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CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS
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INSTITUTO DE INVESTIGACIONES MARINAS

MASTER THESIS GRANT

The Institute of Marine Research offers 6 Master thesis grants to promote scholarly research in marine sciences by students already enrolled in a Master programme at any European University.

These scholarships are focused to master students interested in starting a research career, making possible the realization of a period of fellowship in one of the research groups that develop their work in the Institute of Marine Research (IIM) of the Spanish National Research council (CSIC), according to the thesis topics described below.

Master's students are invited to apply under the following conditions:

Deadline: 30 October 2020.

Location: the successful candidates will be based at Instituto de Investigaciones Marinas (Institute of Marine Research) in Vigo, Spain.

Host institution: IIM undertakes research on oceanography, global change, fisheries ecology, stock assessment, biodiversity, reproductive ecology, aquaculture, larval rearing, microbial ecology, marine pollution and conservation of marine endangered species. It runs long-term projects on ecology of coastal and shelf ecosystems, studying organisms from phytoplankton to cetaceans, and the environmental (natural and anthropogenic) factors affecting their abundance, distribution and dynamics. CSIC is the largest public research institution in Spain and the third largest in Europe, hosting over 4000 doctoral and post-doctoral researchers across 138 institutes. Its mission is to foster, coordinate, develop and promote scientific and technological research, of a multidisciplinary nature, in order to contribute to advancing knowledge and economic, social and cultural development, as well as to train staff and advise public and private entities on this matter.

Funding: Each fellowship will be funded with a monthly stipend of 800€ up to a total of 4,800 € (6 months). The scholarship will not be considered salary or remuneration, but scholarship training.

Period and duration: The intended duration of each fellowship is 6 months, ideally between January and June 2021, although eventually the research stay may be started earlier and finished not later than August 31 2021. It is compulsory to stay during January and March 2021.

Requirements: Applicants must hold a first degree in relevant subjects (see below) and should not have initiated the Master Thesis, but should be already enrolled in a master programme. A minimum grade point average is established for each thesis topic (see below).

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Training: IIM offers during the research stay a range of short training courses, as i) code of good scientific practice; ii) data management and open science; iii) public outreach and media communication. Regular scientific seminars are also hosted at IIM. The fellows must give a seminar about their thesis results.

Application procedure: Applicants should send a single PDF document with i) a letter of motivation (no more than 1 page) and their CV (no more than 4 pages), including descriptions of the candidate's education and work experience, plus elementary personal data (date and place of birth, citizenship, language proficiency), indicating your grade point average (GPA), in the units used by your institution, over all courses excluding the thesis grade for each diploma that you have earned or are currently studying towards. In addition, the GPA must be converted onto a 0 to 10.00 scale. The document should be submitted to Fran Saborido-Rey, jaeintro@iim.csic.es.
Applicants may contact with the PIs to obtain further information about each thesis theme (details are provided below).

Thesis topics:

IIM offers to conduct Master thesis in the following topics:

1. Land-sea input of rare earth elements
2. Development of artificial intelligence (AI) techniques for the photo-identification of fish individuals and implementation of a capture-mark-recapture model (CMR)
3. Development of molecular markers to study kinship relationships in coastal elasmobranchs
4. Effect of seawater warming and turbulence on ecophysiological responses of the infaunal clam *Polititapes rhomboides*
5. Genetics of pigment pattern formation in fishes. Evolution of counter-shading mechanisms
6. Microbial interactions in macroalgae with implications in aquaculture

Details for each topic are found in the table below, including the requirements regarding degree subjects and the GPA.

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#1 Land-sea input of rare earth elements

The rare earth elements (REEs) constitute a group of 17 elements (scandium, yttrium and lanthanides) widely used in our high-tech society. Despite this, the biogeochemical cycle and anthropogenic impact, as emerging contaminants, of REEs has been scarcely tackled in coastal systems, particularly in the Galician Rias (NW Iberian Peninsula).

The reason of this Master Thesis Grant is to introduce a student in the REEs questions.

The Training Plan will follow three steps:

- Bibliographic review on REEs in estuarine waters and sediments: search for publications in Scopus, CSIC library, and Marine Biogeochemistry Group (BGQM; IIM-CSIC) collection.
- Knowledge of equipment and techniques for REEs: participation in sampling (if possible) and sample processing in a clean room.
- Data processing and study, techniques for writing scientific articles learning, and preparation (as co-author) of a manuscript about fluvial REE contributions to a Galician ria, quantifying pristine and anthropogenic inputs, to be submitted to a JCI journal.

Moreover, if the fellow shows skills, support in an application for a predoctoral contract in a public call to carry out a thesis on REEs in BGQM (IIM-CSIC).

Supervisor	Ricardo Prego (prego@iim.csic.es)
Degree Subject	Applicants must hold a first degree in chemistry, environmental science, or similar.
GPA	The minimum required is 8

#2 Development of artificial intelligence (AI) techniques for the photo-identification of fish individuals and implementation of a capture-mark-recapture model (CMR)

Photo-identification tagging-recapturing systems are an effective, fast, inexpensive and non-invasive way of studying fish populations, identifying and tracking individuals in time and space. However, the application of CMR by photo-identification depends on the fact that individuals can be photographed under different conditions and that the organisms studied possess a phenotypic trait that is recognizable and stable over time. For this study, we have selected the Raja undulata as the target species to develop and test the system. This species has a very recognizable color and shape skin pattern that is easy to capture through photographs either in its natural environment or once captured. This project requires the development of photo collection surveys that will allow the generation of a complete database of digital images that feed the recognition algorithms (based in deep learning) used to discriminate between individuals. Surveys will be carried out to ensure a minimum number of recaptures that test the recognition algorithms. Different types of campaign (diving, fishing) will be carried out to test the system in different conditions. The experience obtained by the IIM-CSIC BioProcess Engineering group, an integral part of the current research team, during the development of the SICAPTOR project (Pleamar Programme 2018) will be a guarantee for the viability of this objective. This group will be in charge of setting up the individual recognition system based on artificial intelligence concepts (mainly deep learning algorithms and convolutional neural networks) while the Fisheries Ecology group will provide support applying CMR.

Supervisor	Luis Taboada Antelo (ltaboada@iim.csic.es) and Alexandre Alonso Fernández (alex@iim.csic.es)
Degree Subject	Applicants must hold a Bachelor's degree in relevant and related subjects (e.g., biology or marine biology, , biotechnology, physics, mathematics, engineering or similar).
GPA	The minimum required is 7

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#3 Development of molecular markers to study kinship relationships in coastal elasmobranchs

Genetic techniques require minimally invasive sampling methods and can be used to identify individuals, eliminating the need to physically mark the specimens, as is traditionally done. Molecular identification techniques are routinely being used to monitor endangered, rare or invasive species, among others. However, in this project, genetic tagging is proposed as an alternative for those species lacking phenotypic traits clearly recognizable from photographs. Coastal species can develop more or less complex social structures, although observations of elasmobranchs in groups suggest sociality in sharks and rays. The role of kinship in structuring social organization in fish species is largely understudied. We propose to develop molecular markers to genetically identify individuals, eliminating the need to physically tag them. This data, in combination with high spatial resolution information from acoustic telemetry (project TAC and DESTAC) will be used to determine if kin structure plays a role in social networks in elasmobranchs. Furthermore, kinship analysis might allow to estimate population size and other demographic population parameters of interest (abundance, connectivity, reproductive output, etc.).

Supervisor	Alexandre Alonso Fernández (alex@iim.csic.es) and Laura Casas (lauracasas@iim.csic.es)
Degree Subject	Applicants must hold a first degree in relevant subjects (for example, biology, biotechnology, marine biology, environmental science).
GPA	The minimum required is 8

#4 Effect of seawater warming and turbulence on ecophysiological responses of the infaunal clam *Polititapes rhomboides*

The banded carpet shell clam *Polititapes rhomboides* is a very particular infaunal bivalve mollusk with special importance for the ecosystem Rías Baixas (NW Iberian Peninsula). Unlike other clam species of commercial interest like *Ruditapes philippinarum* (Manila clam), *R. decussatus* (carpet shell clam) and *Venerupis corrugata* (pullet carpet shell), *P. rhomboides* corresponds to the only species not impacted by anthropogenic actions (seed exchange, purchases, etc), being only harvested directly from natural sandy bottoms. In the past, events of massive mortality were noted for *P. rhomboides* associated to periods of seawater warming and excess of turbulence (e.g. impacts of waves) that, after weakening the health condition of the clams, triggered the proliferation of rickettsias (natural intracellular prokaryotic colonies) infecting the gills of specimens. In order to understand the set of responses that the exploited clam *P. rhomboides* may activate facing environmental stress and their impacts, laboratory-based experiments in small culture tanks will be conducted changing the environmental scenarios according to these two key abiotic factors (temperature and turbulence). The aim is to detail the importance of each factor and their potential synergies for the health status of the organisms. Both the commercial interest of the species and the ecological and biodiversity impacts on their native ecosystem will be better understood and preserved with an integral knowledge of the impacts in the clam's health system of these two natural stressors.

Supervisor	José Manuel Fernández Babarro (jbabarro@iim.csic.es) and Miguel Gil-Coto (migil@iim.csic.es)
Degree Subject	Applicants must hold a first degree in relevant subjects (for example, biology, marine biology, marine science, environmental science, chemistry, etc.), and should not have initiated the Master Thesis
GPA	The minimum required is 8

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#5 Genetics of pigment pattern formation in fishes. Evolution of counter-shading mechanisms

How does animal colouration come about? What processes control the distribution of pigments or pigmented cells in reproducible ways? How is the diversity of coloured fish in a tropical reef generated? This is the problem of pigment pattern formation. Pigment pattern formation is a classic problem in biology, with wide implications both at a basic biological level and an applied level. In this project we aim to understand the genetic and cellular bases for dorso-ventral pigment pattern formation in fishes. We use zebrafish and turbot as animal models. The molecular and cellular understanding that the ICUS-Fellow develops will have direct implications for a comprehensive understanding of vertebrate pigment pattern formation, but will also have application to the industrial problem of fish stock discolouration.

Supervisor	Miquel Planas (mplanas@iim.csic.es) and Josep Rotllant (rotllant@iim.csic.es)
Degree Subject	Applicants must hold a first degree in relevant subjects (for example, biology, marine biology, environmental science, biochemistry, biotechnology, etc.), and should not have initiated the Master Thesis
GPA	The minimum required is 8

#6 Microbial interactions in macroalgae with implications in aquaculture

Bacterial communities associated with Ulva spp. play an important functional role both in morphogenesis and reproduction, considering Ulva and its associated microbiota a singular functional entity or holobiont. Moreover, Ulva spp. host antibiotic-producing bacteria (APB, e.g. *Phaeobacter* sp.) with known antagonism against fish pathogens.

Using a multi-disciplinary approach, including -omic techniques, the research will contribute to the understanding of the role those APB, and the conditions that favour their predominance in Ulva spp., which would have implications in disease control in fish-algae IMTA-RAS systems.

Supervisor	José Pintado (pintado@iim.csic.es)
Degree Subject	Applicants must hold a first degree in biology, marine biology, environmental science, or similar. Background in microbioloy and genomics will be valuable.
GPA	The minimum required is 8