

## **Umami Bioworks Unveils the World's First Virtual Marine Cell to Transform Aquaculture and Marine Bioactive Discovery and Build the First Computational Engine for Aquatic Biology**

Tokyo, 2 December 2025 — Umami Bioworks today announced the launch of the world's first Virtual Marine Cell, a constraint-based metabolic model powered by artificial intelligence and machine learning that simulates the internal biology of aquatic species with unprecedented precision. The company positions this technology as a new digital backbone for Japan's blue economy, enabling faster R&D, stronger predictive capabilities, and sharply reduced wet-lab experimentation across aquaculture, cultivated seafood, and marine bioactives.

The Virtual Marine Cell represents a shift from observation to prediction. Using species-specific datasets from tuna, salmon, yellowtail, eel, mackerel, and red seabream—species central to Japan's domestic production, exports, and regional food culture—the platform models how real marine cells grow, respond to nutrients, react to stress, produce key compounds, and transport them outside the cell. By learning directly from biological and environmental data, the system compresses multi-year development cycles into rapid, computation-driven insights.

Japan's aquaculture sector is confronting structural challenges. Warming coastal waters, recurring disease events, fry shortages, feed-price volatility, and unstable yields are affecting producers nationwide. These pressures sit alongside long-term decline: average production prices have risen over 40% in the past decade, total capture volume has dropped 67% from its historical peak, and more than half of fish species around Japan are categorized as low-resource. Many of these issues originate at the cellular level, where growth variability, immune response, metabolic efficiency, and stress tolerance have been difficult to measure or predict. The Virtual Marine Cell allows Japanese researchers and producers to model these dynamics directly, enabling more resilient stock, improved survival, tighter control over fat composition and nutritional quality, and reduced biological risk across major species.

The platform also advances Japan's leadership in marine-derived functional ingredients. Marine lipids, peptides, enzymes, and bioactives underpin significant domestic industries in skincare, nutrition, pharmaceuticals, and wellness, yet discovery has traditionally required long and costly experimentation. The Virtual Marine Cell enables rapid in-silico assessment of metabolic pathways and secretion profiles, allowing teams to identify high-value compounds within days and optimize their production through metabolic engineering without genetic modification.

"Marine biology has never had a computational engine like this. The Virtual Marine Cell cuts through biological uncertainty and allows the industry to operate at software speed rather than biology speed," said Nina Honda/Strasky, Product & Strategy Manager at Umami Bioworks.

Umami Bioworks has built a strong and growing innovation pipeline in Japan, working closely with leading domestic seafood, aquaculture, biotech, and consumer-goods companies. These collaborations apply the Virtual Marine Cell to real-world challenges in productivity, environmental resilience, breeding optimization, and bioactive discovery. The company's deep engagement with Japanese partners positions the technology as an enabler of next-generation competitiveness for the nation's blue economy. Umami Bioworks is in advanced stages of establishing its AI Innovation center in Tokyo in the coming months and plans to deepen its collaboration in Japan.

By strengthening the biological performance of key species and providing a predictive infrastructure for future climate and supply challenges, the Virtual Marine Cell supports Japan's long-term food security and signals the arrival of a new era of AI powered aquaculture innovation.

#### About Umami Bioworks

Umami Bioworks is a global aquatech innovator using AI-powered tools and cultivated-seafood technologies to accelerate sustainable growth across the marine economy. Its Japanese investors include Maruha Nichiro, Tokyo Seikan, and Untrod, alongside global blue-economy investors such as Aqua-Spark and Hatch.