

PhD POSITION TO APPLY TO THE SPANISH FPU PROGRAM

Research Project - **Climate Change and Future Marine Ecosystem Services and Biodiversity**

FutureMARES is an EU-funded research project examining the relations between climate change, marine biodiversity and ecosystem services. Our activities are designed around three Nature-based Solutions: Marine Protected Areas, Marine Restoration and Sustainable Harvesting of Marine Resources.

Reference: H2020-CLIMATE/0713

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Centre: Institut de Ciències del Mar (ICM-CSIC)

Project description

Anthropogenic climate change is one of the main drivers of the on-going biodiversity crisis (1). The rapid modification of abiotic conditions, mainly temperature, is accelerating population decline and local extinction, substantially modifying the networks of interactions among the levels of diversity, from gene to communities (2). These biotic alterations impact the functioning of ecosystems altering related socio-economic services and, calling for a change in governance paradigm and ambitious conservation actions (3).

Complex feedbacks among ecological (e.g. reproduction) and evolutionary (e.g. local adaptation) processes are driving the biodiversity response to disturbances, over contemporary timescale (4). This eco-evolutionary framework takes on its full meaning to tackle climate change issues, particularly when considering that, besides extinction, the response of biodiversity relies on two non-exclusive strategies: i) migration to track optimal conditions, resulting in shifts in species distribution ranges; ii) adaptation, through genetic adaptation, or acclimatization, through phenotypic plasticity, to the new conditions (5). Accordingly, intraspecific genetic diversity changes, and underlying eco-evolutionary processes, are receiving particular attention from conservation biologists, but still remain barely considered by policy makers (6). In the marine realm, for instance, marine protected areas (MPAs) and ecological restoration, two of the most efficient nature-based solutions to tackle climate change impacts (7), usually rely on “species-based pattern” rather than “eco-evolutionary-based processes” considerations, limiting their efficiency (8). Acknowledging this need to shift from a pattern-based to a process-based conservation biology, the main objective of this work will be to develop evolutionarily enlightened management of habitat-forming octocorals in the Mediterranean sea.

The Mediterranean Sea is, at the same time, considered as a hotspot of marine biodiversity and as a hotspot of climate change. In the last decades, mass mortality events (MMEs)

linked to marine heat waves have been observed along thousands of kilometers of Mediterranean coastal habitats. Populations of habitat-forming octocorals were dramatically impacted by MMEs, with up to 80% of impacted individuals in some locations (Cerrano et al., 2000; Garrabou et al., 2001, 2009, 2019). The reported high incidence and mortality rates in these ecologically key species may induce cascading effects at the ecosystem level, questioning the future of associated communities. Interestingly, intensive field surveys conducted during the MMEs demonstrated that these events are characterized by their differential impacts at all the biological levels considered: among individuals, populations and species and even within colonies for colonial species such as octocorals. It has been proposed that individuals or populations within species may show different levels of tolerance to thermal stress and that thermoresistant individuals may be use for restoration actions. Nevertheless, the underlying eco-evolutionary processes explaining those differential responses remain to be fully characterized.

Here, we aim to improve our understanding of habitat-forming octocorals eco-evolution in the context of climate change in order to improve their conservation and restoration. This project will benefit from the the genomic resources (de novo whole genome) recently (Paramuricea clavata) or being (Eunicella cavolini, Eunicella singularis) developed in Mediterranean habitat forming octocorals.

As a starting point, we suggest:

- i) the characterization of the pattern of neutral and selective genetic diversity in the target species;
- ii) the inference of underlying processes with particular focus on connectivity, genetic drift and local adaptation to thermal conditions;
- iii) a characterization of the processes and genetic factors implied in the differential responses to thermal stress combining experimental ecology (common garden experiment) and population genomics.

These objectives will be refine based on the candidate skills and interests within the range of comparative genomics, population genomics and molecular ecology.

Requierments of the candidate

- We are looking for a candidate with strong interest in evolutionary biology, population genetics and skills in bioinformatics.
- Academic records higher than 8
- The candidate must be enrolled in a doctorate program for the course 2020/2021.
- Experience in scuba diving may be a plus to take part in field work and eventually develop in situ experiments.
- For more information on the application form, please see [this link](#).

Hosting research team

The candidate will join the Ecology and Resilience of Benthic Ecosystems in a Changing Ocean team at the Institut de Ciències del Mar ([ICM-CSIC](http://www.icm.csic.es)) in Barcelona (Spain) [More information](#). The team is part of a multiple institution group [MedRecover](http://medrecover.org) devoted to marine conservation in the global change context (<http://medrecover.org>) composed by scientists from different background dedicated to the conservation biology of Mediterranean biodiversity.

The hosting team is currently involved in several National and EU projects aiming to projects providing insights in the implementation of science-based effects of climate change and other major drivers of degradation embracing multidisciplinary from benthic ecology, hydrology, mineralogy and genomics. The team has been especially active in analyzing the central role of Marine Protected Areas (MPAs) as tools to counteract the negative effects of human activities. The ultimate final goal in enhancing the effectiveness of marine management and conservation strategies. To this end the group works in close cooperation with the administration, authorities and society in general (educational and outreach projects) as key issue for our research group.

How to apply

- At the first step, the applicant will be evaluated based on the university degree. If appropriate, selected candidates could be invited for an interview. The period of application is **from 16 November to 11 December 2020**.
- At the second step, selected applicants, together with the PhD project, will be evaluated for a final selection.

Interested candidates, please contact the Principal Investigators:

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