

Post-Doctoral Fellowship: Proposal Outline

Topic	Beyond the NAO: Advancing understanding of atmospheric variability impacts on ocean ecosystem processes and fisheries in the Northeast Atlantic
Research Theme(s)	<p>Climate Change: Understanding and predicting climate-driven changes in marine ecosystems.</p> <p>This research aligns with global and regional priorities to improve our understanding of how atmospheric drivers of climate variability impact oceanographic processes and marine ecosystems, particularly in the context of climate change and sustainable fisheries.</p>
Background and Rationale (including Strategic Priority)	<p>The North Atlantic Oscillation (NAO) has long been a focal point in studies of atmosphere-ocean interactions in the NE Atlantic. However, recent research shows that other modes of atmospheric variability such as the East Atlantic (EA) Pattern, the Scandinavian Pattern (SCA), and Arctic Oscillation (AO) also exert significant influence on regional climate and oceanography, including on the Atlantic Meridional Overturning Circulation (AMOC) and the Atlantic Multidecadal Variability (AMV). These modes impact sea temperatures, salinity, ocean circulation, nutrient fluxes, and ultimately, ecosystem structure and fish distributions. In addition, atmospheric blocking events can influence some ocean phenomena (e.g. marine heat waves).</p> <p>As marine resources face increasing pressure from climate variability and anthropogenic stressors, there is a pressing need to understand linkages between atmospheric variability, oceanographic variability and ecosystem responses. Increasing our understating of how atmospheric variability impacts fish populations can lead to more climate-informed fisheries management through improved forecasting and scenario modelling.</p> <p>Work carried out by the proposed postdoctoral fellow should align with Ireland’s Climate Action and Low Carbon Development (Amendment) Act 2021 and other national climate strategies to provide reliable, evidence-based guidance for climate adaptation. The project objectives are relevant to several Marine Institute strategic priority areas (e.g. advice and services, climate and biodiversity, research and innovation, Blue Economy, stakeholders and society). The proposed research should support objectives and actions in Ocean Knowledge 2030 addressing “positioning Ireland as a leader for marine research” and “providing evidence to understand both baseline conditions and patterns of change linked to climate change”.</p>

	<p>Specifically, this research fellow will address the recommendation “Future research examining modes of atmospheric variability should extend beyond analysis of the NAO alone with an emphasis on connecting to changes in ocean and ecosystem processes” as stated in Chapter 2: Atmospheric drivers of marine climate (Hanley, 2023) in the Irish Ocean Climate and Ecosystem Status Report (Nolan <i>et al.</i> 2023).</p>
<p>Scope of Research (Scientific/ Technical Challenge)</p>	<p>This research call aims to develop research on understanding how atmospheric variability interacts and influences NE Atlantic oceanography, and how changes cascade to affect lower and upper trophic levels, particularly commercially and ecologically important fish species (e.g., Atlantic mackerel, herring, cod).</p> <p>The overarching aim of this fellowship is to integrate atmospheric indices (teleconnections and blocking systems) with indicators of fish population dynamics to help assess the resilience of fish populations to climate variability and change.</p> <p>The fellowship should address key research objectives as follows:</p> <ol style="list-style-type: none"> 1. Quantify the relative and combined effects of multiple atmospheric modes (NAO, EA, SCA, AO) on oceanic conditions in the NE Atlantic. 2. Investigate how the multiple atmospheric modes (NAO, EA, SCA, AO), the non-stationary behaviour of these teleconnection patterns and blocking systems influence fish populations over time. 3. Establish long-term atmospheric monitoring indices (teleconnections and blocking systems), proven to strongly influence waters in the vicinity of Ireland, for future research and operational use. Indices developed must show high correlations with the instrumental records indicating their reliability. 4. Use indices to track changes in marine fish (commercial and ecological importance) followed by modelling mechanistic linkages. 5. Assess fish population vulnerability under different climate scenarios (RCP 8.5 and RCP 4.5) using outputs from Met Éireann (atmosphere) and Marine Institute (ocean) developed models where possible. <p>Researchers will collaborate closely with the Marine Institute’s (MI) Oceanographic, Climate and Information Services (OCIS) team and Met Éireann to ensure effective knowledge sharing and adherence to FAIR data principles.</p>
<p>Expected Impact(s)</p>	<ul style="list-style-type: none"> • Broaden understanding of how atmospheric variability beyond the NAO shapes marine ecosystem dynamics. • Enhance predictability of fish population shifts, aiding adaptation to climate change.

	<ul style="list-style-type: none"> • Support ecosystem-based fisheries management (EBFM) and inform stock assessments under climate variability. • Contribute to climate services for fisheries, aquaculture, and coastal communities. • Strengthen interdisciplinary research between climatology, oceanography, and fisheries science. • Produce policy briefs for stakeholders, and publish research findings as widely as possible through peer-reviewed papers, conference presentations, articles, etc.
Outcomes	<ul style="list-style-type: none"> • The project will identify patterns between climate indices with fish distribution and abundance, and predict how climate change might affect marine fish communities. • The project will enhance our understanding on how climate indices affect fish migration patterns, spawning seasons, and population dynamics to support the development of more sustainable fishing practices. • This fellowship will help to build national expertise in this research area. • Peer-reviewed publications linking atmospheric variability modes to oceanic and ecological responses in the NE Atlantic (minimum of two scientific publications). • An integrated framework or tool for assessing atmospheric mode impacts on fish populations. • Data products: indices developed are made operational and transferred to the Marine Institute and Met Éireann for input into Climate Ireland (website) where the new indices will be available to the wider community for further research and application. • Contributions to ICES working groups and Irish climate adaptation plan and sectoral adaptation plans (CAP & SAPs). • The fellow should engage with relevant national and international networks to explore opportunities for collaboration to secure further research funding (e.g. under EC FP10).
Specific Collaboration	Oceanographic Climate Services section of the Marine Institute and Met Éireann.
Location of Fellow	<p>Primarily based in the Marine Institute with research visits to and strong links with activities in Met Éireann. The fellow will reside in the Ocean Climate Service Group at the Marine Institute, RInville, Oranmore Galway.</p> <p>Contacts: Caroline Cusack and Denise O’Sullivan, Marine Institute John Hanley, Met Éireann</p>

<p>Duration and Funding Available</p>	<p>4 years</p> <p>€100,000 per annum (i.e. total €400,000 maximum for duration of four years)</p> <p>This fellowship is jointly funded by the Marine Institute (50%) and Met Éireann (50%).</p>
<p>References</p>	<p>Hanley, J. (2023). Atmospheric Drivers of Marine Climate. In G. Nolan, C., Cusack, D., Fitzhenry (Eds.), Irish Ocean Climate & Ecosystem Status Report (pp. 13 - 24). Marine Institute, Galway, Ireland. http://hdl.handle.net/10793/1850</p> <p>Nolan, G., Cusack, C., Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland, pp 182. http://hdl.handle.net/10793/1844</p> <p>Other relevant references:</p> <p>Zubiate, L., McDermott, F., Sweeney, C., O'Malley, M., 2017. Spatial variability in winter NAO–wind speed relationships in western Europe linked to concomitant states of the East Atlantic and Scandinavian patterns. <i>Quart J Royal Meteor Soc</i> 143, 552–562. https://doi.org/10.1002/qj.2943</p> <p>Comas-Bru, L., Hernández, A., 2018. Reconciling North Atlantic climate modes: revised monthly indices for the East Atlantic and the Scandinavian patterns beyond the 20th century.</p>