated master's student with a background in Ecology and Biology. Interest in fieldwork, lab work and ecological modelling is essential. Good organizational skills and attention to detail are required. Basic knowledge of statistical analysis in R is preferred.

Additional Information

Start: May 2025

Duration: approx. 8 months

Location: Some fieldwork in two coastal lagoons of Central Italy for sampling and ecological characterization of the study sites; some laboratory activities at the Laboratorio di Ecologia Sperimentale e Acquacoltura (LESA) – Dipartimento di Biologia, for the taxonomical identification of plankton;

A consistent part of the work will be conducted at the Laboratorio di sensoristica e imaging del Centro di ricerca Ingegneria e Trasformazioni agroalimentari - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (CREA) (Monterotondo, RM)

Supervisors: Dr Corrado Costa (CREA, external) and Prof. Eleonora Ciccotti (internal)

Co-supervisor: Ing. Lavinia Moscovini (CREA)

Interested candidates are invited to send a short motivation letter to:

ciccotti@uniroma2.it and corrado.costa@crea.gov.it