3D printed artificial reefs: a relevant technology aiming to mimicry natural structural complexity and to mitigate lost of habitat in coastal ecosystems

#OceanAction15740

by Monegasque Association for the Protection of Nature (Non-governmental organization (NGO))

DESCRIPTION | SDG 14 TARGETS COVERED | DELIVERABLES | RESOURCES MOBILIZED

The Monegasque Association for the Protection of Nature is an NGO in charge of the management of the marine protected areas of the Principality of Monaco. The core idea of the management of these urban and small scale MPAs is to offer a natural laboratory to the academic institutions. In partnership with the Prince Albert II of Monaco Foundation, the Boskalis Company and the ECOMERS laboratory (Nice University/CNRS), a program on 3D printed artificial reefs (3D ARs) has been launched in 2015. The main objective is to propose a set of specifically designed 3D ARs allowing to restore the normal structural complexity of coastal degraded habitats.

Artificial reefs are often used to mitigate impacts from human activities in coastal ecosystems, to enhance fisheries yield or as a coastal management tool. For an AR to have a high chance of success, it should be site-specific and in harmony with the chemical, physical and biological characteristics of its target species. So, restoration strategies should consider techniques that maximize freedom of form and freedom of material types. These objectives can be achieved with 3D printing.

In a pilot project in the Larvotto MPA in Monaco, 3D printing is currently being developed through 3 different ways: optimizing the material used in the 3D printer, analyzing the biofilm and the macro-fouling development on the selected material, and assessing the link between the structural complexity of the 3D ARs and the diversity and abundance of the fauna inhabiting the artificial reefs.

The 3D printed ARs must meet two major constraints: print-ability and long term underwater resistance, both using natural material with a low CO2 footprint. The currently selected material, mainly composed of Dolomite sand, fits to these criteria, and allows to print large (1 cubic meter) ARs.

The biofilm development on Dolomite substrate is currently compared to that on concrete and on natural rock. The first results show that the bacterial communities shaping the biofilm are very similar between Dolomite and rocky substrate. However, the adjuvants used in concrete do not impair biofilm development but slows it.

To assess the link between the AR structural complexity and the fauna abundance inhabiting the AR, it is mandatory to be able to quantify the structural complexity. Consequently, we propose a simple method that can be used underwater to quantify the structural complexity of an AR, and to compare it with that of a rocky habitat.

These 3 research axes started in 2015 and will end in 2019. The main deliverable will be a set of 3D ARs, allowing to create specific habitats according to the species that a stakeholder or a manager would like to enhance within a restored habitat.

Throughout this program and a deep cooperation with scientific laboratories, AMPN wants to promote at the Mediterranean scale a model of urban and small scale marine protected areas acting as a natural laboratory to foster a more scientifically-based management of the coastal areas and to export this innovative technology from regional to international level.

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BASIC INFORMATION

Time-frame: 01/2015 - 12/2019
Website

PARTNERS

Monegasque Association for the Protection of Nature (NGO). Prince Albert II of Monaco Foundation (NGO). Boskalis Company (Private sector). ECOMERS Laboratory (Academic institution).

OCEAN BASINS

- North Atlantic

BENEFICIARY COUNTRIES

OTHER BENEFICARIES

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OTHER SDGS