# Numerical Modelling of Submerged Mussel Longlines with Protective Sleeves

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## ABSTRACT

A submerged longline mussel farming is a relatively safe, reliable and profitable way to produce mussels in the exposed ocean environment [1]. However, variations in the environmental conditions (strong currents and storms) and potential presence of predator species (e.g. eider ducks) requires robust engineering approaches to design longline mussel farms and their components.

This paper describes application of fluid-structure interaction modeling software Hydro-FE to predict the dynamic response of different mooring/longline/dropper configurations subjected to fair and storm conditions typical to North Atlantic mussel farming sites. Hydro-FE is a software tool that expands and modernizes the approach previously implemented in the finite element program Aqua-FE described in [2]. The numerical models include Reynolds number dependence of drag force and contributions of predator-protection sleeves to the overall mechanical response of mussel droppers. The simulations provide estimates of anchor forces, tension in mooring lines, and time-series data on the motion of the droppers. This information can be used to prevent anchor failure, rope breakage, line entanglement and mussel fall-off.

## REFERENCES

[1] R. Langan, "*Mussel culture, open ocean innovations*", Encyclopedia of Sustainability Science and Technology, pp. 6758-6768, 2012.

[2] I. Tsukrov, M. Ozbay, D.W. Fredriksson, M.R. Swift, K. Baldwin, B. Celikkol, "Open ocean aquaculture engineering: numerical modeling", *Marine Technology Society Journal*, **34** (1), pp. 29-40, 2000.