**Nature based Solutions for coastal zone management**

**Biogenic reef concepts**

**Initial aim (2017-2020)** - To check overall feasibility of three nature-inspired design (NID) solutions (Flora, Lanice and Bivalve reef) that enhance coastal resilience by using innovative bio-stabilization methods.

**Next step (2020-2023)** - Blue Mussel reef concept validated as most promising, several reef facilitating systems will be deployed to induce the early stages of mussel biogenic reef formation in different dynamic nearshore coastal environments.

- **Biodegradable materials**: Can tuneable (controlled over time) biodegradable material be used to replace conventional materials and textiles as building components of the nearshore mussel farming setup?
  - **Sustainable eco building blocks**
  - **Pioneering configuration and Flexible modular design (pilot upscaling)**: What is the most appropriate technical, spatial and temporal design of the offshore setup stimulating efficient biogenic reef forming and survival under different hydrodynamic conditions?
  - **Novel monitoring methodologies**: Which advanced environmental observation techniques are necessary to scientifically underpin the development, the evolution and overall resilience of the newly formed reef?

- **Ecosystem services approach**: What are the boundary conditions (e.g. biology, safety and survivability) and added ecosystem values and services of such mussel banks?
Aggregations of the ecosystem engineer *Lanice conchilega* (Pallas, 1766) (Sand mason worm) stabilizes the sediment bed of sandy shorelines. Therefore, this polychaete is considered as an interesting target species in the search for Nature Inspired Solutions in coastal zone management.

Research phase

Developing a standard protocol for culturing *L. conchilega* larvae and producing high quality and quantity of larvae. A *closed Recirculating Aquaculture System* combining spawning induction and larval rearing was designed and tested. The adults were exposed to different photo periods (0:24 LD (Light/Dark), 16:8 LD and 24:0 LD) prior to water temperature rise (8°C to 16°C) in 5 days and 24 h. A spawning and fertilisation event was recorded in the 0:24 LD tank up to the *trochophore* stage (Wyns et al. 2020).

Settlement conditions were examined and build on by providing artificial settlement substrate for the larvae. Different designs of geo-textiles were investigated and tested. In vitro experiments with *aulophore* larvae revealed the potential of artificial substrates to trap larvae. Nonetheless, a preference in substrate type is not to be excluded yet (Wyns et al. 2020).

To optimize the design further near low water line and to actually build, install and monitor their performance in the field, to the dynamic circumstances that occur in the intertidal zone of a selected beach along the Belgian coast.

A higher species richness was observed due to the artificial substrates. (Figure: X-axis: MAT and wooden sticks with higher species richness! Density of 2272 *Lanice worms/m²* as threshold for successful colonization was obtained with a density between 1083 and 5493 ind./m² in Bredene in 2018.)