

BIOGENIC MUSSEL REEF HAS POTENTIAL AS COASTAL PROTECTION TECHNIQUE AND ECOSYSTEM ENHANCER



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PROMISING RESULTS FROM BLUE CLUSTER PROJECT COASTBUSTERS 2.0

Smartly constructed, self-growing mussel reefs at the boundary of shallow water (the foreshore) can reduce coastal erosion while making a positive contribution to biodiversity and the coastal ecosystem. This result comes from The Coastbusters research project.

On 16 October 2023, the project results were presented to the press in Ostend (B), and to policymakers, marine stakeholders and NGOs at an afternoon symposium. Coastbusters is a Blue Cluster project with partners DEME, Jan De Nul, Sioen, ILVO and VLIZ financially supported by VLAIO.

After six years of experimentation and scientific observation at sea, a new nature-based coastal protection technique is on the table. One of the innovative elements in it is the so-called mussel shaker. The new technique uses mussels to build a reef that acts as a biologically-reinforced dune-by-dike underwater, as the first hurdle against storm surges. Beach and dunes then become the second line of defence.

The biggest challenge was to find how best to help biobuilders such as mussels and shell tube worms settle, under prevailing conditions.

Climate change and sand loss: serious challenges

Rising sea levels and possibly more frequent future storms make maintaining the basic coastline difficult in many countries. Governments must continually invest in dyke reinforcements, raising embankments and massive sand replenishments. Conventional ways of coastal defence risk becoming unaffordable. Nature-based, sand-saving coastal protection techniques are being developed and applied in many places: dune planting, artificial sandbanks of all kinds.

With their combined technical, biological, ecological and socio-economic expertise, Coastbusters partners targeted an innovative method from 2017: A biogenic reef in the foreshore, made from local bio-farmers, as a working underwater shore-by-dune or shore-by-beach.

Tomas Sterckx, Coastbusters project coordinator (DEME): *'The cooperation with biologists is particularly enriching and has yielded new techniques for coastal protection. These techniques complement traditional methods, such as sand replenishment or dyke reinforcement. We now consider coastal zone management as a comprehensive approach to the entire coastal strip. Underwater biological protection lines prove to be a promising technique.'*

The Coastbusters technique

Innovative is the combination of aquaculture techniques (suspended cultures) with ingenious mussel shakers. In essence, the search aimed to develop the reef adapted to local conditions: which species? Which properties for the ropes used? Which set-up? In a spacious test set-up about 2 kilometres off the coast of De Panne, different species and techniques were first tested separately as biogenic builders. Mussels and shell tube worms proved to be a more obvious reef-building pioneer species than oysters and seaweed.



Ine Moolaert, Blue Innovation Officer VLIZ: *'Our innovative monitoring techniques including the VLIZ underwater drones made it possible to closely monitor the evolution of the mussel reef, even during storm conditions.'*

The proposed optimal formula so far is an elongated mussel reef installed parallel to the shoreline, which expands in a balanced and continuous manner, also including other species such as shell tube worms and seaweeds. The natural accretion of the reef should come into balance with the growth-inhibiting action of predators (starfish and crabs) and high physical environmental stress (wave action).

Sustainability and ecosystem services built in and monitored

As the North Sea is among one of the roughest seas, it can never be ruled out that materials may be damaged and enter the marine ecosystem. Within the Coastbusters project, Sioen succeeded in identifying bioplastics that slowly biodegrade under marine conditions.

Bert Groenendaal, R&D coordinator at Sioen: *'Sioen is a global player in technical textiles and concerned about the problem of microplastics. The developed bioplastics have been processed into fibres and ropes suspended as droppers in the North Sea for the capture of baby mussels. They will degrade within a certain time period under the influence of microorganisms.'*

The reef itself already brings two potential environmental benefits, ILVO biomonitoring shows.

Alexia Semerano, ILVO marine researcher: *'The research sites attract a lot of additional marine life and act to promote biodiversity. Secondly, mussels are filter animals that remove their nutrients from the water. So on net, the seawater becomes (slightly) cleaner.'*

A hypothesis to be further substantiated is the beneficial climate effect. Mussels also absorb CO₂ and store it for a long time in their shells in the form of calcium carbonate. This is a (small) form of blue carbon storage.

Creating added value, locally and even globally

Jan Fordeyn, Director Project Development and Conceptual Design Jan De Nul: *'On the Belgian coast, high beach and dunes are relatively stable, but below the low water line we have seen systematic erosion for more than 10 years. As a result, the tidal edge becomes steeper and we regularly have to sand replenishment. Coastbusters will stabilise that foreshore, reducing the need for sand, reducing environmental impacts and improving biodiversity.'*

The two participating hydraulic engineering firms see a possible international future in working with this nature-based coastal protection technique. Mussels are found almost everywhere in the world. Using them as a reef builder is therefore widely implementable in principle, provided a preliminary study of local seabed and current conditions'.

For the fishing industry, a strip of coastal protection reefs would be no place for trawling. Alexia Semerano, ILVO marine researcher: 'A combination with passive fishing of the latest generation could be explored. ILVO already studied the feasibility of hanging culture (mussels and oysters) combined with pot fishing (cuttlefish and crustaceans). The question is whether pot fishing near the coastal reef would also be efficient to organise together with the necessary management and monitoring tasks above the reef'.

Jo Brouns, Flemish Minister for Economy, Work, Innovation and Agriculture: *'Coastbusters is a wonderful example of Flemish innovation and a showpiece of the Blue Cluster. The effect of our two million euro research funding from Flanders, combined with one million euro co-financing from three private players, is clear. A specialised coastal market is unfolding with this new form of coastal protection - carefully constructed, ecologically sound mussel reefs. Flemish knowledge and expertise will soon translate into successful applications, also internationally.'*

North Sea Minister Vincent Van Quickenborne: *'This summer we reached a milestone in North Sea mariculture with the first Belgian mussels. The Coastbusters project now shows that mussels have additional assets, as a natural, protective buffer. We need smart solutions like this. Once again, it makes our North Sea a paragon of innovative and pioneering research.'*

"There are now enough answers to speak of a promising concept. There is a blueprint for global application, sufficiently market-ready to start working with it in practice."

The Coastbusters partners