

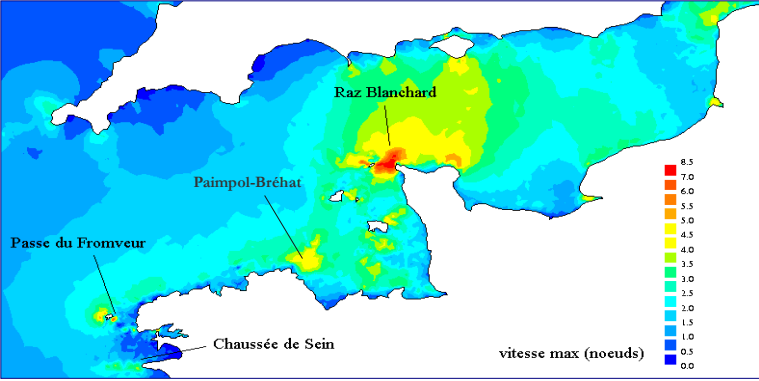
Environmental monitoring of the Paimpol-Brehat tidal project

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With contributions from Julien Dubreuil (In Vivo), Florence Lafon (EDF), Nina Cudennec (IFREMER), Xavier Demoulin (Marée/Altran), Bretagne plongée

A step by step deployment



May 2011
Licensing

Nov 2011
1st in situ turbine test

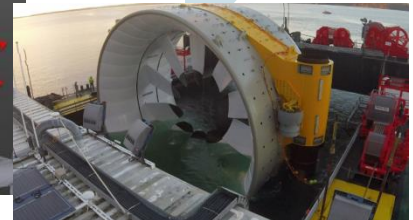
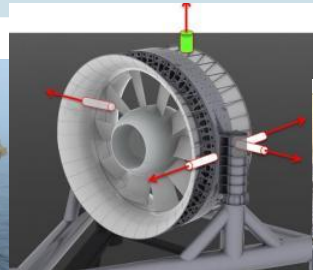
2012
Export cable laid

2013
stabilization of the cable

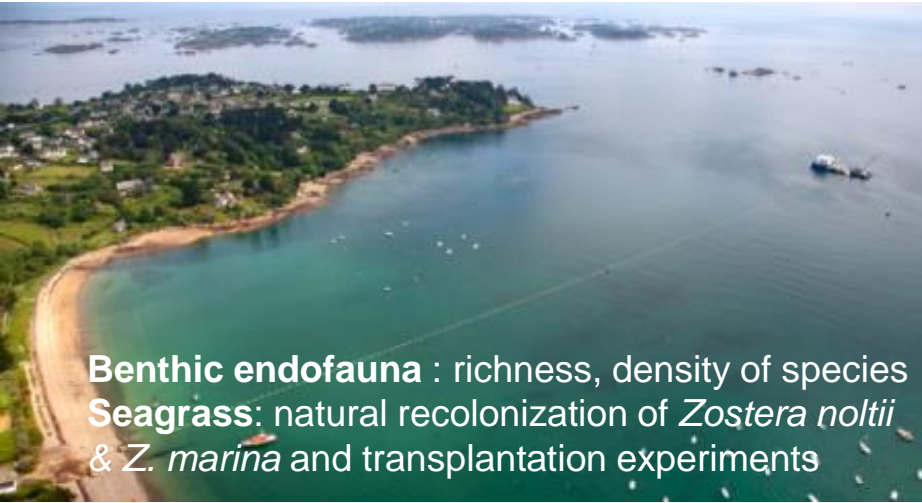
2014
In situ 500 h
Turbine testing phase 1

**20 Jan 2016
Turbine phase 2
deployed**

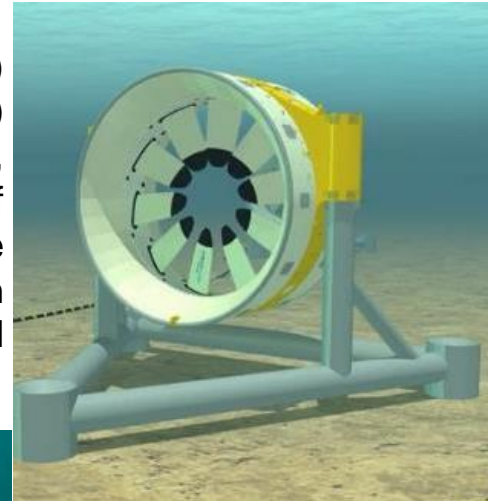
Spring 2016
tidal farm deployment



Adapted environmental monitoring



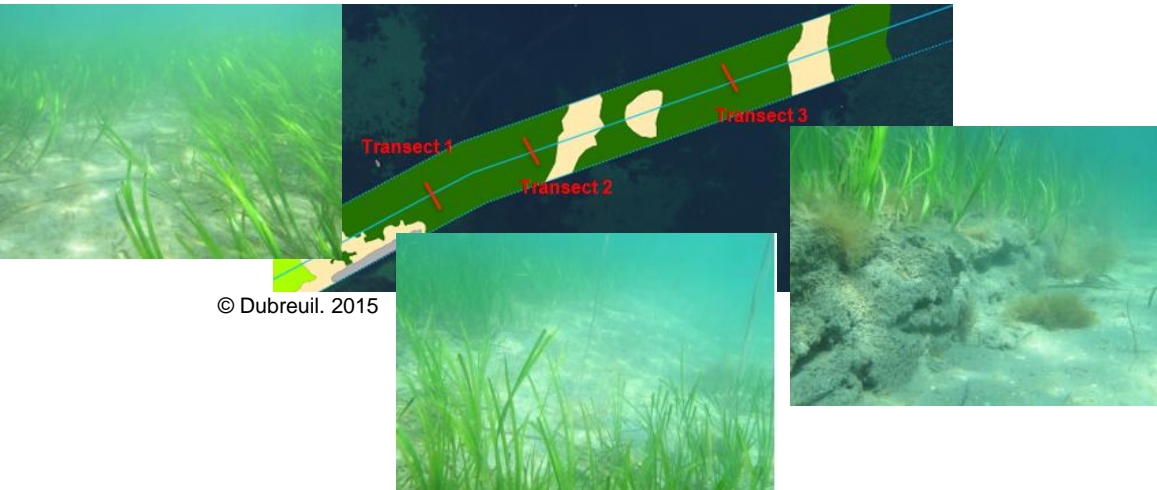
Noise (drifting hydrophons)
Tidal currents (ADCP)
Fauna : for the time being, only the initial state of benthos and marine mammals has been assessed



Zostera sp.: natural recovery relatively quick for *Z. noltii* and slower for *Z. marina*

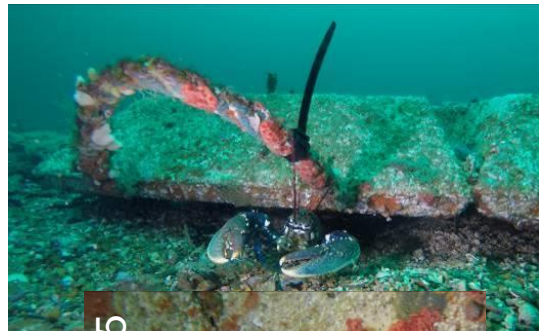


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- ❑ begins after the trench refills with natural sediment (1 year)
- ❑ still on-going for *Z. marina* in 2015 (90m)
- ❑ natural recolonization from seagrass close to the trench

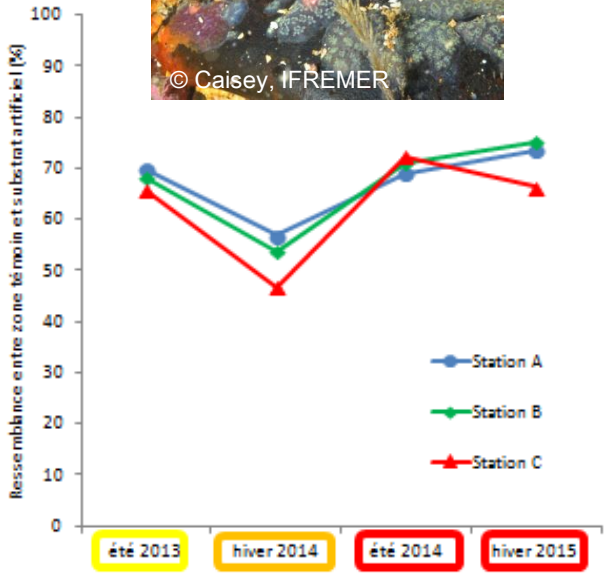
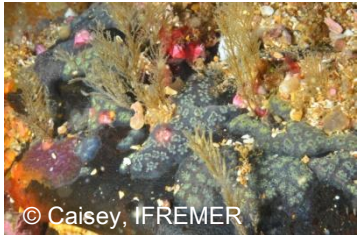
Biological colonization of the cable and mattresses (1)



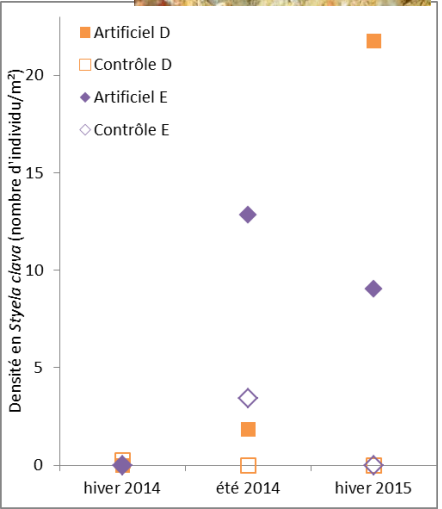
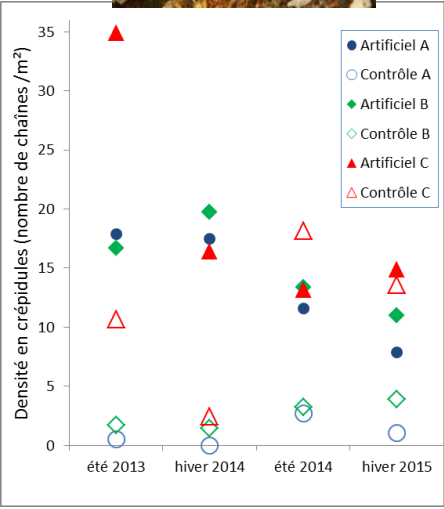
Benthic colonization is gradual with a high seasonal variability (winter/summer)

Matresses are significant habitats for Crustaceans (lobster, ...), Fish (conger, ..) and are attractive for numerous other fish (pollock, dogfish...)

Biological colonization of the cable and mattresses (2)



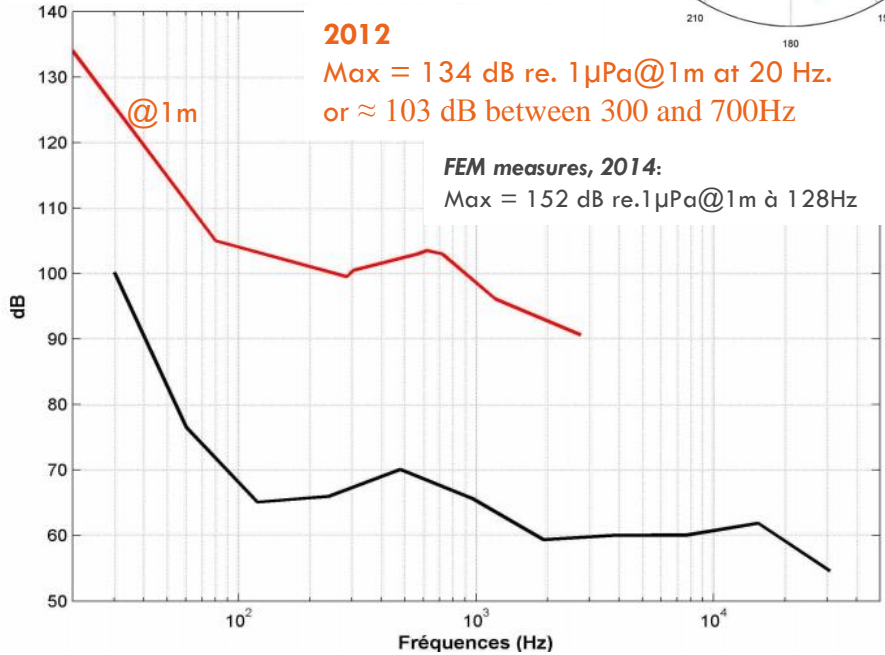
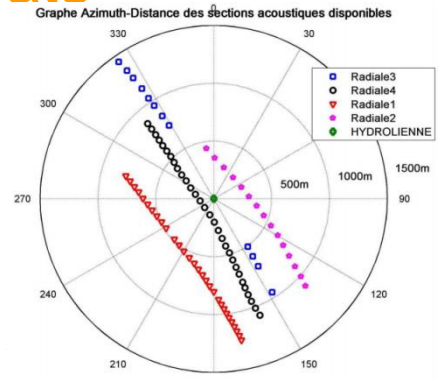
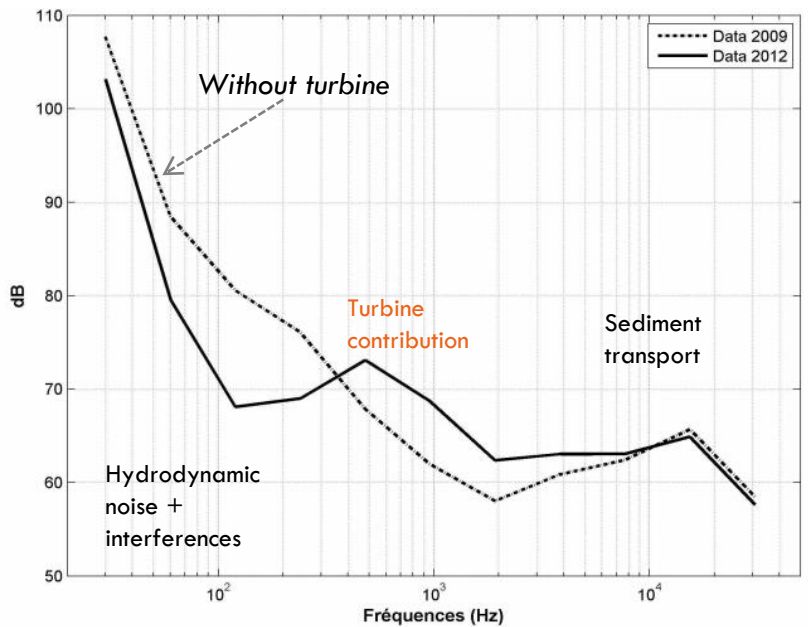
Biocenoses are 60-70% similar to the natural control ones



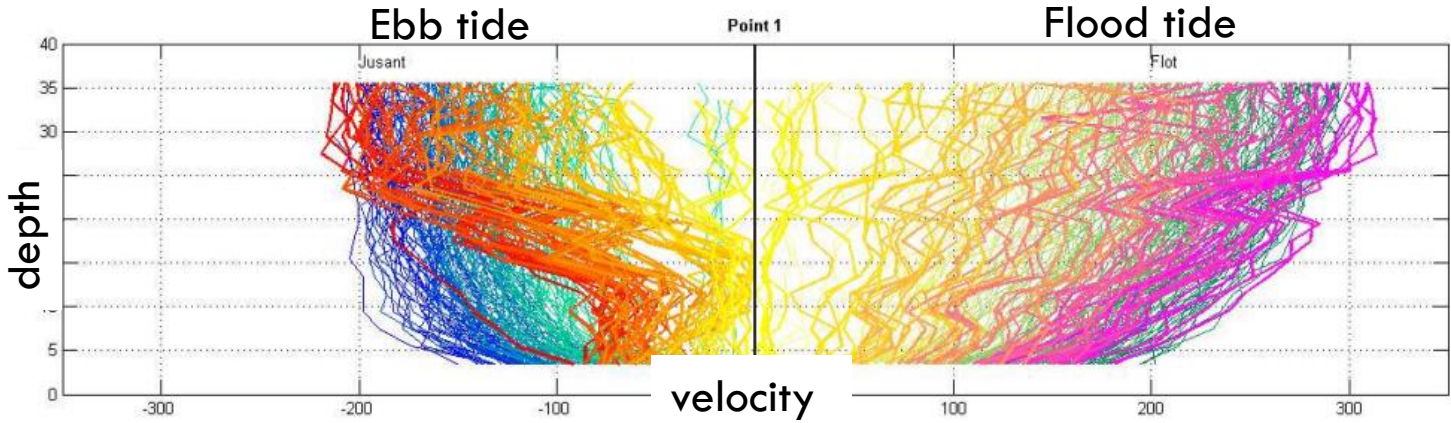
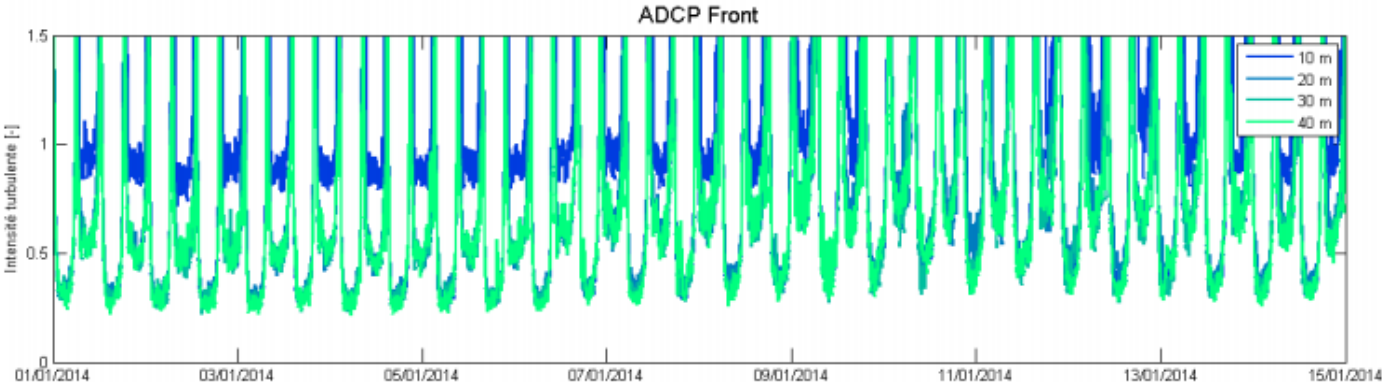
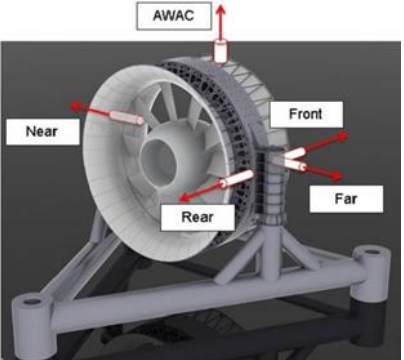
Introduced species show different dynamics of colonization on artificial substrates :

- Decreasing density over time for common slipper limpet ;
- Increasing density for *Styela clava*

The turbine is as noisy as small tugs or fishing boats



Influence of the turbine on the flow velocities



Messages to take home

- **Cable (muddy sediment)** : High localized impact on fauna and flora. Recovery within one year (fauna, *Zostera noltii*) or when the trench is refilled (2 to 3 years for *Z. marina* in deepest zones)
- **Zostera transplantation experiment** : effective, providing the zone is chosen with care.
- **Cable and mattresses (rocky substrate)** : progressive biological colonization with 60-70% similarity of the communities (compared to control) ; introduced species colonize artificial substrates more than natural ones. Mattresses attract crustaceans (lobsters) and fish (conger, ...)
- **Current** : localized wake effect (30-50% reduction of velocities at 45m ; no further disturbance of turbulence intensity after 40m). The wake effect is perceptible up to 250m at ebb tide and 800m at flood tide.
- **Noise** : the site is noisy ; turbine makes little noise which is not discernable from 500 to 1200 m away (depending on tides) (20 – 4000 Hz ; 134 dB re. 1 μ Pa@1 m at 20 Hz).
- **Bio-monitoring** : highly difficult because of depth (up to 35m), distance (15 km out of sea), and ... current
- *Next step : monitore the farm noise (impact on marine mammals) and the benthos*

Thank you for listening

