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Development and testing of molecular-based methodologies for real-time profiling of biological communities in freshwater aquaculture

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The lack of expansion in the freshwater aquaculture sector as a whole has become an alarming concern over the past 20 years in Ireland. This is in marked contrast with FoodWise 2025 which seeks to increase food exports by €19 bn by 2025. Impediments to the traditional flow-through production process encompassing fatal disease outbreaks, issues with uncertainty over discharge licensing and a lack of understanding of the overall culture-water dynamic have contributed to this stagnation. In order to address the intensive sustainability of Irelands' freshwater aquaculture sector and to inform these bottleneck concerns, it is important to develop an in-depth understanding of the dynamic mix of biological and physico-chemical parameters governing desirable rearing water as a baseline for successful operation. This project focuses on development and testing of novel molecular diagnostic methods facilitating DNA profiling of predominant bacterial and algal communities in rearing water, with real-time detection of important fish pathogens. Gaining an understanding of target species that contribute to finfish disease outbreaks and poor water quality is essential for prevention and control of problematic species. Molecular-based techniques, such as real-time PCR, have many advantages over traditional plating methods in the identification of species present, as less than 1 % of environmental microorganisms are culturable. The use of species-specific probes enables detection of problematic pathogens and therefore aids future characterization of harmful bacteria and algae. Linking the biological profile with water quality parameters such as nitrates, nitrites and ammonia in a pill-pond farm when production is thriving will allow for the amendment of the process when production regresses or fails. It will also identify the potential to up-scale and replicate this type of fish farm in the culturing of a variety of freshwater species such as trout, therefore providing an opportunity to expand the industry.

Figure 1. Diagrammatic representation of the dynamic relationships that influence the aquaculture process.

Biography

Sarah Naughton has graduated with BSc in Biomedical Science, and with a BSc in Forensic Toxicology and the BSc (Hons) in Human and Animal Toxicology. Her work focuses on using microbiological techniques coupled with DNA and RNA informatics; on novel, non-chemical disinfection technologies such as pulsed ultraviolet light (PUV), as well as the rapid diagnosis and remediation of sudden changes in freshwater aquaculture.

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