

Cullen Scholarship: Seabed Landers for Ocean Processes and Ecosystems (PhD Award)

Background

Ireland is required to designate 30 % of its EEZ as marine protected areas (MPA) by 2030. In order to do so, scientific data and evidence is required to underpin the designation of particular sites. Offshore marine protected areas are dynamic and often inaccessible using conventional ship-based sampling techniques. Several member states are using novel approaches to acquire high temporal resolution data at specific sites to assist in the designation of MPAs and environmental reporting.

Recent field tests show the potential of low-cost arrays of seabed landers and sensors off the Iberian margin where ocean current, temperature, seabed imagery and ancillary biological variables have been systemically collected over timescales from weeks to years. In some experiments, up to 20 landers were deployed enhancing the spatial footprint of this approach.

Data collected have enhanced the evidence-base for Marine Protected Area designation and monitoring at various locations along the Iberian margin. The data have also enhanced understanding of physical and biological processes in the regions of interest. Shared research cruises between Spain, Portugal and Ireland have enabled technology transfer of this novel sampling approach ([LanderPick](#); Gonzalez-Pola *et al.* 2022).

We propose to build and use lander-based systems to observe and collect baseline data to support Marine Protected Area designation and environmental monitoring in Irish waters as part of the wider Atlantic Arc Lander Monitoring (AALaMo) initiative (an emerging network of ocean bottom observations).

Proposal

We propose a **structured four-year PhD** on a full-time basis to build and deploy lander-based systems in Irish coastal waters, shelf seas and deep Atlantic habitats. The landers developed will typically measure ocean currents, temperature, salinity, oxygen and benthic imagery. Data generated from these deployments will feed into the development of data products of policy relevance.

The project aims to:

1. Demonstrate the feasibility of the lander concept under real circumstances.
2. Assess lander performance and cost efficiency, and evaluate its "fitness-for-purpose" to improve coverage for long-term shelf and deep ocean *in-situ* monitoring programmes.
3. Evaluate and validate lander technological capabilities to observe the ocean in hard-to reach, under-sampled areas sensitive to climate change.

The specific objectives of this scholarship are to:

1. Co-design policy relevant outputs from the Lander arrays deployed in Irish waters to assist with MPA designation, ocean climate monitoring, fisheries science and contribute to data collection for the MSFD and the forthcoming nature restoration law.
2. Build capacity in the construction, deployment, retrieval and analysis of lander arrays and the associated data streams.
3. Conduct three pilot-studies to investigate:

- a. A MSP policy relevant case study, determined by policy makers in the initial phase of the scholarship.
- b. Lander suitability to establish a long term uninterrupted bottom temperature time series at locations across the Celtic Sea where fishing effort is high and at a control site where fishing activity is low. We will co-develop this pilot-study with fisheries scientists to ensure data products developed are fit-for-purpose and they enhance existing fisheries and climate change research in the region.
- c. The continuity of the European Shelf Edge Current (ESC), Porcupine Bank: The ESC connects the eastern subtropical and subpolar North Atlantic bringing warm saline water northward along the European shelf edge. There is uncertainty about the continuity of the European shelf edge current. This pilot-study will use landers deployed between the continental shelf and 3000 m to monitor water currents and other physical variables (temperature and salinity) to assess ESC continuity.

Location of Scholar

The scholar will be based for circa 50 % of their time, over the four years, at the Marine Institute HQ in Rinville, Galway.

Outcomes

The scholarship will produce a suite of benthic and oceanographic products for national and international reporting purposes and input to research and ocean observing activities in Ireland.

The scholarship will enhance links between the Marine Institute, The Spanish Institute of Oceanography (IEO-CSIC, Spain), University of Cantabria (Spain), and Portuguese Institute for the Ocean and Atmosphere (IPMA, Portugal) as the AALaMo initiative develops to use landers in a systematic and operational manner.

It is expected that the student will publish at least three peer-reviewed papers. It is also expected that the methodologies (principles, tools and practices) and transferable framework developed in the project will be used in future national and international projects.

Project outputs will inform the EU Biodiversity Strategy, the EU Water Framework Directive (2000/60/EC) and the Marine Strategy Framework Directive (2008/56/EC) monitoring programmes. Results should also be relevant to the UN Sustainable Development Goals 13 “Climate Action” and 14 “Life below water”. Harnessing Our Ocean Wealth – An Integrated Marine Plan for Ireland, stresses the need to maintain and expand key marine observations for essential climate variables, endorsed by the UNFCCC Global Climate Observing system (GCOS).

Recommendations for future work using this technology will also be produced.

Marine Institute Corporate Strategy 2023-2027

The table below summarises the Marine Institute strategic priority areas (headings in table) and the associated strategic initiatives (numbers in table) that this project will address.

Advice and services	Climate and biodiversity	Research and innovation	Digital ocean	Blue Economy	Sustainability	Stakeholders and society
1,3,4,6,8	1,2,3,5,6,7	1, 3,5	1,2,3,4	4,5	2,4	3, 5

Specific Requirements

The scholar should have a primary degree in marine science, physical oceanography, physics, ocean sciences, mathematics, IT or civil engineering.

Financial Details

Scholarships will be up to €34,000 per annum (maximum funding PhD of €136,000 over four years or €68,000 over two years MSc). This amount comprises a maintenance award of €25,000 (rate effective 1-Jan-24) to the student as well as payment of fees to the host higher education institution (HEI). The maximum fees payable to the HEI will be €6,000 per annum. The scholarship award also includes a budget of up to €3,000 per annum for eligible research costs (travel & subsistence, publication costs, consumables and other costs, such as minor kit purchase e.g. camera) for the sole use of the student, and are payable on a reimbursement basis direct to the host institution where the postgraduate student (scholar) is registered. There are no overheads payable on the scholarship.

Publication costs are intended to cover publications on which the scholar is listed as first author and are published under Open Access.

Scholars can also supplement this funding by applying to the Marine Institute’s Networking & Marine Research Communication Awards annual call.

In addition, the cost of a laptop will be covered by the Marine Institute (purchased via the Research Funding Office).

Marine Institute Co-Supervisor

Name: Glenn Nolan

Service Area: OCIS (Ocean Climate and Information Services)

Email Address: glenn.nolan@marine.ie

References

Gonzalez-Pola, C., Sánchez, F., Rodriguez Cobo, L., Graña, R., Rodriguez, J. M., Valdiande-Gutierrez, J., Hernandez-Urbieto, D., and Aierbe, E.: LanderPick, a Remote Operated Trawled Vehicle to cost-effectively deploy and recover lightweight oceanographic landers, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-11921, <https://doi.org/10.5194/egusphere-egu22-11921>, 2022.