

# Advancing the Gangwon Food-Tech Industry: Standardization of a Native *Rosa rugosa* Functional Ingredient and Development of a Low-Salinity Freshwater RAS for Salmon

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## Introduction

■ We present two case studies designed to advance the Gangwon food-tech industry.

■ **Case 1 — Native functional ingredient.** A standardized natural ingredient was developed from the Korean East Sea coastal species *Rosa rugosa* to support liver health. Stage-specific analyses of flower-bud extracts were used to quantify yields and marker compounds, enabling raw-material specifications and consistent quality. Multi-functional benefits were verified, including improvements in serum triglycerides and liver-function biomarkers.

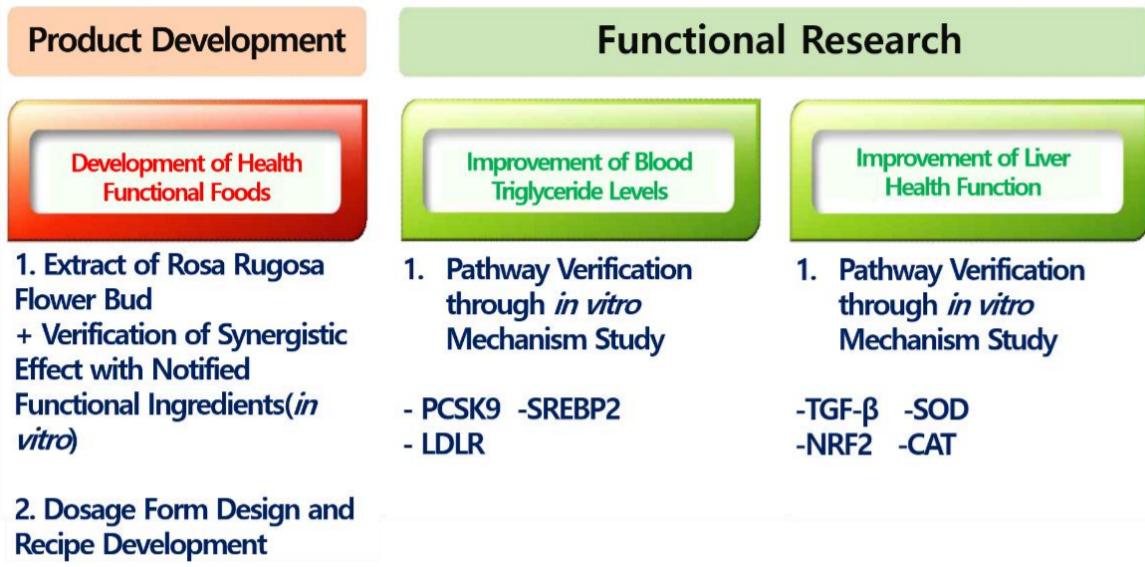


Fig. 1. R&D workflow and key steps.



Fig. 2. System design and expected impacts.

■ **Case 2 — Low-salinity salmon RAS.** A low-salinity recirculating aquaculture system(RAS) for Atlantic salmon was established in a naturally ventilated plastic-film greenhouse in Yangyang, Gangwon Province. Together, these outcomes promote public health, secure sustainable protein resources, and create high value for Gangwon's regional agrifisheries sector.

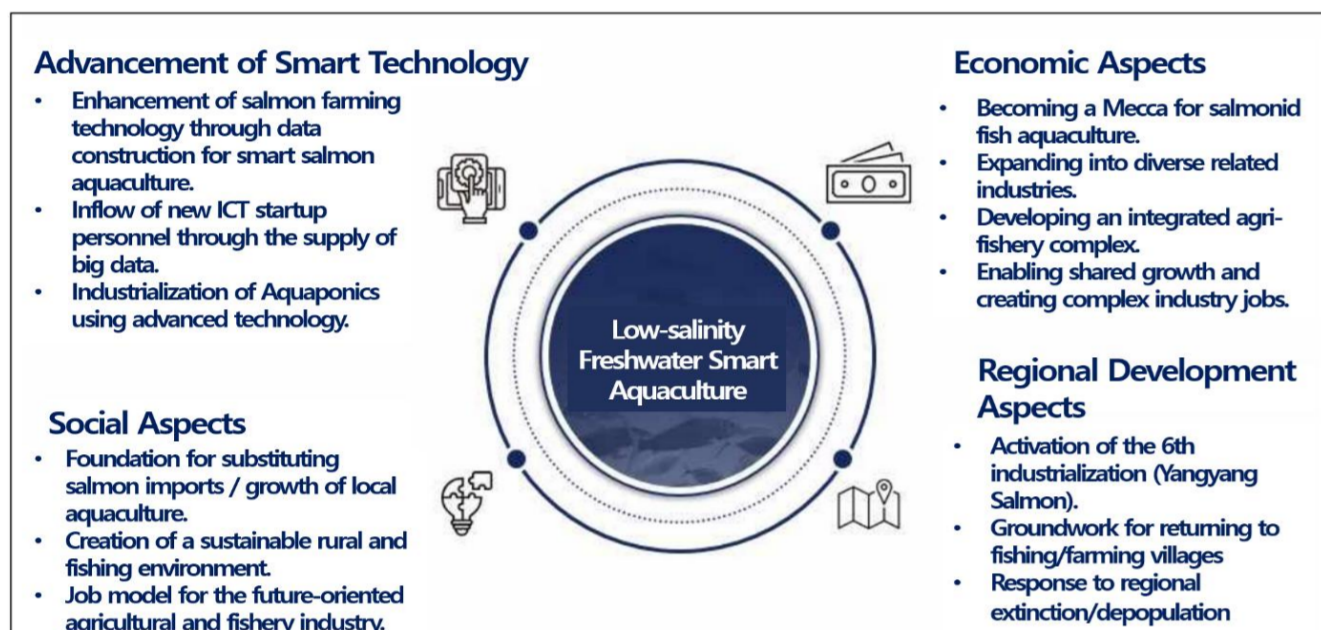


Fig. 3. Pursuit of R&D as a Strategic Alternative.

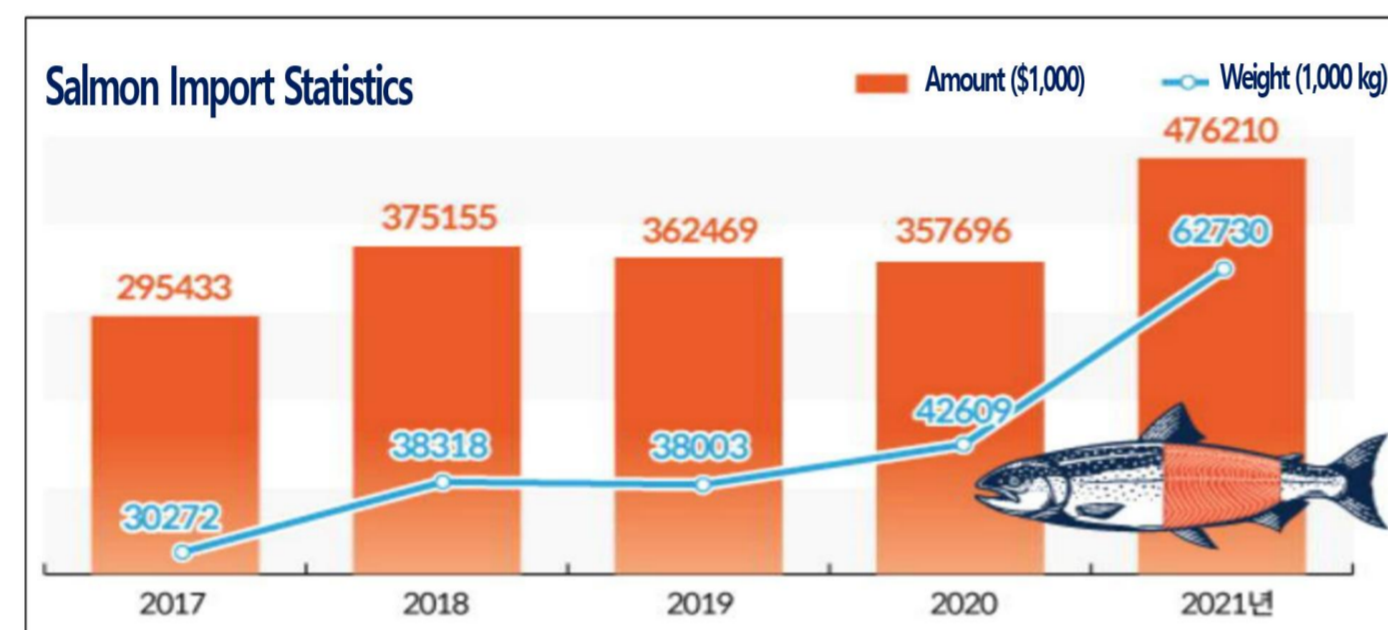


Fig. 4. Trends in salmon imports and market context.

## Research Method

■ **Project purpose:** Rapid support for R&D projects that address regional science and technology needs.

■ **Support areas:** Gangwon's core industries (bio-healthcare, semiconductors, future mobility, clean energy, food tech, defense industry, climate tech., etc.).

■ **Support scale:** Approximately 10 projects; total budget of KRW 746 million; per project KRW 60–80 million.

■ **Project period:** April–November (8 months).

■ **Eligibility:** Research performers based in Gangwon.

■ **Project procedure**



## Results and Discussion

### Native Functional Ingredient (*Rosa rugosa*)

■ Stage-specific analyses of *Rosa rugosa* flower-bud extracts enabled raw-material standardization by quantifying extraction yield and marker compounds across harvest stages. This established reproducible specifications suitable for scale-up and regulatory documentation.

■ In hepatocyte assays, the standardized extract improved liver-health-related biomarkers and reduced intracellular triglyceride accumulation relative to vehicle control. These effects were consistent across replicate experiments and were supported by complementary readouts.

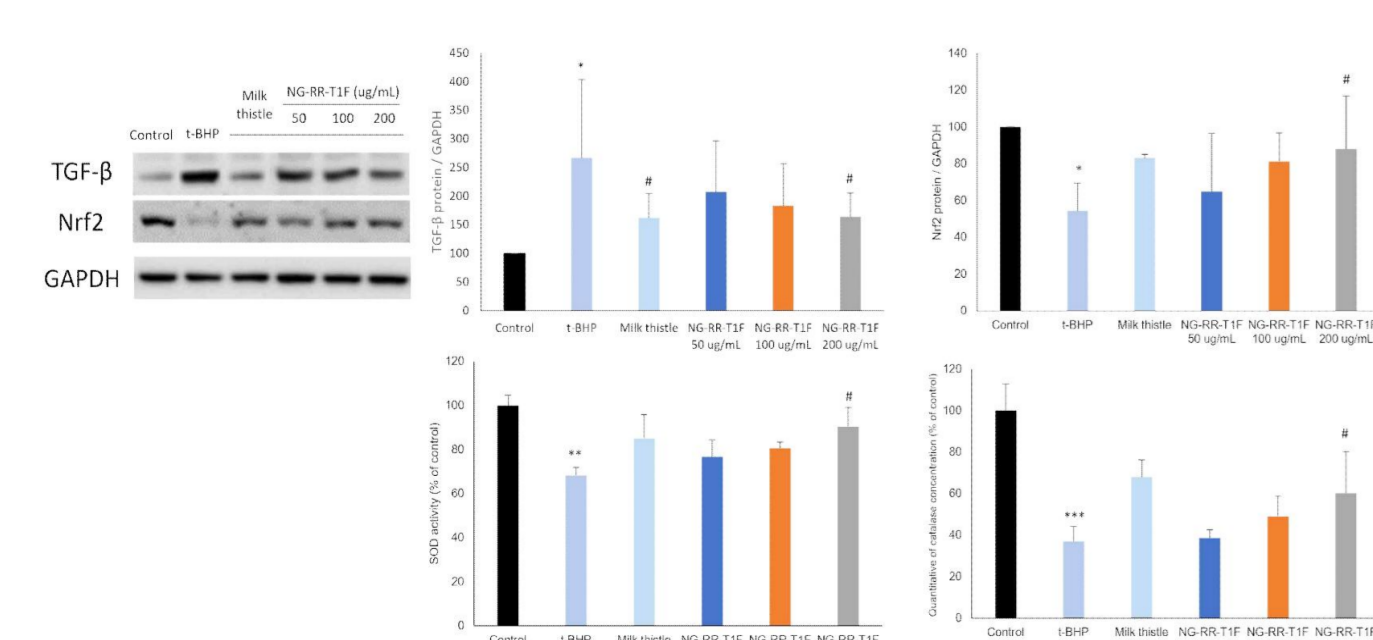


Fig. 5. Effects of *Rosa rugosa* flower-bud extracts on liver-health biomarkers in hepatocytes.

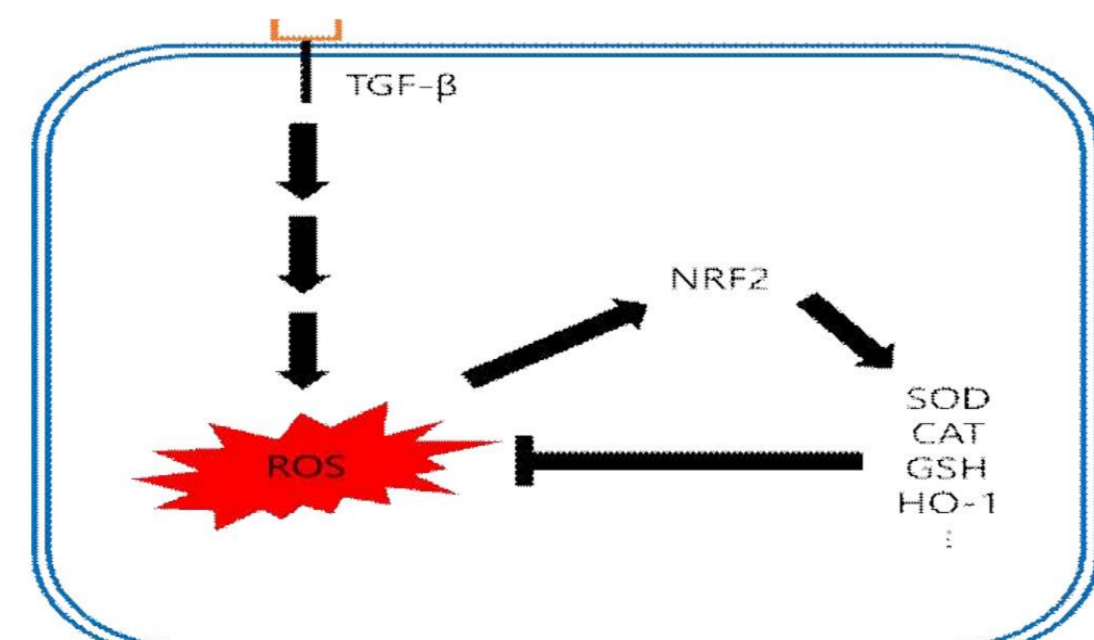


Fig. 6. Proposed pathway underlying improvements in liver-health function.

## Results and Discussion

■ Pathway mapping suggests the extract modulates lipid-handling and liver-function pathways implicated in triglyceride turnover and hepatic protection. The schematic highlights candidate nodes consistent with the observed cellular phenotypes.

■ The standardized extract, formulated as “Beach Rosan Meta Slim-Up,” demonstrates manufacturability and label-ready quality metrics based on the established markers. This supports downstream applications in functional foods or nutraceuticals targeting liver-health support and triglyceride management.

■ Findings are based on in-vitro hepatocyte models; confirmatory studies in appropriate in-vivo models and human trials are required to establish efficacy, safety, and effective dose. Batch-to-batch stability and long-term storage studies are underway/required to finalize specifications.

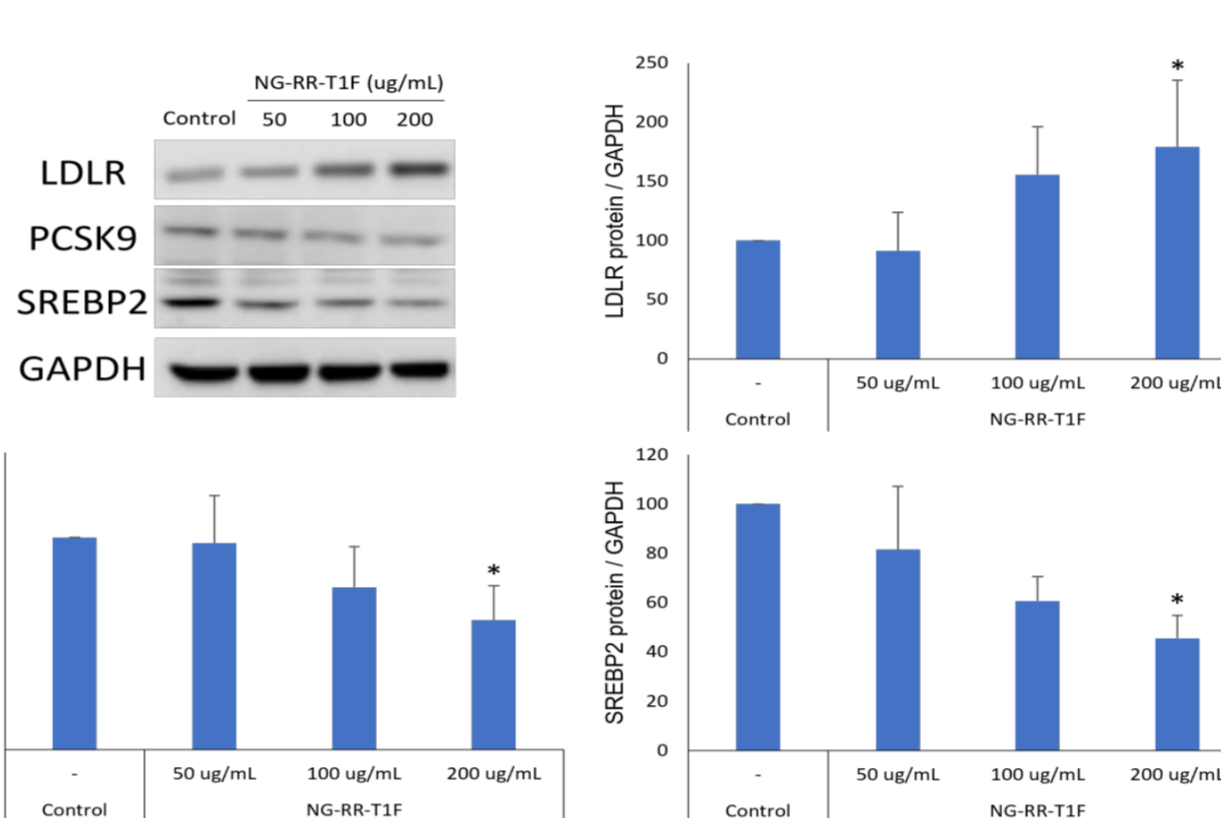


Fig. 7. Effects of *Rosa rugosa* flower-bud extracts on triglyceride metabolism in hepatocytes.

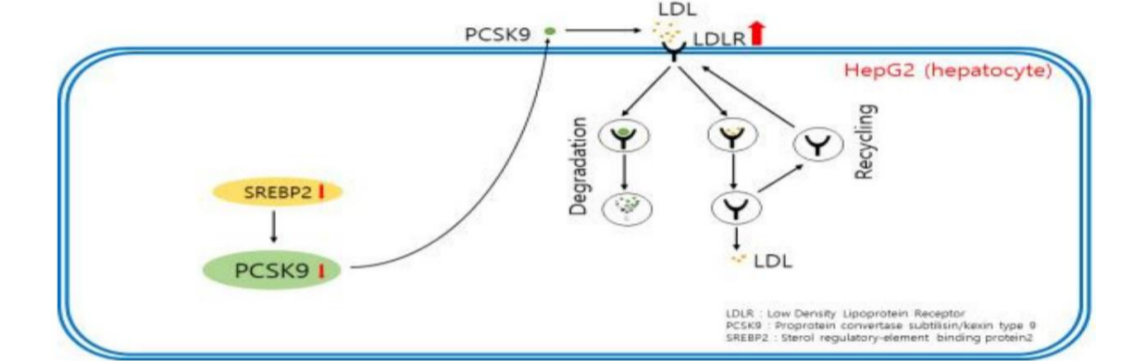


Fig. 8. Proposed pathway for triglyceride reduction and lipid handling.

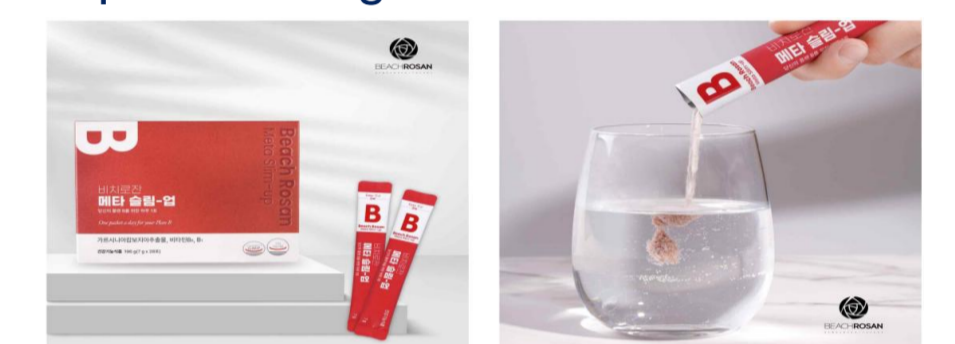


Fig. 9. “Beach Rosan Meta Slim-Up” product concept based on the standardized extract.

### Low-salinity salmon RAS (Smart Aquaculture)

■ We established a low-salinity RAS for Atlantic salmon in a naturally ventilated plastic-film greenhouse. The system integrates mechanical/biological filtration, oxygenation, and real-time monitoring to maintain target water-quality ranges while reducing salinity and energy demand.

■ In sequential rearing trials, fry successfully progressed to parr under low-salinity conditions with stable survival and growth profiles. Subsequent parr-to-smolt trials showed consistent smoltification and market-relevant growth trajectories, indicating physiological adaptation to the reduced-salinity regime.

■ A smart farm management platform aggregated sensor streams and issued automated alerts for threshold deviations. This improved husbandry decisions, reduced manual checks, and supported day-to-day biosecurity.

■ The greenhouse-based, low-salinity design lowers site and utility barriers relative to conventional marine net-pens, enabling inland or peri-rural deployment. Modular greenhouses allow complementary year-round horticulture, creating diversified revenue options and supporting Gangwon's agri-fisheries value chain manual checks, and supported day-to-day biosecurity.

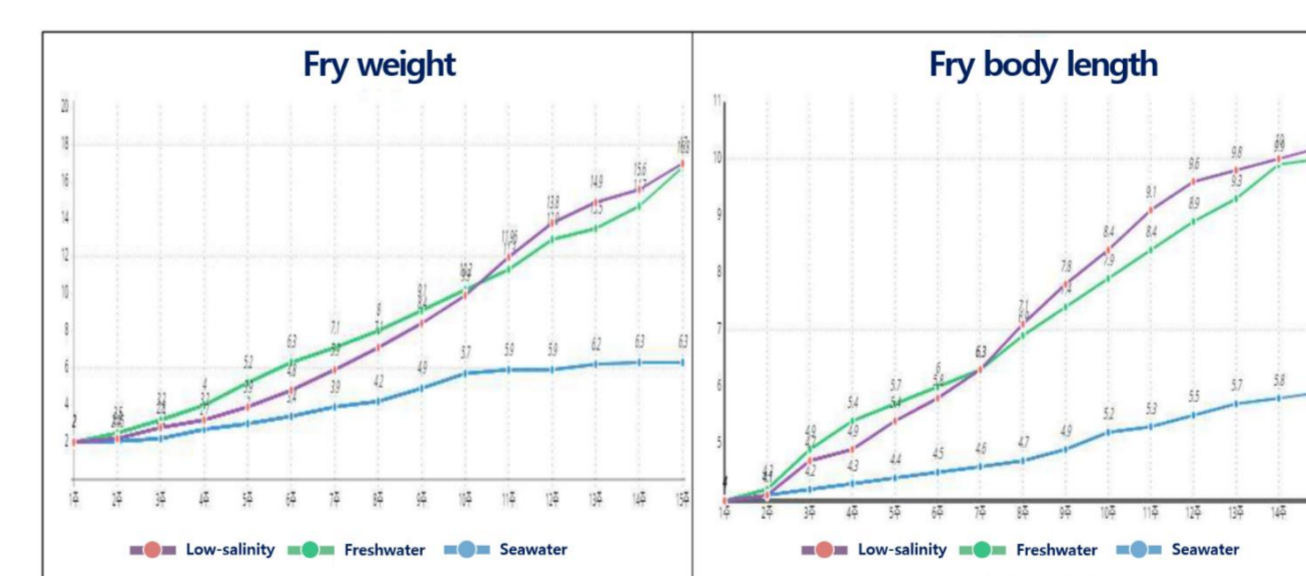


Fig. 10. Low-salinity rearing outcomes: fry → parr (survival, growth indices, water-quality stability).

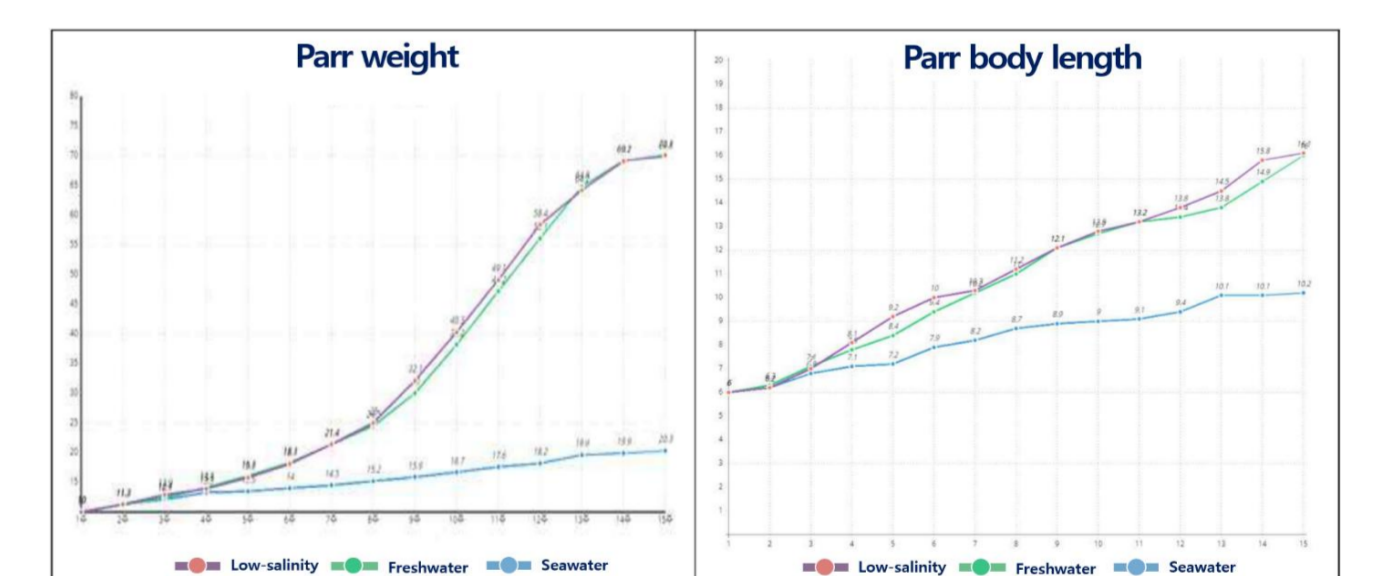


Fig. 11. Low-salinity rearing outcomes: parr → smolt (smolt rate, growth trajectory, condition factor).

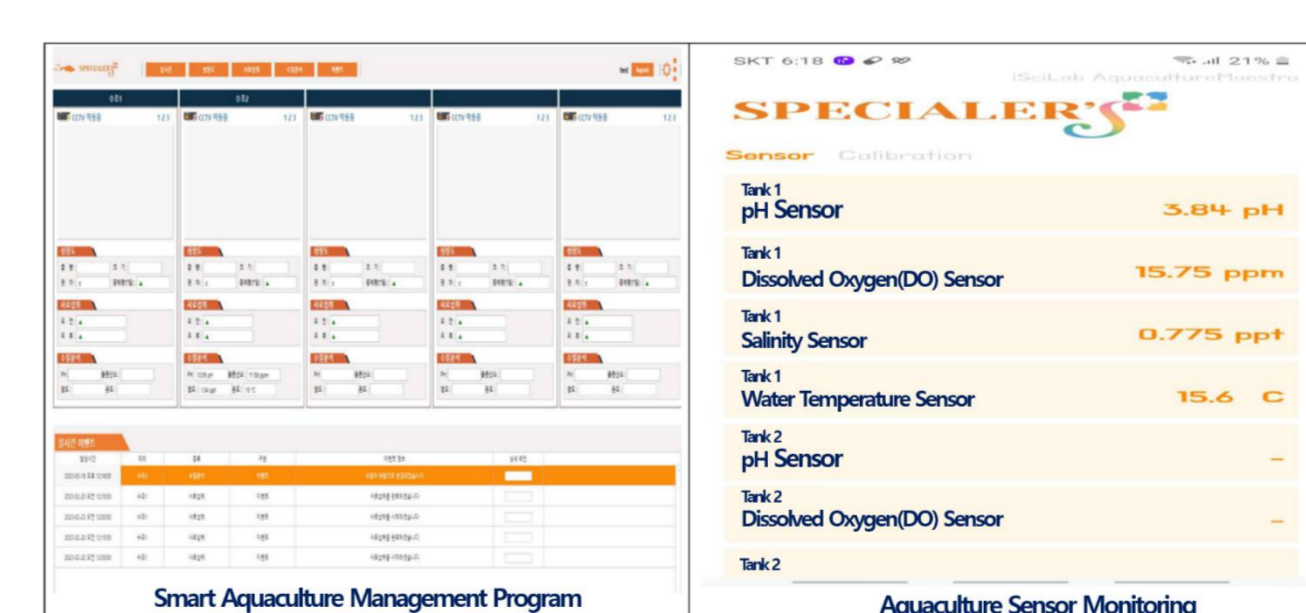


Fig. 12. Smart RAS management dashboard: sensors, alarms, and control loops.



Fig. 13. Smart RAS management dashboard: sensors, alarms, and control loops.

## Conclusion

### Native Functional Ingredient (*Rosa rugosa*)

■ Through the establishment of a quality control system for genes, flowering degree, and marker compound content, the raw material of *Rosa rugosa* flower-bud extracts has been standardized.

### Low-salinity salmon RAS (Smart Aquaculture)

■ A real-time integrated aquaculture management data system has been established to operate an intelligent monitoring system that collects and manages water quality data such as temperature, salinity, pH, and dissolved oxygen for each tank.