Sustainable Development of Mesopelagic Resources

Project Outline:

The Marine Institute (MI) is seeking support for dedicated ship time to collect both acoustic survey data and also collect biological samples for ground truthing of the acoustic analysis, as well as for the eDNA, and the Stable Isotope Analysis (SIA) work. The MI would also build, test and deploy the proposed mesopelagic research net and validate it for sampling the mesopelagic community.

Ship time

In terms of additional ship time, it will be most feasible to extend existing dedicated acoustic surveys carried out onboard the RV Celtic Explorer, namely the IBWSS and WESPAS (Western European Shelf Pelagic Acoustic) by an additional 5-6 days. Extending an existing survey to allow for dedicated mesopelagic sampling has several distinct advantages. The Celtic Explorer is a state-of-the-art research vessel and is equipped with scientific grade sampling tools, including multifrequency scientific echosounders (18, 38, 120 and 200 kHz). In terms of logistics, no time would be lost transiting to/from sampling locations or gearing up a vessel as the vessel would be on-site. All equipment calibrations would already be in place. Furthermore, utilising the IBWSS means that we will more readily be able to translate our findings to historic data sets which will allow us to explore not only spatial but also temporal trends of mesopelagic fish abundances. Figure 1. shows a heatmap of where putative mesopelagic fish have been identified from distinct acoustic marks during the IBWSS (March-April) time series with particular areas of interest highlighted in red circles. Utilising the WESPAS survey will allow for explorative sampling of spawning pearlsides along the shelf edge.

In addition, a number (2-3) of dedicated short commercial charter surveys (7-8 days) could be undertaken to provide important information on the seasonality of distribution and biology, including the spawning period (May-July). A suitable charter vessel capable of single midwater trawling and with a suitable acoustic system (omni sonar (low to medium frequency) and multiple frequency single beam echosounders, including 38 kHz) would be required as a minimum. Logistically, a 7-8 day survey allowing for mobilisation, calibration and transit times would mean an effective survey time of 5-6 days.

Suitable sampling net

The provision of a suitable trawl net would have to be determined prior to any survey. The MI borrowed a macro-zooplankton net from IMR Bergen for the two surveys in 2021, but this proved difficult to use, could only be towed at around one knot and provided poor samples. In collaboration with other MEESO partners and Irish net design expertise, the MI has come up with a prototype scientific design using a modified existing trawl net design with the aim of capturing fish down to 15mm, and also suitable for higher speed towing (3-4 knots). The net would be tested, and modified if necessary on the surveys described above.

eDNA and SIA

Incorporated into all those sampling efforts will be the collection of stable isotope samples as well as environmental DNA samples. Stable isotope analysis can tell us about trophic position and food-web dynamics of the mesopelagic organisms which will give important insights into specific ecosystem structures. Whereas environmental DNA analysis picks up DNA fragments of fish and other organisms which have been released into the water. This allows us to confirm the presence and absence of a particular species from distinct acoustic layers and advance our understanding of the species composition in these layers (e.g. the deep scattering layer) and overall aid in the interpretation of acoustic data.

Protein hydrolysates

In terms of product development of key species, Teagasc has indicated the benefit of assessing different procedures to optimise fraction extraction and evaluation of their composition and suitability as food or feed ingredients. Also, the potential of pilot scale production of taste-neutral protein powder based on key species should be assessed.

Project Objectives:

- To collect acoustic data and biological samples of mesopelagic resources during dedicated scientific surveys to aid in the understanding of biomass and community structures. This will further build on the knowledge base of information the MI has on mesopelagics and will help determine the principal mesopelagic species that could be exploited and their initial biomass levels. These baselines are fundamental to developing an understanding whether these species can be exploited from a sustainability (biology) and a commercial viability (abundance) perspective.
- To carry out stable isotope analysis of samples collected to determine the trophic positions and food-wed dynamics of key mesopelagic resources. These insights further aid our understanding of the mesopelagic ecosystem.
- To carry out eDNA analysis to confirm the presence and absence of a particular species from distinct acoustic layers and determine the species composition to aid the interpretation of acoustic data. These analyses are vital to verify assumptions being made in the acoustic analyses.
- To carry out product development on key resources to assess ingredient opportunities. These appraisals will determine the product applications, techno-functional properties and value of ingredients derived from mesopelagic.
- To engage the pelagic sector on surveys and update them on progress made on developing Ireland's knowledge base on mesopelagics. It is vital that Irish industry stakeholders are fully engaged and involved in the knowledge gathering and assessments. BIM will ensure regular engagement and industry insights are captured throughout the project.

Expected Benefits:

- Improved understanding of mesopelagic resources off the Irish coast, including biomass and trophic levels.
- Development and deployment of specific sampling techniques that aid understanding of mesopelagic resources.
- Enhanced collaboration with industry to identify the potential to sustainably exploit novel resources.
- Developing a knowledge base on novel resources off the Irish coast.
- Enhance the economic viability of the pelagic sector in the long term.

Projected Cost: €292,125