

21 June 2023

SUBMARINER Network Aquaculture Working Group meeting. Let's talk about Aquaponics!

The second session of the year of the Aquaculture Working Group was held on June 20. About 25 participants gathered online for two hours to discuss different projects and topics related to Aquaponics.

Maria José de la Peña, from [SUBMARINER Network For Blue Growth EEIG](#), moderated the session. She shortly introduced the SUBMARINER Network, the working groups (algae, mussels and aquaculture), and the [TETRAS project](#), which works on recirculating aquaculture systems (RAS) in combination with other industrial processes for the efficient use of resources (water) and improving the environmental and economic sustainability of RAS in the Baltic Sea Region. One of the four pilots from TETRAS will have a small-scale RAS and aquaponic system for data collection and social awareness. Learn more about Pilot 4 located in Guldborgsund, Denmark [here](#).

AWARE – Aquaponics from Wastewater Reclamation

The session started with a presentation by Fabio Ugolini, from [INNOVA](#), about the [AWARE](#) project – Aquaponics from Wastewater Reclamation. This HORIZON project has a budget of 5.1M euros and started recently in November 2022, and will run until October 2026. The project aims to create a new farm-to-fork value chain for European economic growth and urban KM 0 farming. By providing EU towns with an aquaculture system independent of natural water bodies, the project seeks to foster the circular use of resources and enhance food production systems' resilience to climate change, while making valuable use of urban space, empowering local communities, and enabling urban farming.

Fabio emphasized the increased need for seafood in Europe as a low-carbon footprint protein and the political will of the European Union to increase the aquaculture seafood production, which currently only amounts to 26% of the total seafood production, whereas the worldwide average is 60%. The growth is still limited for different reasons, f.ex. due to lack of access to space and water and complicated national regulations, among others, and innovative production systems are needed to overcome these barriers.

So far, according to data from 2021, the main freshwater aquaculture production systems in Europe are tanks and raceways (65%) and extensive pond systems (33%). Only a tiny number of RAS (2%) exist, which

have several advantages compared to the traditional systems: nutrient recycling, water conservation, reduced environmental impact, and multitrophic.

AWARE seeks to integrate aquaponics with wastewater treatment to increase the resilience to water scarcity further, to make use of low-value space, to exploit residual heat and nutrients, and to foster urban farming and local production. Achieving these goals is quite complicated, but the project members can build on experiences from a former Horizon project regarding advanced tertiary wastewater treatment which ensures the removal of residual pollutants and contaminants, such as heavy metals, microplastics, and antibiotics. The project will build the first European Aquaponic farm running on reclaimed water and demonstrate a novel food value chain with technological, social, and political innovation. The pilot farm will be located in the town of Castellana Grotte (Italy). The pilot will include two systems, one control system running on natural water and the other using reclaimed water to facilitate comparisons. The Municipal Wastewater Treatment plant will carry out primary, secondary, and tertiary treatment, which results in reclaimed water fit for discharge and irrigation, which will then be treated in an advanced tertiary treatment step (advanced biofilter, UV-C LED, and microfiltration) before using it in the aquaponic RAS system.

In the first year, iceberg lettuce and tilapia shall be produced. After checking the toxicological and nutritional profiles of the produced seafood and vegetables, the products will be tested by volunteers. Socio-economic and legal analyses will be done, business cases will be developed, and consumer acceptance will be tested.

So far, it is a pilot because there is no existing regulation for this. The project wants to demonstrate the feasibility and inform policy on a European level to facilitate replicability in other countries, especially countries facing water scarcity in the Mediterranean. Further studies are planned on microbial communities in nutrient bio-cycling, extraction of collagen from the fish, conversion of fish waste to insect meal, and plant-enhanced filtration. The project wants to reach commercial scale (10 times the size of the pilot) between 2027 and 2030.

Fabio finished his presentation by giving an outlook on 2050, assuming that 100 cities take up the concept.

Q&A session

- Regarding the permits, is the main issue the use of wastewater?

There is not yet an aquaponic in Europe that uses reclaimed wastewater, and no policy allows it. There have been attempts in the 1970s in Germany, but they all failed. Zeitgeist hopefully has changed. For ornamental fishes, it already exists in Munich, but not for fish for human consumption. In Asia, southern China, and South America, the practice is already established, but not regulated, and it wouldn't comply with European standards.

- Rolf Morgenstern shared that there is a similar project from Fraunhofer Institute (<https://suskult.de/>). In his experience, suitable facilities are rather outside of the cities and in rural sites, with agricultural areas around. So that aquaponics can be economically viable, they need a lot of space (approx. ratio 1:10), and there might be competition with traditional agriculture and backlash from farmers. He also suggests verifying the numbers shown to produce fish and vegetables. If more fish than vegetables were produced, the produced volume of nutrients would exceed the potential uptake capacities of the plants. He doubts that the fish sludge would be suitable to feed insects as they probably wouldn't like the consistency. From a technological point of view, it might be better to return the sludge to the waste water treatment plant system.
- How do you get rid of heavy metals and drugs that you often find in wastewater?
By applying the advanced tertiary water treatment that has been validated in a former project. More information on the method can be provided by email.

Fabio Ugolini

f.ugolini@innova-eu.net

ProGireg and INCITIS Food

Rolf Morgenstern, from the South Westfalia University of Applied Sciences in Germany, continued the session by presenting two projects, starting with **ProGireg**, which stands for 'productive Green Infrastructure for post-industrial urban regeneration.' The Horizon 2020 project is about to end, and after a long process, they had the opening ceremony of the aquaponic system last Friday (16.06.2023).

The project is not only about aquaculture but about nature-based solutions (NbS) for urban regeneration, city planning, more sustainable cities, and co-design. In four front-runner cities - Dortmund (Germany), Turin (Italy), Zagreb (Croatia), and Ningbo (China)-, eight different NbS have been implemented. In Dortmund, five NbS were selected for implementation; one of them is an aquaponics system.

They encountered lots of difficulties finding an appropriate site. The hypothesis that in post-industrial industries, space is an available resource proved wrong; they found lots of competition around available space. Finally, two greenhouses have been constructed at the site of the former Hansa Coking Plant, which stopped operations in the 1990s and is nowadays used as a museum. A considerable issue represented the contamination of the soil, and foils usually used to cover waste dumps had to be purchased and used under the greenhouses, which had a substantial impact on the financial resources of the project as this was not included when planning the budget. The set-up of two greenhouses will allow to compare data.

Rainwater is collected and stored in a wall of tanks inside one of the greenhouses. The greenhouses are set up in a Chinese style, in the direction from east to west. It's standard greenhouses that are retrofitted so that the low-standing winter sun hits the wall of stored tanks and warms up the water, and in summer, the wall works as a sun shield.

The intention is not to market food products through conventional channels like supermarkets because profit margins there are very low. You would need to have a much bigger system (more than 1ha) which is not possible within city limits; instead, the hydroponic rafts are available to interested citizens for rent, a system the project copied from the established urban business model "rent a field", where you can rent parcels without being responsible for the soil preparation, etc. A monthly fee will be paid, which decouples the income from the produced volume.

When asked, the participants from the working group meeting indicated being willing to pay between 20 and 50 Euro monthly, but the willingness might also depend on the volumes that can be harvested.

Due to the COVID-19 pandemic, the co-designing process was not possible as planned, but students developed lots of prototypes, and the system is now almost entirely set up. As the greenhouses are unheated, they need to think about how to use them during winter times; microgreens might be an option as they need less light.

The system will also be used within the curriculum and the course on urban agriculture for project works and master thesis. A digital twin of the aquaponic will f.ex. be developed, and a sensor system will be established to gain more data. Home automation sensors are sufficient, there is no need to purchase expensive sensors for industrial use.

Learn more about the aquaponic system [here](#). And if you want to learn even more, you can meet the team at VERTI FARM in Dortmund next September 26-28, 2023.

The second project is called the **INCITIS food project** (INTEgrated and Circular Technologies for Sustainable city region FOOD systems in Africa), which is implemented together with the Universität der Bundeswehr München.

In six African countries, eight Living Labs will be set up, where people are trained to use aquaponic systems so that they can produce for the local markets or sell aquaponic systems to others. The project focuses on the training of vulnerable groups and entrepreneurship.

Site visits in an informal settlement showed that vertical pipes didn't work well, but good examples for insect farming, (crickets for human consumption – really tasty! -, and black soldier flies – mainly for aquaculture feed).

Q&A session

- Which institutional actors did you need to get involved?
 - The company running the site (to rent the space)
 - The environmental department (because of the soil contamination)
 - Hazard analysis and critical control points (HACCP), the concept for food security had to be approved by the regulatory office “Ordnungsamt”
 - No fishes yet – but in the future, the veterinarian department will need to approve.

- To make an aquaponic profitable, how big does it need to be?:

If you're growing for the commercial market, probably 1ha is necessary (see feasibility study from Aquaponik manufaktur) with a ratio of 1:10 (aquaponic:hydroponic). The ratio also depends on the species and their nutrient output.

The company that produced herbs in supermarkets in Germany just went bankrupt. I probably also wouldn't put greenhouses on roofs because it is a technological problem to build safe greenhouses in height with the wind. It is difficult to reach profitability, that's why we chose the model of community supported aquaponics.

- Is the nutrient content always optimal or do you need to add nutrients?

Probably not, we know that we have to add iron.

The correlation between nutrient provision and yield is very different, f.ex the correlation between phosphorus and nitrogen.

Nutrient optimization might be overrated as a topic; almost no data is available about the tolerable levels of nutrients for fish.

Rolf Morgenstern

morgenstern.rolf@fh-swf.de

Open Space for pitches

The SAVRY

Tobias Lipsewers presented the [Finnish Aquaponics Society \(SAVRY\)](#), a non-profit organization established in 2021, aiming to promote, develop & commercialize aquaponics in Finland by focusing on the four aspects of education, communication, organization, and research.

With currently seven people, they cover a broad range of knowledge (aquaponics, hydroponics, Recirculating Aquaculture Systems (RAS),

urban gardening, etc.) and are working on a funding proposal for their work. SAVRY is currently looking for new board members for the executive committee. Besides, people interested in joining their mission are welcome to become members. No membership fees are charged.

Besides working for SAVRY, Tobias also offers consultancy services for aquatic ecosystems (f.ex. system development, feasibility studies, fish diseases, parasites etc.) for private and commercial use. More information and contact details will be shared with the participants of the meeting by email.

Tobias Lipsewers

tobias.lipsewers@gmail.com

Decoupled Aquaponics

Hendrick Monsees/Leibniz Institute of Vegetable and Ornamental Crops, IGZ) shared his knowledge on Decoupled Aquaponics. According to his research, in a decoupled system, decoupling aquaculture and hydroponics, productivity in terms of harvest yield can be increased by 30 %. Decoupled components allow to regulate the nutrient and pH-level better to ensure optimal growth conditions for both fish and plants. Additionally, by separating the fish from the plant unit, safety can be increased, f.ex. in case of any disease that needs treatment. The demonstrator produces catfish and tomatoes, and the products are sold on-site, which allows for higher prizes.

The topic of coupled vs. decoupled systems might be further discussed in another working group meeting as there was a lot of interest and debates around, but no more time left to go into the details.

School of Aquaponics

Pierre Garsi, from the [Lycée Professionnel Olivier Guichard](#), talked about the vocational school in Guérande, France, close to Nantes, where more than 500 students between 14-20 years are signed up for technological and professional training courses in eight professional sectors. The school owns 25 ha of

land, one agriculture farm and one learning restaurant. The agriculture section includes 4 facilities: Marine aquaculture, Freshwater fish farm, Horticulture and Aquaponics. The aquaponics facility exists for more than ten years. All facilities were built by themselves together with the students; therefore, it is relatively low-tech facilities but also easy to replicate and adapt with low investment needs.

They act like a small company within the school, selling fish and vegetables to the school cantina and shop. They produce more than 1t of fish yearly – very diversified species. They tried more than 25 sorts of vegetables, and 8 species of fish, currently rainbow trout and cress in the winter and basil, tomatoes, and pike perch in the summer. They teach different techniques, the welfare of the fish, and the reproduction of the fish, with a particular focus on RAS because there is not so much water available on the farm, trying to keep the water quality and using the least water possible. Further problems they encountered: adapting the pH level, theft of fish and vegetables, and electricity cuts during the night.

They welcome more than 2,500 visitors per year and have lots of cooperation with scientific and professional partners and projects.

Aquaponik Manufaktur

Ingo Bläser talked about [aquaponik manufaktur](#) and what they do. Aquaponik manufaktur was founded in 2014 with a focus on large-scale aquaponic systems, water treatment in aquaponics (anaerobic treatment), small-scale aquaponics training in African locations and European regions and multitrophic (IMTA).

Highlights: In 2016, they started building experimental bioreactors (anaerobic) for scientific projects; scientific aquaponic systems and developed trainings. They have experience with Integrated farms; an example was shown, which integrates aquaculture, chickens, zooplanktons, mushrooms, algae, microgreens, and more. They are also involved in the project “Close the loop – new urban food” on nutrients and circularity.

Their experience in feasibility studies showed that a peri urban aquaponics farm needs to be at least 2.000m² in space to be economically feasible in Germany.

During the meeting, we saw the work of aquaponik manufaktur in Rolf Morgenstern and Hendrick Monsees presentations. Looking forward to see more of what aquaponik manufaktur is doing!

www.aquaponik-manufaktur.de

Mark your calendars! See you in Gothenburg in November!

Before closing the session of the Aquaculture Working group, **Efthalia Arvanati**, **SUBMARINER Network**, showed an overview of the current project portfolio of the network and presented **BlueMissionBANOS**, which supports the EU Mission Restore our Ocean & Waters in the Baltic and North Sea to make the blue economy carbon-neutral and circular.

All participants are invited to register for the **Mission Arena**, which will take place from **November 14-16, 2023**, in Gothenburg, Sweden, with a focus on the following subregions: Norway (South), Sweden (West-South), Denmark (East), Germany (Baltic, Schleswig-Holstein).

More info: www.bluemissionbanos.eu/events



BLUE MISSION BANOS

1st MISSION ARENA

14-16 NOVEMBER 2023 GOTHENBURG SWEDEN

SUBREGIONS
NORWAY | South
SWEDEN | West-South
DENMARK | East
GERMANY | Baltic | Schleswig-Holstein

MORE INFO SOON: www.bluemissionbanos.eu/events

Up-coming AWG activities

From now on, TETRAS will coordinate the Aquaculture Working Group activities, so we invite you to follow the project's progress to stay tuned for future meetings. It is important to highlight that despite the meeting evolving around the topic of aquaponics, all aquaculture-related projects and topics are invited to participate in the Aquaculture Working Group meetings.

For feedback or topics for our next meetings, please contact **Maria J. de la Peña** (mp@submariner-network.eu).

TETRAS – Technology Transfer for Thriving Recirculating Aquaculture Systems in the Baltic Sea Region



www.interreg-baltic.eu/project/tetras/



tetras@submariner-network.eu



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