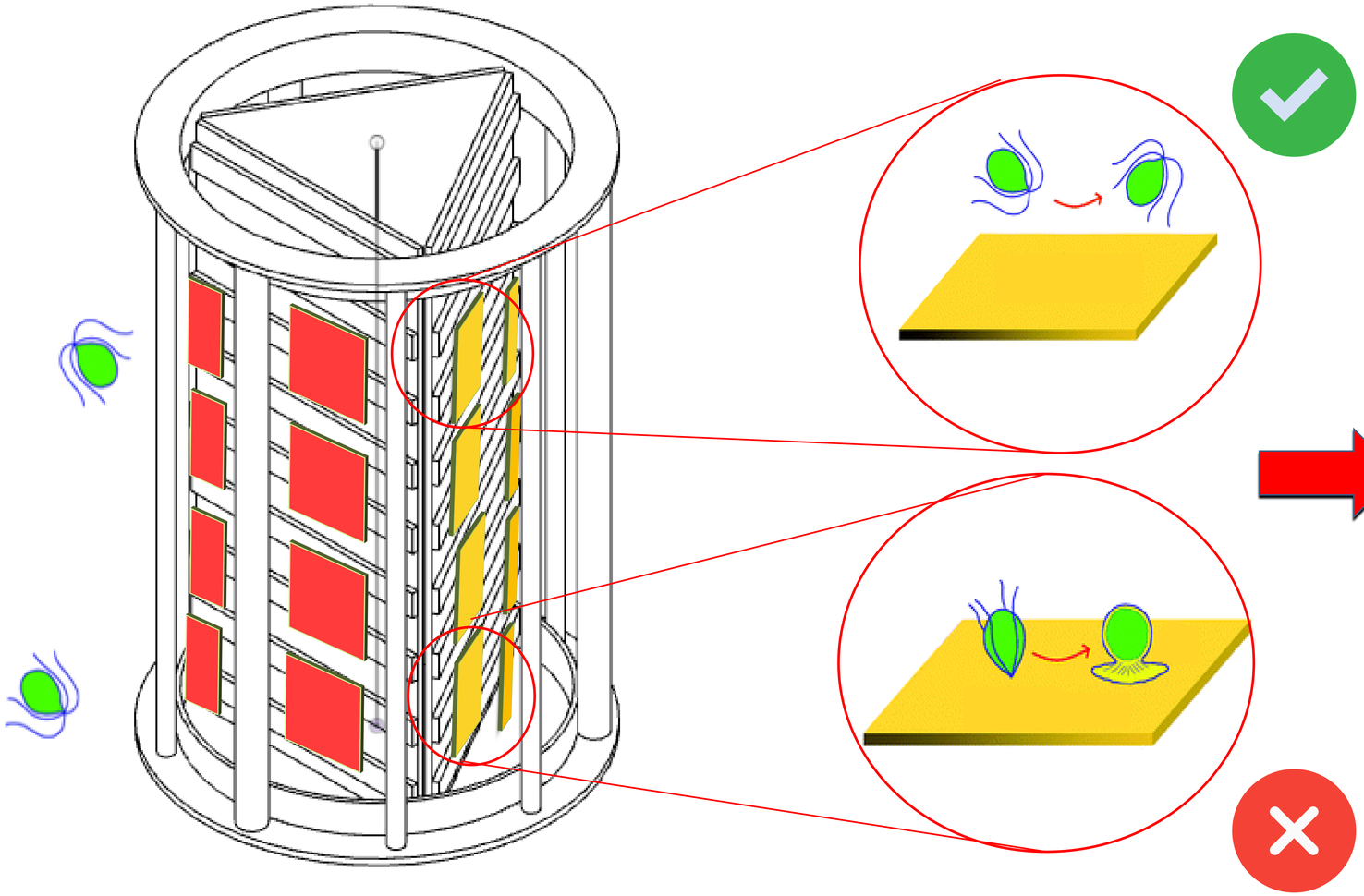
Biofouling studies on marine rated materials and coatings



Coating/Material cage test submerged under the water for 1 year antifouling performance

Coating/Material evolution of the biofouling growth on the different materials and selection of those which perform the best

Material implementation in the sensor

Biofouling studies on marine rated materials and coatings

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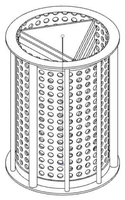
Background

Materials immersed in water undergo a series of biological and chemical processes, resulting in the formation of complex layers with attached organism, known as biofouling. Biofouling In the aquatic environment shortens the life-time of immersed structures affecting the functioning and data quality of water Instrumentation. For a large percentage of deployed instrumentation, biofouling is the single biggest factor affecting the operation, maintenance, and data quality and responsible for high ownership costs to the point where it becomes prohibitively expensive to maintain operational networks and infrastructure.
The selection of materials, and coatings with anti-fouling properties has become an increasingly difficult challenge but one that must be constantly reviewed and updated to advance the development of materials, composites and coatings that can be widely used in aquatic ecosystems and allow devices and structures submerged or in contact with water to last longer and reduce maintenance costs.
In this scoping study, a range of materials commonly used in the construction of marine sensors and 2 anti-fouling paints were deployed for 1 year to test their robustness and anti-fouling performance in the estuarine brackish water ecosystem in Dublin.

Results: Design, materials and fouling organism's identification

Deployment

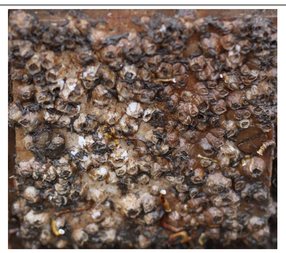
- Deployment period (12 months): March 2020-March 2021
- Frequency of Sampling: monthly
- Type samples: Photographs




Materials performance after 12 Months deployment

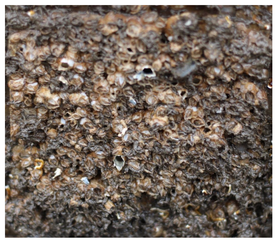

Copper


Composite


POM-H

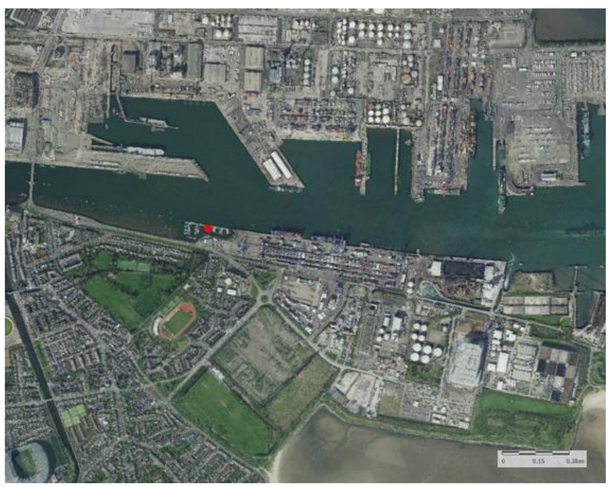

POM-C


Antifouling paints


Stainless Steel

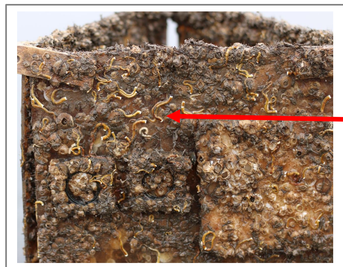
Site and Description

Dublin Port is located on the Lower Liffey Estuary (highly saline stratified macrotidal estuary). Constantly changing and dynamic water body (anthropogenic activity, tidal flushing, WWTP discharges, freshwater inflow).



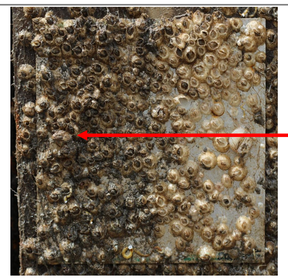
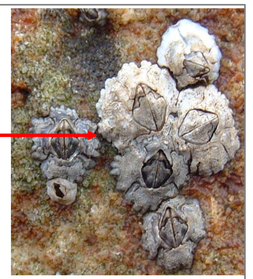
Main macrofoulers organisms: visual identification

Annelids




Ficopomatus enigmaticus (Invasive Species)

Crustacean

Elminius modestus (Invasive Species)

Summary of findings

- **Results of biofouling growth on the materials after 12 months deployment showed that copper is the most resistant material and remains the cleanest over time due to the toxic effects it has on the organisms.**
- **The antifouling paints also showed strong performance against biofouling coating over time, although their erosion over time begins to show signs of adhesion and colonization by fouling organisms.**
- **The rest of the materials were affected by significant bio-fouling with no significant differences between them.**
- **As for the organisms identified visually, macrofoulers organisms were mainly identified as tunicates, annelids and barnacles, highlighting invasive species such as *F. enigmaticus* and *E. modestus* standing out.**
- **Organisms such as microfoulers not visible to the naked eye as bacteria and microalgae will be identified using molecular eDNA metabarcoding techniques using 16S region and also an ITS region (18S).**

Acknowledgements

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