



► Frej Gustafsson and Mitchell Williams testing their 'living breakwater' in MARIN's Concept Basin

**T**hese SME basin slots allow these companies to test their innovation at an early stage in the design process. Such early-concept tests help designers to obtain a solid understanding of the strengths and weaknesses of their initial design – lessons that prove highly valuable when advancing their design to a higher technology readiness level.

A particularly innovative concept tested in 2021 was the 'living breakwater' designed by ReShore, a Wageningen-based startup founded by Frej Gustafsson (aquaculture lead) and Mitchell Williams (business lead). Their living breakwater combines traditional floating breakwater engineering with shellfish and seaweed aquaculture. The combination of these elements aims to create a nature-inclusive tool for the application in and around harbours or for shoreline protection. Moreover, the low-trophic species (shellfish, seaweed) are nature's water filters, boosting the water quality and providing a positive impact to the aquatic system.

The living breakwater was tested during a two-week campaign in MARIN's Concept Basin. The breakwater design that was tested involves a double-pontoon floater with a vertical cage for aquaculture purposes. The setup featured scale modelling of a suspended mussel culture inside the cage in order to simulate the

effects of aquaculture on hydrodynamic damping. The tests aimed to quantify the floater motions, as well as the wave attenuation performance in mild and survival sea states. Multiple drafts were tested to simulate the various stages of aquaculture growth.

**Combining mussel aquaculture and floating breakwaters** The results of the testing are positive. Crucially, the results prove ReShore's concept of combining mussel aquaculture and floating breakwaters to increase the breakwater's performance. It appears that the mimicked mussel aquaculture increased the attenuation of the floating breakwater and thus reduced its motion response to the waves. These results are subject to further evaluation and more work remains to be done to better understand the system's behaviour and to further optimise the design in terms of motions, wave loads, and wave attenuation performance.

Frej Gustafsson, co-founder of ReShore, comments: "The testing was a great success to us, and we were incredibly happy with having the opportunity to test a scaled model in the basins at MARIN. Not only were we able to prove the concept that we have been working on, but we also got to learn a lot of other technologies and processes in maritime engineering. Not being engineers ourselves, it was also

surprisingly valuable to work directly with the various staff at MARIN, understand how they approach different problems, and what they thought were the most important hydrodynamic aspects of our project. The support from MARIN before, during and after the testing was stellar. They understood our proposition well, helped us prepare, both with our model and our testing schedule, and made sure we had the correct tools to understand the data that was produced. All in all, we couldn't be happier with how the testing went!"

**Full demonstration project** Further collaboration between MARIN and ReShore is foreseen through the NWO Take-Off programme that stimulates the valorisation of knowledge from Dutch research institutes by starting companies. Within this project, MARIN will assist in further improving the breakwater design in terms of wave loads, motions, and wave attenuation through numerical calculations. Following the study with MARIN, ReShore is aiming to have a full-scale demonstration project on the water by the end of 2022. In order to conduct a successful demonstration, ReShore will need to raise capital, find suitable project partners and build a reliable supply chain. It is an ambitious goal, but the founders of ReShore are confident that they can achieve this. More information on ReShore's innovation and developments can be found at [www.reshore.blue](http://www.reshore.blue). □

# Successful tests of ReShore's 'living breakwater' design



MARIN aims to stimulate innovations by small and medium-sized enterprises (SMEs) in the Dutch maritime sector. One of the means is the annual granting of free basin time for model testing for up to six SMEs.

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