Multi-Use - a solution? Example: ULTFARMS

Eva Strothotte
SUBMARINER Members Assembly 2024, Berlin

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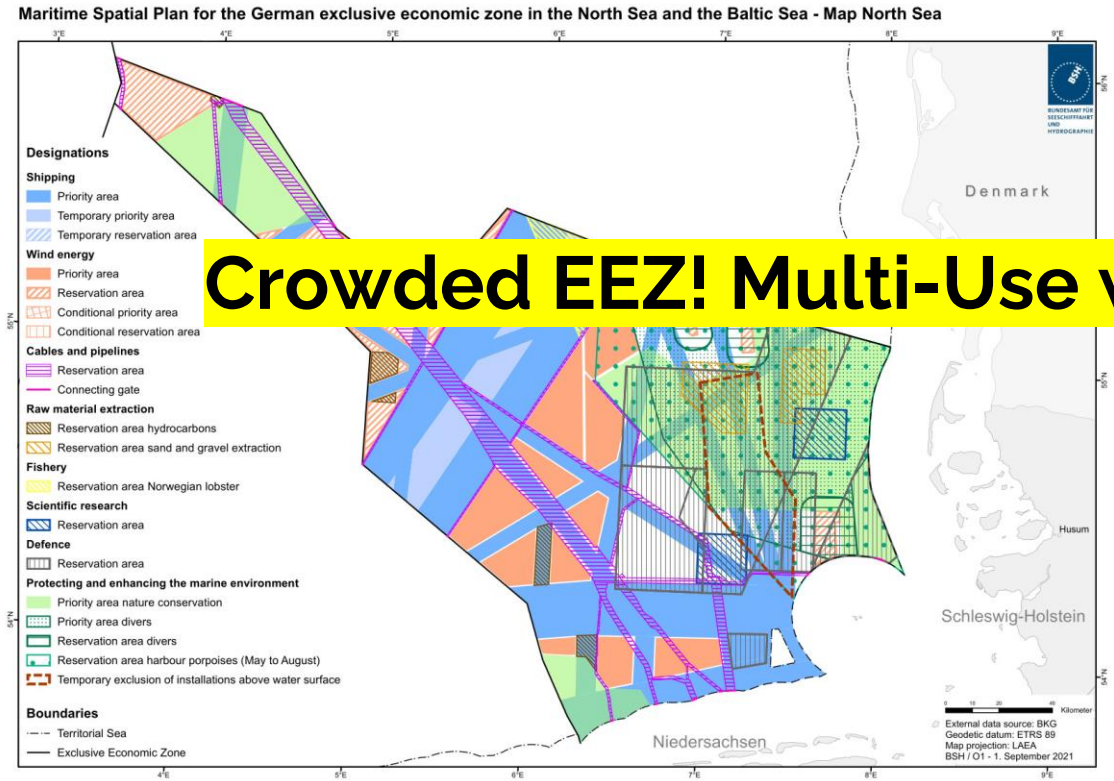
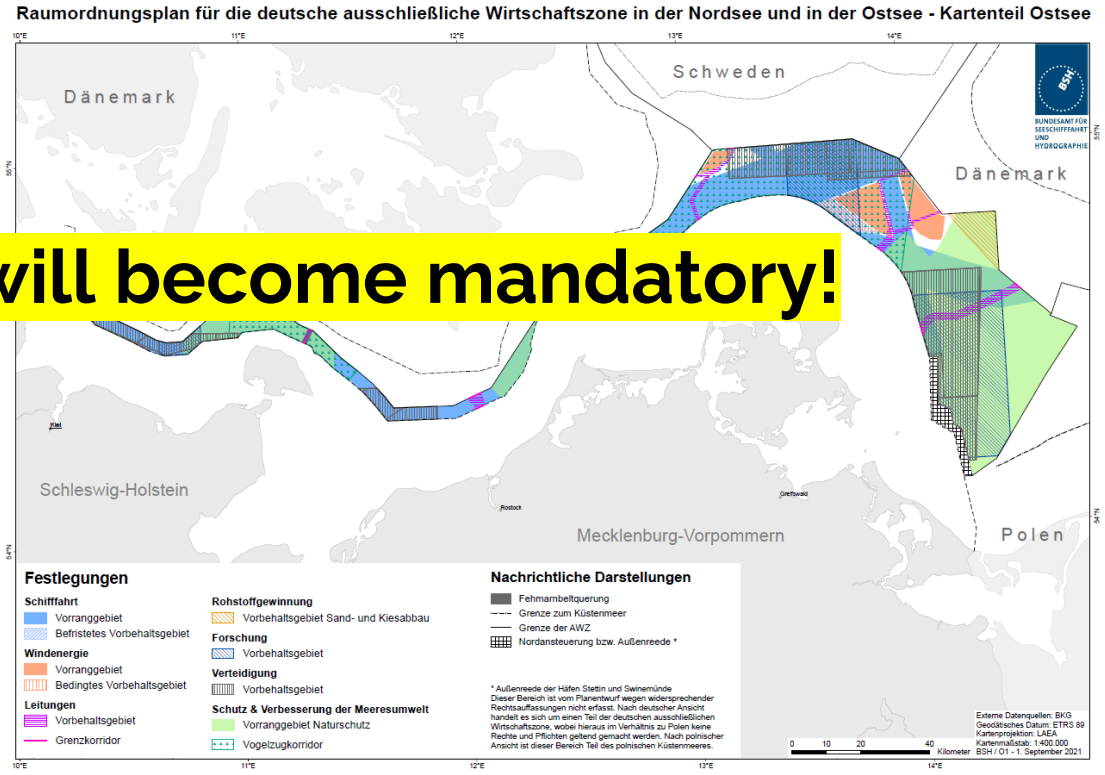
Where to go?



https://www.bsh.de/EN/TOPICS/Offshore/Maritime_spatial_planning/Maritime_Spatial_Plan_2021/maritime-spatial-plan-2021_node.html

Crowded EEZ! Multi-Use will become mandatory!



https://www.bsh.de/DE/PUBLIKATIONEN/_Anlagen/Downloads/Offshore/Raumordnungskarten/7007-2-Raumordnungsplan-Kartenteil-Ostsee.html

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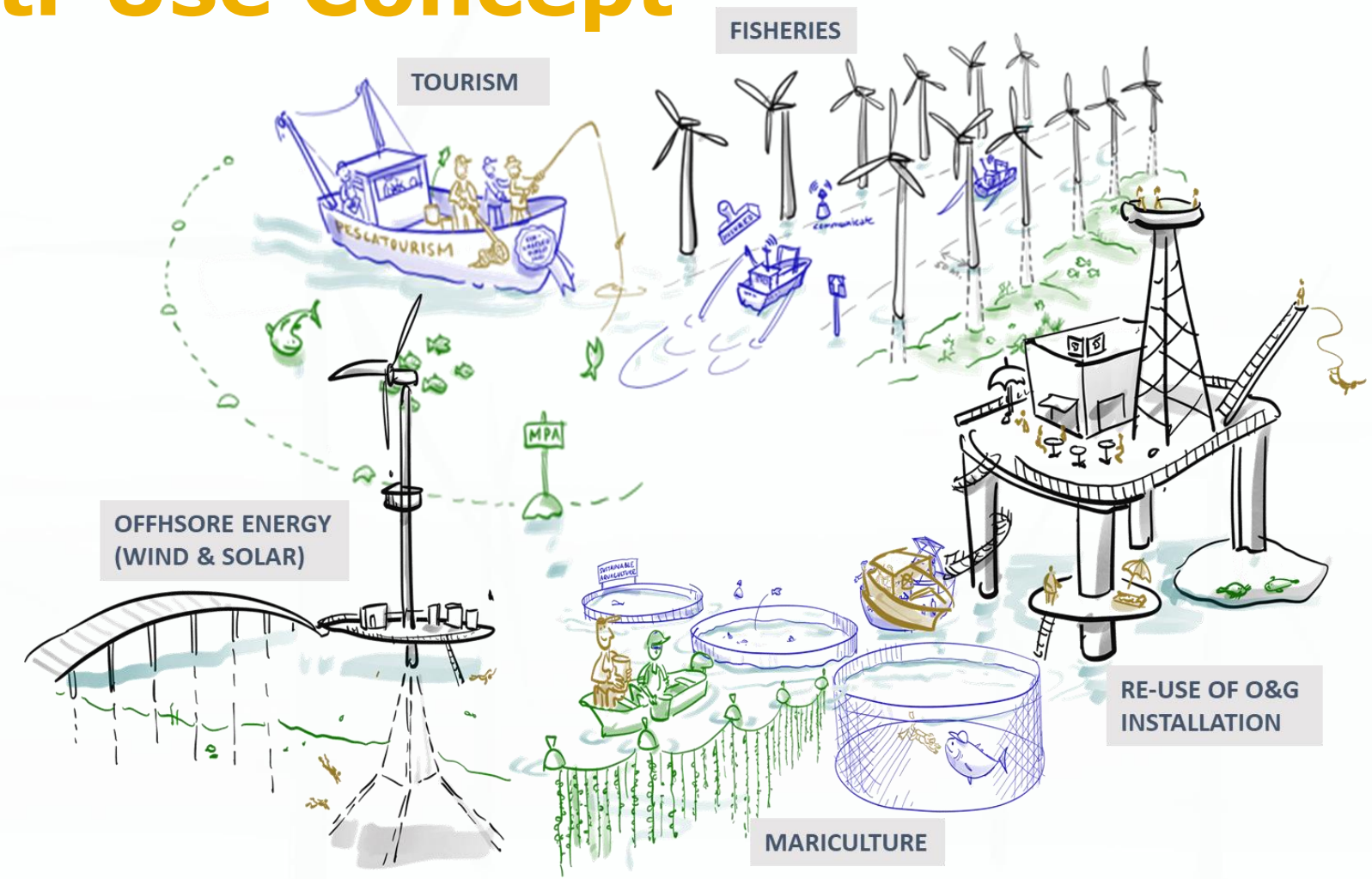
The Multi-Use Concept

Reduced Demand For Space For All Interests

Environmental Benefits

Socio-Economic Synergies

Efficiency and Cost Reductions



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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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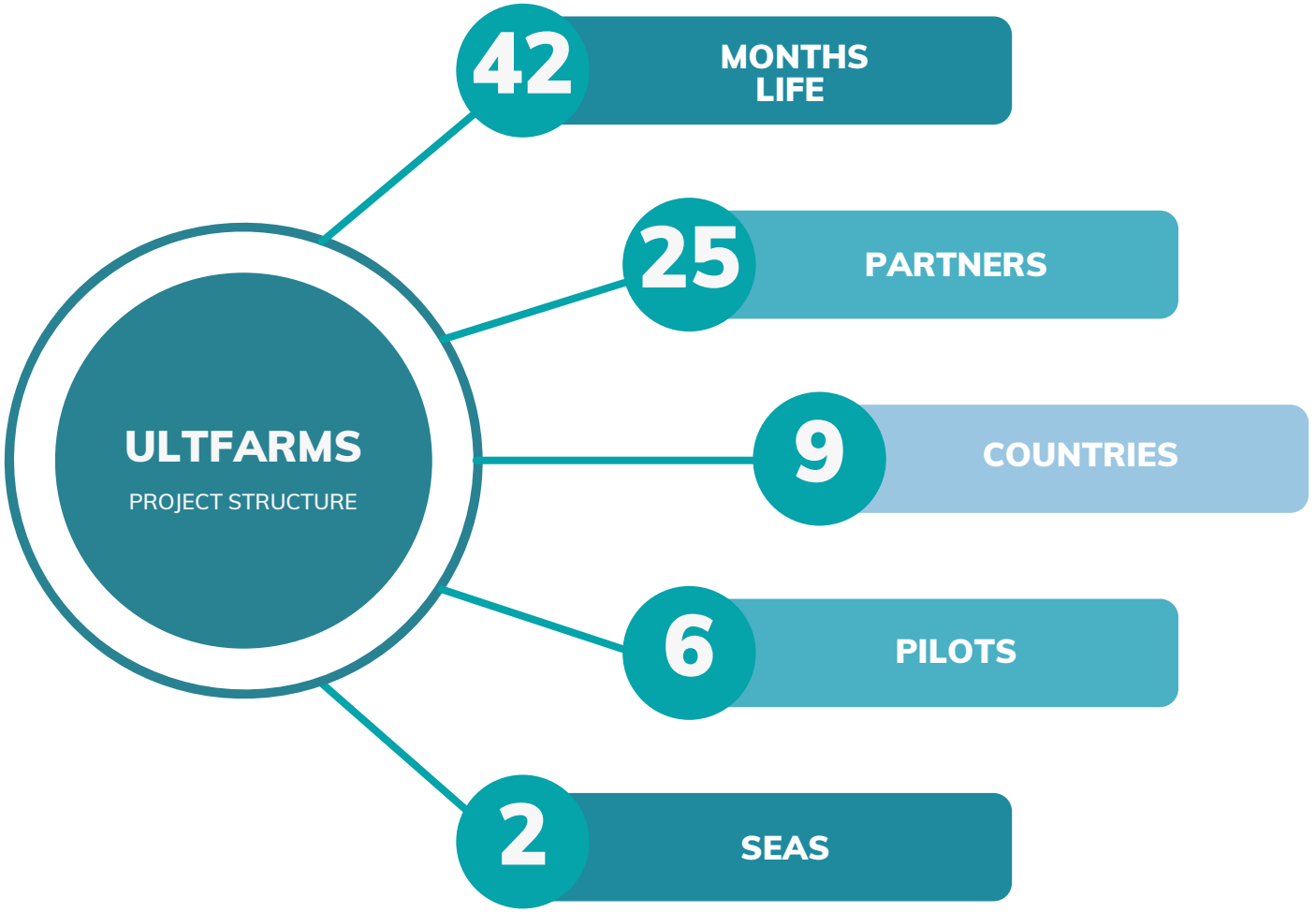
KEY FACTS



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SPECIFIC GOALS

- Enhance sustainable solutions for offshore aquaculture (molluscs and seaweed) in wind farms
- Implement efficient technical solutions (e.g. monitoring) for offshore LTA
- Develop a socio-ecological governance framework to achieve the full potential for LTA in a multi-use setting.
- Biodiversity restoration in offshore wind farms

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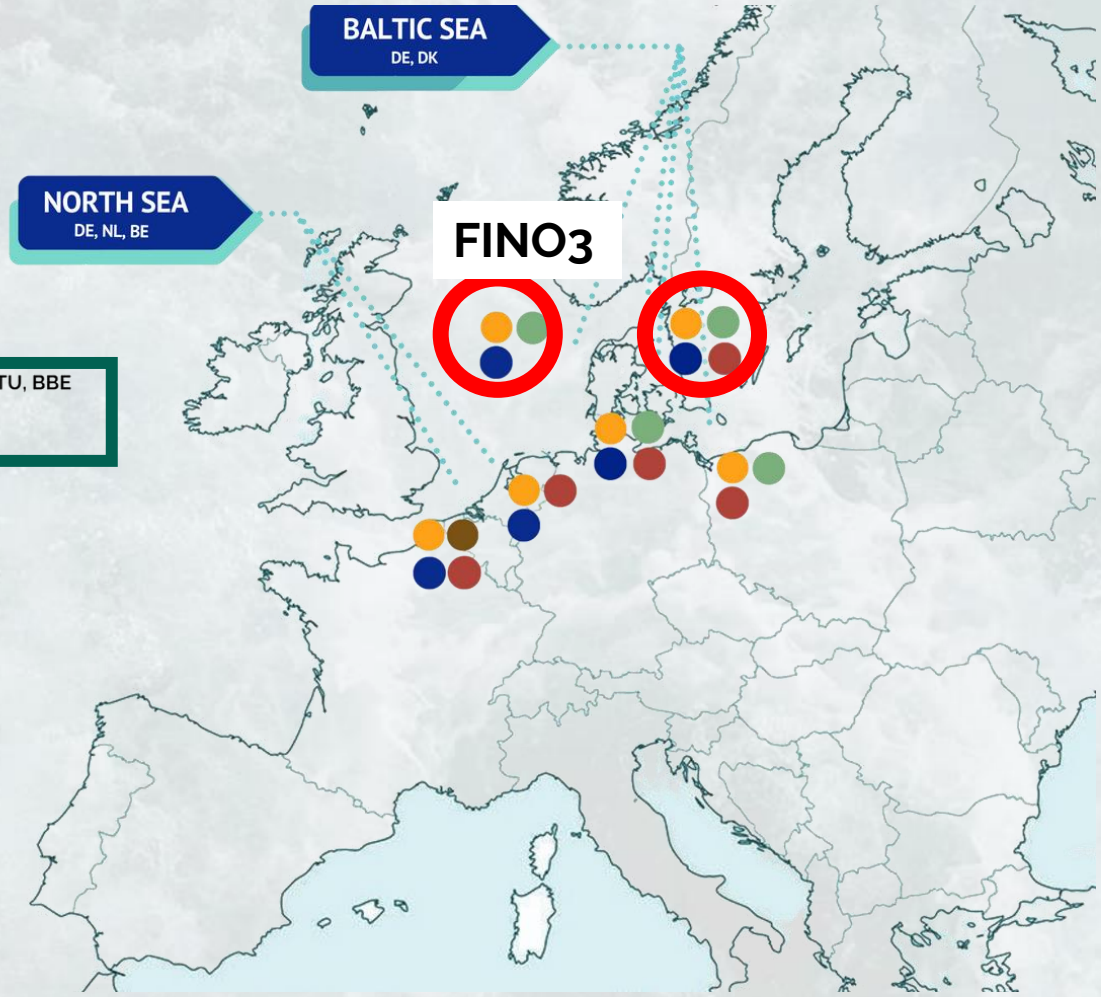
PILOTS

ULTFARMS´CASE STUDIES

	PILOT	COUNTRY	PARTNERS
1	Samsø	DEN	DTU, BBM, øST, NSF
2	Anholt	DEN	DTU, BBM, øST, NSF
3	Fino2	GER	FuE, SUB, KMF, DNV, UG, NSF, DTU, BBE
4	Fino3	GER	FuE, KMF, HOR, BBE
5	Borssele	NLD	WR, OOS, UGent, SAS
6	Belwind	BEL	UGent

Sectors covered:

- Mussels aquaculture
- Seaweed aquaculture
- Nature restauration
- Renewables
- Oyster aquaculture



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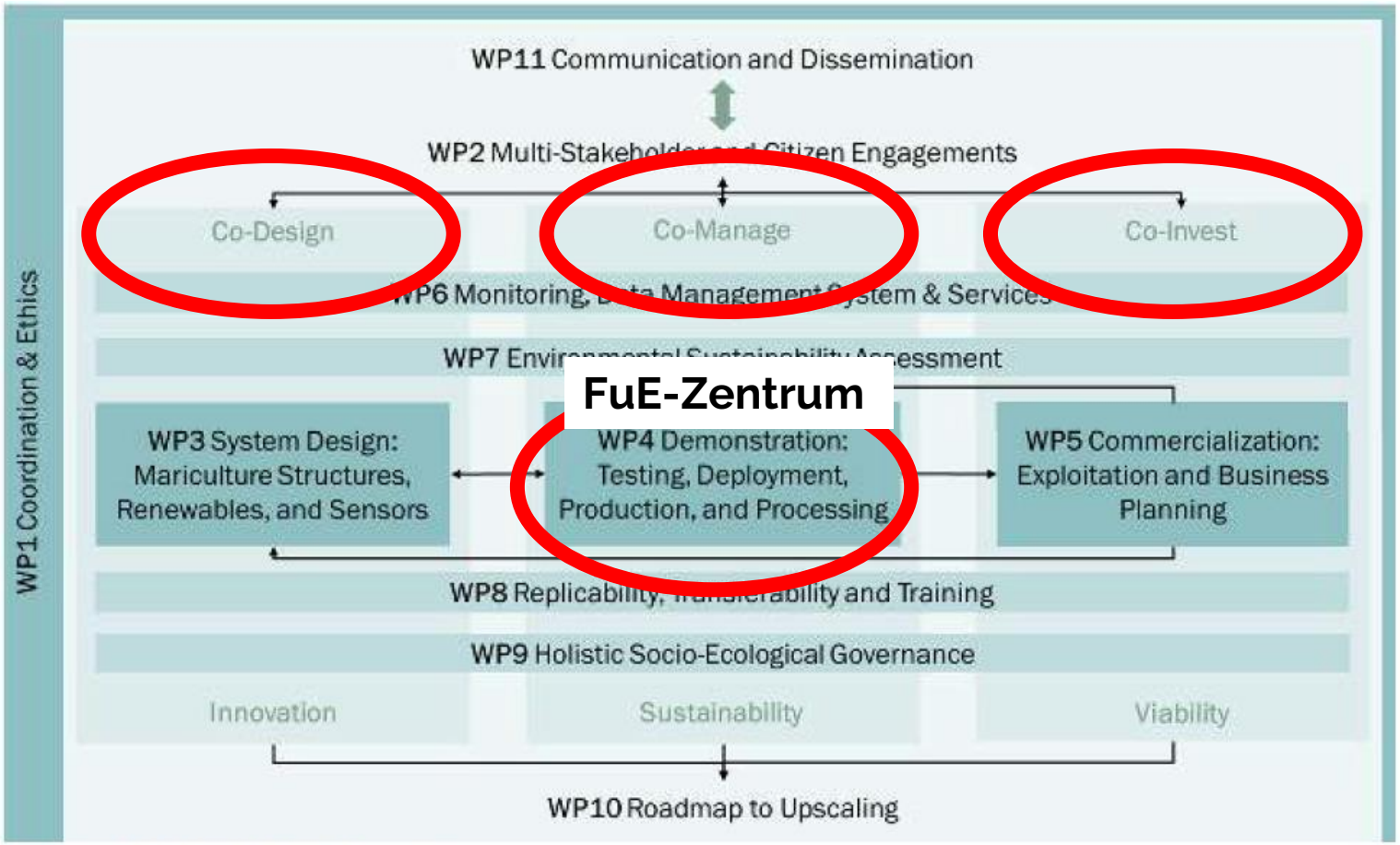

Figure 7 ULTFARMS Pert Diagram

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PILOT FINOS,Germany: North Sea

Partners:

- **Co-management** and **Co-design** to coordinate aquaculture with offshore operations, partners and stakeholders.
- Optimize **seaweed**, **mussel and oyster cultivation** techniques for **commercial scalability**, tailored to specific offshore conditions.
- Implement advanced remote and standard **monitoring systems** for efficient offshore management of remote system.
- Enhance biodiversity and environmental sustainability through **nature-inclusive designs (NID)**

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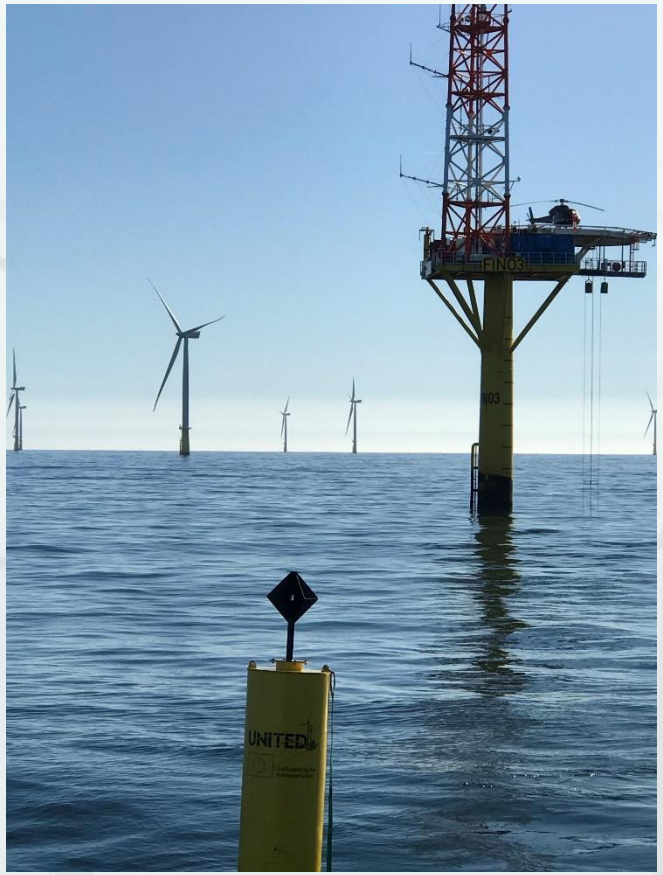
Short Pilot Description



TRL5 → TRL7

TRL 5 – Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 7 – System prototype demonstration in operational environment

FINO3, North Sea:	
Next harbour:	**97 nm**
Water depth:	**23 m**
Sign. wave height:	**9.2 m**
Max. wave height:	**17.9 m**
Wave period:	**10.7 – 13.9 s**

ps://www.fino3.de/de/medien/fotos/impressionen.html

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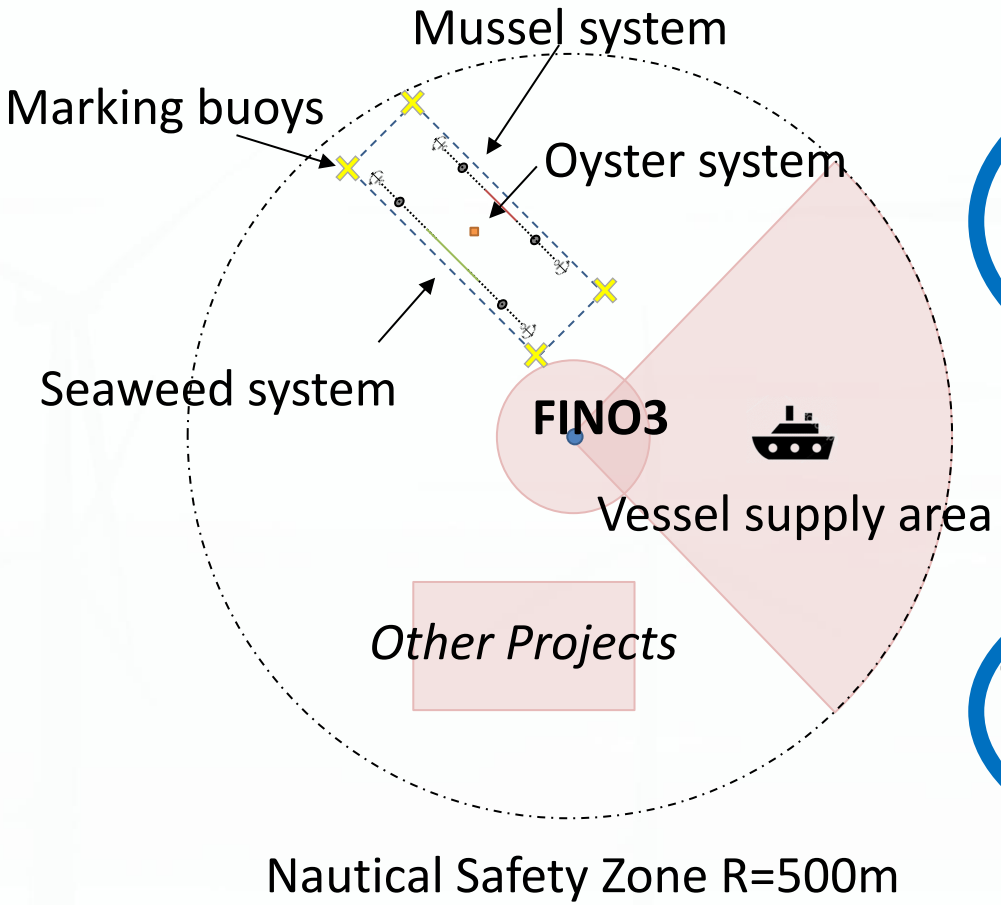
Short Pilot Description at FINO3



Multi Use: Co-Design & Co-Manage

Offshore Aquaculture

Legislation & Governance

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Offshore Wind Research

FINO 1 2 3

Shipping companies

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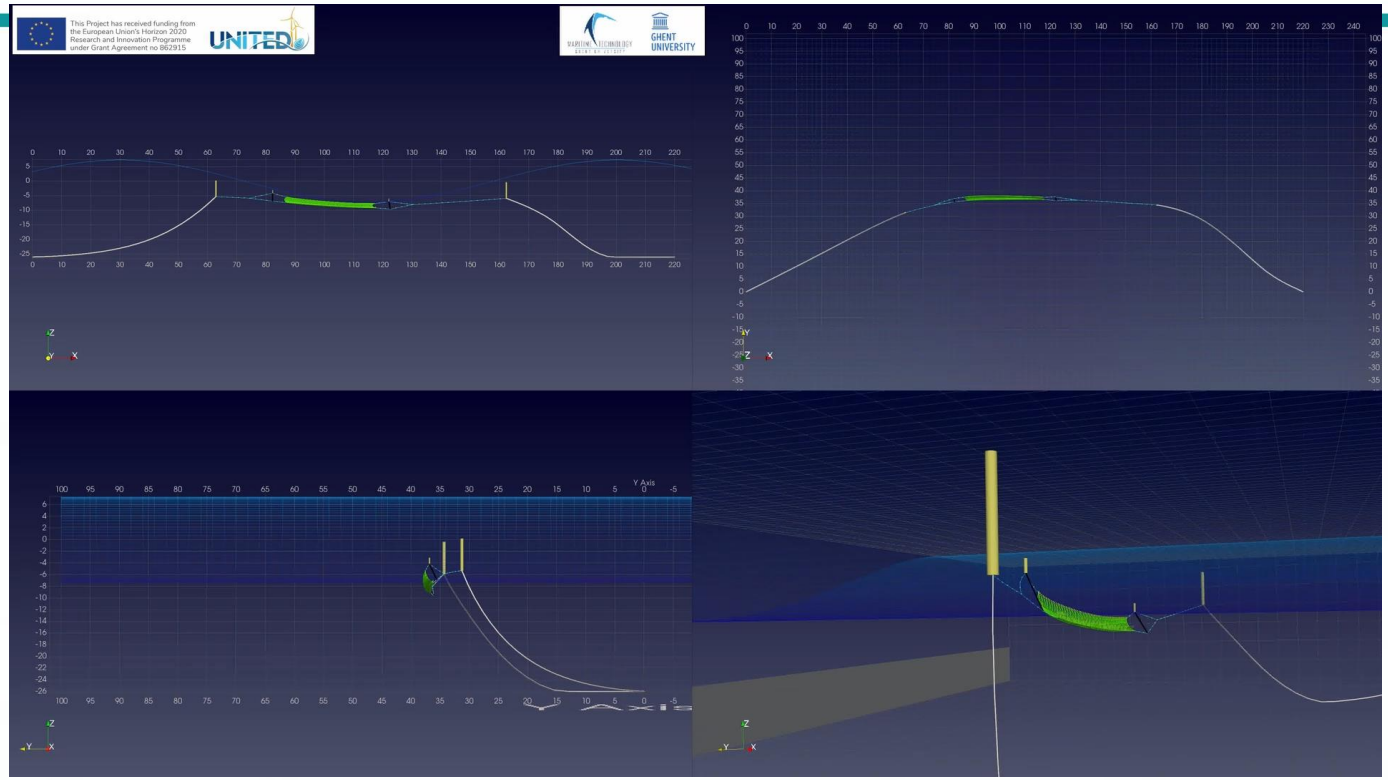
UNITED FINO3 pilot – Simulation

Structural Element	Maximum Tension at mooring chain (kN)	
Load case	No-Fouling	Fouling
1	171	174
2	246	249
3	408	373
4	153	160
5	244	265
6	121	101



	Wave					Current	
Case	input	return period	height	period	direction	speed	direction
[-]	[-]	year	[m]	[s]	[going-to]	[m/s]	[going-to]
1	Regular wave	1	11.2	11.1	South-East	1.20	South-East
2	Regular wave	5	14.5	12.1	South-East	1.20	South-East
3	Regular wave	50	17.9	13.9	South-East	1.40	South-East
4	Regular wave	5	14.5	12.1	South-East	1.20	North-East
5	Regular wave	5	14.5	12.1	North-East	1.20	North-East
6	Regular wave	5	14.5	12.1	North-East	1.20	South-East

[1] Strothotte, Eva, Strothotte Jaeger, Julian Pforth, Annelies Declercq, Brecht Stechele, Nancy Nevejan, Jessica Knoop, et al. *Delivrable 7.2 - Blueprint for the offshore site operation*. H2020UNITED, 2021. https://www.h2020united.eu/images/PDF_Reports/D72_blueprint_for_the_offshore_site_operation_v30220224.pdf.

and innovation programme under Grant
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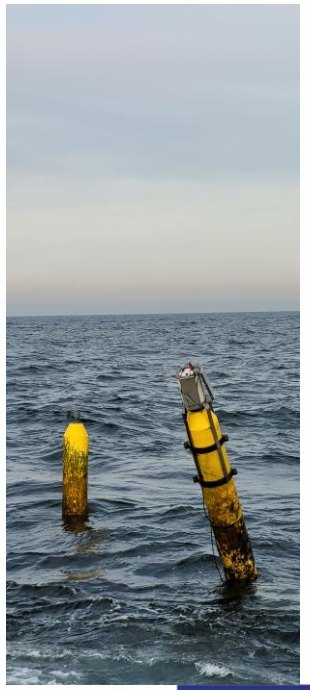
Monitoring the possible!



WEB-Cam

LoRaWan-Network

Satellite Connection

Data Buoy

FINO3

Onshore

Manual Transfer

Integrator: e.g.,: AquaReal

Chl a

light

Temperature

O2

Handheld Sensors

Watersamples for Chl a

Local-Data-Loggers e.g. HOBO

Underwater cameras

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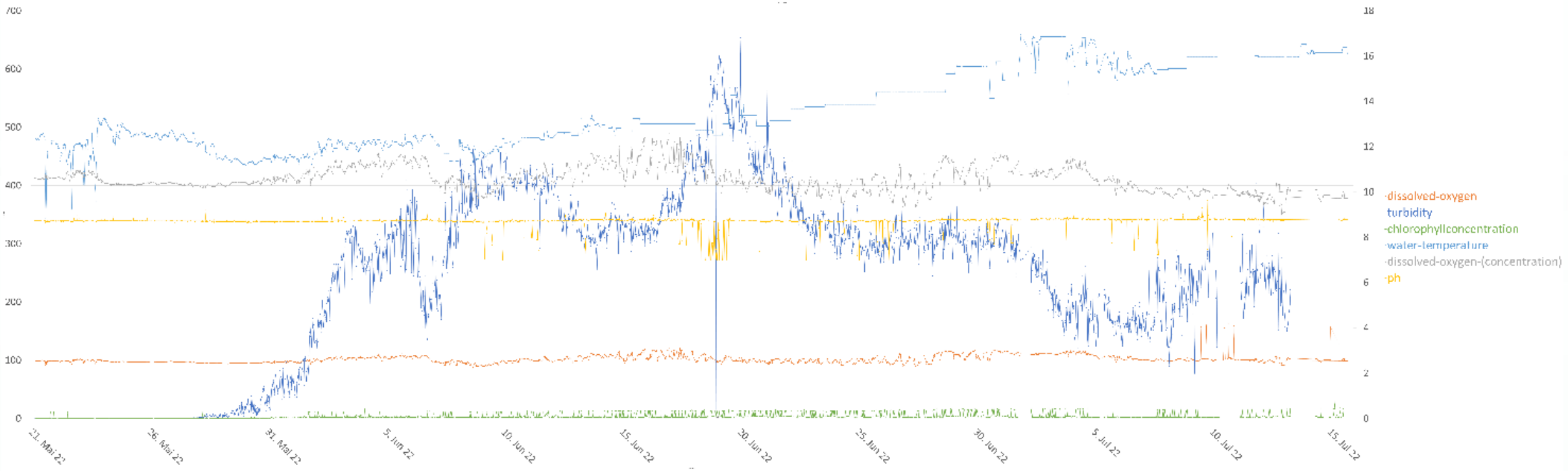
Remote data set



Remote Buoy Data sets, showing percentage of dissolved oxygen in orange, turbidity in dark blue, Chl a in green, water temperature in light blue, dissolved oxygen concentration in grey and pH in yellow

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Decision making process

Initial Information about options

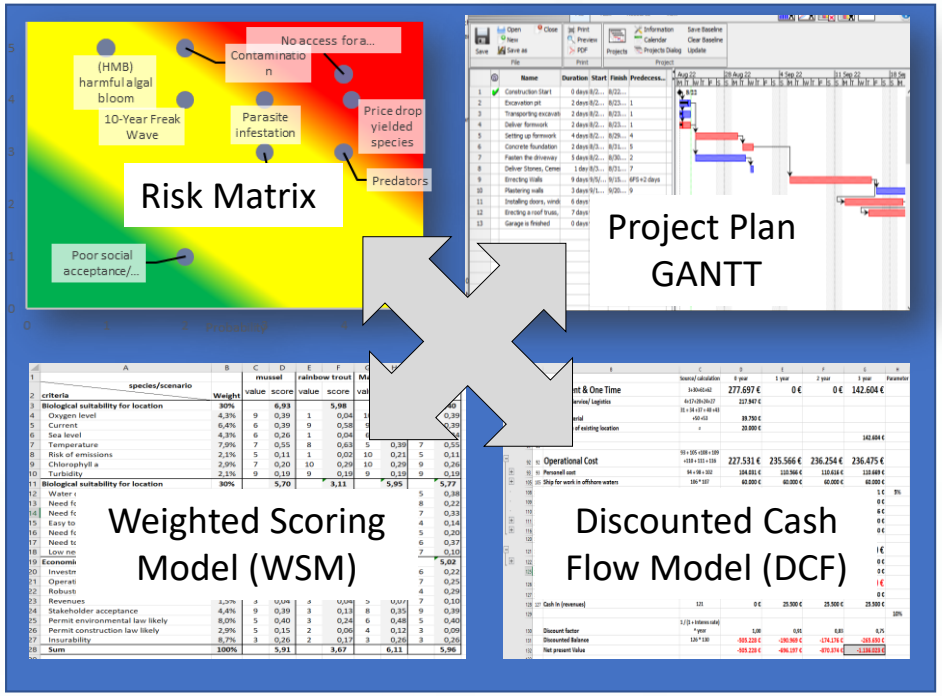
Change in environment

New information new options 1

Change/ Crisis

New information new options 2

...



Initial decision and plan

New decision and plan 1

New decision and plan 2

...

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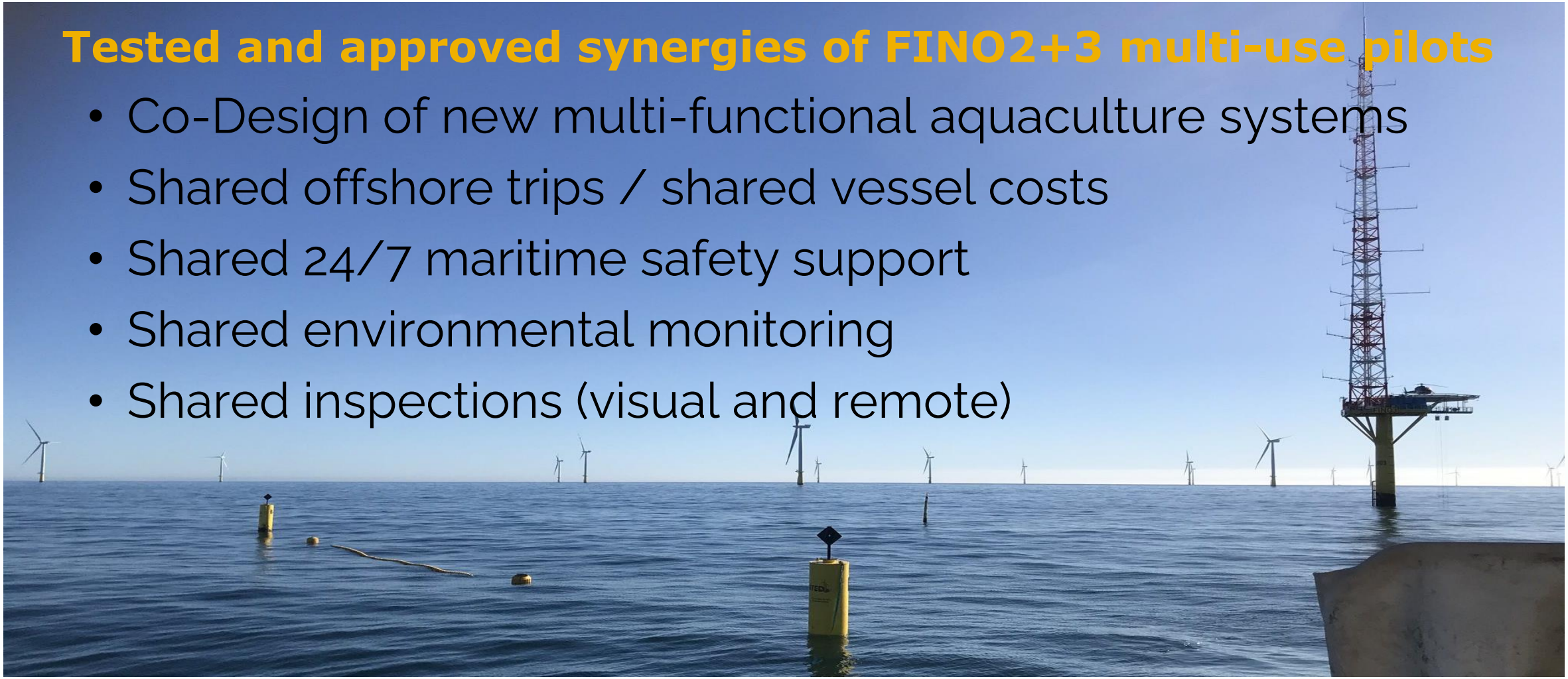
Tested and approved synergies of FINO2+3 multi-use pilots

- Co-Design of new multi-functional aquaculture systems
- Shared offshore trips / shared vessel costs
- Shared 24/7 maritime safety support
- Shared environmental monitoring
- Shared inspections (visual and remote)



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Some offshore impressions

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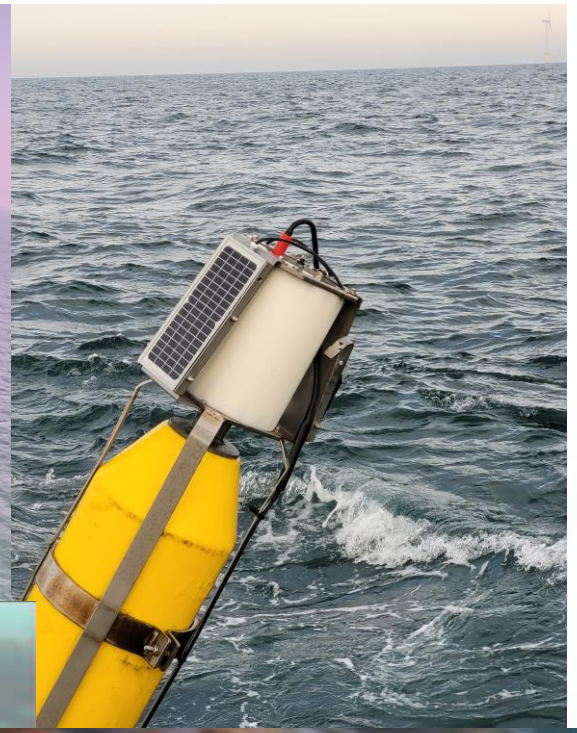

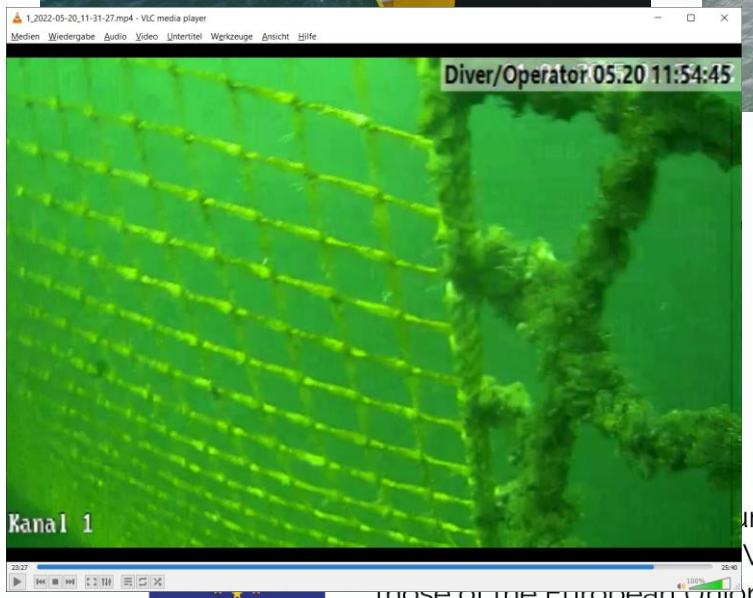

programme under Grant
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PILOT *FINO2, Germany: Baltic Sea*

Partners:

Forschungs- und Entwicklungszentrum
Fachhochschule Kiel GmbH

Ørsted

bbe
moldaenke

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.
A nature-inclusive design that adapts to specific Baltic Sea conditions is crucial for scalability, with effective marketing strategies developed to highlight the added value of a more expensive product.

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Short Pilot Description FINO2

TRL5 → TRL7

TRL 5 – Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 7 – System prototype demonstration in operational environment

FINO2, Baltic Sea:	
Next harbour:	30 nm
Water depth:	23 m
Sign. wave height:	6.2 m
Max. wave height:	12m
Wave period:	9 s

ps://www.fino3.de/de/medien/fotos/impressionen.html

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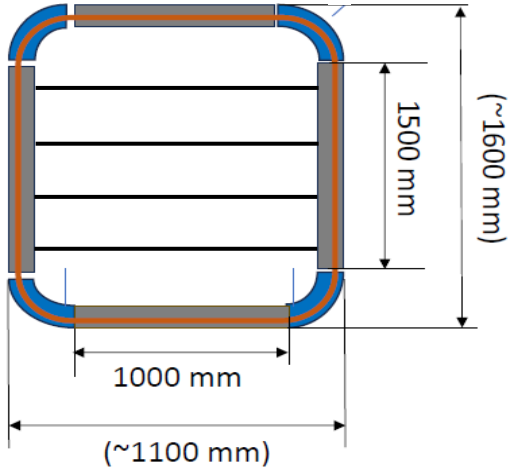
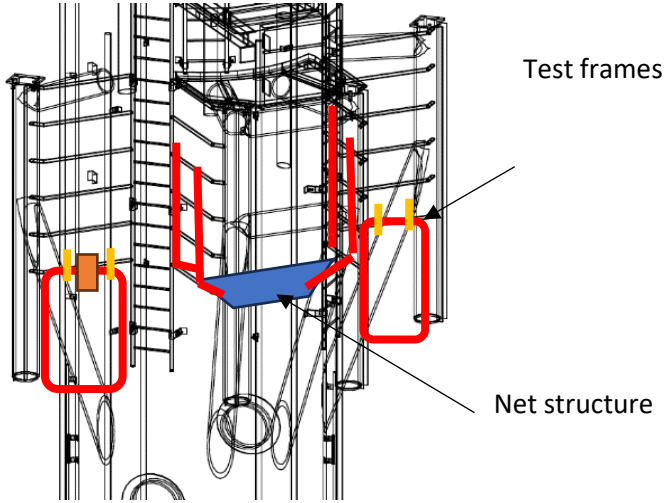
Baltic Sea FINO2: Co - Design phase

Forschungs- und Entwicklungszentrum
Fachhochschule Kiel GmbH

Novel Multi-Frame:
First Approach 2023





1. System Design

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Q1 2023 Q2 Q3 Q4 Q1 2024 Q2 Q3 Q4

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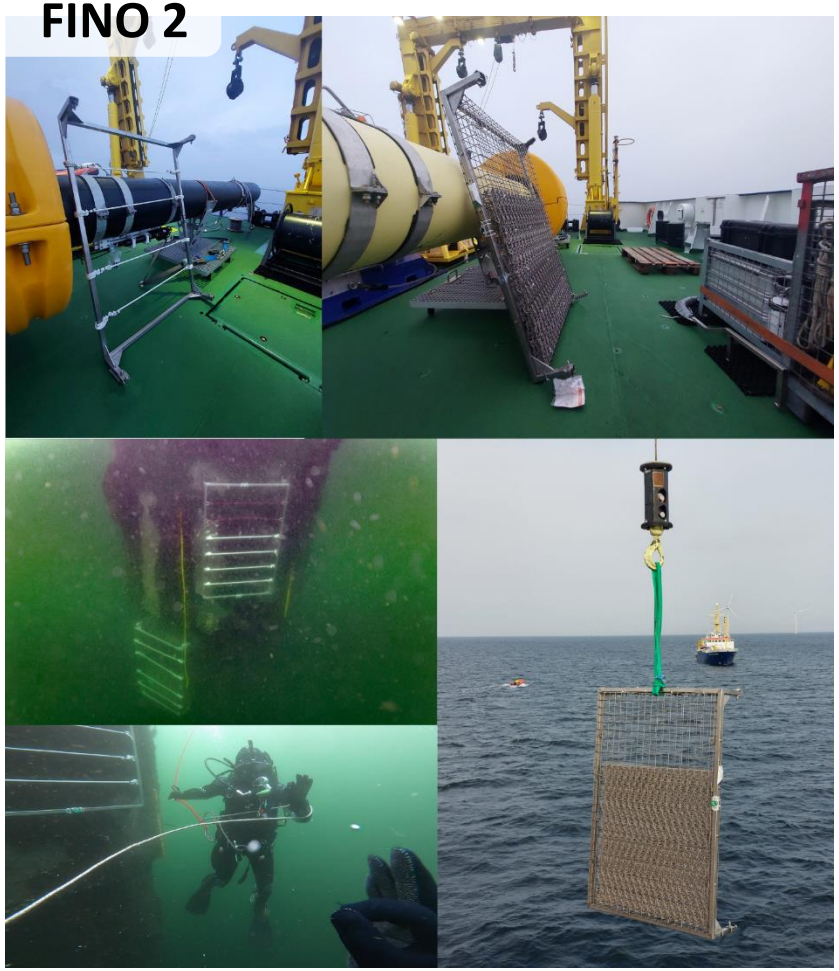
Multi-Use: Co-Design & Co-Manage

FINO 2



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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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