Masters' thesis offer (2027/2028)

Mesopelagic–demersal trophic connectivity along the Faroe Islands shelf break

Supervision: Hélène THIBAULT and Tom LANGBEHN
University of Bergen
Theoretical Ecology Group

Email: helene.thibault@uib.no
tom.langbehn@uib.no

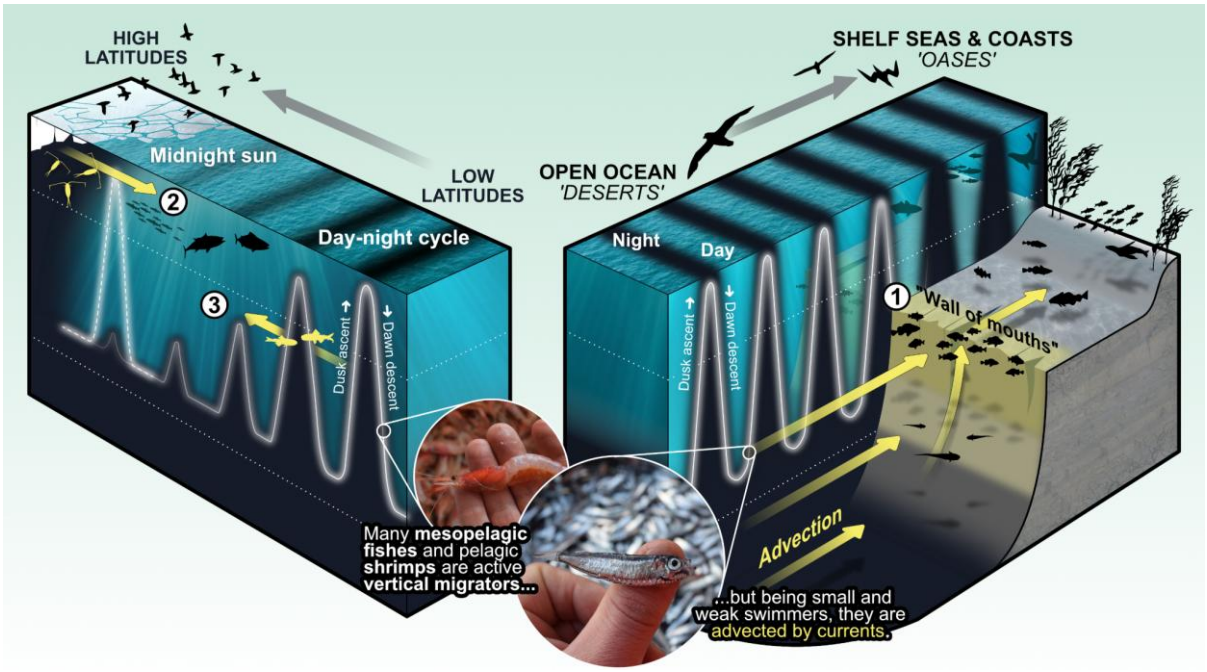
Background

The mesopelagic zone (200–1,000 m depth) supports a substantial biomass of marine organisms, including fishes, crustaceans, cephalopods, and gelatinous zooplankton. Many of these organisms perform diel vertical migrations, moving towards surface waters at night to feed before returning to deeper waters during the day. These movements contribute to the transfer of energy and organic matter between surface and deep-ocean ecosystems.

Although mesopelagic ecosystems have been extensively studied in the context of vertical connectivity, much less is known about their interactions with adjacent continental shelves and slopes. In particular, the contribution of mesopelagic organisms to demersal food webs along continental shelf breaks remains poorly understood.

The Faroe Islands provide an ideal setting to investigate these interactions. The region is characterized by complex bathymetry, strong hydrographic gradients between Atlantic and subarctic waters, and contrasting shelf-break environments. Along the northern Faroe Islands, the continental slope is relatively steep, potentially bringing vertically migrating mesopelagic organisms into proximity with demersal predators. In contrast, the northeastern region has a gentler slope, where currents may facilitate the horizontal redistribution of mesopelagic organisms towards shallower waters. Previous studies have highlighted the importance of ocean circulation, cross-shelf exchange, and the

transport of offshore biological resources in shaping the Faroe shelf ecosystem (Gaard & Hansen, 2000; Rasmussen et al., 2014; Hátún et al., 2025).



© Tom Langbehn

As part of the interdisciplinary DRIFT project, a research cruise was conducted aboard the R/V *G.O. Sars* from 12 to 24 October 2026. Approximately 150 demersal fish individuals were sampled from deployed bottom trawls, with sampling generally conducted around dawn and dusk at comparable locations. Stomach contents and muscle tissue were collected from the same individuals, while additional tissue samples were collected from mesopelagic fishes and crustaceans for stable isotope analysis. Trophic proxies like carbon and azote stable isotope values (δ13C and δ15N) of fish tissues offer complementary information to investigate foraging ecology and trophic relationships at the ecosystem level (e.g., Annasawmy et al., 2020). While $\delta^{13}C$ reflects the primary carbon source and spatial foraging origin (e.g., epipelagic vs. mesopelagic), $\delta^{15}N$ increases with trophic level and provides insight into species' positions in the food web (Post, 2002).

These samples provide an opportunity to investigate whether the shelf break functions as a trophic interaction zone, or *"wall of mouths,"* where mesopelagic organisms become accessible to demersal predators.

Objectives

The main objective of this Master's thesis is to investigate trophic connectivity between mesopelagic organisms and demersal fish communities along contrasting shelf-break environments around the Faroe Islands.

Depending on the student's interests and background, the thesis could focus on one or several of the following objectives:

1. Characterize the stomach contents of selected demersal fish species and quantify the occurrence and relative contribution of mesopelagic prey.
2. Investigate trophic relationships using carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope analyses of demersal predators and potential mesopelagic prey.
3. Examine how feeding patterns and isotopic signatures vary among predator species, sampling periods, and the northern and northeastern shelf-break regions.
4. Integrate trophic observations with existing acoustic and environmental datasets to explore how mesopelagic prey distribution and hydrographic conditions may influence prey accessibility to demersal predators.

Stomach content and isotope results will be analyzed using appropriate statistical methods to assess trophic differences among species and sampling environments.

Processed acoustic, hydrographic, and current measurements collected during the cruise will provide additional environmental context for interpreting the observed trophic patterns.

References

Annasawmy, P., Cherel, Y., Romanov, E. V., Le Loc'h, F., Ménard, F., Ternon, J. F., & Marsac, F. (2020). Stable isotope patterns of mesopelagic communities over two shallow seamounts of the south-western Indian Ocean. *Deep Sea Research Part II: Topical Studies in Oceanography*, *176*, 104804.

Gaard, E., Hansen, B. (2000). Variations in the advection of *Calanus finmarchicus* onto the Faroe Shelf. *ICES Journal of Marine Science*, 57, 6, 1612–1618.

Hátún, H., Danielsen, J., Olsen, B., Jacobsen, S., Vang, H.B.M., Kristiansen, I., Larsen, K.M.H., Gaard, E., Salter, I., Steingrund, P. and Mork, K.A. (2025). Unifying local and large-scale drivers of the Faroe shelf ecosystem. Front. Mar. Sci. 12:1662766.

Post, D. M. (2002). Using stable isotopes to estimate trophic position: models, methods, and assumptions. *Ecology*, *83*(3), 703-718.

Rasmussen, T. A., Olsen, S. M., Hansen, B., Hátún, H., & Larsen, K. M. (2014). The Faroe shelf circulation and its potential impact on the primary production. *Continental Shelf Research*, *88*, 171-184.