

Post-Doctoral Fellowship: Proposal Outline

Topic	Risk Assessment for Potentially Polluting Shipwrecks in Irish waters
Research Theme(s)	<ol style="list-style-type: none"> 1) Marine Pollution 2) Underwater Archaeology and History 3) Marine Spatial Planning 4) Marine Protection 5) Climate Change
Background and Rationale	<p>The waters surrounding Ireland contain thousands of shipwrecks. The EU Parliamentary Assembly Resolution 1869 (2012) clearly states that shipwrecks (75% sunken during the Second World War) are among the biggest sources of marine pollution.</p> <p>The Wreck Archive published by the National Monuments Service consists of over 18,000 paper files that hold information relating to each individual wreck recorded in the Wreck Inventory of Ireland Database (WIID). Of these 3555 shipwrecks do have a documented position within the Irish EEZ as can be seen in the National Monuments Service Wreck Viewer (Figure 1).</p> <p>Currently 457 of these shipwrecks have been confirmed by high resolution seabed mapping thanks to the ongoing effort carried out by the Irish National Seabed survey (2000-2006) and then INFOMAR (see INFOMAR viewer here).</p> <p>Of the 457 shipwrecks:</p> <ul style="list-style-type: none"> - 272 wrecks are currently <u>of unknown origin</u>. - 59 fall within the boundaries of future ORE development. 33 out of 59 are of unknown origin (see figure 1). - 111 are inside or within 10 km distance from an Irish SAC. 47 out of the 111 are of unknown origin.

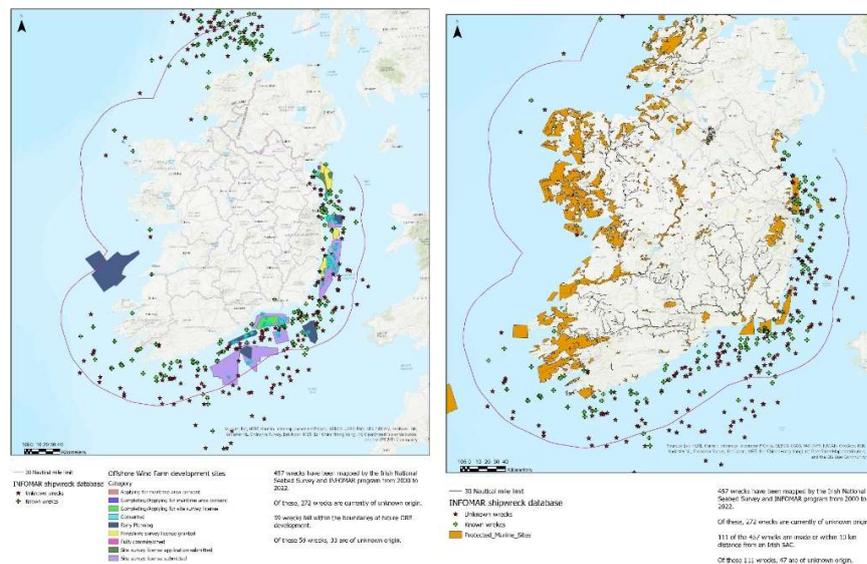


Figure 1 – Distribution of confirmed, mapped shipwrecks in Ireland. Map also shows the extent of the planned ORE sector in Ireland (left image) and the extent of SAC (right image).

A significant number of these wrecks sank with cargo onboard of potential pollutants in the form of oil, chemicals, heavy metals, ordnance and other hazardous substances. These shipwrecks are actively degraded by sea water and marine organisms, and therefore have a limited lifespan within the marine environment. As these wrecks degrade they will release their pollutants into the environment.

Oil pollution from shipwrecks has been the most studied of these pollutants but explosive remnants of war (ERW), chemicals and heavy metals also have the potential to create social, economic and environmental damage on a scale that is potentially equivalent if not greater than that of oil, although their effects are perhaps not as visible to the media and the public more generally.

The risk from polluting wrecks has been studied in the USA (Overfield & Symons 2009; Michel, et al. 2005), the Pacific (Gilbert and Nawadra, 2003; Monfils, Gilbert and Nawadra, 2006), the Baltic (Ndungu et al. 2017; Rogowska et al. 2010; Rogowska et al. 2015), Mediterranean (Alcaro et al., 2007; Renzi et al. 2017) and UK (Wyse and Leary, 2016; Alexander, 2019; Goodsir et al., 2019).

A recently published study (Van Landuyt Josefiën, 2022) for example demonstrate how World War II shipwreck leaks heavy metals, arsenic and other pollutants into North Sea.

Back in 2013, a [study commissioned by NOAA](#) developed a list of the most ecologically and economically significant potentially polluting wrecks in US waters.

Starting with 573 wrecks that could pose a substantial oil pollution threat, additional research was conducted to identify 87 priority wrecks with potential ecological and socio-economic impacts if there was an oil release.

A recent study (Fernández-Macho, 2016) indicated that coastal zones such as those in the UK and Ireland are some of the highest risk locations from marine oil spills and as a result it is vital that the risks posed by polluting vessels within Irish waters are better understood and correctly managed.

[The EU Parliamentary Assembly Resolution 1869 \(2012\)](#) clearly states that shipwrecks (75% sunken during Second World War) are among the biggest sources of marine pollution. The North Atlantic Ocean contains 25% of the potentially polluting wrecks in the world. These wrecks are estimated to contain nearly 38% of the total volume of oil trapped in sunken vessels. The same EU Resolution also states that without maps charting these risks, no accurate assessment of the threat can be made. A number of recommendations were also proposed (see references).

The environmental risk, potential to hinder national strategic development plans, and significant costs associated with remediating these wrecks means that it is essential that we improve our knowledge, our ability to assess the risk from these vessels, and that we develop suitable monitoring and management strategies based on available data and/or additional future wreck site assessments.

Remediation of high risk wrecks before potential leaks occur is critical in order to minimize environmental damage and/or costs incurred through associated clean-up, damaged or lost resources, delayed sectoral development costs (e.g. ORE), or reputational damage (e.g. to seafood sector). Ideally any management strategy arising should be pro-active rather than reactive, and while there are numerous uncertainties and unknowns around shipwreck identification, pollution risk level, and remediation potential or cost, there is adequate justification, and vested stakeholder interest to address this appropriately.

There is a clear and urgent need for a better understanding of the threat that potentially polluting wrecks pose in Ireland, to the benthic and pelagic habitat, and to the marine and coastal environment overall. Changing climate conditions are increasing wreck exposure to more severe weather and oceanographic conditions, and in turn to faster breakup, particularly in nearshore locations.

While many countries have struggled to address this issue due to the lack of detailed wreck information, Ireland is well positioned to develop best practice in Europe and effectively undertake such a comprehensive assessment. Ireland's extensive DECC funded INFOMAR programme related Marine institute and

	<p>Geological Survey Ireland acquired high resolution multibeam survey data provides accurate positioning and shipwreck status data. It can be used to cross reference the location of the sites with historical records, to assess the size, shape and orientation informing wreck identification. This can inform the evaluation of the state of wreck preservation, or the effective design of further investigations where required.</p>
<p>Scope of Research (Scientific/ Technical Challenge)</p>	<p>The overarching aim of this fellowship is to carry out research and develop a multi-year national shipwreck investigation and monitoring program to address a number of key questions. Specifically:</p> <p><u>How many polluting wrecks are there?</u></p> <p>Quantification of potentially polluting wrecks is the first step in understanding the scale of the polluting wreck problem in Ireland. This is the basis upon which management decisions can be made. However, quantification of the number of potentially polluting wrecks and understating their real potential impact on many sectors is not an easy tasks considering that 272 out of the 457 wrecks currently mapped by INFOMAR remain “unknown”. As such,</p> <ol style="list-style-type: none"> 1) To reduce the number of “unknown” wrecks, a detailed analysis of all available shipwreck and related cargo databases is required for wrecks in Irish waters, and the cross referencing of same with the observed INFOMAR inventory and related mapping data. These databases include but are not limited to DHLGH’s UAU database, National Museum databases, underwater diving records, and essential UKHO, MCA and MOD databases. Improving knowledge on the identification and type of ships on the seabed as well as their potentially dangerous cargo is the first step required. Similar work has already been undertaken in the UK by McCartney, Innes (Bangor University, 2022), and by the UK’s Ministry of Defence. 2) Analysis and review of current INFOMAR shipwreck data needs to be completed to evaluate the list of potentially high risk wrecks based on their exposure to environmental and oceanographic conditions, considering their size, shape, orientation, and based on their historical shipping manifestos preceding their last passage before sinking. 3) Where data and knowledge gaps are identified following the initial assessment, based on the latest wreck remediation methodologies and information/data requirements, a site investigation methodology will be designed for the varying wreck site environmental regimes (depths/currents etc.), and/or the vessel type and remediation scenarios anticipated.

	<p>4) This will inform multi-annual hydrographic, geophysical, underwater camera/ROV, and potentially geochemical survey plans needed to establish the identity of unknown wrecks and to monitor the state of preservation of potentially dangerous wrecks, and/or wrecks requiring monitoring for conservation purposes.</p> <p>The work highlighted above will then help to <u>address a number of further-questions such as:</u></p> <ul style="list-style-type: none"> • Is there a requirement to remediate potentially polluting wrecks in Ireland? • If potentially polluting wrecks are identified in Irish waters, what is the risk and consequences from these potentially polluting wrecks? • How should the remediation be prioritized? • What should be considered in future development of a management strategy for potentially polluting wrecks? <p>The overall risk assessment should aim to incorporate a stakeholder analysis and socio-economic data in order to fully assess the real impact on multiple sectors, protected areas and/or other stakeholders such as the fishing and aquaculture industry, tourism, offshore infrastructure and ORE sector, etc. This analysis can benefit from a large range of publicly available data commonly used in MSP analysis that can be used to improve our understanding of the potential impact of a polluting event from shipwrecks, and to understand which stakeholders are most likely to be affected. It can also give us an indication of how to minimise disruption to stakeholders during remediation and management of shipwrecks.</p>
<p>Expected Impact(s)</p>	<ul style="list-style-type: none"> • The fellow will engage with relevant national and international networks, and explore opportunities for collaboration and securing further research funding under Horizon Europe and other national funding schemes. • Developing a multi-year seabed investigation strategy and obtaining research vessel time (via competitive ship time applications) will be part of the impact. • Data acquired as part of this effort will not only be used to identify potentially polluting wrecks but will be integrated into the Marine Institute seabed imagery catalogue and will serve multiple users from historian, archaeologists, marine ecologist and the diving community. • This fellowship will help to build national expertise in this research area. A national database of potentially polluting wrecks, impact assessment and management strategy will be created. • National and international research collaboration will be enabled, through interdepartmental stakeholder engagement, and through linking the underwater observation research community into field survey support, and data visualisation, analytics and dissemination efforts.

	<ul style="list-style-type: none"> • The fellow will produce policy briefs for stakeholders, and publish their research findings as widely as possible through peer-reviewed papers, conference presentations, articles, etc.
<p>Outcomes</p>	<ul style="list-style-type: none"> • A review of current available data toward the reduction of uncertainty around the “unknown” wreck sites • A National database of potentially dangerous and polluting wrecks • Develop a survey methodology, and a multi-annual site survey investigation using multibeam / ROV / laser scanners and contributions from Marine archaeologist and maritime experts focused on potentially polluting wrecks in order to evaluate their status. • A risk assessment and stakeholder analysis to fully assess the real impact of potentially polluting wrecks on multiple sectors and protected areas. • Improved knowledge on shipwreck conservation and environmental/pollution risk status, particularly for “unknown” wrecks • A review of actions and mitigation measures for each individual shipwreck based on their specific characteristics and potential dangers.
<p>Specific Collaboration</p>	<p>The following partners are anticipated to guide and/or collaborate on the research;</p> <p>Underwater Archaeology Unit – National Monuments Service, DHLGH Centre for Maritime Archaeology – University of Ulster Marine and Coastal Unit – Geological Survey Ireland Marine Robotics Laboratory - University of Limerick</p> <p>A steering group is proposed to oversee the research due to the multi-sectoral interest and oversight required. The following will be invited to participate;</p> <ul style="list-style-type: none"> • Department of Transport (Hydrographic Office & Coastguard) • Department of Environment, Climate and Communications (ORE) • Department of Defence (Naval Service) • Department of Agriculture, Food and Marine (Fisheries & Aquaculture) • Department of Housing, Local Government & Heritage (UAU & MSP) • Environmental Protection Agency • UKHO (Hydrographic Office) • UK Maritime & Coastguard Agency • UK Ministry of Defence

Location of Fellow	<p>Marine Institute (Galway) and/or Higher Education Institute or Public Research Body (Republic of Ireland or Northern Ireland)</p> <p>The fellow may be based in the Marine Institute dependent on accommodation and in discussion with the HEI involved. At the Marine Institute, the contacts will be Dr. Fabio Sacchetti (fabio.sacchetti@marine.ie) and Thomas Furey (thomas.furey@marine.ie).</p>
Duration and Funding Available	<p>4 years</p> <p>€100,000 per annum (i.e. total €400,000 maximum for duration of four years)</p>
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