LOW-TROPHIC AQUACULTURE IN OFFSHORE WIND FARMS

THEMATIC ROADMAP

Lessons Learned



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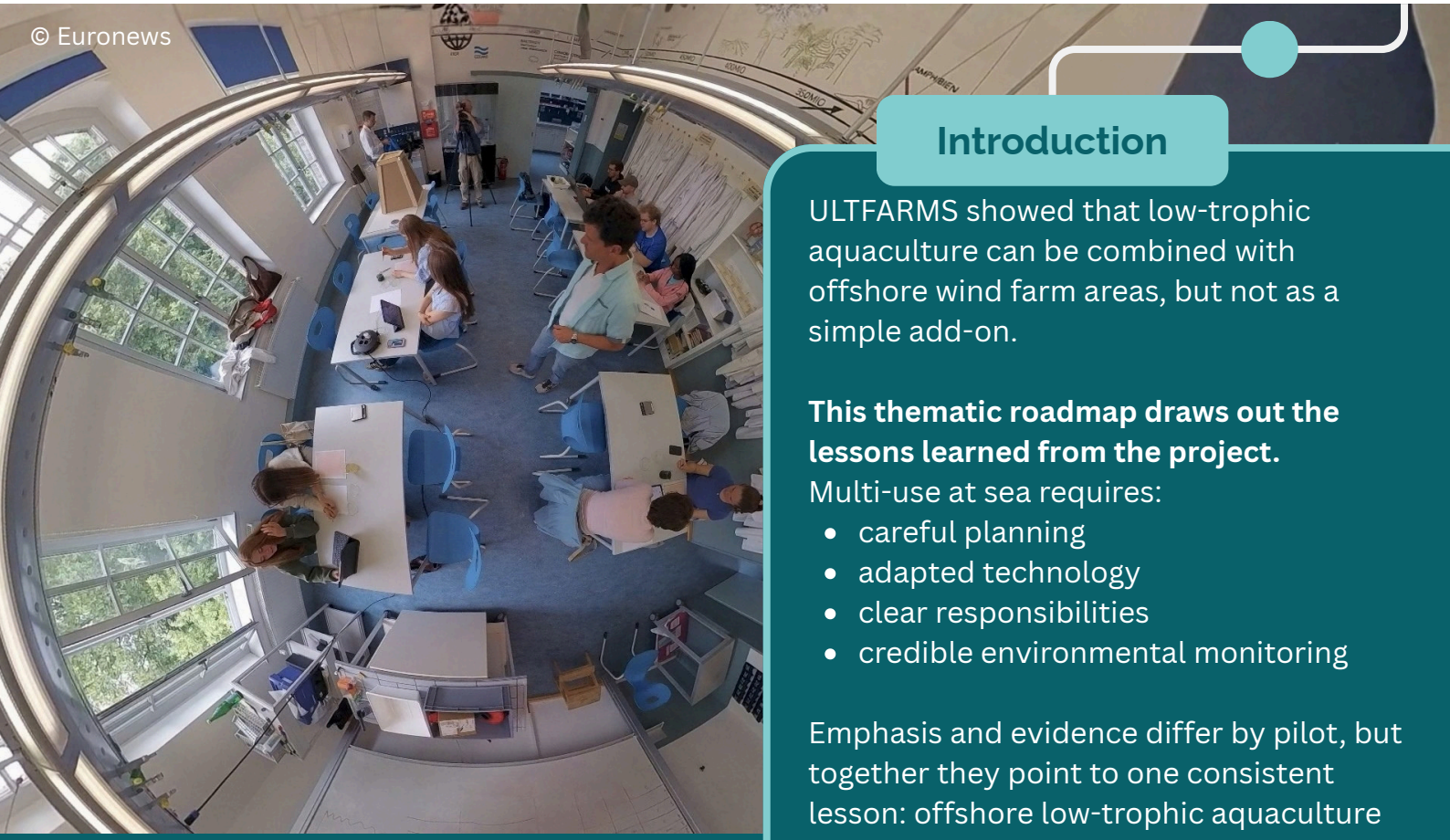
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Lessons Learned


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Introduction

ULTFARMS showed that low-trophic aquaculture can be combined with offshore wind farm areas, but not as a simple add-on.

This thematic roadmap draws out the lessons learned from the project.
Multi-use at sea requires:

- careful planning
- adapted technology
- clear responsibilities
- credible environmental monitoring

Emphasis and evidence differ by pilot, but together they point to one consistent lesson: offshore low-trophic aquaculture must be designed as an offshore activity from the start, not a copy of nearshore practice. For policymakers, industry and science, this means treating multi-use as a system challenge, developing technical design, licensing, safety, monitoring, business conditions and stakeholder trust together.

Why This Matters

Combining aquaculture with offshore renewable energy makes more efficient use of marine space. It can support seafood and biomass production without claiming separate sea areas, while contributing to climate and food-system objectives. Low-trophic aquaculture may also provide environmental benefits, such as water-quality regulation or habitat support, but these can not simply be assumed: they depend on species, site conditions, farm design, production intensity and the quality of monitoring before and during operation. This is why ULTFARMS' lessons matter beyond the six pilots: they help define what must be arranged before multi-use can be replicated responsibly.

Lessons learned

The ten lessons below bring together insights from the ULTFARMS pilots and thematic roadmaps. They show that successful multi-use depends on organising the technical, environmental, regulatory, operational and social dimensions as one connected challenge.

1 Planning

Plan multi-use before offshore wind deployment, not after problems arise. Considering aquaculture requirements early, such as where it can fit within the wind farm layout, as well as how vessels can safely access the site, which licenses are needed, and who is responsible for safety, operations and maintenance are all important. This also reduces uncertainty for authorities, developers and operators.

2 Co-design is essential

Practical solutions need early collaboration between engineers, aquaculture operators, wind farm operators, regulators, researchers and local stakeholders. This improves technical alignment, identifies safety and licensing constraints early, and builds trust across sectors that normally work under separate rules and risk cultures.

3 Offshore systems must be adapted to offshore conditions

Harsh weather, waves, currents and limited access create different requirements from nearshore aquaculture. Systems need robust designs, clear maintenance procedures, and contingency options. Designs, configurations and routines may need adjusting through iterative testing before wider application.

4 Operations and maintenance must be realistic and pre-agreed

Future projects need clear arrangements for inspections, repairs, vessel access, safety procedures and responsibilities, defining what happens when equipment is damaged, access is restricted, or activities need to pause.

5 Monitoring is key

Environmental and operational monitoring is key to responsible offshore aquaculture. Water quality, seabed conditions, biodiversity, farm performance and equipment condition need to be assessed before and during operations. Monitoring supports adaptive management, helps prevent negative impacts, and makes sustainability claims more credible for authorities, investors and the public.



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6 Environmental benefits must be demonstrated, not assumed

Low-trophic aquaculture can be designed to support marine ecosystems, for example through habitat structures or native shellfish restoration. However, positive effects depend on local conditions and farm design. ULTFARMS' Nature-Inclusive Design work and sustainability pathway show that broad claims about ecological benefits should be avoided unless supported by monitoring data and clear indicators.

7 Licensing and governance remain decisive for scale-up

Technical feasibility alone is not enough. Clear regulations, predictable licensing routes and well-defined responsibilities are needed before multi-use can move from pilots to wider application. Policy can help by clarifying where multi-use is allowed, which conditions apply, and how evidence on safety and environmental performance should be assessed.

8 Social acceptance and trust must be actively built

Multi-use projects need support from stakeholders and society. Trust depends on transparent communication about benefits, risks, monitoring results and responsibilities. Engagement should not only explain the concept, but also show how environmental impacts are managed and how lessons from pilots are used to improve future projects.

9 Scale-up depends on an integrated package

Replication needs workable operations, credible monitoring, clear governance and licensing, realistic business models and strong cooperation between science, policy and industry. Weakness in any one element makes scale-up slower and riskier.

10 Sea-basin cooperation must feed into national decisions

Platforms such as the Greater North Sea Basin Initiative, HELCOM-VASAB, the North Seas Energy Cooperation, OSPAR and EU-funded projects help align approaches across countries. But ULTFARMS showed that cooperation alone doesn't deliver multi-use: without routes from regional guidance into national maritime spatial plans and permitting, progress stays slow and uneven.



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Taken together, these ten lessons show that offshore low-trophic aquaculture can move beyond pilot-scale experimentation only when planned, operated and governed as an integrated offshore system. Technical feasibility is necessary but not sufficient: future projects also need predictable licensing, robust safety and maintenance arrangements, transparent monitoring, realistic business conditions and sustained stakeholder confidence.

Historical Note: Building on UNITED

UNITED reached a parallel conclusion across its own five pilots: that multi-use needs technology, economy, legal, social and environmental strands managed together, not solved in isolation. It produced its own cross-pilot synthesis report (D7.7) and a dedicated report on stakeholder involvement and trust-building (D5.5), both feeding into its Ocean Multi-Use Commercialisation Roadmap. ULTFARMS' ten lessons extend this same integrated approach specifically to offshore low-trophic aquaculture.

The Way Forward

Future offshore low-trophic aquaculture projects should build on ULTFARMS by moving from pilot learning to structured implementation. Policy should provide clear spatial and licensing pathways; science should support shared indicators, monitoring methods and evidence standards; industry should focus on robust designs, safe operations and realistic business cases. Together, these steps can make future projects easier to permit, safer to operate and more credible to scale.

Further Reading

ULTFARMS Deliverables

- D2.1 Stakeholder engagement strategies for pilots
- D3.1 Co-design of production-related activities
- D7.2 Nature-inclusive designing of offshore multi-use infrastructure
- D8.1 Harmonized recommendations for production systems
- D10.3 Guidance catalogue for offshore multi-use developments

ULTFARMS Policy Briefs

- Lessons learned, Knowledge Gaps and Outlook from All Pilots
- Role of Associated Regions and Transferability

OLAMUR Deliverables:

- D2.1 A protocol for multi-use for stakeholders
- D2.2 Report on micro-siting criteria and mapping of co-location scenarios within pilots
- D5.4 KPI monitoring report
- D6.1 Life cycle sustainability assessment of OLAMUR systems and associated restorative food production and supply systems

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