Biodiagnostic techniques on blue mussels (*Mytilus edulis*) as site-selection criteria for offshore farming

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Offshore production offers a new perspective for shellfish and fish cultivation in the German Bight (North Sea), as no expansion of this food production sector within intertidal and subtidal areas of the coastal sea is allowed due to restrictions on the number of licenses, environmental protection and stakeholder conflicts. The development of a newcomer, the offshore wind farm operators, offers a unique opportunity to co-use large marine areas with submerged culture systems for various candidates. Modified and improved offshore culture techniques withstand the high energy environment of the North Sea, but, however, will certainly cause higher investments costs. Therefore, site criteria of a culture plot should be well known to calculate economic risks.

Modern biodiagnostic tools can be deployed to analyse the overall health status of marine organisms, e.g. the blue mussel (*Mytilus edulis*), grown in different offshore-areas of the North Sea to characterise site conditions. Using these tools product and site conditions can be analysed in a fast and inexpensive way. With these methods the tissue of the mussel's digestion system responsible for food uptake, storage of reserve substances and detoxification can be analysed and provides a clear signal on the health status of the mussel. For example, the condition of the surrounding membrane of a cell organelle - the so called lysosome - is tested. Lysosomes are usually responsible for the recycling of used-up cell organelles, metabolic products as well as harmful substances once they enter the cells. In case the storage capacities of lysosomes is overloaded and cells are stressed by high concentrations of harmful substances, the lysosomal membrane become instable and leaky and pollutants re-enter the cytoplasm with serious risk for health. If membrane stability and over-all health status of mussels are low, more specific tests may elucidate type and background of pollution. In contrast, if membranes of the lysosomes are stable there is strong evidence that the individual mussel grew under good water conditions.

The implementation of bio-diagnostic methodologies to identify potential culture areas within the areas proposed for offshore wind farms is one focus of a new project called „*MytiFit*" financed by the Ministry for Construction, Environment and Transport in Bremen (Germany) and the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven (Germany). In a test field 17 nautical miles off the coast from the city of Bremerhaven, three test moorings with large buoyancy will be deployed to analyse blue mussels in different water depths. The test field is the vicinity of a planned offshore wind farm. The aim of this approach is to accumulate relevant information for interested parties for the selection of appropriate cultivation sites of mussels in the planned offshore wind farm areas. The prediction of best water conditions and proofed product quality should yield to a qualitatively better product for human consumption and could be an argument to come up with a bioproduct. This should compensate higher investment costs compared to traditional on-bottom or nearshore culture techniques and help to install a functioning offshore aquaculture system in the German Bight.

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