

Conference

BALTIC STATES – CHALLENGES FOR INLAND AQUACULTURE

POSTER PRESENTATIONS ABSTRACT BOOK

JŪRMALA, LATVIA, NOVEMBER 7-8, 2024

Institute of Food Safety,
Animal Health and Environment, BIOR

International Organization for the Development
of Fisheries and Aquaculture in Europe, EUROFISH



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Ministry of Agriculture
Republic of Latvia



BIOR

INSTITUTE OF FOOD SAFETY, ANIMAL HEALTH
AND ENVIRONMENT



EUROFISH
INTERNATIONAL
ORGANISATION



Rural Support Service
Republic of Latvia

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The role of the Latvian Fish and Crayfish Farmer Association in promoting sustainable aquaculture practices in Latvia

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The Latvian Fish and Crayfish Farmer Association actively engages in promoting and developing the aquaculture sector in Latvia through fostering member participation in regional and national seminars, conferences, and working groups focused on fisheries development, best practices, and industry-related issues. In 2023, the association's representatives attended various educational seminars on organic aquaculture, including an event held in Tome, the event "Lielais loms"/"Big Catch", and a fisheries conference in Jelgava.

Membership in the association has shown consistent growth in 2023, with increased interest and activity from both current and potential members. As of December 2023, the association has welcomed new members and seen a rising number of individuals expressing a desire to contribute to its work. This growth reflects the expanding interest in Latvia's aquaculture sector and highlights the association's commitment to fostering collaboration and sharing knowledge within the industry.

By participating in the conference "Baltic Inland Aquaculture Sector – Challenges and Opportunities", the association aims to strengthen its efforts in promoting sustainable aquaculture practices both in the commercial fish farming, as well as the concept of "back-yard fish pond". It strives to ensure networking with regional and international stakeholders, and addresses the sector's most pressing challenges and promising opportunities.



Knowledge transfer for aquaculture sector support, implemented by Institute of Food Safety, Animal Health and Environment (BIOR)

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Support for the aquaculture sector in Latvia, providing the opportunity to receive consultations and to participate in educational group events, is one of the key aspects in the activities of Institute of Food Safety, Animal Health and Environment (BIOR) Aquaculture Research and Innovation Infrastructure Center. From 2017 to 2024, five European Maritime, Fisheries and Aquaculture Fund (EMFAF) projects have been implemented, providing trainings, seminars and individual consultations for representatives of registered fish farms of Latvia. Since the end of 2023, such events have become available and are held for anyone who wants to learn fish farming from the basic to the expert level, or for beginning a new business.

”The institute organized seminars, industry workshops, theoretical and practical trainings for specialists with participation of experts from educational and research institutions, as well as from consulting companies of Latvia, Belgium, Poland, Czech Republic, Lithuania and Finland. These events were held within the framework of EMFAF programme “Innovation, pilot projects, cooperation with science in fisheries, aquaculture and processing and transfer of knowledge in aquaculture”. Experience exchange trips were organized to fish farms, processing facilities, research and educational institutions in Czech Republic and Finland. The aim of these projects was to increase the general performance and competitiveness of aquaculture in Latvia and to reduce the negative impact of aquaculture enterprises on environment.

In total, 11 seminars and 5 theoretical and practical trainings were carried out, providing information on the breeding and rearing of different fish species, recirculation aquaculture systems (RAS) and ponds, biosecurity measures and



Figure 1. Demonstration of the pond harvesting during the trip to Czech Republic.



Figure 2. Training on RAS operation and salmonid fish farming.

biological aquaculture, production pre-processing and fish feeds. Experts from Belgium, Finland, Lithuania and other countries were invited to group events for an average of 25 people each. This year, two experience exchange trips were organized: the first one to Czech Republic, focused on pond aquaculture, the second – to Finland, primarily focused on the RAS, fish feed and further education.

As of 2024, besides research and demonstrations, the equipment and systems of the institute's newly built Aquaculture Research and Innovation Infrastructure Center will provide additional opportunities for practical trainings and demonstrations during events, improve their quality and ensure tangible examples of the components.

The further projects will continue providing for group events for the next year, seminars in different regions of Latvia, workshops, theoretical and practical trainings for high-level specialists, experience exchange trips. In addition, the experts of the scientific institute BIOR – veterinarians and fish farmers – will offer individual consultations to all persons interested in a field of aquaculture. The implementation of multifaceted events enables the institute to inform industry representatives in a comprehensive manner, and, moreover, gives the necessary motivation and space for discussions of important issues to participants among themselves and with invited experts.

The future initiatives will include a series of targeted events, such as regional seminars, practical workshops, and in-depth theoretical and applied trainings for specialized professionals across Latvia. Additionally, experience exchange trips will offer further professional development opportunities. The aquaculture experts of Institute BIOR – veterinarians, as well as fish-rearing specialists – will also provide individual consultations to those seeking expert advice in aquaculture.

This multi-tiered approach facilitates comprehensive information sharing among industry representatives, and, furthermore, fosters active engagement, meaningful discussions, and collaborative problem-solving with expert guidance, addressing vital topics and advancing aquaculture knowledge.



OLMIX animal care solutions offer for aquaculture value proposition: from macroalgae to healthy food for the consumers

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The first step to implement an antibiotic-free program is to have a high standard of biosecurity and production management. To achieve this, OLMIX relies on specialists working on audits, recommendations and follow-up in farms committing to an antibiotic-free program “Thanks to Algae”.

The aquaculture range “Animal Care” addresses critical farm management issues in the rearing phase, considering the animal production as a whole. It offers solutions to improve the animals’ environment and to ensure inner balance, working on five functionalities.

Intensive production systems with high density, short rearing time, reduced genetic diversity by breed selection, usage of alternative raw materials to fish meal and reduction of use of antibiotics expose fish to several challenges throughout their entire cycle, particularly – infectious diseases. It is of the key importance to support the natural defences of fish to make them stronger, more resistant and able to achieve their full potential. Safe and healthy feed (with good digestibility and low mycotoxin risk) is part of the holistic biosecurity approach resulting in healthy animals. MFeed+ improves the use of the feed, MT.X+ reduces the effects of mycotoxin contamination. Moreover, Algimun® is based on a combination of two biologically active macroalgal extracts: MSP®IMMUNITY, which modulates innate and adaptive immune responses, and MSP®BARRIER, which enhances the integrity of mucosal barriers. These natural products ensure OLMIX contribution to feed quality and efficiency.



Occurrence of antibiotics downstream from fish farms in Latvia

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Freshwater aquaculture production is growing worldwide (FAO, 2022), including Eastern and Northern EU states, which have increased their freshwater aquaculture production during the last decade (Gyalog et al., 2022). The aquaculture production in Latvia mostly uses extensive production methods, i.e., ponds, however, flow-through and recirculation systems have also been constructed. In Latvia, finfish production from inland aquaculture is on the increase. Besides finfish production, fish juvenile rearing is an integral part of aquaculture. Intensification of aquaculture production and increased fish density lead to the spread of diseases and, therefore, an increased use of antibiotics and disinfectants. Shar et al. (2020) have estimated that by 2030, global antimicrobial consumption will increase by 33%, compared to about 10 259 tons in 2017. The aim of this work was to evaluate occurrence of antibiotics in water, sediment and molluscs downstream from the discharge points of freshwater aquaculture sites in Latvia.

Sampling was done in 13 aquaculture farms in Latvia, representing all major types of freshwater aquaculture systems: recirculating, flow-through and ponds. Part of the farms have more than one type of aquaculture system. Fish farms were surveyed in 2020 and 2021. Each farm was visited two or three times during the study. Water and sediment samples were analysed for 23 pharmaceutical compounds – erythromycin, amoxicillin, ampicillin, penicillin G, penicillin V, enrofloxacin, nalidixic acid, oxolinic acid, sulfadiazine, sulfadoxine, sulfaguandine, sulfamerazine, sulfadimethoxine, sulfadimidine (sulfamethazine), sulfamethoxazole, sulfamonomethoxine, chlortetracycline, doxycycline, oxytetracycline,

tetracycline, trimethoprim, florfenicol and chloramphenicol. Antibiotics were quantified by UHPLC-MS/MS methods.

Four out of 23 studied antibiotics were detected in discharge from flow-through and recirculation systems, as well as downstream from the farms with mixed aquaculture systems. Enrofloxacin and doxycycline were the most frequently detected antibiotics. Concentrations of doxycycline were in the range from 28 to 775 ng/L, enrofloxacin – in the range from 5.6 to 1315 ng/L, oxytetracycline – from 56 to 100 ng/L. Florfenicol was detected only in one sample at a concentration of 1623 ng/L.

In sediments, oxytetracycline was detected downstream from four fish farms with concentrations ranging from 34 to 154 µg/kg. Enrofloxacin was detected in sediments downstream from two fish farms with concentrations 180 µg/kg and 13811 µg/kg. Doxycycline was found downstream from one farm (627 µg/kg).

Antibiotics were detected in discharge and sediment downstream from flow-through, recirculation and mixed type aquaculture systems. Antibiotics were not detected in sediments and discharge from pond systems. The highest concentrations of antibiotics were found in the farms rearing fish juveniles for restocking. As fry and fish juveniles are susceptible to pathogens, a higher usage of antibiotics in juvenile rearing systems than in finfish production farms can be expected.

This study indicates that freshwater aquaculture is one of the pathways through which antibiotics enter the environment. Measures should be planned to minimize the risk to the environment and human health.

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REFERENCES

- Schar, D., Klein, E. Y., Laxminarayan, R., Gilbert, M., Van Boeckel, T. P. (2020). Global trends in antimicrobial use in aquaculture. *Scientific reports*, 10(1), 21878.
- FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. <https://doi.org/10.4060/cc0461en>
- Gyalog, G., Cubillos Tovar, J. P., Békefi, E. (2022). Freshwater aquaculture development in EU and Latin-America: Insight on production trends and resource endowments. *Sustainability*, 14(11), 6443.



First attempt of using environmental DNA to identify rare, protected and invasive fish and crayfish species in waterbodies of Latvia

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Environmental DNA (eDNA) offers a sensitive method for detecting species by analysing DNA traces they shed into their environment, including skin cells, excrement, or other bodily fluids. This study outlines Latvia's first use of eDNA for identifying rare and invasive fish and crayfish species across several water bodies. Employing real-time PCR (rtPCR) techniques, we developed and tested primers and probes for nine target species based on the cytochrome oxidase 1 gene, encompassing species like pond loach, amur sleeper, and signal crayfish.

Our primary goal was to establish an effective eDNA-based protocol to enhance species monitoring in Latvia. Field tests involved water sample collection at eight monitoring stations with known species presence, confirmed by prior electrofishing. For five species, rtPCR primers were sourced from existing studies, while primers for four species, including grayling and sabrefish, were designed *de novo*, yielding reliable performance.

Results highlight eDNA's utility in detecting low-density populations in Natura 2000 areas, successfully identifying the presence of protected pond loach (*Misgurnus fossilis*). Although not a replacement for traditional monitoring, eDNA offers complementary insights into species presence, providing a non-invasive, efficient option for detecting rare or elusive species where traditional sampling may fall short.



Elaboration and application of Fish Health Index Model in fish health assessment for aquaculture

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Animal health and welfare are two closely linked concepts. Here, good health refers to the absence of disease or injury, as well as an animal's ability to carry out its physiological functions at natural (normal) levels. Welfare, on the other hand, refers to the physical and mental condition of an animal in relation to its living conditions, as well as its ability to adapt to its environment. It is crucial to emphasize that welfare involves more than just the absence of harmful stimuli, it also includes exposure to positive experiences that enhance the well-being of fish. It is especially important to rear healthy, viable fish for release into natural waters to supplement and enhance fish stocks.

For assessing the health status of juvenile salmon, zander and other fish species in hatcheries, the Fish Health Index Model (FHIM) has been elaborated within the Interreg project "Latvian and Lithuanian Conjunction - Improvement of Baltic Salmon and Pikeperch Rearing Methods for More Sustainable, Resilient and Healthy Fish Populations" (SPPwelfare). This model provides the guidelines and outline the creation of a comprehensive index incorporating physiological, behavioral, and environmental parameters. The index will be calculated using the developed methodology and will provide a quantitative measurement of fish health. By implementing FHIM, fish hatcheries can improve fish welfare, optimize production, and prevent disease outbreaks.

The indicators will represent a compliance with species-specific health and welfare requirements for the fish. The evaluation will inform us about the approximate health state of reared fish. This, in turn, will provide us with the necessary information regarding the required improvements to counter the diagnosed problems.



Long-term salmonid restocking practice and contemporary challenges in Latvia

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The artificial stocking of salmonid resources in Latvia already spans 140 years. Although it has been periodically interrupted by regional conflicts, it has resiliently continued thereafter. The construction of hydroelectric power stations in the mid-20th century on the Daugava River, Latvia's primary salmon river necessitated the establishment of a science-based salmon stock reproduction program. This initiative focuses on maintenance of salmonid resources through the rearing of juveniles at the fish hatchery "Tome". Despite the cessation of natural spawning grounds below the Riga's hydropower plant, the artificially maintained salmon population has demonstrated long-term preservation of homing instincts, underscoring the program's success. Additionally, salmon populations exist in the Gauja, Venta, Salaca, and in other rivers of Latvia.

Current challenges in salmon rearing include the effects of climate change, rising water temperatures, and increased susceptibility to diseases. Temperature fluctuations affect the growth and health of fish in flow-through hatcheries, leading to the need for innovative management solutions. To address these challenges, BIOR is exploring the use of natural immunostimulants like probiotics and beta-glucan to boost the immunity of hatchery-reared salmon and reduce mortality rates. In combination with ongoing efforts to restore natural salmon habitats and improve fisheries management, these advancements are essential for ensuring the future sustainability of Latvia's salmon populations.



Knowledge transfer in aquaculture: Situation in Latvia

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The territory of Latvia has a long coastline of the Baltic Sea and extensive areas covered by rivers and lakes. Most lakes and ponds are privately owned. In line with EU guidelines for more sustainable and competitive aquaculture production, one of the objectives is to increase knowledge and innovation. Therefore, it is important to establish a knowledge cycle for the sustainable development of water resources available for aquaculture. Research and educational institutions in Latvia are involved in this cycle, focusing on both natural fish resources and aquaculture. Experience with knowledge transfer from researchers to European farmers is well-established in aquaculture. In the case of Latvia, there are established opportunities to obtain and implement aquaculture knowledge at different levels. These opportunities range from the study course Aquaculture at Latvia University of Life Sciences and Technologies for students of the Agriculture program specializing in Zootechnics, to lifelong education study courses in Aquaculture. Daugavpils University offers a study course in Aquaculture facilities and their cultivation technology for biology students. The Institute of Food Safety, Animal Health and Environment (BIOR) plays a leading role in the preservation and breeding of national fish resources, while the Agency of Daugavpils University, Latvian Institute of Aquatic Ecology, monitors natural water resources and searches for environmental solutions. The Latvian Rural Advisory and Training Centre has established a connection with fishermen and aquaculture farms for the exchange of experience through the Fishing Network. However, there is still room for improvement and development in knowledge transfer to farmers.



Bacteriophages for combating fish diseases in Latvian aquaculture

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The fish farming industry is experiencing rapid growth due to increasing demand for fish products, making it a vital part of the global economy, including Latvia. However, this expansion faces significant challenges, particularly bacterial infections that threaten the health of fish and the industry's sustainability. Antibiotics are commonly used to manage these infections, but their overuse has led to the emergence of antibiotic-resistant bacteria, posing risks to the environment, as well as human health.

Among the most problematic pathogens in aquaculture are the species of the *Aeromonas* genus, such as *A. hydrophila*, *A. salmonicida*, and *A. veronii*, which cause severe haemorrhagic ulcers and tissue damage in fish. One promising alternative to antibiotics is phage therapy, which employs bacteriophages – viruses that specifically infect bacteria – offering a targeted, self-regulating treatment approach.

In this study, 30 bacteriophage isolates capable of infecting eight potential species of the *Aeromonas* genus were obtained, identified through 16S rRNA and *GyrB* gene sequencing. Genome analysis of these phages revealed their classification into six families within the class *Caudoviricetes*, spanning seven known and five potentially novel genera. Detailed characterization of these isolates, along with related phages from the genera *Sharonstreetvirus*, *Cinquassovirus*, *Biquartavirus*, and *Teseptimavirus*, was performed. A comprehensive pangenome analysis was conducted, and selected phage isolates were tested for host range and lysis efficiency under various experimental conditions.



Comparative study of growth performance and meat quality characteristics of *Clarias gariepinus* fed with feed produced with non-pre-treated and bio-modified soya

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Our previous study showed that fermentation can improve the nutritional value of soy (1). Hence, the aim of this study was to modify (M) the main protein component of feed (soya), using technological microorganisms – *Pediococcus acidilactici* (Pa) and *P. pentosaceus* (Pp) – and to assess the impact of feed produced with non-pre-treated and M soy on the growth performance and meat quality of *Clarias gariepinus*. An 18-week experiment was conducted in a recirculating aquaculture system using 150 fish (12 weeks old, with a body weight of 100±10 g). The fish were divided into three groups (50/tank): a control group (C) fed with basal feed, and two treated groups fed with basal feed where the soy was M with Pa and Pp, respectively. After the experiment, parameters of 12 randomly selected fish from each group were analysed. Significant differences ($p \leq 0.05$) were observed in the dorsal finbase (in C, Pa, and Pp, 33.1±2.47, 32.6±1.65, and 30.0±1.72, respectively) and caudal peduncle length indexes (47.2±1.53, 47.9±1.56, and 49.9±1.89, respectively). Compared to the C group, the Pa and Pp groups showed, on average, 13.1 and 40.3% higher meat intramuscular fat (IF) content,

respectively. Higher dry matter (DM), ash (AC), and protein (PC) content was found in the Pa and Pp groups' meat, compared to the C group (on average, 5.5 and 3.5% higher DM, 20.5 and 40.9% higher AC, and 3.4 and 4.2% higher PC, respectively). The meat from the Pp group also showed, on average, 4.7% higher monounsaturated fatty acid content compared to the C group. It can be concluded that feed prepared in this manner can be recommended for a more efficient catfish farming.

REFERENCES

Bartkiene, E, Krungleviciute, V., Juodeikiene, G., Vidmantiene, D., Maknickiene, Z. (2015). Solid state fermentation with lactic acid bacteria to improve the nutritional quality of lupin and soya bean. *J Sci Food Agric*, 95(6), 1336-42. <https://doi.org/10.1002/jsfa.6827>. Epub 2014 Aug 12. PMID: 25042749.



Impact of long-term β -glucan and BGN-2 supplementation on immune response, growth hormone, and growth metrics in juvenile sea trout (*Salmo trutta*)

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This study investigates the effects of prolonged β -glucan and β -glucan-based product (BGN-2) supplementation on immune responses, growth hormone regulation, and growth performance in juvenile sea trout (*Salmo trutta*). Emphasis was placed on analysing key immune markers, including tumor necrosis factor-alpha (TNF- α), interleukin-6 (IL-6), fish heat shock protein 70 (HSP-70), and growth hormone (GH). Additionally, growth performance indicators such as weight gain, specific growth rates, and condition factors were measured.

Juvenile trout (15 000 individuals) were divided into five groups, with one control (D1) and four experimental groups (D2-D5), receiving diets with varying levels of β -glucan and BGN-2 supplementation. Immune markers were analysed using enzyme-linked immunosorbent assays (ELISA), while growth performance was tracked across all groups. Results indicated a significant immune response boost in the D4 and D5 groups, evidenced by elevated IL-6, HSP-70, and GH levels. Although TNF- α fluctuated across months, no definitive trend was observed.

Regarding growth metrics, D4 and D5 groups receiving 6 g/kg and 14 g/kg of BGN-2 respectively, showed the greatest improvement, with the D5 group achieving the highest final weights and specific growth rates, suggesting a dose-dependent relationship.

In conclusion, long-term supplementation with BGN-2, especially at higher doses, significantly benefits immune function and growth performance in juvenile sea trout. These findings highlight BGN-2 as a promising feed additive for boosting health and growth in aquaculture, supporting efficient production of resilient, fast-growing trout.



Probiotic effects on skin-mucus microbiota, health, and growth in reared Baltic salmon (*Salmo salar*)

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This study investigates the impact of probiotics on the skin-mucus microbiota, health, and growth performance of Baltic salmon (*Salmo salar*) presmolts in aquaculture. The skin mucus plays a crucial role as a defense barrier, housing a complex bacterial community, which is essential for the immune system of fish. However, little is known about how probiotics can enhance this microbiome in farmed salmon.

The experiment involved 9000 presmolts divided into three groups: a control group with no probiotics, a group fed probiotics (containing lactic acid microorganisms, yeasts, fermented herbs, and phyto-ferments), and a group receiving probiotic baths. Over a two-week period, growth parameters, including weight gain and Fulton's condition factor, were measured. Microbial community changes were analysed in the skin-mucus bacterial community, and antimicrobial resistance tests were conducted to assess any impact on bacterial resistance.

The results demonstrated that both probiotic feeding and bathing improved growth performance, with the highest weight gain observed in the probiotic feeding group. Probiotic supplementation also led to favorable changes in the skin-mucus microbiota, increasing beneficial bacterial populations and reducing opportunistic pathogens, as well as suppressing antibiotic resistance.

These findings suggest that probiotics can improve the health, growth, and microbial balance of Baltic salmon in aquaculture, offering a sustainable alternative to antibiotic use.



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This year, the Fish Processing Biotechnology Study and Research Centre opened its doors at the Faculty of Agriculture and Food Technology of the Latvian University of Life Sciences and Technologies (LBTU) in Jelgava. It is currently the only centre of its kind in the Baltics, dedicated to study and research in collaboration with the industry. The centre aims to promote closer links between students, scientists, businesses and the industry. The premises of the centre were reconstructed, adapted and equipped on two floors, covering an area of 1810 square metres. On the first floor of the building, there is a pilot-laboratory with 60 experimental fish processing points and processing equipment, allowing to carry out practically all technological processes, while the second floor houses laboratories for testing raw materials, semi-finished and finished products. There is also a seminar and tasting room for assessing the organoleptic characteristics of newly developed fish products and for holding seminars for small groups. The centre is equipped modern facilities, including camcorders that enable the staff to monitor students remotely and to conduct online courses. The Fish Centre was set up and the equipment purchased in cooperation with the Latvian Fish Processors' Association, which helped to ensure that the equipment purchased met the needs of the industry. The total funding amounts to approximately three million euro. This funding was provided by the Ministry of Agriculture's Rural Support Service from the European Maritime and Fisheries Fund.



Pikeperch artificial reproduction methodology in Latvia for more effective, sustainable restocking and aquaculture

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Pikeperch is considered one of the most promising freshwater fish species in domestic aquaculture in Europe. As a predator, it has an important role in freshwater ecosystems, however, it is crucial to improve and adapt its existing reproduction and farming methods to ensure the future successful resource restocking and overall development of freshwater aquaculture on a European scale. In order to ensure the successful, economical production of this fish species in modern systems – recirculation aquaculture systems (RAS) – and maximize the number of healthy pikeperch larvae and fingerlings, artificial intensive breeding methods must be learned and, if necessary, adapted to local conditions.

The methods of the pikeperch artificial reproduction have been successfully tested using broodfish from Latvian waterbodies, annually adding and adjusting the applied biosecurity and hormonal stimulation methods, as well as egg incubation and fingerling feeding protocols. This year, in the newly built Aquaculture Research and Innovation Infrastructure Center of the scientific institute BIOR, the full cycle of pikeperch artificial reproduction and larvae rearing was carried out in fully controlled conditions, using three different recirculation systems with specialised tanks.

The new facilities ensured the application of previously tested methods in a new, higher quality, which led to a significant improvement in the results obtained both in terms of the quality of the eggs and the number of obtained larvae to the total volume of eggs. The developments and acquired experience will enable to conduct high-quality training for fish farmers and other experts



Figure 1. Good cortical reaction of the pikeperch eggs (personal archive).



Figure 2. Pikeperch egg incubation in recirculation aquaculture system (personal archive).

in aquaculture, to increase the number of released fingerlings for restocking of natural resources in conditions of a shortage of high-quality breeders, and will also allow for the constant maintenance of broodstock and off-season spawning in the future.



Latvian Fish Farmers Association: Supporting sustainable aquaculture and organic growth in Latvia

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The Latvian Fish Farmers Association (LFFA) aims to unify Latvian fish farmers, foster a supportive economic and political landscape, and advocate for the sector's interests both domestically and internationally. LFFA closely collaborates with state and international institutions to advance sustainable fish farming practices.

Comprising aquaculture farms with a total pond area of approximately 3000 hectares, the association employs over 60 full-time and 30 seasonal workers, making a significant contribution to the rural economy. Carp is the primary product, and approximately 90% of all carp production in Latvia is produced by these farms. Most fish are sold live or fresh at farms, wholesale and for processing. Some member companies also process fish for added market value.

Carp is raised naturally, often in the Natura 2000 areas, promoting biodiversity and creating favorable habitats for various bird and animal species. Pond fish, especially carp, are fed natural feeds and grains, with minimal use of artificial pellets limited to early growth stages, ensuring high-quality, eco-friendly products. Several association members are pursuing organic certification, promising a future increase in organic aquaculture products in Latvia.

The LFFA member farms consistently produce over 70% of Latvia's total aquaculture fish output, underscoring the association's pivotal role in the country's aquaculture industry.

