

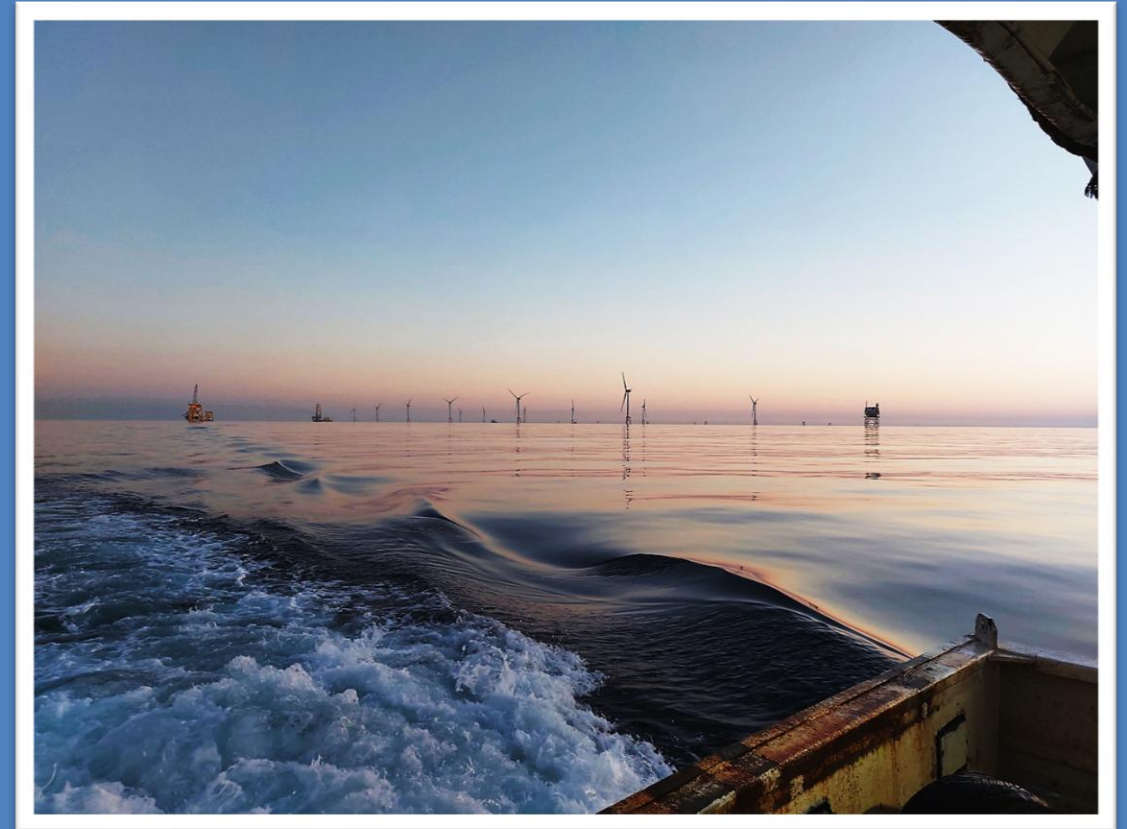
IMPACT OF OFFSHORE WIND FARM CONSTRUCTION ON BENTHO- DEMERSAL FISH: INSIGHTS FROM SIX YEARS OF CANADIAN TRAWL SURVEYS IN THE SAINT-BRIEUC BAY

**GWENHAEL ALLAIN, MATHIS CAMBRELING, YANN PATRY,
RAQUEL MARQUES, PHILIPPE BORNENS, THOMAS
POMMIER**



CWW 2025
8-12 SEPTEMBER

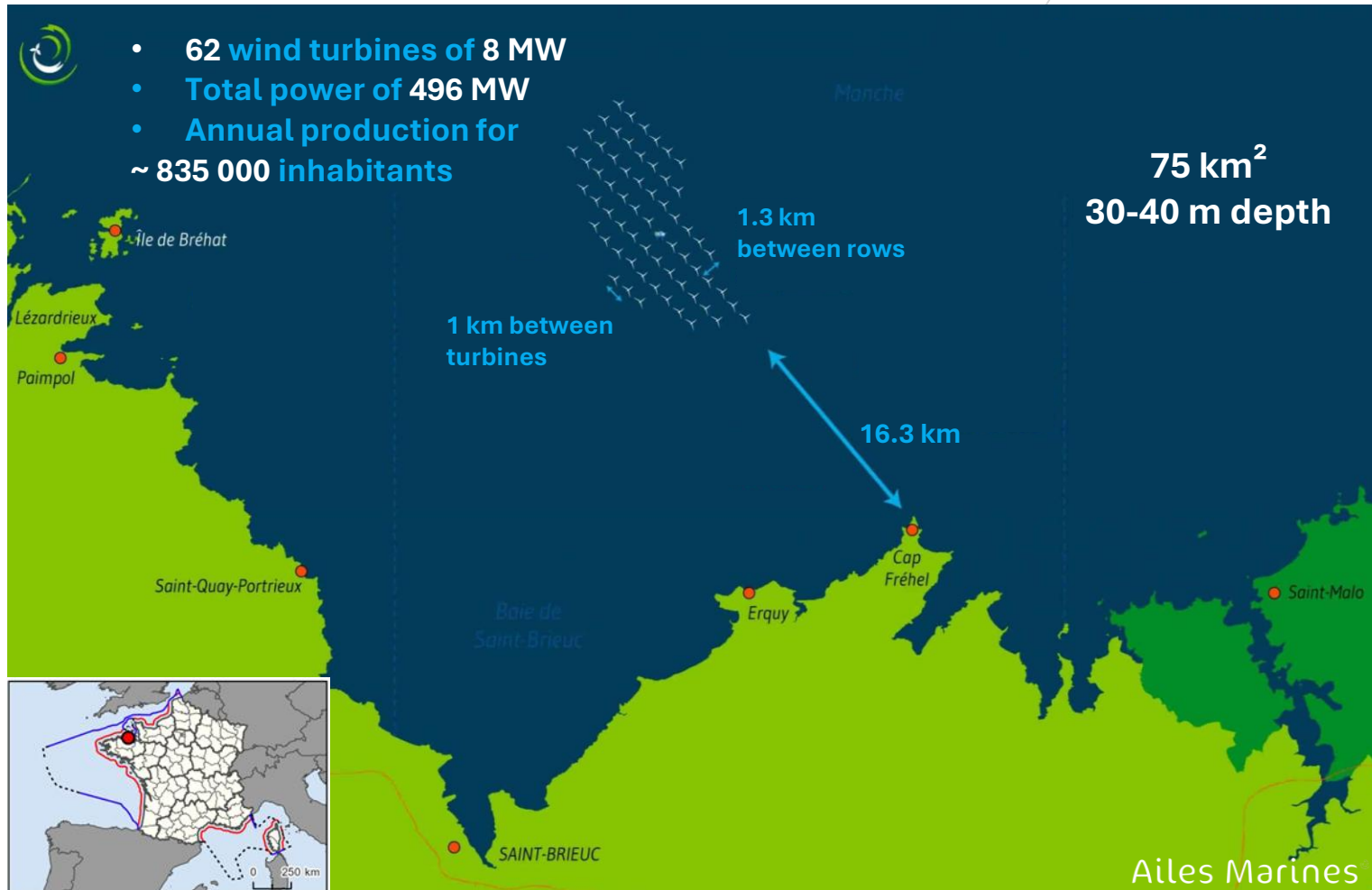
Co-organisers:



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1-INTRODUCTION

The wind farm off the Saint-Brieuc Bay



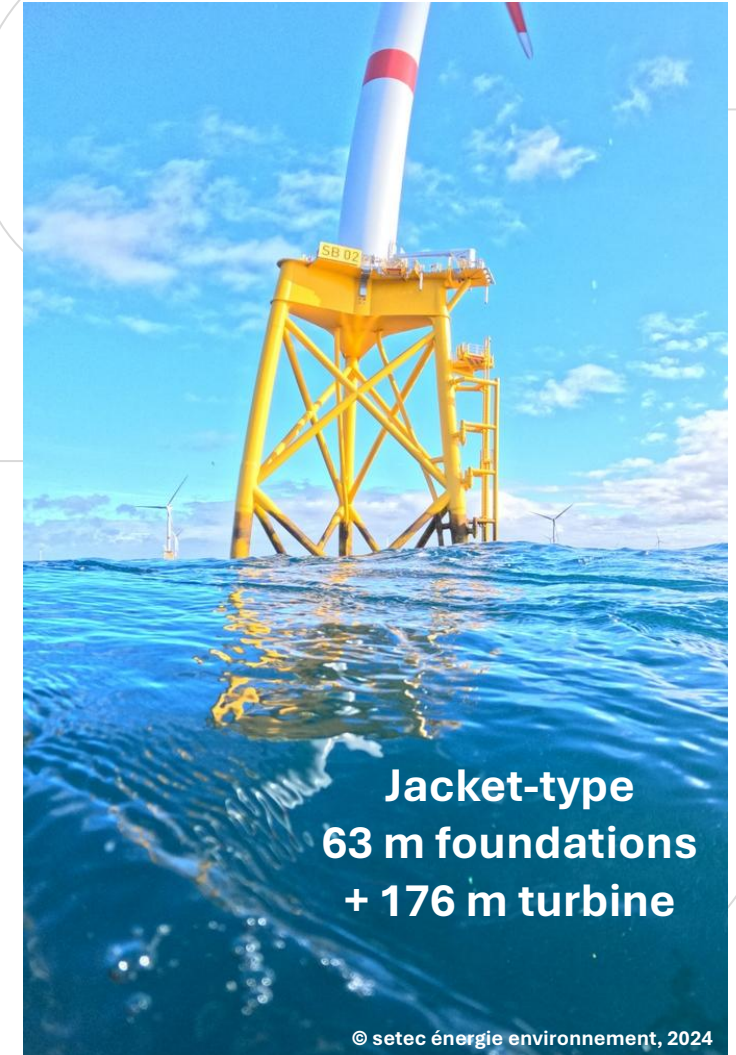
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Conference on
Wind energy and
Wildlife impacts

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Co-organisers:



1-INTRODUCTION: CONSTRUCTION

Turbine installation



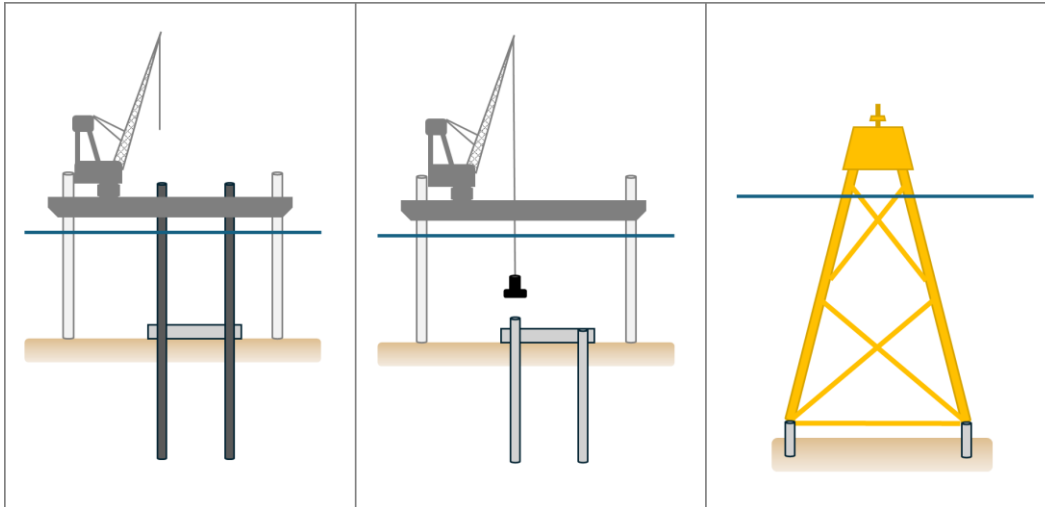
Drilling



Hammering



Jacket
installation



Main pressures:

- Noise and vibrations
- Sediment resuspension/deposit
- Crushing

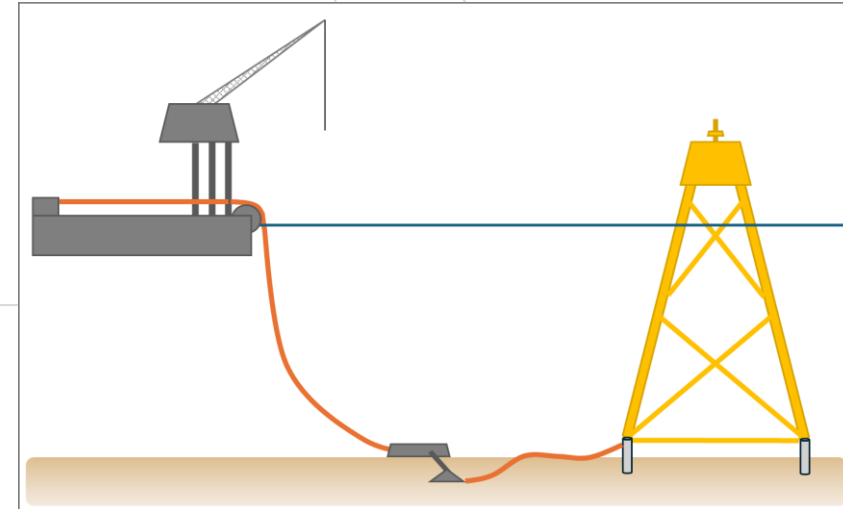
Cables installation



Trenching



Cable
installation



Main pressures:

- Sediment resuspension/deposit
- Crushing



Fishing ban

2-MAIN QUESTIONS



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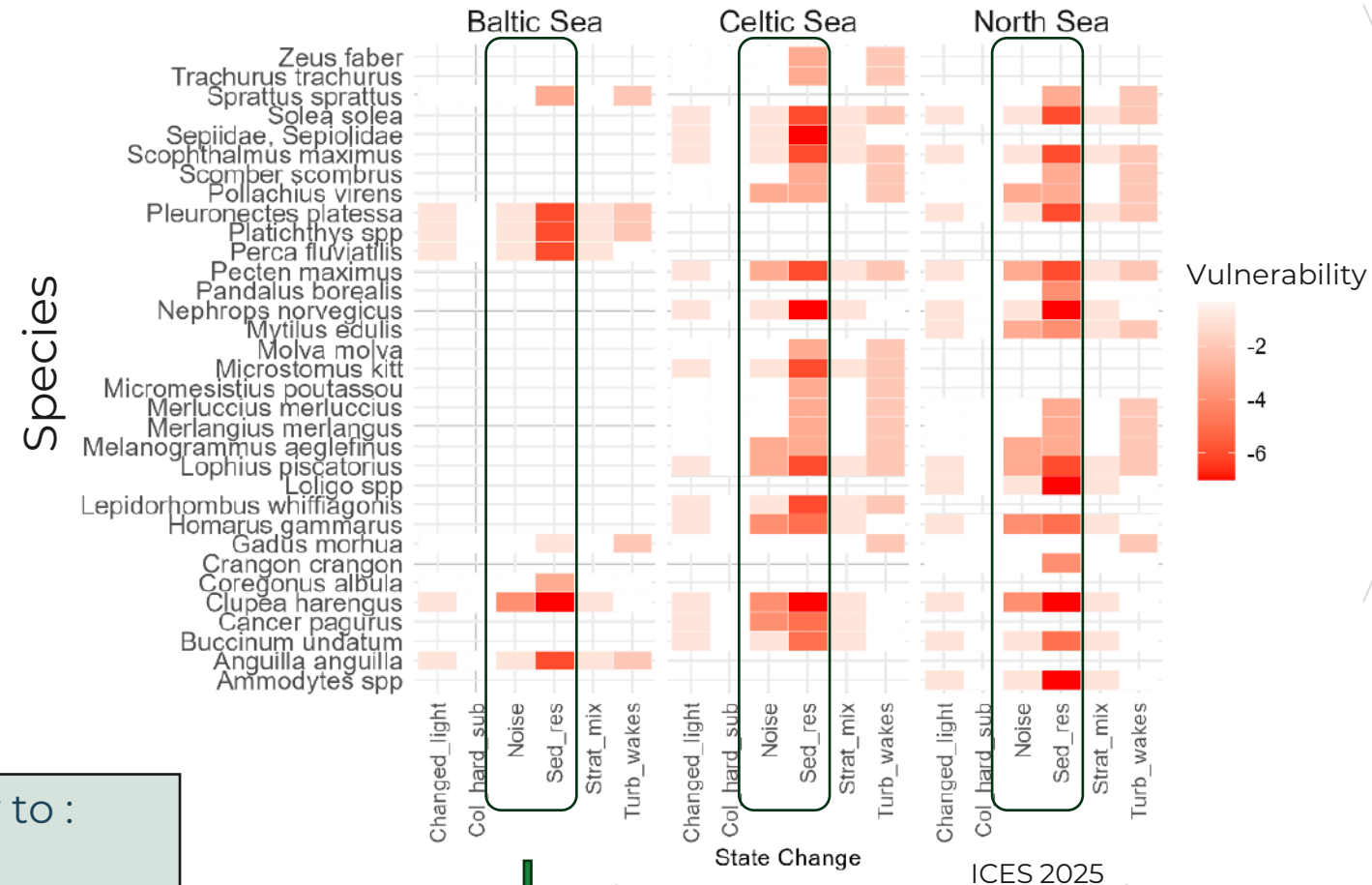
Co-organisers:



How does the installation work affect the local fish community ?

- Decrease in total abundance?
- Decrease in total biomass?
- Decrease in biodiversity?
- How do functional groups respond?

Heatmap of Total Vulnerabilities by State Change and Species



3-METHODS: SAMPLING



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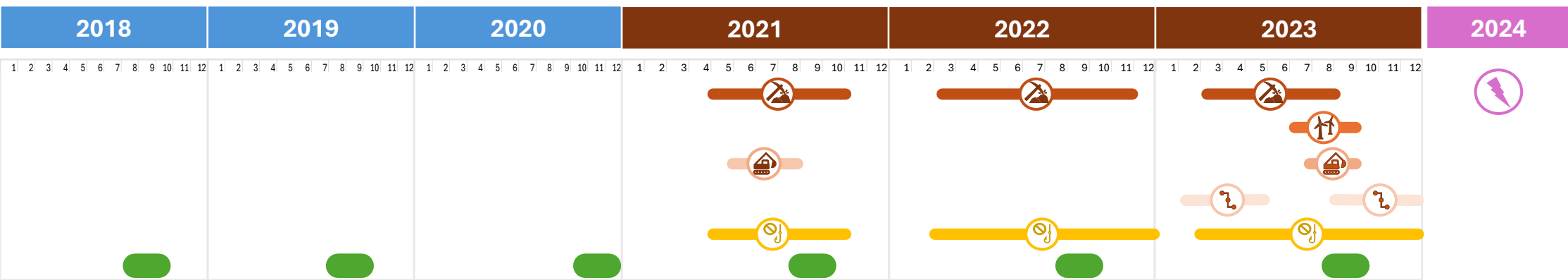
Co-organisers:



Reference period

Installation work

Commissioning



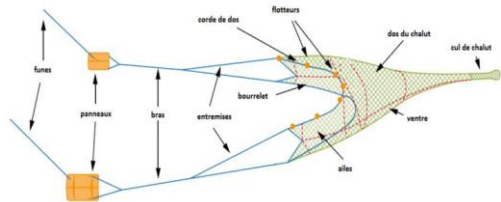
← This study →

3-METHODS: SAMPLING

Sampling: Benthic and demersal fish species



Bottom trawl



BACI analysis

(Before After Control Impact)

Before

After

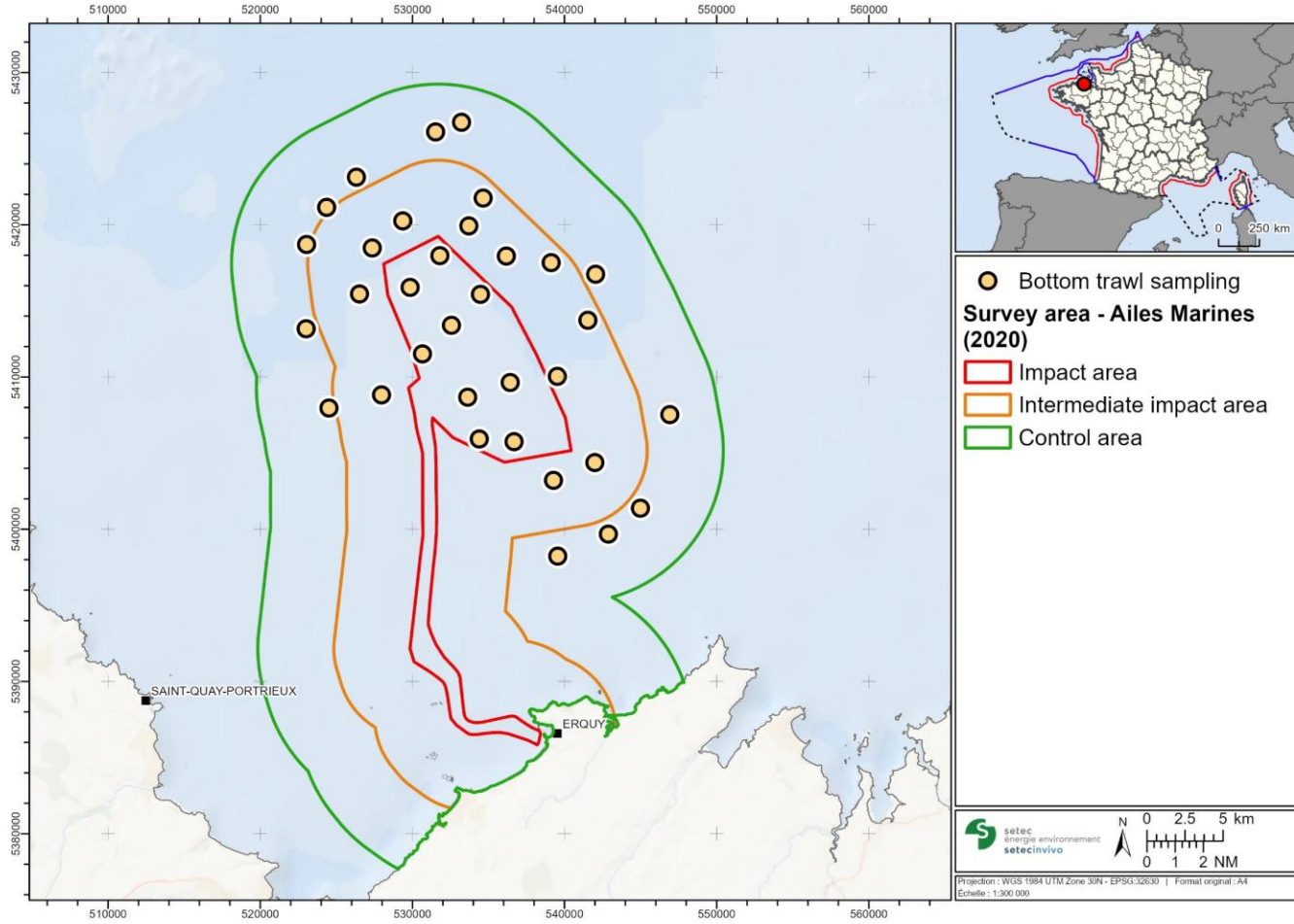
2018	2019	2020	2021	2022	2023
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Impact area: 75 km², 9 stations

Intermediate impact area: < 3.7 km, 12 stations

Control area: 4.6 – 9.3 km, 12 stations

Total of 198 samples



Projet de loi relatif à la transition énergétique, 2017-2018. Sources : BSE, SSO, Ailes Marines, Brest. Projection : WGS 1984 UTM Zone 30N - EPSG:32630 | Format original : A4 Echelle : 1:300 000

3-METHODS: MODELLING TIME SERIES

Generalised Linear Mixed Models (GLMM)

Detect changes in time and space of biomass, abundance and biodiversity

Independent variables:

- Biomass (CPUE Kg/km²)
- Abundance (CPUE nb/km²)
- Species richness
- Shannon diversity index
- Pielou diversity index

Explanatory variables:

- Before-After
- Control-Impact
- Year

Model selection:

- P-values
- AIC
- Dredging

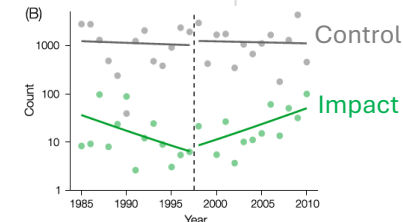
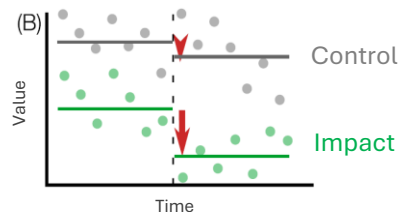
$Variable \sim Year + BA + CI + (BA \times CI) + (BA \times Year) + (CI \times Year) + (BA \times CI \times Year) + Random\ Spatial\ Effect$

Temporal trend

Change in average after impact

Interactions

Change in trend after impact



Wauchope et al 2021

3-METHODS: FUNCTIONAL ANALYSIS

Detect functional group specific responses



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Co-organisers:



Triangular life history model:

- Compare life history strategies and detect responses to environmental variation



Generalised Linear Mixed Models (GLMM)



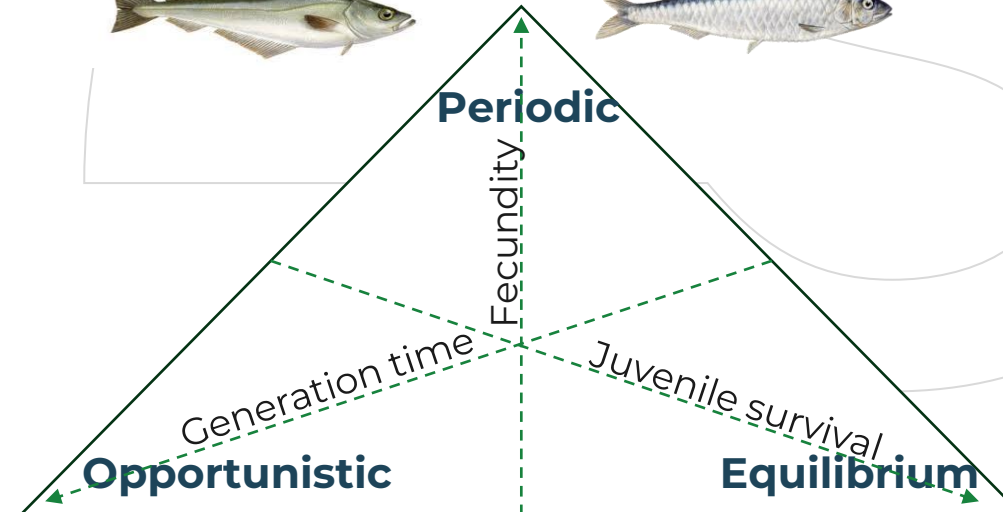
Photo : NFM



Photo : NFM



Small, short-lived, high reproductive effort, high demographic resilience



Long-lived, high fecundity, high recruitment variation



Traits:

- Size
- Maximum age
- Reproduction age
- Fecundity
- Growth rate



Photo : NFM

Long-lived, low fecundity, large size

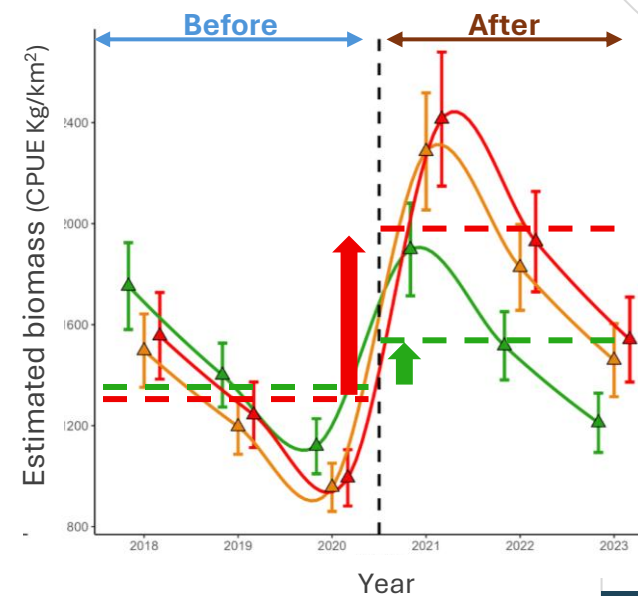
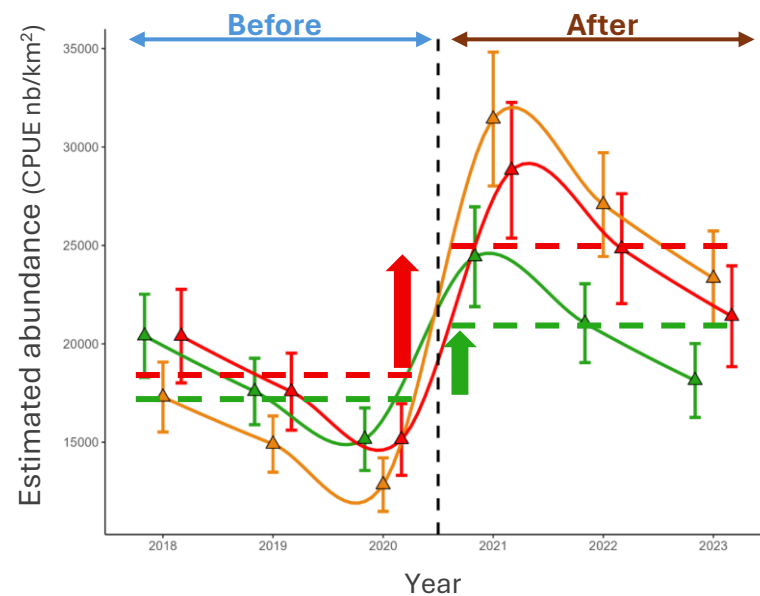
4-RESULTS

GLMM: Total Abundance and Biomass

Variables	Intercept	YBACI	BACI	YBA	YCI	Year	BA	CI
Abundance	10.07	NA	0.17*	NA	NA	-0.15***	0.63***	0
Biomass	7.69	NA	0.36*	NA	NA	-0.22***	0.75***	-0.12
Richness	15.09	NA	NA	NA	NA	-0.81***	1.93**	NA
Shannon	1.32	NA	-0.58*	NA	0.19**	0.06	-0.26*	-0.42*
Pielou	0.48	NA	-0.25**	NA	0.08**	0.04*	-0.13*	-0.15*

★ Significant positive ★ Significant negative Excluded from the model

- On average, fish abundance and biomass **increased** during the installation, **particularly in the impact area**



Impact area
Intermediate impact area
Control

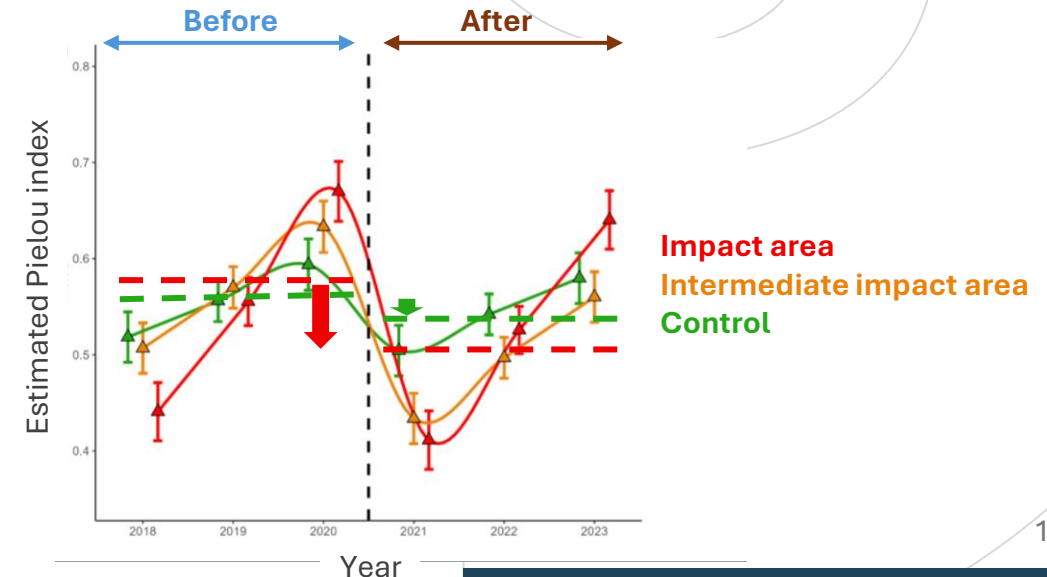
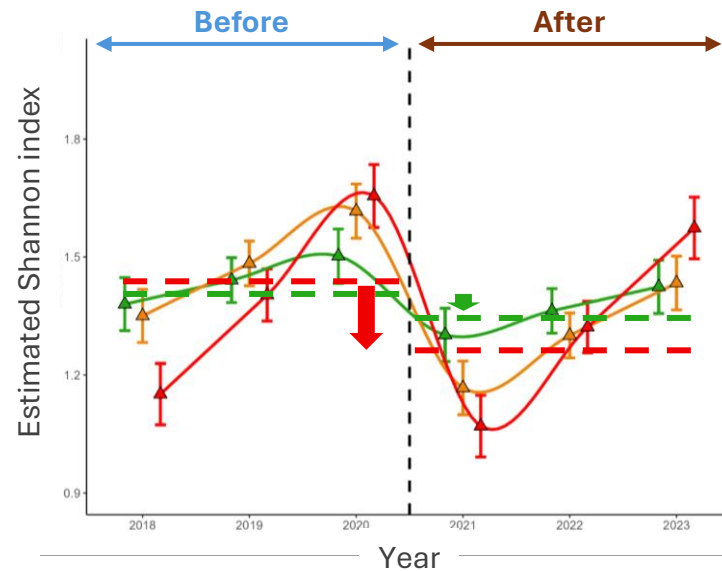
4-RESULTS

GLMM: Shannon and Pielou diversity indices

Variables	Intercept	YBACI	BACI	YBA	YCI	Year	BA	CI
Abundance	10.07	NA	0.17*	NA	NA	-0.15***	0.63***	0
Biomass	7.69	NA	0.36*	NA	NA	-0.22***	0.75***	-0.12
Richness	15.09	NA	NA	NA	NA	-0.81***	1.93**	NA
Shannon	1.32	NA	-0.58*	NA	0.19**	0.06	-0.26*	-0.42*
Pielou	0.48	NA	-0.25**	NA	0.08**	0.04*	-0.13*	-0.15*

★ Significant positive ★ Significant negative Excluded from the model

- On average, fish biodiversity indices **decreased** during the installation, **particularly in the impact area**



4-RESULTS

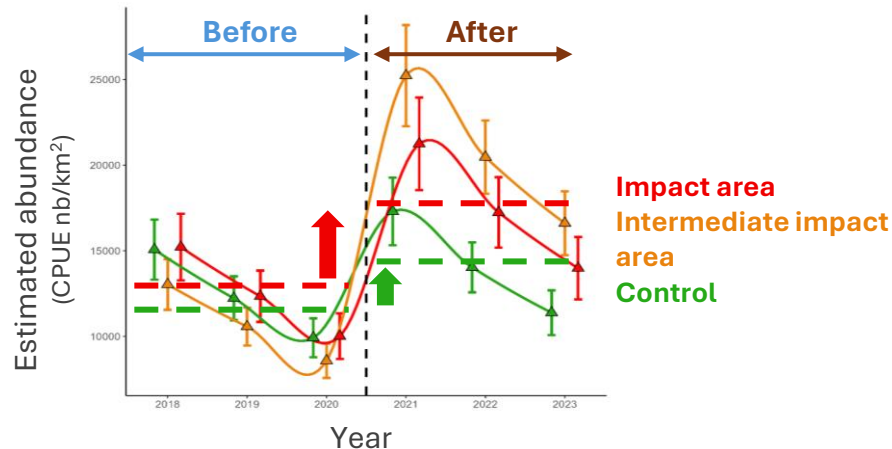
GLMM: Abundance of opportunist, periodic and equilibrium functional groups

Variables	Intercept	YBAC	BACI	YBA	YCI	Year	BA	CI
Opportunist	9.83	NA	0.2*	NA	NA	-0.21***	0.76***	0.01
Periodic	7.69	NA	NA	NA	NA	NA	0.91	NA
Equilibrium	6.73	NA	NA	NA	NA	-0.41**	1.08***	NA

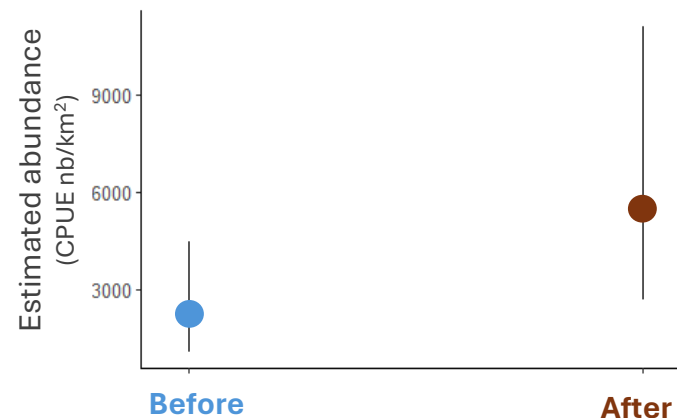
* Significant positive * Significant negative Excluded from de the model

- **Opportunists:** On average, the abundance increased during the installation, particularly in the **impact area**
- **Periodic:** On average, the abundance slightly increased during the installation (not significant), but no difference from **control**
- **Equilibrium:** On average, the abundance increased during the installation, but no difference from **control**

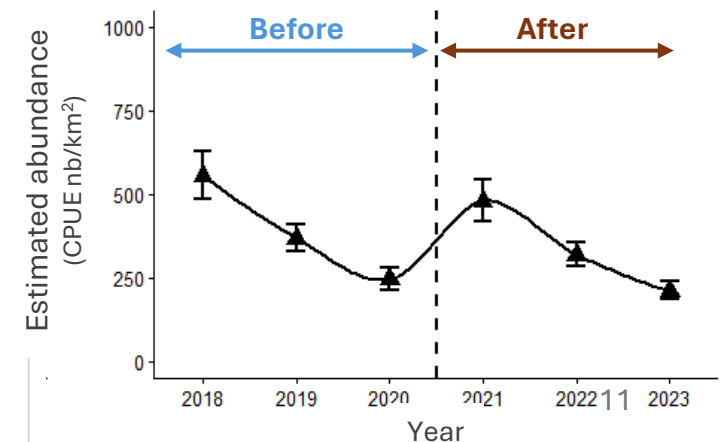
Opportunists



Periodic



Equilibrium



5-DISCUSSION AND PERSPECTIVES



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Co-organisers:



Both the Abundance and Biomass increased **after** the installation work begins, but this was stronger at the **impact area**

Difference in time:

- Environmental variation

Difference between areas:

- Positive effect of fishing ban
- Attraction to turbines



Mainly influenced by **opportunistic species** such as **pouting** (*Trisopterus luscus*, the most common species) which has demonstrated positive abundance changes as a response to offshore wind farms (Krone et al. 2013; Van Hal, Griffioen, and Van Keenen 2017)

Next steps:

- Improve model (GAMMs + environmental variability)
- Perform functional analysis using stress-response traits
- Include commissioning period



THANK YOU

setecinvivo by **setec énergie environnement**

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