

# THEBEHAPPYFISH: AN EELISA INTERNATIONAL ACTIVITY

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## Abstract

TheBeHappyFish is an international challenge, a hackathon-like event, in the framework of the European Engineering Learning Innovation and Science Alliance (EELISA), more precisely within the community entitled Sustainable Food Production (SFP). TheBeHappyFish has been designed by Universidad Politécnica de Madrid (UPM) and coordinated with ITU (Turkish Technical University), and ZHAW (Zürcher Hochschule für Angewandte Wissenschaften) in a hybrid format. It allows participants to join either in person, online, or through a combination of both, providing the opportunity to develop cutting-edge solutions using artificial intelligence, computer vision, and satellite data analysis, while fostering collaboration and knowledge exchange. In this graduate-postgraduate challenge, 31 students of 8 nationalities were prone to propose innovative ideas towards the improvement of fish welfare under fish farming in one of these categories: a) Develop AI-powered Tools for Fish Counting, Disease Recognition, and Behavior Analysis; b) Water Quality Monitoring Through Satellite Observation; c) Designing Sustainable Systems; and d) Free Contribution Ideas. Participants were grouped into teams of 3 to 5 members. A webinar was held 15 days in advance of the challenge itself (15th January), which consisted of a series of expert-led webinars, with recordings later made available on YouTube. The BeHappyFish event (30-31 January) was structured into two different phases: Day 1, ideation, development, and complementary expert talks; and Day 2, refinement, final presentations, networking, and awards ceremony. As a result, most participants rated the event positively, with many appreciating the opportunity to collaborate on real-world challenges. Students reporting on the activities also highlighted various learning tips, including aquaculture industry insights, sustainability practices, and AI applications. The support from mentors and organizers received mostly positive ratings, but a few students felt that expert talks could have been more aligned with the technical challenges. Some students suggested that the mentoring process could be more structured, with clearer guidance on project development and problem-solving. Many participants expressed interest in joining again but suggested improvements, such as more interactive sessions between researchers and students, better datasets, and a clearer focus on coding and AI for those. In principle, TheBeHappyFish may be repeated with another of the university partners as the host institution: ITU or ZHAW.

Keywords: Hackathon, gamification, EEES, Interuniversity activity.

## 1 INTRODUCTION

Challenge-based learning (CBL) is a growing approach in higher education that has been promoted as a means for students to align the acquisition of disciplinary knowledge with the development of transversal competencies while working on authentic and sociotechnical societal problems; the term CBL has appeared in academic literature since 2001. CBL has the same definition as other similar pedagogies such as project-based learning (PBL); however, CBL has a focus on sustainability issues and demands a verifiable and urgent solution. Publications referring to CBL have boosted since 2018[1].

CBL often proposes a multidisciplinary approach in its execution within Science, Technology, Engineering and Mathematics (STEM). CBL is also included as a novel pedagogical approach to supplement existing structures. Within this literature there are some examples of competitions or

hackathons described with the term CBL. The benefits of CBL are commonly reported in the literature by analyzing student or academic feedback or through a descriptive approach.

The challenges presented to students in CBL differ from those of PBL where problems are often predefined and developed by the teachers. Still, CBL courses and projects share the use of open-ended, real-world cases as a starting point for student learning [2].

Hackathons are one of the newest implementations included within CBL, defined as events where individuals engage in rapid and collaborative engineering over a relatively short period. However, teachers often encounter difficulties designing the course activities, facilitating students' teamwork, and balancing between helping and influencing the students' work. [2].

Hackathons are typically extra-curricular, being mostly software-focused, though this can extend to include hardware. Hackathons foster creativity and seem to contribute positively to an affective domain adoption of the importance of investigation and analysis in engineering work [3].

The European Engineering Learning Innovation and Science Alliance (EELISA) is a consortium of ten higher education institutions (graduate engineering schools, technical and full-spectrum universities) from eight different countries in Europe with the common ambition of defining and implementing a common model of European engineer rooted in society and of bridging engineering, sciences and humanities for inclusive, sustainable and digital societies[4].

EELISA communities are mission-driven working groups that bring together students, teachers, and researchers from all partner universities with prestigious professionals, grassroots organizations, citizens, private companies, and public institutions to find innovative solutions to real-world challenges. In November 2022, EELISA launched the EELISA days, as it was the commemoration of Elisa Leonida Zamfirescu's birthday, the woman who inspires the acronym of the Alliance, and the World Science Day for Peace and Development. The EELISA communities offer the students the possibility to gain EELISA Credentials, a passport in which the student collects the evidence or "badges" of his/her contribution to social challenge solving processes.

In this paper we present The BeHappyFish Challenge, an interdisciplinary hackathon aimed at promoting technological innovation in aquaculture. The activity was held in the context of EELISA community Sustainable Food Production, which is the perfect environment to host a CBL.

## METHODOLOGY

Before the main activity took place, a webinar was held to provide common ground for the participants. Key topics related to digitization in aquaculture were considered, presented by international experts who addressed different aspects of interest. The seminars were delivered live via Zoom and were: "Aquaculture for a Blue Transformation" by Alfredo F. Ojanguren; "Physio-loggers Advancing Fish Welfare Research" by Asgeir Bjarnason; "Fish Welfare Assessment" by Linda Tschirren; and "Automatic Analysis of Fish Images" by Juana M. Gutiérrez Arriola. Before the event, participants were provided with a detailed schedule of activities and all the necessary information for their participation. Seminars are available on a YouTube channel: <https://www.youtube.com/@TheBeHappyFishChallenge>.

The Hackathon itself focused on five challenges which were sanctionable by the groups of students:

**Computer Vision Fish Disease Recognition Software:** This challenge aimed to develop software based on artificial intelligence (AI) that uses images or videos of fish to detect early signs of diseases. Computer vision algorithms can identify visual patterns in the skin, fins, or eyes of fish, allowing for a quick and efficient diagnosis.

**Fish Counts in Aquaculture:** This challenge focuses on creating automatic solutions to count fish in large aquaculture systems accurately. Accurate counts allow farmers to better manage their resources, avoiding overcrowding and ensuring healthy growth.

**Recognition of aberrant behaviors in fish farms:** Abnormal behaviors, such as lack of appetite or erratic movements, may be indicators of stress, illness, or problems in the environment. This challenge

focuses on developing tools that, through video analysis, recognize patterns of anomalous behavior in fish.

**Creation of a label and/or quality and welfare system in aquaculture systems:** This challenge seeks to develop a certification system that assesses and ensures welfare and sustainability in aquaculture systems. This system could be based on quantitative data related to fish health, water quality, and feeding practices.

**Water quality through satellite observation:** This challenge proposes the use of satellite imagery to monitor water quality in large bodies of water where aquaculture is practiced. Parameters such as temperature, turbidity, and chlorophyll concentration, which are key indicators of the health of the aquatic environment, could be analyzed.

Participants received initial guidance and support, ensuring balanced teams with diverse skills. This phase also involved setting up communication channels and providing access to resources that would help teams prepare for the challenge.

The BeHappyFish Challenge was conducted in a hybrid format, allowing participants to attend in-person, online, or through a combination of both. This approach ensured accessibility for international participants and those unable to travel.

The event was structured into different phases, allowing for progressive development of the projects:

- **Day 1:** Ideation, development, and expert talks.
- **Day 2:** Refinement, final presentations, networking, and awards ceremony.

Figure 1 shows the rubric for awarding prizes.

<b>Main Prize – Best Overall Project</b>	
(Evaluating overall project quality, impact, feasibility, and innovation.)	
<b>Criteria</b>	
<b>Innovation</b> (How unique and creative is the solution?)	
<b>Feasibility</b> (Is the project realistically implementable?)	
<b>Impact</b> (Does it address an important challenge in aquaculture?)	
<b>Presentation Quality</b> (Was the project well-explained and defended?)	
<b>Team Collaboration</b> (Did the team work effectively together?)	
→ Total Score for Main Prize: /50	
<b>🔗 Best Code</b>	
(Evaluating software performance, efficiency, and implementation.)	
<b>Criteria</b>	
<b>Technical Complexity</b> (How well-implemented is the code?)	
<b>Efficiency &amp; Optimization</b> (Is the code well-structured and performant?)	
<b>Functionality</b> (Does it work as expected?)	
<b>Documentation &amp; Readability</b> (Is the code well-documented and easy to understand?)	
→ Total Score for Best Code: /40	
<b>Best Solution</b>	
(Evaluating how well the project solves the problem and its potential impact.)	
<b>Criteria</b>	
<b>Effectiveness</b> (Does it successfully address the challenge?)	
<b>Scalability</b> (Can it be applied to real-world scenarios at scale?)	
<b>Sustainability</b> (Does it promote long-term environmental or economic sustainability?)	
<b>User-Friendliness</b> (Is the solution easy to use/adopt?)	
→ Total Score for Best Solution: /40	
<b>Best Theoretical Concept</b>	
(Evaluating research depth, scientific validity, and novelty of the idea)	
<b>Criteria</b>	
<b>Scientific Soundness</b> (Is the idea well-founded in research?)	
<b>Theoretical Innovation</b> (Does it introduce new scientific concepts?)	
<b>Supporting Data &amp; Justification</b> (Are there strong references and supporting arguments?)	
Total Score for Best Theoretical Concept: /30	

Figure 1. Rubric for evaluating the projects.

## 2 RESULTS

### 2.1 Web page

A web page has been created as a means of interaction, both to engage the students and deliver the schedule and details of the hackathon: <https://blogs.upm.es/the-be-happy-fish-challenge/> (Figure 2).

The web page incorporates several sections: presentation, challenges, organization details, and links to the webinars, and was enriched during the event with more detailed information, participants, awards and winners.

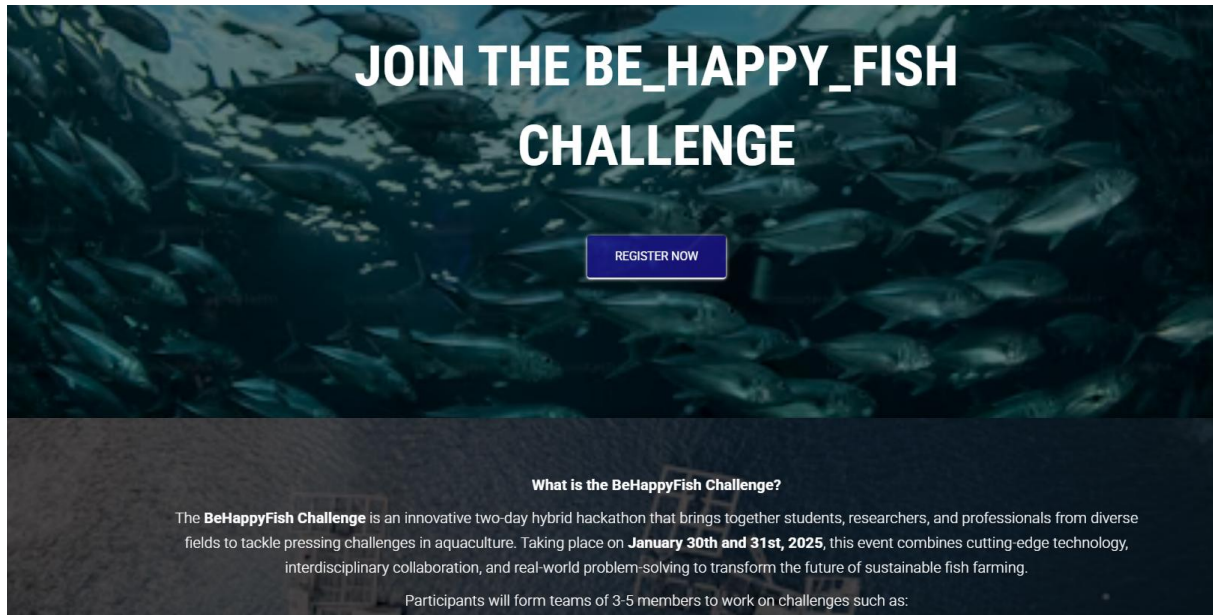


Figure 2. Web page aspect.

### 2.2 Teams

As for global enrollment, it can be highlighted that 31 students of 8 nationalities joined the hackathon, distributed in 9 teams:

- o **Unity Team (University of Algarve):** Aligned with the third challenge. They presented a marine aquaponics system for the use of fish (tilapia) waste through the cultivation of Salicornia, achieving the use of non-arable land, minimal use of fresh water, effluent recovery, and the production of high-value products.
- o **Ecobees Team (Istanbul Technical University):** Aligned with the third challenge. They presented a project aimed at the early detection of diseases in fish in aquaculture farms using AI and ML, using images of sick fish, pH and temperature measurements. They concluded that the goal is to continuously improve the system by increasing the parameters and training the artificial intelligence.
- o **Naive Nemos Team (FAU):** Aligned with the second challenge. The team presented a real-time water quality monitoring system that uses satellite image analysis and in situ measurements to detect problems, alert aquaculture farmers, report issues, resolve them, and learn from the process to refine the system.

The UPM Riders Team (Teleco Campus Sur, UPM) presented a detailed algorithm that is based on videos of salmon. Position, speed, and acceleration curves were obtained during movement to study behaviour and relate it to aspects of health and well-being.

- o **GLUGLU Team (Computer Science, UPM):** Aligned with the first challenge. They presented a detailed algorithm for the early detection of eye diseases and overweight in salmon through the analysis of fish images.
- o **Eco Biomas Team (Istanbul Technical University):** They presented an intelligent alarm system based on the monitoring of dissolved oxygen in water, detecting consecutive changes and activating an alarm and correction system to prevent damage to aquatic systems.
- o **Finding Nemo Team (University of Oviedo):** Aligned with the third challenge. They presented a salmon aquaculture system combined with mussels to preserve the marine ecosystem and prevent the uncontrolled growth of algae, discussing scientific articles and estimating the amount of mussels to be cultivated based on the P and N content dissolved in the sea.
- o **Aquafauna Team (University of Zurich):** Aligned with the first challenge. They presented a fish disease detection system based on machine learning models developed on moving images, showing the algorithms developed and implemented and the future validations required.
- o **Clearwaste Team (ETSIAAB, UPM):** Aligned with the third challenge. They presented a sludge treatment system to minimize its environmental impact and maximize its value in agricultural production or as food for low-trophic organisms, extracting lipids by centrifugation and presenting an economic and productive impact study.

### 2.2.1 Awarding prizes

Table 1 shows the final assessment of the solutions

Table 1. Prizes

	Assessment (%)	
AquaFauna	85.3	<b>Overall Best</b>
Naive Neemos	70.8	<b>Best Code</b>
Eco biomass	74.2	<b>Best Solution</b>
GluGlu	98.9	<b>Best concept</b>

### 2.2.2 Assessment by students

After the event a qualitative survey was conducted. Most participants rated the event positively, with many appreciating the opportunity to collaborate on real-world challenges. Some students expected more focus on AI and coding, while others appreciated the broader discussions on sustainability and aquaculture. A few participants found that they learned mainly through their efforts rather than from structured event content, which is in fact a main objective of the activity.

Students reporting on the activities also highlighted various learning tips, including aquaculture industry insights, sustainability practices, and AI applications. The support from mentors and organizers received mostly positive ratings, but a few students felt that expert talks could have been more aligned with the technical challenges. Some students suggested that the mentoring process could be more structured, with clearer guidance on project development and problem-solving. Many participants expressed interest in joining again but suggested improvements, such as more interactive sessions between researchers and students, better datasets, and a clearer focus on coding and AI for those.

## 3 CONCLUSIONS

The BeHappyFish Challenge successfully fostered innovation in sustainable aquaculture, bringing together interdisciplinary teams to tackle real-world problems. The event provided an enriching learning experience, facilitating networking opportunities and encouraging the development of impactful solutions for the future of aquaculture.

The level of satisfaction of the students who participated in the event can be considered very high.

For new editions, the organizers could incorporate a more detailed procedural guide for developing a CBL project in general and EELISA in particular.

Documentation on standard solutions for these problems is important for this project. The alignment of the expert talks with the proposed challenge is also crucial.

Participating in the BeHappyFish Challenge proved to be more than just a hackathon, becoming a part of a movement to create sustainable solutions for global food security and environmental health.

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