AN INNOVATIVE PLATFORM FOR NEW CIRCULAR AQUACULTURE MODELS: THE CASE OF MULTI-TROPHIC SYSTEMS (IMPAQT PROJECT)

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Introduction

One of the major challenges to EU aquaculture growth is the optimization of the production systems while ensuring that environment impacts are minimized. In this context, IMPAQT is a European project that aims at validating in-situ a multi-purpose, multi-sensing and multi-functional management platform for a sustainable IMTA production. This project also seeks to validate the Integrated Multi-Trophic Aquaculture (IMTA) concept, adopted by 6 different pilot farms in Scotland, Ireland, The Netherlands, Turkey and China. IMPAQT also promotes the transition towards a circular economy business model, where the sustainability of the processes is a driver for the circularity.

A tailored made platform for IMTA production systems have been defined in the project, looking at end-users and stakeholders needs. To do so, several requirements have been defined, identifying the attributes that aim at boosting the sustainability within the multi-trophic production systems. These attributes are also expected to maximize the social, economic and environmental benefits of the new aquaculture systems.

This paper entails the assessment of the circularity associated to the new aquaculture model based on multi-trophic systems, where each attribute is analysed concluding how they are aligned with the circularity principles.

Material and methods

The circularity assessment of the new aquaculture model is firstly based on a qualitative approach for the evaluation of synergies areas between the circularity principles and IMPAQT management platform. Secondly, the attributes of the platform are prioritized through a quantitative approach to identify the most relevant requirements that promote circularity. Finally, recommendations are provided for the industry in order to increase the sustainability of the systems paving the path for a circular economy.

Three main principles that set the basis for the circular economy (Ellen MacArthur Foundation, 2015), can be summarized as follows:

1. Preserve and enhance natural capital controlling finite stocks and balancing renewable resource flows.
2. Optimize resource yield by circulating products, components and materials in use at the highest utility always in both technical and biological cycles.
3. Foster system effectiveness by revealing and designing out negative externalities

IMPAQT platform design is based on several business requirements, the more prominent ones to be as follows:

- BR-01: Structured storage and archiving of IMTA system data
- BR-02: Optimal collection time (fed)
- BR-03: Optimal seeding time
- BR-04: Optimal feeding time
- BR-05 Maximise production
- BR-06: Optimal species grading during each growth stage
- BR-07: Disease prevention and mitigation
- BR-08: Optimal collection time (non-fed)

- ❖ BR-09: Breeding / Broodstock (fed/non-fed)
- ❖ BR-10: Infrastructure, stock integrity and security and damage control
- ❖ BR-11: Environmental and regulatory compliance
- ❖ BR-12: Minimal environmental footprint

Results

The qualitative and preliminary evaluation of the meeting points between the circularity principles and the platform attributes are summarized in the table below:

Table 1. Circularity of IMPAQT platform and multi-trophic production model

	Principle 1	Principle 2	Principle 3
BR-01: Structured storage and archiving of IMTA system data	✓	The multi-trophic system promotes the circularity at biological level.	✓
BR-02: Optimal Collection Time (fed)	✓		-
BR-03: Optimal seeding time	✓		-
BR-04: Optimal feeding time	✓		✓
BR-05 Maximise production	-		✓
BR-06: Optimal species grading during each growth stage	✓		
BR-07: Disease prevention and mitigation	✓		✓
BR-08: Optimal Collection Time (non-fed)	✓		✓
BR-09: Breeding / Broodstock (fed/non-fed)	✓		-
BR-10: Infrastructure, stock integrity and security and damage control	✓		✓
BR-11: Environmental and regulatory compliance	✓		✓
BR-12: Minimal environmental footprint	-		✓

Once the principal synergies have been preliminary analysed, principle 2 is identified as the circularity dimension that is totally addressed by the multi-trophic production. Through the multi-trophic systems, some of the uneaten feed and wastes, nutrients, and by-product are recaptured and converted into harvestable and healthy seafood (Chopin, 2013). Therefore, all IMTA components have a key role in recycling processes within the systems, where the bio mitigation operates under a circular economy approach.

Conclusions

Based on the attributes of IMPAQT platform and the Multi-trophic systems, relevant synergies with Circular Economy have been identified. The contribution of the IMTA systems to the circularity of nutrients have been highlighted in the analysis, since it is totally aligned with principle 2 under a biological perspective. The assessment has also revealed that most of the management practices promote the resources consumption and this aspect should be prioritized for increasing the circularity on the aquaculture systems.

Bibliography

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