

Building Marine Infrastructure That Supports Marine Nature:

Understanding how life first develops on concrete in the sea

Why this project matters

More concrete will be placed in the sea, as climate change increases the need for coastal protection, harbors, bridges, and marine infrastructure. At the same time, marine ecosystems are facing growing challenges, including biodiversity loss, oxygen depletion, and declining fish populations. The question is: can future infrastructure be designed to support marine life rather than harm it?

This project explores the very first stages of life that develop on submerged concrete. Within days of entering the water, concrete surfaces are covered by microscopic organisms that form thin biological layers called biofilms. These early colonizers influence both the marine communities that later settle on it and thereby also the durability of the concrete structure. Yet little is known about how this process begins across different marine environments.

What the project will do

Researchers will compare the development of microbial communities on concrete in three very different marine environments:

- Taarbæk Harbour in Denmark (brackish Baltic waters)
- Port Camargue in southern France (Mediterranean Sea)
- Vigo Harbour in Spain (Atlantic coast)

These locations differ in temperature, salinity, and nutrient levels, making them ideal for understanding how local conditions influence the growth of marine life on concrete surfaces.

How the study will be carried out

Concrete samples will be placed in seawater and monitored over one to two years. The research team will collect biofilm samples and analyse environmental DNA (eDNA), which allows scientists to identify organisms from genetic traces left in the biofilm.

By combining eDNA analysis with measurements of concrete properties and environmental conditions, the team can track how marine communities develop through time and compare patterns across countries and ecosystems.

The project brings together researchers from DTU Sustain in Denmark, IMT Alès in France, and industrial partners, building on two ongoing PhD projects focused on marine ecology and concrete durability.

Expected impact

The project will generate new knowledge about how marine ecosystems interact with construction materials. The findings can help engineers design coastal and offshore infrastructure that is both longer lasting and more supportive of biodiversity.

In the longer term, the results may contribute to more sustainable harbors, bridges, and tunnels. They will also support Danish and international efforts to combine climate adaptation with nature restoration, helping future marine infrastructure work in harmony with the ecosystems that surround it.