INNO ECOFOOD

Funded by the European Union

UK Research and Innovation

INNOECOFOOD NEWSLETTER

Issue 4: July 2026



CONTENTS

Editors' Note ii

Foreward iii

Notable Events

Feira Viva 2026, Portugal 1

ISEKI-Food Conference 2026, Portugal 2

HealthyDiets4Africa Project Mid-term Workshop Kenya 2

24-Moth Consortium Meeting in Ghana 3

Updates From Our Work Packages

Work Package 1: project management 5

Work package 2: establishing ECOHUBS and living lab cages in African countries 6

Work package 3 ECOHUBS eco-farmed fish, feed and post-harvest technologies and living lab cages 7

Work package 4: optimization of production of selected spirulina species and processing 8

Work package 5: optimization of selected insect species production and post-harvest 14

Work package 6: up-cycling waste nutrients from fish by-products, spirulina and insects 18

Work package 7: validation of quality, acceptance, LCA and certification of product 19

Work package WP8: training and Dissemination 21

Upcoming Events 22

EDITOR'S NOTE

Dear Readers,

Welcome to the fourth issue of the INNOECOFOOD Newsletter, covering the period from January to July 2026.

This edition captures a pivotal moment in our project's journey as we reach the 30-month milestone. The past six months have witnessed remarkable progress across all fronts, particularly in the establishment of our ECOHUBs in Kenya, Egypt, Ghana, and Tanzania, which are now approaching operational readiness. The Kenya ECOHUB stands at 95% completion with RAS systems already operational, while Egypt, Ghana, and Tanzania continue to make significant strides in infrastructure development.

Scientific breakthroughs have been equally impressive. Our partners have achieved major milestones in spirulina research, including the molecular characterization and genomic sequencing of newly isolated African strains from alkaline lakes across Kenya, Tanzania, Ghana, and Egypt. An optimized phycocyanin extraction method has been developed, and promising spirulina strains have been selected for ECOHUB production. Training programs have been launched to build local capacity, ensuring knowledge transfer to communities across participating countries.

In insect production, training sessions on black soldier fly and cricket rearing have been successfully conducted in Kenya and Tanzania, to start the empowering journey to the community members with practical skills for sustainable insect farming. Feed trials have demonstrated that diets incorporating spirulina and Black Soldier Fly are viable alternatives to fishmeal, with additional benefits for fish health and product shelf life.

Product development has flourished under Work Package 6, with biscuits, porridge, nutrient bars, and extruded snacks enriched with fish, spirulina, and insect ingredients being developed and tested across Kenya, Ghana, Uganda and Portugal. Sensory evaluations have yielded promising results, and products are being refined for market readiness.

With infrastructure nearing completion and production activities set to commence, INNOECOFOOD is poised to deliver lasting impact across Africa's aquaculture and food systems.

Happy reading!

Warm regards,

Editors Team

Disclaimer!
Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or UKRI. Neither the European Union nor UKRI can be held responsible for them.

Foreword

As the INNOECOFOOD project reaches the 30-month milestone, we are delighted to reflect on the remarkable progress we have achieved together. The first half of 2026 has been a period of significant developments, with our ECOHUBs moving from construction toward operational readiness across Kenya, Egypt, Ghana, and Tanzania. In Kenya, the facility now stands at 95% completion with the Recirculating Aquaculture System already operational and fish production underway, while Egypt, Ghana, and Tanzania continue to make substantial advances despite some challenges reflected in this Issue 4.

On the scientific front, our teams have delivered outstanding results. The isolation and molecular characterization of new Spirulina strains from African alkaline lakes represent a major achievement, with whole-genome sequencing now underway. We have developed optimized methods for phycocyanin extraction and completed feed trials demonstrating that spirulina and black soldier fly are viable alternatives to fishmeal. Our insect production training programs have started to empower community members in Kenya and Tanzania with practical skills for sustainable farming.

What particularly excites us is the progress in product development. Our teams have created cookies, porridge, nutrient bars, and extruded snacks enriched with fish, spirulina, and insect ingredients. Sensory evaluations have been extensively positive, and we are now refining these products for market readiness, demonstrating how circular economy principles can transform by-products into nutritious foods that create economic opportunities.

Looking ahead, our focus will shift to operationalizing the ECOHUB facilities, launching comprehensive training programs, and strengthening dissemination efforts to ensure innovations reach farmers and communities. We extend our deepest appreciation to all partners for their dedication and collaboration. We are confident that INNOECOFOOD will deliver lasting impact by empowering communities and advancing sustainable aquaculture across Africa.

António Marques
Project Coordinator

Mariana Palma
Project Manager

Notable Events

The INNOECOFOOD Project consortium members continued to work on the implementation tasks, in the first 6 months of 2026, the 3rd year of the project. Much attention was on the completion of the construction work of the ECOHUBs and installation of the living labs to improve local aquaculture using AI and IoT in six African countries; Egypt, Ghana, Kenya, Namibia, Tanzania and Uganda. Within this period some of our partners have presented our innovations and research outcomes at a number of national and international conferences.

This ensured that project innovations, research findings and best practices does not remain in the silos of INNOECOFOOD but reaches different stakeholders including farming communities and youths, policymakers, scientists, and international collaborators. Moving forward, with the project mission, our partners continue to local innovations co-created with local communities through research and amplifying visibility across Africa and Europe. Find notable events INNOECOFOOD took part in:

Feira Viva 2026, Portugal

Members of CIIMAR — Mariana Palma, Ricardo Pereira, Carla Pires, Maria Leonor Nunes — together with Maria Joo Fraqueza from FACULDADE DE MEDICINA VETERINRIA - ULISBOA (FMV, participated in the Feira Viva 2026 event, organized to celebrate World Food Safety Day, 7 June 2026.

During the event, the team showcased prototypes of insect flour cookies and energy bars enriched with fish protein hydrolysates, both developed within the INNOECOFOOD project.

See more **here.**



Mariana Palma, Ricardo Pereira at Feira Viva 2026

to the festival participants. Photo: Makerere University

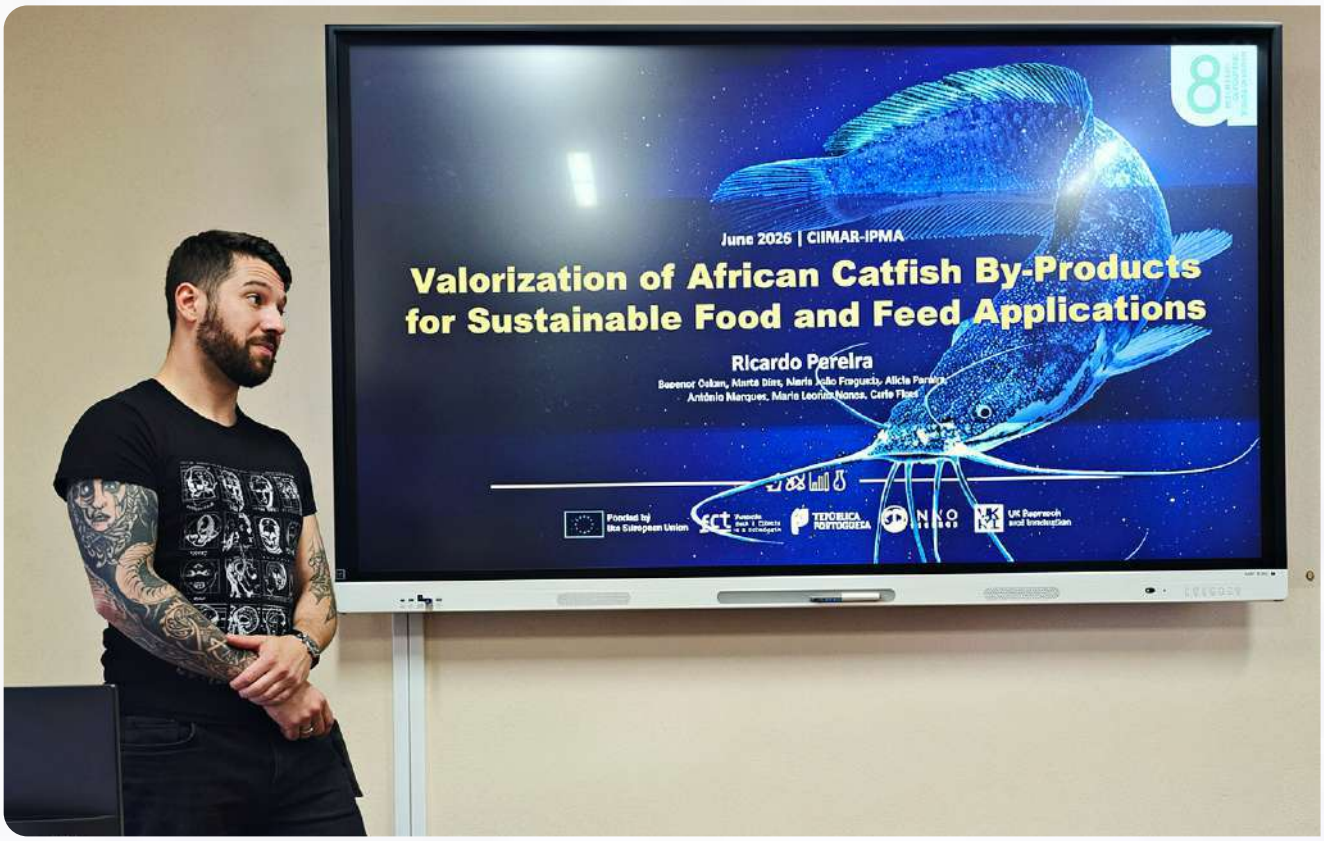
ISEKI-Food Conference 2026, Faro, Portugal

At the 8th International ISEKI-Food Conference 2026 in Faro, Portugal, Ricardo Pereira (CIIMAR) delivered an oral presentation on the `Valorization of African catfish by-products for sustainable food and feed applications', developed under Work Packages 6 and 7 of the INNOECOFOOD Project.

The study explored how by-products from African catfish processing can be transformed into fish silages and protein hydrolysates, creating safe, sustainable, and high-value protein ingredients for animal feeds, food applications, and even organic fertilizers.

The findings demonstrate how circular economy approaches can reduce waste, strengthen food security, and generate new income opportunities for small-scale producers.

As global demand for sustainable protein continues to grow, innovations such as these are helping build resilient and climate-smart agri-food systems across Africa and Europe.



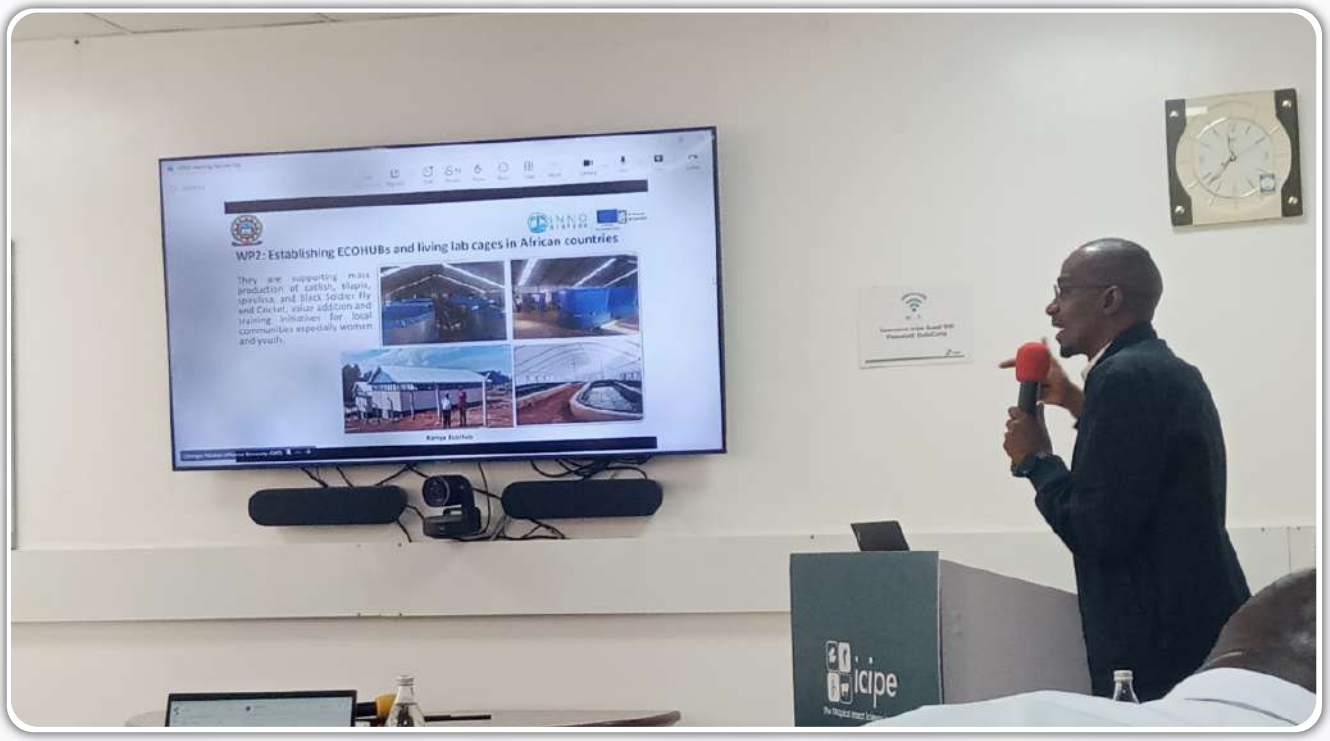
Valorization of African catfish by-products for sustainable food and feed applications at the ISEKI-Food Conference 2026

HealthyDiets4Africa Project Mid-Term Workshop, Kenya

On 24th March, the INNOECOFOOD Project participated in the European Union -funded project, HealthyDiets4Africa Project Mid-Term Workshop held at *icipe* in Nairobi, Kenya. Dr. John Kinyuru from JKUAT represented the INNOECOFOOD Project, sharing insights into our mission to strengthen aquaculture systems and improve livelihoods through the establishment of ECOHUBS.

He highlighted the ongoing work within the ECOHUBS and Living Labs, outlining key roles, milestones, and progress across different work packages. He showcased innovative technologies being implemented, including Recirculating Aquaculture Systems (RAS and In-Pond Raceway Systems (IPRS, which are designed to reduce water usage while improving the efficiency of tilapia and catfish production.

In addition, the presentation covered the integration of AI and IoT technologies within the Living Labs is enhancing real-time fish monitoring and how the project is expanding access to knowledge through a Community Virtual Hub platform, offering self-paced learning on fish, insect, and spirulina production, processing, and marketing. We extend our sincere gratitude to HealthyDiets4Africa project for providing a platform to share our work and exchange ideas.



Dr. John Kinyuru representing INNOECOFOOD at the HealthyDiets4Africa Midterm Workshop, Nairobi, Kenya.

24-Month Consortium Meeting in Ghana

The INNOECOFOOD consortium's 24-Month Coordination Meeting, held hybrid in Accra, Ghana from 12-14 January 2026 and hosted by CSIR-FRI Ghana, marked significant advancements in eco-innovative agroecological food production across Africa. Partners from Africa and Europe reviewed progress across nine Work Packages, highlighting ECOHUB construction nearing completion in Kenya, Ghana, Tanzania, and Egypt; distribution of spirulina inoculums for early production; optimized insect rearing and sustainable harvesting; flagship product development; rigorous quality validation via Food Technical Sheets; capacity-building through Training of Trainers; and ethics compliance with animal welfare training. A key decision was the near-unanimous vote (16-1) for a project extension to finalize infrastructure, research, and training, ensuring sustainable nutrition and market pathways for spirulina, insects, and aquaculture products.

During the meeting, the team visited the Akosombo ECOHUB and Living Lab near Volta River, witnessing a closed-loop system in action: tilapia and catfish ponds with optimized feeds, emerging insectaries for crickets and Black Soldier Flies converting waste to protein, spirulina raceways blending local resources with science, and solar drying/extrusion processing to minimize waste. Interactions with local Ghanaian technicians underscored co-created innovation, skill development, and community benefits, transforming abstract concepts into tangible circular economies. This site fuels future phases, positioning ECOHUBs as catalysts for resilient food systems and entrepreneurship in Africa.



INNOECOFOOD at the ECOHUB in Akosombo, Ghana during the 24-month consortium meeting, 12th January 2026









Pictoirial of INNOECOFOOD team at the 24-month consortium meeting in Accra, Ghana

Updates from Work Packages

Work package 1: project management

During the first semester of the third year of the INNOECOFOOD project, the consortium continued to achieve important progresses towards the project's goals, strengthening our commitment to the deployment of ECOHUBs as a sustainable and innovative approach for Africa's agri-food sector. Some delays have occurred, mainly due to slower-than-expected construction works, procurement procedures, and administrative processes at some partner institutions. Despite these challenges, the partners have worked proactively to identify alternative solutions and minimize the impact on the overall project progress. The project has been extended by six months to allow enough time to complete the construction and operation of the ECOHUBs. This extension will help ensure that all planned activities and project objectives can be successfully achieved. The next project events are currently being planned, including the 36-Month Consortium Meeting in Tanzania in November 2026 and the Final Consortium Meeting and Conference in Egypt in May 2027. During this reporting period, close communication between the project partners has been maintained. Regular meetings and continuous exchanges have supported effective coordination and timely decision-making.

Significant findings, events, workshops, conferences, or dissemination activities:

WP1: Three deliverables were successfully submitted during this period, reflecting the implementation of different project activities. In particular, Deliverables D1.5, D1.11, and D2.3 were completed by CIIMAR and ICIPE, demonstrating the progress achieved in their respective tasks and contributions to the project objectives.

WP8: The results of the INNOECOFOOD project were presented as a poster and an oral presentation at the IZEKI-Food Conference in June 2026, Faro, Portugal. The prototypes of insect flour cookies and energy bars enriched with fish protein hydrolysates, developed under the scope of the project, were presented during Feira Viva 2026, an event organized to celebrate World Food Safety Day by the Faculty of Veterinary Medicine.



INNOECOFOOD Project Coordinator António Marques giving his remarks at the Ghanian ECOHUB at Akosombo during the 24-month Consortium meeting when the partners visited the facility on 12th January 2026.

Work package 2: establishing ECOHUBs and living lab cages in African countries

The establishment of four sustainable agribusiness ECOHUBS in Kenya, Egypt, Ghana, and Tanzania represents a cornerstone of the INNOECOFOOD project. At Month 30, significant progress has been achieved across all sites, with most ECOHUBS nearing operational readiness.

Kenya ECOHUB (led KMFRI, Icipe & JKUAT) is approximately 95% complete, with the main facility's class, reception, and processing areas already handed over. The Recirculating Aquaculture System (RAS) equipment is installed and operational, with several tanks already stocked for fish production. Spirulina production ponds and the greenhouse structure are complete, though production has yet to commence. The facility is connected to the national three-phase power grid, and AI and IoT sensors are already installed in the fish tanks. Insect production of crickets and Black Soldier Fly is ongoing, with communities being trained in handling and feeding.



The Kenyan ECOHUB operational at Lunjre village, Siaya County, Kenya.

Egypt ECOHUB (CLAR) is also approaching 95% completion. The fish processing building structure and electrical installations are finalized, with windows and doors currently being fabricated. The In-Pond Raceway System (IPRS) has advanced significantly, with containment screens and white-water units fully installed, and aerators being tested before fish transfer. The Spirulina production unit is in place at 80% completion, pending renovation works. IPRS completion was slowed by prolonged bottom water drying. The processing building is expected to be completed by mid July 2026, after which efforts will shift to finalizing the Spirulina production lab.



The Egypt ECOHUB at Abbassa, Egypt.

Ghana ECOHUB (CSIR-FRI)ands at about 90% completion, with insect production, processing, and washroom buildings in their final finishing stages. The RAS and hatchery areas are being refined to ensure full suitability. All construction work is expected to be completed by the end of July 2026, with production activities commencing in August.



The Ghana ECOHUB ready for windows and doors installation at Abbassa, Ghana.

Tanzania ECOHUB (TAFIRI) is approximately 90% complete. The fish and Spirulina processing buildings are 90% and 85% complete, respectively, while insect production areas, classrooms, and feed stores are at 80% completion. IPRS pond

excavation is 90% done, pending installation of the IPRS cells. Challenges include rising underground water in the excavated IPRS pond that delayed work. The team is fast-tracking painting, window fixing, test pumping,



The Tanazanian ECOHUB at Magu, Mwanza Region, Tanzania. Finishing is ongoing.

Work package 3: ECOHUBs eco-farmed fish, feed and post-harvest technologies and living lab cages

In the area of fish production, the project has made strong headway across all partner countries. In Egypt, the In-Pond Raceway System (IPRS) construction is now 100% complete, with aeration systems being installed and units ready to receive tilapia fingerlings once final equipment is fixed. In Ghana, the main fish hatchery and grow-out structure are fully completed, though RAS installation awaits resolution of water treatment challenges. Kenya's RAS building is now fully roofed and operational, with tanks installed. In Tanzania, IPRS pond excavation is complete and construction anticipated to be completed by the end of July 2026.

On the feed front, experimental diets incorporating Spirulina and Black Soldier Fly (BSF) as fishmeal replacements have yielded highly promising results. Five experimental diets were tested, and findings show no differences in



Dr. Mary Opiyo leading the trial on experimental diets incorporating Spirulina and Black Soldier Fly (BSF) as fishmeal replacements at KMFRI.

growth performance, body composition, or nutrient digestibility compared to conventional feed. Notably, BSF diets enhanced fillet stability and shelf life by reducing lipid peroxidation and boosting antioxidant capacity. Under normal conditions, Spirulina diets improved metabolism and immunity, while under cold stress, BSF diets better supported immune function. A separate 126-day trial with African catfish at KMFRI confirmed that BSFL meal is a viable replacement for fishmeal, with no significant haematological differences observed among treatments.

Read more **here**.

In post-harvest handling and processing, all hubs now feature functional fish processing areas with value-addition zones, changing rooms, and essential installations such as drainage, storage coolers, and gutting benches. The multipurpose dryers (MPDs) are advancing well: Ghana's MPD has completed test runs in Germany and components are already delivered, while Kenya's MPD test runs are ongoing, adapted specifically for spirulina drying. Additionally, flake ice machines powered by photovoltaic (PV modules are being designed, with an alternative hybrid grid-support concept also being explored.

Finally, the Living Lab aquaculture cages have been successfully established across multiple sites. In Ghana, six cages are complete and mounted on Lake Volta, awaiting IoT installation. and fish stocking. In Uganda, cages at Lake Victoria are already operational, with water quality confirmed suitable and the first harvest completed in December 2025. Namibia has installed a Wi-Fi aquaponics kit with multi-parameter sensors, now providing environmental data through the IoT system. Tanzania has identified its Living Lab site in Magu, with installation planned for March–April 2026 and monitoring to follow March–April 2026. Although operations faced delays all Living Labs are expected to be fully operational within the next few months.

Work package 4: optimization of production of selected spirulina species and processing

Key Milestone 1: Molecular Characterization and Genomic Analysis of Newly Isolated Spirulina Strains

Building on the extensive fieldwork and sampling activities previously conducted within the INNOECOFOOD project, significant progress has been achieved in the characterization of locally isolated Spirulina strains from African alkaline aquatic ecosystems.

During the earlier fieldwork, water samples were collected from diverse natural and production environments across Kenya, Tanzania, Ghana, and Egypt. Sampling sites included Lakes Simbi, Nakuru, Oloiden, Elementaita, and Bogoria in Kenya; Lakes Manyara, Natron, Small Momella, and Big Momella in Tanzania; Lake Volta in Ghana; and Lake Elhamra in Egypt. In parallel with biological sampling, the physicochemical characteristics of the sampling environments were comprehensively assessed to provide information on the ecological conditions associated with naturally occurring cyanobacterial populations.

Following sampling, cyanobacterial strains presumed to belong to Spirulina-related taxa were successfully isolated and purified. The isolates were phenotypically characterized using light and confocal microscopy and subsequently established as stable monocultures under controlled laboratory conditions.

Major Achievement

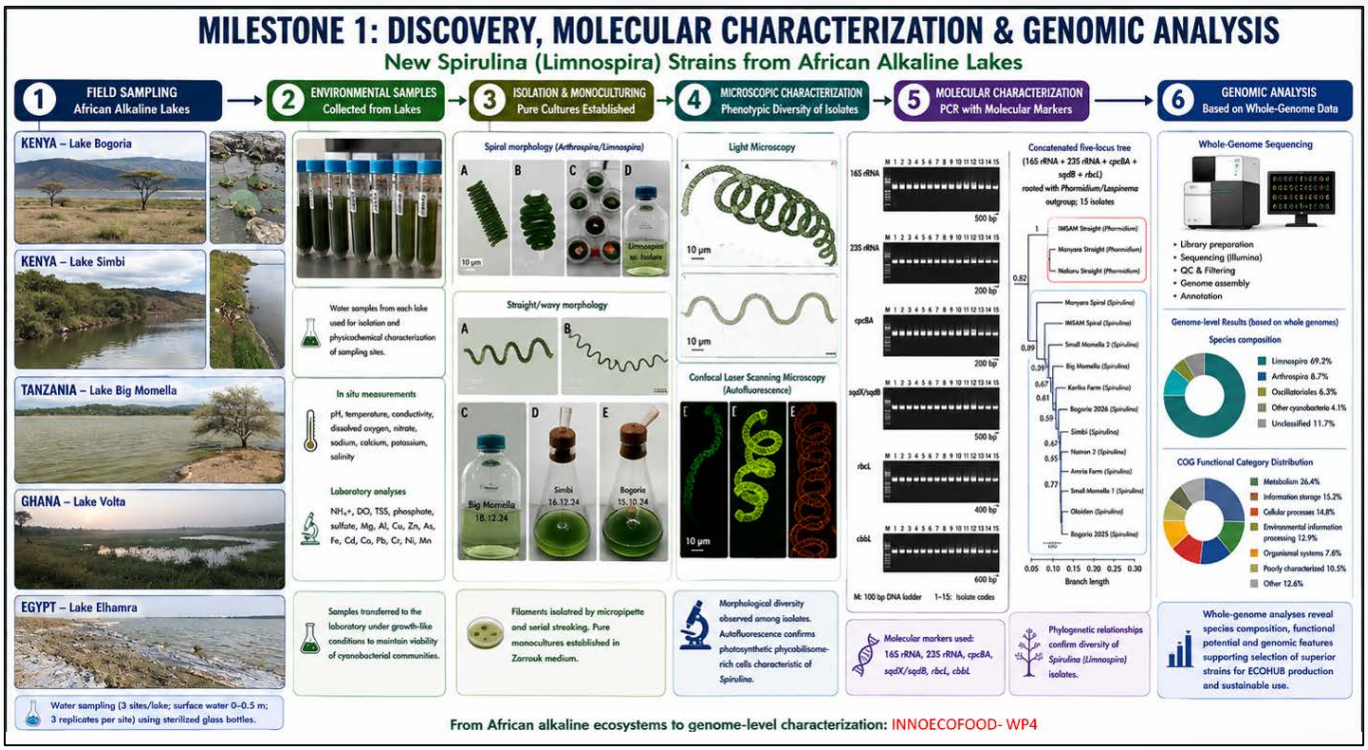
An important milestone was reached with the completion of the molecular characterization of newly isolated Spirulina strains originating from local alkaline lakes in Kenya and Tanzania. Molecular data were used to determine the taxonomic relationships among the isolates and to construct a phylogenetic tree, providing a stronger scientific basis for their identification and comparison with related cyanobacterial taxa.

Following successful molecular characterization, the project has now advanced to whole-genome sequencing of the cultivated monocultured strains isolated from Kenya and Tanzania. This represents a major transition from phenotypic and marker-based characterization toward comprehensive genomic characterization of the newly obtained African isolates.

Whole-genome information will enable a more detailed assessment of the genetic diversity and biological potential of these locally adapted strains and will provide an important foundation for identifying promising strains for future sustainable Spirulina production and application within the INNOECOFOOD framework.

Overall, these achievements establish a valuable progression from field sampling and environmental characterization to strain isolation, laboratory cultivation, molecular identification, phylogenetic analysis, and whole-genome characterization, strengthening the scientific basis for the selection and future utilization of locally adapted Spirulina resources.

INNOECOFOOD WP4 conducted systematic water sampling and environmental characterization across alkaline aquatic ecosystems in Kenya, Tanzania, Ghana, and Egypt. Cyanobacterial strains obtained from these samples were isolated, purified, established as monocultures, and phenotypically characterized using light and confocal laser scanning microscopy. Molecular characterization using multiple genetic markers was followed by marker-based phylogenetic analysis to establish the taxonomic relationships among the isolates. The newly isolated strains from Kenya and Tanzania are subsequently being subjected to whole-genome sequencing and genome-level characterization. Integration of environmental, phenotypic, molecular, genomic, cultivation, and biochemical information provides the scientific basis for selecting promising locally adapted Spirulina strains for future large-scale production within the INNOECOFOOD ECOHUBs.



From African alkaline lakes to genomic characterization of new Spirulina strains. Credit: BMAEU

Key Milestone 2: Development of an Optimized Phycocyanin Extraction Method for Spirulina Biomass

Another major achievement is the systematic evaluation and optimization of phycocyanin extraction from Spirulina biomass, with particular emphasis on extraction efficiency, reproducibility, cost-effectiveness, optimization potential, and practical applicability.

Phycocyanin is the predominant blue pigment–protein complex found in Spirulina and represents one of its most commercially valuable

bioproducts. Owing to its intense natural blue color and bioactive properties, phycocyanin has attracted considerable interest as a natural food colorant and functional ingredient. It also has potential applications in pharmaceutical, biomedical, and cosmetic products, making efficient recovery of phycocyanin an important component of Spirulina biomass valorization.

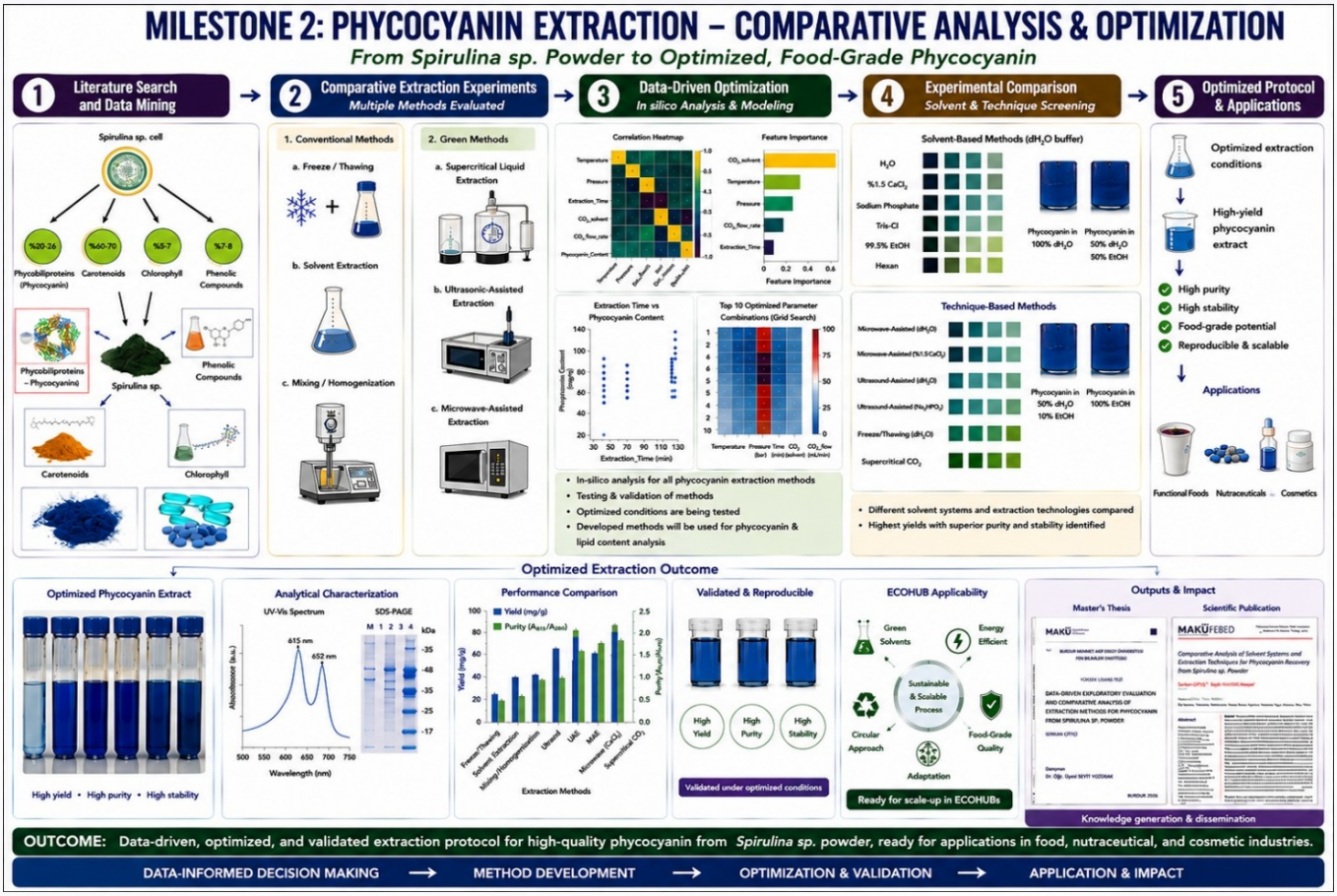
Although numerous conventional and green extraction approaches have been reported for recovering phycocyanin from Spirulina, differences in extraction conditions and incomplete reporting of experimental parameters can limit their reproducibility and practical transferability. To address this challenge, reported phycocyanin extraction approaches were systematically examined using a data-driven exploratory analysis. The individual extraction parameters associated with each method were comparatively evaluated to determine their contribution to phycocyanin recovery. The effects of specific parameter values on extraction performance were investigated, and optimal conditions associated with improved phycocyanin recovery were identified and comparatively characterized.

From Research to Practical ECOHUB Application

Based on these analyses and subsequent experimental work, an optimized, food-grade, reproducible, cost-effective, and practically applicable phycocyanin extraction approach was developed.

This achievement has direct relevance to the INNOECOFOOD ECOHUB concept. The optimized procedure is designed to provide African project partners with an accessible approach for recovering a high-value natural pigment from locally produced Spirulina biomass in ECOHUB centers. Its application can therefore contribute to the value addition and downstream processing of Spirulina biomass, extending production beyond biomass cultivation toward the development of higher-value ingredients and products.

This work also generated important academic and dissemination outputs. The research formed the basis of a Master's thesis and resulted in a scientific publication, demonstrating the integration of research, postgraduate education,



Development and optimization of a practical phycocyanin extraction approach from Spirulina biomass. Created by BMAEU

knowledge generation, and dissemination within the project.

Overall, this milestone represents an important progression from scientific evaluation and process optimization to a method with potential for practical implementation in the INNOECOFOOD ECOHUBs, supporting the sustainable utilization and valorization of Spirulina biomass.

Key Milestone 3: Biochemical Characterization and Selection of Promising Spirulina Strains for ECOHUB Production

A further major milestone was achieved through the comprehensive biochemical characterization of the newly isolated Spirulina strains, providing essential information for the selection of suitable strains for future large-scale production within the INNOECOFOOD ECOHUBs.

The biochemical composition of the cultivated isolates was systematically investigated, including total protein content, peptide profiles, phycocyanin content and purity, total lipid content, and fatty acid profiles. These analyses provided a detailed assessment of the nutritional and value-added biochemical characteristics of each strain and enabled direct comparison among the newly obtained isolates.

Importantly, strain selection was not based on a single characteristic. Instead, biochemical performance was evaluated together with microscopic and phenotypic characteristics, molecular and genomic identification, and cultivation performance under controlled conditions. This integrated approach provided a scientifically robust basis for identifying the most promising Spirulina strain(s) for subsequent scale-up and production.

From Strain Discovery to ECOHUB Production

By integrating genomic identity, biochemical composition, phenotypic characteristics, and cultivation performance, we have established a comprehensive framework for selecting locally sourced Spirulina strains with strong potential for larger-scale cultivation.

The selected strain(s) will provide biological material for the next stages of the INNOECOFOOD production chain, supporting the transition from laboratory-scale research toward larger-scale Spirulina biomass production and value-added processing within the ECOHUB centers.

This represents an important step toward one of the central objectives of the project: transforming locally available biological resources into scientifically characterized and practically applicable resources for sustainable food and bioproduct production.

The comprehensive dataset generated through this work—including microscopic, phenotypic, molecular/genomic, cultivation, and biochemical information—is also being prepared for scientific dissemination. The resulting publication(s) will constitute an important scientific output of the INNOECOFOOD project and will document the characterization and selection process for the newly isolated African Spirulina strains.

Key Milestone 4: International Spirulina Training Program Builds Capacity for INNOECOFOOD ECOHUBs

Preparing Local Experts Before Production Begins

As the INNOECOFOOD project advances toward the establishment and operation of innovative ECOHUB centers in Africa, an equally important milestone has been achieved: building the local technical capacity required to operate future Spirulina production and processing facilities.

To support this objective, Burdur Mehmet Akif Ersoy University (BMAEU), as leading partner of Work Package 4 (WP4), launched an international online training program on Spirulina biology, isolation, cultivation, large-scale production, downstream processing, and commercialization for experts from Kenya, Ghana, Tanzania, and Egypt.

The program is coordinated and delivered by Dr. Seyit Yuzuak, WP4 Leader, together with Dr. Murat Telli, Task Leader, within the Horizon Europe INNOECOFOOD project. The initiative represents

an important knowledge-transfer and capacity-building activity designed to ensure that scientific and technological developments generated within INNOECOFOOD can be effectively transferred to the African partner countries.

A central feature of the initiative is its train-the-trainer approach. Experts participating in the program are being equipped not only with scientific and technical knowledge but also with the expertise needed to support future Spirulina production within the ECOHUBs and subsequently transfer this knowledge to local technicians, students, young professionals, entrepreneurs, and surrounding communities.

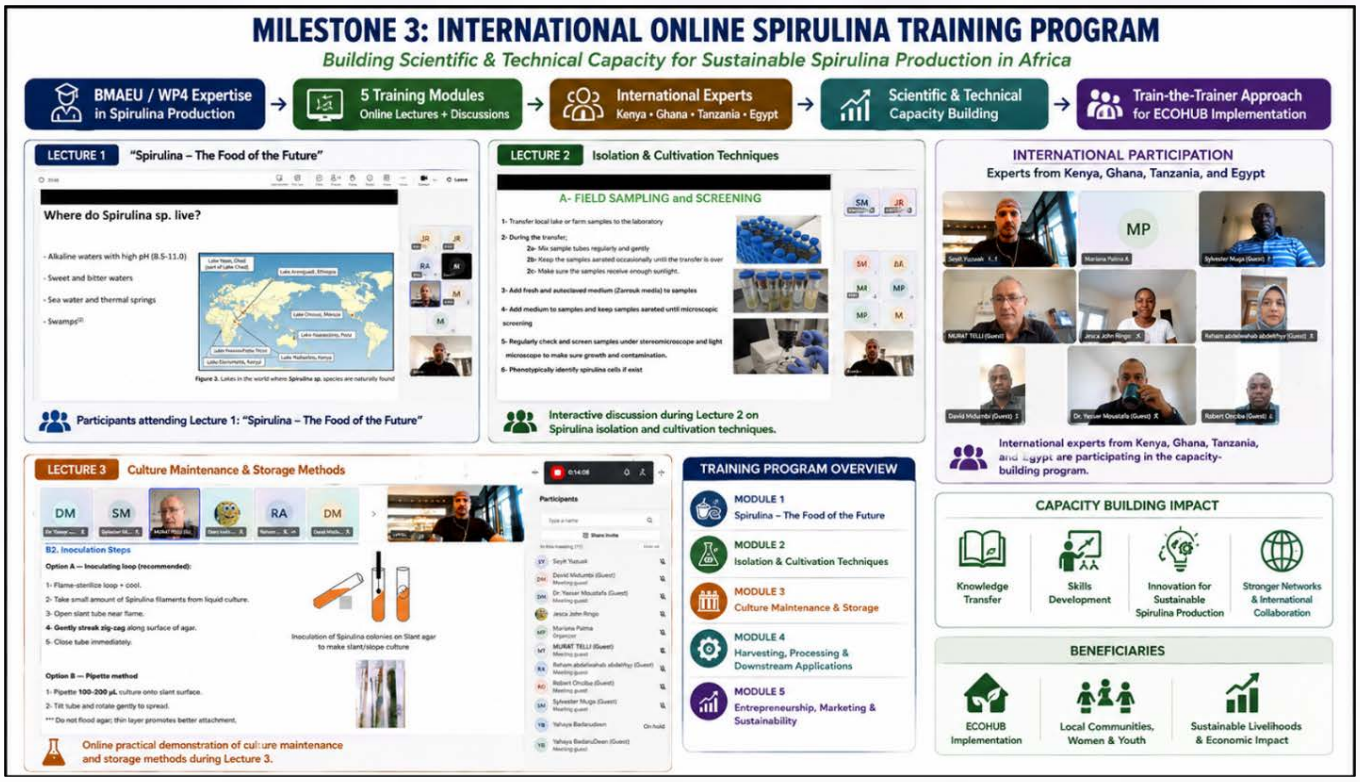
By initiating training before the Spirulina production facilities become operational, INNOECOFOOD is helping to establish the human and technical foundations required for sustainable implementation and long-term continuity of ECOHUB activities.

From Spirulina Biology to Commercial Application

The online training program consists of five comprehensive modules covering the complete Spirulina value chain, from biological resources and cultivation to downstream processing and commercial utilization:

- Spirulina – The Food of the Future
- Isolation and Cultivation
- Maintenance and Culture Preservation
- Large-Scale Production and Downstream Processing
- Post-processing, Marketing and Commercial Applications

Through these modules, participants develop knowledge and skills covering Spirulina biology, environmental sampling, strain isolation, laboratory cultivation, culture preservation, scale-up strategies, biomass harvesting and processing, value-added products, and potential market applications.



Building scientific and technical capacity for sustainable Spirulina production in INNOECOFOOD ECOHUBs. Created by BMAEU.

Experts from Kenya, Ghana, Tanzania, and Egypt are participating in the program, strengthening cross-country knowledge exchange and scientific collaboration among INNOECOFOOD partners.
Following completion of the initial training modules, participants have established a strong foundation in Spirulina biology, sampling and isolation techniques, cultivation strategies, and culture maintenance. Interactive online sessions and practical discussions have also provided opportunities to exchange experiences and address challenges relevant to future ECOHUB implementation.

Building Sustainable Local Capacity
The training program provides an important bridge between the scientific achievements of INNOECOFOOD and their practical implementation in Africa. By preparing local experts in advance of ECOHUB production activities, the project is creating a foundation for effective technology transfer, sustainable local operation, and multiplication of knowledge through subsequent hands-on and community-level training.

The trained experts are expected to play an important role in transferring knowledge to broader beneficiary groups, with particular attention to women and young people, thereby extending the impact of the project beyond the initial group of trainees.

This capacity-building activity therefore represents an essential step toward ensuring that the knowledge, technologies, and production approaches developed through INNOECOFOOD can be sustainably implemented, adapted, and further disseminated within participating African countries.

BMAEU, as leader of WP4, implemented an international online training program to prepare experts from Kenya, Ghana, Tanzania, and Egypt for future Spirulina production activities within the ECOHUB centers. The program covers the complete production chain through five interconnected training modules, including Spirulina biology and its future potential; isolation and cultivation; culture maintenance and preservation; large-scale production and downstream processing; and post-processing, marketing, and commercial applications. Interactive lectures, practical demonstrations, technical discussions, and experience sharing are used to transfer scientific knowledge and operational expertise to participating specialists.

Through a train-the-trainer approach, these experts are expected to support ECOHUB implementation and subsequently transfer acquired knowledge and skills to local technicians, students, entrepreneurs, women, youth, and surrounding communities. The initiative therefore represents an important INNOECOFOOD capacity-building milestone, linking scientific expertise with local skills development, technology transfer, international collaboration, and the long-term sustainability of Spirulina production in participating African countries

Work package 5: optimization of selected insect species production and post-harvest

Capacity Building on Black Soldier Fly (BSF) and Cricket Rearing

At the Kenyan ECOHUB (Ugunja, Kenya)

Ms. Faith Nyamu and Mr. Chrispin Onyango (research officers from icipe Duduvile and Mbita respectively, facilitated practical, hands-on training sessions on Black Soldier Fly (BSF) (see figure below) and cricket rearing for the members of the FOSAPA Community-Based Organization (CBO.

The training was conducted over a five-day period from 16th to 19th June 2026.

The sessions focused on equipping participants with practical knowledge and skills in insect production, including the establishment and management of BSF and cricket rearing systems, routine husbandry practices, and best management practices for sustainable insect farming. The training emphasized experiential learning through practical demonstration.

A total of approximately **60 members** of the FOSAPA CBO successfully participated in the training during the period, thereby strengthening local capacity in sustainable insect production and supporting the adoption of insect-based technologies for improved livelihoods.



Trainees (CBO members) being taken through the BSF production levels. i.e basic layout, waste preparation, insect feeding and sorting of larvae on the trays.



Left-Ms. Faith Nyamu (in White lab coat) and Mr. Chrispin Onyango (Cream lab coat) training some of the CBO members on how to handle crickets. The fig on the right is a demonstration of how to incubate the eggs and how they will appear when pinheads emerge.

The ECOHUB continued to serve as a demonstration and learning centre by attracting visitors from the North Carolina State University who visited the facility to gain knowledge and practical insights into BSF and cricket rearing. During the visits, participants were introduced to key aspects of BSF and cricket production (Guided by Mr. Chrispin Onyango), including rearing systems, husbandry practices, and the potential applications of the two insects' production in sustainable food, feed and livelihood systems. These visits provided an important platform for knowledge exchange, stakeholder engagement, and the dissemination of best practices in insect



North Carolina State University members keenly learning on how cricket eggs are collected and incubated to multiply the colony.

Participants received practical hands-on training on the collection of cricket frass, as well as the feeding and management of juvenile crickets, during the cricket rearing sessions as shown in the figure below. This practical component enhanced the understanding of essential husbandry practices required for effective cricket production.



Trainees learning on how to collect frass from cricket rearing and feeding the young crickets.

Training conducted at the University of Dar es Salaam (UDSM)

A team from the International Centre of Insect Physiology and Ecology (*icipe*), comprising Dr. Tanga, Dr. Cynthia Mudalungu, and Ms. Faith Nyamu, travelled to the University of Dar es Salaam (UDSM, Tanzania, to conduct a cricket rearing training from 24th to 30th June 2026.
The training was designed to build the technical capacity of participants in sustainable cricket production and management. Key areas covered included the fundamental requirements for successful cricket rearing, with emphasis on optimal environmental conditions such as temperature, humidity, ventilation, and housing (Fig. 5. Demonstrations were conducted on the proper arrangement of insect hideouts to enhance cricket welfare, reduce stress and cannibalism, and improve overall productivity within the rearing units.

In addition, the training provided practical instruction on cricket egg collection and incubation techniques to maximize hatchability and ensure healthy colony establishment (Fig. 6. Participants were also trained on appropriate methods for the collection of wild crickets for domestication and breeding purposes.

The training combined both theoretical and hands-on practical sessions, equipping participants with the knowledge and skills required to establish and manage efficient cricket production systems.



Assembly of cricket rearing materials and training on the arrangement of insect hideouts



Fig. 5: Assembly of cricket rearing materials and training on the arrangement of insect hideouts





Fig.6: Incubation of cricket eggs (Left) and a sample of incubated eggs





Fig. 7: Setting up a wild harvesting trap for crickets on UDSM farm

Participants from the UDSM received comprehensive training from the icipe team on sustainable cricket rearing practices. In total, ten (10) UDSM partners were trained, followed by continuous technical backstopping and mentorship to support the effective adoption and implementation of the rearing techniques.



The trainers and a section of trainee team at UDSM

Work package 6: up-cycling waste nutrients from fish by-products, spirulina and insects

Reducing food waste and creating value from what would otherwise be discarded is at the heart of Work Package 6. With up to 40% of fish lost during processing, the INNOECOFOOD team is turning fish by-products, along with spirulina and crickets, into nutritious new food products that support both food security and the circular economy.

Across the project, partners are using innovative drying and extrusion technologies to transform these protein-rich ingredients into a variety of appealing foods. The multipurpose solar dryers being installed in Kenya and Ghana will soon produce high-quality powders for human consumption, while new twin-screw extruders at the University of Namibia and other institutions are already creating puffed snacks and instant porridge mixes. Early trials with pearl millet, sorghum, maize, and cassava combined with spirulina or cricket powder have shown promising results in terms of texture, colour, and consumer appeal.

Product development has been particularly active. In Kenya, researchers have been perfecting biscuits, breads, and porridge containing cricket powder, with sensory evaluations recently completed in schools near the ECOHUB. More than 120 schoolchildren and parents participated in tasting trials, and the products were well received. Recipes have since been refined to improve moisture content, protein levels, and shelf-life. In Ghana, extruded snacks made with cassava flour and fortified with crickets or spirulina have demonstrated interesting puffing properties, while catfish sausages containing cricket and spirulina have scored highly for overall acceptability.

Beyond conventional foods, the team is developing non-conventional value-added products including

fish protein hydrolysates, bioactive peptides, and nutrient-rich powders. Enzymatic hydrolysis of tilapia and catfish by-products has yielded protein hydrolysates with excellent functional properties, including good solubility and emulsification. Fish bones recovered during processing have been analysed for mineral content, with calcium, phosphorus, and zinc among the most abundant nutrients. Importantly, heavy metal levels in all products remain well below regulated safety limits.

In Uganda, nutrient bars and traditional 'baghia' products have been developed using fish, cassava, sweet potato, and maize. Ethical clearance has been obtained for further consumer trials in schools, and initial feedback from exhibitions has been overwhelmingly positive. Meanwhile, work continues on extracting valuable phycocyanin from spirulina and on characterising oils from fish and insects.

Looking ahead, the team is focused on confirming the nutritional, sensory, and shelf-life properties of final products, scaling up production using materials from the ECOHUBS, and selecting appropriate packaging and labelling. With continued collaboration across partners, the products developed under WP6 are set to make a real difference in local communities, offering affordable, nutritious options that also help reduce waste.



Cricket enriched cookies baked by Peche Foods, Kisumu



Nutrient bars made with Fish + spirulina at Makerere University

Work package 7: validation of quality, acceptance, LCA and certification of products

Producing a Manual for the Assessment of Nutritional Value, Quality, Safety, Shelf Life, and Functionality of fish, insects, spirulina, and their products.

A Manual was developed using a systematic, evidence-based approach. The manual compiles scientifically validated and internationally recognised analytical methods to ensure harmonised, reliable, and reproducible assessments across a wide range of biological matrices.

Method selection was based on internationally accepted standards and protocols established by recognised organisations, including AOAC, ISO, CEN, Codex Alimentarius, AOCS, and FDA, where applicable. The development process comprised the definition of the scope and objectives, identification of target users, review of international standards, selection of validated analytical methods, and establishment of a harmonised template for method documentation. The resulting manual provides a standardised reference to support research activities, quality assurance, regulatory compliance, and industrial implementation, thereby facilitating the generation of comparable analytical data and promoting best practices within the INNOECOFOOD project.

Assessing the Quality and Safety of raw materials, foods, feeds, and co-products developed within the INNOECOFOOD Framework

Activities focused on the comprehensive characterization of fish, insects, and spirulina raw materials, derived food products, and their co-products to support their safe and sustainable use as food, feed, and ingredient sources. The work comprised: (i the assessment of nutritional quality, microbial and chemical safety, functional properties, and potential benefits and risks; and (ii the preparation of technical documentation (e.g., technical data sheets to support industrial uptake, exploitation, and implementation by relevant stakeholders.

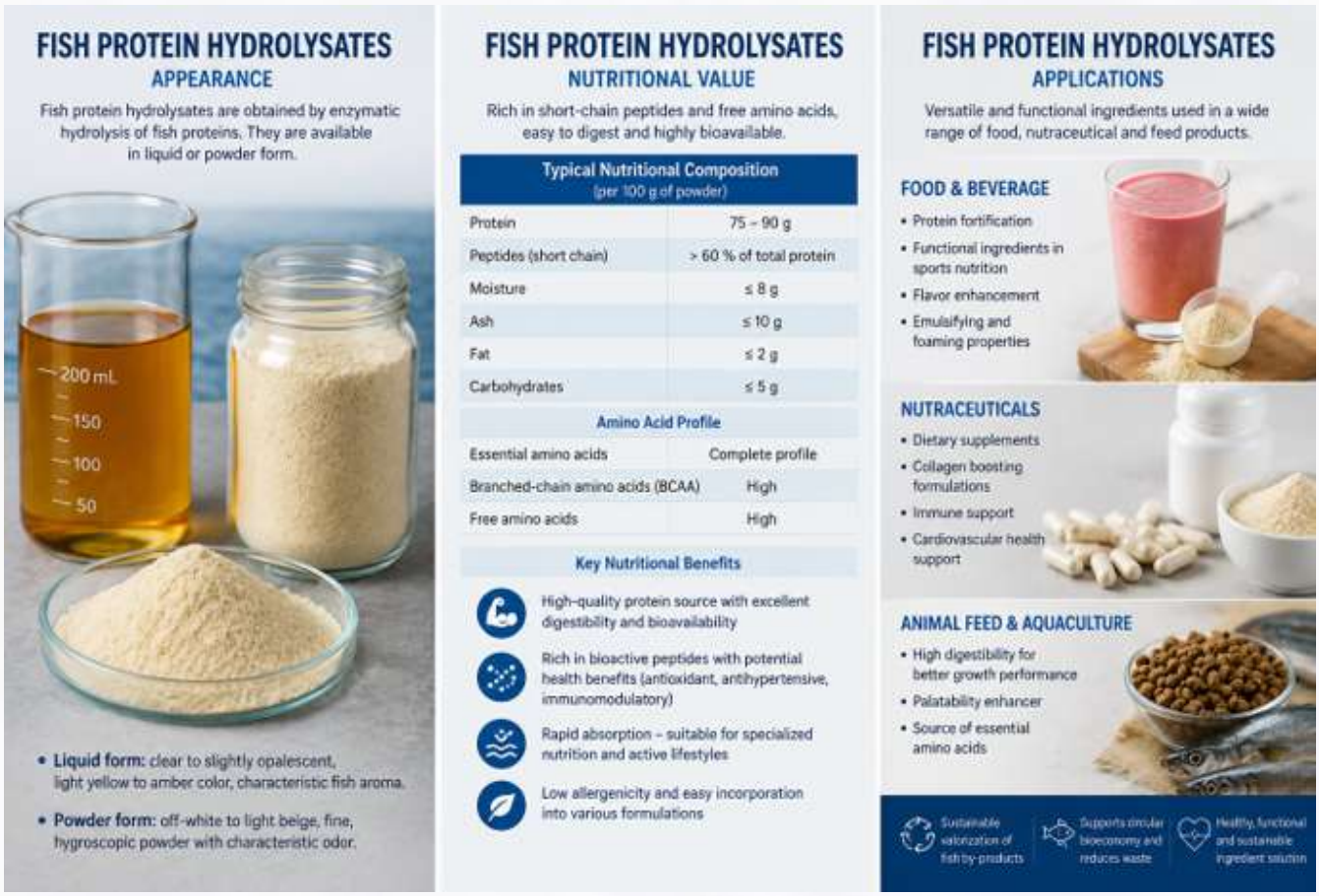
These activities provide a robust scientific basis for the evaluation of innovative bio-based products and contribute to their safe integration into sustainable food and feed value chains within the INNOECOFOOD project.



Manual for Nutritional value, quality, safety, shelf life and functionality of fish, feeds, insects, spirulina and their products



Smoked catfish fillets nutritional characterization. Created by CSIR-FRI



Fish protein hydrolysates appearance, nutritional value and applications

Work package 8: training and dissemination

Ensuring that project results reach the people who need them most is the driving force behind Work Package 8.

The baseline survey work has been completed, with country-specific reports scheduled for publication by the end of July to mid-August. These studies provide a crucial foundation for measuring the project's impact over time.

On the training front, significant progress has been made. Five training modules are currently under development, and 210 Trainers of Trainers (ToTs) have already been mobilised and registered across Egypt, Ghana, Kenya, and Tanzania to be trained both online and in person at the ECOHUB. The Community Virtual Hub e-learning platform is now complete and ready to host training sessions. Visit CVH.Africa to learn more.

Communication and dissemination activities are ongoing. The project website remains live, social media platforms and the INNOECOFOOD YouTube channel are active. Visit for regular updates on the milestones the project has achieved so far. Partners have also continued participation in conferences, exhibitions, and food fairs to showcase project's research outcomes and innovations.

From June 15th to 19th, 2026 work package 8 was involved in the filming of the educational videos at the Kenya ECOHUB at Lunjre Village in Siaya County and Dunga Beach in Kisumu for fish market and Kakamega for the spirulina production at Nasio Trust Farm, which was a success. The task was lead by B2E Blue BioEconomy and FSPN Africa and supported by Kenya partners; KMFRI, icipe and JKUAT. We are looking forward to the final video output for dissemination and educating our communities.



Filming of the education videos for the INNOECOFOOD documenting the production of fish, insects and spirulina and processing of high protein rich foods in Kenya.

Upcoming Events

The folllowing are some of the upcoming events where INNOECOFOOD partners have shown interest or submitted abstracts for dissemination of project results and showcasing innovation:



Source: WEFTA



Source: Pin Your Fooststeps





Transforming Aquaculture for Community Empowerment

For More Information Visit:

Website: innoecofood.eu

Engage us on: