BSAP Fund

# Feasibility Study of Focus v. as a part of Regenerative Integrated Multi-Trophic Aquaculture (IMTA) in the Baltic Sea, Finland

**Nemo Seafarms Oy**

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# Executive summary of the project

Anthropogenic pressure has induced abnormally high levels of nutrients in the Baltic Sea, leading to a eutrophic state of the waters. Eutrophication favours opportunistic species, causing e.g. blue-green algae blooms, leading to an imbalance in the marine ecosystem. Further consequences occur when ultimately the excess biomass sinks to the bottom and begins to decompose. The decomposition process utilises oxygen. Once oxygen is depleted, causing an anoxic state, a vicious self-strengthening circle occurs where nutrients are added to the water column both internally and externally.

In this project, we focused on reducing the impact of one of the point sources for nutrient input, offshore fish farming. Sea-based fish farming has a local impact, which extent is highly dependent on cultivation and feeding techniques, as well as location properties. The project was managed by Nemo Seafarms Oy, a Finnish startup company developing seaweed cultivation techniques and marine ecosystem services. The project investigated the technical and environmental prerequisites for a viable business case where two different forms of aquaculture are combined, fish and seaweed. Seaweed, or macroalgae, efficiently absorbs nutrients from the water, thus, by harvesting and utilising seaweed we can remove excess nutrients from the water. The environmental advantages of seaweed are not limited to nutrient removal. Seaweed also binds CO2, produces oxygen through photosynthesis, and increases biodiversity by providing habitat and food for several aquatic species. By integrating seaweed with fish cultivation, and forming an IMTA system (Integrated Multi-Trophic Aquaculture), seaweed can compensate for the nutrient runoff caused by fish farming. We chose to focus on one of the key species in the Baltic Sea, bladderwrack (Fucus vesiculosus).

The project started early summer of 2022. Geographically, the main activities took place on the west coast of Finland and the north coast of the Åland Islands. Direct partners for the project included Origin By Ocean (seaweed biorefinery), Under Ytan (Åland Island-based startup company focusing on seaweed cultivation and seaweed as food) and fish farmers. In March 2023 we also initiated a cooperation project together with Under Ytan and the Swedish offshore energy company OX2, called “Project Björkskär”. The activities from both projects were partly integrated and allowed us to share resources and equipment to achieve the best outcomes. We have also built an extensive network of experts from various areas including academia, NGOs and private companies around the Baltic Sea. On top of that, we have initiated discussions with coastal communities to find solutions for a circular economy on a local scale and arranged events where we have introduced seaweed as both a resource and an ecosystem service.

The project included both on-land and sea-based activities:

- We designed and built both lab- and pilot-scaled seaweed nursery systems in a controlled and semi-controlled environment, and successfully managed to manipulate the reproduction cycle of bladderwrack.

- Developed methods to utilise the natural reproduction cycle in nature as an alternative to a hatchery-induced farming technique.

- Conducted a thorough literature review, planning and discussions with external experts (researchers and farmers) regarding the environmental and technical aspects of an IMTA system.

- Designed, deployed and studied the functionality of a hatchery-induced cultivation system for bladderwrack in a sea-based environment.

- Compiled a summary analysis of the business case for an IMTA system on the Finnish coast of the Baltic Sea.

During the project, the aims were updated according to the findings and knowledge we acquired. The results gave us a solid ground to continue the development and gave us a better understanding of what to focus on. Consequently, although this particular project has concluded, the R&D continues both within Project Björkskär and Nemo Seafarms internally. Seaweed cultivation is still in its infancy in the Baltic Sea area, however, we see great potential in the industry as part of the broader green transition. Today's seaweed market makes it challenging to make a feasible business case based on bladderwrack biomass in the Baltic Sea. However, with the new sustainability targets set by the EU, there are upcoming possible revenue streams for seaweed cultivation in general, extending further than just biomass production.