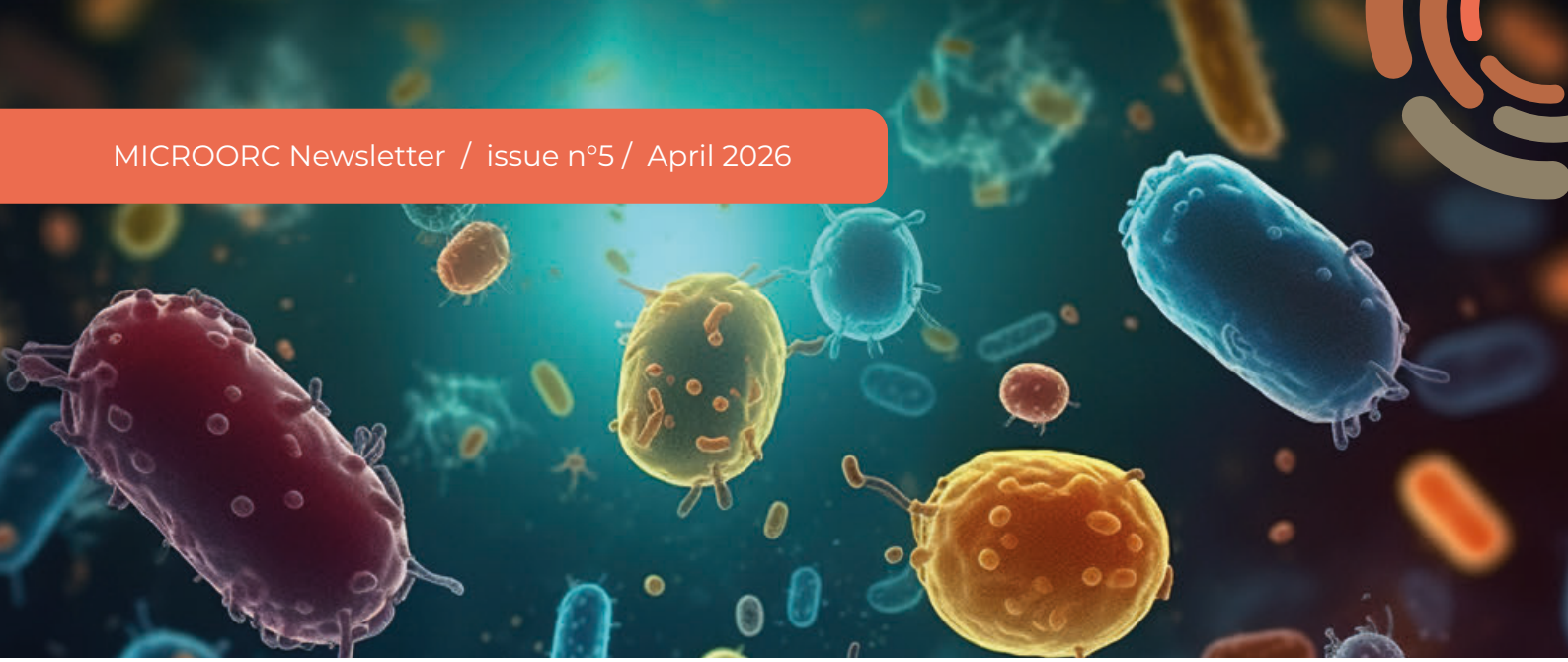

MICROORC

Orchestrating food system microbiomes to minimize food waste

Results of the second year of MICROORC implementation

From smarter shelf-life prediction to microbiome-based protection and sustainable packaging, MICROORC is advancing practical solutions to reduce food waste and improve food quality.

In this newsletter, discover the latest progress across our work - from real-world trials in chicken and salmon to innovative labelling technologies, biosolutions, and system-wide sustainability assessments shaping the future of food systems.

Business solutions for shelf life prediction and labelling

- Food waste is often caused by a mismatch between a product's actual shelf life under real storage conditions and the date shown on the label. To address this, MICROORC is carrying out extensive environmental monitoring and shelf-life studies in chicken and salmon processing environments, now entering the second year of data collection. The aim is to identify reliable data sources and sensing approaches that can support more accurate shelf-life prediction.

- For chicken breast fillets packed in modified atmosphere packaging (MAP), results show that production day and early microbial growth patterns are key factors influencing shelf-life variability. In contrast, initial total bacterial counts appear to be less informative, suggesting that how microbial communities evolve over time is more important than their initial levels.
- For salmon, the research combines repeated sampling of processing environments with controlled storage studies. This allows for a better understanding of batch-to-batch differences in microbial development and how these relate to early-stage microbiota and processing conditions.
- In parallel, smart labelling technologies are being tested under realistic conditions. These include both analogue indicators (such as time-temperature and freshness indicators) and electronic sensor-based labels designed for batch monitoring and integration with predictive models.

In the coming months, efforts will focus on improving shelf-life prediction models by combining microbiological and sensor data, as well as developing rapid methods to detect key spoilage bacteria.

Microbiome-based protection for optimized food quality and safety

Over the past few months, the screening process for biosolutions (fermentates and food cultures) delivering the best performance (sensory, microbiological, etc.) has continued across the three matrices of interest:

- For smoked salmon, one 2- strains cocktail has been selected for the remainder of the project. Current efforts are focused on assessing the potential to reduce salt content (2.25% vs. 3%) and on evaluating the impact of the timing of culture application (pre- or post-smoking/salting steps).
- For chicken, the first trials enabled a reduction in the number of biosolutions under investigation to two cultures and two fermentates (buffered vinegar). In the next month, further studies will be conducted focused on marinated chicken.
- For sliced plant based products, two cultures and three fermentates have been selected. Most demonstrated good efficacy in limiting Listeria monocytogenes growth during shelf life.
- Finally, plant-based burgers (pea- and soy-based) with a simplified label and containing food cultures (potentially combined with buffered vinegar) were produced. Sensory and microbiological data collected so far highlighted the potential to produce high-quality products with a limited number of ingredients, leveraging fermentation processes.

Packaging for sustainable food systems

MICROORC is working to optimize packaging systems by reducing material use and improving recyclability, for example by shifting towards monolayer structures. A key challenge is to achieve these improvements without compromising product shelf life.

Packaging for chicken:

- Promising results show that reducing packaging impact - such as lowering the gas-to-product ratio and using thinner trays - does not affect microbial development. Further work is ongoing to assess the impact on sensory quality.

- Findings also indicate that the composition of the gas mixture plays a more significant role in shelf life than the shift to monolayer packaging.

Packaging for meat analogues:

- Switching to monolayer packaging had little effect on microbial growth or microbiota. However, multilayer packaging performed better in terms of limiting off-odours associated with product degradation.

The next steps will focus on combining these improved packaging approaches with microbiome-based solutions to further enhance shelf life and sustainability.

Consumer acceptance and sustainability

To ensure fair evaluation throughout environmental, economic and social lenses we've developed an evaluation framework that integrates life cycle assessment, cost-benefit analysis and planetary boundaries thinking. It is easy to zoom-in on an intervention and conclude whether it works or not, but the real challenge begins when we zoom-out and try to assess the change in a holistic way. A perfect scenario saving lots of footprints means nothing if consumers don't trust it or if food producers can't build a viable business case around it. Our framework keeps all of this in view. Based on initial LCA results, the biggest hotspot in the chicken and salmon food system models is food waste at retail and consumer levels, making it critical to accurately assess the food waste reduction potential of MICROORC solutions. To avoid

expensive empirical research, we're building a Python-based simulation model, together with work related to business solutions for shelf life prediction and labelling, tracing the food journey from supermarket shelf to consumption. Using carefully selected parameters across printed and dynamic label scenarios, with and without biosolution application, we predict food waste outcomes via Monte Carlo simulation. Next steps include generating the first full model outputs, linking simulated food waste to LCA results, alongside ongoing socioeconomic data collection feeding into the broader assessment framework.

Regulation and policy recommendations

One of the highlights in this work package during the last year is the collaboration with our sister EU-project FoodGuard. We have together discussed and shared information about our results and best practice.

Stakeholder outreach, communication, dissemination and exploitation

Our work on the valorizations of MICROORC's results continues to support the project's communication, dissemination, and exploitation efforts, with a strong focus on stakeholder engagement and the future uptake of results. A key recent milestone was the joint MICROORC-FoodGuard webinar held on the 4th of February 2026, which strengthened collaboration with sister initiatives and engaged a broad stakeholder community. In parallel, outreach activities remain active through regular updates across the project's digital channels, alongside the development of new materials, to further communicate project results. On the exploitation side, partners are progressing in the consolidation of key exploitable results and contributing to tools that will support their future valorization, paving the way for dedicated exploitation workshops. In the coming months, WP7 will intensify its activities through the organization of thematic webinars, such as the upcoming "Smart Labels Webinar" to be held on the 21st of May, as well as further collaboration with related European initiatives and continued dialogue on consumer and policy aspects. These efforts will contribute to strengthening the project's visibility, stakeholder engagement, and long-term impact.

Policy dialogue

MICROORC contributed a short statement to the EU consultation on plastic waste, reinforcing its commitment to sustainable and recyclable packaging solutions. This action supports broader policy engagement and alignment with EU regulatory developments. The consortium emphasized both the importance of harmonized rules and the need to keep future innovation pathways open.

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PROJECT COORDINATOR
Solveig Langsrud, NOFIMA
solveig.langsrud@nofima.no

PROJECT MANAGER
Anne Risbråthe, NOFIMA
anne.risbraathe@nofima.no

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