

Biodiversity Challenge Awards 2025

The Rotterdam Reef Reefy, Rijkswaterstaat, municipality Rotterdam, Boskalis Rotterdam *New build*

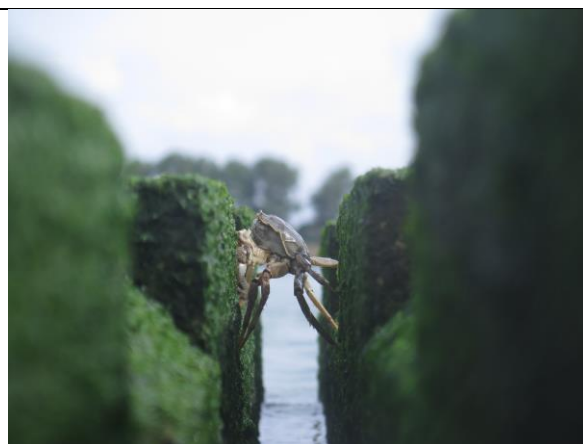
Entry 30

Award category: 5. Biodiversity Feature Award: Coastal Eco-engineering

1. Project overview:

First application and monitoring of the Reef Enhancing Breakwater (REB).

The REB is an innovative solution for nature-inclusive coastal protection. It uses ReefBlocks, a modular unit that provides both shoreline protection and ecological benefits. The structure includes tunnels that support fish migration, suitable substrate for biofilters and help improve water quality. Its textured surfaces and shape create habitats that encourage marine life to settle and grow. The REB forms a complex, integrated reef system that can adapt to rising sea levels. It is also flexible and can be easily adjusted or expanded in the future, making it a sustainable and forward-looking choice for coastal eco-engineering.



Installation of ReefBlock as part of the Reef Enhancing Breakwater. For the Rotterdam Reefy 17 ReefBlocks were installed.

The Reef Enhancing Breakwater is now teaming with life, above and underwater.

2. Please provide an explanation of the planning stages and how this project was set up for success.

The REB has been developed by Reefy, Reefy founder Jaime (Coastal Engineer) worked in coastal protection in fragile marine eco-systems and saw the need for better solutions. During his masters at the TU Delft he started with the first proof of concept in small scale. He bundled his efforts with Leon Haines (Marine Biologist), who was restoring reefs in south east asia at the time. Together they founded Reefy and developed the Reef Enhancing Breakwater. As part of the development ReefBlock has been tested in 2020 and 2023 at Deltares and in 2024 at the TU Delft, ensuring a durable and stable solution that can withstand storms and provide effective solutions. The results have been published as part of the International Conference of Coastal Engineering 10.9753/icce.v38.papers.15 in collaboration with UNAM, Deltares and the TU Delft. During the development collaboration with many universities and zoos, material experiments were executed making sure that the materials are suitable for the recruitment of reef building species like oysters or corals.

The vision of the REB has always been to combine the efforts of marine ecology and coastal engineering to make large scale positive impact on the oceans.

The REB as a system allows for fish migration and water transport mitigating the negative effects of traditional solutions. Furthermore, the footprint of the REB is generally smaller by 2 times, having a smaller footprint and impact on the local ecology. Before installation of the Rotterdam Reef, the team has executed careful monitoring of the area to ensure no negative impacts would be made.

The Rotterdam Reef has been constructed in an integral project team consisting of the national water board (Rijkswaterstaat) the municipality of Rotterdam to give voice to the local community. While Boskalis provided the expertise to ensure safe deployment and installation of the structure.

3. Please provide an explanation of what has been delivered as a result of the project.

After deployment the Rotterdam Reef has been monitored for 2 years, using many techniques such as diving, eDNA and remote sensing.

The project have raised the TRL level from 4 to 8 for the innovation.

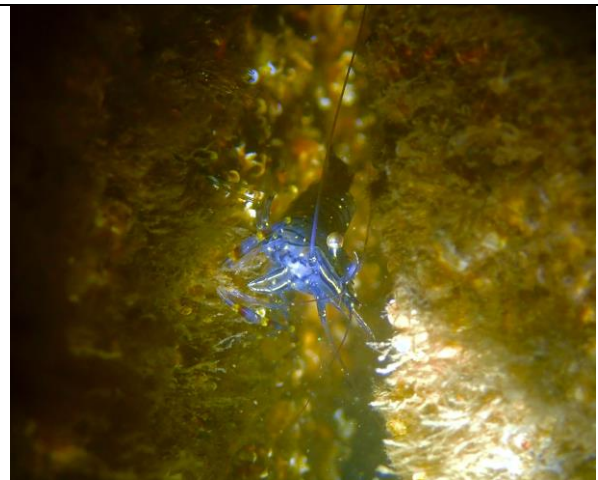
The measured biodiversity was increased by two times compared to traditional rock structures (based on the Simpson index) and ReefBlock provides 3 times the biodiversity compared to traditional concrete with a flat surface.

During two years of loading the ReefBlocks were 100% stable and effective in the operational environment.

The project has been perceived positively by all parties, and have led to further deployment of a nature inclusive Reef Enhancing Breakwater which will be installed at the end of 2025.



The Rotterdam reef is teeming with life. A great example of greening the grey above water and



Below the water line an incredible reef has started to grow, providing habitat for many species.

4. Please provide an explanation of how on-going benefits are being monitored and maintained.

The biodiversity impacts have been monitored with multiple methods among which are, diving inspections, drone inspections, eDNA and water quality sampling. The first monitoring of 2 years is concluded and will be extended to monitor long term effects.

Every year in December a multi beam measurement is taken to map the local bathymetry and the location of the reef. This will ensure regular monitoring of stability, provide input for maintenance and mapping of effects on the surrounding area.

A model of the ReefBlock has been placed in the Maritime Museum to showcase the ReefBlock in an interactive way.

Stakeholder engagement is largely supported by meetings with Municipality of Rotterdam and Rijkswaterstaat. Publication of monitoring helps to explain what happens underwater and remains invisible for the public.



Monitoring of the REB by drone and diver.

Fish hiding inside of the ReefBlock integrated tunnel system.