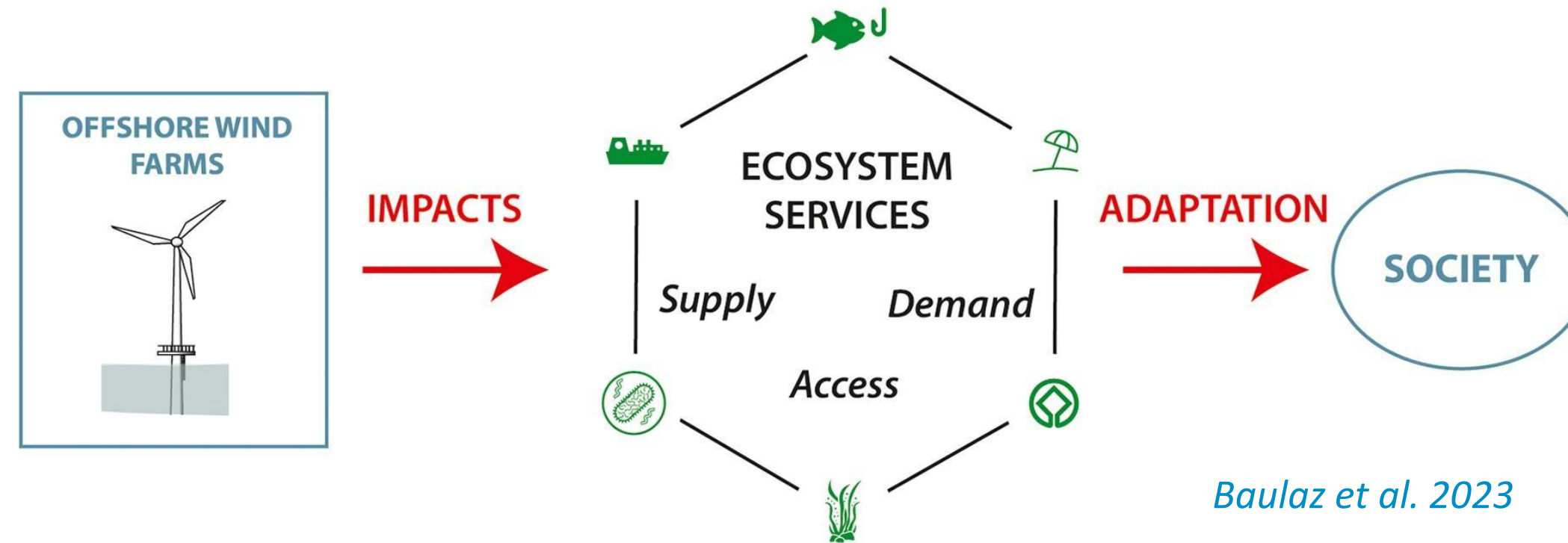




# How can ecosystem services mapping support marine spatial planning?





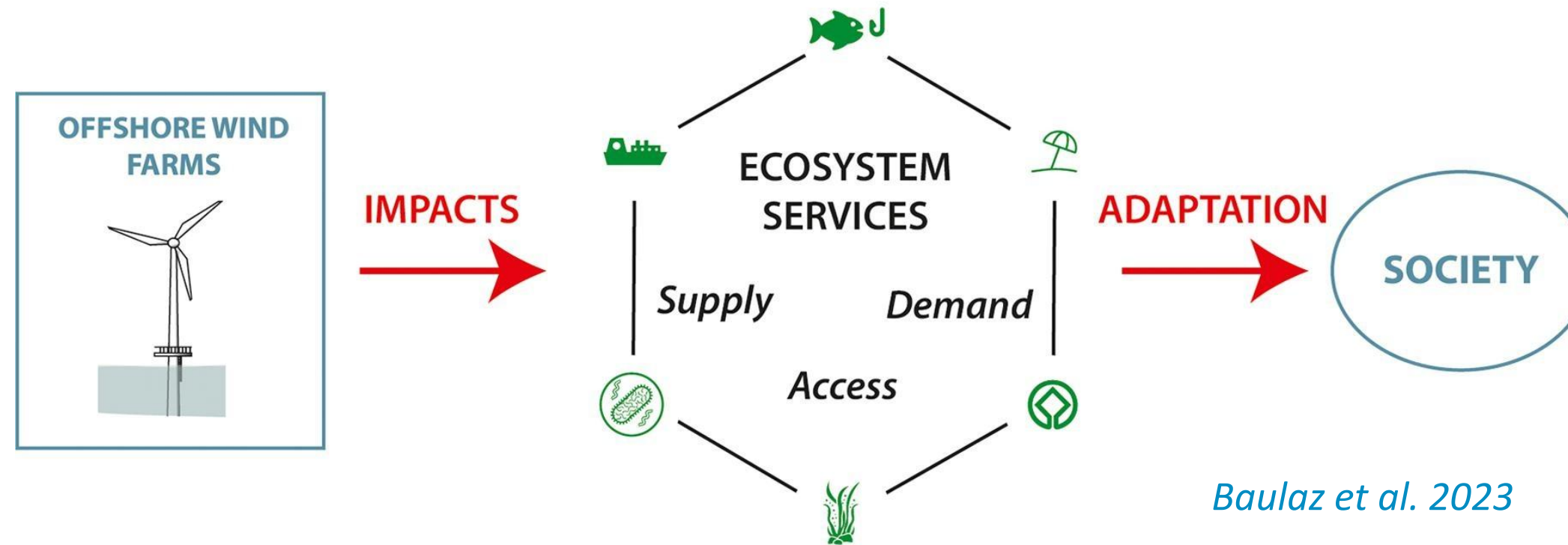
1. OWF reshape **benefits** – *not just* « impacts » - by reconfiguring who gain/loses, and where/when

2. ES responses are **phase-dependant** and **spatio-temporally heterogeneous**

*Püts et al. 2023*

*Hernandez et al.2021*

*Niquil et al. 2024*



1. OWF reshape **benefits** – *not just « impacts »* - by reconfiguring who gain/loses, and where/when

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**MSP CHALLENGE**  
turning uncertain,  
cumulative pressures into  
explicit spatio-temporal  
trade-offs

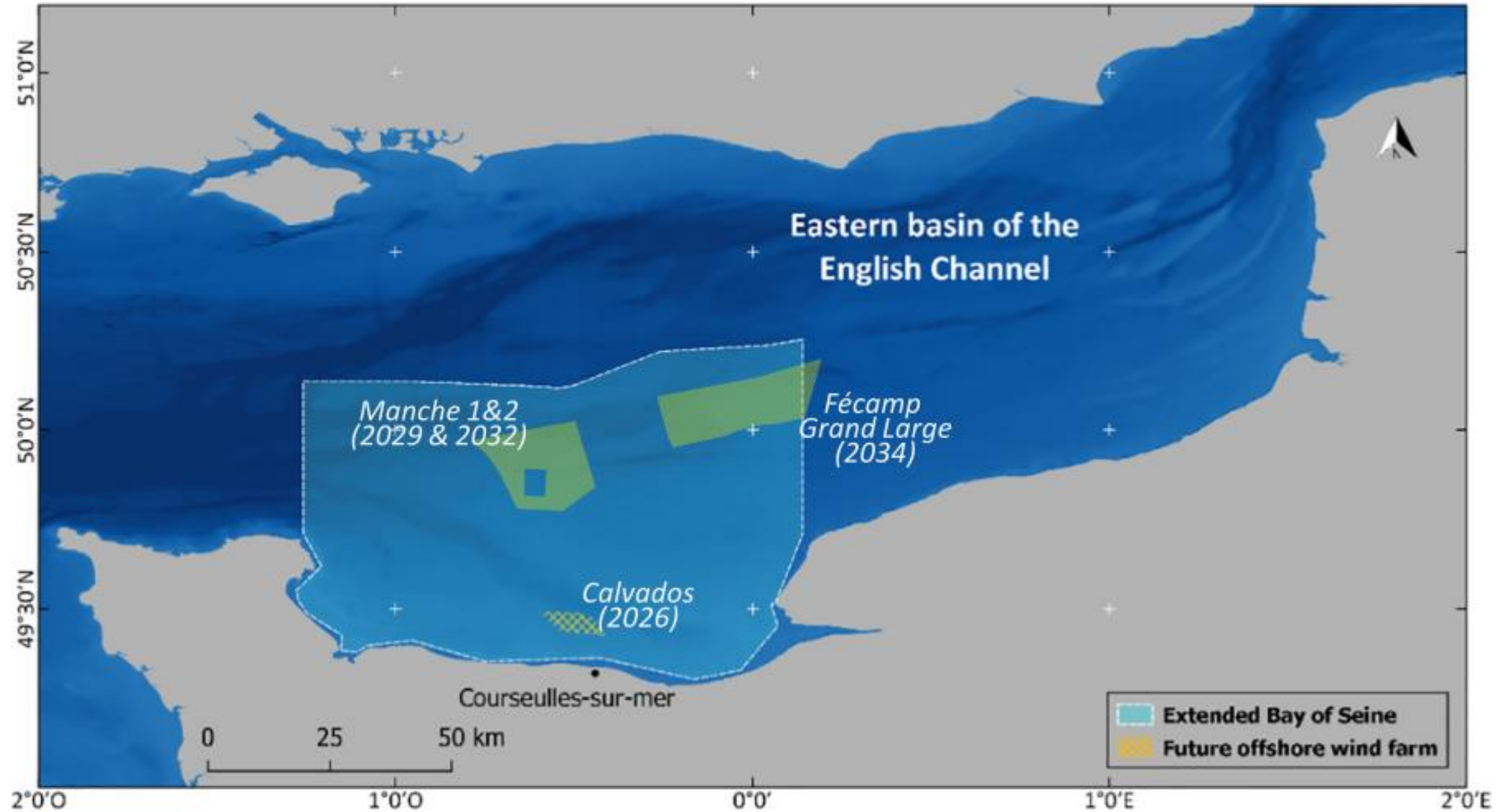
### Can ES mapping provide an empirical, spatially explicit entry point to support MSP decisions in offshore wind contexts?

- Spatially explicit modelling
- Multi-ES assessment
- Cumulative OWF effects assessment
- Lifecycle-based trajectory tracking



*St-Brieuc OWF – personal credit(s)*

# Case study: extended Bay of Seine, with 4 OWFs planned for 2050

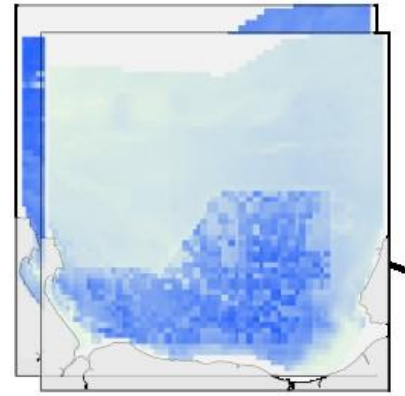


## ECOSYSTEM FONCTIONS

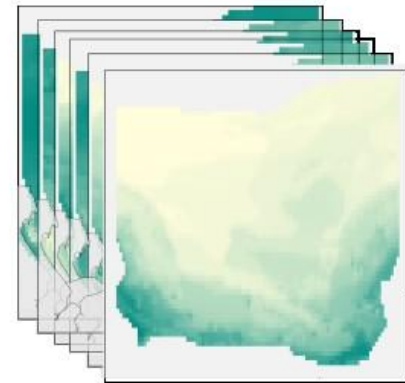
### OWF project-level impacts

- Construction phase
- Operation phase

2 INDICATORS



6 INDICATORS



2 INDICATORS



Ecopath  
suite

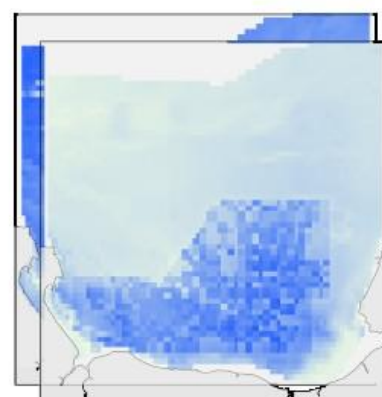
# Spatially explicit workflow for ES supply mapping

## ECOSYSTEM FONCTIONS

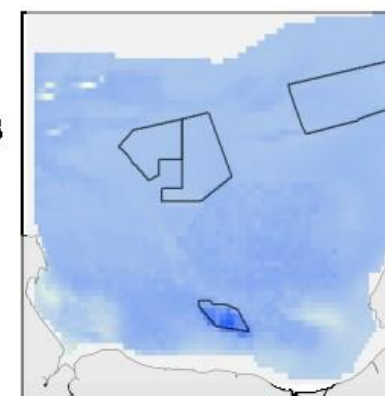
## SERVICES

**OWF project-level impacts**  
- Construction phase  
- Operation phase

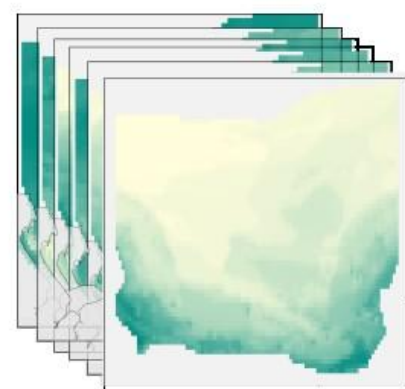
2 INDICATORS



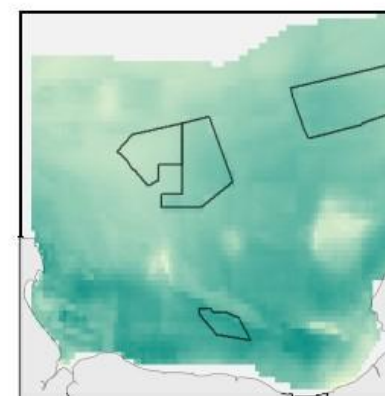
**Food through fisheries**  
1  
0



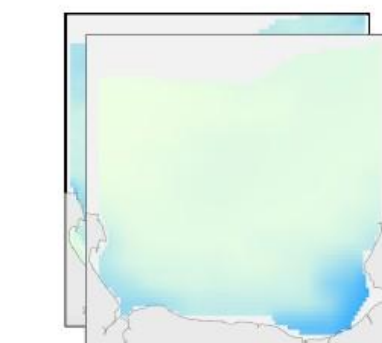
6 INDICATORS



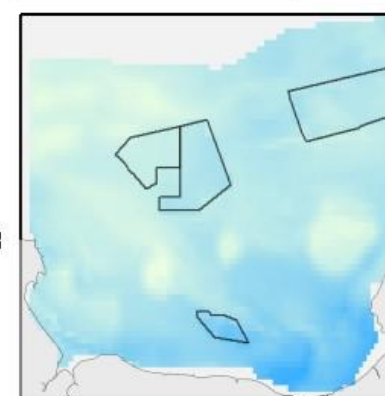
**Lifecycle maintenance**  
1  
0



2 INDICATORS

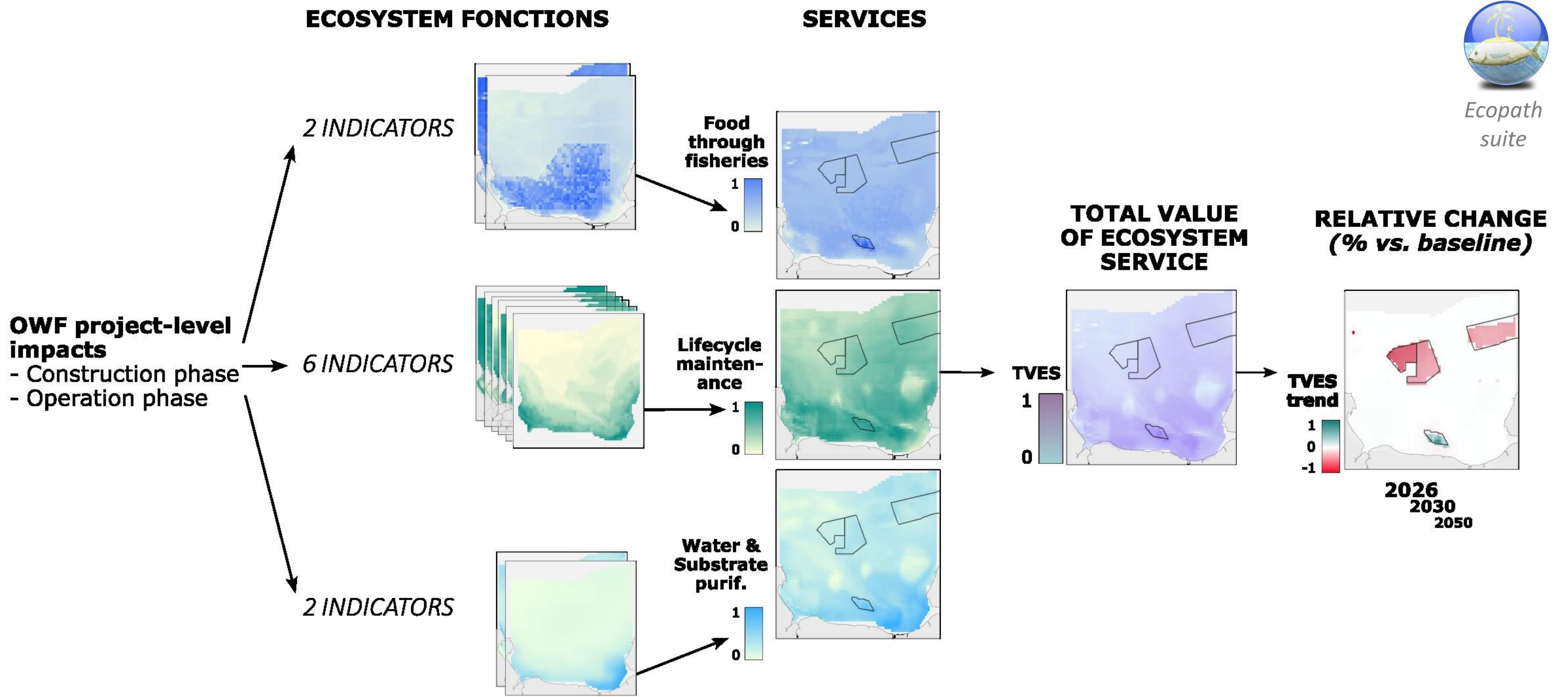


**Water & Substrate purification**  
1  
0



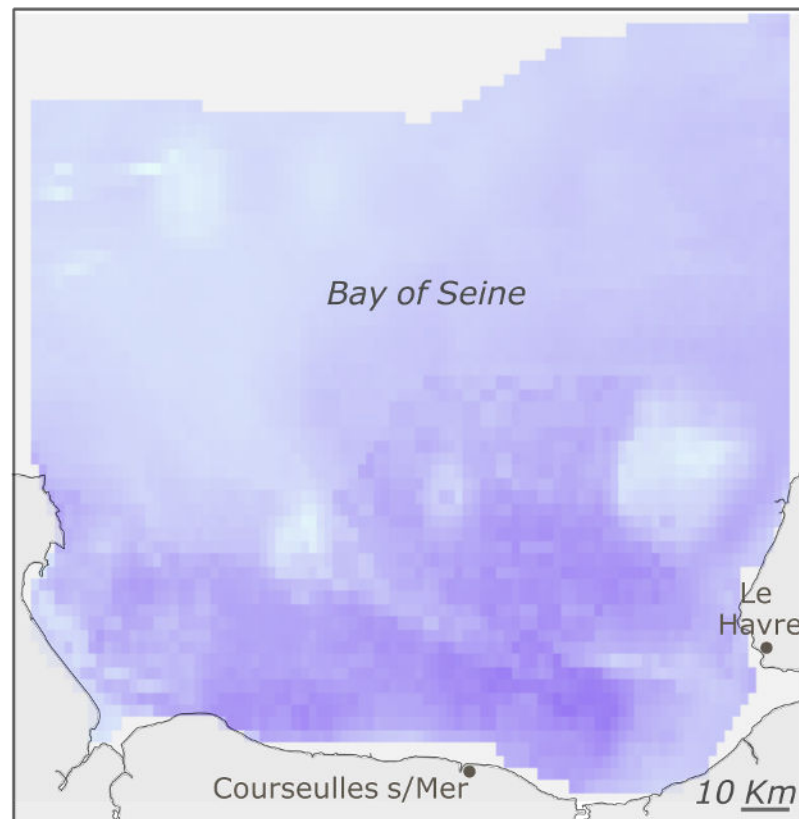
*Ecopath suite*

# Spatially explicit workflow for ES supply mapping



## TVES potential supply

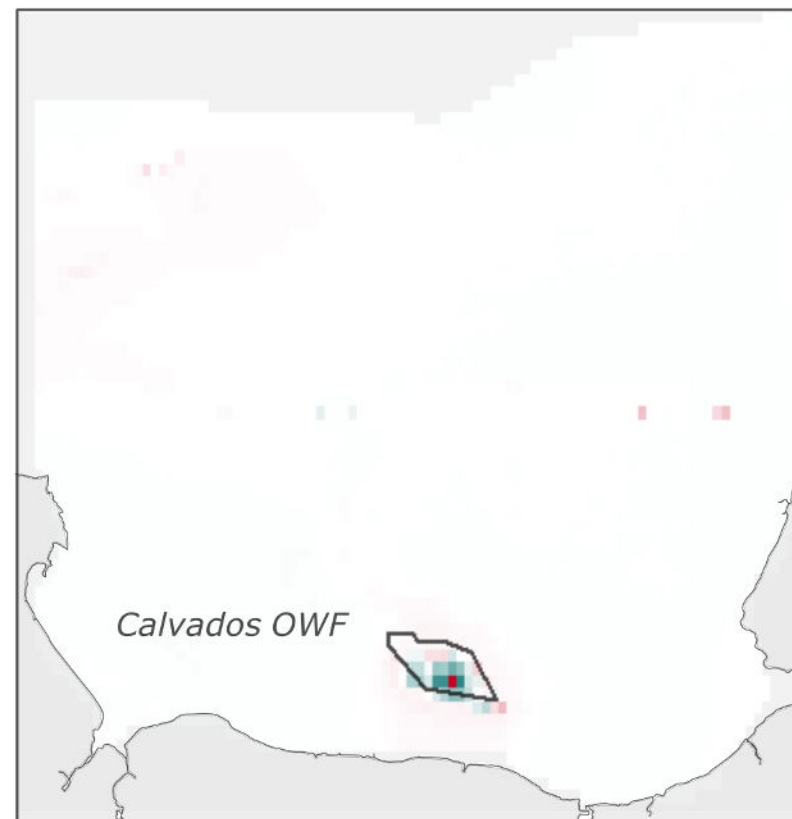
**2021**  
Pre-OWF



## TVES change (OWF) vs control scenario (no OWF)

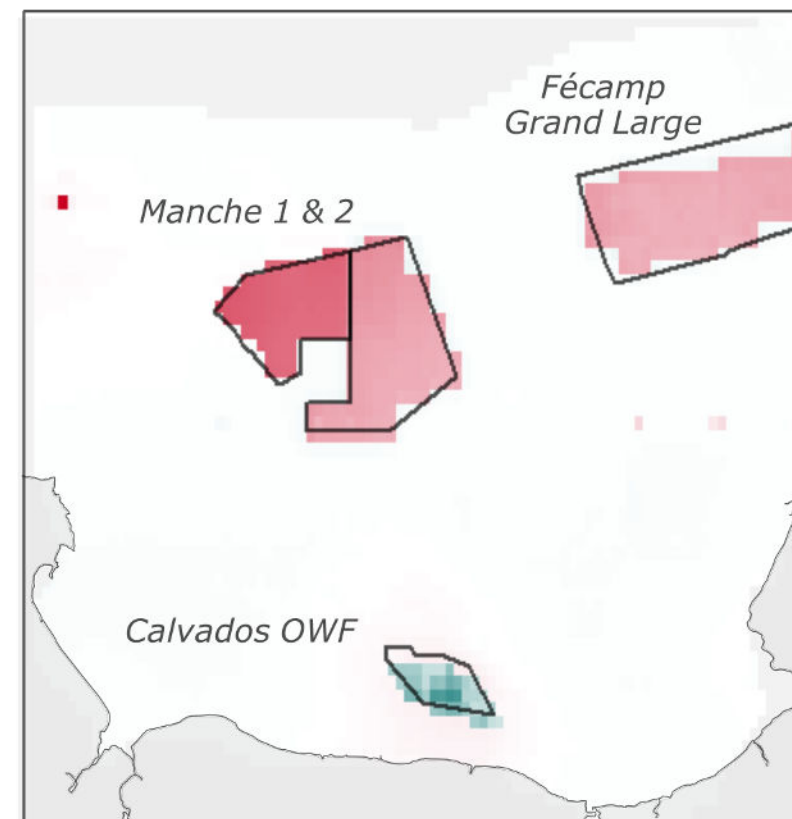
**2026**

End Calvados construction  
vs control - no OWF



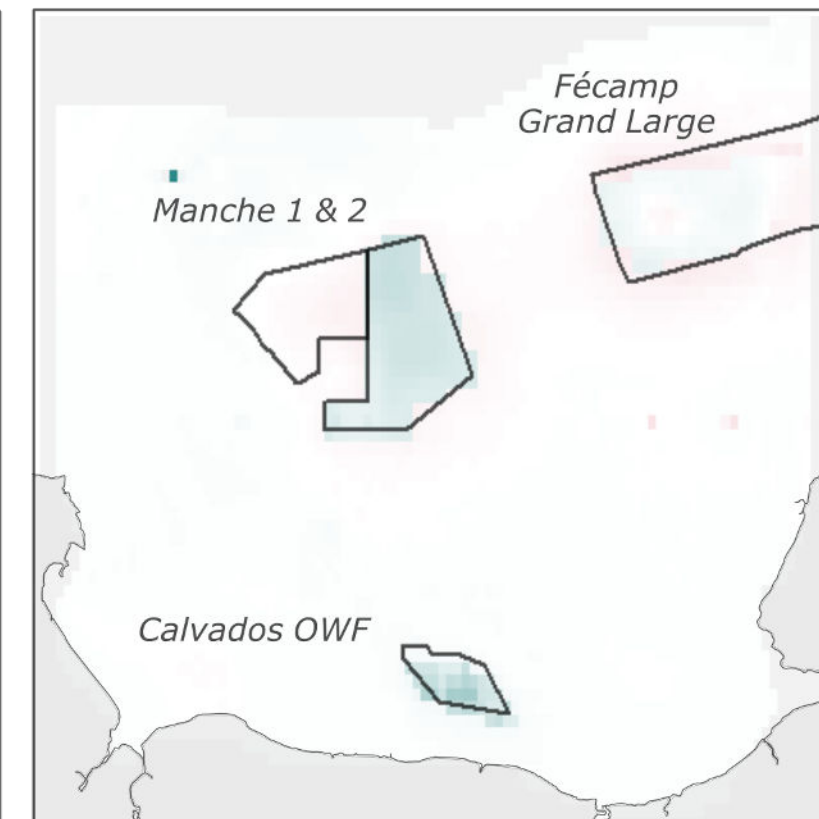
**2030**

Further OWF construction  
vs control

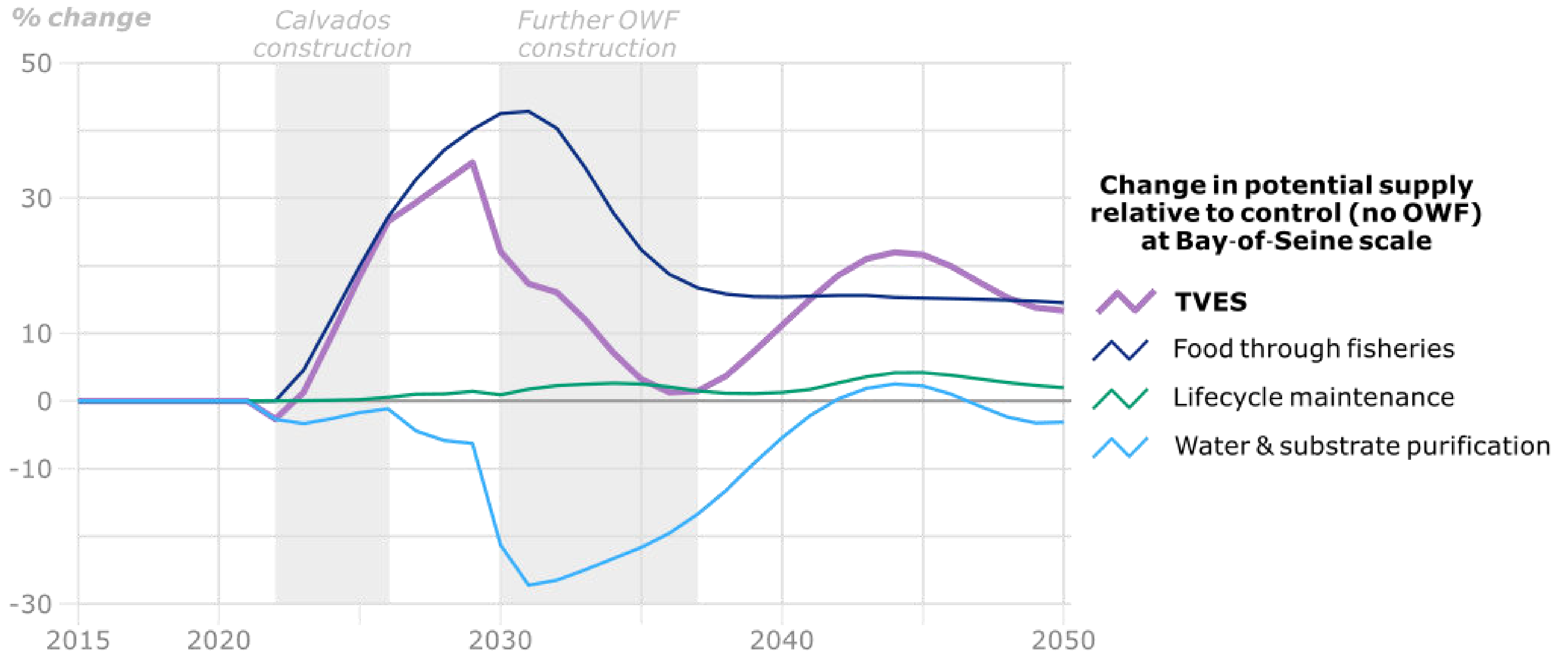


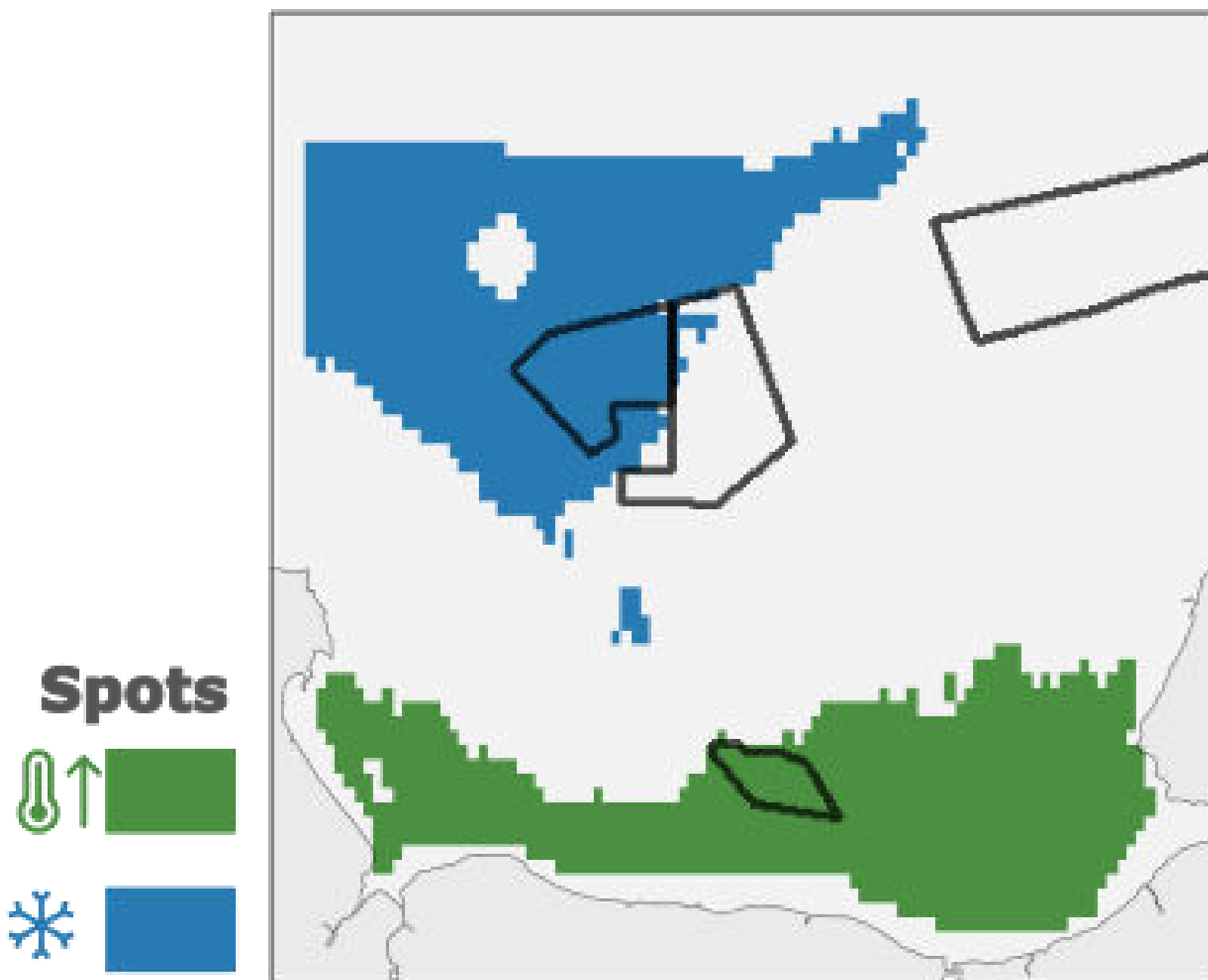
**2050**

All OWF operational  
long term vs control



# Results: temporal dynamics of TVES and ES supply





## Spatial occurrence of TVES hotspots and coldspots (robustness map)

**Hotspots** = top 25% TVES values;  
**Coldspots** = bottom 25%.

*Based on 6,400 simulations; only areas consistent in >90% of runs are shown.*

ES mapping contributes 4 ***building blocks for*** marine spatial planning:

1. **Leverage points** - gain/risk areas, spillovers
2. **Timing** – phase-specific pathways (construction, operation)
3. **Confidence** - uncertainty and sensitivity analysis
4. **Positive framing of the ES concept** – to support collective action

**Marine spatial planning:** the ability to turn ES trajectories into shared, actionable choices – by making trade-offs visible, pinpointing where and when options emerge, and supporting collective action of planning options

## ESTIMATIONS

**Ready!**



- Identify priority areas
- Support stakeholder dialogue
- Compare OWF scenarios



**Apply in new areas**

**To improve ...**



- Map multi-ES sensitive areas
- Scenario planning for Bay of Seine



**Assess ES demand and cultural ES**

**Not ready!**



- Use in formal planning
- Set conservation priorities
- Support long-term management



**Broaden pressures; link outputs to actions**

THANK YOU!



## When Offshore Wind Reshapes MSP

Baulaz. Y, Bourdaud P., Aignous E. Aguelal H., Niquil, Le Guyader D., Tissot C., Halouani G., Mouchet M., (in prep.) Mapping long-term offshore wind farm impacts on marine ecosystem service supply: a scenario-based, spatially explicit approach. Ecological Indicators.

**Yoann Baulaz**<sup>1</sup>  
Pierre Bourdaud<sup>1</sup>  
Emma Aignous<sup>1</sup>  
Hind Aguelal<sup>1,3</sup>  
Nathalie Niquil<sup>3</sup>  
Damien Le Guyader<sup>4</sup>  
Tissot Cyril<sup>5</sup>  
Ghassen Halouani<sup>6</sup>  
Maud Mouchet<sup>2</sup>

<sup>1</sup> *France Energies Marines (Brest, FR)*  
<sup>2</sup> *National Museum of Natural History (Paris)*  
<sup>3</sup> *Normandy University  
Caen Normandy University (Caen, FR)*  
<sup>4</sup> *Geo4seas (Brest, FR)*  
<sup>5</sup> *Institut Universitaire Européen de la Mer (Brest, FR)*  
<sup>6</sup> *IFREMER, (Boulogne-sur-Mer, FR)*



[Yoann.baulaz@france-energies-marines.org](mailto:Yoann.baulaz@france-energies-marines.org)

