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AQUAMIMICRY: NATURE-BASED SELF-SUSTAINING AND CLOSED-LOOP AQUACULTURE ECOSYSTEMS

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Aquaculture is growing fast to meet the world's demand for fish and shrimp to fulfil the protein requirements of the world. World fish per capita consumption rate increased in last two decades in twofold. Global fisheries and aquaculture produced a record 223.2 million tonnes in 2022. About 185.4 million tonnes of aquatic animals and 37.8 million tonnes of algae. In that, 89% of all aquatic animal production is used for human food (about 20.7 kg per person), with the rest used for non-food items like fishmeal and oil. Aquaculture alone hit 130.9 million tonnes, worth $312.8 billion, making up 59% of all production. Aquaculture overtook capture fisheries for the first time, producing 94.4 million tonnes of aquatic animals (51% of the world's total and 57% of food-grade production). In this, most of the production comes from the modern semi-intensive and intensive aquaculture technologies like biofloc, aquaponics, RAS, IMTA etc compare to traditional fish farming. However, traditional fish farming often faces challenges such as poor water quality, disease outbreaks, and high feed costs. A new method called aquamimicry is helping solve these issues by working with nature instead of against it.

What is Aquamimicry?

Aquamimicry is a mimicking natural estuarine conditions by creating zooplankton diversity (mainly copepods) by addition of fermented carbon source such as rice bran is used with some probiotics like bacillus species *B. subtilis* and *B. licheniformis*, Lactobacillus species (*L. acidophilus, L. plantarum, L. fermentum*) and etc. that create phytoplankton and zooplankton population considered as supplemental nutrition and beneficial bacteria improve water quality in fish and shrimp cultures and mimic natural pond conditions.

History

In 1990s, mass mortality and disease outbreaks occurred in shrimp industry of Thailand. At that time, in some extensive shrimp ponds, they were growing healthy and disease-free. As the farmers, had limited resources available, so using these practices formulation of feed as a substitute by only rice bran. Because of its impending reason for the enhanced performance in the pond ecosystem. Over time, this protocol gradually developed after extensive trial and error. Two shrimp farmers (Sutee Prasertmark and Veerasan Prayotamornkul) in Thailand were who established this scientific aquamimicry technique in 2013.

Aquamimicry vs Biofloc

Although similar to biofloc technology, aquamimicry has some differences:

Feature	Aquamimicry	Bio floc
Main food	Zooplankton (copepods)	Microbial flocs
Aeration	Moderate	High
Feed input	Low	Moderate
System type	Natural-based	Microbial-based

Step-by-step Process

1. **Pond Preparation -** Pond filled with clean water about 80-100 cm depth. Add probiotics (e.g., Bacillus and Lactobacillus spp.). Drag chains for 7 days to mix soil well. Apply tea seed cake (~20 ppm) and fermented rice bran (50-100 ppm). Keep aeration running. Plankton (like copepods) develop in ~2 weeks.
2. **Carbon Source Preparation** - Mix rice/wheat bran with water (1:5-10 ratio) and probiotics. Ferment for 24 hours (pH 6-7).
3. **Application in Pond -** Add fermented rice bran (FRB) about 500-1000 kg/ha, adjusting for turbidity (Secchi disk: 30-40 cm ideal). Add probiotics monthly. Phytoplankton, zooplankton, and biocolloids grow.
4. **Stocking Phase** - Stock post-larvae (10–20/m^2) after ~1 week. System turns biologically active.

5. **Natural Food Production** - Copepods and zooplankton take over; minor biofloc (<25 mL/L) forms.
6. **Grow-Out Pond System** - Use paddlewheels for continuous water circulation. Stock fish such as catfish or milkfish to stir detritus. Worms and benthic organisms offer additional nutrition.
7. **Sedimentation Pond** - Solids settle (4 m deep at center, 2m at edges). Low-density bottom feeders clean debris and waste reduced.
8. **Biofilter Pond** - Water flows in from sedimentation pond. Fish like tilapia absorb excess nutrients and purified with low nitrogen waste.
9. **Water Recirculation** - Clean water loops back to grow-out pond. Closed-loop system.
10. **System Output** - Stable water quality, lower feed costs, natural plankton nutrition, fewer diseases/chemicals.

Advantages of Aquamimicry

- This method enhancements productivity and sustainability in aquaculture. It keeps water clean by using microbes to break down waste, while balancing pH and oxygen levels. It reduces feed costs by cultivating natural plankton in the pond, thereby reducing reliance on expensive commercial feeds.
- This system fights against diseases too, as good bacteria stop harmful pathogens, often skipping antibiotics altogether and enhance immunity and health
- Environmentally, it uses little water and cuts pollution. Overall, fish grow faster, survive better, stay healthier, and resist stress due to balanced natural nutrition.
- Natural live feed is rich in proteins, fatty acids, and vitamins, it improves growth and survival of fish larvae and reducing the need for expensive artificial feed.
- Self-sustaining aquaculture ecosystem and Closed-loop system.

Conclusion

Conclusively, aquamimicry is a basic, environmentally friendly and sustainable alternative to intensive aquaculture systems like biofloc technology. It creates a self-regulating and balanced culture environment by imitating natural processes of aquatic ecosystems and

improving the microbial and planktonic food webs. The system enhances recycling of nutrients, bioremediation of microbes and natural feeds which in effect enhance water quality, lowering the input cost and dependency on artificial feeds. Moreover, the simulation of natural pond conditions can enhance the growth performance, survival and health of cultured organisms due to the alleviation of stress levels and development of immunity. Hence, aquamimicry is an emerging, low-input aquaculture method that is consistent with the principles of ecological sustainability and ecosystem-based management.

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