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Pilot 1 TARAS

Testing Algae Applications in Recirculating aquaculture systems (RAS) to improve aquaculture circularity potential in the SB region (PL)

AquaLoop Kick-off meeting

Rostock | 7-9 November 2023

Filip Pniewski, University of Gdańsk

#AquaLoop

https://southbaltic.eu/

Background and challenge

Problem

Every animal farm always faces the same problem - pollution of waters due to animal metabolism and feed.

RAS and semi-RAS systems are only a partial solution to the problem (pollutants collected and disposed after treatment)

Combining ideas:

- zero waste
- zero pollution
- development of new value chains
- increase of sustainability of existing RAS and semi-RAS systems
- Introduction of circularity

University of Gdańsk: https://old-en.ug.edu.pl/

RAS experimental system, University of Gdańsk:, photos: Basia Dmochowska

Blue Platform

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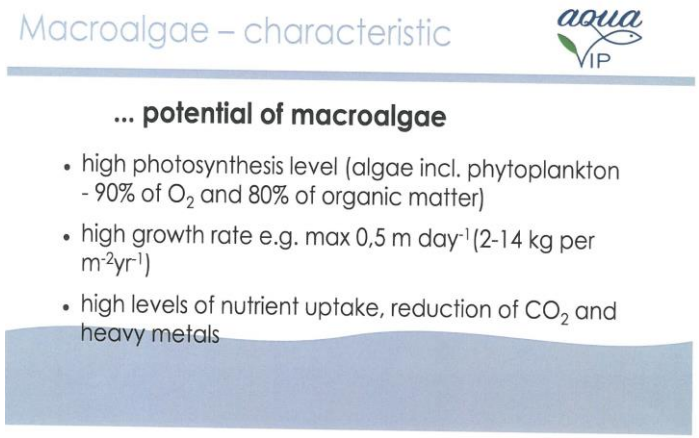
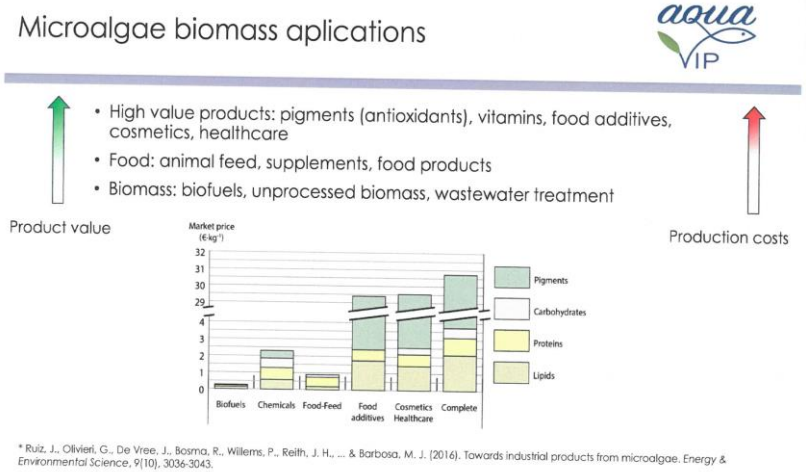
Background and challenge

Benefits of combining RAS and algae

- reduction of costly water treatment
- expanding the range of food and products from aquaculture
- additional value chain related to microalgae
- development of economomy and circularity.





Macro- & microalgae application findings, AquaVIP project (Photos, slides: A. Zgrundo, M. Klin)

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Background and challenge

Potential

Results of previous projects showed aquaculture potential of shrimp aquaculture and Baltic algae:

- **Shrimps** – RAS aquaculture
- **Macroalgae** – RAS waters purification and positive effects on animal welfare
- **Microalgae** – screened for growth in RAS waters and adapted but their commercial potential needs to be investigated

Litopenaeus vannamei, at the UG, InnoAquatech project (Photo: Piotr Kendzierski)

Macro- & microalgae instalations at the UG, and algae strains developed on RAS water, AquaVIP project (Photos, slides: A. Zgrundo, M. Klin)

Solution

Pilot 1: TARAS – Testing Algae Applications in Recirculating aquaculture systems (RAS) to improve aquaculture circularity potential in the SB region (PL)

1. Led by PP2 with contribution of all PPs
2. With the aim to develop technology on cultivation of shrimps and specific strains of microalgae, for recirculating aquaculture system (fish and shrimp RAS facilities) effluent purification, while producing high-value algal biomass, and to demonstrate applications of the biomass produced (in cooperation with the networks of APs).
3. Focused on testing, demonstration and results delivery

Solution

Shrimps RAS aquaculture

Effect of dietary supplementation on growth performance, bioenergetics and health status of *Litopenaeus vannamei*

Litopnaus vannamei - individual cultured at the UG during InnoAquaTech project (photo: InnoAquaTech archive)

Diet: from the selected manufacturer (e.g., Le Gouessant, Spezialfuttermittelwerk Beeskow, Aller Aqua, CreveTec)

Supplement: probably betaine (a multifunctional nutrient that acts as a chemoattractant or osmolyte in osmotic regulation, improving growth performance and resistance to pathogens)

Breeding: two cycles, each approximately 4 months (T=25^{o}C, S=30 psu, feeding frequency: 6 times per day)

Post-Larvae: WhitePanther Hatchery (Austria), à 1000 per cycle

Studied indicators: body weight gain, scope for growth (SFG), net growth efficiency (K2), infections (bacterial, viral, fungal) and abnormalities in digestive, circulatory and respiratory systems

Waste water: filtration, UV irradiation, nitrification and use for microalgae production

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Solution

Microalgae production and application

- Water from the RAS systems will be collected, and used as a medium in algae cultures.
- Water chemical composition (nutrient content) will be determined.
- Specially designed photobioreactor panels with a large surface area for absorption of light will be used for algae cultivation.
- Two phased approach will be used; cells from the culture medium (phase I) will be transfered to the effluent (phase II) – cells will be harvested by centrifugation and then resuspended in the RAS water. Subsequent, biomass will be collected and subjected to biochemical analysis.
- *Know ho*w of high-value algal biomass production and its use as a natural purifier of RAS effluent will be delivered.

Algae strains developed on RAS water, AquaVIP project (Photo: M. Klin)

Solution

Macroalgae RAS water purification and harvesting

Macroalgae will be tested for water purification and harvesting at UG RAS facility.

Potentially two demonstration sites to test, demonstrate and communicate the concept of circularity to different target groups will be chosen:

1. Commercially farmed fish (chosen RAS or semi-RAS fish farm)
2. Rehabilitated seals pools (Marine Station keeping seals unable to live in the wild in salt water pools).

Organisms will include: green algae of the genus *Ulva* to remove excess nutrients and provide biomass for further testing.

Macroalgae instalations at the UG, AquaVIP project (Photo: A. Zgrundo)

Seal sanctuary, Hel Marine Station: https://eholidaypoland.pl/noclegi/hel/fokarium-i1108

Example of a semi-RAS trout farm, Upilka trout farm, in the Pomorskie region (Photo, B. Dmochowska)

Activities

Pilot main activities

2.1 Development of pilot 1
Preparatory activities for pilot's development including desk research, consultations, identification of the most promising solutions, (e.g. sample materials, species that are relevant, potential for further applications), laboratory and trials' set-ups.

2.2 Testing for results delivery
Carrying out testing, focused on reduction of waste and water use/loss, production of valuable by-products, including testing innovative solutions, performance and efficiency analysis, additional necessary analysis, recording of results and observations.

2.3 Pilot's demonstration
Demonstrating the circular approach within innovative aquaculture production methods, during science festivals, fairs, and training activities in connection with WP3: TrainingLoop activities 3.3, 3.4, 3.6, and WP4 SupportLoop activity: 4.4.

2.4 Pilots results delivery and communication
Preparation of protocols and communication to the stakeholders

Target group

The target group will include

- students and PhD students engaged in the experiments

- **SMEs** interested in pilot results and applications

- fish farmers and aquatic animal breeders facing the problem of water pollution, as a result of their activities (producing post-culture wastewater with a high content of nutrients).

The report to be delivered from the pilot will serve this group as **a source of methodology** to apply for better environmental and economic benefit.

What is more important the target group of **the demonstrations** will be very broad including **fish farmers and visitors** of the demonstration facilities.

Activities

Pilot 1 cross-WP activities

3.3: Development of training programme for students
The framework, curricula and manuals for the student TrainingLoop program will be developed in connection with Pilot 1.

3.4: Implementation of TrainingLoop for students
Organization and running of the TrainingLoop programme for LP, PP2 and PP3 students, cross-border student exchange between partner countries to provide practical training in different circular pilots within WP2.

3.6: Implementation of TrainingLoop for professionals
A short course for professionals and stakeholders will be organized on-site in connection with Pilot 1

4.4: SupportLoop study visits
A study visit to the Pilot 1 facility will be organised.

4.7: Circular aquaculture conference
Pilot 1 results will be presented at the final conference.

Activities

Workplan for Pilot 1 main activities

Activity	Brief description of the activity	2023/2024 reporting period	2024/2025 reporting period		2025/2026 reporting period		2026 reporting period
		Sep -Mar	Apr -Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Aug
Activity 2.1	Development of three cross-border physical pilots	X	X				
Activity 2.2	Testing for results delivery		X	X	X		
Activity 2.3	Pilots demonstrations			X	X	X	
Activity 2.4	Pilots results delivery and communication	X	X	X	X	X	X

Outputs and results

The primary outcome of TARAS pilot will be the development of a scientific basis for the creation of well existing system within chosen RAS, with the methodology for further application, with special emphasis on know-how development on cultivation of high-value shrimps, macroalgal biomass, and specific strains of microalgae.

The **demonstration** sites themselves will raise awareness of the stakeholders: fish farmers, researchers, and visitors showing the environmental and economic sustainability of the circular systems.

Outputs:

1. **Cross-border pilot focused on testing and demonstration.** The pilot will be documented, confirming the joint development (PPs & APs meetings, consultations, workshops with stakeholders) and by pilot implementation report included in pilot protocol.
2. **Pilot 1 protocol** will be included in the PilotLoops toolbox, delivered and available on the AquaLoop platform.
3. **Enterprises** interested in circular aquaculture solutions tested in Pilot 1 will be approached.
4. **Applications taken up or upscaled of the Pilot 1 protocol** by different groups of stakeholders will be delivered.

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