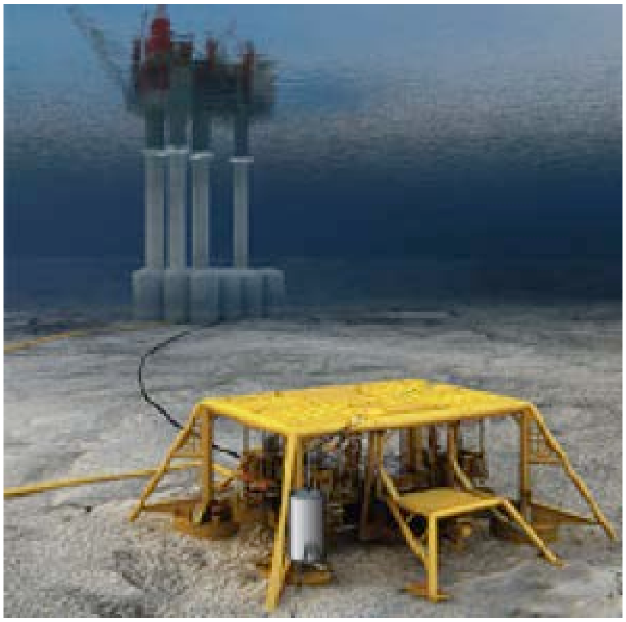
# Innovative Biomonitoring for Offshore Oil and Gas Industry

Marine biomonitoring is the science of determining the ecological condition of aquatic environments like oceans, rivers, lakes, streams, and wetlands by examining the organisms that live there.



Some of the newest research combined interdisciplinary fields of biology, chemistry and high technology to introduce innovative solutions in real-time monitoring of marine life connected to the oil and gas industry with the possibility of application in other areas such as monitoring river estuaries, on-shore industrial sites and harbors.

## Animal Biosensors

Real-time environmental monitoring with biosensors has been available for more than 20 years, and has been widely applied to monitoring of drinking water and acute discharges. These 1st generation biosensors have been developed to monitor responses such as heart rate, valve gape, tension field and oxygen consumption.

The modernization of these sensors led to the development of 2nd generation biosensors. Limitations with these sensors, such as low sensitivity to low-dose exposure and complex mixtures of toxic substances, generated a need for a next generation of biosensors that are more sensitive and can be integrated into the IO-center (Integrated Operations) of companies. In addition, the new technology measures fitness end-parameters that can be utilized in established environmental risk assessment models.

## Third Generation of Biosensors

New biosensors have been developed to monitor growth and the uptake of energy (via clearance rate) of filter feeders. These end parameters are normally included in the ERA (EU Technical Guidelines) of discharges and the population parameters are very sensitive for pollution. The technology is based on measuring the growth by laser diffraction, which is looking at the differences in the diffraction pattern made by a laser beam directed at the edge of the shell of a mussel. As the shell grows, the laser beam will gradually bend and create a pattern that changes over time. Am experimental set-up is shown on the following page:

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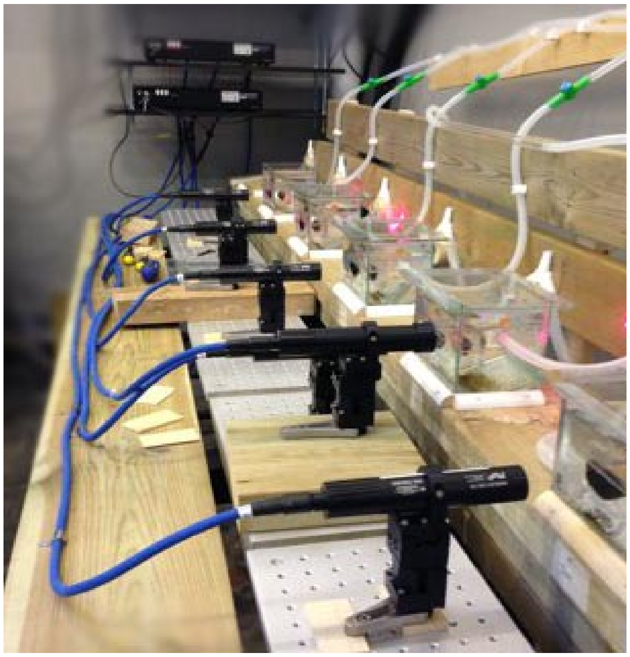


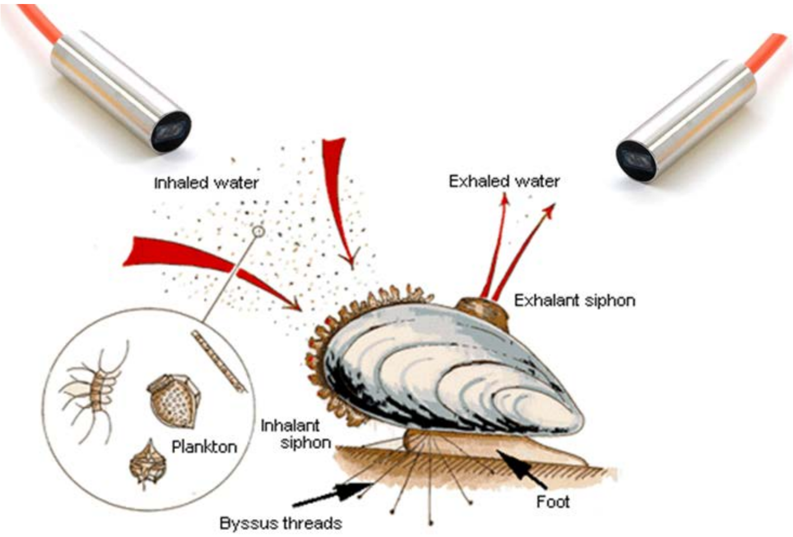
The laser sensor can measure accurately the feeding habit of the mussels by measuring the particle size, particle count and the flow speed both for the intake and outflow of each mussel. By subtracting the mass out from the mass in, the amount of the material taken by the mussel can be calculated. See the figure and graph:

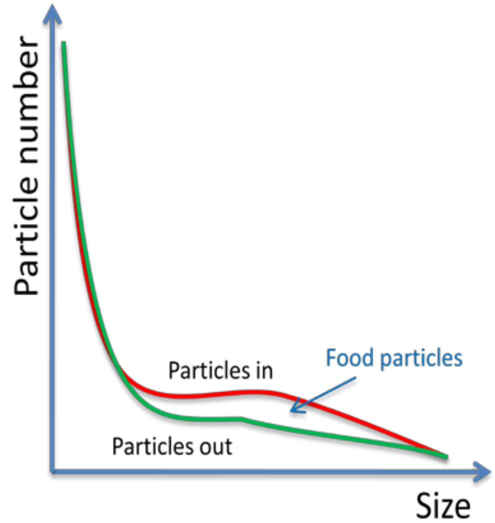
Mussels have been used as test organisms since they are already well established in the monitoring of the water columns offshore. Some experiments were also carried out by implementing Iceland scallop as a representative for communities at deeper depths and the Barents Sea.

Biosensor must be sensitive for low dose chronic exposures and simple live organisms are the most sensitive to changing environment. Their response is easy to interpret and they are flexible in use. Different environments like South East Asian marine ecosystems have different species that can be used for bio-monitoring.

## References:

1. Measurement Science Enterprise Inc., Pasadena, USA
[http://www.measurementsci.com](http://www.measurementsci.com)
2. BiotaTools AS, Stavanger, Norway
[http://www.biotatools.no](http://www.biotatools.no)

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