



Advanced Course

Fish Nutrition, Feeding and Health

Zaragoza (Spain) • 5-9 June 2023



CIHEAM
ZARAGOZA



NewTechAqua



Objective

The contribution of aquaculture as a sustainable food producer has become more and more important in European and Mediterranean countries, both by the supply of aquatic products, and by the economic benefits obtained by the people involved in aquaculture and related activities.

However, the sector is now challenging the needs of high-quality circular feed ingredients to reduce its dependence from wild-marine and land-based vegetable resources, both associated to environmental impact concerns such as fish stock over-exploitation and over-deforestation, land-use displacement and eutrophication.

Today, the conventional aquafeed ingredients are only partly being replaced by other protein and fat-rich resources such as animal and agricultural by-products, insects, algae and single cells. Hence, there is a need to develop industries to produce these novel circular feed resources taking into account their nutritional composition, availability, costs and safety.

At the same time, fish farmers need to ensure that the nutritional requirements of the fish are met, and that the technical quality of the feed is tailored for the production system used. Under cultured conditions, fish are often exposed to management and environmental stressors as well as to parasite and infectious diseases, which may impact the overall biological and economic performance.

Much work has been done on nutritional and husbandry approaches to improve the feed efficiency of alternative feed resources, while much effort is still needed to improve fish robustness, disease resistance and fish quality, which are also current key topics of research in order to improve fish welfare and reduce the use of chemical treatments at farm level.

The aim of the course is to present recent knowledge on fish nutritional physiology, the use of conventional and novel feed ingredients, and on tools and feeding strategies to improve fish performance and health. The course emphasizes particular aspects of main European fish species and production conditions. At the end of the course the participants will:

- be aware of major challenges of fish nutrition, feeding and health;
- have gained advanced knowledge on fish nutritional physiology;

- better understand the role of conventional and novel ingredients in aquafeed formulation;
- acknowledge the importance of aquafeeds and feeding strategies as tools for improving fish robustness;
- have gained advanced knowledge about functional ingredients and the application of selective breeding for feed efficiency;
- understand the role of the gut microbiome on fish health and its modulation mechanisms through functional ingredients;
- have acquired experience on practical feed formulation at commercial and research level, and on the evaluation of feeding efficiency, fish performance and robustness;
- be updated on the feed ingredient legal framework and most relevant certification schemes.

Organization

The course is jointly organized by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (CIHEAM Zaragoza), and the EU H2020-funded project NewTechAqua (New Technologies Tools and Strategies for a Sustainable, Resilient and Innovative European Aquaculture, grant agreement No 862658), whose main goal is to expand and diversify European aquaculture production of finfish, molluscs and microalgae by developing and validating technologically-advanced, resilient and sustainable applications. Lectures will be delivered by well qualified experts participating in the NewTechAqua project and from international institutions, universities, research centres and private companies in different countries.

The course will take place in Zaragoza, at CIHEAM Zaragoza, and will be held over a period of one week, from 5 to 9 June 2023, in morning and afternoon sessions. It will be taught through a combination of lectures, open discussion and supervised practical work. The main working language of the course will be English. The Organization will provide simultaneous interpretation of the lectures into English, French and Spanish. The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view.

Programme

1. Opening (1 hour)

2. Introduction to fish farming challenges (1 hour)

- 2.1. The contribution of fish farming as a protein supplier
- 2.2. Fish farming: species, systems, and feeding
- 2.3. Fish nutrition and feeding challenges
- 2.4. Fish health management challenges

3. Nutritional physiology (5 hours)

- 3.1. The integrity of mucosal tissues
- 3.2. The fish digestive system. Gut anatomy and functionality
- 3.3. Microbiome in fish
- 3.4. Tools and experimental approaches for fish nutrition: in vitro modelling

4. Aquafeed ingredients (7 hours)

- 4.1. Conventional ingredients
 - 4.1.1. Fishmeal and fish oil production trends
 - 4.1.2. Vegetable ingredients
 - 4.1.3. Other sources: krill, land animal by-products
- 4.2. Alternative ingredients
 - 4.2.1. Macro and micro algae, insects, SCP yeast, fungi, bacteria, etc.
 - 4.2.2. Effects on zootechnical performance, health and quality
 - 4.2.3. Advances from EU projects
 - 4.2.3.1. NewTechAqua and Nextgenproteins: microalgae, by-products from fisheries and aquaculture, single cell protein
 - 4.2.3.2. PerFormFish and Aqualmpact: single cell protein, insect meals, alternative oil
- 4.3. Open discussion: potentials and constraints

5. Improving fish health and performance in farmed fish (8 hours)

- 5.1. Nutritional requirements under different environment conditions
- 5.2. Selective breeding and feed efficiency
 - 5.2.1. Selective breeding to improve zootechnical performance and quality
 - 5.2.2. NewTechAqua and Aqualmpact projects: Improvement of fish health and quality of selected seabass families and improvement of feed efficiency in Atlantic salmon
- 5.3. Functional ingredients
 - 5.3.1. Fish feed additives
 - 5.3.2. Project advances
 - 5.3.2.1. Proimmunoil+: practical diets and functional ingredients
 - 5.3.2.2. NewTechAqua: pro-health feed to reduce Sparicotyle in seabream
- 5.4. Gut microbiome: microbiome assessment in aquaculture
 - 5.4.1. Main goals for a metagenome study
 - 5.4.2. Marker gene and shotgun metagenomics
 - 5.4.3. Steps for a metagenomic study: study design, sampling and storage, DNA extraction, library preparation, NGS sequencing
 - 5.4.4. Bioinformatics and biostatistics for data mining in metagenomics

6. Feed formulation and feeding (8 hours)

- 6.1. Challenges in feed formulation and technology
- 6.2. Precision feeding and modelling
- 6.3. Legal framework and certification schemes
 - 6.3.1. EFSA guidelines and requirements for feed ingredients and additives
 - 6.3.2. Certification schemes in aquafeed manufacturing and fish farming
 - 6.3.3. Organic certification. NewTechAqua: organic feed trials
- 6.4. Practical work. Feed formulation and evaluation of feeding efficiency, fish performance and robustness.

7. Final discussion and closing session (1 hour)



Guest lecturers

Bonaldo, Alessio - Univ. Bologna (Italy)
Candela, Marco - Univ. Bologna (Italy)
Carvalho, Marta - Univ. Las Palmas de Gran Canaria (Spain)
Conceção, Luis - Sparos, Olhão (Portugal)
Estèvez, Alicia - IRTA La Ràpita (Spain)
Firmino, Joana P. - EFSA, Parma (Italy)
Gisbert, Enric - IRTA La Ràpita (Spain)
Kortner, Trond M. - Norwegian Univ. Life Sciences (Norway)
Moya, Marcos - Aquaculture Stewardship Council (Spain)
Parma, Luca - Univ. Bologna (Italy)
Sonesson, Anna K. - NOFIMA AS, Sunndalsøra (Norway)
Torrecillas, Silvia - IRTA La Ràpita (Spain)

Admission

The course is designed for a maximum of 30 participants with a university degree, and is intended for professionals of the feed industry and fish farming sector, as well as for technical advisors and researchers in the field.

Registration

- Candidates may apply online at the following address: <http://www.admission.iamz.ciheam.org/en/>
- Applications must include the curriculum vitae and copy of the supporting documents most related to the subject of the course.
- Applications are open from 19 January to 6 March 2023. Applications from candidates requiring authorization to attend the course may be accepted provisionally.
- There are not registration fees for this course.

Financial support

A limited number of candidates from Mediterranean and other European countries may receive financial support covering the cost of travel and accommodation. Preference will be given to low and medium income countries. If you wish to request a scholarship, please complete the relevant section when you apply online to participate in the course.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

Insurance

It is compulsory for participants in face-to-face modality to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the Organization, upon payment of the stipulated sum.

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<https://edu.iamz.ciheam.org/FishNutrition/en/>

