



Blue Horizons in Coastal Farming: Evolving Practices in Shrimp Aquaculture

Stephen Edwards*

Department of Aquatic System Engineering, Northern Maritime University, Vancouver, Canada

DESCRIPTION

Shrimp aquaculture has expanded significantly over recent decades, responding to global demand for seafood and the need for reliable protein sources. This expansion has encouraged new ideas in production systems, environmental management, and biological understanding. Modern shrimp farming is no longer limited to traditional pond-based approaches; instead, it incorporates advanced techniques designed to improve yield, reduce environmental strain, and enhance animal health. These developments are reshaping how shrimp are cultivated across diverse geographic regions.

Recirculating aquaculture systems also represent an important step forward. These setups filter and reuse water, allowing shrimp to be farmed in areas with limited water availability. Mechanical and biological filtration processes remove waste, maintain stable conditions, and reduce the risk of disease transmission from external sources. Such systems offer greater control over parameters like temperature, salinity, and dissolved oxygen, which are essential for shrimp growth and survival. Although initial investment costs may be high, long-term benefits include improved consistency and reduced environmental footprint.

Feed development has undergone notable changes as well. Traditional reliance on fishmeal has been reconsidered due to sustainability concerns. Researchers and producers are exploring alternative ingredients such as plant-based proteins, insect meal, and microbial biomass. These substitutes aim to maintain nutritional quality while lowering pressure on wild fish stocks. Improved feed formulations also enhance digestion efficiency, leading to better growth rates and reduced waste output. The integration of probiotics into feed has further supported shrimp health by promoting beneficial gut microorganisms and strengthening resistance to pathogens.

Disease management remains a central focus in shrimp aquaculture innovation. Viral infections such as white spot syndrome have historically caused significant losses, prompting the need for improved prevention strategies. Biosecurity

measures have become more stringent, including controlled access to farms, disinfection protocols, and monitoring of water sources. Selective breeding programs are being developed to produce shrimp strains with higher tolerance to diseases. These genetic approaches aim to improve survival rates without relying heavily on chemical treatments.

Water quality monitoring has become more sophisticated with the introduction of digital tools. Sensors and automated systems now allow real-time tracking of parameters such as pH, ammonia, and oxygen levels. Farmers can respond quickly to changes, preventing stress and maintaining stable conditions for shrimp. Data-driven management supports informed decision-making, leading to more efficient resource use and improved outcomes. Integration of remote monitoring also enables oversight of multiple farming sites, increasing operational efficiency.

Environmental considerations play an increasingly important role in shaping shrimp aquaculture practices. Coastal ecosystems such as mangroves have often been affected by farm expansion in the past. New approaches encourage the coexistence of shrimp farming with natural habitats. Integrated systems that combine shrimp ponds with mangrove conservation help maintain biodiversity while supporting production. Efforts are also being made to treat effluents before release, minimizing nutrient pollution and protecting surrounding waters.

Socioeconomic factors are closely linked to the evolution of shrimp aquaculture. Many coastal communities depend on shrimp farming for their livelihoods. Innovations that improve productivity and reduce risk can have direct impacts on income stability and food availability. Training programs and knowledge transfer initiatives help farmers adopt improved practices, ensuring that technological advances are accessible beyond large-scale operations. Supporting small and medium enterprises contributes to balanced development within the sector.

Despite progress, challenges remain in ensuring long-term sustainability. Climate variability, including changes in temperature and salinity, can affect shrimp growth and survival. Continued research is needed to develop adaptive strategies that

Correspondence to: Stephen Edwards, Department of Aquatic System Engineering, Northern Maritime University, Vancouver, Canada, E-mail: stephen.edwards@nmu.ca

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allow farms to remain productive under changing conditions. Collaboration among scientists, industry stakeholders, and policymakers will support the development of solutions that balance productivity with environmental care.

CONCLUSION

Shrimp aquaculture is undergoing significant transformation through the adoption of new technologies and practices.

Innovations in system design, feed development, disease management, and environmental stewardship are shaping a more efficient and responsible industry. These advancements not only improve production outcomes but also contribute to the well-being of communities and ecosystems connected to shrimp farming. As research and practical experience continue to expand, shrimp aquaculture will remain an important component of global food systems.