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Boom-Bust dynamics in native and non-native mussel species and their hybrid crosses in Irish near shore environments over two decades.

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Investigating boom-bust cycles in animal populations over a prolonged period, provides insights into factors such as climate/environmental change and interspecies interactions that influence population dynamics. Globally, mussels belonging to the Genus *Mytilus* are a significant ecological and commercial species of nearshore marine habitats and are considered keystone ecosystem engineers. Studies from the 1970s to date have documented the expansion and “northward creep” of the Mediterranean mussel *Mytilus galloprovincialis* in Europe and predict this trend will continue with climate change. Along the southern, western and northern coasts of Ireland, intertidal populations of mussels consist of the native blue mussel *Mytilus edulis*, *M. galloprovincialis* and hybrids of both parent species. An Irish study carried out from May 2003 to February 2006 identified 1306 mussels to species level using PCR at twenty sites along all Irish coasts. In that study, *M. galloprovincialis* was the dominant species. In a later study (Lynch et al.), from June 2010 to November 2017, 1549 mussels from twenty seven sites were identified from all Irish coasts including some of the sites from the previous study, and *M. edulis* was observed to be dominant. During this current study 471 mussels from seventeen sites, including those common to the two historical studies, have been identified and indicate that *M. galloprovincialis* is once again dominant at most sites. The findings from this study indicate that mussel species diversity and abundance remain stable at a minimal number ($n=2/17$) of Irish sites studied, and that a “Boom-Bust” dynamic exists at eight sites. (47.05%). In Lough Hyne, a marine nature reserve, hybrids have dominated from 2013 to 2024. This instability of population dynamic composition and abundance may be due to natural phenomena, in particular driven by climatic events such as the Atlantic Multidecadal Oscillation (AMO) where there are warm or cool phases of the sea surface temperature in the North Atlantic or it may be due to natural fluctuations in both native and non-native populations driven by reproductive success, larvae settlement, competition and adaptation to localized environmental parameters.

These research outputs generated by the Aquatic Animal Health Group at the School of BEES, ERI and MaREI (UCC) will inform management strategies for sustainable mussel harvesting, conservation efforts for native species, and policies regarding the management of invasive species and hybrids. This research is part of the BIVALVI Project and is funded by the ERA-NET BlueBio Cofund in association with the Marine Institute Ireland, project coordinator Nofima AS (Norway) and project partner University of Bologna (Italy).



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