



An Roinn Talmhaíochta,  
Bia agus Mara  
Department of Agriculture,  
Food and the Marine

## PhD Postgraduate Research Opportunity

**Project Title:** Molecular characterization of microalgae (*Alexandrium* spp) and development of novel diagnostic Harmful Algal Bloom (HAB) surveillance tools to address increasing risks of paralytic shellfish poisoning events in Ireland

**Funding:** Department of Agriculture, Food and the Marine

### Short description

A four-years PhD scholarship is available to take part in a research collaboration between Galway-Mayo Institute of Technology (GMIT), University College Dublin (UCD) and the Marine Institute (Galway), in Ireland. This full-time research opportunity will aim at developing and implementing state-of-the-art molecular tools to characterise and monitor the occurrence and abundance of Paralytic Shellfish Poisoning (PST)-producing microalgae (*Alexandrium* spp) in Irish waters, with particular attention to Castlemaine Harbour (Co. Kerry), where recent Harmful Algal Bloom (HAB) events have been documented. The project will involve field (e.g. participation to the Marine Institute's routine phytoplankton monitoring programme) and laboratory components (e.g. development of targeted quantitative real-time PCR (qPCR) assays and transcriptomic analysis of PST-producing *Alexandrium* species following High Throughput Sequencing (HTS)). It is envisaged that findings will generate high-impact scientific evidence that will provide recommendations on early-warning protocols for the detection of HAB in shellfish production areas, hence aiding the Irish aquaculture industry and ultimately human health.

### Background and project details

#### Research topic

Marine biotoxins are naturally occurring and are produced by a small number of phytoplanktonic species, referred to as Harmful Algal Bloom species (HABs), which are ingested by filter feeding bivalve molluscs, where these biotoxins can accumulate within the tissues of the shellfish. If these intoxicated shellfish are consumed, the ingested toxins can give rise to several associated human illness syndromes when above regulatory levels. Recently, there has been an increasing concern in the number of occurrences reported for the presence of the highly potent neurotoxin, Paralytic Shellfish Toxins (PSTs) in shellfish (mussels, oysters, clams) in Ireland. These toxins can cause Paralytic Shellfish Poisoning (PSP) and are produced by phytoplankton species belonging to the genus *Alexandrium*, which is also observed to be increasing in its distribution and abundance in Irish waters. Since 2019, PSTs have been

regularly recorded in oysters and mussels in Castlemaine Harbour, Co. Kerry, with 2020 yielding the highest concentrations ever recorded since PSP national monitoring began in the late 1990's. Ireland has a diverse and varied production of bi-valve molluscan shellfish species around its coastline, encompassing over 100 classified shellfish aquaculture areas for the production and harvesting of marine bi-valve molluscan species, including mussels, pacific and native oysters, clams, cockles, razor clams and scallops, thus HAB events can severely impact the industry and is an urgent food safety concern to address. Current methodologies for the determination and enumeration of HAB species for routine monitoring programmes rely on light microscopy, however, many of the toxigenic causative species which comprise the Irish marine biotoxin profile, can only be identified to genus or group level. Therefore, there is an increasing demand for novel molecular methods to be developed, validated and implemented. Thus, the rationale for the PhD research programme is to develop novel molecular tools to be integrated in a comprehensive sampling and analytical programme targeting PSTs in the water, sediment and shellfish, from selected aquaculture production areas.

This structured four-year PhD research scholarship will be on a full-time basis and is part of an ongoing research programme that aims at investigating the causes, timing, environmental factors and mechanistic pathways of toxin occurrence in aquaculture production areas. While the PhD research will focus on novel molecular methods, predictive modelling and risk assessment tools will also be developed by project partners at UCD and the Marine Institute.

The scholar will engage and have access to the molecular laboratories of GMIT's Marine and Freshwater Research Centre (MFRC)(<https://mfrc-gmit.ie/>) and the phytoplankton unit in the Marine Institute (<https://www.marine.ie/Home/site-area/areas-activity/marine-environment/phytoplankton-monitoring>). It is expected that findings will generate high-impact scientific evidence that will allow for risk management strategies and predictive forecasting tools to be implemented as an early warning system for the aquaculture industry and regulatory competent authorities, thus providing increased assurances to consumer safety and supporting the integrity, quality and commercial reputation of Irish shellfish.

The main objectives of the project will be to:

- Review existing molecular methodologies in place for the detection of *Alexandrium* spp and if appropriate develop and validate new approaches for the detection of PST-producing organisms
- Establish a reference tissue bank and associated DNA sequence database of *Alexandrium* spp of relevance to Irish waters
- Monitor and characterize temporal occurrence and abundance of PST-producing *Alexandrium* spp in Castlemaine Harbour, Co. Kerry
- Conduct a gene expression and RNAseq analysis to characterize inter- and intra-specific variation of genes associated to PST in HAB in Irish waters

The expected outcomes from the project will be:

- The validation and implementation of molecular methods for the detection and quantification of *Alexandrium* spp in Irish coastal waters and sediments into a routine monitoring programme

- Complete an experiment aimed at transcriptomic and gene expression characterization of *Alexandrium minutum* found in Irish waters, including the potential identification of novel biomarkers associated to levels of toxicity
- Present findings at relevant national and international conferences
- Peer reviewed publications detailing the methodologies and results of developed molecular approaches, including recommendations on early-warning protocols for the detection of HAB in shellfish production areas

Foreseen key responsibilities:

- Develop and apply appropriate sampling protocols
- Conduct field work for sample collection, including participation in the Marine Institute's phytoplankton monitoring programme
- Conduct molecular laboratory procedures, including DNA/RNA extraction, gel electrophoresis, NA quantification, PCR, qPCR, dPCR, library preparation for HTS, and Sanger sequencing for DNA barcoding;
- Execute analytical pipelines for the processing of transcriptomic data generated by High Throughput Sequencing (e.g. Illumina);
- Establish and maintain a reference database for biological and genetic data;
- Maintain laboratory notebooks, research records and generate technical reports and data as required by the management team;
- Disseminate findings by means of conference/symposia contributions and publication in peer-reviewed scientific journals.

**Requirements/Qualifications:**

Minimum requirements:

- A Honours Degree (minimum 2.2 BSc) in Biology, Molecular Biology, or equivalent/relevant area.
- Some experience with basic molecular techniques such as Nucleic Acid extraction, PCR and gel electrophoresis.
- Expertise in either field and/or laboratory experimental design.
- Evidence of planning and executing concurrent tasks as an individual and as part of a research team.
- Must be fluent in spoken and written English.
- Proficiency in communication, initiative, flexibility and organisational skills.

Additional desirable requirements:

- Publication track-record and strong technical report writing and presentation skills.
- Experience in DNA/RNA-based field approaches, including sample acquisition and nucleic acid isolation.

- Experience in DNA/RNA-based laboratory approaches, including quantitative real-time PCR (qPCR) and sample preparation for High Throughput Sequencing (HTS).
- Experience with transcriptomic data handling/processing and associated bioinformatics.
- Experience working in a “clean room” environment and/or an accredited molecular laboratory (e.g. ISO17025 standard).
- Have a full (international EU) driving licence.

**Project Duration:**

4 years

**Conditions:**

- €18,000 Stipend per annum.
- Postgraduate fees for EU students will be covered by the project.
- In addition, any necessary travel, training and material costs incurred during the project will be covered.

**Please Note:** Candidates from outside the EU are eligible to apply but may be expected to provide evidence of sources of additional funds to cover excesses associated with Non-EU fees.

If either English or Irish is not the applicant’s first language, evidence of English language proficiency is required for registration. Please refer to web link: [English Language Requirements | GMIT | Galway Mayo Institute of Technology](#) to view the minimum English language proficiency standards for entry to GMIT

**Project Start Date:**

Not later than April 2022

**Application Closing Date:**

Thursday 27<sup>th</sup> January 2022, at 12 Noon (IST, UTC+01:00)

***Applications must be submitted to the Research Office e-mail address ([ResearchOffice@gmit.ie](mailto:ResearchOffice@gmit.ie)) only, including:***

- Curriculum Vitae (including 2 referees contactable prior to interview stage)
- a copy of transcript of results
- A Personal Statement

The Personal Statement should not exceed 2 pages and should explain:

- How you meet the minimum and how you plan to meet the desirable requirements of the position
- What is your motivation and interest in the topic, with specific reference to details provided in this advert
- Why you would like to pursue a PhD research programme

***Please ensure all documents are emailed as a single Word or PDF file.***

For further information on the project please contact:

Dr Luca Mirimin ([luca.mirimin@gmit.ie](mailto:luca.mirimin@gmit.ie))

### **Data Protection Statement**

GMIT takes very seriously its legal obligations as set out in the General Data Protection Regulation 2016/679 (GDPR) and the Irish Data Protection Act 2018 to safeguard and protect your personal information in our possession. The personal information which you disclose to us in this form will only be used to assess your suitability; administer and register you for this scholarship. We will not keep your personal information for any longer than is necessary for those stated purposes. **For more details, please refer to GMIT's Student Privacy Statement: <http://www.gmit.ie/general/student-privacy-statement>**