AFISHE

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TRAINING REPORT

Training for researchers/teachers on their professional modules

AFISHE

Development of Aquaculture and Fisheries Education for Green Deal in Armenia and Ukraine: from Education to Ecology

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SUA Slovak University of Agriculture in Nitra

NAS RA INTERNATIONAL SCIENTIFIC EDUCATIONAL CENTER

U.PORTO

SVEUČILIŠTE U DUBROVNIKU UNIVERSITY OF DUBROVNIK

Sumy National Agrarian University

National University of Water and Environmental Engineering

Contents

1. General part – aim, and scope of the training

The AFISHE project overall goal is mitigation of the adverse environmental effects of the aquaculture and fishery sectors in Armenia and Ukraine. This could be achieved by creating and enhancing Master's degree programs in aquaculture and fisheries, aligning them with top-tier European programs and tailored to local requirements. One of its most important prerequisites is the improvement of human resources, that is, to have teaching personnel with appropriate capabilities and knowledge in the field of aquaculture and fishery.

Additionally, the project aims to promote collaboration among universities, and establish a network connecting Armenia, Ukraine, and EU partners in aquaculture and fisheries. This network will facilitate joint educational and research endeavors to advance ecology-focused practices aligned with SDG goals and the Green Deal. Through enhanced collaboration between universities and enterprises, the project will promote research-driven and eco-friendly operations, improving the efficiency of aquaculture and fishery enterprises. Training teachers in new modules in EU universities is the first step in creating such a network.

The AFISHE project was planned to hold trainings at the EU universities within the WP3 - Development of Human Resources. They took place in February-March 2024 at the University of Porto (U.Porto), University of Dubrovnik (UNIDU), and Slovak University of Agriculture (SUA in Nitra). As a result of the trainings, the participating AM and UKR universities obtained capable teaching staff who will undertake the preparation of new module programs, and study materials, and also teach the modules developed by them. Through completed trainings, Armenian and Ukrainian universities will ensure the ability and sustainability of educational research work in the field of aquaculture and fishery.

The scope of the training is 90 hours (3 credits) and 2 weeks of training of 44 AM and UKR teachers on new and updated modules in EU universities.

2. The place, duration and period of training

2.1. University of Porto (U.Porto)

The training of AM and UKR teachers took place mainly at the Department of Aquatic Production (DPA), which is one of the 10 Departments of the Instituto de Ciências Biomédicas Abel Salazar (ICBAS) one of the faculties of the University of Porto (U.Porto). The training also took place at the Department of Chemistry of ICBAS. Human resources include around 20 persons, among professors, external teachers and technicians. The department is divided into 8 Laboratories: Applied Physiology, Aquatic Engineering and Production Systems, Fish Immunology and Health, Developmental Biology, Aquatic Ecology, Ichthyology, Aquatic Food Technology, and Microbiology and Food Technology. The practical part of the training took place mainly in the laboratories of DPA and the Interdisciplinary Centre of Marine and Environmental Research (CIIMAR). It is one of almost 50 R&D centers U.Porto also houses. The training of 16 AM and UKR teachers took place at U.Porto for 2 weeks - from February 19 to March 1, 2024.

2.2. University of Dubrovnik (UNIDU)

The University of Dubrovnik (UNIDU) is a public university consisting of six departments: the Department of Economics and Business, the Department of Maritime Studies, the Department of Electrical Engineering and Computing, the Department of Applied Ecology, the Department of Communication Sciences and the Department of Arts and Restoration. The training of AM and UKR teachers took place mainly at the Department of Applied Ecology, where practical work was performed in well-equipped biological, chemical, and biotechnological laboratories. Besides that, training took place at the Laboratory for Mariculture, which is located in Mali Ston Bay and is used for research and education in the field of marine aquaculture, as well as for conducting various interdisciplinary activities related to the sea. It has a fully equipped and functional bivalve hatchery. The training of 17 AM and UKR teachers took place at UNIDU during 2 weeks - from February 26 to March 8, 2024.

2.3. Slovak University of Agriculture (SUA in Nitra)

Three structural divisions of the Slovak University of Agriculture in Nitra (SUA) were involved in the training. The Institute of Animal Husbandry has various specialized centers located apart from the university campus, including fishponds and fish breeding sampling locations. The participants of the training got acquainted with the research activities of the institute, focusing on freshwater fish, with an emphasis on the production of healthy animal commodities.

The Institute of Nutrition and Genomics (FAFR) provided training modules focused on the importance of nutrients in animal nutrition and their determination, energy and metabolism, biochemistry and physiology of nutrition, and principles of various feed treatment and preservation methods. Within the genomic part, teaching is focused on genetics and breeding, biometrics and livestock biodiversity, as well as nutritional genomics and human genetics using information obtained through the newest methods in genomics.

The Institute of Applied Biology is part of the Faculty of Biotechnology and Food Science, providing training in many areas, including ecophysiology and animal physiology, physiology of regulatory mechanisms, immunobiology, microbiology and parasitology, neurobiology, pathophysiology, and animal toxicology.

The training of 11 AM and UKR teachers took place at SUA for 2 weeks - from February 26 to March 8, 2024.

3. Implemented activities and outcomes

The training program organized by the AFISHE project team from the EU Universities consisted of two main parts:

1) General training and visits, introduction of participants of training to the university, and excursions to enterprises and institutions involved in fishing, processing of fish, growing aquaculture objects, scientific research, as well as an exposition of decorative hydrobionts.

2) Individual training sessions and preparation of presentations on the modules included in the new and updated Master's programs in aquaculture and fisheries at universities in Armenia and Ukraine.

3.1. University of Porto (U.Porto)

1) General training and visits

On February 19, Welcome at School of Medical and Biomedical Sciences (ICBAS). On the first day of the training, a group of teachers from Ukraine and Armenia was met by the vice-rector of the University of Porto, Joana Carvalho. Then, there was a tour of the university grounds led by a guide who shared insights into its history and notable figures associated with it, as well as introducing them to an exhibition of sculptures in the naive art genre. In addition, project managers Augusto Faustino and Paulo Vaz-Pires familiarized the participants with the training and excursions schedule.

In the frame of general training there were excursions to the exposition of the "SEA LIFE" network of aquariums in the city of Porto and to the Interdisciplinary Center for Marine and Environmental Research "CIIMAR RESEARCH CENTER".

In the aquarium "SEALIFE," participants were given a familiarization tour of the variety of living organisms and the variety of ecosystems that are represented on its territory - from freshwater rivers to tropical and cold-water seas. The guide of the aquarium exhibition, Ana Ferreira, introduced the most famous inhabitants of aquariums and told about the peculiarities of the functioning of the public aquarium in the city of Porto, which is one of the tourist centers of Europe. The aquarium is used for educational tours and education on ecologically responsible attitudes to natural resources. It is important for the formation of ecological consciousness in society that visitors, in particular children, In this public aquarium, can be aware of the negative results of the negligent attitude of man to nature and realize their responsibility for preserving the biodiversity of the oceans. In addition, trainees were shown the complex life support system of the facilities and shared the experience of organizing the maintenance of a large number of various organisms in closed water systems.

During the visit to the "CIIMAR" center, participants were introduced to the main directions of scientific research conducted in collaboration with the University of Porto team (CIIMAR publishes more than 500 international scientific articles annually). Equipped with state-of-the-art laboratory equipment and engineering facilities, the scientific center simultaneously implements a vast number of projects in areas such as sustainable management of marine resources, environmental monitoring, aquaculture, and biotechnology. Portuguese partners presented key scientific departments engaged in the cultivation of aquaculture objects and feed organisms, research on the conservation of valuable and endangered species, coastal biodiversity conservation, animal health and aquaculture, nutrition, and immunobiology, immunological, morphological and genetic studies, evolutionary genomics and blue biotechnology, water quality, pollution pathways, and toxicity mechanisms, and biological degradation processes of ocean pollution. It was noted that the scientific center fulfills an important function of combining scientific research and education because university students' classes and qualification work are carried out here at the same time as applied scientific research is conducted. Introductory lectures were given to us by leading scientists of such scientific laboratories as "*Coastal Biodiversity and Conservation," "Animal Health and Aquaculture," "Nutrition and Immunobiology," "Bioremediation and Ecosystems Functioning," etc.*

The subsequent visits were next to the port of the city of Porto, to the fish market managed by DOCAPESCA Portos e Lotas SA, and to the "PINHAIS e Cia Lda" fish cannery.
The participants visited an important enterprise of the city of Porto in terms of the fishing industry - the port and official fish market run by "Docapesca Portos e Lotas, SA." It is here that the veterinary control laboratory accepts fish and seafood caught in the ocean, conducting their sorting, certification, and subsequent sale at an open auction, live and online. The AFISHE project delegation had the opportunity to trace the entire path of the caught products, from unloading from the ship and reception to sorting, weighing, packaging, and preparation for auction. Portugal government and citizens places great emphasis on preserving the ocean's biodiversity, therefore fishing is closely monitored, and efforts to combat poaching occur at various levels. At the Docapesca fish market at Matosinhos, representatives from restaurants or specialized stores can purchase certified products with a guarantee of freshness and quality.
During a visit to the cannery "PINHAIS" and the museum from the company "Pinhais & Cia, Lda.", training participants had the opportunity to learn about the main processes of fish processing and the production of "NURI" canned goods. Processing is carried out using traditional methods passed down through generations for over 100 years, particularly the packaging of canned goods by hand. A compelling testament to the authentic quality of the products was the tasting of the flagship product - sardine canned goods. The history of this enterprise and its experience left no one indifferent, as it provided a vivid example of a family business where children continue and develop the work started by their parents. Their traditions and reputation are valued more than short-term commercial interests and profit. The visit ended with a taste of several canned products of their production.
There were also trips to the intensive aquaculture farm "FLATLANTIC AQUACULTURE" and the museum and aquarium "ELA". During the visit to the modern high-tech mariculture farm "FLATLANTIC AQUACULTURE," the most renowned and largest in Portugal, project participants witnessed the prospects and scale of modern intensive aquaculture. The participants familiarized themselves with the technology of cultivating commercially valuable species of turbot in closed and semi-closed recirculating systems. Guided by the company's representative, Carolina Castro, they were introduced to the main facilities for fish cultivation at various stages and learned about the peculiarities of turbot feeding using automation systems. The production volumes of this farm are impressive; therefore, it is crucial that most of the production processes are mechanized or automated. Participants were shown the process of sorting juvenile turbots before transferring them to basins for the next stage of cultivation using modern equipment. Participants also had the opportunity to observe the operation of water treatment facilities, including mechanical and biological filters, floaters, and disinfection units. The volumes of water consumption by the farm necessitate powerful equipment for water processing. To improve the quality of ocean water supplied to fish basins, it undergoes preliminary purification. The level of control over the main water parameters was also impressive—key indicators are maintained through automated systems, and parameters are available to staff on special displays. Despite significant water volumes withdrawn by the farm's water supply system, the impact on the environment is minimal due to their reuse and purification before discharge. Also, the FLATLANTIC farm has its own solar power plant, which allows you to save electricity for the main production processes. As the participants from Armenia and Ukraine were convinced, the products are not only safe and ecologically clean but also tasty - a group of teachers was treated to a lunch featuring fried turbot, showcasing the farm's delectable offerings.
During a visit to The Littoral Station of Aguda, Museum and Aquarium "ELA", guests also saw the convincing results of hard and painstaking work aimed at conserving biodiversity. The center was created on the initiative of a famous scientist, a talented artist, and just a patriot, Professor Mike Weber. He and his team participate in scientific and educational programs, develop measures for conserving local fauna, and promote green tourism in the region. The aquarium and museum are dedicated to local marine and freshwater biotopes, aquatic fauna and flora, including fish caught by

local fishermen, as well as marine invertebrates and macroalgae. The delegation had the opportunity to get acquainted with the representatives of the ocean fauna and freshwater reservoirs of the region collected in the exposition to see the careful attitude of the ELA team to the history of fishing in the area. In addition to a good display of aquariums, the center has a fisheries museum and an exhibition hall with works of art also dedicated to fishing.
In the final part of the training period (29 February), the morning period was dedicated to a session about modern *e-learning* teaching skills, performed by the trainers, Drs. Teresa Correia e Nuno Regadas, and for all the trainees in the Rectorate building.

2) Individual training
Besides general meetings and training, the AM and UKR teachers also had individual training regarding their modules and topics.
Trainings on the following modules were conducted at the University of Porto.

Animal welfare in Aquaculture and Public Aquariums. Trainers: Ana Valentim and Ana Magalhães. Trainee: Shkurko Maryna (SNAU).

Doctor Ana Valentim and Professor Ana Magalhães introduced the theoretical part of the main topic, which concerns animal sentience, vital ethical considerations in animal care and use, understanding the concept of animal welfare, legislation to protect fish and basics of animal welfare assessment. This made it possible to discuss the issues of the importance of ethology in aquaculture and public aquariums, recognition of normal and abnormal behaviors, communication in aquatic animals, and behavioral valence. Trainers also explained in detail the issue of stress in fish, physiological responses, behavioral responses, coping styles, environmental stressors in aquaculture and public aquariums, and stress mitigation strategies. During practical sessions, the teachers focused on the opportunity to discuss animal welfare topics with researchers in the field (João Saraiva and Ana do Vale).

Aquaculture of artificial and natural reservoirs. Trainer: José Calheiros. Trainee: Olga Korg (SNAU).

Dr. José Calheiros presented the theoretical part, which deals with general information on aquaculture—next, had been looked at a topic that concerns the potential of aquaculture in Europe and Ukraine. Within the framework of this topic, the following questions were considered: licensing authorities, final documents, EU legislation (water framework), and strategic plan for aquaculture. In the next lesson, José Calheiros paid much attention to Aquaculture Facilities and explained their breeding, maintenance, and cultivation in detail. The next module presented a topic that concerns hydraulic structures used in fisheries. The teacher also focused on the subject of Grids. Within the framework of this topic, we discussed the following questions: design, netting, anti-fouling, and maintenance. Together with trainer Vítor Carvalho and the trainee Naira Aloyan (module ***Basic aquaculture engineering***), a visit to a cage farm aquaculture in Pisões, near the dam and basin of the river Alto Rabagão (north of Portugal) was realized to be able to see directly an actual cage farm facility and the operations involved in this particular kind of aquaculture.

Aquaculture processing technology. Trainer: Paulo Vaz-Pires. Trainees: Olga Bordunova and Anna Petrenko (SNAU).

Professor Paulo Vaz-Pires presented the theoretical part of the complete processing chain of aquaculture products. All processes, from methods of catching, transportation, industrial processing, culinary home processing, product quality, sanitary issues, and consequences after consuming these products, were considered. In practical sessions, the teacher demonstrated the use of equipment for determining the freshness of fish and methods for assessing fish spoilage.

Aquatic Animal Feeding and Nutrition. Trainers: *Helena Peres and Rui Magalhães*. Trainee: Armine Hayrapetyan

Professor Helena Peres and Doctor Rui Magalhães focused on the following theoretical topics, as well as hands-on practical classes and activities introduced during the training: basics in fish nutrition, protein, lipids, and carbohydrates nutrition, and metabolism, energy nutrition, micronutrients in fish nutrition, fish feeding, and growth. Practical activities included: analytical procedures for studying diet composition, body composition, and plasma metabolites; Hands-on experience with live fish experiments and daily routines; Fish handling; Dissection sessions to explore the digestive tracts of various fish species with differing feeding habits, providing insights into their anatomy; Hands-on experience in feed formulation and manufacturing processes; Critical analysis of diet compositions tailored for two distinct fish species occupying different trophic levels; engaging visits to industry and academic entities pertinent to the field, facilitating exposure to real-world applications and innovations.

This comprehensive training program equipped participants with a deep understanding of aquatic animal nutrition and practical skills essential for effective feed management and optimization of aquaculture practices.

Bioresources of the hydrosphere and their use. Trainers: Benjamin Costas, Alberto Teodorico Correia. Trainee: Halyna Rebenko (SNAU).

Professor Benjamin Costas introduced the theoretical foundations of farming higher-quality aquatic bioresources, focusing on improving productivity and sustainability performance in the context of current challenges. He demonstrated new tools to mitigate the adverse effects of climate change. Practical sessions included fish blood sampling to analyze main blood indexes, fish dissection, and tissue sampling for cell culturing. Professor Costas demonstrated his teaching approaches. Professor Alberto Teodorico Correia presented modern tools for monitoring fish distributions, growth intensity, feed compliance, and stress effects. Additionally, he provided insight into the history of fisheries and introduced the social and medical aspects of fishermen's daily routines.

Fish Products Sanitary Control, Standardization, and Certification. Trainers: Inês Rodrigues, Bernardo Archer. Trainee: Alla Kucherova (NUWEE).

Professor Inês Rodrigues introduced techniques for assessing microbiological parameters in food, water, and surfaces through proper sampling, suspension preparation, dilution, and culturing techniques, as well as interpretation of the results. Also, major fish diseases the diagnostic process for bacterial infections in fish, the the concept of antimicrobial resistance covering examination, sampling, and laboratory processing were analyzed. There were discussed principles and stages of the aquaculture farm biosecurity plan. Bernardo Archer shared his experience in implementing of biosafety measures in aquaculture, certification processes, traceability, food safety, fish processing, and packaging practices, and international trade requirements.

Food Nutrition and Technology. Trainer: Rui Magalhães and Helena Peres. Trainee Koshel Olena (SNAU).

Professor Helena Peres and Doctor Rui Magalhaes introduced the theoretical part of the topic, which was the overview of aquaculture feeds, nutritional requirements of cultured fish, Proteins, Fats, Carbohydrates, Energetics models, Digestive physiology in fish, Feedstuff and Feed Production, Feed manufacture. The trainee received much theoretical knowledge about the fish nutrition, its peculiarities, and feeding. The trainee familiarized herself with the material and technical base of the department at the CIIMAR Scientific Center. During practical sessions, Doctor Rui Magalhães and Professor Helena Peres presented the NUTRIMU lab and research, demonstrated fish handling in nutritional trials, models for estimating growth, dissection of the

digestive tract, feed formulation, and manufacturing. Under the guidance of teachers, the trainee got involved in practical work of feed manufacturing, Bromatology equipment, and Digestive tract dissection of different fish species. This intensive training program equipped the trainee with a deeper understanding of feed formulation and manufacture, aquatic animal nutrition, and practical skills essential for effective formulation, production, and application of aquafeeds in a practical context.

General hydrobiology. Trainers: Adriano Bordalo e Sá and Catarina Teixeira. Trainee: Susanna Hakobyan (ICBAS).

Professor Adriano Bordalo presented the main steps in developing the legislative framework of the EU Water Framework Directive, creating a coherent legislative and policy framework for all outstanding water-related issues, with the ultimate goal of achieving a high level of environmental security for all European water bodies by 2027. Doctor Catarina Teixeira conducted practical classes. Water samples were taken from the Douro River, its tributaries, and estuaries. Using appropriate equipment, the concentrations of nutrients (nitrogen and phosphorus) were determined in field and laboratory conditions. In addition, a microbiological analysis of the water was carried out. An effective technology is the membrane filtration method. The laboratory examined samples, including the total microbial count, coliforms, and *E. coli*.

***General Hydroecology*.** Trainers: Adriano Bordalo, Catarina Teixeira. Trainee: Gor Gevorgyan (SCZHE).

Professor Adriano Bordalo introduced the theoretical part of the module, which concerns the structure and functioning of hydroecosystems, biotic and abiotic components, and interactions between them, both in natural and human-modified systems, as well as under the impact of climate change. The trainer also focused on water management in the European Union (Water Framework Directive). Doctor Catarina Teixeira conducted the practical part focused on water sampling, on-site and in-lab measurements, and assessment of the physical, chemical, and microbiological quality of water with the use of express and traditional methods.

***Ornamental aquaculture*.** Trainers: Mike Weber, Ana Ferreira. Trainee: Serhii Konontsev (NUWEE).

Professor Mike Weber shared his experience creating and operating a public aquarium dedicated to local fauna species. The focus was on the aquarium's significance for society and ecology, challenges related to adapting aquatic organisms to artificial ecosystems, and the potential for reproducing endangered species. The practical aspect of the training explored the intricacies of the aquarium's operation as a semi-closed system with recirculation, sourcing water directly from the ocean, construction, and use of pumping equipment, filters, skimmers, and aerators. Dr. Ana Ferreira introduced the principles of operation of public aquariums with closed water supply systems and the most typical representatives of decorative aquariums. Practical sessions covered the technical operations carried out by staff, including the use of equipment to maintain water parameters and animal feeding.

Population Ecology. Trainer: Isabel Costa. Trainees: Zinaida Budnik, Olha Varzhel (NUWEE).

Professor Isabel Costa introduced the theoretical course of the module Population Ecology. Significant attention was paid to the consideration of the population as a biosystem of a supra-organism integration level, the basic principles of the structural and functional organization of natural populations, the clarification of the reasons that cause fluctuations in the number of populations of various species, the conditions for the formation of the population structure, the peculiarities of their development and functioning. Some attention is paid to applied issues related to scientifically based bases for exploiting plant and animal populations. During the practical

classes, the trainer demonstrated the appropriate equipment and the practice of selecting organisms for population assessment.

Water Quality and Fish Health. Trainers: João Neves, Maria Antónia Salgado and Vítor Carvalho. Trainee: Yuliia Hrokhovska (NUWEE).

Professor João Neves introduced the theoretical part of the main topic, which concerns the composition and properties of aquatic ecosystems, the biology and health of fish, and the peculiarities of the functioning of the fish's immune system. During practical sessions, the teacher demonstrated the use of appropriate equipment for assessing fish health, and the practice of dissection and sampling. Professor Maria Antonia Salgado focused on hydrochemical parameters and monitoring and management of water quality in fish farms. Dr. Vitor Carvalho introduced the topic related to maintaining the oxygen regime in reservoirs and basins for growing fish and the distribution of feed and nutrients, presented different methods of aeration, etc.

Environmental and Water Management. Trainers: Maria Antónia Salgado. Trainees: Artur Alaverdyan (ANAU).

During the theoretical sessions Professor Maria Antonia Salgado focused on hydrochemical parameters, monitoring, and management of water quality in fish farms. The lecturer presented the basics and necessity of water analysis for aquaculture, basic water quality control methods and current EU standards in this field. Sampling methods and the theoretical basis for analyzing different elements were also presented. Practical sessions with the lecturer were held in the laboratory, where we determined the amount of biologically active oxygen and phosphorus in water samples taken from different sources using two different methods. During the theoretical sessions, Dr. Vítor Carvalho introduced the topic related to maintaining the oxygen regime in reservoirs and basins for growing fish, the distribution of feed and nutrients, presented different methods of aeration, etc. The lecturer presented modern systems of water aeration, innovative equipment, and tools for water cleaning.

Basic aquaculture engineering. Trainer: Vítor Carvalho. Trainee: Naira Aloyan (ANAU).

Dr. Vítor Carvalho introduced the topic related to maintaining the oxygen regime in reservoirs and basins for growing fish, the distribution of feed and nutrients, presented different methods of aeration, etc. The main issues were Water Treatment Plants, Wastewater Treatment Plants, and Aquaculture. Maria Antonia Salgado focused on hydrochemical parameters and monitoring and management of water quality in fish farms. In particular, the following issues were considered: Aquaculture and the environment, Fish farms legislation compliance, Identification of the physicochemical water quality parameters relevant for aquacultures, Assessment of laboratory facilities for water monitoring, Implementation of analytical ISO standards, Methodology and instrumentation, Analysis and results, Quality assurance and quality control of analysis. Jose Calheiros introduced the following topics: Aquaculture data – general overview, Licensing, Aquaculture facilities, Cage structures, Nets, Mooring, Reproduction, Daily routines, Public perception & concerns.

3.2. University of Dubrovnik (UNIDU)

1) General training and visits

On 26 February, the participants of the AFISHE training program were welcomed by the Department of Applied Ecology. On the first day of the training program, a group of teachers from Ukraine and Armenia visited the building where the Department of Applied Ecology is located. They toured the building and also visited the laboratories of the other departments, including the Navigation simulator and Marine engineering simulator at the Maritime Department and the Laboratory for Intelligent Autonomous Systems at the Department of Electrical Engineering and Computing. After the welcome and tour of the building, the tour continued with individual introductions and discussions about the training for each course. During this phase, participants had the opportunity to get to know the lecturers better, ask questions, and clarify any uncertainties. Each discussion offered the chance to gain a deeper understanding of the topics covered in the training.

A meeting with the Vice-Rectors occurred on campus on 27 February: Assoc. Prof. Marijana Pećarević, PhD Vice-Rector for International Relations and Science, Assoc. Prof. Sanja Žaja Vrbica, PhD Vice-Rector for Study Programmes and Students, and Prof. Nebojša Stojčić, PhD Vice-Rector for Business Affairs, to discuss the AFISE project and possible opportunities for future cooperation between the universities. Following the meeting, the group toured the building and visited the laboratories of the Department of Art and Restoration and the operational dynamics of the TV studio and radio station of the Department of Mass Communication.

Following the tour of the building, a visit to the Dubrovnik Natural History Museum and the Ethnographic Museums was arranged, accompanied by professional guides. The participants were familiarised with the rich heritage of scientific research and cultural heritage of the region and explored aspects such as agriculture and local customs from the time of the Dubrovnik Republic. The museum visits not only provided a captivating insight into the past but also deepened our appreciation and comprehension of the complex cultural and scientific milieu of the region.

As part of the overall training programme, a day trip was organised for participants to the Laboratory for Mariculture, an integral part of the Department of Applied Ecology. This laboratory is located directly on the calm waters of Bistrina Bay in Mali Ston Bay and offers a unique opportunity for hands-on learning. Mali Ston Bay is the largest production area for European flat oysters (*Ostrea edulis*) in the entire Mediterranean, emphasizing the importance of the ecosystem and the important research conducted at the laboratory site. Year after year, this extraordinary ecosystem serves as a beacon for various research projects and attracts scientists from all over Croatia and beyond to its shores. Established primarily for research and educational purposes in the field of mariculture, the laboratory has become a centre for various interdisciplinary activities related to the sea. Its dynamic environment encourages collaboration between experts from different fields, from marine biodiversity research to exploring sustainable aquaculture practices. State-of-the-art laboratories, well-equipped classrooms, and systems for the care of marine organisms are just some of the facilities offered by the Laboratory for Mariculture, ensuring a comprehensive learning environment for teachers and students alike. In addition, the lab's capabilities are enhanced by an at-sea research concession that allows for hands-on experiments and data collection in the natural marine environment. The facility has fully equipped amenities such as a canteen and accommodation facilities to cater to the needs of visitors and ensure a comfortable stay during educational excursions.

During the visit, the participants had the unique opportunity to visit the newly built hatchery for European flat oysters, which offered an insight into the latest advances in mariculture technology. In addition, the Croatian partners gave a presentation that provided a historical overview of oyster and mussel farming in Mali Ston Bay, highlighting the centuries-old traditions and development of aquaculture in the region. This immersive experience gave participants a holistic understanding of the rich cultural and scientific heritage interwoven with the region's marine ecosystem.

After the visit to the laboratory, a visit to the mussel and oyster farm was included in the programme. At the farm, the participants were introduced to the method of collecting larvae, setting up collectors, and the entire breeding process. After the tour, they had the opportunity to taste the oysters. The day ended with a visit to Ston, where the participants explored the well-preserved mediaeval city walls, enjoyed a view of the Adriatic Sea, and tasted fresh oysters and mussels from the local farms.
As part of the general training, a visit to the aquarium, which also belongs to the University of Dubrovnik and is dedicated to the local marine fauna and flora, was organised, as well as a visit to the island of Lokrum, a Unesco-protected forest reserve.

2) Individual training
Trainings on the following modules were conducted at UNIDU.

Biology of Cultured Algae. Trainer**:** Sanja Tomšić, Trainee**:** Lusine Hambaryan

Joint discussion with Dr. Sanja Tomšić of the main topics in the training program became the basis for a more expanded approach to the subject of using not only microalgae in aquaculture but also the wide possibilities of macroalgae for remediation and providing biocomponents, as well as fertilizers, food products, etc. The new topic for students will focus on the Integrated Multitrophic Aquaculture (IMTA) concept, which is designed to increase the sustainability and intensity of aquaculture systems using an ecosystem approach. For demonstration practical experience, a visit to a farm located on the River Bistrina was provided, where oysters were grown, and various types of microalgae were used for laboratory feeding.

Breeding Technologies in Mariculture. Trainer: Kruno Bonacic. Trainee: Viktoriia Vechorka (SNAU).

The main topics covered included fish reproduction regulation, incubation technology for marine fish eggs, crustacean and mollusk breeding, and live feed production. Practical sessions involved comparing males and females of different fish species, conducting in-depth analyses of fish gametogenesis, and observing the development of fish embryos and larvae. Together with trainer Kruno Bonacic, a shellfish farm was visited; the topics of the Breeding Technologies in Mariculture module were discussed and planned, adapting them to the regional needs of Ukraine. A list of literature sources and supplementary materials (presentations, videos) were compiled, as well as a syllabus for the module "Breeding Technologies in Mariculture" was developed.

Diversification of Fish Farming. Trainer: Kruno Bonacic. Trainee: Oleksandr Mykhalko (SNAU).

Ass. Prof. Kruno Bonacic presented the theoretical part on the general vision of Aquaculture, its main principles, and issues of sustainable development in the whole world as well as in Croatia and Ukraine. This made it possible to discuss the issues of diversification of fish farming and criteria for selection of new species in both marine and freshwater aquaculture, as well as to explore topics related to current farming and hatchery technology that can be used for the introduction of new species, issues of reproduction, quality of offspring and larval rearing of fish new to aquaculture, and issues of fish feeding. Mr. Bonacic demonstrated topics of water quality, assessment of oxygen content, and contamination with pollutants using the example of the use of monitoring equipment under the conditions of the university laboratory.

Diversification of Shellfish Farming. Trainer: Ana Bratoš. Trainee: Oleksandr Kyselov (SNAU).

Assoc. Prof. Ana Bratoš prepared and demonstrated the theoretical and practical parts of the course. During the internship, the characteristics of different shellfish species growing in various ecological and geographical habitat conditions were analyzed. Also, during the classes, issues of organization and management of various methods of growing shellfish were discussed. This made it possible to formulate a clear structure of the curriculum, modules were formed that contained such areas as diversification of shellfish farming as a tool for sustainable development of the aquaculture

industry, diversification of the production cycle when growing shellfish, environmental and feed control of the reproduction and cultivation of shellfish, promising ways of diversification and innovative technologies for growing shellfish.

Entrepreneurship in Aquaculture. Trainers: Zorica Krželj, Iris Lončar, Ivona Vrdoljak Raguz. Trainee: Viktoriia Tkachenko (SNAU).

Under the supervision of Zorica Krželj, the Entrepreneurship Center of Dubrovnik has been visited, where I got acquainted with the tools for stimulating the development and functioning of enterprises. Specific entrepreneurs spoke about their activities and the support of entrepreneurship from the local authorities. Among the main goals of the center are increasing the level of success of newly established enterprises, promoting local entrepreneurship, supporting the economic growth of the region, promoting survival on the market, and developing start-ups. Iris Lončar. An open lecture was held on the balance sheet, accounting in business, and the structure of accounting bills. Generalized information on the movement of economic assets and sources of their formation. The structure of the accounting bills is considered based on examples of specific economic transactions. Ivona Vrdoljak Raguz. Meeting with leading specialists of Hrvatska Gospodarska Komora (HGK), Croatia, about the main areas of economic development of Dubrovnik-Neretva Country, including aquaculture, tourism, agriculture, renewable energy sources, transport, and logistics. The level of income from entrepreneurship and the level of wages of employees were analyzed. Discussed the prospects of cooperation with international organizations and the state in the context of further development and improvement of this territory.

Fisheries Technology and Evaluation of Fisheries Resources. Trainer: Branko Glamuzina. Trainee: Tetiana Kuchkova (SNAU).

Professor Branko Glamuzina introduced the development of fisheries in the world, with marine fisheries in Croatia, as an economic activity that is related to the management of living or renewable resources of the sea and includes the protection, fishing, and breeding of fish and other marine organisms; spoke about the popularity of sport fishing. It was explained in detail what is needed for marine fisheries to function at total capacity: exactly what equipment is required, fishing gear, devices for breeding fish and other marine organisms, plants for producing feed for fish breeding, etc. It has emphasized the importance of fish and seafood consumption in people's diets and assessed the stocks of fish resources. Besides, issues were discussed regarding the essential technologies of oyster breeding in Croatia, genetics, breeding of various types of fish, and aquaculture development in the light of new genetic perspectives.

***General Ichthyology*.** Trainer: Vlasta Bartulovic. Trainee: Bardukh Gabrielyan

During the theoretical part of the module, modern approaches to teaching general ichthyology were presented. The trainer proposed slightly expanding the taxonomy of fish in the module, in particular, to include lampreys and hagfish. The practical part was spent at the fish market, where local fish species were presented and the specifics of their structure and biological features were shown.

Ichthyopathology. Trainer: Tatjana Dobroslavic. Trainee: Oleg Shcherbakov

During the theoretical part of training, approach to teaching ichtyopathology in UNIDU was presented. The trainer suggested expanding a section on general pathology, stress, and immunity, emphasizing histological examination, as well as adding fish anatomy and physiology topics. The fish vaccination topic was excluded as unnecessary for specialists in aquaculture and fishery. The practical part included a field trip to a shellfish farm, where specific pathogens and pests of oysters and mussels were presented; a visit to the fish market, where local fish species, their pathogens,

and veterinary control features were presented; laboratory work on fish general sanitary and pathological examination.

Introduction to Ecology. Trainer: Josip Mikuš. Trainee: Ihor Kovalenko (SNAU).

Assoc. prof. Josip Mikuš presented a set of basic theories about water bodies and processes. During the training were explored the current causes of water pollution and their solutions, discussed the assessment of the state of aquatic ecosystems, and the characteristics of the main ecological communities of aquatic organisms, and considered the processes of self-purification and ecosystem recovery after the impact of pollutants. Josip Mikuš also explained in detail the analysis of methods and techniques for regulating the ecological parameters of aquatic ecosystems and supporting the sustainable use of water resources. As a result of the internship, fundamental knowledge of ecology was gained for the rational use of water resources and for solving environmental problems related to water use. Under the trainer's guidance, a curriculum for the discipline "Introduction to Ecology" was developed, which will be implemented at Sumy National Agrarian University.

New Technologies in Mariculture. Trainer: Marina Brailo Šćepanović. Trainee: Yana Illiashenko (SNAU).

During the training, various aspects of mariculture were considered, including the use of advanced technologies in the cultivation of fish, mollusks, and algae. Assoc. prof. Marina Brailo presented a wide range of innovative approaches to the management of mariculture systems, including the use of automated water parameter control systems, optimization of containment conditions, and use of alternative energy sources to ensure environmentally friendly production. Special attention was paid to the new technologies in mariculture, such as water recycling and vertical cultivation systems. Were examined in detail the anatomy, physiology, and behavior of fish and mollusks, which helped to better understand their needs and requirements for conditions of detention, in particular temperature conditions, water salinity, and nutrition.

Organization of business and financial activities of fishery enterprises. Trainers: Ivona Vrdoljak Raguž, Iris Lončar. Trainees: Vladyslav Solodkyy, Liudmyla Beztelesna (NUWEE).

During the training sessions, the trainers thoroughly explained the theoretical and practical aspects of business organization and financial activities of fishery enterprises. The lecture component of the training was focused on providing complete and useful information on the balance sheet and its components as the main accounting indicator of financial strength. Important and useful components of the training were meetings with representatives of the Department of Economics and Business and The Croatian Chamber of Economy Dubrovnik County Chamber, which allowed us to form a comprehensive understanding of approaches to the work and organization of financial activities of the enterprises and the functioning of the business system as a whole.

Prevention and treatment of fish diseases. Trainer: Tatjana Dobroslavic. Trainees: Tetiana Poltavchenko, Tetiana Solodka (NUWEE).

Ass. Prof. Tatjana Dobroslavic emphasized the treatment and diagnostic methods for various fish diseases, including their causes, progression, and implications for both maritime and freshwater aquaculture. Trainees also deepened their understanding of the pathophysiological changes that occur with various fish diseases. In practical classes, trainees honed diagnostic skills for diseases using different methods such as sampling, pathomorphological analysis, microscopic examination, bacteriological testing, and histological research. Additionally, they gained a comprehensive understanding of sanitary measures and rapid methods for assessing the freshness of fish and seafood products.

World fisheries. Protection and reproduction of hydrobiological resources. Trainer: Branko Glamuzina. Trainee: Alla Pryshchepa (NUWEE).

The classes were conducted as a combination of a theoretical approach and a discussion of teaching methods. Discussed at lectures about the biological resources of the World Ocean in fishing regions, the composition of catches, the infrastructure of fishing fleets of countries, considered the legal aspects and mechanisms of regulating the extraction of aquatic living resources, the operation of transport and fish processing vessels, terminals, etc. In practical classes learned to identify problems and evaluate the prospects for the development of world fisheries and aquaculture, to evaluate the role and effectiveness of state policy in this area, got acquainted with the approaches to assessing the state of fisheries in Ukraine and other countries, considered the prospects for their development in the context of sustainable development of the industry.

Food safety of aquatic animals' products. Trainer: Marina Brailo Šćepanović. Trainee: Garegin Hambardzumyan (ANAU)

During the training the several questions were discussed with the trainer: chemical hazards for aquatic animals and food; biological most common hazards for aquatic animals and food, the main sources of hazard and prevention mechanism. During the meeting the state food safety control were presented in both Armenia and Croatia with the obligatory safety control. In addition, numerous case studies about foodborne diseases connected to marine products were presented. The chemical risk assessment were discussed with the example of heavy metals.

Entrepreneurship in fishery and aquaculture. Trainers: Ivona Raguz, Iris Lončar, Zorica Colovic. Trainee: Hasmik Gevorgyan (ANAU).

Ivona Raguz gave us a thorough overview of the balance sheet and its parts as the main financial indicator for strength in fishery and aquaculture.

She explained key elements such as assets, liabilities, and equity in a clear way, showing us how they indicate solvency and liquidity. Iris Lončar guided us through the process of curriculum development during our training. She provided clear explanations and practical examples, helping us understand how to structure and design curricula to meet the specific needs of our students and the demands of the industry. With Iris Loncar and Zorica Colovic we had meetings with the president of the Dubrovnik Chamber of Economy, and with director of the Dubrovnik entrepreneurship center. Zorica Colovic introduced us to the key insights of the syllabuses for the entrepreneurship in fishery and aquaculture module. She provided valuable guidance and feedback, helping us ensure that our syllabuses were comprehensive, coherent, and aligned with the learning objectives of the course.

3.3. Slovak University of Agriculture (SUA in Nitra)

1) General training and visits

The training program at SUA Nitra was organized by the local AFISHE project team between 26th February and 9th March 2024. Based on application of selected trainees individual training activities were prepared in following modules: Aquaculture, Biodiversity Conservation, Biostatistics, Ecotoxicology, Fish Biochemistry and Physiology, Fishery, Management of Fishery and Aquaculture, Methodology of Scientific Research, Research Methodology, Technical Equipment of Aquaculture.

Each module was organized in two parts:

1) Theoretical background and organization of teaching plan at SUA
2) Practical work - case studies, examples of group work, laboratory, sample class

On the first day of training all participants we invited to meeting with assoc. prof. Dr. Lucia Palsova, vice-rector for international relationships for introductory presentation and formal welcome at SUA Nitra. Project manager at SUA Nitra, prof. Dr. Radovan Kasarda then informed participants about organization of training, individual schedules of lectures and practical activities. After the meeting were participants split to the groups based on the selected courses to meet with respective trainers and guided through the future training facilities.

First week of training was covering main theoretical outlines of selected modules, setting up basic prerequisites and preliminary knowledge essential for successful passing through the module. Trainers were providing sample lectures, different methodology of education and use of didactic and presenting techniques. Main accent was given to presentation of theoretical knowledge and active involvement of students in the teaching process. Theoretical training was split into four lecture blocks and trainees were assigned individual tasks and presentation preparation.

The second week of training was oriented on practical/ laboratory work and application of project and problem-oriented education techniques. Trainees were faced with examples/ labs that are used for practical education of students, guides used in search for solutions, and critical evaluation of presented conclusions.

During the training were organized several excursions and visits through the facilities used for research, teaching and training of students. All participants were invited to the AGROBIOTECH - biotechnology scientific centre of SUA in Nitra for guided tour through the research facilities and laboratories, practical presentation of infrastructure and equipment used in as well as application of scientific outcomes in the form of functional food products. The campus of SUA Nitra includes 25 ha of Botanic Garden with a collection of thousands of plant varieties (herbs, flowers, bushes, trees) used in the practical education of Botany and as a vital part of the Campus. Trainees were invited to a practical demonstration of facilities used in special husbandry: kennel and falconry, which are used in formal as well as non-formal education, hobby, and pleasure purposes as for presentation for visitors and future students.

2) Individual training

Trainings on the following modules were conducted at SUA.

Methodology of scientific research. Trainer: Radovan Kasarda. Trainees: Olha Biedunkova, Alina Petruk (NUWEE).

Professor Radovan Kasarda shared many years of experience in the effective selection of strategies and methods depending on the specific requirements of scientific projects, as well as the implementation of best practices in the educational process. During practical sessions, considerable attention was paid to the issues of state support for the fish farming industry in AFISHE partner countries, as well as the use of artificial reservoirs or the cultivation of fish in particular conditions, which allows controlling the living conditions of the animals for maximizing their growth and fast

development. The tools for motivating students to conduct scientific activities, the use of the latest teaching methods, as well as the issue of academic integrity, were discussed.

Technical equipment of aquaculture. Trainers: Jaroslav Andreji, Martin Fik. Trainee: Vasyl Korbutiak (NUWEE)

Assoc. prof. Jaroslav Andreji introduced the idea of fish farming technology concerning the species farmed in Slovakia in ponds or special cultural units, including the fundamental hydrobiological principles taking place in the aquatic environment. Within the pond, management gave knowledge about the reproduction and farming of the carp. Within trout farming, the focus was laid on the rainbow trout, which has the leading position in the total production of the Slovak aquaculture. Also, the trainees were presented with the main reproduction systems and technologies of farming species within Slovak aquaculture. Assoc. prof. Martin Fik introduced the laboratories and training centers of SUA.

***Aquaculture*.** Trainers**:** Jaroslav Andreji, Martin Fik. Trainees: Arman Harutyunyan(ANAU), Nelli Barseghyan (NAS)

Assoc. prof. Jaroslav Andreji presented outlines of the course as a combination of a theoretical approach (depending on previous knowledge about each area) and discussion of teaching methods to support classes with the aim to gain knowledge from the fish cultural systems (cold- as well as warm-water systems). Presented the origin and main characteristics of cultured fish species in both cultural systems, acquaints with culture methods and final products technology. At the end of the training, the trainee prepared and presented the class plan as an example of what they will have to do in the future. This plan has been critically discussed and adjusted accordingly. Assoc. prof. Martin Fik introduced laboratory and practical classes.

Biostatistics. Trainer: Juraj Candrak, Trainee: Hakob Khachatryan (ANAU)

Assoc. prof. Juraj Candrak provided an introduction to the field of Biostatistics and shared many years of experience in the form of theoretical and practical knowledge in the field of statistical evaluation of biological data and research application in practical field conditions. During the training, basic statistical methods were discussed in analyzing biological data and processes of livestock and humans with the main aim to allow for independently statistically analyzing biological data in the preparation of final theses and professional and scientific publications.

Biodiversity conservation. Trainer: Nina Moravcikova. Trainee: Zarine Tarkhanyan (ANAU)

Assoc. prof. Nina Moravcikova provided theoretical and practical experience in the methodology of education on the conservation of biodiversity. Different aspects of biodiversity were discussed in detail, as well as the role of AnGR in agriculture and food production. Trainee was introduced in the analysis and quantification of the state of AnGR biodiversity using methods utilising pedigree and molecular genetic data. Practical experience in best practices in the field of AnGR population management and avoidance of increase of risk of biodiversity loss were provided.

Ecotoxicology. Trainer Anton Kovacik, Trainee: Hranush Melkonyan (NAS)

Assist. Prof. Anton Kovacik shared broad experimental background about the exposure and bioavailability of contaminants in aquatic organisms and overall knowledge about the assessment of the toxicity of substances and their mixtures, the impact of pollutants on biomarkers, and the determination of the long-term risk of pollution of aquatic organisms and populations. Best practices in the fields of interpretation and use of biological results, analysis of the risk of harmful effects, and evaluation of ecotoxicological interactions. All topics, procedures, protocols, and

experimental tasks will be consulted, adapted, and optimised according to the possibilities and needs.

Fishery. Trainers: Jaroslav Andreji, Martin Fik. Trainee: Vardan Asatryan (NAS)

Assoc. prof. Jaroslav Andreji divided course infofmation to 4 main areas: physical -chemical properties of water, basics of biology, morphology, anatomy and physiology of fish, taxonomy of fish and angling (fishing). Main accent was given to the acquaintance of morphology, anatomy and physiology of fishes and types of aquatic environments. Detailed knowledge on generic composition of ichthyofauna and differentiation of fish species. Practical part was oriented on fishing methods, especially angling in the context of current legislation, which are applied in practice. Assoc. prof. Martin Fik introduced laboratory and practical classes.

Fish Biochemistry and Physiology. Trainer: Anton Kovacik. Trainee: Gayane Marmaryan (ANAU)

Assist. Prof. Anton Kovacik presented the course as a comprehensive guide to the complex biological systems of fish, offering a detailed exploration of their structure and function. The trainer informed trainees about overall knowledge of the analysis of anatomical systems such as the skeleton, muscles, respiratory, and circulatory systems, as well as the study of the physiological adaptations of fish to life in aquatic environments with emphasis not only on theoretical knowledge but also on practical skills in the laboratory and field research. Trainees discussed best practices in the fields of the biological complexities of fish, which helped them understand the broader ecological contexts and evolutionary adaptations that contribute to the diversity of aquatic life.

Biostatistics. Trainers: Juraj Candak: Trainee: Hakob Khacahatryan (ANAU)

Juraj Candák presented the main topics of biostatistics, which were related statistical methods that can be used to perform analyses in the field of fish farming. The software was used to perform multifactorial analyses and displayed statistical estimators.In the practical sessions, Juraj Candák introduced the SAS statistical package, which enables deep and multifaceted analysis, using big data and outputting results simultaneously in various MS Office applications. Associate Professor Juraj Candák conducts deep and detailed studies in the field of animal husbandry, particularly in cattle.

Research methodology. Trainer: Radovan Kasarda. Trainee : Arusyak Gharibyan (ANAU)

During the two-week Afishe Erasmus+ training on Research Methodology, Arusyak Gharibyan engaged in a sequence of lectures and discussions led by Professor Radovan Kasarda. The topics covered included various stages of research organization, analysis of research findings, the intricacies of composing scientific articles and posters, intellectual property, plagiarism, literature review, scientific writing, etc. In addition to the theoretical sessions, a guided tour of the SUA library was organized, during which Beata Bellerova, the library director, shared insights into the library's history and delivered a lecture on scientific integrity and publishing ethics. At the conclusion of the training, Arusyak Gharibyan presented a report focusing on the ethical principles of scientific research and also introduced the curriculum for a master's course in Research methodology.

Aquatic Animals Biochemistry and Physiology. Trainer: Anton Kováčik, PhD. Trainee: Gayane Marmaryan (ANAU)

Anton Kováčik presented the theoretical part of the core topics. Regarding the biochemistry module, the introduction to biochemistry of fish, the biochemical foundation, circulatory system and biochemistry of blood, enzymatic adaptation and metabolic pathways, lipid metabolism, fatty acids profile and oxidation, protein synthesis and nitrogen excretion have been discussed. What

refers the physiology module, external description of fish, movement system, respiratory and gastrointestinal system, nervous and sensory system, adaptation to aquatic environment were considered.

During a practical session, participation in biochemistry lab class was organized; the experiment was the separation of algae DNA by polyacrylamide gel electrophoresis method. The class was hold by Ing. Milan Chňapek. Dissection of fish and standard ichthyology evaluation was introduced by Anton Kováčik. A visit to the AgroBioTech research center was organized. By the end of the training the PPT on own vision on the subject content was presented by the trainee.

Management in Fishery and Aquaculture. Trainer: Martin Fik. Trainee: Arman Harutyunyan (ANAU).

During training, Martin first presented the study program based on which he is teaching the subject Management In Fishery and Aquaculture at their university. Participation in activities and lectures with students within the given subject was organized. Visits were made to infrastructures related to the taught subject, and the order and importance of practical training were presented. A textbook in English prepared by his colleagues was given by Martin, which will be the basis for the lectures and practical training to be prepared by the trainee. As a result of the training, the study program of the courses and the structure and content of the lectures were also discussed. At the end of the training, the trainee lectured students and colleagues on issues of fisheries and aquaculture management in Armenia.

4. Summary

To summarize, the internship and training program at the EU Universities was really rich and interesting. Participating researchers and teachers from Armenia and Ukraine were presented with all directions related to fisheries and aquaculture in Portugal, Croatia, and Slovakia. All the modules for which the AM and UKR participants were trained were provided at the highest scientific and teaching level because their organizers from the University of Porto, University of Dubrovnik, and Slovak University of Agriculture involved real professionals with practical experience and deep knowledge in teaching.

Moreover, the training facilities met the highest standards and included not only laboratories but also operational facilities. This allowed gaining practical skills in conditions of real functioning aqua systems and laboratories.

The training provided the participants with knowledge/tools that allowed them to know and understand key aspects of Aquaculture and Fishery on the background of current world environmental problems, and to use the most common field and lab equipment appropriate to the module. During the training sessions, the trainers thoroughly explained the theoretical and practical aspects of the modules. The lecture component of the training was focused on providing complete and useful information on a theoretical basis as the main indicator of practical strength. Also, comprehensive answers to a wide range of questions were received. The trainers presented the thematic content and rules for the formation of syllabuses, answered questions, and provided materials for preparing syllabuses and presentations.

At the end of the training, all participants presented their modules at a joint meeting and received certificates.

5. Appendixes

RESERCHERS/TEACHERS LIST FOR THE TRAINING

	Name, Surname	Position, academic degree/title	Email	Module	Training place
Armenian National Agrarian University					
1.	Arusyak Gharibyan	Lecturer, Chair of Social Sciences	ar.a.ghyan@gmail.com	Research methodology	SUA
2.	Zarine Tarkhanyan	Assistant, Chair of Forestry and Agroecology	tarzara5@gmail.com	Biodiversity conservation	SUA
3.	Artur Alaverdyan	Lecturer, Chair of Forestry and Agroecology	arthuralaverdyan1@gmail.com	Environmental and Water Management	U.PORTO
4.	Hakob Khachatryan	Associate Professor, Chair of Data Science	hkhachatr@mail.ru	Biostatistics	SUA
5.	Garegin Hambardzumyan	Associate Professor, Chair of Food Safety and Hygiene	garegin77@gmail.com	Food safety of aquatic animals	UNIDU
6.	Gayane Marmaryan	Associate Professor, Chair of Bioscience and general Chemistry	gmarmaryan@gmail.com	Fish biochemistry and physiology	SUA
7.	Arman Harutyunyan	Associate Professor, Head of Chair of Agribusiness Management and Politics	armanhar@list.ru	Management in fishery and aquaculture	SUA
8.	Naira Aloyan	Associate Professor, Chair of Water and Soil Resources Management	nairaloyan@gmail.com	Basic Aquaculture Engineering	U.PORTO
9.	Hasmik Gevorgyan	Lecturer, Chair of Agribusiness Management and Politics	gevgoghas@gmail.com	Entre. in fishery and aquaculture	UNIDU
International Scientific-Educational Center of NAS RA Scientific Center of Zoology and Hydroecology of NAS RA					
	ISEC				
1.	Oleg Shcherbakov	DVM, PhD, Researcher, Laboratory of Molecular Parasitology	oleg1vet@gmail.com	Ichthyopathology	UNIDU
2.	Hranush Melkonyan	Senior researcher, PhD, Associate Professor	hranushmelkonyan@gmail.com	Ecotoxicology	SUA
3.	Nelli Barseghyan	Senior scientific researcher Ph.D., Ecology	nelli.barseghyan@yahoo.com	Aquaculture	SUA
	SCZHE				
4.	Bardukh Gabrielyan	Head of Laboratory, Dr.of Biol. Sci. Professor	gabrielb@sci.am	General Ichthyology	UNIDU

5.	Vardan Asatryan	Lead researcher, PhD/Dr.	asatryanvardan@gmail.com	Fishery	SUA
6.	Armine Hayrapetyan	Senior scientific worker / PhD in Biology	armhayrapetyan309@gmail.com	Aquatic Animal Feeding and Nutrition	U.PORTO
7.	Lusine Hambaryan	Head of Hydroecology laboratory, PhD, Associate professor	lus-ham@yandex.ru	Biology of Cultured Algae	UNIDU
8.	Susanna Hakobyan	Head of laboratory of hydrobiology, PhD	susannahakob@gmail.com	General Hydrobiology	U.PORTO
9.	Gor Gevorgyan	Head of Laboratory, PhD	gor.gevorgyan@sczhe.sci.am	General Hydroecology	U.PORTO
Sumy National Agrarian University					
1.	Viktoriia Vechorka	Dean, professor of the department, professor, doctor of science	vvvechorka@gmail.com	Breeding Technologies in Mariculture	UNIDU
2.	Kyselov Oleksandr	Associate professor of the department, candidate of sciences	kyselov_snau@ukr.net	Diversification of Shelfish Farming	UNIDU
3.	Mykhalko Oleksandr	Associate professor of the department, doctor of philosophy	snau.cz@ukr.net	Diversification of Fish Farming	UNIDU
4.	Yana Illiashenko	Phd student of the department of Technology and Food Safety	Yannulia0911@gmail.com	New Technologies in Mariculture	UNIDU
5.	Kovalenko Ihor	Vice rector for academic work, professor, doctor of science	kovalenko_977@ukr.net	Introduction to Ecology	UNIDU
6.	Kuchkova Tetiana	Assistant of the department, PhD student	kuchkova1992@ukr.net	Fisheries Technology and Evaluation of Fisheries Resources	UNIDU
7.	Tkachenko Viktoriia	Associate professor of the department, candidate of sciences	viktoriyatk@gmail.com	Entrepreneurship in Mariculture	UNIDU
8.	Bordunova Olga	Head of the department, professor, doctor of science	bordunova.olga59@gmail.com	Aquaculture processing technology	U.PORTO
9.	Petrenko Anna	Assistant of the department, PhD student	anyutapetrenko@gmail.com	Aquaculture processing technology	U.PORTO
10.	Shkurko Maryna	Associate professor of the department, candidate of sciences	m.shkurko@ukr.net	Animal Welfare in Aquaculture and Public Aquariums	U.PORTO
11.	Koshel Olena	Associate professor of the department, candidate of sciences	olena.koshel@snau.edu.ua	Food Nutrition and Technology	U.PORTO

12.	Rebenko Halyna	Associate professor of the department, candidate of sciences	rebenko.halina@gmail.com	Bioresources of the hydrosphere and their use	U.PORTO
13.	Olga Korg	Associate professor of the department, candidate of sciences	korg.olga@ukr.net	Aquaculture of artificial and natural reservoirs	U.PORTO
The National University of Water and Environmental Engineering					
1.	Olha Biedunkova	Professor of the Department of Ecology, Technologies of Environmental Protection and Forestry, Doctor of Biological Sciences	o.o.biedunkova@nuwm.edu.ua	Methodology of scientific research	SUA
2.	Alina Petruk	Associate Professor of the Department of Water Bioresources, Candidate of Agricultural Sciences (Ph.D.), Associate Professor	a.m.petruk@nuwm.edu.ua	Methodology of scientific research	SUA
3.	Vasyl Korbutiak	Associate Professor of the Department of Land Management, Cadastre, Land Monitoring and Geoinformatics, Ph.D. in Technical Science	v.m.korbutiak@nuwm.edu.ua	Technical equipment of aquaculture	SUA
4.	Sergii Konotsev	Professor of the Department of Water Bioresources, Doctor of Technical Sciences, Associate Professor	s.v.konontsev@nuwm.edu.ua	Ornamental aquaculture	U.PORTO
5.	Yulia Hrokhovska	Professor of the Department of Water Bioresources, Doctor of Agricultural Sciences	y.r.grokhovska@nuwm.edu.ua	Water quality and fish health	U.PORTO
6.	Alla Kucherova	Senior Lecturer of Agro chemistry, Soil Science and Farming Department, Head of International Projects Department	a.v.kucherova@nuwm.edu.ua	Fish products sanitary control, standardization, and certification	U.PORTO
7.	Alla Pryshchepa	Director of Institute of Agroecology and Land Management, Doctor of Agricultural Sciences, Professor	a.m.pryshchepa@nuwm.edu.ua	World fisheries. Protection and reproduction of hydrobiological resources	UNIDU
8.	Tetiana Poltavchenko	Head of the department of Water Bioresources, Candidate of Veterinary Sciences (Ph.D.), Associate Professor	t.v.poltavchenko@nuwm.edu.ua	Prevention and treatment of fish diseases	UNIDU
9.	Tetiana Solodka	Associate-Professor at the Department of Agrochemistry, Soil Science and Agriculture, Candidate of Agricultural Sciences (Ph.D.), Associate Professor	t.m.solodka@nuwm.edu.ua	Prevention and treatment of fish diseases	UNIDU

10.	Vladyslav Solodkyy	Associate Professor of the Department of Enterprise Economics and International Business, Candidate of Economics (Ph.D.), Associate Professor; Head of the Department of International Cooperation and Migration Issues at the Center for International Cooperation and Education of the University	v.o.solodkyi@nuwm.edu.ua	Organization of business and financial activities of fishery enterprises	UNIDU
11.	Lyudmila Beztelesna	Professor of the Department of Management, Doctor of Economic Sciences, Professor	l.i.beztelesna@nuwm.edu.ua	Organization of business and financial activities of fishery enterprises	UNIDU
12.	Zinaida Budnik	Associate Professor of the Department of Ecology, Technologies of Environmental Protection and Forestry, Candidate of Agricultural Sciences (Ph.D.), Associate Professor	z.m.budnik@nuwm.edu.ua	Population ecology	U.PORTO
13.	Olha Varzhel	Senior lecturer of the Department of land management, cadastre, land monitoring and geoinformatics, PhD in "Environmental protection technologies"	o.v.varzhel@nuwm.edu.ua	Population ecology	U.PORTO

AFISHE - Development of Aquaculture and Fisheries Education for Green Deal in Armenia and Ukraine: from education to ecology

TRAINERS LIST

	Name, Surname	Position, academic degree/title	Email	Module
University of Dubrovnik				
1.	Marina Brailo Šćepanović	Assistant Professor	marina.brailo@unidu.hr	Food safety of aquatic animals
2.	Zorica Krželj Čolović	Associate Professor	zorica.krzelj@unidu.hr	Entrepreneurship in fishery and aquaculture
3.	Tatjana Dobroslavić	Associate Professor	tatjana.dobroslavic@unidu.hr	Ichthyopathology
4.	Vlasta Bartulović	Full professor with tenure	vlasta@unidu.hr	General Ichthyology
5.	Sanja Tomšić	Full professor	sanja.tomsic@unidu.hr	Biology of Cultured Algae
6.	Kruno Bonačić	Associate Professor	kruno.bonacic@unidu.hr	Breeding Technologies in Mariculture
7.	Ana Bratoš Cetinić	Associate Professor	abratos@unidu.hr	Diversification of Shelfish Farming
8.	Kruno Bonačić	Associate Professor	kruno.bonacic@unidu.hr	Diversification of Fish Farming
9.	Marina Brailo Šćepanović	Assistant Professor		New Technologies in Mariculture
10.	Josip Mikus	Associate Professor	josip.mikus@unidu.hr	Introduction to Ecology
11.	Branko Glamuzina	Full professor with tenure	branko.glamuzina@unidu.hr	Fisheries Technology and Evaluation of Fisheries Resources
12.	Zorica Krželj Čolović	Associate Professor	zorica.krzelj@unidu.hr	Entrepreneurship in Mariculture
13.	Branko Glamuzina	Full professor with tenure	branko.glamuzina@unidu.hr	World fisheries. Protection and reproduction of hydrobiological resources
14.	Tatjana Dobroslavić	Associate Professor	tatjana.dobroslavic@unidu.hr	Prevention and treatment of fish diseases
15.	Ivona Vrdoljak Raguž Iris Lončar	Full professor Associate Professor	ivona.vrdoljak@unidu.hr iris.loncar@unidu.hr	Organization of business and financial activities of fishery enterprises
University of Porto				
1.	Maria Antónia Salgado	Auxiliary Professor, BSc Sciences of the Aquatic Environment, PhD Marine Sciences	msalgado@icbas.up.pt	Environmental and Water Management
2.	Vítor Carvalho	Aquaculture projects consultant, BSc Sciences of the Aquatic Environment	vtcarvalho@hotmail.com	Basic Aquaculture Engineering
3.	Helena Peres	Auxiliary Professor, PhD Fish Nutrition	pereshelena@ciimar.up.pt	Aquatic Animal Feeding and Nutrition

4.	Adriano Bordalo e Sá	Full Professor, PhD Hydrobiology/Ecology	bordalo@icbas.up.pt	General Hydrobiology
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6.	Paulo Vaz-Pires	Associate Professor, PhD Biotechnology (Food Microbiology)	vazpires@icbas.up.pt	Aquaculture Processing Technology
7.	Ana Maria Valentim Ana Magalhães	BSc Biology, PhD Veterinary Sciences Invited Auxiliary Professor, MSc Ethology, PhD Biomedical Sciences	amaria@i3s.up.pt anam@i3s.up.pt	Animal Welfare in Aquaculture and Public Aquariums
8.	Rui Magalhães	BSc Sciences of the Aquatic Environment, MSc Biological Aquatic Resources, PhD Biology	rmagalhaes@ciimar.up.pt	Food Nutrition and Technology
9.	Alberto Correia + Benjamín Costas	Auxiliary Professor, BSc and PhD in Sciences of the Aquatic Environment Invited Auxiliary Professor, MSc Aquaculture, PhD Animal Science	atcorreia.ciimar@gmail.com bcostas.ciimar@gmail.com	Bioresources of the hydrosphere and their use
10.	José Calheiros	BSc Sciences of the Aquatic Environment, Director of a trout farm (cage farm)	quintadosalmao@mail.telepac.pt	Aquaculture of Artificial and Natural Reservoirs
11.	Mike Weber Ana Ferreira	Retired Auxiliary Professor, PhD Ecology, Director of a Public Aquarium and Museum BSc Sciences of the Aquatic Environment, Director of a Public Aquarium	ela.aguda@mail.telepac.pt ana.ferreira@merlinentertainments.biz	Ornamental Aquaculture

12.	Maria Antónia Salgado João Neves José Fernando Gonçalves	Auxiliary Professor, BSc Sciences of the Aquatic Environment, PhD Marine Sciences Invited Auxiliary Professor, PhD Associate Professor, BSc Sciences of the Aquatic Environment, PhD Aquaculture	msalgado@icbas.up.pt jfpvneves@gmail.com jfmg@icbas.up.pt	Water Quality and Fish Health
13.	Inês Rodrigues Bernardo Archer	MSc Veterinary Medicine, PhD student Animal Science MSc Veterinary Medicine	icrodrigues@icbas.up.pt bernarcher@gmail.com	Fish Products Sanitary Control, Standardization, and Certification
14.	Isabel Costa	Invited Associate Professor, PhD Estuarine Ecology and Modelling	isabel.costa@ciimar.up.pt	Population Ecology
Slovak University of Agriculture in Nitra				
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2.	Nina Moravčíková	teacher/ assoc.prof.	nina.moravcikova@uniag.sk	Biodiversity conservation
3.	Juraj Candrák	teacher/ assoc.prof.	juraj.candrak@uniag.sk	Biostatistics
4.	Anton Kováčik	teacher/ assist.prof.	anton.kovacik@uniag.sk	Fish biochemistry and physiology
5.	Marti Fik	teacher/assoc. prof.	martin.fik@uniag.sk	Management in fishery and aquaculture
6.	Anton Kováčik	teacher/ assist.prof.	anton.kovacik@uniag.sk	Ecotoxicology
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9.	Radovan Kasarda	teacher/ professor	radovan.kasarda@uniag.sk	Methodology of scientific research
10.	Jaroslav Andreji	teacher/assoc. prof.	jaroslav.andreji@uniag.sk	Technical equipment of aquaculture