ULTFARMS

Circular Low Trophic Offshore Aquaculture in Wind Farms and Restoration of Marine Space

Alexander Ziemba

ULTFARMS in General

ULTFARMS.eu

@ULTFARMS

ULTFARMS

EU MISSIONS
RESTORE OUR OCEAN & WATERS

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WHAT IS ULTFARMS

ULTFARMS is an ocean multi-use project that aims to increase European capacity for commercially viable low-trophic aquaculture production and marine restoration in offshore wind farms, while safeguarding the environment and biodiversity, minimizing carbon footprints, and maintaining commercial viability.

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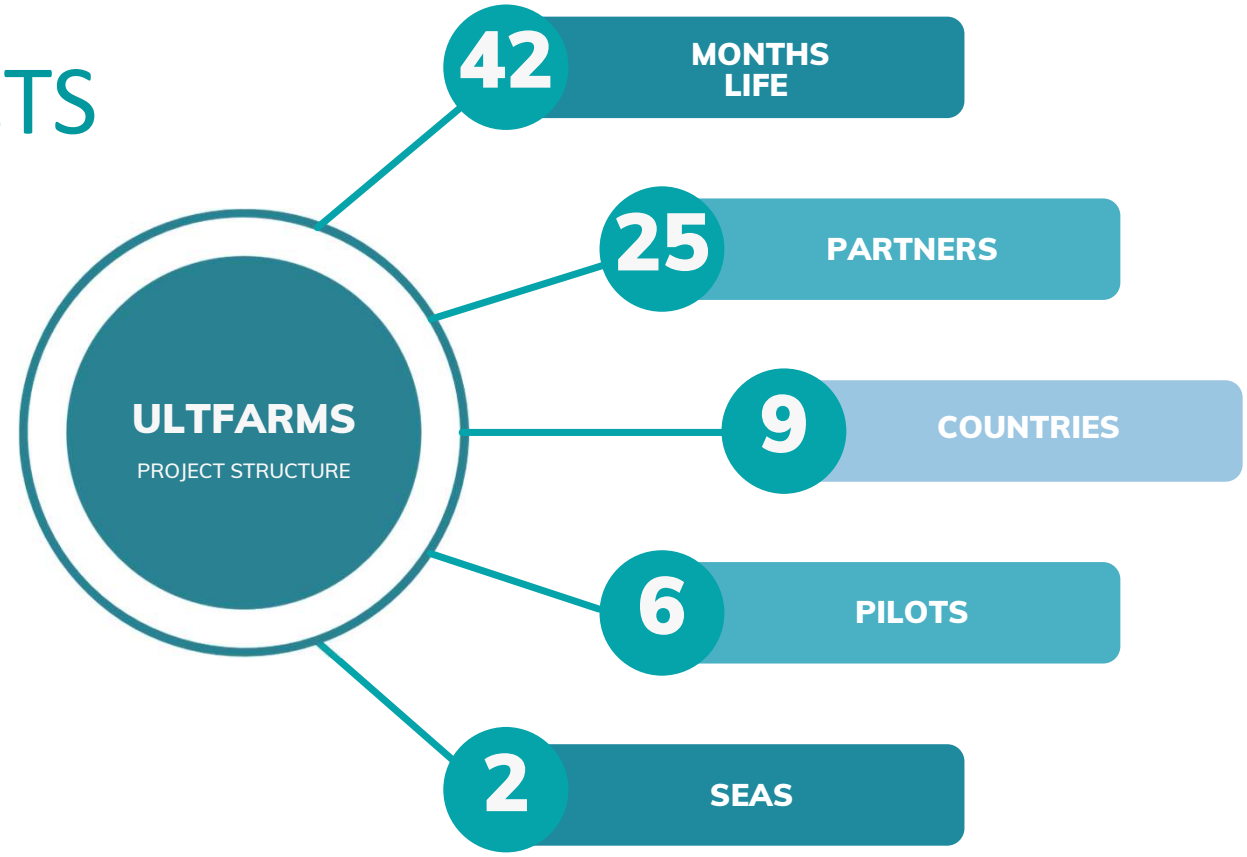
KEY FACTS



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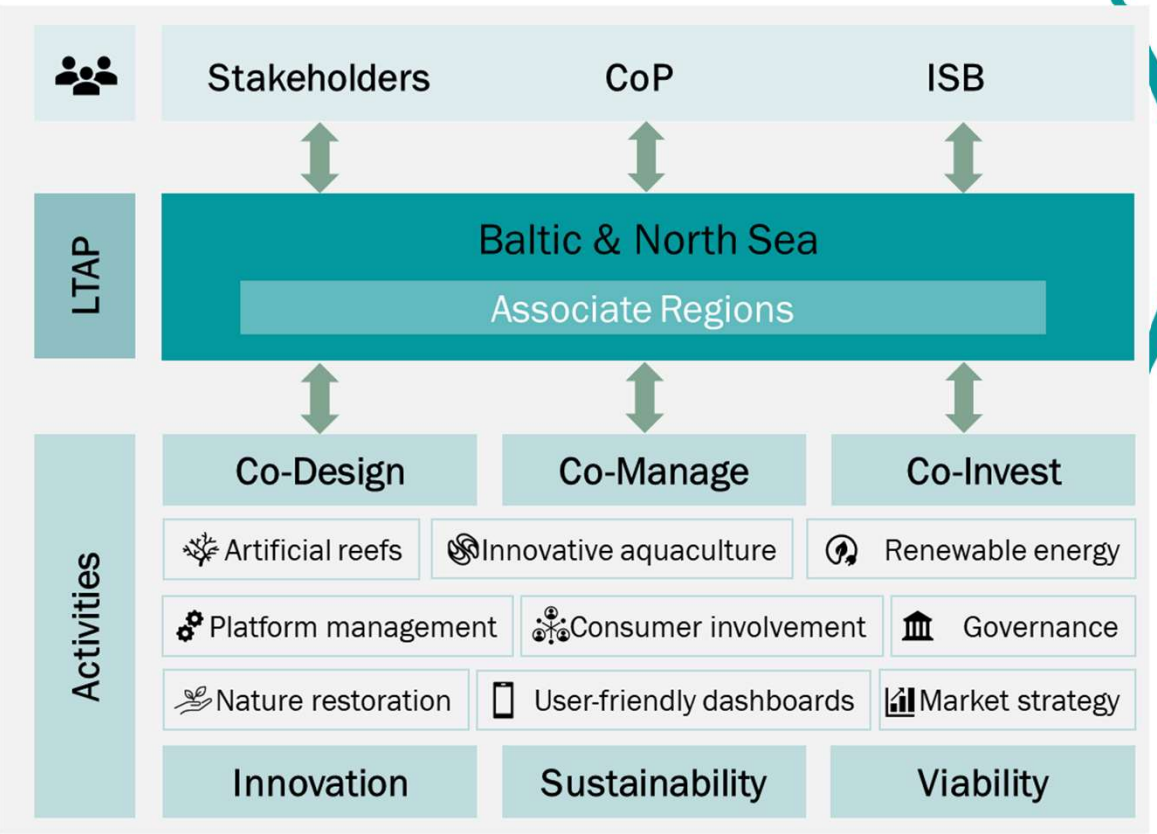
THE ULTFARMS PROJECT

- **Focus on Low Trophic** Aquaculture: mussels, oysters, seaweeds
- **Integration of multiple activities**
  Renewable Energy, Nature Restoration, Food Security
- **Adaptation, Replication, Commercialization**



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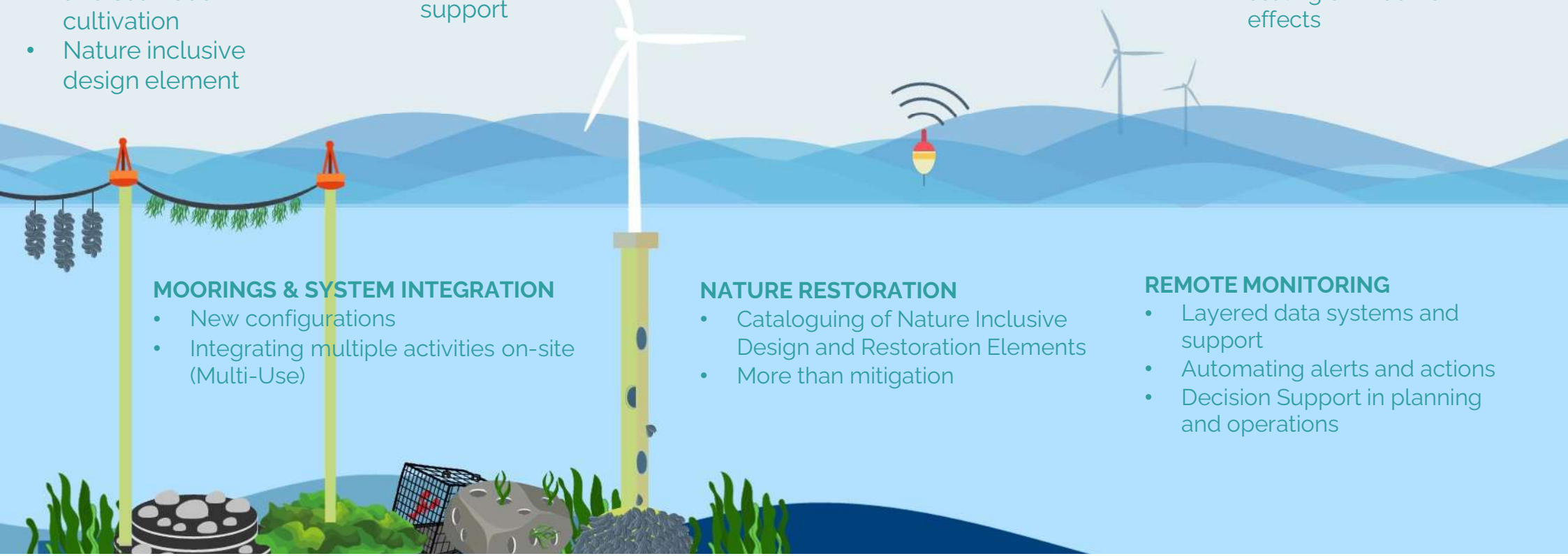
Offshore Wind & Low Trophic Aquaculture & Nature Restoration or Protection

System Designs
- Mussel, oyster and seaweed cultivation
- Nature inclusive design element

Suitability
- Regional and basin level suitability
- Tools for mapping or optimization and support

REGULATORY RELEVANCE
- Biodiversity targets 30 by 30
- EU nature restoration law
- Rapid near & offshore developments

REPLICABILITY & UPSCALING
- Catalogue of adaptable and high TRL solutions
- Impacts of density and scaling or knock-on effects

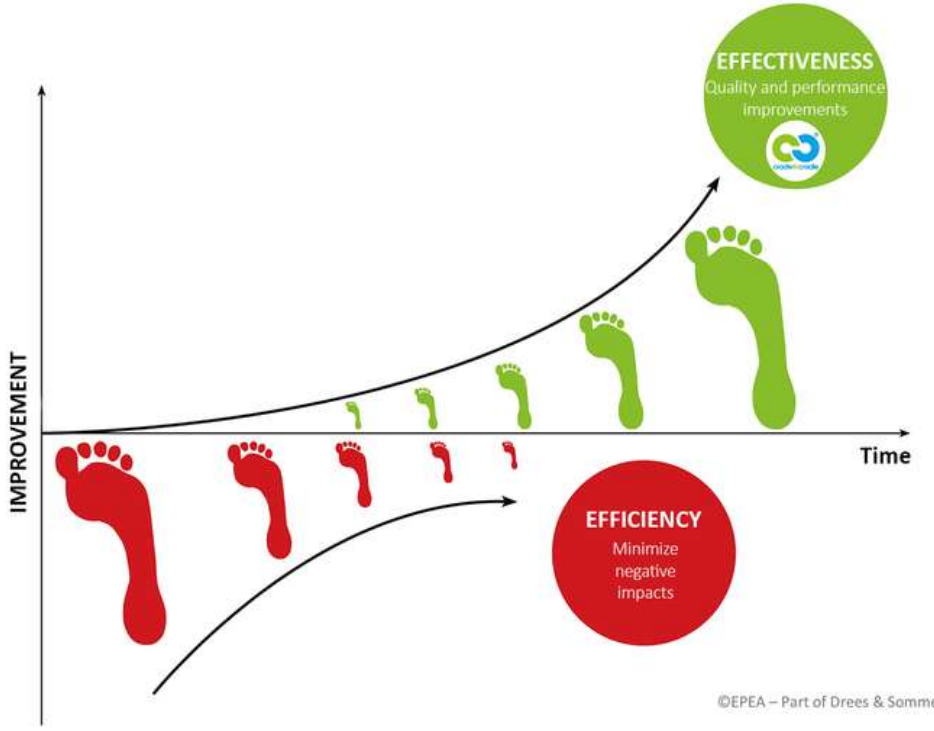


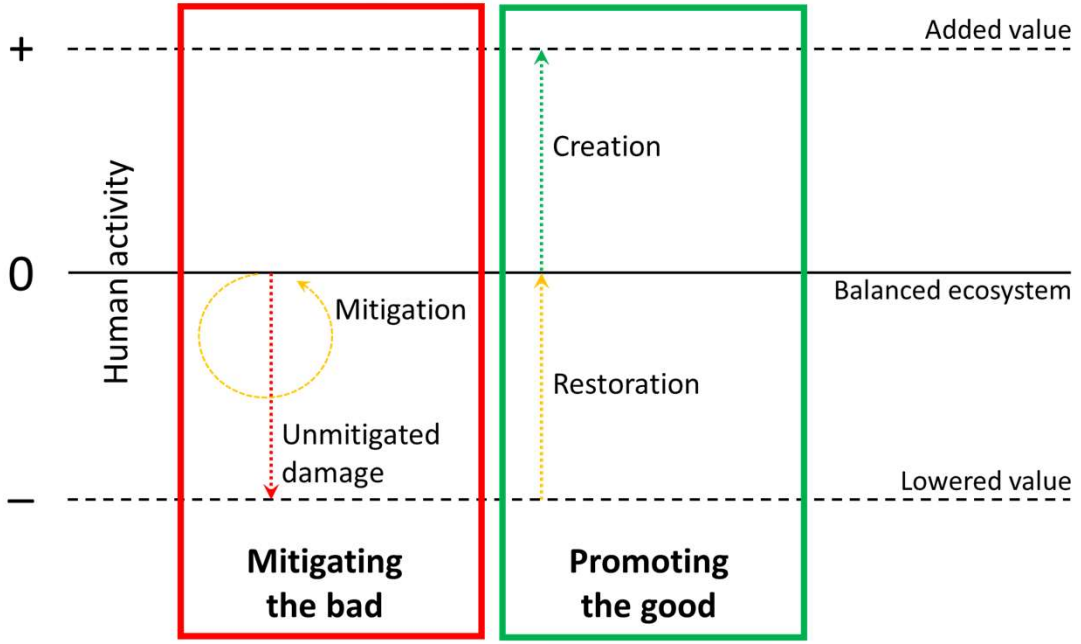
MOORINGS & SYSTEM INTEGRATION
- New configurations
- Integrating multiple activities on-site (Multi-Use)

NATURE RESTORATION
- Cataloguing of Nature Inclusive Design and Restoration Elements
- More than mitigation

REMOTE MONITORING
- Layered data systems and support
- Automating alerts and actions
- Decision Support in planning and operations

Sustainability and Restoration





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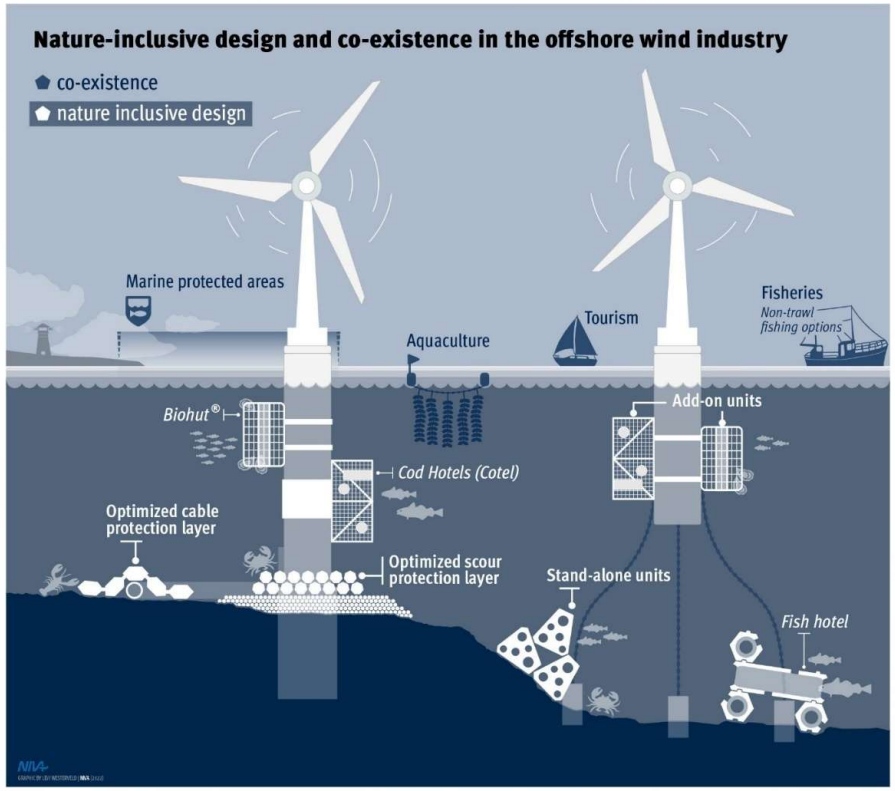
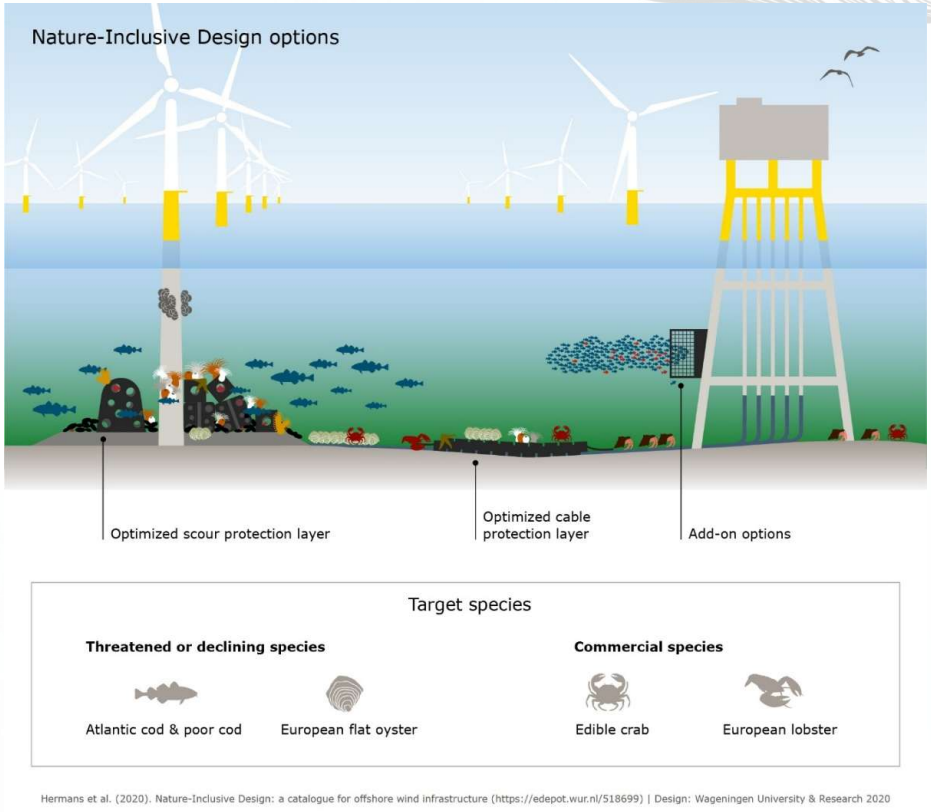
Sustainability and Restoration





Hermans et al. (2020). Nature-Inclusive Design: a catalogue for offshore wind infrastructure (https://edepot.wur.nl/518699) | Design: Wageningen University & Research 2020

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Sustainability and Restoration

Figure 3 Visual representation of NID options 1 – 12. Strategy 1 (orange) and strategy 2 (light blue). Table of image sources can be found in Annex C.

Figure 4 Visual representation of NID options 13 – 24. Strategy 2 (light blue), strategy 3, (green), strategy 4 (dark blue) and other option (red). Table of image sources can be found in Annex C

Nature Inclusive Design: Challenges and Opportunities for UK Offshore Wind Farms Harry Cale and Beth Churn 2021

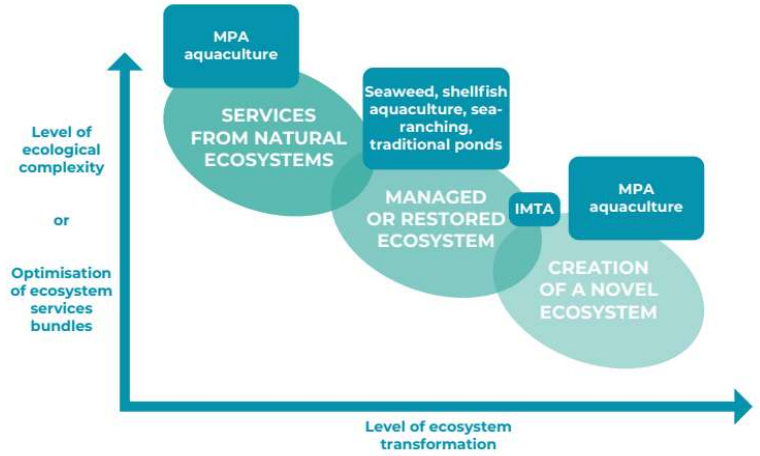
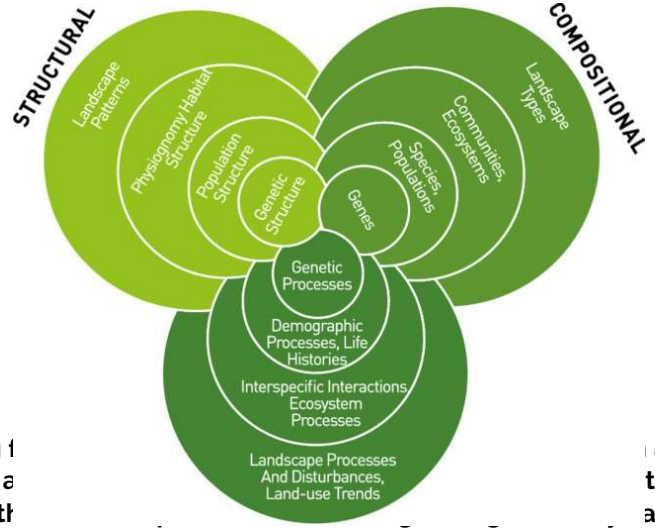


Figure 12: Aquaculture systems, ecological complexity, ecosystem services optimisation and level of ecosystem transformation

(Source: Adapted from IUCN, 2020)



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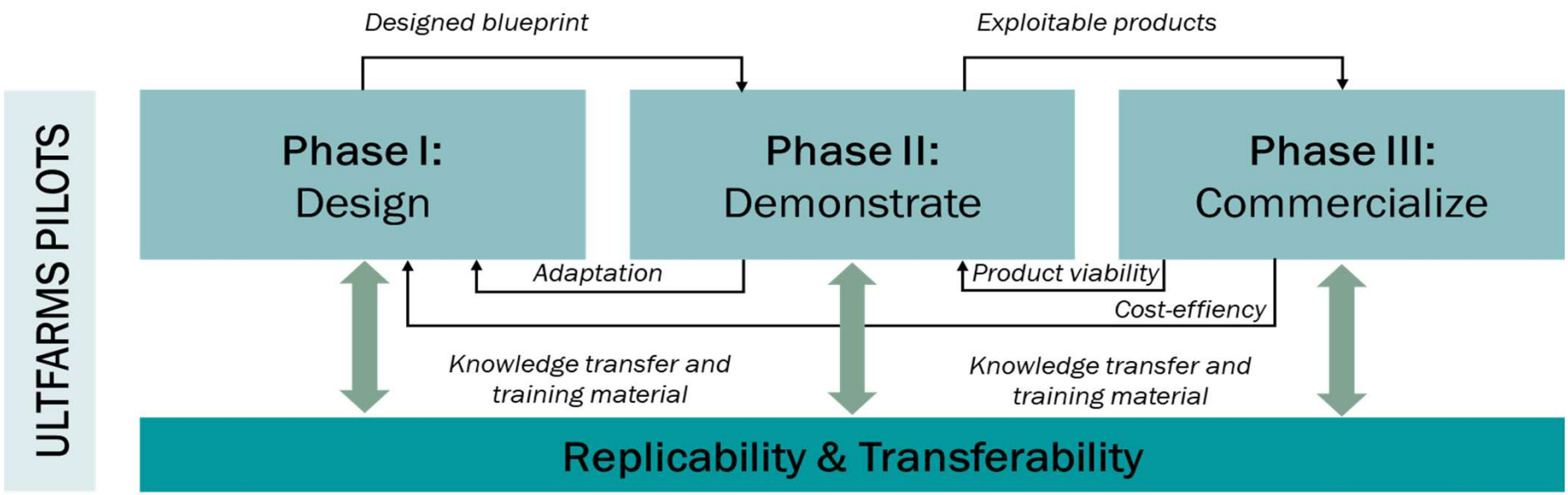
Development Status



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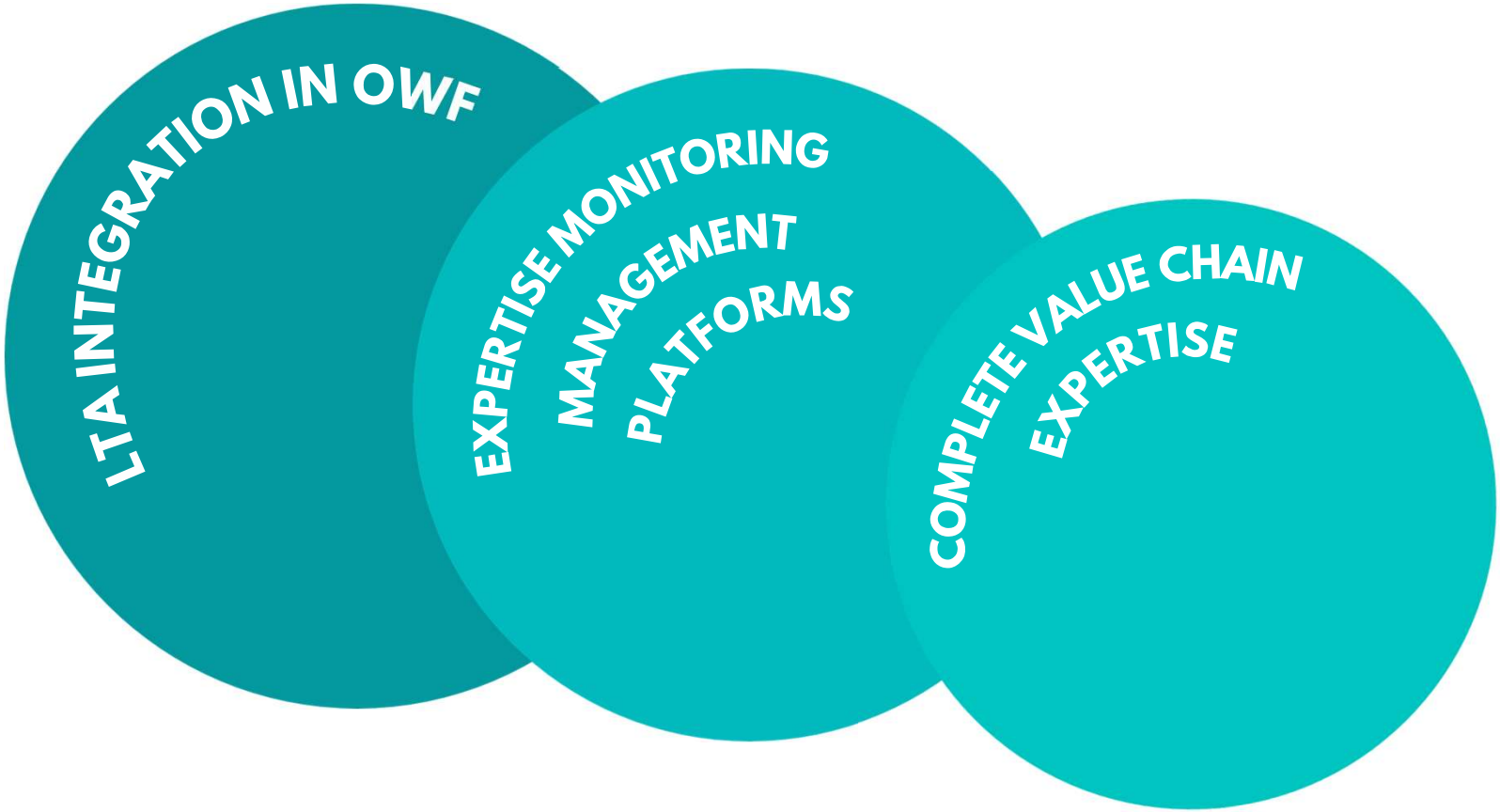
PILOTS KEY FACTS



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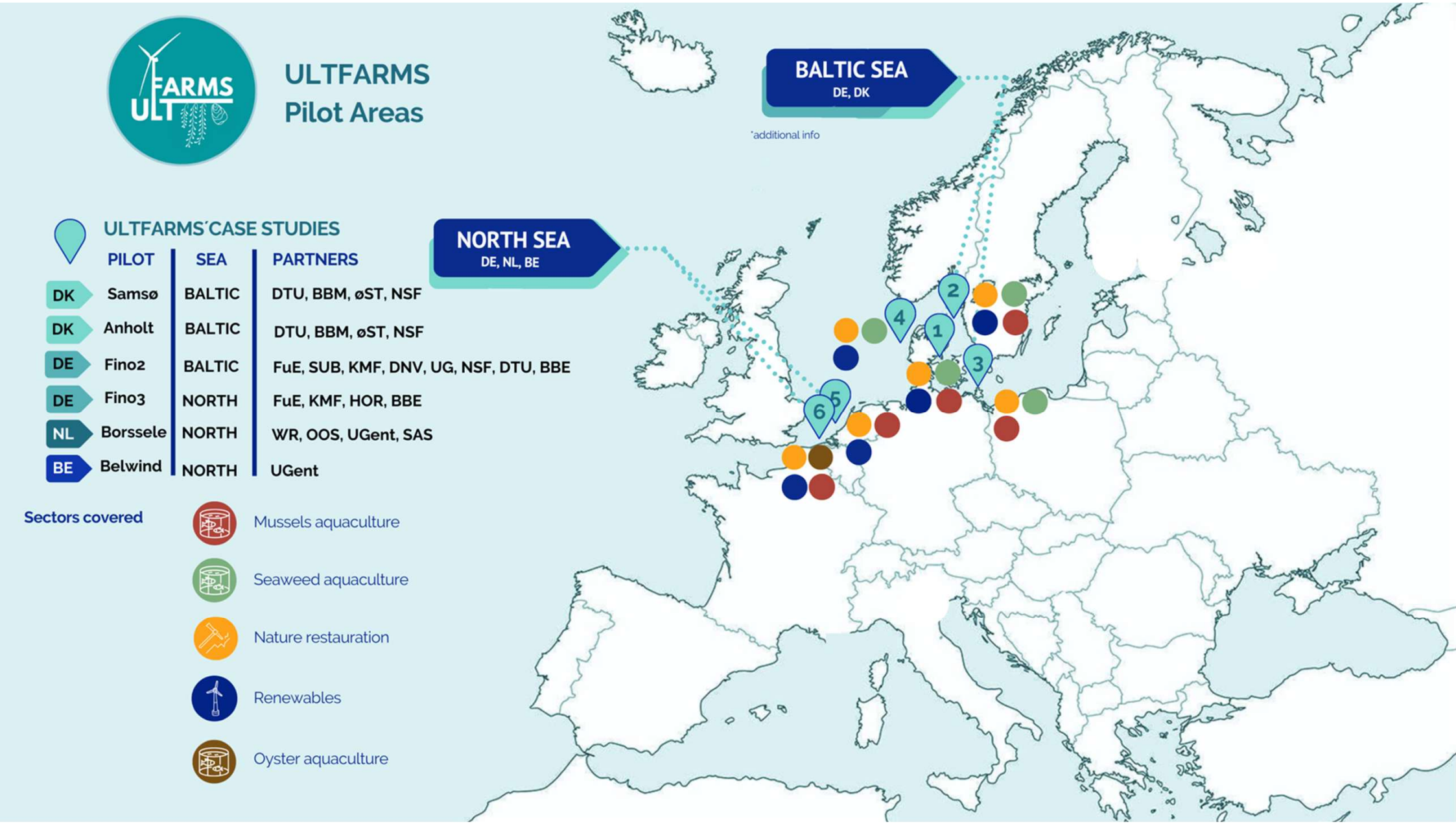
ULTFARMS
Pilot Areas
BALTIC SEA
DE, DK
*additional info
NORTH SEA
DE, NL, BE
ULTFARMS´CASE STUDIES
PILOT | SEA | PARTNERS
DK Samsø | BALTIC | DTU, BBM, øST, NSF
DK Anholt | BALTIC | DTU, BBM, øST, NSF
DE Fino2 | BALTIC | FuE, SUB, KMF, DNV, UG, NSF, DTU, BBE
DE Fino3 | NORTH | FuE, KMF, HOR, BBE
NL Borssele | NORTH | WR, OOS, UGent, SAS
BE Belwind | NORTH | UGent
Sectors covered
Mussels aquaculture
Seaweed aquaculture
Nature restauration
Renewables
Oyster aquaculture
1
2
3
4
5
6

PILOT 1 & 2

Samsø Offshore Wind Farm and Anholt Park, Denmark, Baltic Sea

Partners:

DTU

BLÅ BIOMASSE A/S

Wind Estate's Samsø South offshore wind farm is an ideal site for integrating aquaculture activities. A pilot project is underway to evaluate the feasibility of cultivating commercially viable LTA species in offshore conditions. The pilot will assess operational costs, commercial aspects, and the potential for multi-use integration during planning stages.

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Danish pilots

Anholt is an experimental site for:

- Seaweed and mussel cultivation
- Offshore gear development and testing
- Environmental and farm physical monitoring
- Biodiversity assessment

Samsø is a commercial test site for:

- Commercial mussel farming
- Testing of existing technology (tubes and net)
- Will start spring 2024

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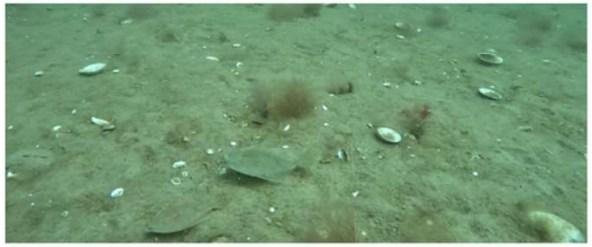
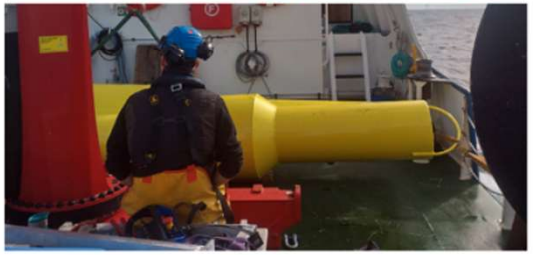
Mussel longlines

Mussel tubes and net system

Danish pilots





PILOT 1

AIMS

- **Assessing LTA production potential in the pilot area.**
- **Operation by a commercial farmer to evaluate business case for production in an offshore wind area.**
- **Novel vessels for safer and faster operations, maintenance, and harvesting**

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PILOT 2

AIMS

The Anholt offshore wind farm, operated by Ørsted Wind Power, is one of the largest offshore wind areas in the Baltic basin. It has been identified as a potentially suitable site for the integration of aquaculture activities in Danish offshore wind farms. The pilot aims to investigate the production potential of commercially viable LTA species in the Baltic Sea basin and develop adaptations of existing and emergent technologies to endure offshore conditions. The pilot also focuses on monitoring systems, biodiversity effects, and the development of innovative LTA cultivation techniques.

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PILOT 3

FINO3 Platform, Germany: North Sea

NORDIC SEAFARM

Partners:

Forschungs- und Entwicklungszentrum Fachhochschule Kiel GmbH

SUBMARINER NETWORK

HORTIMARE

bbe moldaenke

OCEAN RAINFOREST

FUE's FINO3 Platform, located 80 km offshore in the North Sea, is an ideal site for demonstrating a commercially viable aquaculture operation. The German North Sea pilot involves sustainable cultivation of mussels and seaweed, with multi-use research trials currently underway as part of the Horizon 2020 UNTIED project.

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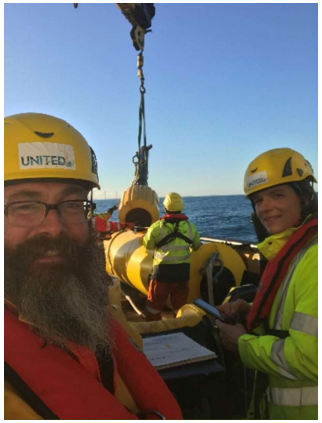
FARMS ULT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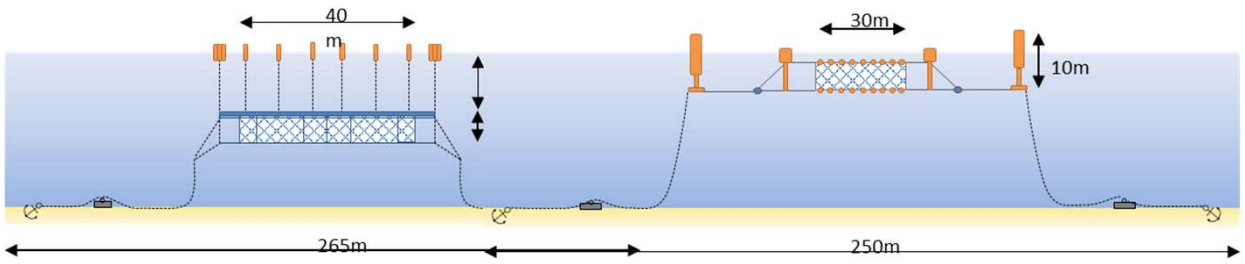
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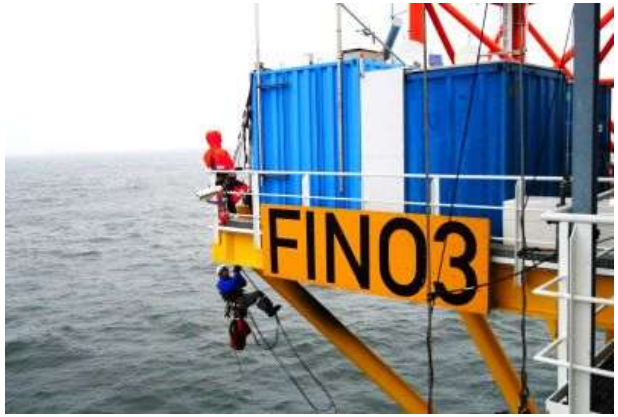
FINO3

PILOT 3

AIMS

- **The pilot project plans to integrate seaweed, oyster, and blue mussel cultivation in an existing offshore wind-park.**
- **Techniques for offshore cultivation of profitable seaweed and mussel species along with new monitoring techniques**

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PILOT 4

FINO2 Platform, Germany: Baltic

Partners:

The site faces challenges due to low salinity, shorter waves, and almost no tidal currents.
The pilot aims to optimise seaweed cultivation, focusing on green algae Ulva (sea salad) which show promising growth in the Baltic Sea.
Introduction of a nature-inclusive design adapted to specific Baltic Sea conditions is another goal of FINO 2.

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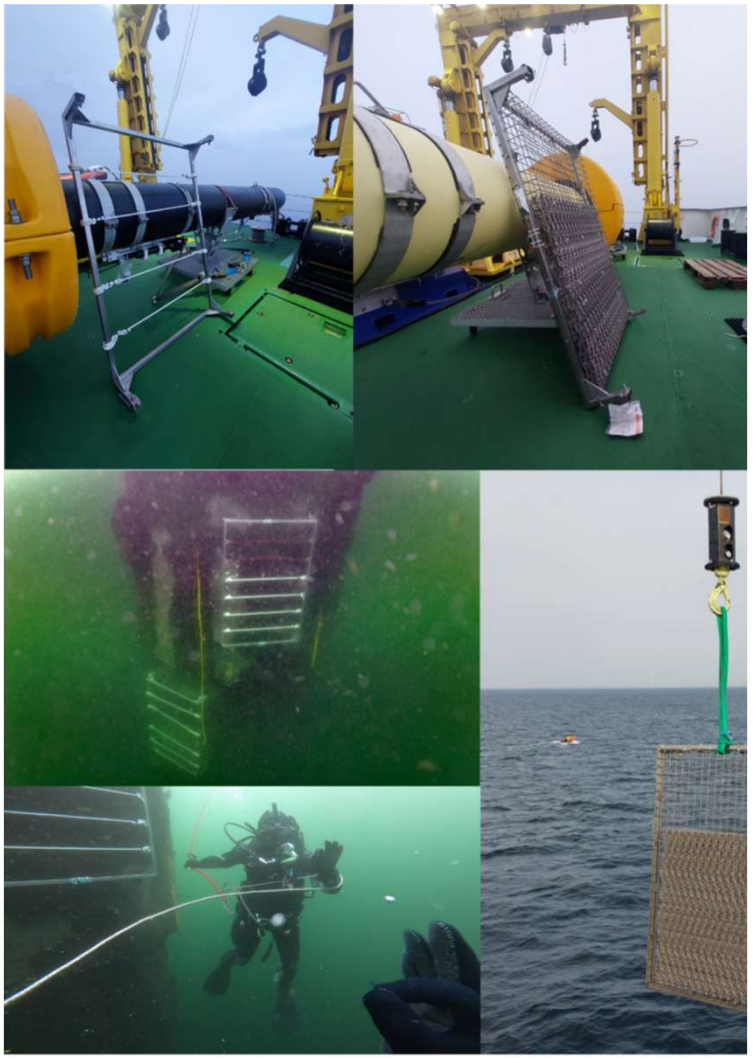
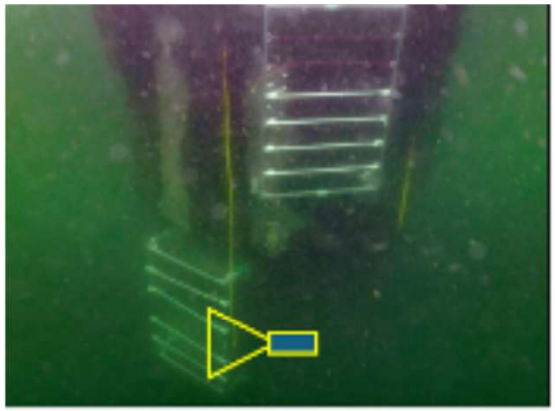
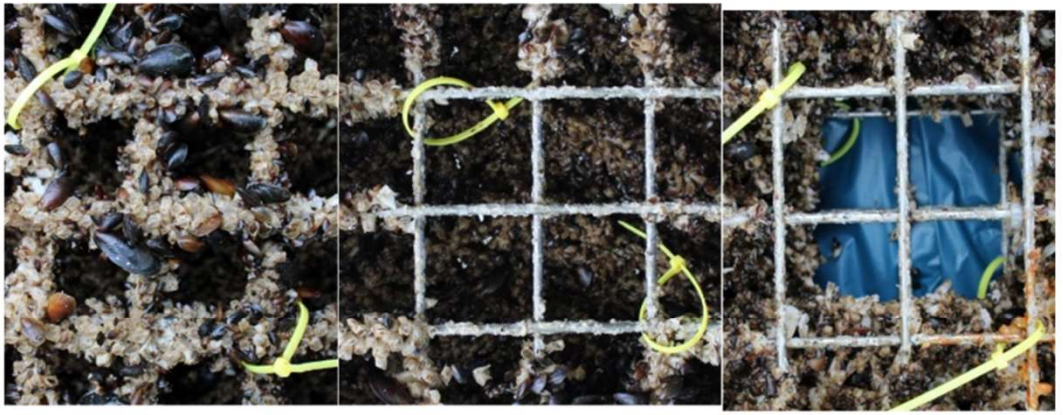
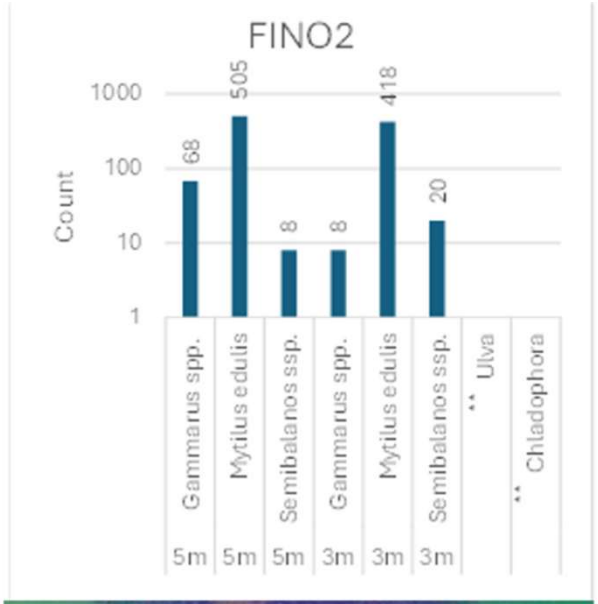
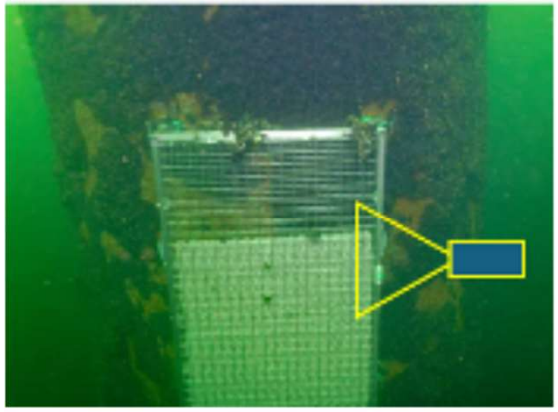


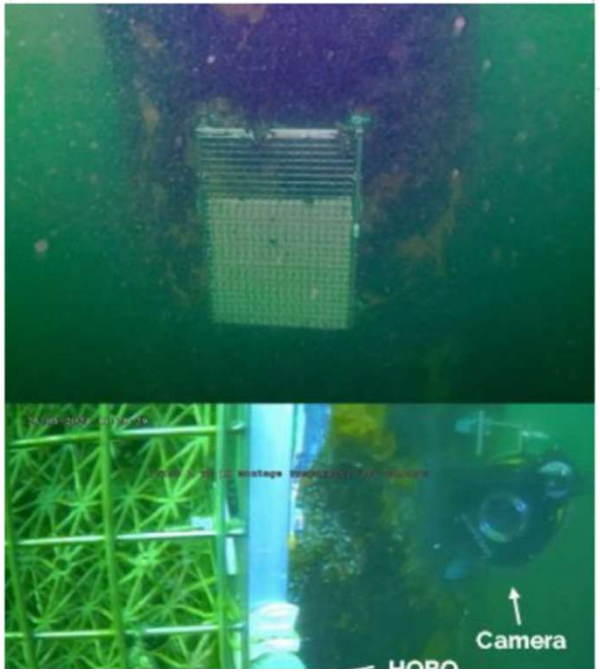


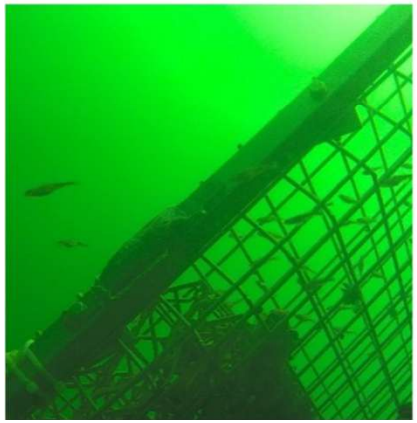


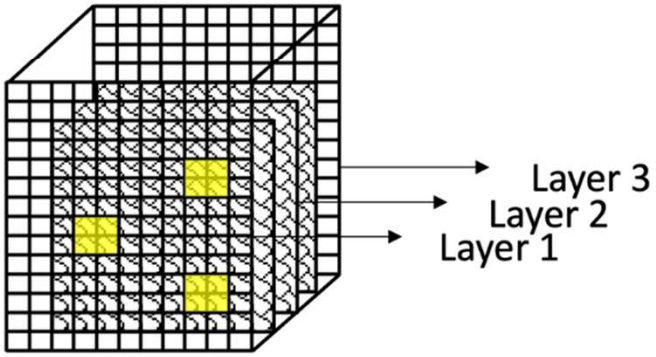




German Baltic Sea pilot first NID result:







PILOT 4

AIMS

- **Pilot 4 aims to optimize Baltic Sea seaweed production and prepare for market entry.**
- **The pilot will develop large-scale seeding techniques and optimize grow-out systems for specific seaweed species.**
- **The project will engage fishermen in monitoring activities, explore wind energy utilization, and develop a nature-inclusive design to support the stressed Baltic Sea environment.**

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PILOT 5

Depth-Adjustable Submersible Mussel Farm (SMF) in Borssele III,Netherlands : North Sea

Partners:

WAGENINGEN UNIVERSITY & RESEARCH

·0·0·S·

SMF

GHENT UNIVERSITY

SUSTAINABLE AQUACULTURE SOLUTIONS

Implementation of a unique, denser line deployment system.

Combination of monitoring technologies to assess mussel performance and ecological impact and footprint.

Eco-friendly artificial reef development.

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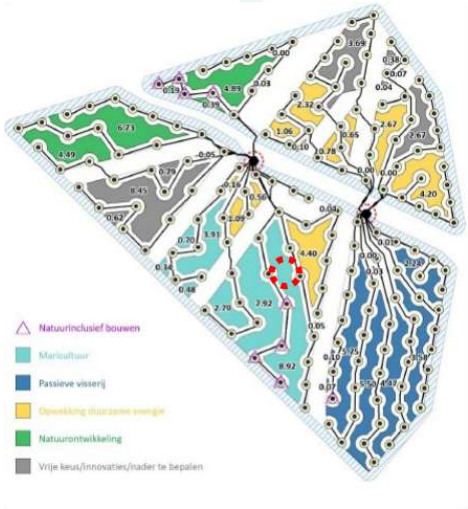

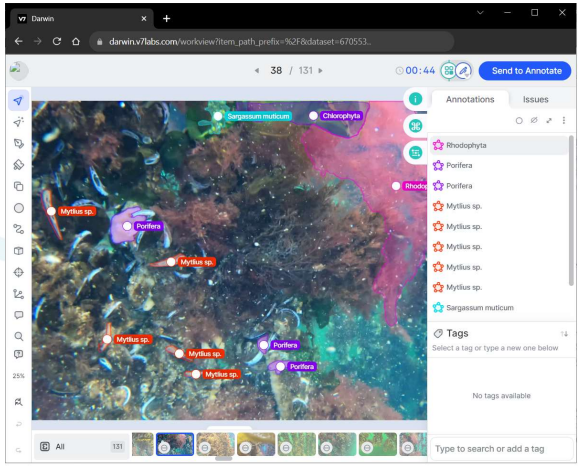

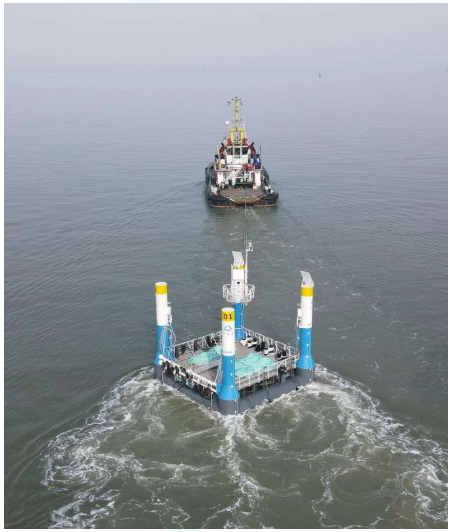

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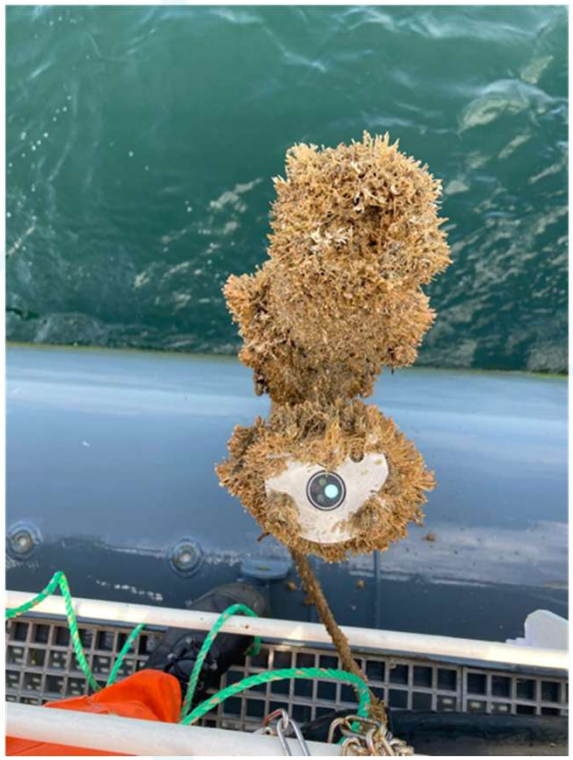
13 August: chlorophyll sensor wiper works



7 November: mussels from rope collected for shell length (44 mm) meat content (26%) and toxins and contaminants

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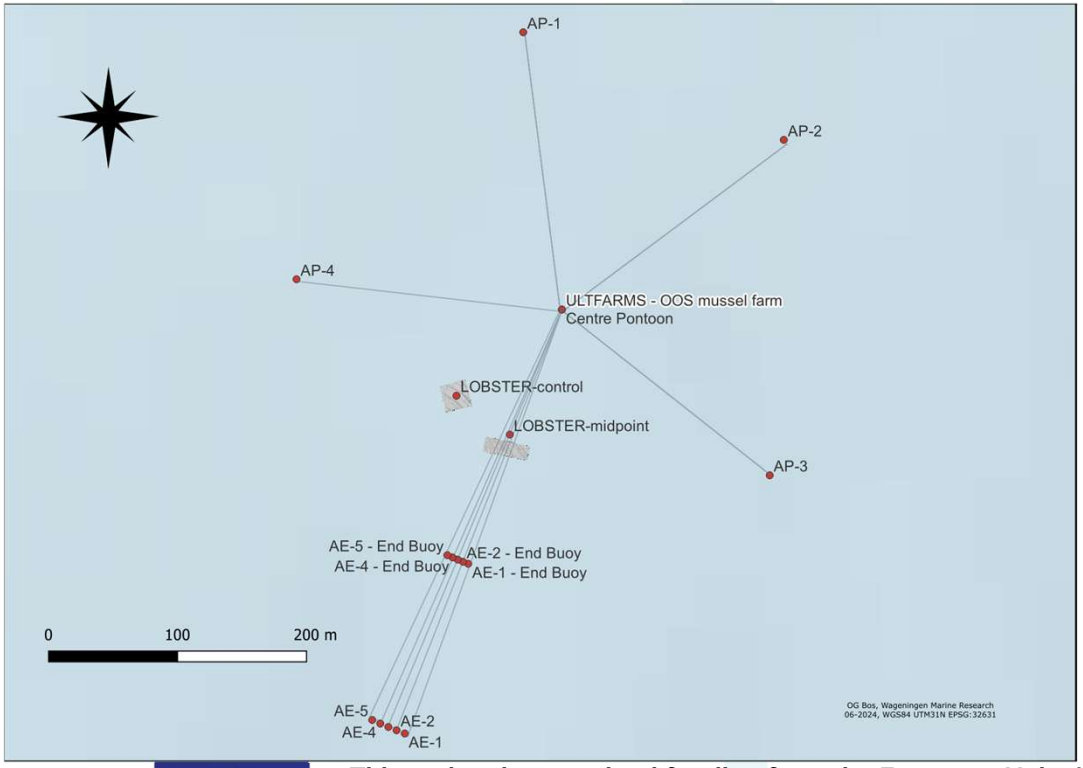

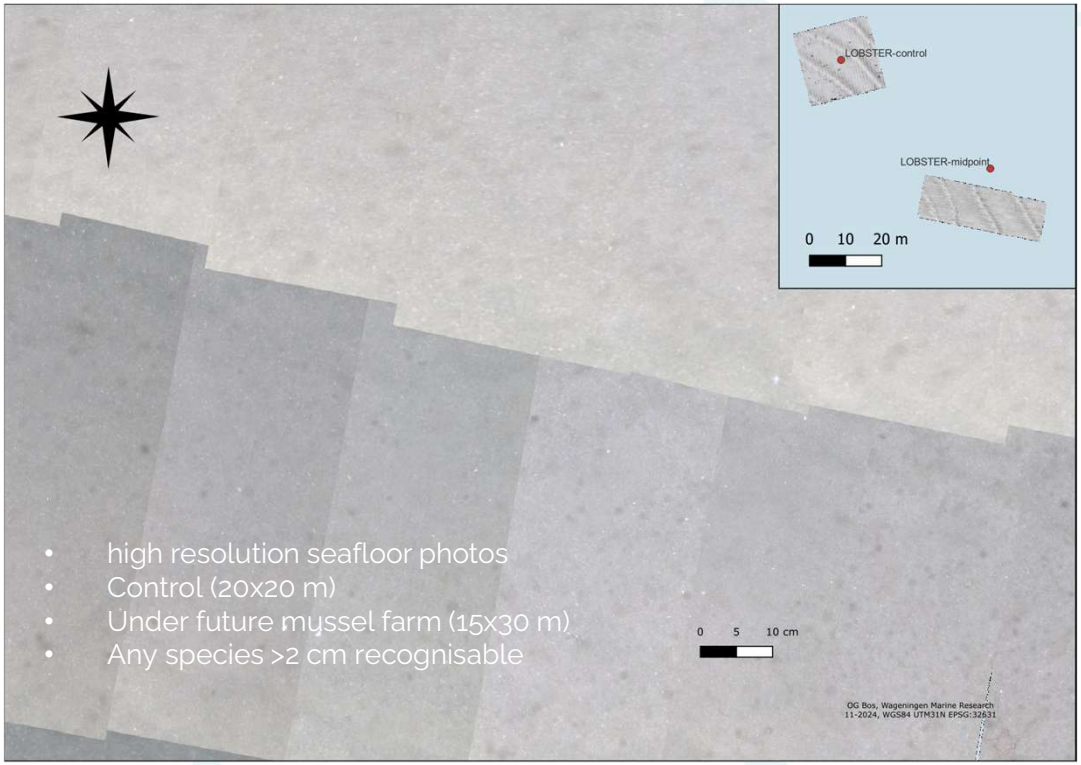

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Biodiversity monitoring mussels & AI

- Test monitoring inshore
- species ID analysis of mussels and other species using AI

- Mussel monitoring
  - Size
- Biodiversity monitoring
  - Sponges, tunicates, crabs, algae, etc
- Policy species
  - Sabellaria
  - Cod
- Exotic species

VIDEO Mussel farm Bruinisse

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PILOT 5

AIMS

- **High-density mussel lines pose challenges, including new management procedures and regulatory frameworks.**
- **Monitoring and automation are critical due to the densely positioned lines and degradation of components.**
- **Collecting additional data on mussel growth and reef development in offshore conditions is important for feeding activities.**

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PILOT 6

Belwind, Belgium, North Sea

Partners:

The Belgian Pilot combines mussel, oyster and seaweed cultivation alongside nature restoration efforts within an offshore wind farm. The Pilot consists of, next to different nearshore testing sites, an offshore pilot site situated within the wind farm of Belwind, operated by Parkwind.

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PILOT 6

AIMS

- **Restorative aquaculture of flat oysters and nature-inclusive scouring protection materials will enhance biodiversity in multi-use aquaculture setups.**
- **Shellfish disease monitoring will be followed up via *e*DNA sampling.**
- **The pilot will demonstrate synergistic cultivation of native mussels, oysters, and seaweed located in an offshore wind farm, using innovative designs and systems, e.g., a submersible seaweed long line.**

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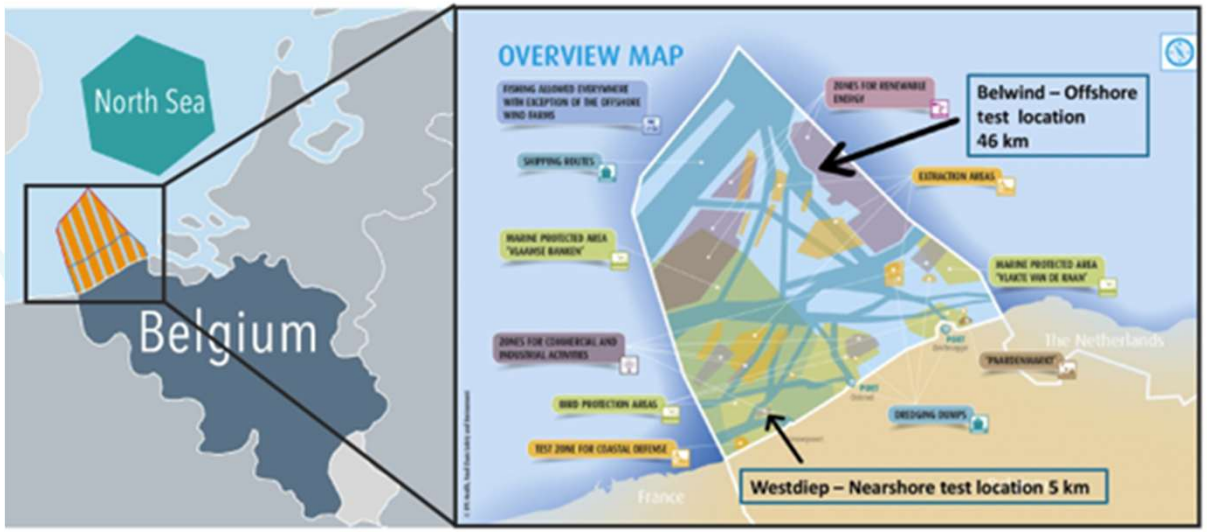

UNITED

Building off lessons learned

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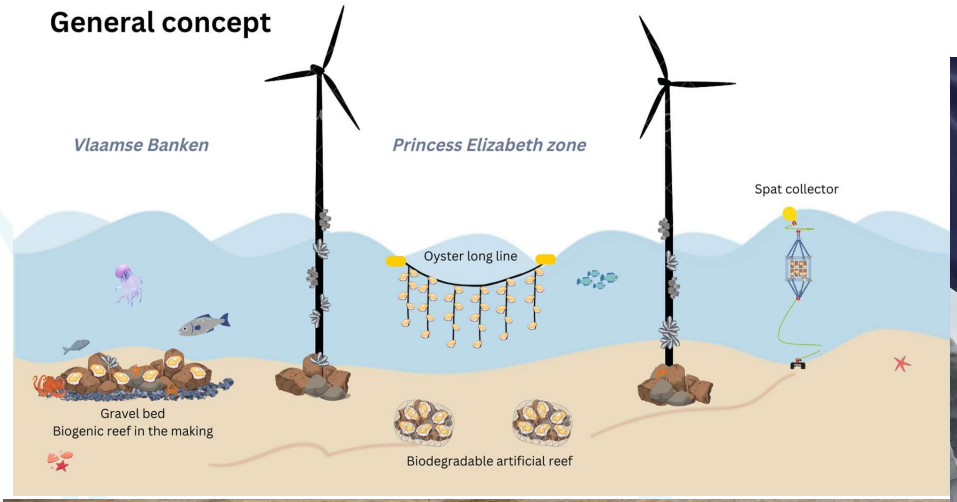
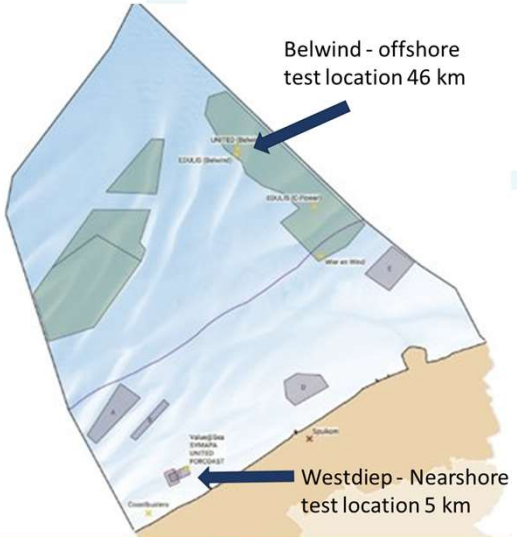
Nature Restorative Design Testing





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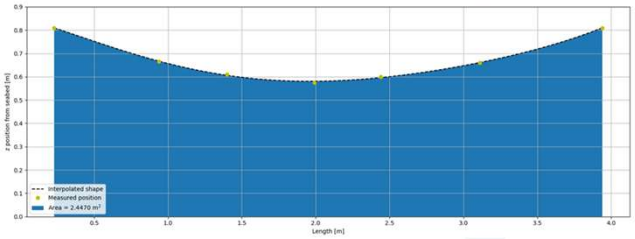

GHENT UNIVERSITY

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Experiments IMPACT9 & Deltares Atlantic Basin (TRL 4-5)

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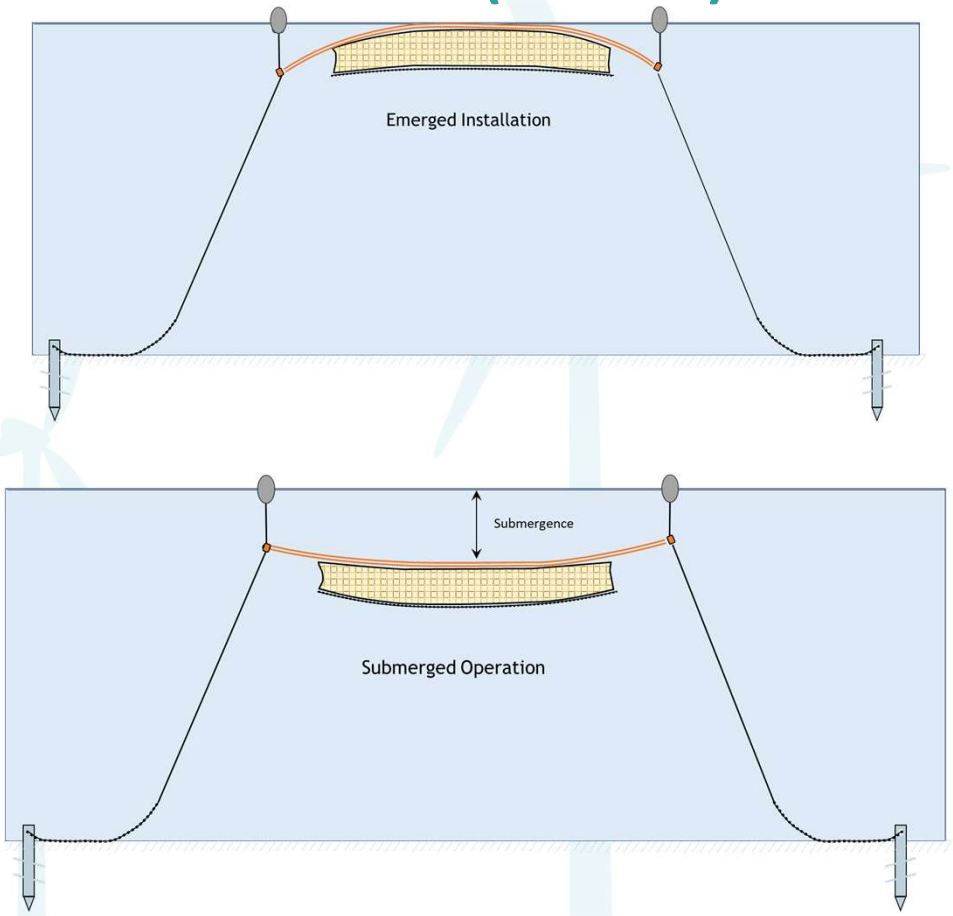
Experiments IMPACT9 & Deltares Atlantic Basin (TRL 4-5)



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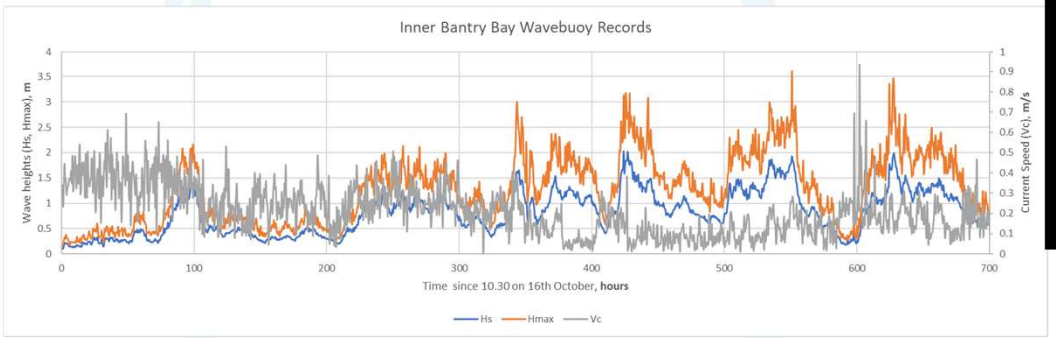
Experiments IMPACT9 in Irish Coastal Waters (TRL 4-5)



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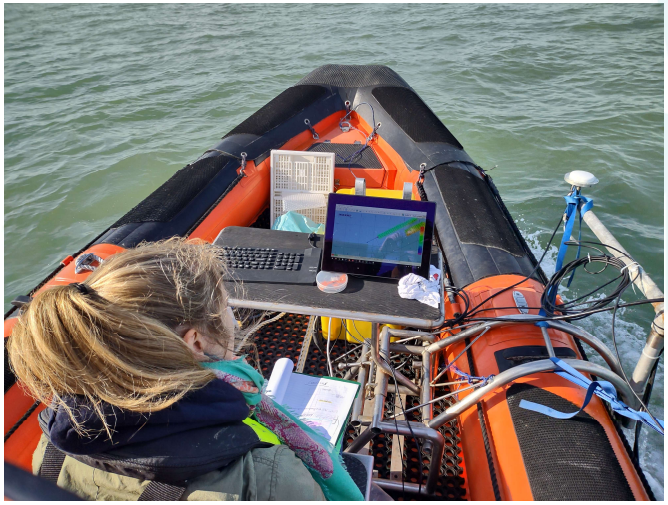
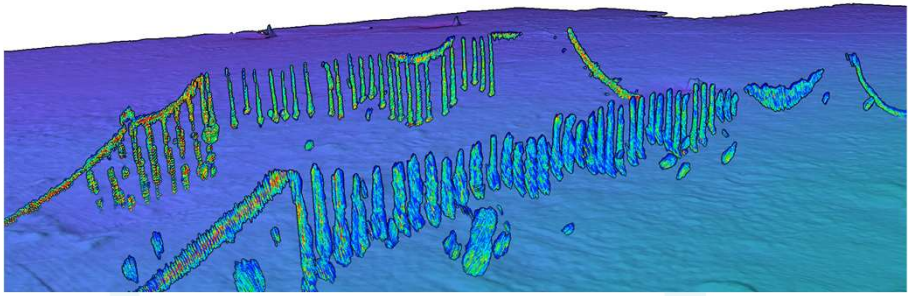
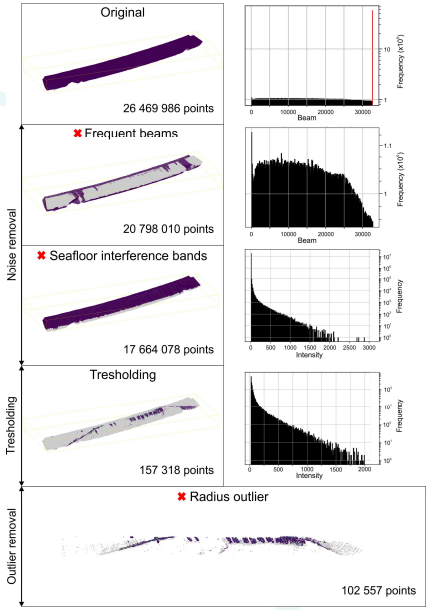
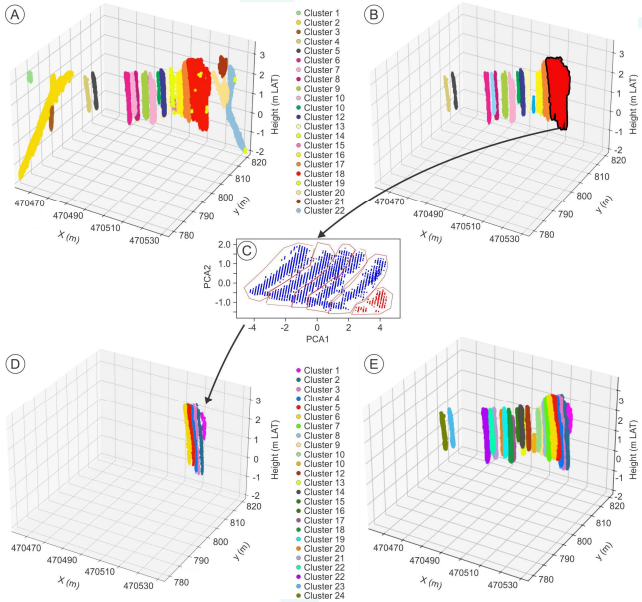
Novel monitoring with Acoustics and Multi-beam









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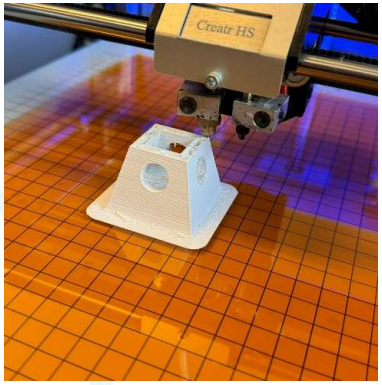
Scour Protection Stability Test with novel 3D-Printed Surfacing





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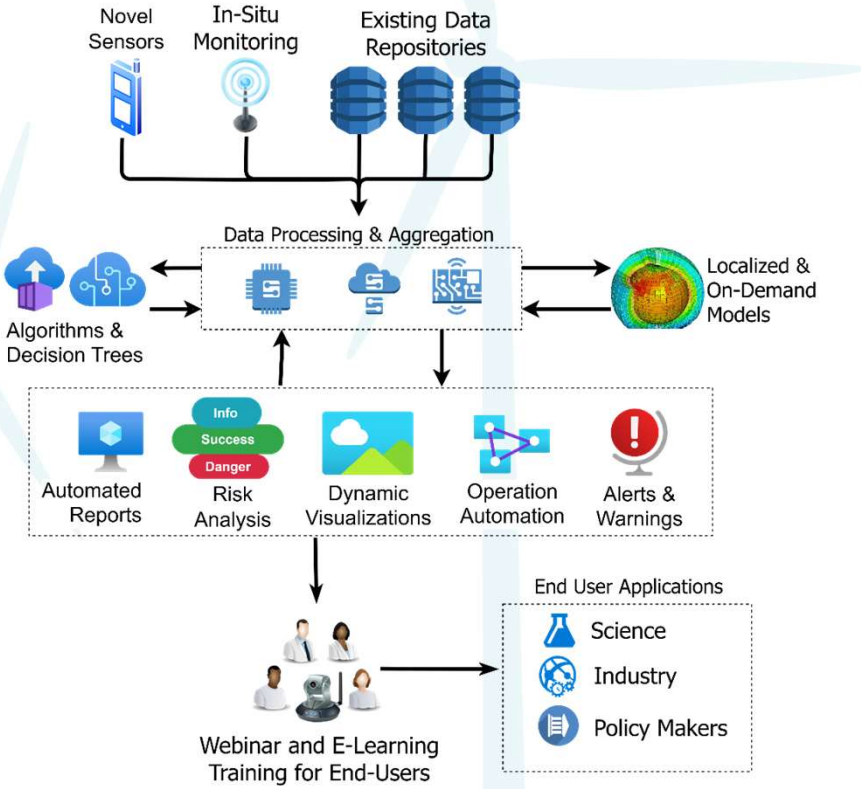
Integrated and Automated IT

- Support to monitoring strategy
- Integration of monitoring technologies & data-base management and Services
- Establishing a data processing and analytics service layer – digital twin concept
- Data Management



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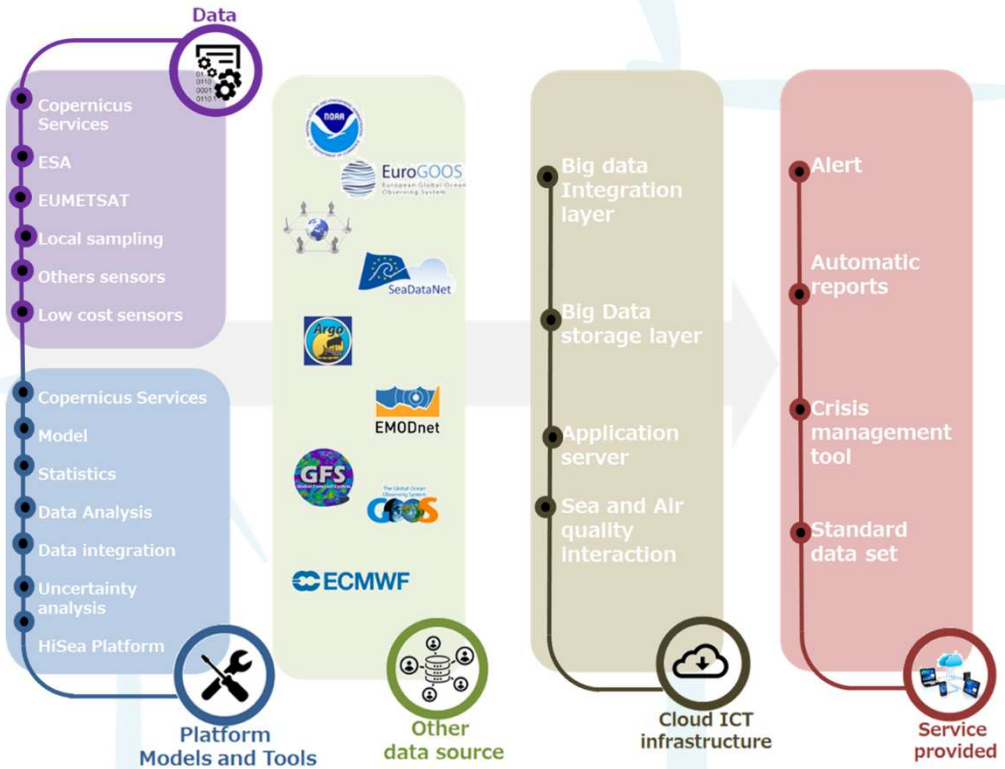
Integrated and Automated IT

Building real-time hydraulic and water quality modeling environments integrating modeling and data in a new and powerful way.

Providing operation and management

- Forecasts
- Diagnostics
- KPI's
- Alerts and warnings
- Decision support
- Improved assets management



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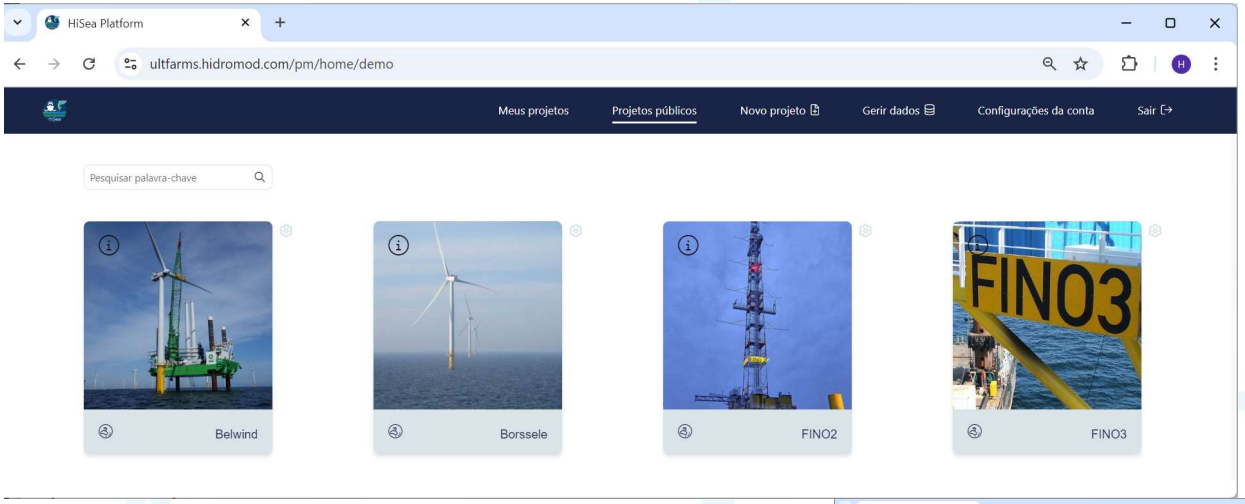
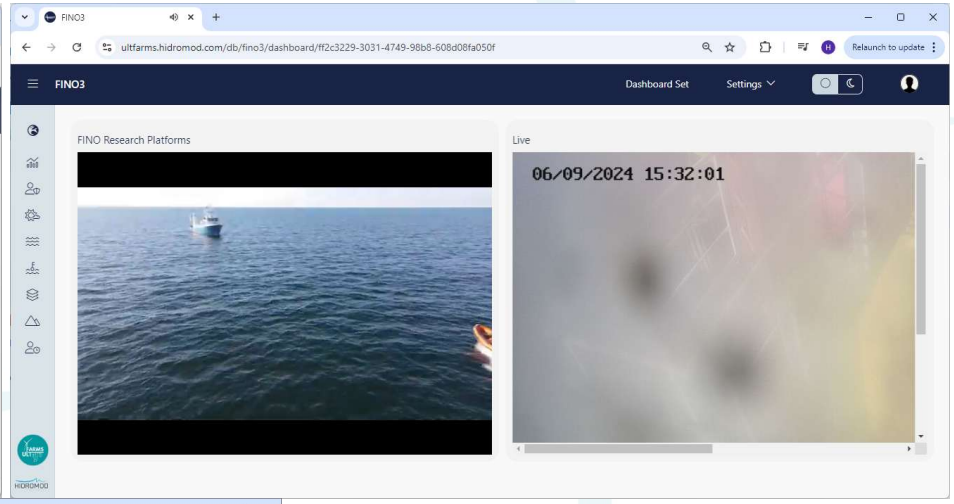
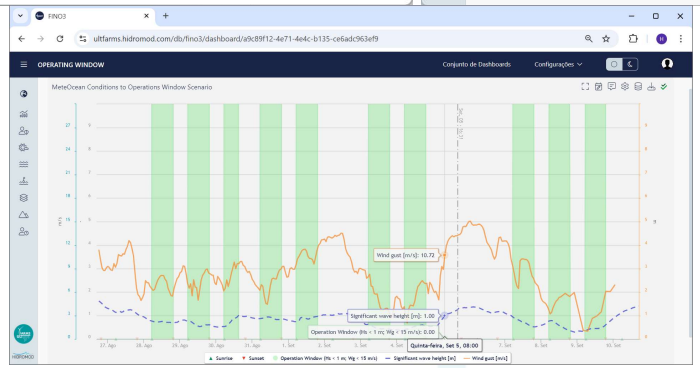
Integrated and Automated IT







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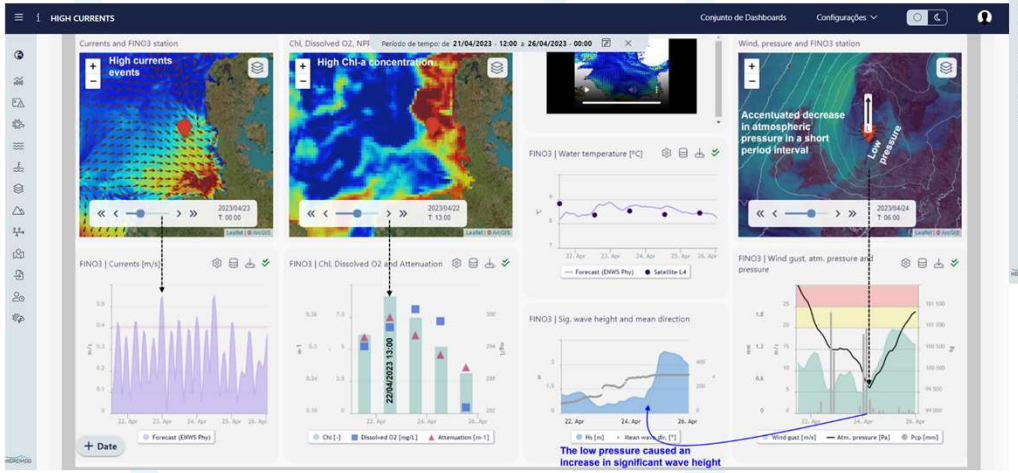

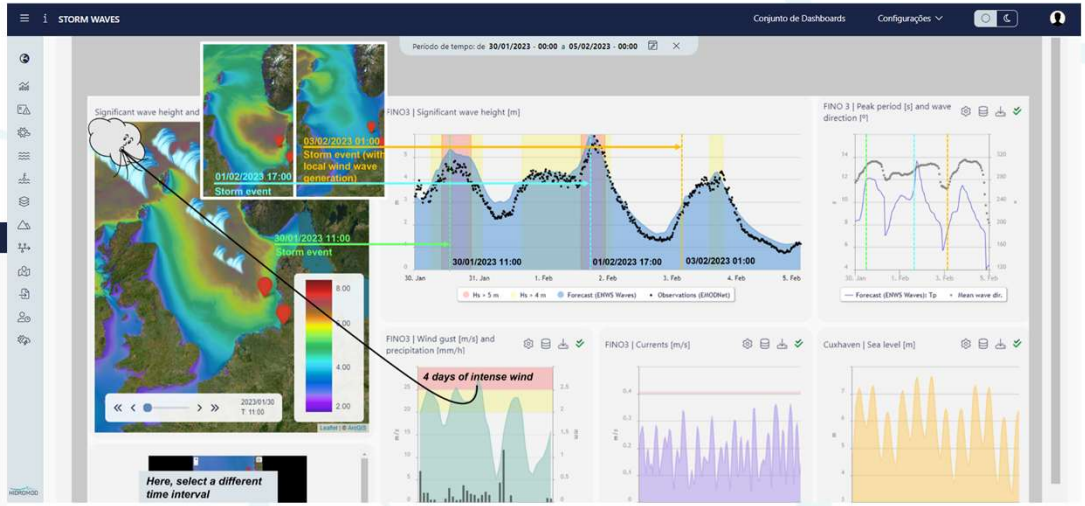

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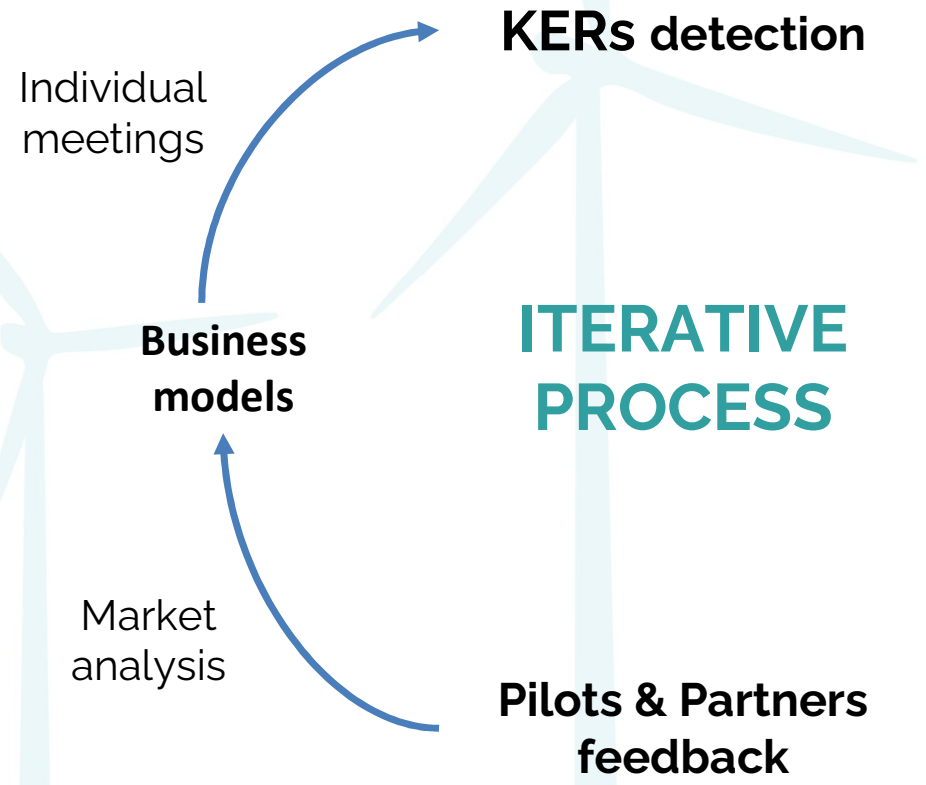
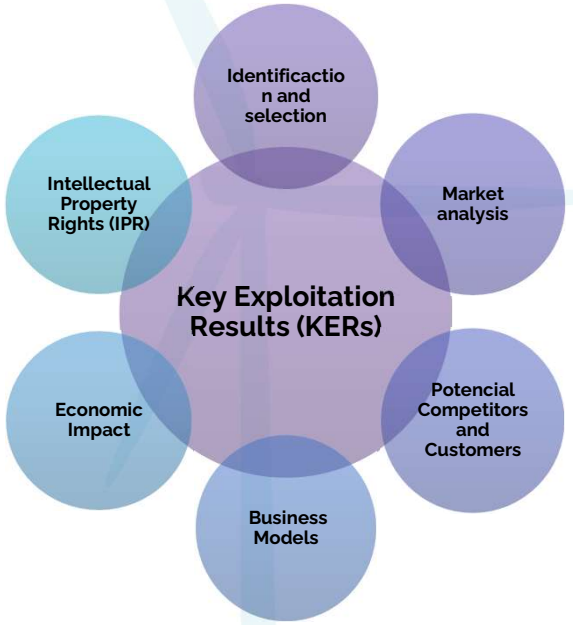
Commercialization





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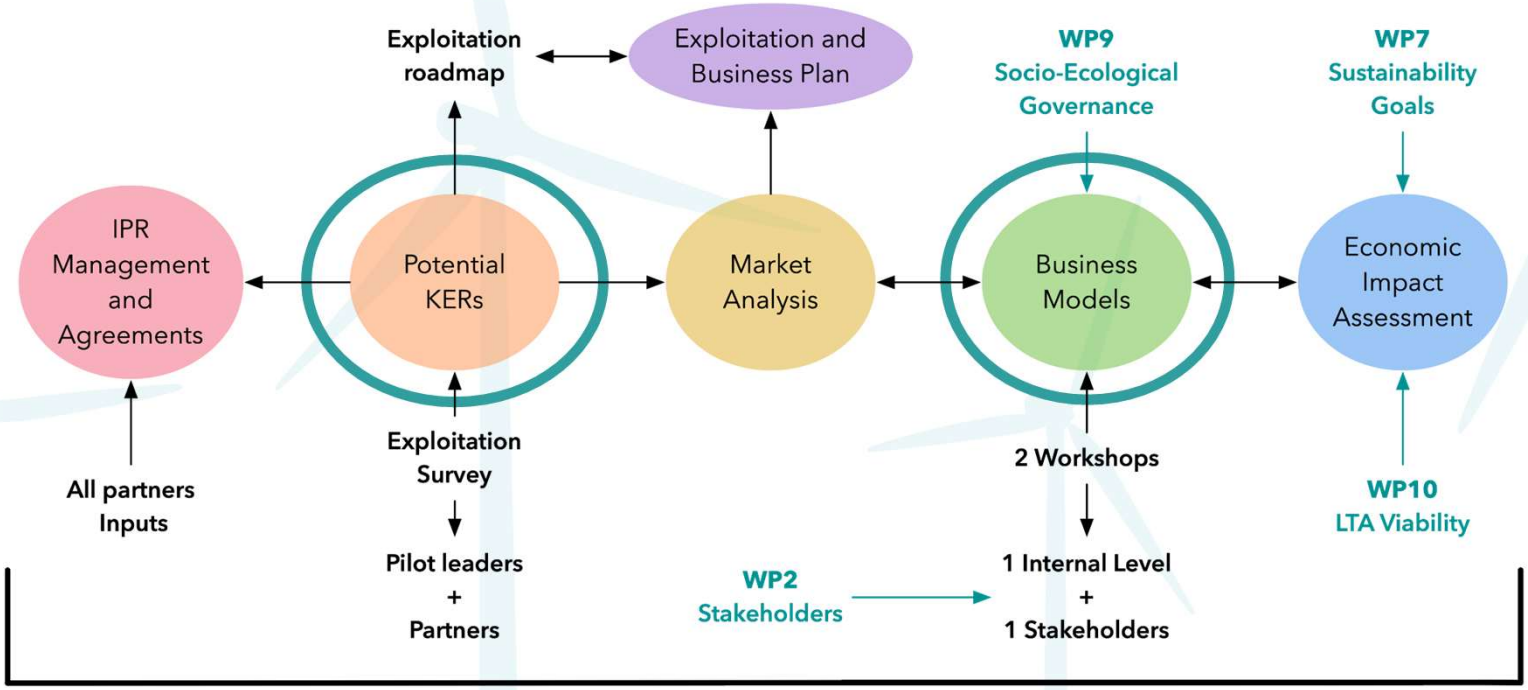

Exploitation and Business Plan | **Economic Analysis** | **Final KERs Business Plan** | **IPR Management Plan and Agreements**

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PARTNERS

Financed under the Horizon Europe Ocean Mission call titled Lighthouse in the Baltic and the North Sea basins – Low impact marine aquaculture and multi-purpose use of marine space.

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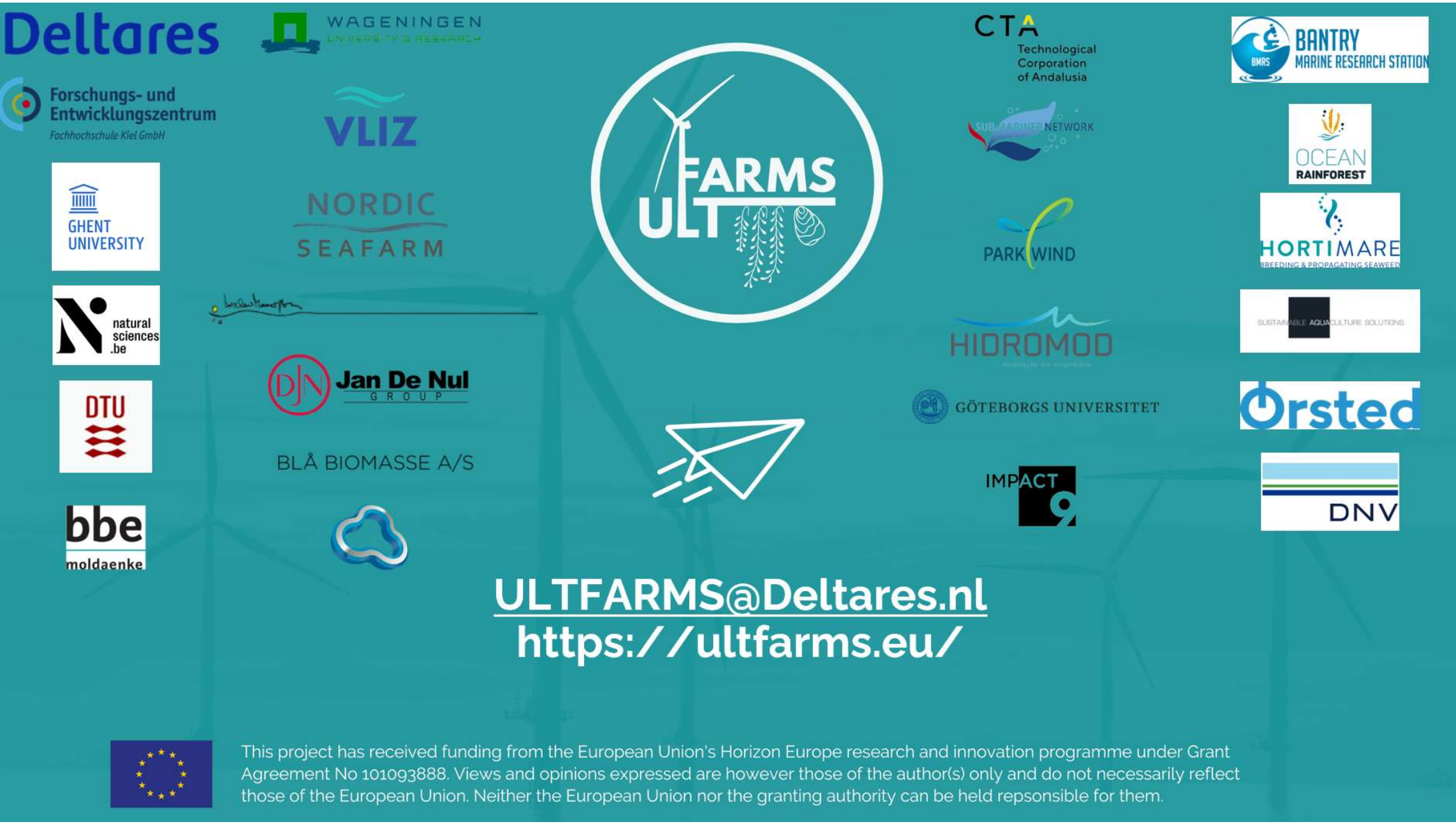

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