Projekt: The use of concrete as bio receptive material for artificial reefs: implications for marine habitat restoration and coastal protection

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Background / Motivation
In many parts of the world, marine reef ecosystems have degraded in recent decades, with severe implications for the associated marine life and fisheries. Deteriorating marine reefs may also threaten human settlements in low-lying coastal regions and contributes to the redistribution of sediment along sandy coasts. Increasingly, reefs are therefore restored to recover the ecosystem services and enhance coastal protection. Further information is provided here and here. In addition, artificial reefs are created specifically to improve local and regional fisheries. Installing marine reefs requires engineering solutions that are socially, biologically and technically meaningful.

Objective:
In Denmark mostly granite, a material with little porosity, is used for the restoration of reefs. In this project, the use of a material that requires no import of granite is in the focus of investigation with respect to the benefit of a porous material to shorten the time of acceptance in the ecosystem. Geological calcium carbonate sources are used in cement production, which is used in combination with water as the glue in concrete. During its life-time, concrete takes up CO$_2$ from its surroundings and forms again CaCO$_3$. This process is on land unwanted as it threatens the structural integrity of steel-reinforced structures. However, this capability may facilitate the settlement of marine ecosystems, which is further supported by the property of concrete to be shaped in almost any form. Ideal forms and surfaces for various types of colonization (e.g. species of macro algae) are largely unknown, but may have the potential to improve reef restoration projects.

Topics to work on:
Reef restoration and the development of artificial reefs that provide important marine habitats and act as coastal protection offer an interesting engineering prospect in times of global warming, degrading reefs, collapsing fish stocks and rising seawater levels. Here, we focus on:

Evaluation of cement types for their use in underwater reefs, beneficial surface textures and durability of the concretes in combination with the bio-acceptance in comparison to natural stones and ARMS. For example, different concrete surfaces and reef shapes may be compared in the laboratory and field and surveyed for colonized organisms and associated fish abundance and diversity.
Sted: København og omegn
Virksomhed/organisation: DTU Byg / DTU Aqua
ECTS-point: 15 - 35
Type: Bachelor degree project, Master degree project
Skal have taget: Preferably 11561 for experimental work with concrete.