Integrating underwater video and eDNA metabarcoding methods to assess oyster aquaculture gear as fish habitat

Summary:

Bivalve aquaculture plays a growing role not only in sustainable food production but also in providing potential ecological benefits. Oyster farms create complex three-dimensional structures that may function as artificial habitats, supporting higher biodiversity and enhancing ecosystem services. These habitats can offer essential functions such as nursery areas for juvenile fish, refuges from predators, and foraging grounds for mobile fauna. Yet, the habitat role of oyster farming systems remains insufficiently documented, partly due to methodological challenges related to traditional field-based approaches in these structured habitats. This PhD project, developed within a recently-funded project (AQUABENEFIT), will assess the ecological function of oyster aquaculture gear as fish habitat using complementary observational and molecular approaches.

Objectives:

1. Quantify fish diversity and abundance associated with oyster aquaculture gear using underwater video across time and tidal conditions. **2.** Compare species detection performance between video observations and environmental DNA (eDNA) metabarcoding of surrounding waters. **3.** Evaluate the use of oyster farm habitats as refuge and foraging grounds through behavioural analyses of underwater video. **4.** Compare fish community structure between aquaculture and non-aquaculture areas to identify potential ecological benefits. **5.** Provide methodological recommendations for biodiversity monitoring using integrative approaches.

This research will generate novel insights into the habitat value of aquaculture infrastructures within coastal ecosystems and contribute to sustainable aquaculture management. By combining traditional and emerging biodiversity assessment methods such as eDNA metabarcoding, the project will advance our capacity to monitor ecological interactions and support ecosystem-based aquaculture planning.

Main Metodologies:

Field Sampling: Seasonal sampling campaigns at a selected oyster farm. Simultaneous deployment of underwater video systems (action cameras) and collection of eDNA water samples around oyster baskets and in nearby reference areas without aquaculture structures. Video Analysis: Quantification of fish abundance, species richness, and behaviour (e.g., foraging, sheltering) using standardized annotation protocols (e.g., MaxN counts). eDNA Metabarcoding: Filtration of water samples, DNA extraction, amplification using universal fish primers (e.g., MiFish), and high-throughput sequencing (Illumina platform). Bioinformatics pipelines (QIIME2, OBITools) for taxonomic assignment. Statistical Analysis: Multivariate modelling to assess differences in fish assemblages across sites, sampling methods, and environmental gradients.

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Place of Work

CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Terminal de Cruzeiros do Porto de Leixões

Will the Proposal research idea be funded by a specific project?

Yes, by COMPETE2030-FEDER-00787300 (nº 16692)

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