

Environmental DNA, an emerging tool to predict the potentiality of nature inspired designs and oyster reef restoration: A Coastbusters case study for oyster reefs construction in the Belgian part of the North Sea

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Ecological engineering uses natural processes and materials to resolve environmental challenges by restoring ecosystems and creating opportunities for nature. Ecosystem functions fulfilled by such nature inspired designs are next to coastal defence and shoreline stabilization, also provision of breeding and nursery habitats. Challenges at hand for the creation or restoration of native oyster reefs are understanding the natural oyster spat availability and hence, its colonisation capacity and the presence of *Bonamia ostrea* oyster disease in Belgian waters. Within the Coastbusters project, which is used as a case study, the use of artificial oyster reefs as an innovative bio-stabilization method is being investigated for application in the Belgian part of North Sea (BPNS).

Previous studies revealed that *Ostrea edulis* (Linnaeus 1758), commonly known as European flat oyster, is the only indigenous oyster in BPNS. However, only modelling data (from Royal Belgian Institute for Natural Sciences) is present on the spatio-temporal spat availability of oyster spat in Belgium. Therefore, the present study will analyse historical water samples from 2000-2010 for environmental oyster mtDNA (eDNA) which will allow us to produce a BPNS eDNA presence map that relates to spat density and the presence of native oyster individuals. To validate the viability of artificial oyster reefs, also the presence of the *Bonamia ostrea* oyster disease (SSU rDNA) in eDNA of the historical water samples will be researched. Preparatory lab experiments on detection sensitivity, primer selectivity and lifetime of eDNA in seawater will support the protocol for oyster mtDNA and *Bonamia* SSU rDNA detection in seawater samples.

Therefore, this innovative eDNA approach will be the cornerstone of oyster reef restoration feasibility and will directly contribute to the Coastbusters development projects.

Keywords: eDNA; Bivalve reefs; Coastbusters; *Ostrea edulis*; *Bonamia ostraea*; Ecosystem services; Coastal resilience