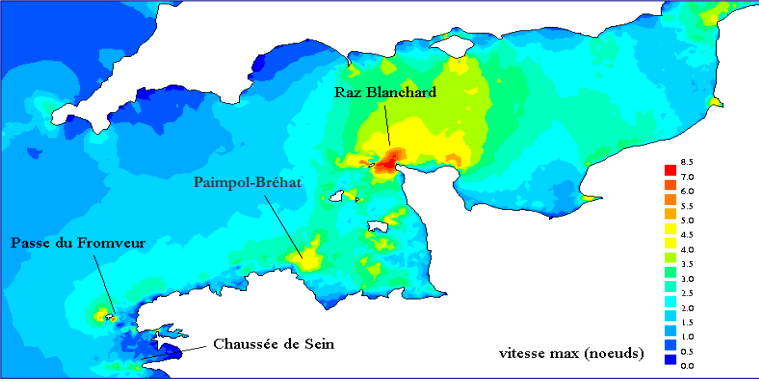


# Environmental monitoring of the Paimpol-Brehat tidal project

Agnès Barillier (EDF) & Antoine Carlier (Ifremer)



*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

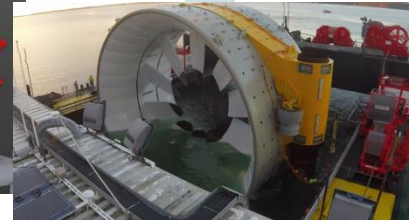
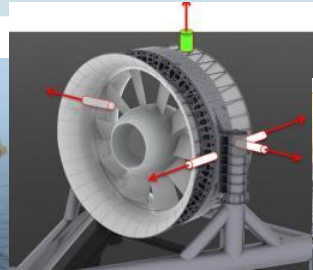
2012  
Export cable laid

2013  
stabilization of the cable

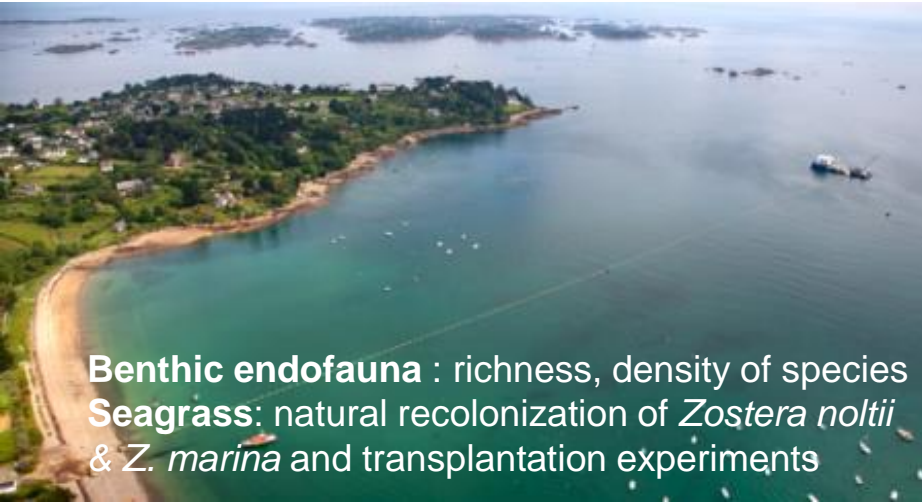
2014  
In situ 500 h  
Turbine testing phase 1

**20 Jan 2016  
Turbine phase 2  
deployed**

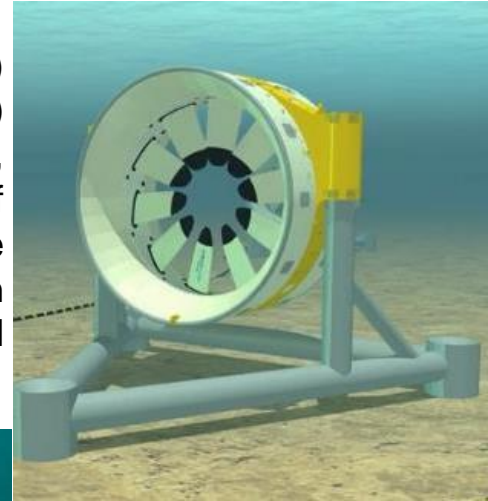
Spring 2016  
tidal farm deployment



# Adapted environmental monitoring



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



**Benthic epifauna**: richness, density of sessile species  
Special focus on introduced species (ascidian *Styela clava* and  
gastropod *Crepidula fornicata*)



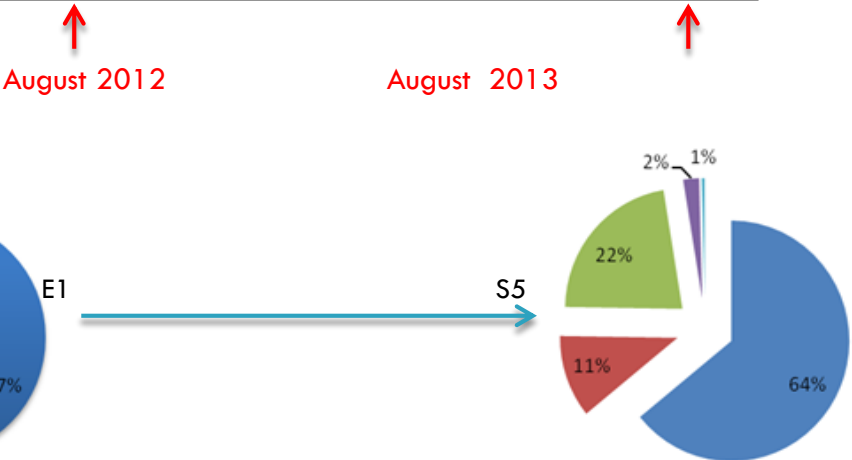
# Endofauna : localized and reversible impact of the cable work



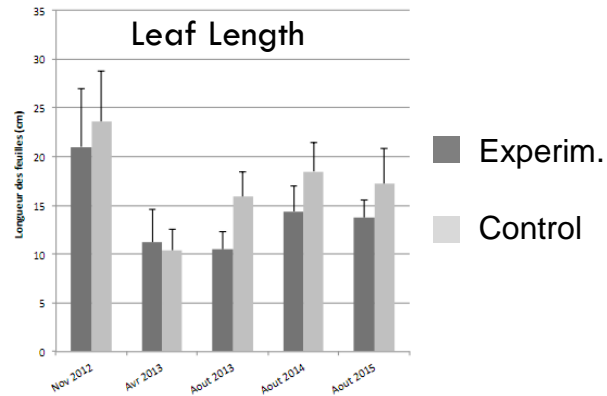
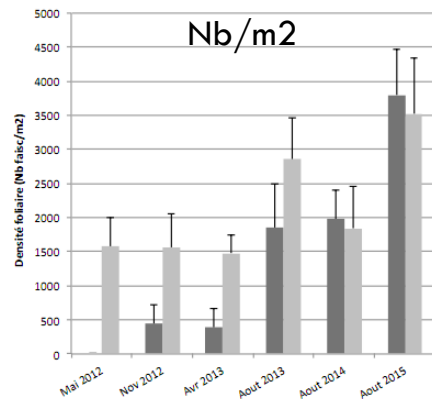
		May 2012			May 2013	May 2014	
	before work	S1	S2	S3+	S3	S4	S5
Abundance, N	425	194	282	913	826	457	346
Richness, nb sp	45	31	27	56	48	53	34

Indice	before work	S1	S2	S3	S4	S5
average diversity	2,36	1,33	1,54	2,37	3,02	2,54
average equitability	0,84	0,57	0,65	0,70	0,88	0,88





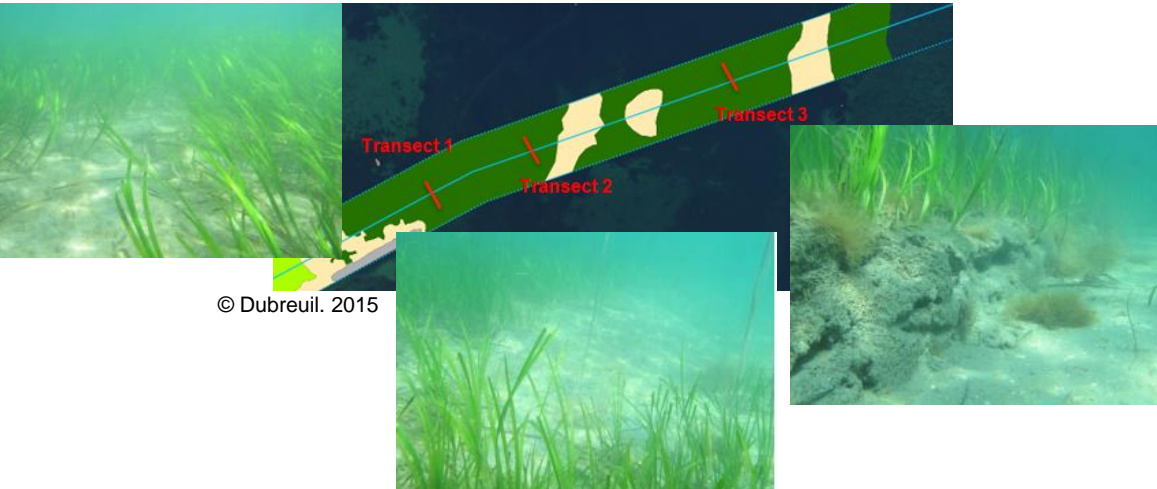


- 
- 04.2012
- 08.2012
- 08.2013
- 08.2014
- 08.2015
- © In vivo

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



© In vivo



- ❑ 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)



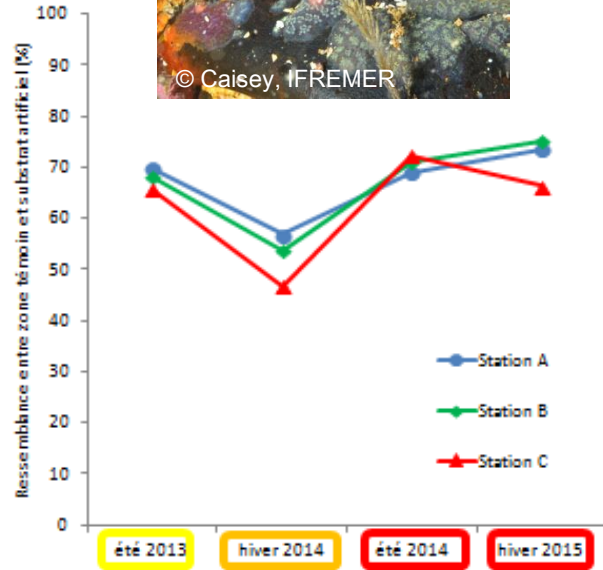
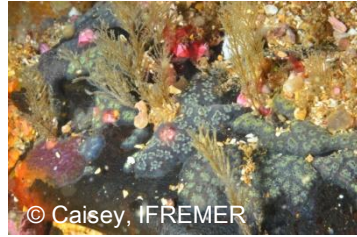
Benthic colonization is gradual with a high seasonal variability (winter/summer)

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

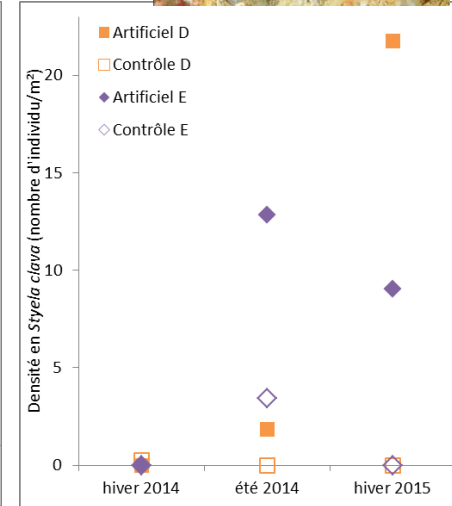
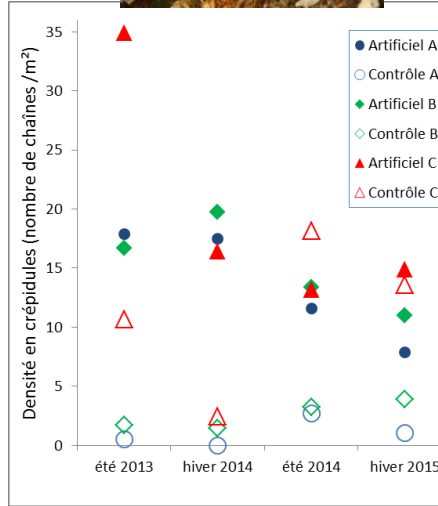




# Biological colonization of the cable and mattresses (2)



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

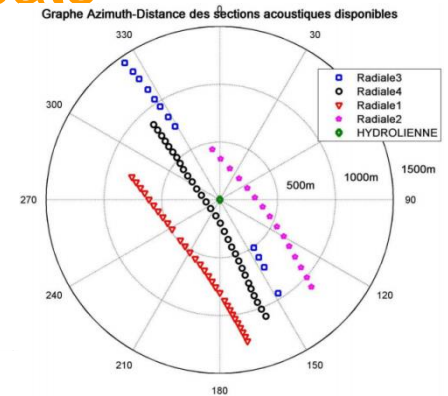
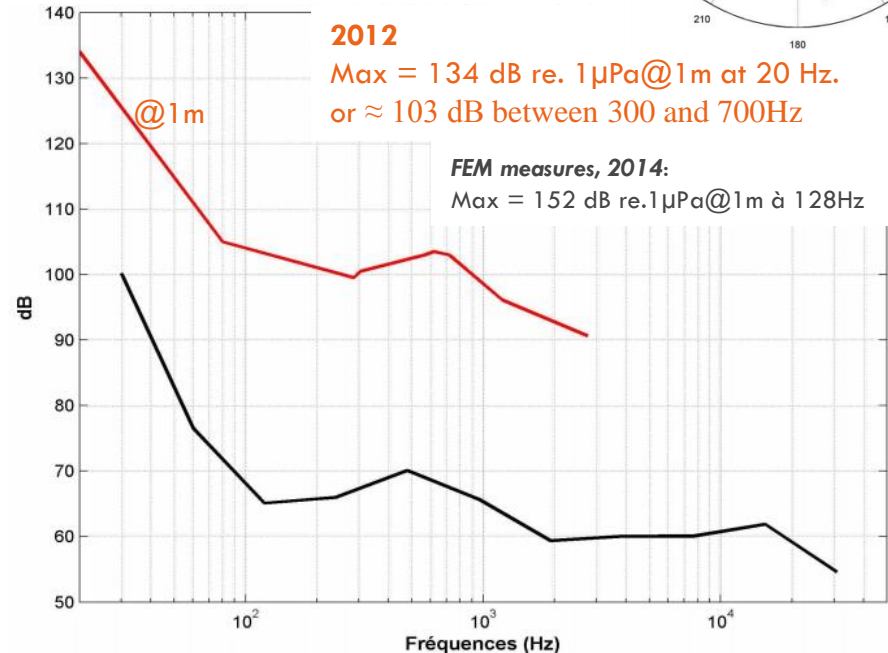
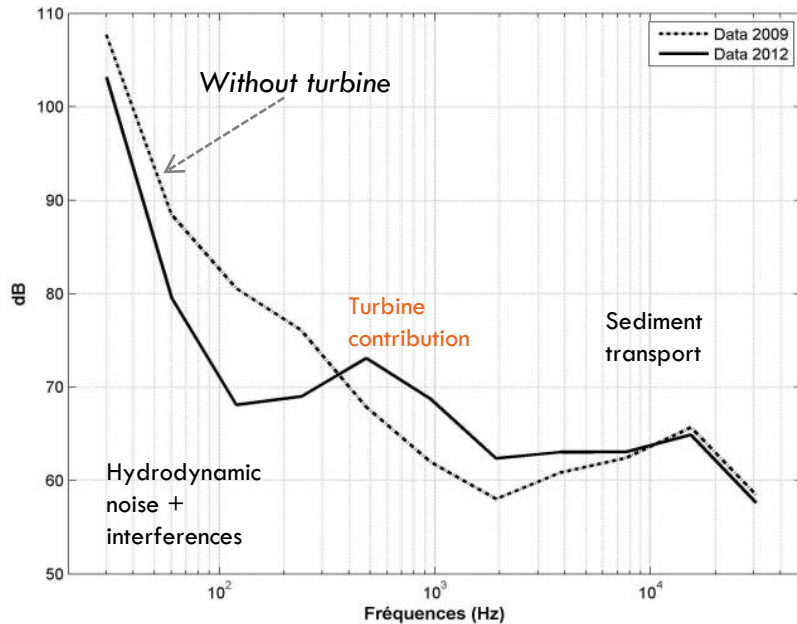


Introduced species show different dynamics of colonization on artificial substrates :

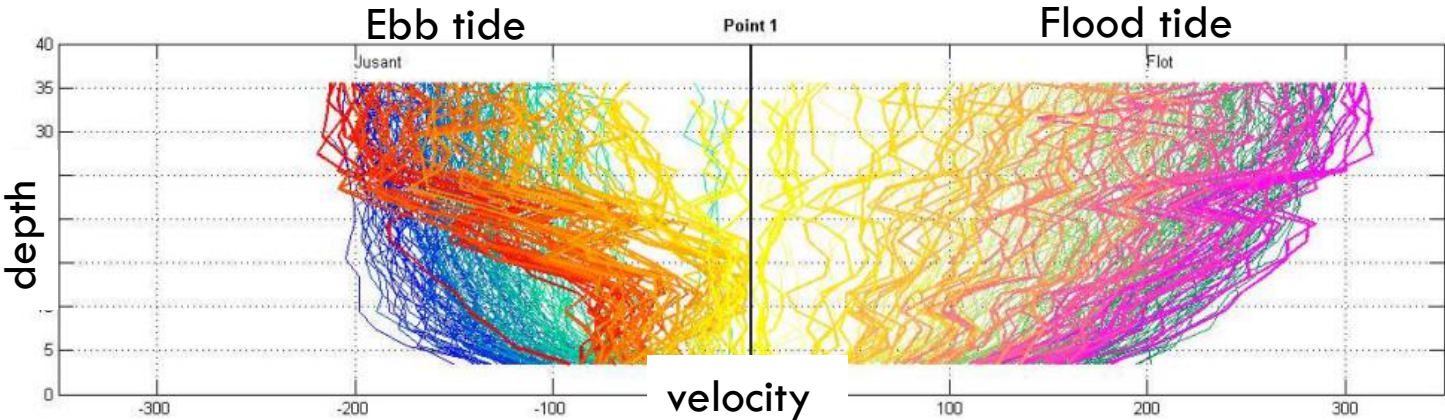
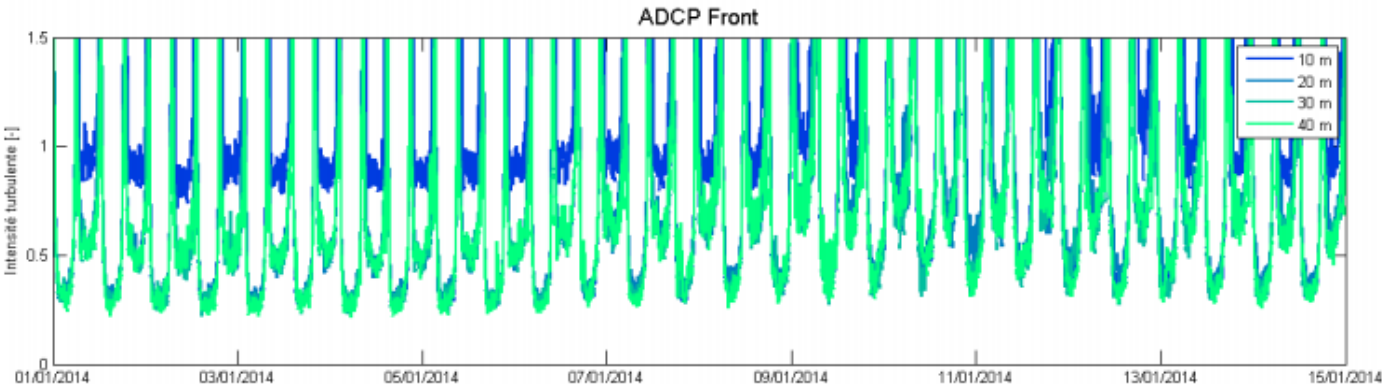
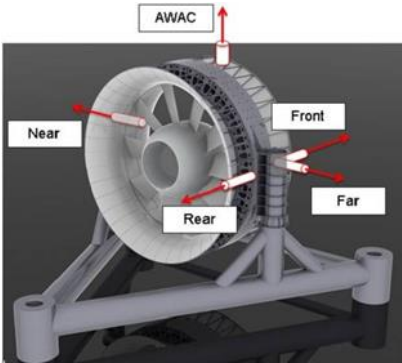
- Decreasing density over time for common slipper limpet ;
- Increasing density for *Styela clava*



# 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 1 200 m away (depending on tides) (20 – 4000 Hz ; 134 dB re. 1  $\mu$ Pa@1m 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

