VALENCIA

SEPTEMBER 22-25, 2025

aquaculture europe 25

#AE25VAL

Summary Report

Aquaculture for everyone

Invest in your planet

Organized by

european aquaculture society

Hosted by

CSIC Consejo Superior de Investigaciones Científicas

Generalitat Valenciana Conselleria de Agricultura, Agua, Ganadería y Pesca

Gobierno de España Ministerio de Agricultura, Pesca y Alimentación

Generalitat Valenciana Conselleria de Educación, Cultura, Universidades y Empleo

www.aquaeas.eu

AE2025 GOLD SPONSOR

AE2025 SILVER SPONSORS

SUPPORTED BY

ENDORSED BY

AE2025 MEDIA PARTNERS

Fish Farmer magazine	MisPeces.com	Aquaculture Magazine
Asia Pacific Aquaculture magazine	Kyst Fish Xpert	Panorama Acuícola Magazine
International Aquafeed Magazine	Industria Acuícola	FishFarmingExpert Magazine
Aquafeed.com	The Fish Site	Eurofish International Magazine
Hatchery International	Pesceinrete	

EAS STUDENT GROUP SPONSORS

This document provides information on the AE2025 scientific conference, with an overview of the event and a compilation of reports received by the session chairs of the parallel sessions, presented in alphabetical order.

Only simple editing has been made by the EAS secretariat.

The Student Spotlight Award, the winners of student travel grants to attend the event, and the AE2025 Poster Awards - as designated by the Session Chairs and Programme co-chairs - as well as the EAS Student Group Ibrahim Okumus Award are also presented.

Compiled by the European Aquaculture Society secretariat. October 2025

Photos courtesy of ThinkinAzul (CSIC) and EAS staff, unless where specifically stated.

Table of Contents

Acknowledgements and AE2025 Organising Committees

The successful coordination of our Aquaculture Europe events relies heavily on the dedicated efforts of our organizing committees, program co-chairs, and session chairs. We extend our heartfelt appreciation for the substantial time and energy contributed by these volunteers to ensure the success of the meeting.

Steering Committee (SC): Chair: Jaume Pérez Sánchez – IATS/CSIC, Diego Mendiola (Caviar Pirinea and EAS representative), Rafael Sebastián/Jorge Miguel Mocholí (DG Science & Research; Valencian Government for Education, Universities and Employment), Carola González Kessler/ Julian Garcia Baena (Spanish Ministry - MAPA), Javier Ojeda (APROMAR), Javier Remiro (Biodiversity Foundation) and Kilian Toledo (Alicante University)

Program Co-chairs: Diego Mendiola and Martin Føre (NTNU, Norway).

Local Organizing Committee (LOC): Ariadna Sitjà Bobadilla (IATS /CSIC), Francisco Montero (UV), Juan F. Asturiano (UPV), Jerónimo Chirivella (UCV), Rebeca Lago Garza (Spanish Aquaculture Technology Platform), Cristina Tomás (Spanish Aquaculture Society, SEA), Alejandro Güelfo / Caty Cabrera (MisPeces, Portal ACUI).

On top of this, our team is profoundly thankful for the invaluable assistance provided by our outstanding group of student helpers!

Figure 1: Student helpers.

Rossella Debernardis, PhD candidate at the Polish Academy of Sciences in Olsztyn, took on the role of Student Coordinator this year. She shared a few words about her experience:

"Being a student coordinator at the EAS Conference in Valencia was such a fun and rewarding experience! I had the chance to meet so many incredible students, and even though it was tiring at times, the energy and dedication of all the student helpers made it completely worth it."

Figure 2: Our EAS Student Group National Coordinators.

Overview, Opening and Plenary Sessions

Organised by the European Aquaculture Society (EAS), hosted by CSIC, Generalitat Valenciana and the Ministerio de Agricultura, Pesca y Alimentacion and supported by AE2025 Gold Sponsor Skretting, Silver Sponsors Biorigin, Dibaq, HIPRA, INVE and Mixscience, with session sponsors CTN as well as associate and media partners, AE2025 was held at the Valencia Congress Center and Sercotel Sorolla Palace hotel in Valencia, Spain.

Taking the theme "AQUACULTURE for EVERYONE. Invest in Your Planet," AE2025 attracted a total participation of 3,115 from an impressive 97 countries. Of the full conference delegates, 381 were students. The trade show presented products and services from 155 exhibitors. The scientific conference received 1,254 abstracts, resulting in 597 oral and 571 e-poster presentations in the 57 sessions of the event. AE2025 also included the Industry Forum, Innovation Forum and several workshops/special sessions specifically targeted towards industry.

Figure 3: AE2025 Conference Chair Jaume Pérez Sánchez.

The Opening Ceremony set the stage for a week of knowledge sharing and collaboration. Conference Chair Jaume Pérez Sánchez welcomed participants and thanked our supporting partners in Spain, the Local Organising Committee, the Steering Committee, and Programme co-Chairs Diego Mendiola and Martin Føre, strongly supported by the EAS Project and Programme Manager Ana Visković.

EAS President Marc Vandeputte extended a special welcome to EAS members and all delegates, highlighting the strong support of our hosting partners CSIC and expressing gratitude to our sponsors and media partners.

The ceremony continued with words of support from distinguished representatives:

- Javier Ojeda Gonzalez-Posada, General Secretary of APROMAR and of the Federation of European Aquaculture Producers.
- Juan Carlos Caballero Montañes, Head of Communication, Valencia City Council.
- José María Martell Berrocal, Vice President of Scientific Research, CSIC.
- José Antonio Rovira Jover, Regional Minister of Education, Culture, Universities and Employment, Generalitat Valenciana.

Figure 4: Speakers at the AE2025 Opening Ceremony - from left to right in the order as above.

As highlighted during the opening speeches, Valencia, the European Green Capital, stands as a living example of how tradition and innovation can go hand in hand to protect ecosystems, promote sustainability, and foster resilience. From the transformation of the Turia River Gardens into a "green lung" for the city, to the conservation of the Albufera lagoon and the farmlands around it, Valencia embodies the values that are also at the heart of aquaculture's future.

Figure 5: Participants and staff at the Opening Ceremony.

The opening ceremony concluded with the award of EAS Honorary Life Membership to Javier Ojeda Gonzalez-Posada for his exceptional contributions to European aquaculture. A key driver in managing producer associations and organisations and communicating complicated aquaculture issues to diverse audiences, Javier is the 17th recipient of this distinguished award.

On day 1, we had the honour of welcoming **Dr. Carlos Duarte**, Ibn Sina Distinguished Professor at KAUST (King Abdullah University of Science and Technology), who delivered an inspiring lecture on **"Regenerative Aquaculture to Reconcile Human and Planetary Health."**

Dr. Duarte reminded us that failure to achieve the Sustainable Development Goals will burden future generations, as hunger, pollution, climate change, and biodiversity loss continue to grow. He argued that regenerative aquaculture - practices that increase economic, social, cultural, and natural capital - can fast track progress toward these global goals.

However, according to the Web of Science (Sept 15, 2025), of the 52,413 papers on aquaculture, just 2,695 specifically focus on sustainable aquaculture and only 69 on regenerative aquaculture.

Key takeaways from his presentation:

- Regenerative aquaculture must create economic value, deliver quality jobs and healthy food, rebuild natural capital, and integrate cultural heritage and traditional knowledge.

- The sector needs to focus on producing seaweed, herbivores, and detritivores - the "blue superfoods" - to transform diets and ecosystems.
- Perceptions must be reframed: while two-thirds of land is transformed for agriculture, only 0.01% of oceans are used for aquaculture, yet it is often perceived as a problem.
- Regulations should enable, not hinder, aquaculture's role in the 4th Industrial Revolution, supported by incentives such as tax deductions and payments for ecosystem services.

And above all, aquaculture must be positioned as a positive force for both ocean health and human health.

Dr. Duarte concluded with a call to action: "Aquaculture for Everyone - Invest in Our Planet." By building partnerships, accelerating innovation, and embracing a regenerative mindset, aquaculture can help reshape a more sustainable and equitable future.

Figure 6: Dr. Carlos Duarte (left), and Jaume Pérez-Sánchez, Dr. Carlos Duarte, and Ariadna Sitja Bobadilla (right).

Plenary 2 was opened by Programme Co-Chair Martin Føre, who welcomed our keynote speaker, **Dr. Elisabetta Giuffra** (INRAE, Paris-Saclay University, AgroParisTech). Dr. Giuffra delivered a thought-provoking lecture on **"Leveraging the value of functional genome annotations and refined phenotypes."**

Since 2015, the functional annotation of genomes has been adding new value to genome sequences in both terrestrial and aquatic farmed species. Projects such as GENE-SWitCH and other H2020 EuroFAANG RI initiatives have paved the way for stronger genotype-to-phenotype research and applications, while shaping future research priorities for animal farming.

She also presented an exciting new European initiative that will further support fundamental and applied research across animal farming domains.

Figure 7: Dr. Elisabetta Giuffra presenting.

And finally, on the last day, Plenary 3 included a presentation from **Joan Riera** of the Kantar Worldpanel entitled **"What's happening with seafood consumption ?"**

The latest Eurobarometer report from the European Commission reveals a decline in seafood consumption across the European Union (EU). Only 29% of Europeans consume fishery and aquaculture products at least once a week at home, a figure that has dropped compared to previous years. However, Spain remains an exception to this trend, leading the EU in seafood consumption.

So what is happening? Is price the only driver? Is this a growing concern for us all?

Joan Riera took us through recent consumption data from Spain and gave us his insights into Spanish consumer trends and patterns for the main seafood products coming from both fisheries and aquaculture.

Key observations:

- While we generally eat more meat than fish, we know that we should take better care of our health and we want to follow a healthy diet.
- But inflation and cost of living increases over the last 4 years mean that we are more price sensitive and we ae looking for cheaper proteins – and changing the way we shop for those.
- We also reduce cooking time by choosing more ready meals _ looking for convenience but also indulgence. And fish is not generally perceived as being convenient, compared to other fresh food.
- But aquaculture has great potential and opportunities. We ae getting older, and as the retired percentage of the population increases, that proportion of the population eats more fish. And Seafood consumption is also higher with families having older children.

So if aquaculture can continue to adapt to consumer needs, there will be a natural growth in demand, as these "older" families and households have time, want and need a healthy diet and love seafood products.

Figure 8: Joan Riera presenting.

The AE2025 Student Spotlight Award

Once again, the event opened with the **Student Spotlight Award**, celebrating the outstanding research and talent of the next generation of aquaculture professionals.

For AE2025, a total of **163 student abstracts** were received by the May 1st deadline. Following a rigorous pre-selection by the **EAS Board of Directors**, the **AE2025 Programme Co-Chairs**, **Diego Mendiola** and **Martin Føre**, selected three finalists to present their work live in the plenary session.

Alice Gasperini Institute of Aquaculture Torre de la Sal (IATS, CSIC), Spain	**Diogo Amaral** Ciimar, Portugal	**Carl John Saromines** IRTA, Spain
		
DECODING BIOLOGICAL AGEING TO ENHANCE WELFARE IN FARMED SEA BREAM: A TRANSCRIPTIONAL AND EPIGENETIC APPROACH	CIRCULAR PRODUCTION OF MEALWORM (*Tenebrio molitor*) MEAL: EFFECTS ON BIOACTIVE PROPERTIES AND IMPLICATIONS FOR RAINBOW TROUT (*Oncorhynchus mykiss*) IMMUNE AND OXIDATIVE STATUS	MUSHROOM MEAL AS AN ALTERNATIVE AQUAFEED PROTEIN INGREDIENT: IMPACT ON GROWTH PERFORMANCE AND GUT MICROBIOME OF RAINBOW TROUT *Oncorhynchus mykiss*

The session was hosted by **Silvia Natale**, Student Representative on the EAS Board of Directors, and the award was presented by **Marc Vandeputte**, President of EAS. Each finalist delivered a concise three-minute pitch, after which the plenary audience voted live to determine the winner.

Out of an estimated **700** attendees in the plenary, the audience voted **Carl John Saromines** as the winner of the **Student Spotlight Award 2025**, receiving additional **€300 prize**.

A special mention goes to **Alice Gasperini**, not only for her excellent research but also for being the youngest finalist at just **21 years old** - an impressive achievement and a testament to the bright future of aquaculture science.

EAS warmly congratulates all three finalists for their inspiring presentations and contributions to advancing aquaculture research.

Figure 9: Student Spotlight finalists presenting their work - Alice Gasperini, Diogo Amaral, and Carl John Saromines (from left to right).

Figure 10: Carl John Saromines receiving his award from Marc Vandeputte (left), and the finalists with Marc Vandeputte and Silvia Natale (right).

AE2025 Travel grants

Each year, the **EAS Student Group** recognises and supports the exceptional work of international students attending **Aquaculture Europe**. The travel grant aims to encourage participation, foster networking, and give visibility to outstanding young researchers in our community.

For 2025, applicants submitted their conference abstracts along with a motivational letter. After a careful selection process, **three students** were awarded the **EAS Student Group Travel Grant**, receiving €250 each:

- **Yoon-Ji Lee** – Jeju National University, Republic of Korea
- **Manojkumar Chandraprakasham** – University of Tasmania, Australia
- **Brenda Maria Alho** – Federal University of Pará (UFPA), Brazil

A short recognition ceremony was held during **Plenary 2**, where **Martin Føre** (Programme Chair) and **Silvia Natale** (Student Representative on the EAS Board of Directors) presented the certificates to the winners.

EAS congratulates all three students for their outstanding contributions and for representing the global aquaculture student community with excellence.

Figure 11: Martin Føre, Brenda Maria Alho, Yoon-Ji Lee, Manojkumar Chandraprakasham, Silvia Natale (from left to right).

Parallel session summaries

The following session reports were provided by the session chairs, with only minor editing made by the EAS secretariat. They appear here in alphabetical order of those reports submitted.

Allocating space for aquaculture

Chaired by Kilian Toledo (University of Alicante, Spain) and Francesco Cardia (ISPRA, Italy).

Four presentations were delivered during this mini session, addressing the challenges faced by aquaculture both on land and at the sea. Not only to find suitable sites for its development, but also to overcome bottlenecks in the licensing process and promote a comprehensive governance framework that ensures sustainable development.

One of the issues that have received little attention in site selection models for aquaculture is the quality of the data that are used to feed the models, and how they can greatly influence their outcomes. The assessment of the data quality in the selection of Allocated Zones for Aquaculture (AZAs) will be of great relevance in the future of Maritime Spatial Planning (MSP), especially if an adaptive approach is to be taken in the context of global change.

Once suitable aquaculture sites are established, the industry faces long licensing processes that are often complex and may prevent a fully deployment of aquaculture potential in certain countries. This may be connected to the fact that in most cases the licensing process relies on regional and local authorities. Experiences demonstrated the potential of multi-criteria spatial analysis, while governance reforms (e.g., Norway) illustrated the benefits of decentralised management and professional regional networks. However, there is a clear need to allocate sufficient human resources with the necessary capacitation to streamline the licensing process.

Recent developments in aquaculture spatial planning show increasing attention to the integration of spatial tools, data evaluation frameworks, and governance mechanisms supporting decision-making. At EU level, Commission Staff Working Documents have consolidated good practices and offered practical guidance on access to space and water. At the global level, the FAO–ISPRA workshop focused on the development of a roadmap identifying priority areas and actions to integrate aquaculture into MSP, to support countries in implementing MSP in aquaculture.

Persistent gaps include uneven availability and quality of spatial data, governance inconsistencies in application procedures, and challenges in balancing environmental and industrial interests. Discussion also highlighted limited institutional capacity and fragmented frameworks constrain MSP integration for aquaculture.

The way forward emerging from the session presentations appears to be oriented towards the adoption of transparent and open-source tools, increased digitalisation, and the strengthening of governance mechanisms such as one-stop-shop approaches and streamlined regulatory frameworks.

Strengthened networking and knowledge exchange are expected to support greater harmonisation, while growing competition for aquatic space and the emergence of new species will likely require innovative approaches to co-use, climate adaptation, and ecosystem restoration.

Challenges include ensuring high-quality spatial data, enhancing cross-sectoral governance, and addressing the social dimension of aquaculture. Is also essential to improve social acceptance, likely through a stronger stakeholder engagement and availability of transparent decision-making processes.

Although the session hosted only a limited number of presentations, this should not be interpreted as a lack of relevance. Unfortunately, the scarcity of contributions suggests that the topic remains underestimated, perhaps perceived as an already achieved or consolidated area by the scientific community. In reality, allocating space through science-based approaches and robust regulatory frameworks still requires further efforts, research, methodological development, and cross-sectoral dialogue to effectively support sustainable and resilient aquaculture growth

Aquaponics

Chaired by Julie Hansen Bergstedt (DTU AQUA, Denmark).

The Aquaponics session brought together 16 oral presentations, which covered a broad range of water sources, technologies, as well as a diverse selection of fish and plant species. All highlighted the development of aquaponic and hydroponic systems as an approach to improve the sustainability of the current food production, by using the unexploited resources of wastewater. Collectively, the contributions demonstrated how aquaponics can transform water and nutrient management both as systems integrated in aquaculture production facilities, but also utilizing urban wastewater as a resource.

The presentations revealed substantial progress in system design, resource recovery, and digitalization. Innovations included advanced water treatment for safe reuse of reclaimed wastewater, scalable nutrient recovery from aquaculture effluents, multi-loop and decoupled configurations, integration of anaerobic digestion for energy and nutrient recycling, and the use of novel biological filters and co-cultivation species. Digital twins and data-driven control strategies are emerging as tools for precision management, enabling optimization of system performance and sustainability. Collectively, these advances demonstrate that modern aquaponics can achieve high food safety standards, improve nutrient efficiency, and minimize environmental impacts.

Despite these promising developments, aquaponics still faces technical, economic, and social barriers. Regulatory frameworks for the use of reclaimed water in food production remain underdeveloped, and public acceptance of wastewater-based systems is also an emerging topic. High capital and operational costs constrain commercial scalability, and knowledge gaps persist regarding long-term contaminant dynamics, microbial stability, nutrient balancing, and the valorization of the solid waste streams. The growing focus towards circular and resilient aquaponic systems that is emerging, emphasizing energy recovery, zero-waste operation,

adaptability to different water sources and climates and promotes more localized food production. Advances in system design (coupled, decoupled, and multiloop configurations), the physiology of the cultivated species, and the development of digital tools are paving the way for more resource-efficient designs, supported by smart monitoring systems and modeling tools. Altogether, the presentations collectively underscore that aquaponics is moving toward a digitally integrated system that provides water reuse technologies with operational flexibility in terms of cultivation species selection, temperature and salinity. Future trends and focus will be placed on economic feasibility in order to support scalable applications, regulatory frameworks, biological and environmental optimization of cultivated species, including welfare aspects, and public acceptance.

Conservation & Restoration

Chaired by Llucia Mascorda Cabre (University of Plymouth, UK).

This session presented a broad spectrum of innovative research topics, highlighting both the scientific progress and the persistent knowledge and implementation gaps within conservation and restorative aquaculture. Topics ranged from low-trophic aquaculture in the Mediterranean and octopus population assessments to cryopreservation of salmonids and sturgeons, and successful seahorse aquaculture. Collectively, these studies emphasize a growing scientific trend toward positioning aquaculture as a tool for conservation and ecosystem restoration.

Knowledge Gaps and Scientific Challenges

One of the key knowledge gaps identified relates to **cryopreservation** technologies. Although promising advances have been made and certain applications are already in place, there remains a lack of standardized, internationally agreed-upon protocols. This has resulted in inconsistent methodologies across countries and laboratories, leading to inefficiencies, limited reproducibility, and fragmented progress (FAO, 2022). To overcome this, greater coordination, funding, and involvement from industry stakeholders are needed to develop harmonized guidelines and foster international collaboration.

Another critical challenge is the **introduction of new species** into aquaculture. Each species presents unique biological and ecological requirements, complicating the development of universal cryopreservation and husbandry protocols. As novel species are explored for aquaculture, particularly those with conservation value, regulatory frameworks and research efforts must adapt accordingly (Henry et al., 2021).

Conceptual and Terminological Uncertainties

The session also revealed persistent confusion regarding terminology and conceptual frameworks within the field. Terms such as *restorative*, *conservation*, *sustainable*, and *low-trophic aquaculture* are often used interchangeably, leading to misunderstandings among scientists, regulators, and industry practitioners. This lack of consensus hampers communication and policy development, and underlines the need for a standardized lexicon and clearer definitions (Troell et al., 2014).

Furthermore, **low-trophic aquaculture**—including bivalves, seaweeds, and other filter feeders—was discussed as a promising restorative tool due to its potential to provide ecosystem services such as nutrient removal and habitat creation. However, the session underscored that there is still **insufficient quantification of these ecosystem services**, limiting the ability to justify and implement these systems at scale. More interdisciplinary research is required to assess the ecological, social, and economic benefits of these practices (Alleway et al., 2019).

Regulatory and Funding Barriers

A recurring theme was the **lack of funding**, particularly for conservation-driven aquaculture initiatives that are not yet market-oriented. Both cryopreservation and low-trophic systems require long-term investment in research, infrastructure, and capacity building. Additionally, **regulatory fragmentation** was identified as a barrier, with varying national approaches to permitting and monitoring these activities. Effective conservation aquaculture requires adaptive and harmonized regulatory frameworks that reflect the unique goals of biodiversity preservation rather than conventional production (Mascorda-Cabre et al, 2021, 2024; Le Gouvello et al, 2022).

Future Trends

The session pointed to a **clear trend towards integrating aquaculture into conservation and restoration strategies**. This includes the use of aquaculture to support depleted wild populations (e.g., seahorses), maintain genetic diversity (e.g., through cryopreservation), and restore habitats (e.g., shellfish reefs or seaweed forests). However, the full potential of these efforts can only be realized through:

- Development of **international standards and protocols**, especially in emerging fields like cryopreservation.
- **Terminological harmonization** to support clearer communication and policy alignment.
- **Quantitative assessments** of ecosystem services provided by restorative aquaculture.
- **Cross-sector collaboration** among scientists, regulators, and industry stakeholders to drive innovation and shared understanding.

In conclusion, while conservation and restorative aquaculture is a rapidly evolving field, realizing its full potential requires addressing foundational knowledge gaps, regulatory uncertainties, and funding limitations. Enhanced collaboration, both scientific and institutional, will be essential to develop aquaculture systems that are not only sustainable but actively contribute to ecosystem health and biodiversity.

References

- Alleway, H. K., Gillies, C. L., Bishop, M. J., Gentry, R. R., Theuerkauf, S. J., & Jones, R. (2019). The ecosystem services of marine aquaculture: Valuing benefits to people and nature. *BioScience*, 69(1), 59–68. https://doi.org/10.1093/biosci/biy137
- FAO. (2022). *Cryopreservation of fish gametes and embryos: A review of current status and future needs*. Food and Agriculture Organization of the United Nations.

- Henry, R. P., et al. (2021). Challenges and opportunities in emerging aquaculture species. *Reviews in Aquaculture*, 13(2), 735–753. https://doi.org/10.1111/raq.12500
- Le Gouvello, R., Brugère, C., Simard, F. (2022) Aquaculture and Nature-based Solutions: identifying synergies between sustainable development of coastal communities, aquaculture, and marine and coastal conservation. *IUCN Report*. https://portals.iucn.org/library/efiles/documents/2022-005-En.pdf
- Mascorda-Cabre, Ll., Hosegood, P., Attrill, M.J., Sheehan, E.V. (2024). Biogenic reef creation and biodiversity enhancement by an offshore longline mussel farm. *Ecological Indicators, 167:112708*. https://doi.org/10.1016/j.ecolind.2024.112708
- Mascorda-Cabre, Ll., Hosegood, P., Attrill, M.J., Sheehan, E.V. Offshore longline mussel farms: a review of oceanographic and ecological interactions to inform future research needs, policy and management (2021). *Reviews in Aquaculture, 1-24*. https://doi.org/10.1111/raq.12549
- Troell, M., Naylor, R. L., Metian, M., Beveridge, M., Tyedmers, P. H., Folke, C., ... & Deutsch, L. (2014). Does aquaculture add resilience to the global food system? *Proceedings of the National Academy of Sciences*, 111(37), 13257–13263. https://doi.org/10.1073/pnas.1404067111

Early life

Chaired by Erik Burgerhout (NOFIMA, Norway), Christiaan Henkel (Norwegian University of Life Sciences, Norway) and Geert Rombaut (INVE Aquaculture, Belgium).

Session sponsor: INVE

During the Early Life session, 17 speakers presented their research on a range of fish and invertebrate species. While their topics were superficially highly diverse, the overarching theme uniting these speakers and the audience of approximately 80 was the conviction that a successful adult life is irreversibly 'programmed' by environmental conditions already during egg and larva development.

As early life causes and long-term effects are separated by months or years, most speakers emphasized the need for a mechanistic understanding of the processes leading to a successful and healthy adult animal. Perspectives ranged from basic developmental biology to feed content optimization, linked by studies on nutritional programming and gut development. Many speakers adopted cutting edge molecular tools to decipher mechanisms, including metabolomics and transcriptomics.

The presentations were organized by life stage, starting at the embryo developing inside the egg, continuing with free-swimming larvae transitioning to exogenous feeding, and finally ending with later effects of early conditions. The main environmental conditions studied were temperature and larval feed. Suboptimal (often elevated) rearing temperatures lead to faster growth, but also to increased deformities and mortality later in life. Similarly, suboptimal larva diets lead to skeletal and other deformities.

The participants collectively outlined a whole-life cycle view of animal health and welfare, in which experimental interventions and observable effects can be years apart. This emerging

integrated perspective is highly valuable for both the aquaculture industry and the research community, both of which are often characterized by specialization and a division of labour.

Education & capacity building

Chaired by Adelino Canario (University of the Algarve, Portugal) and Lluis Tort (University of Barcelona, Spain).

The session on Education and Capacity Building opened with a communication and tribute to the personality and contribution of Margaret Eleftheriou, most probably one of the persons that worked the most and during more than 30 years in the area of Education and Training in Aquaculture in Europe in different languages, through different EU projects and initiatives.

The session continued with the presentation of Kristine Sundell on a successful Master's Program in the Nordic countries based on transdisciplinary collaboration and hands on experience in different settings of this Nordic area. In this direction, Alexandra Neyts presented a new approach for capacity building in Norway addressed to the Aquaculture sector as some unmet competences were detected by associations and companies, particularly by building *a Birdgehead Aquaculture* connecting university with other members of the community and younger students with the aim of integrating not only specific aquaculture knowledge but interdisciplinary competences to foster careers in the blue sector.

Another of the presentations regarding education and learning for the young ones, was the project involving Greece and The Netherlands with the partnering of the European Outdoor Education Hub on fish discards and plastic pollution. Results showed how such programs can encourage sustainability, empowering coastal communities and educating children on the problems and solutions related to the future of the seas and of Aquaculture.

Finally, the last presentation was given by Prof. Adelino Canario by introducing AQUASERV, the research infrastructure program funded by Horizon Europe that offers over 60 European facilities related to Aquaculture, Fisheries, Ecosystem Restoration and Blue Economy. It was emphasized the great opportunity of researchers for travelling, using facilities and being funded for this program, thus allowing technological and scientific impact that could not be obtained from the home institution.

Environment – Interactions

Chaired by Daniele Brigolin (University of Venice, Italy).

The Environment-Interactions session covered different trophic levels, environments and rearing techniques, including freshwater, transitional, and marine waters, extractive and fed aquaculture production systems. Overall, 12 talks were discussed during the afternoon session,

and 7 posters were uploaded. The average quality of the presentations and the posters was high, covering both aspects related to aquaculture pressures on the environment and, the other way around, environmental factors affecting aquaculture performance (impacting productivity, welfare, suitability).

The first area of attention concerned the definition of indicators for assessing environmental interactions and ecological carrying capacity of aquaculture, which was discussed over multiple spatial scales, from the local (e.g. selection of best suited benthic impact indicators) to the whole value chain (e.g. indicators of circularity of nutrients in integrated multi-trophic system).

Climate change was a second topic receiving high attention. Effects of climate induced shifts in water temperatures were considered both at the individual and at the population level, through different methods, including histological and molecular approaches, and measurement of physiological rates, and population level parameters. Interest in assessing climate change effects on the organisms was accompanied by that of identifying resilience of different fish populations to environmental changes. Temperature changes were considered as isolated pressure, or in combination with other abiotic and biotic factors, including shifts in salinity and oxygen, and jellyfish blooms. Interactions among multiple climate-related pressures thus emerged as an important area of research requiring attention.

Changes in environmental parameters were discussed also in relation to the ecology of diseases and parasites, with contributions considering both viruses, and invertebrates. The study of the role of host transfer in the exchange of parasites was discussed.

A better understanding of the relationship between diseases and environmental factors was recognized as an important asset to improve aquaculture resilience and inform spatial management and planning. The topic of escapees was covered in poster presentations, by studying impacts on wild populations through fishery data and isotope analyses. In terms of management implications, the use of schemes for classifying environmental impacts of alien taxa was discussed.

A last important area of interest within the session concerned the socio-ecological systems perspective, in which ecosystem services of aquaculture were discussed: in particular the focus was on non-market values of the activity, with contributions covering freshwater and transitional environments, although the discussion pointed also to applications suited for marine systems.

Environment - Microplastics, Litter & Ecotoxicity

Chaired by Inmaculada Varo (CSIC, Spain).

The session on Environment – Microplastics, Litter & Ecotoxicity addressed some of the most pressing environmental challenges facing aquaculture today, with a particular focus on microplastics, their biological effects, and broader implications for ecosystem health and

regulatory frameworks. It featured seven oral presentations and twelve e-posters,covering a wide spectrum of topics from molecular ecotoxicology to policy analysis.

The oral presentations showcased cutting-edge research on the physiological and behavioural impacts of microplastics and plastic-related contaminants in aquatic environments. Key studies highlighted oxidative stress, anorexia, and anxiety-like responses in species such as European seabass and goldfish. Investigations into pollutant bioconcentration in eels, and the degradation of polyester fibres provided insights into contaminant dynamics and textile-derived pollution.

Molecular-level research revealed endocrine disruption in seabass, while a survey of aquaculture equipment in Norway identified plastic sources contributing to marine litter. The session concluded with an interdisciplinary review of European legal responses to microplastics, emphasizing the importance of science-based policy development.

Additionally, the ePoster session presented a diverse array of studies addressing the environmental impacts of plastics, pharmaceuticals, metals, and emerging contaminants in aquatic ecosystems. Innovative methodologies were presented, including transgenic zebrafish for xenoestrogen detection and multi-omics approaches in seabass linking behavioural changes to molecular biomarkers. Several studies examined microplastic emissions from aquaculture, the toxicity of biobased nanoplastics, and the chronic effects of antibiotics on zooplankton. Notably, research on water contamination from war zones and military activities in Ukraine offered novel insights into ecotoxicology in conflict-affected regions. A study on bioplastics highlighted PHBV toxicity in *Artemia* under food scarcity, providing key data on bioplastic safety.

Overall, the session emphasized the need for integrative, species-specific, and ecologically relevant approaches to pollution monitoring and risk assessment.

Together, the session underscored the complexity of microplastic pollution—from molecular disruptions in aquatic organisms to broader regulatory and ecological challenges. The findings presented highlight the urgent need for integrated, species-specific, and environmentally relevant approaches to monitoring, mitigation, and policy development in both marine and freshwater systems.

Environment - Monitoring, Forecasting & Indicators

Chaired by Paul Mosnier (MRAG, UK) and Leire Arantzamendi (AZTI, Spain).

The session hosted a total of 16 full presentations and one poster presentation, with speakers coming from across the globe - Spain, Italy, France, Hungary, Germany, Portugal, Norway, Faroe Islands, Canada, South Korea, USA and UK were all represented! Species included across the sessions included mussels, salmon, freshwater carp, seabass, olive flounder, farmed sturgeon and even amphipods!

The session showcased the range of monitoring tools, techniques and technologies applied to different bio- and physico-chemical parameters including sea lice prevalence, water chemistry and environmental impacts. More specifically, the presentations ranged across 4 core sub-themes including:

Ecosystem Services

- Aquaculture systems interact with ecosystems in complex ways, providing and relying on a range of ecosystem services. Several presentations explored how ecosystem service frameworks can enhance environmental performance assessments and guide sustainable aquaculture development across diverse production models.

Biomonitoring

- Several presentations brought together cutting-edge research on biomonitoring technologies and protocols that enhance environmental assessment and management in aquaculture and coastal ecosystems. The studies presented spanned molecular, imaging, and ecological approaches, offering scalable solutions for monitoring biodiversity, parasite dynamics, and climate change impacts.

Water Quality

- These presentations showcased innovative tools and strategies designed to improve aquaculture sustainability, resilience, and environmental performance. The presentations spanned AI-driven decision support, water quality management, physiological monitoring, and real-time ocean data systems.

Life Cycle Assessment

- The application of Life Cycle Assessment (LCA) methodologies to aquaculture, with a focus on high-value and luxury products. The presentations highlighted how LCA can identify environmental hotspots, guide mitigation strategies, and support more sustainable production systems.

Figure 12: Some of the speakers from the Environment – Monitoring, Forecasting and Indicators session, with co-chairs Leire Arantzamendi and Paul Mosnier, and student representative Afonso (Photo courtesy of Paul Mosnier).

The presentations included:

- Accessible Deposition Modelling Tools for Environmental Planning (ADepoPlan) *by Birgitta Andreasen*
- Bivalve Aquaculture in the EU: Environmental Benefits, Growth Potential & Challenges *by Leire Arantzamendi*
- Climate Change Adaptations in Salmon Aquaculture: Ecosystem Service Impacts & Trade-Offs *by Megan Rector*
- Ecosystem Service-Based Environmental Performance Indicator for Inland Pond Aquaculture *by Bela Halasi-Kovacs*
- eDNA on Trial: Toward a Standard Protocol for Biomonitoring in Salmon Farming by *Mahshid Oladi*
- Effect of High Sea Water Rearing Temperature on Early Puberty in European Sea Bass *by Alicia Felip*
- Environmental Performance of Farmed Sturgeon Caviar Production: An LCA Study *by Ariana Martini*
- Fatty Acid Composition of Amphipods in Brackish and Marine Environments by *Luisa Marques*

- Harnessing Currents to Quantify Parasites: Molecular Analysis of Passively Collected Plankton *by Nathan Mertz*
- Improving Sea Farm Sustainability and Efficiency Through AI-Based Oxygen Prediction *by Pierrick L'Heveder*
- Long-Term Environmental and Coastal Biocenosis Monitoring in the Valencian Community *by Jose Tena Medialeda*
- Managing Water Quality Hazards in Flow-Through Aquaculture Systems by *Hyunsoo Choi*
- Mining *Lepeophtheirus salmonis* Transcriptomes for Stage-Specific Quantification of Parasitic Larvae *by Nathan Mertz*
- Optimizing Offshore Aquaculture with Real-Time Wave and Current Data *by Jasmine Eggleton*
- Real-Time Monitoring of Planktonic Sea Lice Using Machine Learning *by Bjarne Kvaestad*
- Resolving Species-Specific Function in Microbiome Analysis for Aquaculture Management *by Julianna Stangroom*
- Environmental Sustainability of Luxury Aquaculture Products Under Present and Future Climate Scenarios *by Riccardo Napolitano* (ePoster presentation)

Health management – biosecurity & prevention

Chaired by Carlo Lazado (NOFIMA, Norway) and Raul Benito Marco (HIPRA, Spain).

Session Sponsor: HIPRA

The papers presented in the **Health Management – Biosecurity and Prevention** session highlighted important advances in proactive, integrated, and technology-driven disease management. Progress was evident across the spectrum, from insights into the biology of innate immunity to the application of advanced mathematical models for epidemiological forecasting. Research emphasised efforts to develop needle-free vaccines, apply functional feeds, and implement real-time biosecurity tools to protect both established salmonid industries and emerging non-salmonid sectors. Vaccines dominated the pool of abstracts, underscoring their continued role as the most established measure for disease prevention.

Significant strides are being made in functional feed additives that influence the fish immune functions. A central development is the study of trained immunity in Atlantic salmon, which provides molecular evidence that innate immune cells can retain a form of "memory" after prior exposure. Thinh Hoang Nhan and colleagues demonstrated that β-glucan induced trained immunity in head kidney leukocytes, resulting in enhanced phagocytic activity upon re-stimulation. Complementing this, George et al. demonstrated that dietary supplementation with algal-derived β-glucan functions as both an immunostimulant and a growth promoter in Atlantic salmon and also serves as a tool for managing thermal stress in rainbow trout. However, not all immunomodulators show consistent benefits: E. Hernández and co-authors found that oral delivery of chitosan-encapsulated sea bass β-defensin 1 (Bdef1) produced only limited immune effects against Betanodavirus (NNV) infection, and unexpectedly reduced

virus-specific antibody production. This highlights a knowledge gap in the optimal delivery of antimicrobial peptides (AMPs) in functional diets for non-salmonid species.

Biosecurity advances focused on environmental control and strengthening natural defences. Lazado and colleagues studied disinfection in a Recirculating Aquaculture System (RAS), and confirmed that medium-pressure UV treatment could effectively inactivate the diplomonad parasite *Spironucleus salmonicida*. P. Katharios and team expanded biosecurity tools with bacteriophage cocktails targeting pathogenic *Vibrio* species in live feeds, showing superior bacterial clearance compared to single phages. Natural antiviral solutions also showed promise: Ravina and collaborators reported that extracellular polymers from *Bacillus pumilus* UMA169 provided complete *in vitro* protection against VHSV. On skin health, Karlsen *et al*. developed the Atlantic salmon Scale Explant (SE) model, a valuable system for studying host-pathogen interactions. Their findings indicated that higher dietary lipid levels improved immune responses in SEs and correlated with lower winter ulcer mortality in field trials. Still, progress in preventive strategies is constrained by the lack of standardised health models: Folgueira and colleagues are addressing this by developing reproducible infection models for *Aeromonas veronii* in sea bass, including both injection and immersion methods.

Epidemiology and surveillance are advancing through the integration of modelling and real-time monitoring. Using the AquaNet-Mod framework, Armitage and collaborators compared IHNv and VHSv outbreaks, finding that IHNv epidemics were both larger and 26% more costly under current control measures. Building on this, Kennerley and co-authors produced the first national-level estimate of the economic burden of fish disease control. Their epidemiological-economic model showed that removing all control measures increased epidemic costs twelvefold, underscoring the value of targeted interventions, particularly early contact tracing. In surveillance technology, Benedicenti and team developed an optimised “sandwich” filtration method that enables the detection of multiple pathogens in a single step, reducing time and cost. This method can be paired with third-generation sequencing (MinION) for real-time metagenomics and microbial profiling, pointing to a future of non-lethal, high-throughput monitoring and disease surveillance.

Vaccine research is moving towards needle-free delivery and novel antigen platforms, with advances in both salmonids and non-salmonids. In salmonids, Gómez-Quintanilla, Cerpa-Damas, and their teams are pioneering the use of the microalga *Chlamydomonas reinhardtii* as an oral vaccine platform. This system successfully expressed an IHNV G protein fragment fused to trout interferon-γ, which could significantly boost antibody levels and antiviral gene expression. The approach was also applied to a bivalent candidate against SAV2 and VHSV. Meanwhile, Ortega-Villaizan and her team developed a nanoparticle-based subunit vaccine for IPNV that targets red blood cells (RBCs). The construct was efficiently internalised by RBCs and induced strong antiviral responses, highlighting the potential of RBCs as systemic antigen carriers.

In non-salmonids, Hansen and colleagues reported the development and commercialisation of a safe and effective monovalent injection vaccine against Viral Nervous Necrosis (VNN) in European sea bass. Sridhar *et al* developed an attenuated recombinant vaccine for eels against Anguillid Herpesvirus 1 by deleting the ORF35 gene, producing an abortive infection that conferred protective immunity through immersion vaccination. Nygaard and team presented pre-clinical results for a vaccine *against Aeromonas veronii* in sea bass. Finally, Claudia Maira

and co-authors evaluated the Alpha Ject micro 2000 vaccine for Pasteurellosis/Vibriosis in sea bream, expanding its use to new species.

Health management – treatment & monitoring

Chaired by Ariadna Sitjà-Bobadilla (CSIC, Spain) and Mikolaj Adamek (University of Veterinary Medicine, Germany).

The session ran for a full day on Thursday 25th September and covered a broad range of farmed species (freshwater fish, marine fish and) and culture/production systems. One oral slot was devoted to e-poster pitch-presentations. The average quality of the presentations was quite high, contributing to reinforce the need to advance for better solutions to prevent and combat diseases in farmed species. The session showcased cutting-edge research and technologies aimed at improving fish health and welfare through enhanced treatment and monitoring systems.

Key developments included: 1) Functional feed additives: Use of marine and plant-derived compounds (e.g., taurine, fucoidan, essential oils) to modulate immune responses and improve resilience; 2) Advanced diagnostics: Application of molecular tools such as qPCR, LAMP, and next-generation sequencing (NGS) are now widely used for early pathogen detection and resistance profiling. Biosensors and remote monitoring systems are enabling real-time surveillance of water quality and fish health, often integrated into IoT platforms; 3) biochemistry, transcriptomics, proteomics, single cell sequencing and machine learning are used to understand fish immune response, to monitor gill health, clotting capacity, and parasite pressure; 4) Novel treatments and vaccines: Nanotechnology and encapsulated delivery systems are being explored to improve the precision and efficacy of therapeutics, phage therapy and probiotics are emerging as promising tools in managing bacterial infections, exploration of polymeric adjuvants, ghost vaccines, and natural antivirals, alongside non-invasive parasite control methods.

These advances reflect a transition toward precision aquaculture, integrating molecular tools, nutritional strategies, and real-time monitoring.

Identified Gaps. Despite promising progress, several gaps remain:1) Limited field validation: Many innovations are still in pilot or lab stages, with few tested under commercial conditions; 2) Complex host-pathogen-environment interactions: Multifactorial influences on fish health are not yet fully modelled or understood; 3) Standardization issues: Lack of harmonized protocols for omics and microbiome analyses limits comparability and adoption, 4) Data integration challenges: Translating multi-source data into actionable decisions remains a major bottleneck.

Future Trends. Emerging directions likely to shape aquaculture health management include: 1) Holobiont-centered strategies: 1) Treating fish as integrated systems (host + microbiota + environment) for more resilient interventions; 2) AI-enhanced monitoring: Use of machine learning to assess behaviour, health status, and disease risk in real time; 3) Sustainable

therapeutics: Shift toward natural compounds and circular bioeconomy inputs to reduce reliance on antibiotics; 4) Precision immunology: Tailoring vaccines and feeds to species, life stage, and environmental context using omics-informed approaches, 5) Biobanking and *in vitro* models to accelerate research and reduce reliance on live animal trials.

Challenges & Knowledge Needs. To scale and implement these innovations, the industry must address: 1) Scalability and cost-effectiveness: Ensuring accessibility of advanced tools for small and medium producers; 2)Regulatory adaptation: Updating frameworks to accommodate novel diagnostics and treatments; 3) Training and capacity building: Empowering farm personnel to interpret complex data and apply integrated health strategies; 4) Cross-sector collaboration: Bridging gaps between biology, engineering, and aquaculture operations to co-develop robust solutions.

The session **attracted a large and highly engaged audience**, filling the room throughout the day, which is the most important thing. Presenters received numerous insightful, technically informed questions, leading to lively discussions on methodological approaches, experimental reproducibility and the practical application of findings. This dynamic interaction reflected the aquaculture research community's strong interest in integrated, data-driven health management strategies.

Conclusion: This session underscored the urgency of **building resilient, scalable, and sustainable health management systems** in aquaculture. As the sector faces rising biological and environmental pressures, the integration of diagnostics, digital tools, and ecosystem thinking will be key to safeguarding animal welfare, productivity, and public trust. The strong audience attendance and the large number of high-quality oral and poster presentations emphasised the importance of this session within the conference, as well as the community's commitment to translating these scientific advances into health management solutions for the aquaculture sector.

Health & welfare management– microbiome

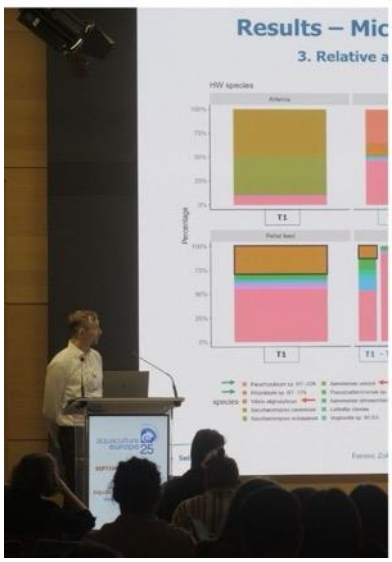
Chaired by Federico Moroni (CSIC, Spain) and Fotini Kokou (WUR, The Netherlands).

In the one-day session, a total of 19 contributions were discussed, encompassing a wide diversity of farmed species, including freshwater and marine fish, such as Atlantic salmon, gilthead sea bream, European sea bass, tilapia, carp, pikeperch as well as shrimp. The overall quality of the presentations was notably high, underscoring the ever-increasing importance of microbiota research in aquaculture, not only considering the gut but also skin, gills, reproductive organs and water-associated microbial communities.




aquaculture
europe 25
SEPTEMBER 22-25, 2025


aquaculture
europe 25


Results – Mic
3. Relative a

aquaculture
europe 25
SEPTEMBER 22-25, 2025


As in the previous years, the microbiome session highlighted how environmental effects, particularly alternative dietary formulations, can modulate the intestinal bacterial populations, and so the host physiology, influencing nutrient absorption, energy metabolism, immune defense, and overall health resilience. The presented works emphasized that in the context of limited fish meal and fish oil availability, different protein sources can represent valid sustainable alternatives which increase microbial richness and evenness and also contribute to the production of several important metabolites such as short chain fatty acids, known to be pivotal in gut homeostasis. Moreover, the importance of selecting specific intestinal district was also underlined. The results presented, in fact, showed that microbial composition of different parts and the associated metabolic functions can vary substantially. Hence, depending on the scientific question, the choice of the district is crucial to avoid partial or biased interpretations of diet-induced effects.

Regarding feeds, particular attention was also given to the advantages of administrating probiotics in the diet to enhance survival rates, innate immune response, and increase the resistance against pathogens through competitive exclusion and production of antibacterial and antibiofilm active molecules. Several speakers demonstrated how probiotics are increasingly recognized as powerful tools for disease prevention and health restoration, thanks to their dual properties as preventative and curative solutions, but also because they reduce dependence on antibiotics and support environmental resilience in the aquaculture sector.

Parallel to the diet, different presentations have clarified the role of genetics in the modulation of gut microbiome using studies conducted with sea bass, sea bream and trout. Although the general rule identifies a biodiverse system as most stable, the aquaculture paradigm highlighted how similar strains and selective programs for growth reduced the individual variability enhancing the importance of the most abundant bacteria and the core fraction. This empirical evidence underlines the need to move from a mere taxonomic evaluation of microbiomes to a more holistic perspective using a multi-omics evaluation and integrate machine learning algorithms, such as Bayesian networks, as presented in the session, to evaluate the causality within the bacterial populations and their connections.

In addition, attention was also brought to the critical role of microbial communities across life stages and environments. Early feed and the rearing environment can modulate the gut microbiome with implications on long-term development and larvae survival. As fish-microbe interactions can become especially critical during the early life stages with impacts on fish development and survival, the importance of early microbiome-based monitoring systems was highlighted in the session. At the same time, the contribution of the gamete microbiome on reproductive quality, and potentially also the larvae quality, was also discussed as a new topic to be explored. In the session, major attention was also focused on the investigation of microbial populations associated with easy-accessible body compartments, such as gills, skin, and water tank, which determine a less invasive sampling protocol. These promising approaches revealed interesting features in response to temporal and environmental changes, particularly those related to temperature fluctuation and climate change aspects, but also environmental contaminants, which normally cause microbial unbalancing. The innovation of these modalities, as shown in the presentations, lies in the possibility to assess the modification of broader physiological traits, such as the modification of welfare condition or the onset of a dysbiotic state, using a low-impact proxy, avoiding sacrificing the animal and minimizing the stress caused.

Finally, as a general remark, this year's microbiota session presented an elevated number of studies conducted using the Oxford Nanopore sequencing platform, reflecting its growing validation and acceptance within the scientific community and its feasible results. Furthermore, comparative analyses between Nanopore and Illumina, although highlighted general differences also revealed strong similarities when focusing on the most influential fraction of microbial communities, particularly the most abundant taxa or the core microbiota, demonstrating a robust parallelism across platforms in the interpretation of the results.

Integrated Multi-trophic Aquaculture (IMTA)

Chaired by Pauline O'Donohoe (Marine Institute, Ireland).

This session included 9 presentations from across Europe including research carried out in open water systems and marine recirculating aquaculture systems (RAS).

The session highlighted the growing interest in this innovative and sustainable aquaculture method across Europe. Although IMTA remains in the pilot stage in many jurisdictions, its potential to enhance environmental performance and diversify production systems has attracted attention from a wide range of stakeholders.

The presentations included 3 presentations from the BlueBoost project and one which showed how an interactive virtual reality application has been used to enhance STEM education looking at a small-scale classroom based IMTA system.

Presenters addressed the complexities of implementing IMTA in both land-based and sea-based systems, including species compatibility, nutrient balancing, and system design. Several pilot projects and research initiatives were showcased, demonstrating promising results and identifying areas for further investigation. The session emphasized the importance of collaboration among producers, researchers, policymakers, and environmental groups to advance IMTA practices.

The time for audience questions was short, however the audience's active participation posed insightful questions and engaged in meaningful dialogue, indicating a strong and growing interest in IMTA across the aquaculture community.

This session successful showed the relevance and potential of IMTA as a sustainable aquaculture production method. Continued research, innovation, and cross-sector collaboration will be essential to move IMTA from pilot projects to mainstream adoption.

Investigations using European flat oyster (*Ostrea edulis*) in Italy, explored its potential in ocean restoration and IMTA systems, when produced closed to sea bream pens, findings showed that the oyster grew better at a distance from the pens (800 m) and benefit indirectly from phytoplankton.

BLUEBOOST has set up six IMTA case studies in five countries, combining low-trophic species with traditional aquaculture, using Life Cycle Assessment to measure environmental impact and assess economic viability, while applying the Theory of Change to guide communication and societal impact. BLUEBOOST hope to deliver a roadmap to reduce environmental impact and increase sustainable blue food and feed production.

In Italy, BLUEBOOST's Sardinian case study combined commercial fish farming with native European flat oyster cultivation to explore sustainable aquaculture in a Mediterranean coastal environment, to a high degree of success. The use of lantern nets proving to be more productive.

The BLUEBOOST project is testing IMTA designs in five countries, using Life Cycle Assessment and cost-benefit analysis to evaluate their environmental and economic sustainability, while highlighting the need for standardized methods to assess the complex outputs and reduced externalities of these systems. Recommendations are prepared from the findings of these investigations.

In IMTA systems in Bremerhaven, joint cultivation of macroalgae and fish helps improve conditions for the sponge *C. reniformis*, which feeds on nutrients and carbon from the water and can be used as a sustainable source of collagen.

Studies carried out by Marine and Environmental Sciences Centre Peniche in Portugal showed that sea cucumbers like *Holothuria arguinensis* and macroalgae like *Ulva lactuca* play key roles in IMTA systems by improving water quality and adding value through organic and inorganic extraction, without extra feed costs.

Research on to the effect of microalgae and probiotic enriched biofloc on stress responses of *Mugil cephalus* under oxygen and density challenges showed that100% survival of all animals and no mortality from stress challenges, with microalgae and probiotics demonstrating protective effects. While oxidative stress enzymes responded differently, only the microalgae group fully recovered enzyme activity. Overall, combining microalgae and probiotics in biofloc systems shows strong potential to improve animal health and resilience under stress.

Two sequential trials were carried out using sole fish in RAS, and another integrating sole with sea lettuce (*Ulva ohnoi*) in an IMTA-RAS, comparing microbiomes and analysing fish, algae, and water parameters to explore future correlations. The outcome of these studies showed that operating IMTA-RAS systems can improve fish health and welfare by influencing microbiome dynamics.

XRAqua showed that combining XR technologies with aquaponics and fish farming is an effective way to teach sustainability and build future aquaculture skills, with strong potential for scaling up across education.

Integrating omic approaches

Chaired by Daniel Żarski and Rossella Debernardis (Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Poland).

The session on *Integrating Omic Approaches* showcased a wide range of innovative applications of proteomics, transcriptomics, and genomics to deepen the understanding of fish physiology, immunity, and stress responses and more. Across 11 oral presentations, various species were represented, including Atlantic salmon, rainbow trout, European sea bass, gilthead seabream, Eurasian perch, and zebrafish, with contributions spanning fundamental biology, aquaculture practices, and methodological advances.

The session reflected a clear trend towards integrative frameworks that combine transcriptomics, proteomics, epigenomics, and genome editing to uncover regulatory pathways and molecular signatures of resilience. Several talks underscored the power of proteomic and transcriptomic profiling in mapping adaptive responses: for instance, thermal stress in salmon brain and immune tissues, seawater transition during smoltification, and acute stress from transport. These studies revealed sequential molecular adaptations, often tissue- and context-specific, that are critical for understanding fish physiology under farming conditions.

Another recurring theme was the dissection of immune system complexity through integrative omics. Presentations covered local and systemic immune responses to single and co-infections, the role of cytokines such as interleukin-6 (demonstrated through CRISPR/Cas9 in zebrafish), and the effects of antimicrobial peptides on seabream proteome dynamics. Collectively, these contributions emphasized that omic approaches are now central to decoding immune modulation in response to pathogens, co-infections, and host-derived molecules.

Beyond immune responses, the session highlighted studies on maternal imprinting of seabass immunity, paternal-effect genes in perch, and sex-driven epigenomic responses to infections opened novel perspectives on how gene regulation across generations can shape disease resistance and early developmental outcomes. This underlined the increasing importance of epigenomics and functional genomics in aquaculture breeding programs.

The use of public transcriptome resources to investigate tissue- and cell-specific gene expression in salmonids was also presented, illustrating the growing emphasis on data integration and open-access resources to accelerate discoveries across laboratories. Additionally, in silico mapping of transposable-element footprints across immune genes showcased the contribution of computational omics to understanding genome regulation and evolutionary pressures in farmed teleosts.

As a general conclusion, the session demonstrated how integrating multiple omic layers can substantially advance our capacity to:

- Identify molecular markers of stress, adaptation, and disease resistance.
- Understand intergenerational regulatory mechanisms in fish health.
- Leverage open-access datasets and computational pipelines for broader application.
- Translate omic insights into breeding, welfare, and sustainable aquaculture strategies.

The session strongly reinforced the view that integrative omics, combined with emerging genome-editing and computational approaches, represent a cornerstone for the next generation of sustainable and resilient aquaculture practices.

Light and Aquatic Organisms

Chaired by: Béla Urbányi, University of Győr (Hungary) and Éva Kovács, EUROFISH (Denmark)

The presentations in this session; focused on how light regimes and lighting technologies influence physiology, growth, maturation, welfare, and nutrition across fish and microalgae systems. The emphasis was on photoperiod, light intensity, spectrum, and novel lighting technologies as management tools in aquaculture.

This report provides an overview of each of the six presentations.

Controlling Maturation and Exploring Submersible Cages in Atlantic Cod (*Gadus morhua*) Farming: Results and Experiences from Ode AS. Speaker/affiliation: Falk D. Øveraas on behalf of Ola Kvalheim, Ode AS, Norway

Core messages:

- Continuous light management to delay or prevent maturation, enabling year-round cod production.
- Use of LED lighting (over 24,000 W per cage) to optimize light intensity, spectrum, and photoperiod for maturation control and growth.
- First public disclosure of submersible cage technology trials in cod farming, with potential welfare, environmental, and production efficiency benefits.

Implications for practice:

- Light regimes can stabilize production and extend operational windows in cod farming.
- Submersible cages may enhance welfare and reduce environmental exposure; integration with light strategies could amplify productivity.

Considerations/challenges:

- Need for optimization of light protocols to balance maturation suppression with welfare and energy costs.
- Early-stage results for submersible cages require further replication and long-term welfare data.

Winding the clock – Exploration of the early development of the circadian lock mechanism in Eurasian perch. Speaker/affiliation: Oliver Barić, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Poland

Core messages:

- The presentation investigated the early development of the circadian clock in Eurasian perch (*Perca fluviatilis*), highlighting the timing and regulation of circadian machinery as fish transition through early developmental stages.
- The study aims to characterize when clock genes and rhythms entrain during embryonic/larval development and to understand how circadian timing may influence later physiology and behaviour in this species.

Implications for practice:

- Understanding the onset and maturation of circadian regulation could inform hatchery scheduling, feeding, and environmental management to align with innate rhythms, potentially improving survival, growth consistency, and welfare in Eurasian perch cultures.

- If clock development proves to entrain early, producers might optimize light-dark cycles in early life stages to support a more robust circadian entrainment, which could translate to better feeding rhythms and stress resilience at later stages of production.

Considerations/challenges:

- The abstract covers a special developmental window (early circadian clock development). Practical uptake may require downstream validation across rearing conditions (light spectra, intensity, schedule) and life stages.
- Species-specificity: findings pertain to Eurasian perch and may not directly translate to other percids or freshwater teleosts without validation.
- Details on experimental design (e.g., light treatments, sampling time points, gene targets, sample sizes) are not provided in the excerpt. For a better appraisal, access to full methods and results would be helpful.

Effects of Different Light Regimes on Growth Performance, Haematology, Blood Biochemistry and Antioxidant Capacity of Largemouth Bass. Speaker/affiliation: Malinovskyi Oleksandr, University of South Bohemia, Czech Republic

Core messages:

- A 16-week RAS trial assessed five light regimes: 8L:16D, 12L:12D, 16L:8D, 20L:4D, 24L:0D (L: light period, D: dark period).
- Early advantages of longer photoperiods; however, 8L:16D yielded the best final growth, feed efficiency, and gonadosomatic index.
- Prolonged light increased physiological stress markers (ALT, AST, CK, NH3, lactate) and oxidative stress; constant light reduced fat reserves and reproductive indices.
- Survival remained high across all regimes (98–100%).

Implications for practice:

- Short photoperiods (8L:16D) may optimize growth efficiency and welfare for largemouth bass in RAS or pond culture.
- Extended or continuous light should be used judiciously due to stress and risks of oxidative damage.

Considerations/challenges:

- Species-specific response: results may not generalize to all Centrarchids or life stages.
- Interaction with temperature, feeding, and water quality warrants integrated management.

UV-B light stimulates the production of vitamin D3 in Atlantic salmon. Speaker/affiliation**:** Øystein Klakegg, Faculty of Logistic, Molde University College, Norway

Core messages:

- The abstract reports that exposure to UV-B light stimulates endogenous production of vitamin D3 in Atlantic salmon.
- The study suggests a causal link between UV-B illumination and increased vitamin D3 synthesis, which could enhance vitamin D status in farmed salmon without dietary supplementation.
- The finding positions UV-B lighting as a potential tool to improve flesh nutrition/quality(?) and vitamin D3 content in commercially produced Atlantic salmon.

Implications for practice:

- Production and welfare: Incorporating controlled UV-B illumination in hatcheries or at the end of rearing phases could improve vitamin D3 status in salmon, potentially reducing reliance on dietary vitamin D3 supplementation.
- Product quality and nutrition: Enhanced vitamin D3 content may improve the nutritional value of farmed salmon for consumers, aligning with health-oriented market trends.
- Energy and design considerations: Implementing UV-B lighting requires evaluations of lamp types, dosage, exposure duration, and safety for both fish and workers, as UV-B, if not properly managed, can have tissue and welfare implications.

Considerations/challenges:

- Details are not provided in the excerpt about dosing, duration, spectral balance, or life-stage specificity; practical adoption requires complete protocol data and validation under commercial conditions.
- Species-specific responses: While Atlantic salmon shows stimulation of vitamin D3 with UV-B, responses may differ by strain, rearing system, and environmental parameters (water clarity, depth, photoperiod).
- Safety and welfare: UV-B exposure must be managed to avoid potential harmful effects (skin or eye irritation) to fish and humans; dedicated risk assessment and safety measures are necessary.
- Regulatory and consumer aspects: Any changes to lighting regimes should consider regulatory guidelines for UV exposure in aquaculture facilities and labelling implications if flesh vitamin D3 content is altered.

Growth and Nutritional Value of *Cylindrotheca closterium* Under Different Light Conditions. Speakers/affiliation: A. Gavrilović and J. Jug-Dujaković, University of Zagreb, Croatia.

Core messages:

- Investigated *Cylindrotheca closterium* (a diatom used as an aquaculture feed component) under three photoperiods: L24/D0, L16/D8, and L12/D12.
- Culture conditions: 7,500 lux light intensity, temperature 20–22°C, continuous CO_2 supply; three cultures per treatment.
- Outcome: Growth was most intense under L24/D0 light; diatoms grown under constant light yielded clams (*Venus verrucosa*) with fully developed gonads when fed with *C. closterium* from L24/D0 regime.
- Practical implication: Constant light enhances nutritional value of *C. closterium* for shellfish broodstock conditioning.

Implications for practice:

- Light regime can directly influence microalgal biomass production and downstream nutritional quality for shellfish aquaculture.
- For conditioning oysters and clams, continuous light production of *C. closterium* could improve gonad development and broodstock conditioning.

Considerations/challenges:

- The study notes comparisons to other reports (e.g., blue light effects on fucoxanthin) and suggests energy-consumption and light spectrum interactions require further optimization.

Light & Breeding: Production and breeding parameters of pond fish species.
Speaker/affiliation: Béla Urbányi, Institute of Agricultural Economics, Hungary; University of Győr, Hungary

Core messages:

- Review and synthesis of how light intensity, photoperiod, and spectral composition influence production traits in pond fish commonly farmed in Central and Eastern Europe (e.g., carp, Chinese carps, pike, pikeperch, European wels).
- Highlights species-specific responses: extended daylight can improve feed intake and growth in certain juvenile stages (carp and Chinese carps); low-light environments can reduce cannibalism and improve survival in larval stages of pike and pikeperch; nocturnal species like European wels may benefit from dimmed light to reduce stress and aggression.
- Emphasizes the importance of tailoring light regimes to species and life stage, particularly in hatchery and grow-out phases, and suggests integration with smart lighting and precision aquaculture.

Implications for practice:

- Species-specific lighting guidelines could improve welfare and yield; a holistic approach across all life stages is needed.

Considerations/challenges:

- The synthesis calls for more empirical data across additional species and life stages; energy efficiency and implementation in RAS and hatcheries should be explored.

Overall impressions and concluding comments

The presentations reinforce a central theme: light is a potent, tuneable driver of physiology, behaviour, growth, maturation, welfare, and nutritional quality across diverse aquatic organisms. Across fish species (cod, largemouth bass, Eurasian perch) and microalgae used as feeds, controlled light regimes and innovative lighting technologies are increasingly being considered as practical levers to improve production efficiency and product quality.

A common strength across the abstracts is their applicability to real-world production contexts (RAS, outdoor ponds, hatcheries) and their emphasis on translating light biology into actionable management strategies. Several studies also push the envelope with novel systems (submersible cages) and feed-tech integration (microalgae as broodstock feed).

The session “Light and Aquatic Organisms” aligns well with current priorities in aquaculture: using photoperiod, light intensity, spectral quality, and new lighting technologies to optimize growth, maturation, welfare, and nutritional quality. It integrates both fish and microalgae perspectives, illustrating cross-cutting biology and applied outcomes.

Several abstracts emphasize commercial relevance (continuous maturation control in cod; submersible cages; growth and welfare trade-offs under different photoperiods). This is a strength, suggesting the session will yield actionable insights for hatcheries, farms, and feed suppliers. The highest value will come from translating these findings into practical guidelines, standardized reporting, and economically viable lighting strategies that can be scaled across species and production systems.

Market & value chain economics

Chaired by Rosa Chapela (CETMAR,Spain) and Ragnar Tveterås (University of Stavanger, Norway).

The "Market & Value Chain Economics" session brought together researchers and practitioners addressing sustainability, innovation, and transparency in aquaculture value chains—from feed systems and by-product valorisation to benchmarking sectoral sustainability and market integrity. The five oral presentations demonstrated how economic, regulatory, and technological insights can converge to strengthen circularity and value creation across the aquaculture sector.

The session opened with P. Mosnier (MRAG Europe) presenting a comprehensive EU-wide study on aquafeed markets and regulations. The study underscored the complexity of feed supply chains and their exposure to environmental and geopolitical risks. It also highlighted the need for harmonised data and certification schemes to guide investment in sustainable feed ingredients, aligning future strategies with EU climate and food security objectives.

J. Reis (B2E Association) followed with *Fish Matter*, a digital ecosystem designed to enhance valorisation of aquaculture by-products. The platform connects producers, technology providers, and research institutions, fostering business matchmaking and innovation. Early pilot results from Portugal showed strong industry interest and illustrated how digital tools can improve transparency, traceability, and trust in circular bioeconomy markets.

L. Ballesteros-Redondo (University of Rostock) presented work on valorisation of African catfish by-products, particularly liver, gonads, and skin, within recirculating aquaculture systems. Her results demonstrated significant nutritional potential, including high levels of polyunsaturated fatty acids, supporting opportunities for full-resource use and new value chains in freshwater aquaculture.

E.M.T. Tharanga (Jeju National University) discussed the development of multiplex PCR and PNA-based real-time PCR tools to identify sea cucumber species in the Korean market. The study addressed traceability challenges in international seafood trade, proposing reliable molecular methods to prevent mislabeling and ensure market transparency—key aspects of economic sustainability in global value chains.

R. Cooney (Bord Iascaigh Mhara, Ireland) presented Ireland's first national sustainability benchmarking report for aquaculture. The analysis combined environmental, economic, social, and innovation indicators across the salmon, mussel, and oyster sectors. Findings confirmed that Irish aquaculture remains a low-carbon, resource-efficient industry but faces demographic challenges. The report provides a model for evidence-based policymaking and sectoral transparency.

Overall, the session demonstrated the increasing integration of economic analysis, data-driven governance, and digital innovation in aquaculture value chains. Presenters highlighted the importance of policy coherence, multi-actor collaboration, and reliable traceability tools to achieve sustainable growth. The session reinforced the central role of market and value chain economics as enablers of circular, competitive, and socially responsible aquaculture systems across Europe and beyond.

Nature-based solutions & regenerative farming

Chaired by Koushik Roy (University of South Bohemia, Czechia).

The session had a total of seven oral presentations and one focus ePoster selected as best of the session. Out of the eight contributions made, half (four) were focused on fishponds alone, whereas the rest were bio-based materials use in aquaculture (3) and bioremediation (1). Based on the talk, the discussions, and the interest of audience turnout in the meeting room, it seems that pond aquaculture and bio-based materials use in aquaculture have profound interest.

The researchers in these two fields have demonstrated strong interdisciplinarity rather than being in the usual monotonous aquaculture or production science realm. For example, fishpond aquaculture presenters demonstrated inter-disciplinarity with the fields of ecology, nutrition and food system science. Whereas bio-based materials researchers connected material science, environmental impact assessments into their products developed for aquaculture. It shows that, we, as aquaculture community are moving towards a more holistic approach. The solutions are plenty and promising to be readily adopted in practice, taking into considerations the notions of multiple stakeholders that interact with the aquaculture industry, not only the commercial enterprise itself.

Figure 13: Full room at Nature-based solutions & regenerative farming. (Photo courtesy of Koushik Roy).

I would like to mention that I was happy seeing the room full. Despite the pond aquaculture themed lectures dominating the session, it seems people are not forgetting pond aquaculture as something old school and not losing interest either. Fishponds are originally a regenerative form of aquaculture, and the production solutions therein are nature-based. We should try protecting this European or rather global heritage, with a limited and overlooked pool of interdisciplinary researchers working at the interface of ecology and production science currently active in European fishponds. It is time to build a consortium, since people easily connect ponds with nature-based solutions and regenerative farming.

Nutrition - Alternative ingredients

Day 1 (Wednesday, September 24) chaired by Silvia Martínez-Llorens (Universitat Politècnica de València, Spain), Jose Luis Tejedor (DIBAQ, Spain) and Angela Trocino (University of Padova, Italy).

Session sponsor: DIBAQ

Day 2 (Thursday, September 25) chaired by Stefano Peruzzi (University of Tromsø, Norway), Silvia Martínez Llorens (Universitat Politècnica de València, Spain) and Ignacio Jauralde (Universitat Politècnica de València, Spain))

This session addressed current advances in the use of sustainable protein sources for aquaculture feeds, exploring innovative approaches to reduce dependency on conventional fishmeal and fish oil. Discussions centred on sustainability, circular economy principles, and functional benefits for fish health, welfare, and product quality. Some speakers also highlighted that the combination of animal, plant, microbial, insect, and algal proteins provides a robust pathway for replacing fishmeal and fish oil.

In many cases, the functional benefits extend beyond growth, as many alternative ingredients enhance immunity, gut integrity, stress resistance, and overall product quality. Sustainability and circular economy themes were central: using byproducts and waste streams that can be successfully valorised into valuable feed inputs.

Over the two-day session, presentations were classified into the following categories:

1. Plant-derived proteins. including barley, hempseed, soybean meals with reduced anti-nutritional factors, corn protein concentrate, and novel ingredients such as cider lees and almond leaf extract. While some plant-based formulations supported growth and health, certain limitations were observed in carnivorous species.
2. Animal-derived proteins. encompassing silkworm chrysalis, poultry and duck byproducts, fish protein hydrolysates, and porcine blood hydrolysates. These ingredients demonstrated potential to enhance growth performance, immune response, and stress resilience in species such as gilthead seabream, olive flounder, turbot, and meagre.
3. Microbial proteins. *Methylococcus capsulatus* and ruminal microbial extracts, offering high-quality, scalable sources suitable for seabream and salmonid diets.
4. Insect-derived proteins. primarily from black soldier fly (BSF) larvae and prepupae, as well as Mediterranean fruit fly meal. These studies showed positive outcomes on growth, gut health, and feed conversion efficiency.
5. Algal and seaweed proteins. spanning from *Spirulina* to macroalgae and DHA-rich microalgae oils. These ingredients provided nutritional and functional bioactive compounds, enabling partial replacement of fish oil.

6. Mixed and novel biomass resources. including forest by-products, mushroom stems, cherry biochar, and combined use of BSF and *Spirulina*, showcasing regional bio-resources and circular economy strategies.

This session attracted significant interest, receiving a large number of submissions. However, some scheduled speakers were absent without prior notice. In their place, several ePoster presentations were showcased, notably from the CIIMAR group, which presented three studies on the inclusion of fish oil ethyl esters in European seabass (*Dicentrarchus labrax*):

- Yue Xu, Lúcia Vieira, Aires Oliva-Teles, Helena Peres, Rui Magalhães. Dietary inclusion of fish oil ethyl esters on growth performance, nutrient digestibility, and lipid metabolism in European seabass.
- Yue Xu, Lina Fernanda Pulido-Rodriguez, Giuliana Parisi, Aires Oliva-Teles, Helena Peres, Rui Magalhães. Effects of dietary inclusion of fish oil ethyl esters on fatty acid profile, plasma metabolites, and liver oxidative stress in European seabass.
- Yue Xu, Lúcia Vieira, Lina Fernanda Pulido-Rodriguez, Giuliana Parisi, Aires Oliva-Teles, Helena Peres, Rui Magalhães. Effects of fish oil ethyl esters on body composition and liver oxidative stress in European seabass under thermal challenge.

Additional ePoster presentations were delivered the following day to fill a vacant slot:

- Thomas Janssens, Paulina Pawlak, Fiona Weirauch, Jean-Baptiste Luce, Vlastimil Stejskal. Growth performance, fillet yield and somatic indices of European perch (*Perca fluviatilis*) fed diets containing varying levels of *Ganoderma spp*. composite mycelium meal.
- Juan G. Haro, Sørine Gerlich, Juan Carlos Navarro, Stine Slotsbo, Martin Holmstrup, Óscar Monroig. From soil to sea: omega-3 biosynthesis in *Enchytraeus albidus* and its potential for aquaculture.

Finally, it is worth noting that the Wednesday afternoon session (24th September) coincided with the presentation of the ThinkingAzul Project, a large-scale Spanish initiative that drew considerable attention from national researchers. This overlap possibly contributed to a lower-than-expected attendance for the Nutrition-Alternative Ingredients session.

Nutrition: Digestibility and Sustainability

Chaired by Lucia Drábiková (Institute of Marine Research, Norway), Anamaria Rekecki (Aquaculture Nutrition Consultancy, Belgium) and David Domínguez (Universidad de Las Palmas de Gran Canaria, Spain).

An increasing growth in aquaculture production of teleost fish and shrimp demands search for alternative ingredients that will be able to sustain it and partly or completely replace the demand for fishmeal from wild capture fisheries. The most used fish meal replacements originate from terrestrial plant protein such as soy protein concentrate. The use of soy, however, carries several disadvantages. It is associated with an extensive land use, deforestation, land

erosion, and use of pesticides. Soy protein is also linked to anti-nutritive properties and leads to impaired digestibility of minerals, nutrients, or gut inflammation. Therefore, other ingredients, for instance barley, brewers spent grain, protein hydrolysates, and insects come into play.

Barley protein concentrate given to rainbow trout (*Oncorhynchus mykiss*), gilthead seabream (*Sparus aurata*), and European seabass (*Dicentrarchus labrax*) at an inclusion rate of up to 26% showed up to 89% protein digestibility and comparable growth to those fed fishmeal-based diet. Barley offers substantial sustainability benefits while it grows without the need for irrigation and across diverse climates. Similarly, **brewer's spent grain protein isolates** have shown to be a sustainable alternative for soy in rainbow trout diets.

A combination of **poultry by-product meal, feather meal hydrolysate, and algal oil** showed promising results in fish meal replacement in feed for rainbow trout supported by Feednetics, a software (Sparos) for predicting performance, body composition, and waste in diversity of farmed teleost fish species. A study looking at these ingredients separately would be beneficial to better understand the influence of the specific dietary components.

Protein hydrolysates from fish by-product and trimmings, insect, and swine represent another good alternative for delivering high-quality peptides with antioxidant and positive microbiome modulation in teleost fish (Monteiro et al. 2025, Antioxidants). According to the molecular markers, protein hydrolysates from swine and insects have a better support for mucosal protection and secretory function compared with hydrolysates from fish meal by-products.

Different fractions of *Tenebrio molitor* (mealworm beetle) **insect larvae** including wet-pressed hemocoele, wet-pressed exoskeleton, and dry-pressed fraction can be obtained cheaply using screw press providing a scalable and sustainable source of protein, fat (both used in feeds), and chitin (used in fertilisers, bio plastic, and cosmetics). The highest yield was obtained from the dry-pressed fraction. Further research is encouraged to analyse the effect of different fractions of mealworm beetle on the farmed teleost fish performance. Crucially, research shows that **lauric acid**, fatty acid naturally occurring in the insect meal (Black soldier fly (*Hermetia illucens*)), is an important component which counteracts the negative effect higher chitin concentrations (1.5%). **Insect oil** moreover represents a feed alternative with a higher omega-6 to omega-3 ratio compared to commercially used plant oils.

A sustainable alternative to partially replace fish meal with feed from **invasive species** of the Adriatic Sea (Blue crab (*Callinectes sapidus*) and Arc clam (*Anadara sp*.) showed promising results in juvenile European seabass. But further studies are required to find the ideal concentrations that can be used in aqua feeds.

In terms of observable effects on reduced carbon footprint we were presented with two promising ingredients: canola meal and lyso-phospholipids. The use of **canola meal** at an inclusion rate of 10% in the feed for salmonids showed good results with positive effect on reduction in CO_2-equivalent emissions in comparison to fishmeal diets. **Lyso-phospholipids** (Aqualyso, Adisseo) used in the feed for shrimps as a tool to reduce lecithin and fish oil content seem to provide a viable alternative to reduce price and improve carbon footprint. Peer-reviewed research would be beneficial to improve the strength of these findings.

Figure 14: Ana Teresa Gonçalves and Lucia Drabikova.

To improve digestibility and sustainability of nutritional components it is moreover important to determine the exact required levels of micro- and macro-nutrients as well as improve our understanding on how different rearing conditions affect the use of these nutrients. For instance, in European seabass, the more optimal **rearing temperature** of 23 °C improved the digestibility of protein, lipids, saturated fatty acids, and energy compared to rearing at 15 °C. No such differences were observed in gilthead seabream. Data on growth performances were not stated. A study looking at the requirements of **dietary phosphorus** in the feed for on-growing stages of farmed Atlantic salmon (*Salmo salar*) determined new lower requirements compared to the current recommendations of 5.8 g/kg available phosphorus (Drábiková et al., 2026, Aquaculture 742915). During a slower growth and temperatures between 5-9 °C salmon (1.8-2.8 kg) reared in sea-cages under natural photoperiod required 3.7 g/kg available phosphorus and during faster growth at 7-14 °C (2.8-4.2 kg) the requirements rose to 4.6 g/kg available phosphorus. The study also revealed an increase phosphorus digestibility during the faster growth period. An application of updated dietary phosphorus requirements has the potential to decrease the use of total phosphorus by up to 24% and reduce solid and dissolved phosphorus waste by 13% and 37%, respectively.

Search for alternative ingredients also involves a better understanding of their impact on fish gut health. Pathogens, stress, and anti-nutritional factors present in the plant-based diet lead to gut inflammation resulting in a disrupted nutritional absorption, impaired immunity, and allocation of up to 50% of energy into defensive processes. A **standardised model to detect gut inflammation** in teleost fish prior the start of clinical signs is missing. Inspired by research done in rodents, Sparos (Portugal) developed a gut inflammatory model which uses dextran sodium sulphate (DSS). DSS is a water-soluble polysaccharide toxic to the intestinal epithelial cells

causing high intestinal permeability – leaky gut. On the other hand, the Norwegian University of Science and Technology created a low-level inflammatory model which uses 48% of high protein soya (HP48) with a high applicability in salmonid aquaculture. These models allow testing novel ingredients and feed additives and their capacity to recover gut homeostasis, provide a series of biomarkers that can be used to detect early onset of gut inflammation, but can be also used as negative controls in case of studies looking at the use of novel protein sources.

Results showing **Bactocell** (*Pediococcus acidilacitici*) can mitigate gut inflammation in Atlantic salmon (*Salmo salar*) (Nordvi et al. 2023, Aquaculture 738920; Aquaculture 739777) are promising. Another promising ingredient to mitigate intestinal inflammation presented is **olive extract** (Liehr et al., 2017, PLoS ONE 12, e0174239). Olive extracts are a sustainable alternative compared to other ingredients since they are produced from pomace, a by-product generated during centrifugal press while producing olive oil. A diet containing 0.4% olive extract led to an improved mucosal barrier repair, performance, and an alleviation of intestinal inflammation in European seabass.

A technically easy and fast process of commercial feed fermentation with *Lactobacillus acidophilus* and *Lacticaseibacillus rhamnosus* for 3 hours showed indication of an improved weight gain in rainbow trout. However, diets fermented for longer didn't show such positive outcomes. More peer-reviewed research is required to understand the promising use of fermented diets in farmed teleost fish.

Limiting results on the restoration of gut inflammation in rainbow trout and seabream have been shown by Mixscience and their product Valopro fit. Although understandably there is a lot of valuable research done by companies that many times doesn't get published for strategic reasons a peer-review published research article supporting the positive claims would be beneficial here. Companies would be encouraged to collaborate with universities and research institutes to improve the independency of the outcomes which would moreover enable an analysis into the fish physiology and mechanisms behind the observed changes.

In summary, the diversity of protein sources available for aqua feed to replace the need for fish meal is rising but it remains crucially important to provide peer-reviewed articles in support of research findings. Still, we see that the use of fishmeal prevails over other sources of protein in countries outside of Europe and North America.

This underlines the requirement for collaborative effort, cross-regional talk, and mutual understanding of the importance of sustainable aquaculture approach. Lastly, research into culturing of certain species of carnivorous teleost fish, such as Atlantic bluefin tuna (*Thynnus thynnus*) with high metabolic and mortality rates in the rearing cages, as well as challenges associated with dry feed vs wet feed/ bait remains questionable in terms of sustainability, management, nutrition, and raises concerns about animal welfare.

Nutrition - Functional ingredients (Tuesday, Sept 23)

Chaired by Charles McGurk (Skretting, Spain) and Genciana Terova (University of Insubria, Italy)

Session sponsor: Skretting

The session provided a comprehensive and integrated overview of recent advances in fish and shrimp nutrition, health, and welfare. The presentations collectively highlighted the strategic role of functional feeds as proactive tools to enhance physiological robustness and sustainability, rather than serving solely as nutrient sources. The scientific quality of the presentations was high, with evidence-based approaches combining nutritional trials, molecular analyses, and biochemical markers to define how bioactive ingredients can optimize performance and resilience under farming conditions.

A central theme throughout the session was the increasing convergence of nutrition and health management. Presentations demonstrated how bioactive and immunomodulatory compounds—such as yeast derivatives, functional peptides, methionine, coenzyme Q10, thymol-based and plant extracts, insect oils, algal biomass, and halophyte-derived ingredients—are increasingly used to improve mucosal integrity, immune response, and stress tolerance. The combination of natural compounds and feed additives is also supporting the reduction of antibiotic use and dependence on marine ingredients, aligning with sustainability and One Health objectives.

Particular attention was given to valorisation strategies for novel and sustainable raw materials. The use of upcycled biomass, krill meal, single-cell proteins, and algal or insect oils has shown promising results in maintaining growth performance while improving oxidative balance and feed efficiency. These findings highlight the potential of circular feed concepts to reduce fishmeal and fish oil use and support the environmental goals of the aquaculture sector. The session further illustrated the importance of natural antioxidants as replacements for synthetic compounds such as ethoxyquin and BHT, although stability and bioavailability during extrusion and storage were identified as key challenges requiring technological innovation.

Another important outcome of the discussions was **the demonstrated capacity of functional feeds to strengthen disease resistance and welfare**. Several studies showed reductions in bacterial and parasitic infections and improved vaccine responsiveness in fish fed immunostimulant-enriched diets, probiotics, or phytochemicals. This synergy between nutrition, immunity, and welfare represents a crucial step toward preventive health management in aquaculture, with functional diets complementing vaccination and genetic programs.

However, speakers also identified several **knowledge gaps and challenges**. The mechanisms by which bioactives modulate immune and metabolic pathways are still not fully understood, and variability across species and life stages remains significant. There was consensus on the need for harmonized protocols, standardized efficacy criteria, and better alignment with regulatory frameworks to support broader use of functional ingredients. The bioavailability and stability of natural compounds, as well as their cost-effectiveness at commercial scale, were also identified as areas requiring further research and industrial validation.

Looking ahead, the session highlighted a **clear trend toward precision nutrition and data-driven feed design**. Omics-based profiling and artificial intelligence are expected to play major roles in predicting synergistic effects of feed components, identifying biomarkers of immune competence, and optimizing formulations across species. Multifunctional diets integrating digestibility enhancers, antioxidants, and immunostimulants are expected to become standard tools for improving both performance and welfare.

In summary, the session reinforced the pivotal importance of functional ingredients and immunonutrition in advancing aquaculture sustainability and resilience. By combining molecular insights with field validation, researchers and industry partners are developing science-based, commercially viable nutritional solutions that can safeguard animal health, minimize environmental impact, and support global food security. Continued collaboration among academia, feed producers, and regulators will be essential to translate these innovations into robust, globally applicable aquaculture practices.

Nutrition - Functional ingredients (Wednesday, Sept 24)

Chaired by Stuart McMillan and Albert Caballero Solares (University of Stirling, UK).

Session sponsor: MiXscience

The second day of the "Nutrition - functional ingredients" sessions included a total of 19 full-length talks and 5 short poster presentations, that covered a wide range of farmed species, from shrimp through freshwater fish and marine fish. The quality of these presentations, and the work described was generally of good quality, illustrating the considerable research endeavours within this area. This was indeed good to see, given the key role functional ingredients can play towards production of healthier, higher welfare fish and shellfish with minimal environmental impact in a rapidly changing world.

Presentations could be divided into groups based on two criteria, the first of which was the physiological role that functional additives were introduced to influence. Talks covered a wide range of targets, including antimicrobials or immunostimulants, reducing the impact of environmental stress, enhancing nutrient uptake, mitigating handling-related stress and accelerating wound healing. Of these, functional additives as antimicrobials or immunostimulants, or those intended to ameliorate environmental stress, predominated. In particular, many talks highlighted the use of naturally derived products to reduce antibiotic consumption or resistance. A key factor highlighted across several presentations was the importance of minimal impact on growth, overall product quality and some morphological characteristics by immunostimulant or antimicrobial additives. In future, setting thresholds for these metrics could be a robust way to evaluate the success of some functional additives.

The second criterion that could be used to group presentations was the source of functional ingredients. These included algae and true aquatic plants, natural products from terrestrial

plants (phytogenics), fractions of yeasts and insect meal. Perhaps in the future, there will be more value to the latter as a key functional ingredient, as opposed to purely a protein source.

One key theme was the revalorising of waste products, including animal by-products by hydrolysis processing, beta-glucans from mushroom storks and polyphenols from plants. Of special note were the many presentations that detailed extraction methods, followed by in vitro or ex vivo assessment of potential ingredients, prior to in vivo trial. This demonstrated a strong commitment towards replacing and reduce the use of live animals in the research pipeline, until there is no viable alternative.

Importantly, a very constructive day's talks did highlight that much additional work needs to be done. Many studies emphasised the need to optimise both dosage and duration of dietary treatments with functional additives, taking into consideration efficacy and wider impact to the animal. Furthermore, where knowledge gaps remain, determining the mechanism behind the positive effects induced by functional ingredients is an important area of research. Not least, because revealing these key mechanisms could identify targets for future novel functional additives. Taken together, the session demonstrated that the field of functional ingredients is flourishing and playing an important role in addressing the multiple challenges we face within the industry, relating to the production of healthy, nutritious, safe and sustainable aquatic products.

Nutrition - Physiology & Requirements

Chaired by Alessio Bonaldo and Silvia Natale (University of Bologna, Italy).

The Nutrition and Physiology session provided an extensive overview of recent progress in feed formulation, nutrient metabolism, and physiological responses of key aquaculture species, including sea bream, sea bass, salmon, cod, mullet, sole, turbot, and shrimp. In total, 20 oral presentations were presented in one-day morning and afternoon session that highlighted emphasized how nutritional strategies are becoming central to optimizing fish growth, health, and resilience under changing environmental and economic conditions.

A clear trend emerged toward the functionalization and sustainability of aquafeeds, exploring replacements for fishmeal and fish oil with plant, algal, insect, or by-product ingredients. Several studies demonstrated that alternative lipid and protein sources can maintain or even enhance growth and feed efficiency when properly balanced for essential amino acids, fatty acids, and mineral availability. However, nutrient bioavailability and digestibility remain key challenges, especially for phosphorus, zinc, and lysine–methionine ratios. The evaluation of phytase enzymes and chelated mineral sources was presented as a promising approach to improve nutrient retention and reduce environmental outputs.

Another important theme was the role of lipids and vitamins in stress resilience and tissue function. Research on calcifediol, vitamin D, phospholipids, carotenoids, and antioxidants revealed intricate links between nutrient status, skeletal development, immune response, and

heat tolerance. These findings underline the growing need for nutritionally driven approaches to mitigate climate-related stress and improve welfare outcomes.

At the physiological level, advances in transcriptomics and metabolomics have begun to uncover molecular mechanisms of nutrient utilization and adaptation. Differential gene expression in liver and adipose tissues highlighted species-specific metabolic plasticity and the capacity to tailor energy use under varying diets and temperatures. Moreover, interactions between omega-3 fatty acids, zinc, and lipid metabolism were shown to influence skin repair and barrier function, offering new insights for functional feed design.

The session also revealed critical knowledge gaps. Nutritional requirements for early life stages, larval digestive enzyme ontogeny, and nutrient–environment interactions are still poorly defined for many species. More research is needed to standardize experimental models, harmonize analytical methods, and integrate omics data into predictive nutrition tools. Additionally, while sustainability goals drive ingredient diversification, long-term effects on fish physiology, product quality, and ecosystem footprints must be assessed through life-cycle and multi-trait evaluation frameworks.

Overall, the session reflected a maturing field that increasingly views fish nutrition as an integrative science, linking feed innovation, physiology, and environmental stewardship. Future efforts should aim at system-level optimization, combining precision nutrition, molecular monitoring, and sustainable ingredient sourcing to ensure robust, efficient, and climate-resilient aquaculture production.

Offshore & Multi-use

Chaired by Diogo Thomaz (Innovasea, Greece).

The session on Offshore and Multi-Use Aquaculture brought together 13 oral presentations covering ecological modelling, engineering solutions, biodiversity and ecosystem services, governance, and innovative production concepts. The discussion reflected Europe's growing need to expand aquaculture into offshore and multi-use areas, driven by space constraints in coastal zones, climate change adaptation, and synergies with offshore renewable energy.

Several EU projects, particularly OLAMUR and ULTFARMS, are advancing offshore aquaculture from concept to practical demonstrations. Pilot trials of mussel, oyster, kelp, and Ulva cultivation at exposed sites in the North and Baltic Seas are beginning to yield performance data. Engineering innovations—such as submersible pens, current barriers, and membrane-based cage systems—demonstrate technical feasibility and resilience in high-energy conditions. Precision aquaculture technologies (real-time monitoring, AI-based feeding, sensor networks) are being adapted for offshore environments. Early results from Nature Inclusive Design modules indicate that offshore infrastructure can also enhance biodiversity. Hydrodynamic and ecosystem models are now capable of projecting aquaculture–environment interactions under future climate scenarios.

Finally, governance and spatial planning emerged as central enablers, with Norway and EU waters requiring integrated marine spatial planning to manage conflicts between aquaculture, fisheries, wind energy, and other uses.

Despite progress, offshore aquaculture remains at the pilot stage. Scaling beyond demonstrations is limited by uncertainties in logistics, harvest, and storm resilience. Biological performance benchmarks for offshore low-trophic species remain context-specific and require standardized data collection. Governance and permitting frameworks for co-location with offshore renewables are not yet fully developed, delaying commercial uptake. Innovative designs focusing on fish welfare show potential but need long-term validation at scale. Modelling tools are improving but require integration with field monitoring for robust decision support.

Economic viability is a critical challenge: few profitability models exist for offshore multiuse systems. Infrastructure and safety standards must be aligned with offshore energy and maritime sectors to attract investment. Biosecurity and environmental monitoring protocols offshore are underdeveloped. Workforce training for offshore operations and cross-sector collaboration will be needed to support expansion. Policy and governance frameworks, particularly marine spatial planning and cross-sector licensing, must advance in parallel with technology development.

In conclusion, the session highlighted that offshore and multi-use aquaculture is transitioning from vision to tested reality. Technological innovation and EU-funded projects are demonstrating feasibility, but scaling requires progress in logistics, economics, and governance.

Moving forward, integrating long-term field data with modelling, developing safety and certification standards, and enabling supportive policy frameworks will be essential for the sustainable growth of offshore aquaculture alongside offshore renewable energy.

Operations in aquaculture facilities

Chaired by Trine Thorvaldsen (SINTEF, Norway).

The operations in aquaculture facilities session focused on finfish, primarily Atlantic salmon. Presentations explored operational challenges and solutions for land- and sea-based farms, looking into current practices, regulations and novel methods and tools.

In total, 7 presentations addressed three main topics:

1. Challenges and risks related to biosafety, personnel safety and environmental impacts from fish farming.
2. Technological solutions for improved inspections, repairs and feeding.
3. The role of standards for sustainable production.

A more diverse technological landscape is prominent in Atlantic salmon farming. New production forms lead to changes in operations and strategies, which in turn might challenge established biosafety measures and regulations. The session highlighted the importance of preparing for future biosafety challenges.

Personnel safety is crucial in operations and was highlighted in the context of fish farmers' use of contractors (specialized vessels and crew). Challenges have been found related to variations in safety practices across companies and sites, limited coordination of health, safety, and environment (HSE) procedures, and unclear responsibilities in interorganizational operations.

Looking into environmental risks, the release of microplastics (MP) during in situ cleaning of aquaculture nets was also discussed. Results of field measurements showed challenges in sampling MP in situ due to e.g., currents and sampling conditions, while laboratory and field trials indicated that the choice of net materials, coatings, and cleaning technologies can influence the release of MP particles.

Different methods and tools are needed to solve challenges and improve operations, including monitoring of fish behaviour for feeding, autonomous solutions for inspection and repair of nets and implementing global standards to improve sustainability in production.

Understanding fish behaviour by integrating 3D multibeam sonar with environmental data shows how advanced monitoring can enhance feeding efficiency and transform aquaculture practices moving forward. Furthermore, on-device AI for real-time fish counting, strengthened by synthetic data generation, provides a practical pathway to more reliable, low-cost, and scalable monitoring in aquaculture.

Automation, such as inspection and repair of holes in net pens, can help prevent escapes of farmed fish. By using remotely operated vehicles (ROVs) a tool that enhances inspections and repairs can be implemented and reduce tedious manual inspections and occupational risk for divers.

The role of standards as frameworks for certification and improvements of sustainability in marine aquaculture was also lifted in the session, looking at advantages that can be gained through such tools.




aquaculture
europe
SEPTEMBER 22-



aculture
europe 25


SALIDA


Precision Aquaculture 4.0

Chaired by Fearghal O Donncha (BIM, Ireland), Eleni Kelasidi (NTNU, Norway) and Noelia Ortega (CTN, Spain).

Session sponsor: CTN

The Precision Aquaculture 4.0 session brought together researchers and practitioners advancing the digital transformation of aquaculture. The session included sixteen oral presentations, twelve ePosters, and a one-hour roundtable discussion hosted by the Centro Tecnológico Naval y del Mar (CTN). Together, the contributions reflected how artificial intelligence, sensing technologies, and data-driven decision frameworks are reshaping the aquaculture sector from research to operations.

A central theme across the oral talks was the use of AI and computer vision for fish behaviour, identification, and welfare monitoring. Several presentations demonstrated new methods for automated detection, tracking, and analysis of fish activity in real time. These included event-based and non-invasive imaging techniques capable of producing continuous welfare insights with reduced human intervention. The discussion highlighted how such approaches are moving aquaculture toward predictive, proactive, adaptive management that can respond dynamically to environmental and biological signals.

Another strong theme was smart sensing and automation. Presentations on autonomous and low-cost systems for water-quality monitoring, portable stereo-vision devices for biomass estimation in offshore environments, and real-time structural health monitoring of offshore aquaculture facilities using advanced sensing showed clear progress toward operational implementation. The session presented a wide spectrum of innovation maturity – from early-stage research on amphibious drones and autonomous underwater mapping to the development of ruggedised, field-deployable sensing platforms. This diversity illustrated how academic exploration and applied engineering are converging to deliver practical digital tools for modern aquaculture.

Data infrastructure, interoperability, and accessibility emerged as recurrent challenges. Several speakers underlined that advances in AI and automation depend on the availability of high-quality, standardised, and shareable datasets. Presentations in this area showcased complementary strategies to address the data bottleneck. Research on data augmentation techniques demonstrated how synthetic data generation and transformation methods can extend limited datasets and enhance model robustness across diverse field conditions. Parallel efforts focused on data standardisation, proposing harmonised protocols for environmental, operational, and biological data collection to ensure consistency and comparability across farms. Speakers also highlighted data sharing initiatives, including open repositories and collaborations aimed at publishing high-quality aquaculture datasets for reuse by the wider community.

Talks on citizen science further extended this perspective, emphasising its potential to complement formal monitoring by engaging farmers, technicians, and other stakeholders in data collection and annotation. Such participatory approaches can significantly enhance data coverage, foster transparency, and strengthen the link between research and practice.

The CTN roundtable discussion reinforced these themes and focused on how data-driven innovation and AI can accelerate progress toward sustainability. Participants identified three strategic priorities:

1. Ensuring reliable and accessible data to support research, operations, and regulation.
2. Advancing feed innovation to further reduce the fish-in–fish-out ratio while maintaining performance.
3. Promoting trustworthy, transparent, and explainable use of AI across aquaculture operations.

The discussion emphasized AI's dual nature – its transformative potential for aquaculture management alongside risks from opaque decision-making and generative-model hallucinations – and reached consensus that developing explainable, verifiable systems is essential, so recommendations remain reproducible and aligned with biological and operational realities.

On sustainable feeds, the group recognized meaningful progress – novel ingredients, improved digestibility, and precision feeding – while noting the work ahead to fully decouple aquaculture from marine-derived inputs; advances in data and AI were highlighted as key enablers for smarter formulation, adaptive feeding control, and system-level sustainability assessment.

Overall, the session showed Precision Aquaculture 4.0 moving rapidly from concept to implementation across perception and automation, data governance, AI ethics, and sustainability, the community is increasingly ready to deploy digital technologies that deliver tangible gains in production efficiency, animal welfare, and environmental stewardship. The combination of scientific depth, applied engineering, and forward-looking discussion made this session a clear reflection of the industry's ongoing digital transformation.

Post-harvest - processing, packing and value addition

Chaired by Fanny Tsironi (Agricultural University of Athens, Greece).

The session Processing, Co-Products, Packing and Value Addition gathered about 50 participants. Presentations highlighted innovations in post-harvest aquaculture, including sustainable packaging, side-stream valorisation, and quality and shelf-life enhancement of seafood. Topics covered sub-chilling, IQF freezing, biogenic smart packaging, AI-driven freshness evaluation, antimicrobial coatings, and detection of quality defects in fish fillets. Several talks focused on valorising marine by-products like collagen and developing biodegradable active films. The session concluded with e-poster reviews and insights into safety, nutritional claims, and regulatory compliance in seafood production.

Presentation list:

- Theofania Tsironi - VALORISATION OF AQUATIC BIOMASS AND SIDE-STREAMS FOR SUSTAINABLE PACKAGING IN THE BLUE BIOECONOMY: INSIGHTS FROM THE AQUAPACK PROJECT.

- Sherry Stephanie Chan - SUB-CHILLING AQUACULTURE SPECIES FOR IMPROVED QUALITY AND SHELF LIFE.
- Ivan řupan - IMPACT OF INDIVIDUAL QUICK FREEZING (IQF) ON NUTRITIONAL QUALITY OF THE OYSTER *Ostrea edulis*.
- Evmorfia Athanasopoulou - EVALUATION OF CHITOSAN BASED SOLUTIONS FOR FISH FILLETS PRESERVATION.
- Evgenia Basdeki - SHELF LIFE MONITORING OF GILTHEAD SEABREAM FILLETS Sparus aurata USING BIOGENIC SMART PACKAGING MATERIALS.
- Yuko Ishiwaka - REAL-TIME FRESHNESS EVALUATION OF FISH USING AI-DRIVEN NEAR-INFRARED SPECTROSCOPY: APPLICATION FOR POST-HARVEST VALUE ENHANCEMENT.
- Christina Anna Stafyli - MITIGATION OF POST-HARVEST CONTAMINATION IN FISH BY A METHYL-CELLULOSE COATING INCORPORATING BACTERIOPHAGES TARGETING *Vibrio alginolyticus*.
- Thomas Larsson - NEW TECHNOLOGY FOR MAPPING OF DARK SPOTS IN SALMON FILLETS.
- Dmitri Fabrikov - ULTRASOUND-ASSISTED EXTRACTION OF COLLAGEN FROM FISH SKIN: A TIME-EFFICIENT STRATEGY FOR MARINE BY-PRODUCT VALORIZATION.
- Petar Zuanovi - CONDITIONING OF THE MEDITERRANEAN MUSSEL *Mytilus galloprovincialis*.
- Marina Cano-Lamadrid - ENSURING EU-METAL(OIDS) LEVELS BELOW REGULATORY LIMITS FOR CONSUMERS IN GILTHEAD SEABREAM *Sparus aurata*.
- Esther Sendra-Nadal - UNLOCKING EU-APPROVED HEALTH AND NUTRITIONAL CLAIMS FOR CONSUMERS OF *Sparus aurata* FED BY ALTERNATIVE FEEDN

For the **ePoster Focus**, two mini presentations were made:

- Aikaterini Spanou - DEVELOPMENT AND CHARACTERIZATION OF PLA-BASED ACTIVE FILMS WITH TIO2 NANOPARTICLES AND THYMOL FOR EXTENDING GILTHEAD SEABREAM SHELF-LIFE (mini oral presentation).
- Aikaterini Kotsatou - CHARACTERIZATION OF POLY 3-HYDROXYBUTYRATE AND DEVELOPMENT OF BIOGENIC AND BIODEGRADABLE MATERIALS FOR PACKAGING AND SHELF LIFE MONITORING OF SEABREAM (mini oral presentation).

Public perception & social acceptance

Chaired by Juliana Arias Hansen (Sjókovin, Faroe Islands) and Bernardo Basurco (CIHEAM, Spain).

The public perception and social acceptance session covered a relevant range of issues related to the session's topic including, stakeholder perception of aquaculture policy, consumer acceptance and preferences, effect of media narratives and actual industrial practices in public perception and distance effect on social acceptance of aquaculture. A broad range of species was covered including mussels, sea bass and sea bream, seaweed, salmon and freshwater species. As well as a broad geographical representation covering the Baltic Sea, Italian and Greek waters, Irish and Norwegian waters, Spain, France, Slovenia and German/Brazilian freshwater cooperation.

A total of 12 presentations were delivered within an afternoon session. The quality of the presentations were high and the discussions were very active. During the session a diverse array of topics were discussed, starting with a local study of stakeholder perception of aquaculture policy which found significant divergence with stakeholder perceived priorities. This divergence highlighted the need to have a better understanding of stakeholder priorities when allocating resources at the regional and national level.

Mussel aquaculture was then in focus, contrasting public perceptions of mussel aquaculture in the Baltic and Mediterranean Sea in the two subsequent presentations. These two interventions on sustainability of mussel aquaculture with a different geographical approach showed the significant differences of aquaculture perception at the regional level and the interventions needed to improve it according to these differences. Furthermore, focus was on consumer preferences with a notion of the generalized positive perception on organic products extending to organic aquaculture products in a so called "halo effect".

A more negative attitude was found when addressing the topic of circular strategies in aquafeeds. These interventions showed that consumer preferences are fundamentally dependent on the transparency of the information provided, however information depth increases complexity which can be detrimental. Also, valuable insights were presented on sensory preferences and consumer trust on fish and shellfish with consumer research done at the national level, and these insights were very relevant for market strategy and positioning of aquaculture products.

The latter part of the session focused on public attitudes towards the aquaculture industry, where a highly interesting study on distant decay effects and public attitudes clearly showed the importance of prioritizing studies on public attitudes at the local and regional levels, where aquaculture is present or where it is planned to expand, in contrast with attitudes in regions where aquaculture is nor present or at national level.

Results showed that people close to the aquaculture practice were much more positive towards it, in the specific local context. In addition, the environmental awareness of populations around aquaculture practices was very high without hindering their attitude towards the industry itself. These results compared with national attitudes showed significant divergence, which highlights the importance of focusing on local and regional studies when discussing public attitudes.

To close, a set of general recommendations were given, which showed a clear alignment with the industry sustainable direction in three areas - policy and regulation, consumer awareness and education and science and innovation - for the sustainable development of aquaculture, with the focus on freshwater production.

A general insight from this varied set of presentations is that while national approaches are relevant for consumer preferences, studies for market strategies and product positioning (taking a local and regional approach) is a preferred and is shown to be a more insightful approach when studying public attitudes and social acceptance towards aquaculture practices.

Recirculating Aquaculture Systems (RAS)

Chaired by Maddi Badiola (Consultant, USA) and Carlos Alberto Espinal (Chimana Tech, The Netherlands).

The Recirculating Aquaculture Systems (RAS) session included 13 presentations covering a wide spectrum of research and development activities related to the operation, optimization, and sustainability of RAS across both marine and freshwater contexts.

An important part of the session focused on **effluent treatment and nutrient recovery**, reflecting one of the most critical current challenges for RAS implementation, particularly in marine environments. Several studies presented advances in end-of-pipe treatment techniques and nutrient mobilization strategies aimed at converting waste streams into value-added outputs. This line of research indicates a growing recognition that waste treatment should not only mitigate environmental impacts but also generate economic value, aligning conceptually with the “aquaponic logic” of turning biological filtration into productive functions.

Another significant theme was **technological innovation in RAS design and operation**. Presentations showcased novel equipment configurations and refinements to improve water quality control. A smaller subset of talks explored the use of RAS to manipulate the rearing environment — for instance, to optimize growth rates or prevent unwanted early maturation.

Despite the diversity of research, a **notable gap** remains in the availability of industrial-scale case studies and operational data from commercial facilities. This reflects the continuing challenge of bridging laboratory-scale innovation and commercial implementation, especially when economic competitiveness against open systems (such as cages) remains a constraint. RAS facilities bear both higher capital and operational costs, including the additional burden of effluent treatment — whereas open systems externalize much of this environmental cost.

The **key challenge and opportunity ahead lies in closing nutrient loops**: developing economically viable pathways to valorize sludge and dissolved nutrients, integrate RAS outputs with other production systems, and thereby improve both the sustainability and profitability of land-based aquaculture. Advances in nitrogen removal and recovery (whether within the recirculation loop or at the discharge point) continue to represent the next technological hurdle to tackle.

In summary, the session demonstrated a field in steady technological progress, but still facing the **dual need to scale up successfully and internalize sustainability costs** without compromising competitiveness. Future research and collaboration between technology developers, farmers, and downstream industries will be essential to achieve this.

Reproduction & broodstock management – freshwater

Chaired by Juan Francisco Asturiano (Universitat Politècnica de València, Spain).

The session dedicated to Reproduction & broodstock management – Freshwater included 5 oral presentations. All of them described the development and assessing of different techniques at laboratory level, but most of them also being practical lines of work with potential farm-scalable applicability to freshwater aquaculture realities.

Electric exposure of early embryo stages was proposed as a non-chemical and inexpensive intervention for trout sex control, although with still limited practical results. New protocols could be assayed in the future.

Protocols for the isolation of primordial germ cells (PGCs) and mitochondria from sturgeon eggs were presented, providing tools for ex-situ conservation, surrogate propagation and potential restoration of endangered broodstock lines. For production operations they point to: (a) potential to preserve female cytoplasmic components important for early development, and (b) long-term biobanking strategies for germplasm (beyond sperm-only approaches).

One research group reported that the spawning of Atlantic salmon can be delayed by up to 2 months via altered photothermal regimes if shifting spawning season is needed for logistics. However, late-spawning females produced larger eggs with altered amino-acid profiles but poorer fertilization and higher early mortality. Offspring showed tissue-specific transcriptomic changes (downregulation of energy metabolism, protein synthesis, cell cycle pathways) and widespread DNA methylation differences, suggesting long-term effects on growth, stress responses and health.

Another group tested extenders and handling workflows for *in-vitro* short-term common carp sperm storage (days). They reported the effects of applying a warming process (bringing stored sperm from cold to room temperature for ~10–120 minutes) as a previous step to use the sperm in fertilization. This step significantly restores motility and fertilization potential.

The last group compared fertilizations using fresh vs. cryopreserved chub sperm, using large-volume containers vs. straws, and measuring hatching rate, larval growth, malformation and survival over time. Cryopreservation reduced some sperm characteristics and hatching rate but did not affect subsequent larval growth, malformation rate or survival, suggesting selection during embryogenesis removes weaker embryos, but survivors develop normally. Smaller straws may improve freezing uniformity and post-thaw motility.

During the concluding discussion the audience was asked to identify the main areas of research having the best application for the sector. Participants emphasized simple, farm-scalable

tweaks (extenders, warming steps, container choice and, especially sperm cryopreservation and cryobanking of genetic resources) rather than purely lab-based methods and solutions. The general idea was that research teams must make the effort of going through standardization processes to give producers a “guarantee” of the know-how produced in the labs, as well supporting those companies that have already incorporated some of the mentioned techniques in their rearing protocols with a good level of success.

Reproduction & broodstock management – marine

Chaired by Ana Gomez (CSIC, Spain).

The session brought together a comprehensive set of studies exploring reproductive performance and broodstock management across a wide range of marine species including European sea bass, gilthead sea bream, sole, cod, flathead grey mullet, greater amberjack, European eel, humphead wrasse and oysters. The programme included 12 oral presentations and 7 posters, covering the spectrum from practical hatchery management and reproductive induction to molecular and environmental control of gametogenesis, reflecting the multidisciplinary progress achieved in the field.

A first group of contributions focused on broodstock management and gamete handling. Regarding sperm, new biodegradable cryopreservation containers aligned reproductive biotechnology with sustainability goals, while pH and temperature challenge tests identified resilient males in sea bass, sea bream and sole for future climate-resilient germplasm banking. The influence of environmental parameters such as light, temperature, rearing depth, and nutritional conditioning was examined in species such as cod and humphead wrasse highlighting their impact on gonadal development and egg quality.

A second block addressed the induction of maturation and spawning in species with reproductive dysfunctions, such as flathead grey mullet and European eel. Major advances were reported through the use of recombinant gonadotropins and gene-based technologies that are reshaping the control of reproduction in captivity. A COST Action on eel reproduction further reinforced the need for international collaboration to close the production cycle of these species.

The third set of presentations provided new insights into molecular regulation of reproductive physiology in European sea bass, presenting functional studies of gonadal regulators and omics approaches centred on the gonad, also in the context of warming scenarios. Altogether, this reinforces this species as a valuable model for research on reproductive physiology.

Posters, which were briefly presented, further enriched these topics with complementary studies. Research on broodstock feeds enrichment and the use of AI-based behavioural monitoring to predict ovulation were presented for Senegalese sole. In reproductive induction, new results confirmed the efficiency of recombinant Fsh in immature mullet. Finally, transcriptomic analyses of eggs, pituitary or testis, aimed to identify makers of dysfunctions or to describe key reproductive processes.

The session highlighted the steady transition of reproductive research in aquaculture towards more technological and integrative approaches. **Advances in recombinant and gene-based biotechnologies, together with omics and molecular physiology, will soon enable finer control of gametogenesis and the closure of reproductive cycles in species that still rely on wild broodstock**. Environmental and nutritional studies complemented this progress, addressing climate resilience (though still few), gamete quality, and welfare-oriented broodstock management.

Overall, the contributions illustrated a clear movement towards precision reproduction, where physiology, biotechnology and digital tools may converge to improve reproductive efficiency.

As a more personal comment, it is noteworthy that without the strong participation of local research groups, the number of oral communications would have been reduced by almost half. Considering the scale of the conference and the broad thematic scope of this session, covering virtually all aspects of reproductive processes and broodstock management, this suggests that the wider community of reproductive physiology, particularly in fish, remains underrepresented in such general aquaculture meetings. This may reflect the existence of numerous specialised international and European congresses focusing specifically on fish reproduction or endocrinology, but also perhaps a broader trend in which reproduction is no longer perceived as a priority topic within the aquaculture sector. Despite this, the research presented in this session clearly demonstrated that advances in reproductive biology remain fundamental to achieving sustainable seed production, genetic improvement, and overall innovation in marine aquaculture.

Selective breeding & genomics

Chaired by John Bastiaansen (WUR, The Netherlands) and Gareth Difford (NMBU, Norway).

Selective breeding was a full-day session in the 2025 Aquaculture Europe meeting, similar to the sessions in recent years. We were happy with the large number of submitted abstracts, given that the International Symposium on Genetics in Aquaculture(ISGA) was held in Cadiz, Spain, only 4 months earlier. We received 23 contributions to this session of which 7 and 13 were presented orally in the morning and afternoon session, in addition 10 submissions were presented as ePosters. Few of the submitted abstracts did not adhere at all to the abstract instructions and were excluded from the session or assigned poster presentation.

Similar topics were grouped together in small blocks to facilitate the attendance for participants with specific interests. The topics of gene **regulation** including methylation, **phenotyping** and **reproductive development** of fish in breeding programs were well represented. Designs of breeding programs and quantitative genetic analyses were less prominent but important contributions on breeding for **climate resilience** in seabass and clams were presented. Novel genomic techniques such as single cell sequencing were not presented, while we know that these techniques are being applied in the aquatic species research. Possibly it is too early to have results presented at EAS conference or scientists applying these techniques may favour attending conferences focussing on genomics research? Finally, the use of **genome editing** in

genetic improvement was presented in a few talks and was shown to be starting to find its way into genetic improvement programs, for regions of the world where this is permitted. Methods for editing were shown to have success rates that start to make editing a useful tool for making genetic change.

Genomics studies were seen for some of the major aquaculture fish species (salmonids, tilapia, catfish), but also upcoming species were represented (arctic charr, meagre). Disease or immune traits were most common in the block of genomics studies.

Novel traits are being studied using phenotyping technology based on imaging. The use of imaging and AI is clearly giving breeding access to traits that have been difficult to measure on large numbers of fish, shrimp, or algae. We foresee the genetic analyses of these image based traits to become even more prominent in the next years. Another set of novel traits is related to climate resilience. With climate change effects were presented on reproductive traits and survival for both fish and shellfish. Environmental effects were shown both on a phenotypic and gene regulation level.

It was nice to have two presentations in the session that addressed research and breeding priorities for aquaculture. One based on the European research policies and priorities, and the other contributed from New Zealand, where climate change and the need for diversification of species are strongly affecting the aquaculture industry.

The Selective Breeding and Genomics session was well attended with participants ranging from 50 to 80 during the day. We had a broad representation of fish species including the major European and international aquaculture species where selective breeding has a longer history: Atlantic salmon, European sea bass, gilthead sea bream, tilapia, and shrimp. Also species where breeding is a more recent or just emerging activity such as in, arctic charr, meagre, macro algae, and clams.

Welfare

Day 1. Chaired by Benjamin Costas (CIIMAR, Portugal) and Juan Antonio Martos Sitcha (University of Cadiz, Spain).

Day 2. Chaired by Juan Miguel Mancera (University of Cadiz, Spain) and Rita Azeredo (CIIMAR, Portugal).

The AE2025 WELFARE session was extremely successful with 80+ abstracts submitted for oral and ePoster presentations. Given the high request by participants, a two-full day session was prepared and organized by experts in the field (i.e. Dr. Rita Azeredo, Dr. Juan Antonio Martos-Sitcha, Dr. Benjamin Costas and Dr. Juan Miguel Mancera). Different topics were discussed.

On the first day, the morning session was covered by health-related topics, addressing issues linked to sea lice surveillance, mucosal host defences, as well as using tailored diets to improve stress resilience and fillet quality. During the afternoon session, talks focused on the

improvement of rearing systems to enhance welfare as well as recent advances on stunning and slaughtering to accommodate the current legislation and social awkwardness on these topics.

On the second day, the morning session was covered by the effects of anthropogenic pressure on fish welfare. From boat noise to more general topics such as those related to climate change effects and farming rearing conditions were evaluated and discussed at the physiological and molecular levels. The morning session was closed with topics covering practical issues to contribute to novel operational welfare indicators. During the afternoon session, topics addressed issues related to immunity and physiology in fish and invertebrate species such as cephalopods and crustaceans and how those can be modulated by nutrition and pathogens. Other talks covered more issues related to governance and welfare and novel topics related to positive welfare, an exciting concept that ignited a constructive discussion in the room and that needs further attention and research.

Both days also allowed ePosters pitches at the end of both morning and afternoon sessions. By doing so, ePosters authors had a great opportunity to swiftly present their research, get the audience attention and profit from a brief discussion of their own results. A total of 6 presenters shared their results and perspectives that encompassed distinct topics, covering fish, crustacean and even a cnidarian species. Presenters offered their insights on the characterization of both marine and freshwater fish species' response to acute stress, where different biological parameters were pointed out as potential mild/non-invasive biomarkers of fish welfare. Marine algae biorefined extracts were proposed as good candidates to boost fish immunity, and light was also shed on increasing efficiency of flatfish stunning prior to slaughtering.

Special sessions

The EAS Student Group Workshop

As part of the Aquaculture Europe 2025 Conference, the EAS Student Workshop provided a unique platform for students to directly engage with leading companies in the aquaculture sector. This initiative aims to foster collaboration between academia and industry, encouraging students to explore real-world applications of scientific knowledge and to better understand the professional landscape of aquaculture.

The session began with a brief presentation by the EAS Student Group, delivered by Silvia Natale, Student Representative of the EAS Board of Directors, with the support of Adriana Oliveria, assistant coordinator, highlighting its continuous growth over the years and its mission to support students across Europe. The presentation aimed to inform participants about ongoing initiatives, opportunities, and activities, while also encouraging students from different countries to join the network and become actively involved in the EAS community.

Following this introduction, three companies, LaMotteEurope, SPAROS, and MATIS, shared their expertise through presentations and interactive discussions. Each company offered a different perspective on innovation in aquaculture, providing students with valuable insights into industrial practices, research applications, and technological advancements

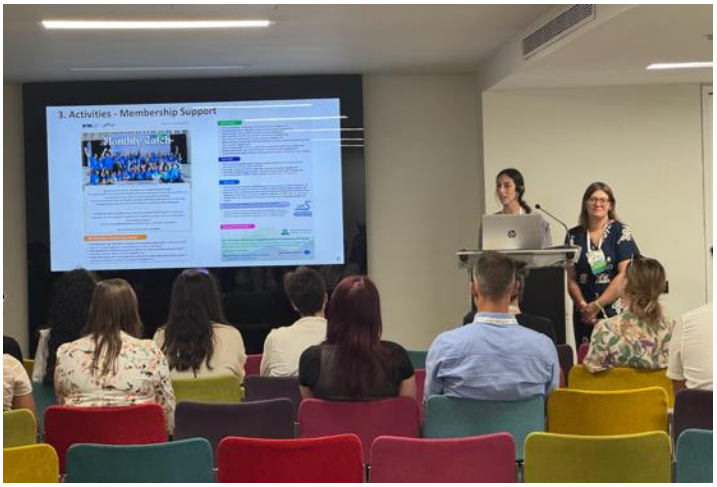


Figure 15: Silvia Natale and Adriana Oliveria with students (from left to right).

LaMotteEurope

LaMotteEurope, a recognized leader in water analysis for over a century, presented its innovative solutions for aquaculture and environmental water quality monitoring. Through the introduction of the SpinTouch® Fx photometer, LaMotte showcased how technological innovation can ensure accuracy, simplicity, and reliability in multi-parameter water testing. The company's presentation emphasized its

commitment to supporting sustainable aquaculture operations through precise, user-friendly analytical tools designed for both professional and educational use.

Figure 16: Tim Schofield presenting (top photo); students following his presentation (bottom photo).

SPAROS

SPAROS introduced its FEEDNETICS Virtual Nutrition Lab, a digital platform that supports innovation and learning in fish nutrition and aquafeed formulation. The company demonstrated how virtual tools can be integrated into academic and research environments to enhance understanding of sustainability and feed optimization in aquaculture. SPAROS's participation reinforced the importance of digitalization and data-driven approaches as key enablers for future advancements in the aquaculture sector.

Figure 17: Andreia Raposo and Ana Nobre (SPAROS) - top left photos; students during the workshop (Photos courtesy of Silvia Natale).

MATIS

MATIS, an Icelandic R&D company specialized in food and biotechnology, presented its activities and research focused on sustainable aquaculture practices. Through its Aquaculture Research Station (MARS), MATIS conducts pioneering work on improving feed efficiency, enhancing fish health, and reducing environmental impacts such as nutrient discharge. The presentation highlighted MATIS's role in promoting responsible and environmentally conscious aquaculture through applied research and innovation.

Figure 18: MATIS representatives and students (Photos courtesy of Silvia Natale).

Connecting Students and Industry

The EAS Student Workshop aims to strengthen the link between students and the aquaculture industry, fostering direct interaction, collaboration, and mutual learning. By engaging with companies like LaMotteEurope, SPAROS, and MATIS, students gain valuable insights into real-world industrial challenges and technological innovation. These connections not only broaden their professional understanding but also create future opportunities for internships, research collaborations, and career development within the aquaculture sector.

THINKIN AZUL- Multidisciplinary Research Program of Excellence

Chaired by Jaume Pérez Sánchez (CSIC, Spain).

ThinkInAzul is a Next Generation EU-funded project in Marine Sciences that, since 2022, has brought together seven Spanish regions (Andalusia, the Balearic Islands, the Canary Islands, Cantabria, Galicia, the Region of Murcia, and the Valencian Community). Over the past three years, the project has pursued a common goal: to integrate and strengthen marine research across three strategic areas:

- Marine and Coastal Monitoring – understanding ocean dynamics and ecosystem changes.
- Sustainable Aquaculture – improving production efficiency while preserving environmental integrity.
- Blue Economy and Innovation – fostering sustainable growth and new opportunities in marine industries.

By the end of 2025, ThinkInAzul will have produced more than 300 scientific publications and over 400 communications presented at national and international congresses. A demonstration of scientific excellence, collaboration, and commitment to marine sustainability.

Trending Topics in Spanish Aquaculture

At the AE2025 Congress in Valencia, ThinkInAzul hosted a Special Session dedicated to the most relevant themes shaping the future of Spanish aquaculture. Through focused presentations and a final round table, 12 leading experts identified current achievements, knowledge gaps, and future research needs, consolidating ThinkInAzul's position as a national platform for marine and aquaculture innovation.

Key Challenges Addressed

<u>Reproduction, Genetics, and Biotechnology:</u>

- Understanding the influence of climate change on reproductive success in cultured and emerging species.
- Advancing reproductive biotechnology to enhance breeding efficiency, reproductive control, and genetic diversity.
- Developing new genomic tools and applications for precision selection, genetic improvement, and optimized stock management.

<u>Nutrition, Health, and Welfare:</u>

- Improving performance, health, and sustainability through functional feeds and optimized nutrition strategies.
- Ensuring optimal health and welfare conditions across all production phases and species.
- Detecting, preventing, and controlling diseases, while adapting to climate change and the emergence of new pathogens.

Food Safety, Quality, and Consumer Orientation

- Evaluating the impact of novel feed formulations on product safety, nutritional value, and sensory quality.
- Adapting aquaculture products to meet diverse consumer profiles, preferences, and market demands.
- Developing innovative surface treatments to enhance sanitization, hygiene, and biosecurity in production systems.

Environmental Monitoring and Sustainable Production

- Enhancing environmental monitoring through integrated observation systems and digital tools for real-time data acquisition.
- Minimizing environmental interactions and promoting synergies between aquaculture and other coastal and marine activities.
- Promoting sustainable production models aligned with circular economy and climate-neutral objectives.

Emerging Challenge: The Microbiota Paradigm

- Change of Paradigm. Strengthening microbiota assessment across species, production systems, and geographical regions to understand its central role in aquaculture.
- Establishing gold-standard protocols for harmonized microbiota sampling, processing, and analysis to ensure data comparability.
- Driving technological innovation through the implementation of fast, cost-effective sequencing technologies suitable for routine monitoring.
- Understanding microbiota interactions by linking microbial community dynamics with environmental quality, fish health, and welfare indicators.

Session Highlights and Outlook

The ThinkInAzul Special Session at AE2025 demonstrated the strength of national collaboration in marine research. Through focused presentations and a final round table, experts identified current achievements, knowledge gaps, and future research needs, consolidating ThinkInAzul's position as a national platform for marine and aquaculture innovation. Although the project will formally conclude in December 2025, the network, knowledge, and partnerships it has created will continue to drive progress in marine science, aquaculture, and the blue economy for years to come.

SEA Young Spanish Scientists

Chaired by Esther Leal Cebrián (CSIC, Spain) and Cristina Velasco Rubial (University of Vigo, Spain).

The session, organised by the Sociedad Española de Acuicultura, brought together presentations made by early-stage Spanish scientists. Seven oral presentations were given, addressing a variety of topics and using different model species. These included rainbow trout (*Oncorhynchus mykiss*), gilthead seabream (*Sparus aurata*), eels (*Anguilla anguilla*) and goldfish (*Carassius auratus*). This variety of species was particularly enriching, both because of the breadth of biological and physiological approaches it enabled us to explore and because of the valuable insights it provided into fundamental processes in aquatic organisms. The diversity of species used also contributed significantly to the fruitful scientific discussion generated during the session.

It is well known that feeding farmed organisms is one of the main costs currently faced by the aquaculture industry. Consequently, there is significant interest within the scientific community in devising strategies to mitigate these expenses without compromising production efficiency or animal welfare. Promising solutions include replacing conventional raw materials with more economical and sustainable alternatives and optimising feeding strategies. This was clearly reflected in our session, during which a significant number of presentations addressed how to improve intestinal health through dietary strategies that promote growth and regulate food intake.

It is also interesting to mention that preliminary research examining the potential impact of climate change on the physiology and welfare of fish was presented. This is an emerging area of increasing importance. This research represents a step forward in preparing the aquaculture sector for the challenges resulting from global warming and other environmental disturbances.

However, despite the quality and relevance of the papers presented, there was a lack of research related to other equally crucial areas for the comprehensive development of the aquaculture sector. In particular, few contributions focused on topics such as reproduction, incorporating new species for farming, studying molluscs or improving strategies for preventing and treating infections. These lines of research were presented in more specific sessions of the conference and their absence in this session may indicate the current research interests of young members of the Spanish Aquaculture Society (SEA).

Although this trend is understandable given the sector's production priorities, it highlights the need to encourage greater diversification in research areas. Fundamental topics for advancing towards a more sustainable, resilient and technologically advanced aquaculture include reproduction, aquaculture health, biotechnology applied to new species and mollusc farming.

Network of Women in Aquaculture: Attracting new talents in aquaculture

The roundtable session "Attracting new talents in Aquaculture: think out of the box, be disruptive and inclusive!" at Aquaculture Europe 2025 in Valencia offered a lively exchange of perspectives from across generations and sectors of aquaculture. Aligned with the conference theme *"Aquaculture for Everyone",* this special session was a moment to reflect on where the industry stands today and what steps are needed to secure its future.

Panellists included: Rosa Chapela Pérez (Executive Director, CETMAR), Dorinde M.M. Kleinegris (Principal Investigator, NORCE Norwegian Research Centre), Kathrin Steinberg, Head of Research (Aquaculture Stewardship Council), João Rito (Founding Partner, SEAntia), Javier Ojeda Gonzalez-Posada (General Secretary of FEAP) and Benjamin Costas, (Principal Researcher, CIIMAR)

Figure 19: Panellists and NOWA staff (Photo courtesy of Christina Zantioti).

Moderated by Christina Zantioti, Marilou Suc, and Garazi Rodríguez Valle, co-founders of the NOWA Network of Women in Aquaculture, the session encouraged open dialogue on strategies to attract and retain talent, promote cross-generational learning, and create equitable opportunities across the sector.

A central theme was the importance of listening, not only to the younger generation entering the field, but also to the experience and knowledge of those who have been shaping aquaculture for decades. As one participant noted, progress requires an open mindset: not assuming we already know the answers, but creating space for diverse voices and ideas. The discussion also highlighted the need to grow the sector to develop new opportunities and positions for upcoming professionals, ensuring aquaculture remains attractive and accessible to new talent. Visibility was another key point: without recognition in policy arenas, the sector risks being

overlooked. Legal support and stronger policy frameworks are essential to underline aquaculture's contribution to food security, sustainability, and economic growth.

The dialogue concluded on a clear **call to action**: the sector must think beyond traditional pathways, embrace disruptive ideas, and ensure inclusivity at every level to attract and retain talent. The session reinforced that cultivating the next generation of aquaculture professionals is not only about education but also about **dialogue**, **visibility**, and **creating opportunities** for **meaningful engagement**.


Water Analys
LaMotte
EUROPE


Kunststoff-Spranger GmbH


AQUASOJA


United Sorghum Checkoff Program


S2AQUAcoLAB & GreenCoLab


AquaBioTech Group
Marine & Freshwater RAS
ABT Innovia


EUAqua


ERINN
INNOVATION

Species-focused sessions

These sessions are organised by species or group and bring together multi-disciplinary research contributions for that group.

Micro/Macro Algae

Chaired by Elisa Capuzzo (CEFAS, UK) and Erik-Jan Malta (CTAQUA, Spain).

This session included 11 oral presentations (6 with focus on macroalgae and 5 on microalgae) and 13 ePosters. Abstracts encompassed different aspects of micro/macro algae value chains, from technology development in production and processing, to assessment of current challenges hampering the development of these industries in Europe.

Multiple presentations (on both micro- and macroalgae) highlighted advances in **cultivation systems**, particularly in Recirculating Aquaculture Systems (**RAS**) and/or Integrated Multiple Trophic Aquaculture (**IMTA**) settings. For example, the green macroalgae *Ulva* showed good biomass when grown in RAS, while the red macroalgae *Palmaria* demonstrated substantial increase in growth when cultured in 50% discharge water from salmon aquaculture in an IMTA set up. Growth of *Palmaria* was associated with removal of ammonium and phosphate from the discharge water, highlighting a potential route of culturing of this species for nutrient valorisation. Microalgae biofilm also showed high algae productivity and biomass production as well as potential for nutrient remediation when cultured in RAS.

Presentations focused on the growth of microalgae in waste streams from aquaculture, brewery and seafood and meat processing. Challenges were highlighted around the scaling-up of microalgae-based wastewater treatment from laboratory set up to industrial scale. Resulting algae biomass could be used for finfish feed demonstrating the role of microalgae to optimise high-value biomass production for aquafeed while also bioremediating effluent through nutrient removal.

However current regulation poses some limitations in the use of these microalgae, and a clearer regulatory framework is needed regarding the use of microalgae biomass cultivated on aquaculture “waste streams” (RAS/IMTA settings).

Advances in **cultivated algae species and strains** were showcased in multiple presentations, addressing the need for continuous diversification in cultured algae. For example, the green macroalgae *Codium* has shown to be a promising candidate for growth in tanks, with seeding and settling procedures optimised, although issues remain with conservation of the harvested biomass (shorter shelf-life than *Ulva*). Advances on cultivation of the brown seaweed *Saccorhiza polyschides* were also presented as well as the adoption of polyploidy in green macroalgae *Ulva fenestrata* to enhance growth and yield.

For microalgae, the focus has been on developments in obtaining microalgae mutants resistant to increased temperatures (heat-tolerance). Examples included the green microalga *Chlamydomonas reinhardtii* and the diatom *Phaedactylum tricornutum* of which a thermotolerant mutant strain was cultivated in photobioreactors. This latter species can synthesise omega-3 fatty acids and fucoxantin which are essential for fish larvae and molluscs. Microalgae mutants for production of the rare carotenoid diatoxanthin (which has anti-

inflammatory and anti-cancer properties) have also been developed. Furthermore, research was also presented around testing of low frequency electromagnetic fields on growth, photosynthesis and antioxidant activity in marine microalgae, which appears to not be generally significant.

For seaweed aquaculture, a poster highlighted the need to reduce transport time of seedlings from nursery to grow-site to a maximum of 6 hours (to ensure full recovery of the photosynthetic capacity of seedlings).

Progresses in **tracing and extracting products from algae** were also reported, particularly optimised protocols for phlorotannin extraction in macroalgae for maximise recovery and purity, and adoption of deuterium to trace omega-3 lipogenic fluxes in microalgae.

At the European level there has been evidence of an increase in investments for algae and there is a general positive view for an algae future in Europe; however, multiple **challenges** remain, hampering the further development of the industry. These include regulatory and legislation hurdles (e.g. around licensing) although they are being recognised and slowly addressed. Business models studies highlighted that cultivated macroalgae is too expensive, so there is a need to reduce costs to make a commercially valuable product. Furthermore, there is a need to identify the right market segments for algae biomass. A move away from food products towards high end products such as cosmetics and nutraceuticals has also been observed, but again, there is a need to understand the customer and the target segment. One presentation also showed that the industry needs both 'slow' (e.g. from R&D) and 'quick' (investors) investment for growth.

Particularly for microalgae, cultivation at a pilot scale in industrial outdoor setting is feasible but challenges remain on optimisation of harvesting and post-processing for ensuring high-quality products.

The potential of algae aquaculture for environmental restoration and for provision of ecosystem services was also highlighted, however these need to be quantified, and farmers should be rewarded for these services.

Finally, multistakeholder engagement (such as business, academia, policy-makers, communities etc.) is essential for overcoming these challenges.

Molluscs & other shellfish

Chaired by Sergio Fernández Boo (CIIMAR, Portugal) and Antonio Figueras and Magalí Rey Campos (CSIC, Spain).

During the *Molluscs and Other Shellfish* session, a wide range of topics were presented and discussed. One of the key themes was the diversification of aquaculture, with a focus on identifying novel species that could be introduced into the market. Notable examples included the scallop *Pecten novaezelandiae* as a new candidate for the New Zealand industry, blue

mussels for the pet food industry in the Baltic Sea, and more exotic species such as naked clams, which were proposed as alternative protein sources for production.

A major concern in mollusc production remains the recruitment of seed and the enhancement of seed production in hatcheries. This issue was thoroughly explored through presentations on Manila clams, abalones, sea urchins, striped venus clams, and greenshell mussels. With global declines in bivalve populations, seed production is increasingly critical—not only to sustain current aquaculture practices, but also for species restoration and restocking in the wild. New insights are needed for both high-production species and lesser-known species that are vanishing from our coasts, such as *Chamelea gallina* in the Mediterranean Sea.

A novel topic discussed was the role of bivalves as potential carbon sinks. The reuse and treatment of shells after consumption attracted considerable interest, as they may contribute to CO_2 emissions. Various shell disposal methods were addressed, with incineration identified as the most harmful and burial as the most environmentally recommended option.

Several presentations focused on the mollusc microbiome, aiming to better understand interactions with the environment and to investigate causes of mortality peaks. The impact of pathogens on the host microbiome was also explored. For example, the parasite *Perkinsus olseni* was found not to induce dysbiosis in three clam species, suggesting it has minimal health effects in this regard. Additionally, metatranscriptomic tools were introduced as a novel approach for the rapid detection of both known and unknown pathogens in the environment. A major limitation of this method is the current lack of robust databases for mollusc pathogens. Nevertheless, it holds great promise for identifying emerging species capable of causing disease outbreaks.

Other relevant topics included the effects of ocean acidification on byssus production and shell biomineralization in mussels, as well as a comparison of growth performance in *Mytilus edulis* mussels from two distinct fishing areas: Ireland and Norway.

Finally, immune priming or immune memory capacity was presented as a strategy to mitigate the impacts of climate change, potentially making animals more resilient to future marine heatwaves following controlled exposure. Additionally, the use of bacteriophages as an alternative to antibiotics in mollusc hatcheries showed promising results, helping to control pathogenic bacteria and reduce bivalve mortality in production systems.

In summary, the 20 oral presentations in the *Molluscs and Other Shellfish* session covered a broad spectrum of topics, highlighting climate change as a major concern due to the rapid shift in environmental conditions and the current lack of tools to address it. Key priorities for the coming decades include improving hatchery seed production, identifying more resilient bivalve strains, and developing methods for the rapid detection and management of pathogen outbreaks.

Percid Fish

Chaired by Oleksandr Malinovskyi (FROV JU, Czech Republic), and Uroš Ljubobratović (MATE HAKI, Hungary).

Despite being scheduled towards the end of the conference program, the session attracted a solid audience, with participation fluctuating at around 70% of the room's capacity. It was noticeable that a considerable part of the audience visited specific presentations rather than staying for the full session programme. The programme covered topics relevant to pikeperch and perch aquaculture, with a strong focus on physiology, reproduction, and adaptation in intensive farming systems.

More than half of the oral presentations came from a single institution, which underlines the importance of increasing presenter diversification in future sessions. While the attendance was good, the balance of contributors could be improved.

Recommendations for future sessions:

- More diverse promotion in advance of the conference to attract contributions from a broader range of institutions and countries. The promotion effort this year was mostly concentrated in the Czech Republic, and expanding outreach may diversify participation.
- Consider broadening the session title and scope. Instead of a species-specific title such as "Percid session," renaming it to "Physiology and adaptation of emerging species in intensive farming" would better reflect the actual content while opening opportunities for presenters working on other aquaculture species to join.

Shrimp & crustaceans

Chaired by Matthew James Slater (Alfred Wenger Institute, Germany) and David Sánchez Peñaranda (Universitat Politècnica de València, Spain).

A vibrant and very well attended session on crustaceans, with a heavy focus on shrimp farming research was held at the EAS 2025 in Valencia.

The first group of speakers focused on welfare and performance as related to health responses to a wide variety of feed additives. Excellent data on prebiotic's, probiotics and even postbiotics along with multiple other additives filled the morning session. Several representatives from industry presented additive products currently finding application in a growing market and providing health benefits to an industry increasingly challenged by novel diseases and environmental stressors. It was exciting to see technology transfer actively practiced and many new products impacting farm performance.

The second group of speakers focused and on challenges related to growth versus water quality and the potential for management responses to improve not only animal welfare but also the socio-economic acceptance of shrimp farms and the perceived value of shrimp farms locally

and globally. Welfare flowed into the third group of speakers who chose to look at methods for measuring animal welfare particularly in response to stressors. Here novel and potentially unique haemolytic indicators were revealed for chronic stress and a variety of improved challenge test results revealed the potential of new methods to highlight animal performance and to measure disease responses more accurately. The value and challenges of studying invasive crab species and their value as model species were also part of lively discussion.

Overall, the session once again – in terms of shrimp - outlined the paradoxes of rapidly growing production of crustaceans worldwide limited by disease and water quality challenges and threw light onto efforts by industry to improve welfare supplemented by efforts of science to better measure welfare and respond accordingly.

Trout

Chaired by Diego Mendiola (Caviar Pirinea, Spain).

The scientific session dedicated to rainbow trout aquaculture (*Oncorhynchus mykiss*) highlighted recent advances in nutrition, physiology, animal welfare, environmental sustainability, and new technologies applied to production systems. The contributions offered an integrated perspective on the opportunities and challenges faced by the sector in a context of climate change, increasing societal demand for animal welfare, and the transition towards more sustainable production models.

In the field of nutrition, several strategies aimed at improving trout resilience under thermal stress and health challenges were emphasized. The use of polymer-based emulsifiers, supplementation with sulphated macroalgae extracts, β-glucans, and functional amino acids such as tryptophan showed potential to enhance feed efficiency, modulate immune responses, and mitigate the physiological effects of stress.

In parallel, the relevance of early feeding strategies was underlined, including the use of alternative live diets such as *Enchytraeus albidus*, with promising results in growth performance and lipid profile adjustment in fry. These approaches confirm functional nutrition as a central tool to strengthen physiological robustness and reduce the impact of adverse conditions.

Animal welfare was another fundamental axis, with studies addressing the validation of health and behavioral indicators for trout across different production phases. The consolidation of objective and reproducible welfare scales is a necessary condition for traceability and social acceptance of aquaculture in Europe. Additionally, the effects of different stunning methods and environmental factors (temperature, photoperiod, light colour) on fish physiology and final product quality were examined, emphasizing the importance of procedures that combine production efficiency, muscle integrity, and welfare.

From a production and environmental perspective, the integration of trout aquaculture into circular and low-emission models was debated. The development of diets formulated with locally sourced, low-impact ingredients, the incorporation of nature-based biofilters (wood chips and tree marshes), and the combination of RAS with marine cage grow-out at different

seasons represent active research lines seeking to balance production efficiency with ecological footprint reduction. Nevertheless, questions remain regarding the adaptation of RAS-raised fish to open-sea conditions and the emission of by-products such as nitrogen oxides in biofilters, underscoring the need for multicriteria sustainability assessments.

Pathophysiological studies highlighted emerging issues such as nephrocalcinosis in hatchery phases and its association with the “loser fish” phenotype. This points to critical gaps in the understanding of etiological mechanisms behind subclinical pathologies that condition productive losses. Complementarily, the characterization of polyunsaturated fatty acid metabolic pathways in salmonids, including different trout ecotypes, opens the door to a better understanding of the genomic bases of nutritional plasticity and its potential application in selection programs and feeding strategies.

In summary, the session identified **several strategic axes for the future of trout aquaculture**:

1. Advancing functional and precision nutrition as a means to increase resilience and welfare.
2. Consolidating operational and standardized protocols for welfare assessment.
3. Deepening the understanding of emerging pathologies that affect critical production stages.
4. Optimizing the integration of low-enviromental- impact production systems.
5. Aligning all of these advances with the European Union’s strategic priorities in food sustainability, nutritional security, and carbon footprint reduction.

Altogether, the evidence confirms that rainbow trout remains a key species for achieving a more resilient, efficient, and sustainable European aquaculture. However, substantial investments in R&D will continue to be required to address knowledge needs related to climate change effects and to transfer innovations effectively to commercial scale.

Other contributed sessions

The other contributed sessions are a collection of contributions that had not been selected in the more targeted sessions but still were considered by those chairs to be of sufficient quality to merit a full oral presentation.

Accordingly, the topics covered in these sessions are diverse, and they have been loosely classified here as Health, Nutrition, Operations and General.

Health

Chaired by Belén Fouz (University of Valencia, Spain).

This miscellaneous session covered different aspects related to the health and welfare of aquaculture species, closely connected to production systems. The quality of the presentations was good, contributing to reinforce the importance of slaughter methods as well as the control of animal exposition to environmental disturbances to improve host fitness.

In total, 4 oral presentations (of 5 planned) were presented in 2 h morning session.

Firstly, it was highlighted that the success of the in-water electrical stunning is dependent on the species, since it cannot be recommended for warm-water ones (ex. Nile tilapia or catfish). Therefore, the current challenge is focused in refining the stunning protocols under commercial conditions with specific parameters for species to ensure humane slaughter of fish.

Secondly, exposition of European sea bass to boat noise demonstrated a lack of physiological response (standard stress markers as plasma levels of cortisol) but significant behavioural alteration related to swimming speed. Discussion on this disconnection in the context of noise exposure requires a revision and further investigation.

Another interesting topic was the need of extra aeration in open-net-pen salmon aquaculture during periods of environmental stress to support water quality and fish welfare. Conventional diesel-powered systems demonstrated to be lesser sustainable (in terms of operational efficiency, environmental impact…) than novel electric-powered systems. Long-term trial will let us confirm the promising advantages of electric aeration systems, therefore contribute to develop sustainable aeration strategies for aquaculture sector.

Finally, the use of herbs (rosemary, mullein, and basil) as anaesthetics was addressed, using goldfish as a model. The histological changes observed in internal organs (kidney and liver) of fish treated with effective doses indicate that the use of the studied compounds for anaesthetic purposes is not recommended. Therefore, major attention should be focused on other safe plants for aquatic animal sedation.

Nutrition

Chaired by Arkadios Dimitroglou (Agricultural University of Athens, Greece).

During this session 22 oral presentations were presented from the morning to the afternoon sessions. At the beginning the importance of running nutritional trials evaluating the effect of nutrition on genes expression using zebrafish was mentioned, mainly because of the high percentage of related genes to mammals and humans. Then, the importance of using hydrolysate proteins in fish nutrition leading to improved growth performance of the test fish was highlighted. Indeed, the hydrolysate proteins can benefit both fresh and marine water fish by increasing nutrient absorption and improving growth performance as well as resistance to various stressors. Similar results were presented when fermentation of plant origin raw materials took place prior to their incorporation in the fish diets. Fermentation process could reduce the negative effects of plant origin raw materials in fish nutrition by improving its palatability, modulating the intestinal microbiota and enhancing the feed intake.

Furthermore, there were presentations related to minimizing the proteins sparing by adjusting the lipid content of the lipids in the feed. This is particularly interesting because it can reduce production cost and the N deposition in the environment at the same time, emphasizing the importance of lipids in fish nutrition. Eminent was the interest in new alternative raw materials for both proteins and lipids. Such alternatives include the use of insect meals, bacterial single cell proteins, aquaculture by-products, even more functional ingredients such as peptides and biochar. For some of them, finding the optimum level of incorporation in the diet is still missing and for others more research is needed in order to have a solid opinion about their use in fish feeds.

Generally, fresh and innovative ideas were presented. In my opinion, the highlight of the session has to do with the cultivation of “sea bugs” such as amphipods which have a clear advantage based on their nutritional value due to n-3 PUFAs presence, compared to other “terrestrial bugs” such as insects. Of course, even in the case of “sea bugs” there are many things that need to be addressed in order to achieve a constant and high-volume production.

Finaly, presentations regarding the management of production as well as the social-economic impacts of the forage fishmeal use in aquaculture were also included in the session. Hence, people’s awareness about aquaculture practices was emphasized, which subsequently leads to the need for incorporation of verified sustainable practices in every stage of aquaculture production.

Operations

Operations 1 :*Chaired by Jonathan Roques (Consultant, France).*

The session comprised 8 presentations showcased a wide range of innovations in aquaculture operations, spanning energy systems, modeling, digitalization, and biological optimization. Key highlights included:

- **Sustainable farm development:** Novel platforms integrating a combination of alternative energy sources to power offshore sea-cage farms, reducing reliance on fossil fuels like diesel.
- **Modeling and decision-support tools:** Development of simulation tools tailored for small-scale aquaculture in developing countries, aiming to increase profitability and resource efficiency.
- **Digitalization in RAS:** Application of advanced technologies such as simulation tools and digital twins to optimize recirculating aquaculture system operations.
- **Fish monitoring technologies:** Non-invasive methodologies and novel recognition tools for individual fish identification through pattern recognition, as well as advances in telemetry that enhance resolution and scalability.
- **Ecosystem modeling:** Simulation of oyster larval drift to better understand colonization patterns, supporting ecological and industry planning.
- **Biological and nutritional optimization:** Research on vitamin D metabolism in salmonids with direct implications for feed formulation and fish health.
- **Circular production systems:** Development of integrated aquaponic systems that convert waste streams into valuable inputs, strengthening resource circularity.

The presentations indicated several key areas where further development is needed and where future trends are emerging:

- **Energy transitions:** While platforms combining renewable energy for aquaculture are under development, scaling, robustness, and cost-efficiency remain open questions.
- **Digital twins and smart farming:** Tools for simulation and real-time optimization are progressing rapidly, but integration into commercial-scale farms is still limited. Future trends point toward broader adoption of AI-driven, predictive management.
- **Fish monitoring at scale:** Individual-level monitoring is improving, but challenges remain in scaling such technologies to large populations while keeping costs manageable.
- **Holistic ecosystem approaches:** Modeling larval drift and similar processes shows a growing trend toward ecosystem-based management in aquaculture site planning.

- **Functional feeds and precision nutrition:** Research such as vitamin D metabolism highlights the need for precision approaches to fish nutrition, with expected future expansion into other micronutrients and metabolic pathways.
- **Circularity and resource efficiency:** Aquaponic and circular systems are gaining traction, but require further testing for economic viability and scalability.

The session also identified several pressing challenges and knowledge gaps:

- **Integration of renewable energy:** Technical and economic feasibility of powering farms sustainably remains a challenge, particularly in offshore settings.
- **Adoption of digital tools:** Industry uptake of modeling, simulation, and digital twins requires demonstration of cost-effectiveness, user-friendliness, and compatibility with existing operations.
- **Data and monitoring:** Scaling individual fish recognition and telemetry to commercial levels demands improvements in affordability, robustness, and automation.
- **Ecosystem interactions:** More knowledge is needed on larval dispersal, biodiversity impacts, and ecosystem services linked to aquaculture expansion.
- **Fish health and welfare:** Precision knowledge on essential components such as micronutrient requirements (e.g., vitamin D) and metabolism is still limited and needs to be translated into feed guidelines.
- **Circular systems:** Economic models and best practices are required to validate aquaponics and similar circular concepts for different species and production scales.

Operations 2 :*Chaired by Martin Føre and Bengt Finstad (NTNU, Norway).*

The session was intended to be a venue for contributions that had not been selected in the more targeted sessions but still were considered of sufficient quality to warrant a full oral presentation. Accordingly, the topics covered in the session were very diverse ranging from high level considerations to more detailed experimental outcomes. Topics covered were numerical analysis of water flows production units, benefits of RAS in hatcheries, new standards for feed production, impact and emergence of climate change, new approaches for weight estimation in individual fish, modelling of national carrying capacity and demands for seafood, amphibious robotics for aquaculture, open ocean farming systems, and the cleaning of wastewater through low-trophic organisms and aquaponics. The quality of the presentations was generally very high, and the audience were very active in asking questions and partaking in discussions in intermissions. All questions asked and discussions raised were also on point, civilized and courteous. In all, this made the session a positive and constructive experience for both presenters, the audience and the chairs.

There were 15 presentations planned in the session, out of which 12 were actually held. The first vacancy was filled with an inspiring discussion on the importance of considering not only carrying capacity in production when assessing national aquaculture production regimes, but also the demand and consumer capacity. In the second vacancy, the discussion was aimed at

considerations regarding climate change and sea temperatures in the mediterranean. This discussion also broadened to cover other regions in the world and appeared to be very appealing to most of the people in the room. The last vacancy was not utilized similarly, thus we simply de-convened the session 15 min earlier than scheduled.

Attendance through the session was varied but generally quite low. A possible explanation for the small audience initially is probably due to the time of day and that the president's reception was held the preceding evening. It is also possible that the session had somewhat lower attendance since it was placed far from most of the other venues (in being in the hotel), but this effect is not very clear considering that other sessions held in the same room attracted a full audience (e.g., the precision aquaculture session on Wednesday).

In all, we would conclude that the session went well, and we believe that the presenters and the audience were happy with the outcomes.

The AE2025 President’s Reception

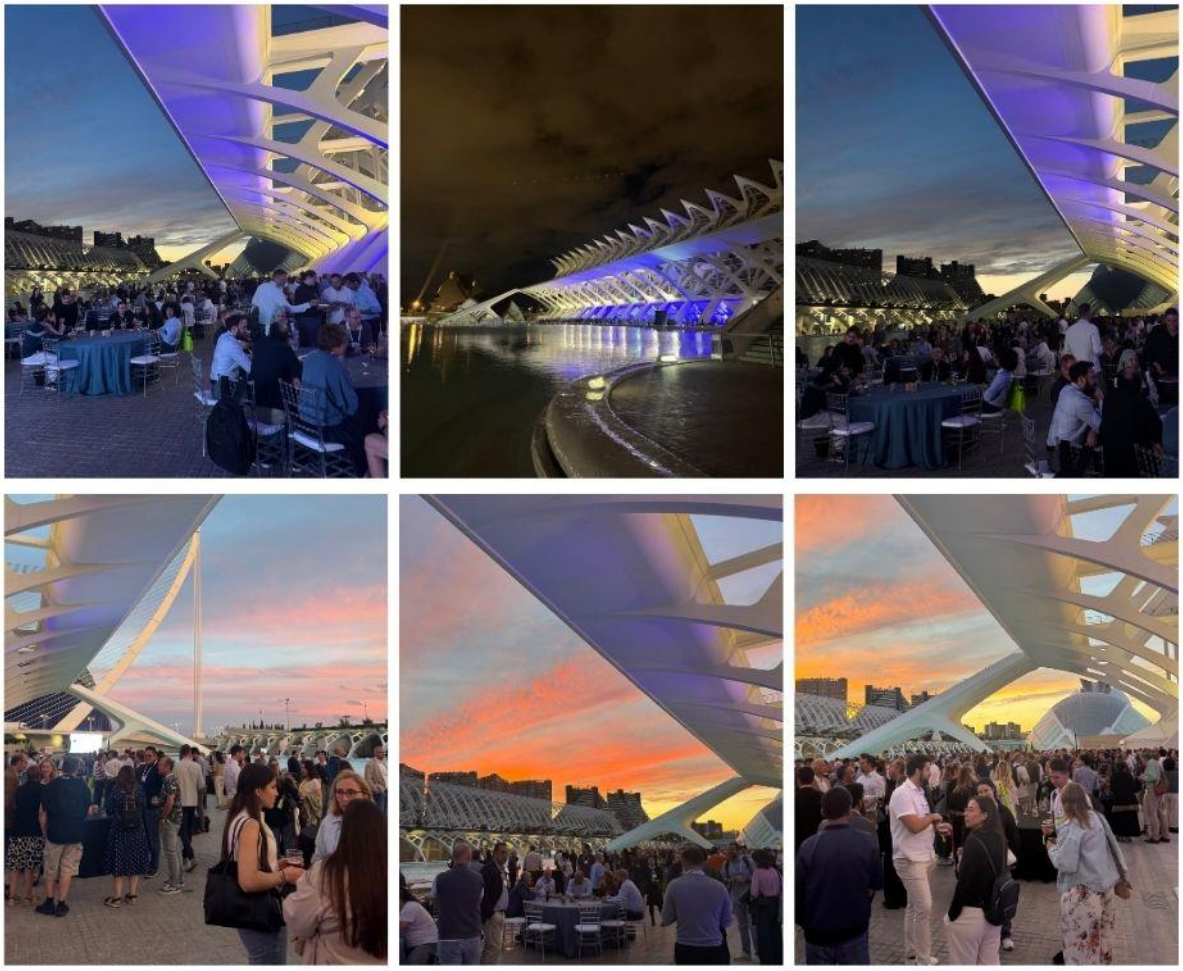


Figure 20: Celebrating AE2025 at the President's Reception.

The **President’s Reception**, held on **Wednesday, September 24**, took place in the magnificent **City of Arts and Sciences** in Valencia, offering one of the most memorable moments of AE2025. The evening gathered more than **1,700 participants** in a stunning architectural setting that perfectly reflected the city’s artistic and cultural spirit. Guests enjoyed an elegant and lively atmosphere filled with **Spanish music, traditional cuisine, and warm hospitality**, creating the perfect environment for networking and celebration. The event provided a unique opportunity for participants from around the world to connect, exchange experiences, and celebrate the success of Aquaculture Europe 2025 in true Valencian style.

The AE2025 Poster Awards & Closing

During the final Plenary Session, awards were made to recognise outstanding ePoster contributions that highlight clear science communication and visual storytelling in advancing aquaculture research. The awards session was chaired by Martin Føre and Diego Mendiola, with Marc Vandeputte (EAS President) presenting the prizes.

The **AE2025 Best Student Poster Award** was presented to **Paolo Guttuso** for his work titled *"Sporeforming bacteria as a probiotic in gilthead seabream (Sparus aurata): effects on growth and appetite regulation."* The study was presented in the **Nutrition - Functional Ingredients** session.

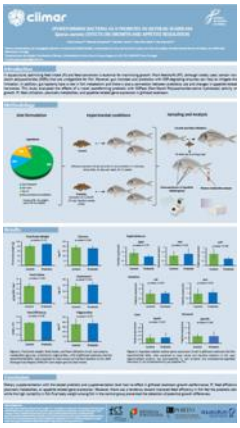
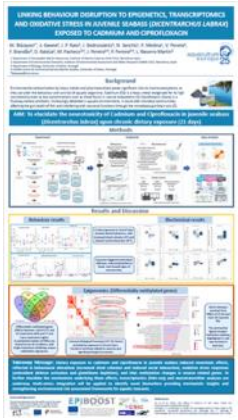


Figure 21: AE2025 Best Student e-Poster (click on the figure to view in larger format).



The **AE2025 Best Poster Award** was granted to **Mercedes Blázquez** for her poster *"Linking behaviour disruption to epigenetics, transcriptomics and oxidative stress in juvenile seabass (Dicentrarchus labrax) exposed to cadmium and ciprofloxacin."* The award was received on her behalf by **Dr. Janan Gawra**. The work was featured in the **Environment – Microplastics, Litter & Ecotoxicity**.

Figure 22: Best e-Poster (click on the figure to view in larger format).

Figure 23: Paolo Guttusu with Marc Vandeputte (left), and Dr. Janan Gawra receiving Mercedes Blázquez's award in her absence with Marc Vandeputte (right).

The **Ibrahim Okumus Award (EAS Student Group)** was presented to **Esther Hoyo Alvarez** for her poster *"Cardiac responses, activity, and oxygen consumption of European seabass subjected to stress challenges,"* presented during the **Welfare** session. The award was introduced by **Silvia Natale**, EAS Student Group Representative.

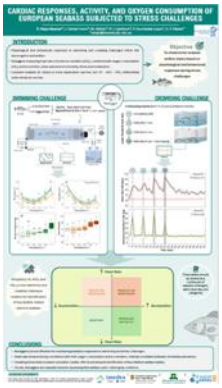


Figure 24: AE2025 ePoster winner of the Ibrahim Okumus Award (click on the figure to view in larger format).

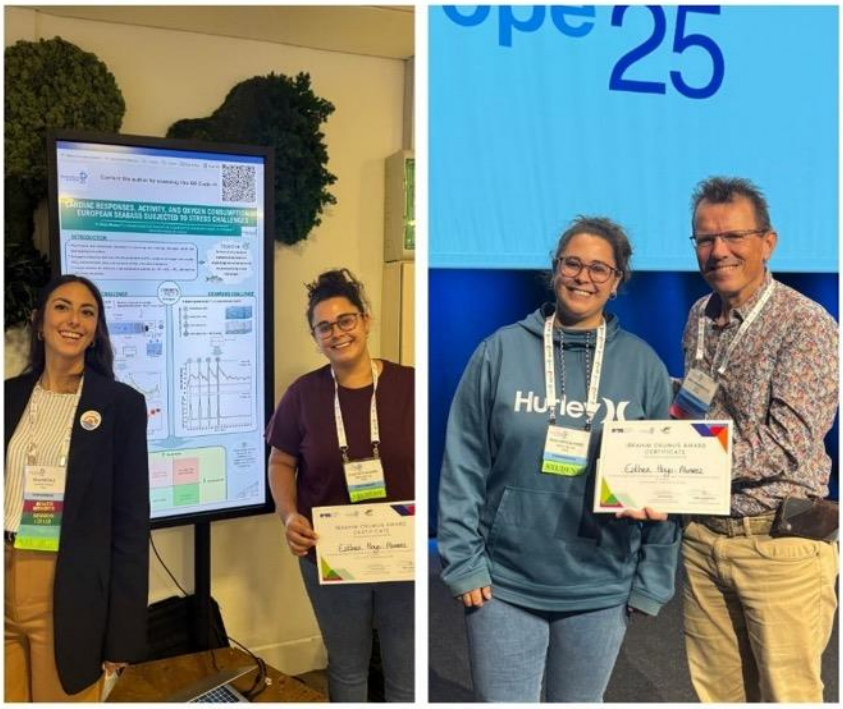


Figure 25: Silvia Natale and Esther Hoyo Alvarez (left photo), and Esther Hoyo Alvarez with Marc Vandeputte (right photo).

All three awardees delivered exceptional abstracts and ePosters, demonstrating strong scientific quality and clear communication, fully adhering to the AE2025 guidelines. **Martin Føre** expressed his gratitude to all authors for their contributions and to the session chairs for their valuable work in reviewing, managing, and assessing the submissions.

SPRINGER NATURE

Each AE ePoster Award winner received a **€200 book voucher** from **Springer Nature**, publisher of the *Aquaculture International* journal, along with **€300 in cash** and a **one-year EAS membership**.

These awards recognize excellence in research and communication and highlight the importance of young scientists' contributions to advancing sustainable aquaculture.

After the awards ceremony, Spain's Secretary General for Fisheries, Isabel Atime, made a special closing address that emphasized the country's leadership role in Europe: Spain has taken a step forward with its national strategy, aligned with the EU Strategic Guidelines 2021-2030, to drive a more sustainable, competitive and resilient aquaculture, key to food security."

And in his final remarks, the AE2025 Conference Chair Jaume Pérez-Sánches reflected on what he thought made the event unique: "This conference has brought together not only experts and industry, but also a community committed to advancing aquaculture, sustainability and innovation here in Spain and across Europe. From the very beginning, with excellent keynote lectures, we have shared ideas, explored solutions and debated the challenges ahead. It is clear that the future of aquaculture depends on collaboration, vision and dedication."

Figure 26: Jaume Pérez-Sánchez (left), and Isabel Artime Garcia (right).

Join us at AE2026 in Ljubljana, Slovenia !

We are looking forward very much to welcoming you to the beautiful and enchanting city of Ljubljana, Slovenia from September 28 to October 1, 2026 for our AE2026 event.

EAS is also celebrating its 50th anniversary in 2026, making this event even more special.

Ljubljana is the capital and largest city of Slovenia, located along a trade route between the northern Adriatic Sea and the Danube region. The city's symbol is the Ljubljana Dragon. It is depicted on the top of the tower of Ljubljana Castle in the Ljubljana coat of arms and on the Ljubljanica-crossing Dragon Bridge. It represents power, courage, and greatness. The city centre is traffic-free and very easy to walk. Many bridges, including the famous triple-bridge cross the Ljubljanica river and the river is lined with cafés, bars and restaurants. It is dominated by the Ljubljana Castle, which is accessible on foot, by bus or by funicular and gives fantastic view of the city. AE2026 will take place at the Gospodarsko Razstavisce Exhibition and Congress Centre, about 20 minutes' walk from the city centre.

Taking the theme **"Aquaculture in Global Change"**, the plenary sessions of the conference will address how food systems, including aquaculture, are being challenged by changes resulting from global warming. These affect all forms of aquaculture, in inland and coastal marine regions, and especially small and medium sized operators that may not have the financial and operational capacity to implement adaptation and mitigation measures. Seasonal "extremes" in water temperature, availability and oxygen content and (for coastal areas) salinity, pH, sea level will have varying effects on aquaculture production that may require the diversification of cultured species. Diseases, parasites, predators, non-indigenous species and algal or jellyfish blooms can also decrease production and challenge aquatic animal welfare. These effects may

require the relocation of sites or the allocation of new sites for production. However, these changes may also provide opportunities to diversify to new species production or the combined production of species that can better mitigate effects. Opportunities also lie in the development of a clear and transparent credit system for the carbon sequestration and other ecosystem services that aquatic animal groups, whether in freshwater or coastal habitats, provide.

AE2026 will therefore put the focus on adaptation to climate effects, the latest research on species adaption capacity and the health/welfare/nutrition/breeding factors that underline this. While Slovenia has a low aquaculture production, it has plans for development of existing and new production methods and species and it is at the heart of central/southern Europe - adjacent to Italy, Croatia, Hungary and Austria – and hence providing a regional focus for both inland and marine aquaculture.

The AE2026 parallel sessions will cover the full scope of European aquaculture scientific disciplines and species and will comprise submitted oral and poster presentations.

AE2026 will feature a trade exhibition, where regional and international companies will present their latest products and services. Standard and Corner booths are available, and each booth is $6m^2$ (2x3m) and features walls, carpet, two chairs and one table, spotlights, one power outlet, fascia identification sign and two free full delegate registrations for the conference. Industry-oriented events will take place around the trade exhibition, and technical tours will be organised. The AE event is a focal point for meetings of European associations, satellite workshops of EU projects and other events. We can provide options for your meeting.

Special events will be arranged for students attending AE2026 to enable networking and exchange of ideas. These include a student workshop and a social reception for attending students. Students receive the full registration package plus the student reception. Membership of the EAS is free for students. To qualify for the student rate and for EAS membership, a copy of your student I.D. is required.

AE2026 organising committees

Chair: Nives Ogrinc (Jožef Stefan Institute).
Steering Committee (SC): Daniel Żarski (Institute of Animal Reproduction and Food Research, Polish Academy of Sciences), Irena Fonda (Fonda Fish Farm).
Program Co-chairs: Simona Sušnik Bajec (University of Ljubljana) and Tanja Šegvić Bubić (Institute of Oceanography and Fisheries, Split, Croatia).
Local Organizing Committee (LOC): Tjaša Kodela (Fisheries Research Institute of Slovenia), Ana Rotter (National Institute of Biology), Sanja Sandić (University of Primorska), Luca Bargelloni (University of Padova), Ana Gavrilović (University of Zagreb) and Sara Kancelar-Juvan (Ljubljana Convention Bureau).

Event website https://www.aquaeas.org/

General conference inquiries: eas@aquaeas.eu

Registration, requests for invoices & visa requests: worldaqua@was.org

Exhibitors, sponsors, media & meeting room requests: mario@marevent.com