Institut de Ciències del Mar

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MSCA DN - Doctoral Candidate 12 - PhD scholarship in robotics and camera-based strategies for monitoring harmful algal blooms

The PhD student will participate in an international team in an EU-funded Marie Skłodowska-Curie Doctoral Network project called BlueOcean (Grant Agreement 101312043). The project consists of 13 PhD students at 6 universities, 2 research centres and 5 companies, with partners from five European countries. All 13 PhD projects are within the overall theme of sensing and mapping the ocean. Projects span from optical instrumentation for sensing the benthic and pelagic zone, AI for improved classification of marine species, robotics and autonomous platforms with geolocalisation, to specific marine applications.

This PhD project will take place at the Institute of Marine Sciences (ICM-CSIC) in Barcelona, Spain. Apart from the time at ICM-CSIC there will be secondments of 2 months at the Technical University of Denmark, DTU Electro (DK), and 2 months at IQUA Robotics (ES). There will also be regular meetings with the other 12 PhD students in the doctoral network, including 3 training schools.

As a participant of the project, the PhD student will become part of a team at ICM-CSIC with expertise in marine robotics, ocean observation technologies, phytoplankton ecology and harmful algal blooms. The activities within the project will benefit from synergies with other projects in the group and at the institute. The thesis will be co-directed by Dr Ivan Masmitja (ICM-CSIC) and Prof. Christian Pedersen (DTU Electro), and a tutor from the UPC doctoral programme will also be appointed. Dr Elisa Berdalet (ICM-CSIC), expert in phytoplankton ecology and harmful algal blooms, and Dr Natàlia Hurtós (IQUA Robotics) will be members of the Thesis Board within the BlueOcean network, providing scientific guidance and support to the candidate.

Responsibilities and qualifications

Introduction. Harmful algal blooms are increasing along European coasts, with impacts on human health, tourism, aquaculture and ecosystems. On Mediterranean beaches, the toxic benthic dinoflagellate Ostreopsis spp. forms recurrent summer blooms that cause respiratory irritation in beach users. Blooms and other aggregations of marine flora and fauna are patchy:

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they appear quickly, drift and change shape, and are easily missed by fixed stations, ship surveys or satellites. Monitoring them calls for autonomous, non-invasive and cost-effective tools that can go where the bloom is and decide where to look next.

Within this context, the candidate will develop new strategies for algal bloom monitoring using robotic platforms equipped with cameras. RGB and low-cost hyperspectral cameras, together with other optical sensors developed in BlueOcean, will be integrated on autonomous surface and underwater vehicles. The candidate will develop adaptive sampling methods, in which the robot uses what it sees to change its path and find, follow and map a bloom in near real time. They will also develop supervised autonomy, in which operators and robots share decisions during a mission so that experts can guide and correct the robot when needed. AI models will detect and classify algae and marine organisms in the images and feed these decisions. Field tests will take place at the Ostreopsis hot spot of Sant Andreu de Llavaneres, 40 km north of Barcelona, where blooms have been recurrent since 1998, and at other sites along the Catalan coast where blooms of the microalgae are also frequent during the summer bathing season.

This PhD project aims to give marine robots the ability to find and characterise harmful algal blooms on their own, and to turn their observations into an early warning system for Ostreopsis spp.

The project will consist among others of the following tasks:

- Integrate RGB and hyperspectral cameras on robotic platforms, synchronised with navigation, positioning and environmental data.
- Develop AI and computer vision models to detect and classify algal blooms, microalgal aggregates and marine animals from imagery.
- Design adaptive sampling strategies that let robots locate, track and delineate patchy blooms in near real time.
- Develop supervised-autonomy frameworks in which human operators and robots share decisions during field missions.
- Carry out the yearly field monitoring of Ostreopsis spp. blooms at Sant Andreu de Llavaneres, collecting environmental parameters (light, nutrients, depth, temperature, salinity, macrophytes) to study the genesis and dynamics of the blooms and the conditions that favour their spread.

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- Validate the robotic system against conventional sampling (cell counts, microscopy), and prepare the network deliverables Description of the Ostreopsis bloom (D3.1) and Early warning system for Ostreopsis spp. (D3.6), as well as the associated Ostreopsis monitoring milestones.

The doctoral candidate (DC) is expected to travel to network partners under two secondments for a total duration of about 4 months. At DTU, the candidate will learn about LiDAR and hyperspectral imaging systems to characterise the water column. At IQUA Robotics, they will learn about instrumentation deployed on marine AUVs. Additionally, the DC is expected to participate in outreach activities including, but not limited to, videos, social media updates, participation in public events and campaigns, as well as dissemination to the popular press. Furthermore, due to the mobility rules of the Marie Skłodowska-Curie programme, the applicant must not have resided or carried out their main activity (work, studies, etc.) in Spain for more than 12 months in the 36 months immediately before their recruitment date. Applicants must not hold a doctoral degree at the date of recruitment.

The candidate must hold a master's degree, or equivalent, that gives access to doctoral studies in Spain, in marine technology, robotics, or engineering (mechatronics, electronics, telecommunications, computer science) or a related field. We are looking for a candidate with a strong background in marine technology and robotics, such as autonomous vehicles, ROS and path planning. Experience with AI and computer vision, ideally for the classification of marine animals or organisms from images, is required, together with good programming skills (e.g. Python, C++). Experience with optics or hyperspectral imaging, fieldwork at sea, drone or boat operation, and knowledge of phytoplankton ecology will be considered an advantage. Fluent English and willingness to do fieldwork at sea are required.

Approval and enrolment

The scholarship for the PhD degree is subject to academic approval. The candidate will be enrolled in either the Doctoral Programme in Electronic Engineering or the Doctoral Programme in Automatic Control, Robotics and Vision at the Universitat Politècnica de Catalunya (UPC), depending on the candidate's profile. The UPC will award the doctoral degree. For admission requirements and the general planning of doctoral studies, please see the UPC Doctoral School website (https://doctorat.upc.edu/en).

We offer

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ICM-CSIC is one of the leading marine research centres in Europe and a Severo Ochoa Centre of Excellence. We offer a rewarding and challenging job in an international and interdisciplinary environment, on the Barcelona seafront, with direct access to coastal field sites. You will receive structured training within a cohort of 13 doctoral candidates and work with partners from academia and industry across Europe.

Salary and appointment terms

The appointment will be a full-time employment contract with the Spanish National Research Council (CSIC), under the rules of the Marie Skłodowska-Curie Actions. The period of employment is **3 years** (36 months), with an expected start in February 2027.

The successful candidate will receive a financial package plus an additional mobility and family allowance according to the rules for Doctoral Candidates (DCs) in an EU Marie Skłodowska-Curie Actions Doctoral Networks (MSCA DN):

- Living allowance* – 3,833.56€ (per month)
- Mobility allowance – 710€ (per month)
- Family allowance** – 660€ (per month – if applicable)

* may differ according to the country correction coefficient.
** The amount for the family allowance (660€/month) will be adjusted according to the actual family status of the recruited researchers (as specified in the 'researcher declaration').

The **living allowance is a gross EU contribution to the salary costs of the researcher**. The net salary will result from deducting all compulsory (employer/employee) social security contributions as well as direct taxes from the gross amounts, according to the law applicable to the agreement concluded with the DC.

Useful links

You can read more about ICM-CSIC at www.icm.csic.es.
If you are applying from abroad, you may find useful information on working in Spain at EURAXESS Spain.

Application procedure

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Applications must be sent by email to Dr Ivan Masmitja (masmitja@icm.csic.es) no later than **December 23, 2026 (23:59 Central European Time).** The subject of the email must be "BlueOcean DC12 application – Name Surname".

To be given consideration, all materials must be attached to the email as one PDF file in English, named "BlueOcean_DC12_Name_Surname.pdf". The file must include:

- A letter motivating the application (1-page cover letter)
- Curriculum vitae (4-page maximum)
- BSc and MSc grade transcripts and diploma, including an official description of the grading scale

You may apply prior to obtaining your master's degree but cannot begin before having received it. Applications received after the deadline, or that do not follow these instructions, will not be considered. Applications will be assessed in an open, transparent and merit-based process, and shortlisted candidates will be invited to online interviews. Personal data will be processed only for this selection process, in accordance with the EU General Data Protection Regulation (GDPR).

All interested candidates, irrespective of age, gender, disability, race, religion or ethnic background, are encouraged to apply. BlueOcean actively aims at gender balance.

The recruitment is taking place following the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, which all candidates are encouraged to study. The position will also be published on the EURAXESS Jobs portal.

About ICM-CSIC

The Institute of Marine Sciences (ICM) in Barcelona is part of the Spanish National Research Council (CSIC), the largest public research institution in Spain. ICM is also the largest marine research centre in Spain and holds two consecutive Severo Ochoa Centre of Excellence accreditations, being the first marine research centre to obtain this accreditation. Its research covers physical, chemical, geological and biological oceanography as well as marine technology, with the aim of understanding the ocean and supporting its sustainable management.