AquaVIP Gdynia summer school

Framework & curriculum
TBC March 2021

Framework

1. **Title:**
   "Aquaculture – promising solutions of technologies for the South Baltic Region: RAS – shrimps – aquaponics – algae"

2. **Aim:**
   In the South Baltic area, aquaculture is not a widespread established sector yet. Practical training courses are crucial for the development of the graduates skills. The purpose of the AquaYouth summer schools is **boosting labour market through the development of aquaculture students skills and expanding their career opportunities.**

   The program of the summer schools is based on previous partners educational experience and solutions on innovative aquaculture, as well as the identification of crucial gaps in knowledge and skills in the aquaculture sector delivered by the outcomes of InnoAquaTech and BluePlatform projects, and the initial actions of the AquaVIP project (cooperation, interviews with experts).

3. **Date and place:**
   Poland: Institute of Oceanography, University of Gdańsk
   (online/onsite event – covid19 situation dependent)
   17-20 May 2021

4. **Duration**
   4 days: Monday-Thursday

5. **Language of instruction:**
   English/Polish

   Covid19 related precautions & solutions:
   - online webinars will be delivered in English or Polish – depending on the participants and interest
   - practical/laboratory activities/study visits will be carried out in Polish, if Polish participants will be the only ones to participate, in English – in case of international participants.

6. **Participation & prerequisites:**
   Maximum 24 participants for the onsite event.
   Online materials can be available as open source to a larger number of participants.

   Undergraduate and graduate students studying at the University of Gdańsk, University of Rostock, University of Klaipeda, other students from the South Baltic region, from aquaculture departments or relevant, as well as professionals willing to improve their skills. Basic knowledge of aquaculture, systems functioning, aquatic organisms is needed.

7. **Lecturers/presenters**
   - AquaVIP partners: University of Rostock, University of Gdańsk, Klaipeda University
     (detail list of lecturers/presenters in the curriculum)

8. Methods

The modules for the summer schools will contain:
theoretical contents

- Presentations/webinars
- discussions
- practical training units
- study visits

which will be carried out through frontal instruction in the form of lectures as well as through practical exercises based on experiments carried out within AquaVIP projects and visual instruction using selected examples.
The summer school program will be divided into thematic sessions.
Study visits to the regional aquaculture facilities will be included in the program.

Covid19 related precautions & solutions:

- online webinars can be available, as open source in case of covid19 related restrictions.
- practical/laboratory activities/study visits can be delivered to University of Gdańsk students only in case of covid19 related restrictions and/or can be presented online as video materials.

9. Registration & fee

Registration via project web site: http://aquavip.edu.pl/email (to be confirmed)
When registering a participant will be obliged to provide his/her affiliation and an initial title of his/her self-presentation (his/her field of work or issue of interest)
There will be **no participation fee**. Participation will be covered by the AquaVIP project funds.

10. Information/promotion

Information about the school will be sent via direct emails to known stakeholders, the information will be available on AquaVIP web page and social media in March 2021.

Curriculum:

#	Title:	Presenter:	Method:	Duration:
I – Onsite presentations/webinars				
Introductory topics				
1.	**AquaVIP** project presentation in the frame of blue bioeconomy	Hanna Łądkowska, University of Gdańsk	Onsite presentations/webinar & discussion	30+15 min.
2.	**State of play**: innovative technologies in aquaculture in the Baltic Sea Region countries	Konrad Ocalewicz, University of Gdańsk	Onsite presentations/webinar & discussion	45+15 min.
3.	**Impact of COVID-19 pandemic** on the aquaculture and fish processing sectors	Konrad Ocalewicz, University of Gdańs	Onsite presentations/webinar & discussion	45+15 min.
RAS				
4.	**Saltwater RAS**: some biological, technical and economic aspects of brackish, marine and geothermal water applications	Nerijus Nika, Klaipeda University	Onsite presentations/webinar & discussion	45+15 min.
5.	**Small scale shrimp RAS system**: Design, operation, parameters, results	Halina Kendzierska, University of Gdańsk	Onsite presentations/webinar & discussion	45+15 min.
Aquaponics				
6.	**Aquaponics:** system design, technology, applications	Adrian Bischoff-Lang, Rostock University	Onsite presentations/webinar & discussion	45+15 min.
Algae				
7.	**Macroalgae** harvesting and cultivation: macroalgae in the Baltic Sea, system design, technology, and application practices in the region	Aleksandra Zgrundo, University of Gdańsk	Onsite presentations/webinar & discussion	45+15 min.
8.	**Microalgae** cultivation: system design, technology, application	Filip Pniewski, Marek Klim, University of Gdańsk	Onsite presentations/webinar & discussion	30+15 min.
Alternative food				
9.	**Native and non- native invertebrates** from the Baltic Sea: food source for humans or in the future fish farm	Urszula Janas, University of Gdańsk	Onsite presentations/webinar & discussion	45+15 min.
10.	**Worms... –** about the use and benefits of worms in aquaculture.	Adrian Bischoff-Lang, Rostock University	Onsite presentations/webinar & discussion	45+15 min.
			TOTAL I	**App. 11h**
II – Participants' module				
11.	**Aquaculture topics of interest**: in studies/research/work	AquaVIP summer school participants & Facilitators: Hanna Łądkowska, Konrad Ocalewicz, University of Gdańsk	Onsite presentations/webinar plus discussion	7 - 10 min each/ 3h in total
			TOTAL II	**App. 3 h**

III – Practical work/laboratory work/video on laboratory work AquaVIP experiments				
12.	Growth and nutritional value of ***Litopenaeus vannamei*** from the small-scale laboratory culture	Halina Kendzierska, University of Gdańsk	Practical work/laboratory work/video	2h onsite/group 1h video
13.	Aquaponic experiment with *Litopenaeus vannamei* and **macroalgae**	Aleksandra Zgrundo, University of Gdańsk	Practical work/laboratory work/video	2h onsite/group 1h video
14.	Aquaponic experiment with *Litopenaeus vannamei* and **microalgae**	Filip Pniewski, Marek Klim, University of Gdańsk	Practical work/laboratory work/video	2h on site/group 1h video
			TOTAL III	**App. 6h**
IV – Study visits/virtual tours				
15.	Visit to the **small scale RAS laboratory**	Halina Kendzierska, University of Gdańsk	Onsite study visit/virtual tour	30 min./group 15 min. virtual tour
16.	Visit to 2-3 **facilities in the region**	Onsite study visit/virtual tour		1 day long study tour/ 2-3 virtual tours
			TOTAL IV	**App. 8h**
TOTAL:				**App. 28h**

I - Onsite presentations/webinars

Onsite presentations/webinars will be focused on state-of play in innovative aquaculture in the Baltic Sea Region in respect to facts, present problems, trends, solutions, and potential of recirculating aquaculture systems which seem to be a predominant solution in the Baltic region, aquaponics, algae and mussels cultivation, new solutions for aquaculture and the products.

1. ***AquaVIP project presentation in the frame of blue bioeconomy***

Presentation description:

There is a significant demand for a high-qualified personnel and knowledge in modern aquaculture. In order to develop innovative aquaculture sector and move the focus into the South Baltic region, competencies and knowledge are crucial. This is where AquaVIP has a field for action. AquaVIP project objective is to boost aquaculture labour market within the South Baltic area by fostering human resources capacity: students and companies along the aquaculture value chain through cross-border training and networking, which will result in an increased number of skilled professionals and future employees in the blue economy sector.

Aim: To familiarize stakeholders and promote the objectives of AquaVIP project, blue bio economy concepts, the place of AquaVIP in the blue bioeconomy framework, outreach activities related to stakeholders.

Presenter: Hanna Łądkowska, University of Gdańśk

Form of presentation: Onsite presentation/webinar

Time: 30 minutes + 15 minutes Q&A

2. ***State of play: innovative technologies in aquaculture in the Baltic Sea Region countries***

Looking at the demand for seafood consumption in Europe, together with considering economy risks showed by the pandemic situation, aquaculture pollution, exploitation of the living resources, climate-change, quality of food from, wild stocks vs. farmed stocks, fish welfare, the sector needs sustainable solutions that which are already present or can be applied within the Baltic Sea Region. Innovative aquaculture encompasses many different production methods and target organisms.

Aim: To illustrate the state of play and trends of new solutions present in the region of the Baltic Sea: open cages, IMTA, RAS systems, aquaponics, and algae cultivation farms, and to familiarize stakeholders with the current situation and future potential.

Presenter: Konrad Ocalewicz, University of Gdańsk

Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

3. ***Impact of COVID-19 pandemic on the aquaculture and fish processing sectors***

The covid-19 has affected producers of fish, fish processing business and fish costumers. The entire pandemic situation caused several issues including health of people involved in the aquaculture sector and consumers, logistical problems (transportations, border restrictions) and problems with market access of the aquaculture products (hotels, restaurants and markets closed due to lockdown) what resulted in decline in demand for fresh aquaculture products, problems with selling of such products, problems with storage of unsold fish and sometimes decline of their prices. On the other hand, in the recent months increased popularity of processed fish has been observed. Small local aquaculture producers and fish/seafood processing plants have survived recent time quite well. Opposite has been noticed for those that based on the import/export activities.
Aim: To present and discuss how pandemic situation changes aquaculture sector, costumers demand and fish and seafood processing industry.
Presenter: Konrad Ocalewicz, University of Gdańsk
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

4. ***Saltwater RAS: some biological, technical and economic aspects of brackish, marine and geothermal water applications***

Regarding recently increasing limitations for off-shore marine aquaculture development due to its environmental impacts, one of the solutions for saltwater aquaculture is to go on-shore. Saltwater RAS technology offers an innovative, sustainable productions possibility of different fish and crustacean species, including salmonids, marine and also, freshwater species. The saltwater RAS technology differs from common freshwater technology, as some additional water treatment and preparation processes are necessary. At Marine Research Institute of Klaipeda University experiments with different salinity and source water (artificial, Baltic and geothermal) are implemented to test for biological, technical and economic aspects and its advantages or limitations. At Fishery and Aquaculture Laboratory, the potential of brackish water for freshwater and euryhaline fish species cultivation is tested (on growth, harvested biomass, meat quality etc.), as it is known that some freshwater or euryhaline species perform better in brackish or marine water vs. fresh water. The other tested technology is a saltwater RAS for whiteleg shrimp cultivation. Our task is to acquire the shrimp aquaculture knowledge and optimize technology to local conditions. One of the main concerns is related to the artificial preparation of marine water, what may become a major limitation for this technology. As one of solutions, the geothermal water application to prepare artificial marine water is tested for biological, technical and economic aspects. The knowledge acquired during the testing of the new technologies is used to support new business activity and to increase competitiveness for the Lithuanian aquaculture industry.
Aim: To familiarize stakeholders with a good practice of an innovative, sustainable saltwater RAS production by applying different source and salinity water, available in the Baltic Sea Region.
Presenter: Nerijus Nika, Klaipeda University, Lithuania
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

5. ***Small scale shrimp RAS system: design, operation, parameters, results***

The first demonstration facility for crustacean production in RAS in Poland has been established at the University of Gdańsk. Two whiteleg shrimp breeding experiments were carried out within InnoAquaTech project. Shrimps (*Litopenaeus vannamei*) were grown at 25°C and with a salinity of 28 PSU. Their nutritional value, i.e. contents of protein, fat, energy, fatty acids and soluble vitamins, protein digestibility, as well as chemical contaminants: mercury, lead, cadmium, organochlorine pesticides and polychlorinated biphenyls, were examined and compared with market shrimp species from different geographical regions. The purpose of the pilot in Pomerania was to raise the awareness of potential consumers to the fact that cultured crustaceans are characterized by a similar nutritional value to those of imported crustaceans, and contain higher levels of polyunsaturated fatty acids. The facility is now further developed and used for AquaVIP experiments and demonstrations.

Aim: To familiarize stakeholders with a design and operation of a small-scale shrimp RAS, together with parameters and results of the experiments obtained in InnoAquaTech and AquaVIP projects, to show the potential for applications.
Presenter: Halina Kendzierska, University of Gdańsk
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

6. ***Aquaponics: system design, technology, applications***

Aquaponics refers to systems combining conventional aquaculture, breeding, fish, crayfish or shrimps in tanks with hydroponics, growing plants in water. The aquaponic system, feeds water from the aquaculture system to the hydroponic system, where the by-products are broken down by nitrifying bacteria into nitrites and then into nitrates, which are absorbed by plants as nutrients. The water is then recirculated back to the hydroponic system. Aquaponic production at Rostock University, combines African catfish breeding with plants breeding. The fish are farmed in the recirculating aquaculture systems, whereas plants are grown on fish metabolic products. The process can be monitored and processed scientifically at Rostock University, since FishGlassHouse is situated at the university campus, and then transferred to the commercial sector. Since aquaponics is considered as one of the most promising innovative and sustainable food production technology the advanced research at Rostock University has a huge potential for the aquaculture and agriculture sectors.
Aim: To introduce the concept of the Fish Glasshouse, the combination of fish and plant production among stakeholders, to show the potential for applications.
Presenter: Adrian Bischoff-Lang, Rostock University
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

7. ***Macroalgae harvesting and cultivation: macroalgae in the Baltic Sea, system design, technology, and application practices***

There are app. 300-400 macroalgae species in the Baltic Sea. Although conditions in the Baltic are not optimal for large-scale commercial production of macroalgae for global markets, macroalgae have potential if their production is linked to ecosystem services. For example, their ability to effectively remove nutrients from the water can help with reduction of eutrophication. The lack of traditions related to exploitation and cultivation of macroalgae can also be considered as one of the factors limiting the popularization of the idea of mariculture of these organisms. In the Baltic region, macroalgae are mainly cultivated and harvested in Sweden, Denmark and Germany, which accounts for around 3% of the European production. Macroalgae production and harvesting of natural populations is also not popular in Europe and remains at a very low level. As market research indicates, macroalgae are seen as nutritionally very wealthy, being claimed as a great source of valuable compounds as polysaccharides, minerals, proteins and vitamins. Macroalgae have good publicity and good promotion – their consumption in Western cultures is in line with the increasing awareness of consumers' perceptions towards organic products and of environmentally sustainable products. Hence the increased interest in the production and consumption of high-value products from macroalgae also in the Baltic Sea region.
Aim: To familiarize stakeholders with system design, technology, and application practices of various macroalgae species in the Baltic Sea Region.
Presenter: Aleksandra Zgrundo, University of Gdańsk
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

8. ***Microalgae cultivation: microalgae in the Baltic Sea, system design, technology, application***

University of Gdańsk has established a Culture Collection of Baltic Algae (CCBA) which maintains the strains of Baltic and freshwater microlgae from a wide range of habitats. The collection specialises in the Polish region but constantly includes new strains from further sources. Strains are available for research and education, as well as for the commercial use. There are numerous commercial applications of microalgae. They be used to enhance the nutritional value of food and animal feed, they can be used in cosmetics, production of pigments, lipids and their use as an additive to plant biomass for biogas production, wastewater treatment, and they play

a crucial role in aquaculture and to name a few. Some strains cultivated at the University of Gdańsk will be used for removal of nutrients from the shrimp recirculating aquaculture systems (RAS) wastewaters.
Aim: To familiarize stakeholders with background information on Baltic microalgae, cultivation methods and applications.
Presenter: Filip Pniewski, Marek Klim, University of Gdańsk
Form of presentation: Onsite presentation/webinar
Time: 30 minutes + 15 minutes Q&A

9. ***Native and non- native invertebrates from the Baltic Sea: food source for humans or in the future fish farm***
In aquaculture efforts are made to reduce fish meat use by replacing it by microalgae or krill meal. However, these alternatives are either expensive or unsustainable. Thus, searching for species suitable for cultivation and possessing for high value feed ingredients is a new challenge which will help to reduce the environmental impact of feed production. Crustaceans are living in most aquatic habitats and are important food items for many fish and invertebrates. Crustaceans could be used as food for fish farming with a high market price: mainly turbot, salmonids and sturgeons or cod, in production of functional food e.g. products with physiological benefits, and can be used in fish aquaculture for conservation projects.
Aim: To familiarize stakeholders with the potential of Baltic native and non-native crustaceans for aquaculture.
Presenter: Urszula Janas, University of Gdańsk
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

10. ***Worms... - about the use and benefits of worms in aquaculture.***
Worms is the colloquial term for a large number of different invertebrate animals. A total of about 57,000 different species have been described so far, which belong to different phylla, such as the flatworms (Plathelminthes), nematodes (Nematoda), scratchworms (Acanthocephala), or annelids (Anneldia). Common to all these worms is their similar anatomy, which is characterized by an elongated and tubular body structure and no external extremities. The size spectrum ranges from a few micrometres to a body length of about 30 meters. An increasing number of different worms are now used in aquaculture, which is simply the controlled farming of aquatic organisms to provide food and protection from disease and predators. The use and benefits of these different worms range from live food organisms for fish larvae, to the recycling of excreted and thus unused nutrients of fish and shrimp culture, to a high-quality broodstock feed to stimulate the targeted spawning of aquaculture organisms. Likewise, worms are used to mitigate the environmental impact of aquaculture.
Aim: To familiarize stakeholders with the potential of warms for aquaculture.
Presenter: Adrian Bischoff-Lang, Rostock University
Form of presentation: Onsite presentation/webinar
Time: 45 minutes + 15 minutes Q&A

II - Participants' module:

11. ***Aquaculture topics of interest: in studies/research/work***
Participants' auto presentations on aquaculture activities and potential projects related to innovative aquaculture (research or commercial): such as recirculating aquaculture practices, technologies, applications, innovations in all kinds of aquaculture productions, algae and mussels cultivation and/or harvesting, application of products coming from fish, shrimps, mussels or algae production, market (marketing and communication) experience on marketing and communication of new product coming from innovative aquaculture.
Aim: To familiarize participants with the activities of co-participants, which hopefully will result in future cooperation. The feedback from presentation will also give more insight into potential interests, solutions and problems, and the ground for future AquaVIP actions.
Presenter: participants
Facilitator: Hannna Łądkowska, Konrad Ocalewicz, University of Gdańsk
Form of presentation: Onsite presentation/webinar, Q&A
Time: 7 - 10 min each/3h in total

III - Practical work/laboratory work/video on laboratory work: AquaVIP experiments:

Three experiments including *Litopenaeus vannamei* cultivation in the recirculating aquaculture system, as well as aquaponic experiments on macro and microalgae are designed and performed at the University of Gdansk as part of the AquaVIP project to serve research, educational and business support purposes within AquaYouth, AquaProfi and AquaTION modules: http://aquavip.edu.pl/services, of the project service offer. Examples of experimental activities will be performed as showcases during the summer school.

12. ***Growth and nutritional value of Litopenaeus vannamei from the small-scale laboratory culture***
    The experiment focuses on a challenge to develop the potential of crustacean aquaculture based on combination of *Litopenaeus vannamei* and recirculating aquaculture technology (RAS). It is a follow-up of the already performed research under the Interreg South Baltic Programme project InnoAquaTech. Previous experiments on *Litopenaeus vannamei* in RAS system were carried out at the University of Gdansk within InnoAquaTech project. A report and video material on previous experiments, analysis, and results are available at: https://www.submariner-network.eu/images/Crustacean_Production_in_RAS.pdf and https://www.youtube.com/watch?v=qH62LT1vS1o. For the experiment a system called RAS 500 is used. The system consists of two sets of inland aquaculture systems with closed water circuit – RAS. The experiment design predicts five phases: cultivation preparation, transport and placing of *Litopenaeus vannamei* shrimps in the tanks, cultivation, harvesting, and analysis.
    Aim: To develop skills in experimental work and familiarize stakeholders with a potential of crustacean aquaculture based on combination of *Litopenaeus vannamei* and recirculating aquaculture technology (RAS).
    Presenter: Halina Kendzierska, University of Gdańsk
    Form of presentation: Practical work/laboratory work/video on laboratory work
    Time: 2h onsite/group and/or 1h video

13. ***Aquaponic experiment with Litopenaeus vannamei and macroalgae***
    Algae scrubber experiments series is based on Baltic Sea water, and *Litopenaeus vannamei* culturing water (from RAS 500 experiments), and the assumption that organisms and propagules included in the water will develop into algal communities in experimental conditions. The assumption is based on wide use of "algae scrubber" systems in aquaria. The Alage Turf Scrubber was patented in 1980. A high development of algae scrubber systems for fish-keeping has been observed among amateurs. Still, there is little research in the scientific literature on the application of this system. Experiments series will include: testing the system known as "algae scrubber" using Baltic water and local organisms, testing the "algae scubber" for culturing of *Litopenaeus vannamei* and selected strains of Ulva sp.
    Aim: To develop skills in experimental work and familiarize stakeholders with a potential of algae scrubber cultivation based on combination of *Litopenaeus vannamei* and macroalgae.
    Presenter: Aleksandra Zgrundo, University of Gdańsk
    Form of presentation: Practical work/laboratory work/video on laboratory work
    Time: 2h onsite/group and/or 1h video

14. ***Aquaponic experiment with Litopenaeus vannamei and microalgae***
    The experiment will focus on the selection of local strains – selection of strains that will grow efficiently using *Litopenaeus vannamei* culturing water as a medium. Special focus will be put on salinity and a nitrogen source influence. Biochemical characterization of biomass will be performed with the purpose to determine the possibilities of commercial use for wastewater treatment, production of pigments, lipids and their use as an additive to plant biomass for biogas production, or protein-rich biomass to be used as a feed additive. An assessment of algae growth in bioreactors and preparation of inoculum for cultivation on a semi-technical scale is planned in the further stage of the experiment, as well as the reassessment of growth rate and biochemical composition to determine the stability of biomass characteristics when changing the way algae are grown.
    Aim: To develop skills in experimental work and familiarize stakeholders with a potential of microalgae application based on combination of *Litopenaeus vannamei* and algae strains.
    Presenters: Filip Pniewski, Marek Klim, University of Gdańsk
    Form of presentation: Practical work/laboratory work/video on laboratory work
    Time: 2h onsite/group and/or 1h video

IV- Study visits/virtual tours

15. ***Visit to the small scale RAS laboratory***

The RAS-500 has been specifically designed and installed for the purpose of cultivating shrimps in closed recirculating aquaculture system and to carry out experiments which determine how different factors in various combinations effect survival, basic physiological processes, protein content and weight gain of the pacific white shrimp. Simultaneously data for the recommendation of the facility set up and shrimps cultivation are collected and processed. RAS-500 consists of 3 separate tanks: water preparation tank, main unit (containing: electric cabinet, electronic cabinet, mechanical filtration, protein skimmer, UV and ozone sterilization, biological chamber, heating, filter sump, aeration) and a shrimp tank. There are two sets of the equipment specified and the sets differ in the biological filtration systems. Biological filtration in RAS 1 is typical wet/dry filtration (trickle filter). Biological filtration in RAS 2 is based on fluidized media fully submerged in the water column. Both systems are used simultaneously. The two sets work independently. It allows us check both filtration systems.

Aim: To familiarize stakeholders with the technology of a small-scale laboratory RAS system and its applications.

Presenters: Halina Kendzierska, University of Gdańsk

Form of presentation: Onsite study visit/virtual tour

Time: 30 min./group, 15 min. virtual tour

16. ***Visit to facilities in the region (2-3)***

2-3 farms from the list presented below will be chosen for the onsite or online (virtual) tour: