seanergy
26›28 June, 2024
Nantes, Pays de la Loire • France

Poster n°9

Multiphysics and multisensor monitoring of biofouling

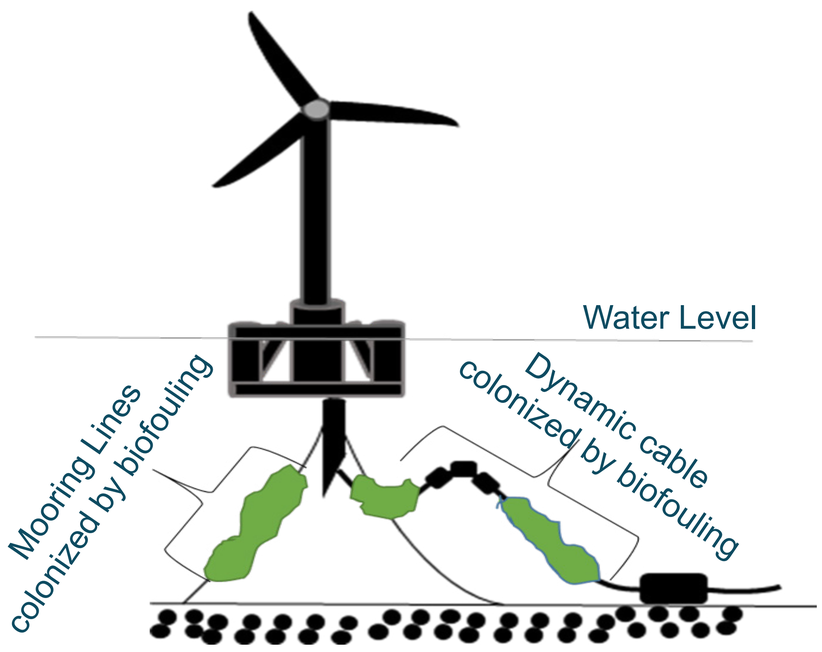
Ziad MAKSASSI[a,e], Ahmed GUELED[b], Benoit Parrein[c], Bertrand GARNIER[d], Franck SCHOEFS[e]

a CAPACITES SAS, Nantes
b Laboratoire de thermique et énergie de Nantes, LTeN, UMR CNRS 6607, Université de Nantes
c Laboratoire des sciences du numérique de Nantes, LS2N, UMR CNRS 6004, Université de Nantes
d Centra national de la Recherche, CNRS
e Institut de Recherche en Génie Civil et Mécanique, GeM, UMR CNRS 6183, Université de Nantes

Context and Objectives

- The growth of biofouling affects **the mooring lines and dynamic cables mechanically**, and causes **thermal effects on the dynamic cables** of floating offshore wind turbines.
- Growth of biofouling, **particularly mussels can modify the heat transfer** around the dynamic cable.
- High voltage dynamic cables are dimensioned to **remain below 90°C into the conductor and XLPE** in normal operating conditions.

➢ **Perform a thermal characterization of live mussels** for different ages by estimating their effective thermal conductivity (k_{biof}) and the heat transfer coefficient of the surrounding water (h_w).
➢ **Modeling the thermal impact** of mussels of various ages on the dynamic cable.
➢ **Monitoring real-time biofouling** growth around dynamic cables and mooring lines.

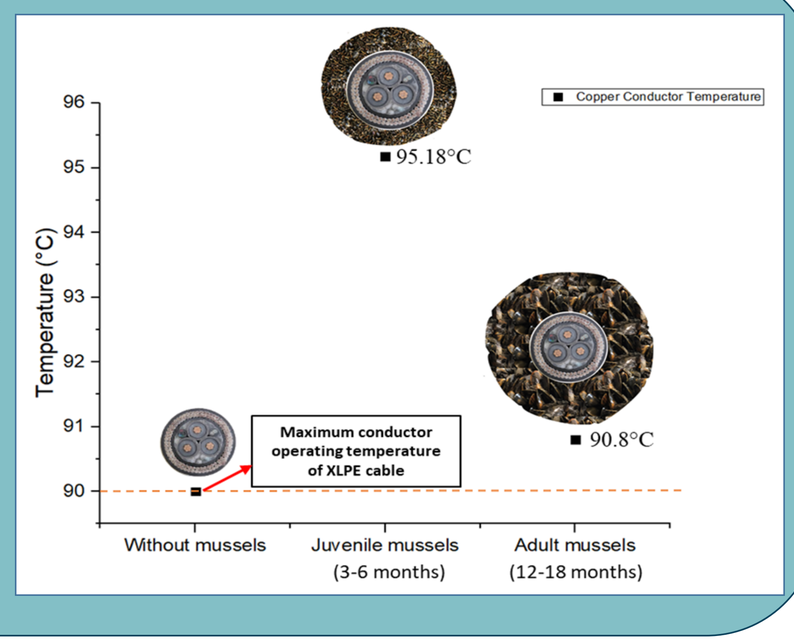


Thermal Characterization and Assessment of Thermal Effects

Mussel's patch	Juvenile (3-6 months)	Mix (6-12 months)	Adult (12-18 months)
			
Thermal Conductivity ($W.m^{-1}.K^{-1}$)	4.4	8	12.8
Heat Transfer coefficient ($W.m^{-2}.K^{-1}$)	3395	873	2682
Thermal Resistance ($K.W^{-1}$)	0.05	0.03	0.02

Thermal Resistance $_{Juvenile} <$ *Thermal Resistance*$_{Mix} <$ *Thermal Resistance*$_{Adult}$

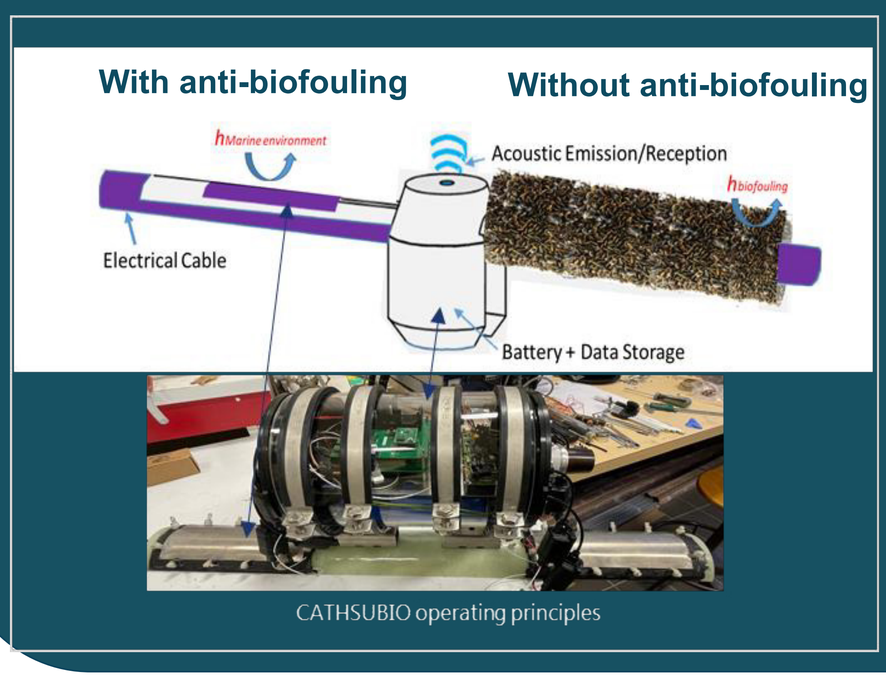
Thermal Simulation



Monitoring of Biofouling in real time

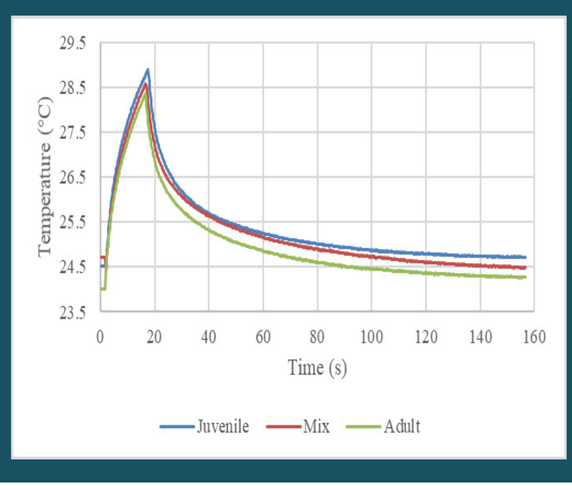
CATHSUBIO – Innovative Thermal Sensor For Monitoring Marine Growth In Real Time

★ **Patent Ouest Valorisation – FR2204752, Date of acceptance: May 2022**



CATHSUBIO operating principles

How it works ?



Equivalent heat transfer coefficient for various ages of mussels