Journal of Aquaculture Research and Innovation
https://www.sciltp.com/journals/jari

Editorial

Introducing Aquaculture Research and Innovation

Simon J. Davies

Department of Agriculture and Environment, Harper Adams University, Newport TF10 8NB, UK; sdavies@harper-adams.ac.uk

How To Cite: Davies, S.J. Introducing Aquaculture Research and Innovation. *Journal of Aquaculture Research and Innovation* **2025**, *1*(1), 1-3.

1. Introduction

Welcome to the *Journal of Aquaculture Research and Innovation* (JARI), a new open-access, peer-reviewed platform dedicated to advancing the science, technology, and sustainable practices of aquaculture worldwide. As the global demand for aquatic food products continues to grow, our journal provides a timely and vital space for researchers, practitioners, and policymakers to exchange knowledge and foster innovation in the rapidly evolving field of aquaculture. Our strategic aims embrace the challenges of growing aquatic protein and vital nutrients to meet expanding world demands for robust and healthy nutrition from the aquatic environment. Aquaculture also generates important biomolecules for industry and medicine, as well as ornamental fish as companion animals and also plants with applications to both freshwater and marine biotechnology.

2. Overview

As global populations grow and pressures on wild fisheries intensify, aquaculture has now emerged as a critical pillar of global food security, nutrition, and economic development. However, the expansion of aquaculture must be guided by urgent, evidence-based criteria and strategies that balance productivity with environmental stewardship, together with economic viability, and social responsibility. Modern aquaculture research and innovation must respond to these multifaceted challenges by embracing integrated, enterprise-focused, and sustainability-oriented approaches. It is essential to reduce ecological footprints through water-efficient systems (e.g., RAS Recirculation Aquaculture Systems), enhance waste management, and practice responsible site selection. We must consider and prioritize biodiversity conservation and minimize escapees, invasive species, and pollution in intensive aquaculture operations. JARI will always be sympathetic and show empathy to sciences that preserve the ethical treatment and efficiency of fish and shellfish production in a balanced approach.

2.1. Economic Viability and Enterprise Development

Aquaculture must be able to support the development of scalable, profitable business models across small, medium, and large aquaculture enterprises. There is now much more of a need to focus on cost-effective production systems, achieve value chain optimization, and create market diversification by introducing new candidate fish species for farming. It is essential to develop suitable tools and frameworks for investment risk assessment and financial planning in aquaculture ventures. Scientific research will enable the implementation of this agenda by increasing our knowledge within key disciplines. Aquaculture enterprises will be increasingly dependent on good labour practices, community engagement, and equitable access to aquaculture resources and technologies. In empowering local and indigenous communities through capacity building and inclusive policies, it will help guarantee employment and wealth creation. Ensuring food safety, traceability, and public trust in aquaculture products will be an important area of research and innovation. It is now of paramount importance to incorporate life cycle assessments (LCAs) to evaluate and guide environmental performance of cultured species of fish, molluscs, crustaceans and seaweeds. As such, JARI will welcome research and innovation directed to these areas where societal and ethical implications are involved.

2.2. Innovation, Research and Technology Integration

The digital revolution allows the application of Artificial Intelligence (AI) technologies, including IoT, and remote sensing, to monitor and manage complex aquaculture systems and especially large-scale intensive production units, both open pond, sea cages and land-based RAS facilities. Advanced protocols and biotechnologies for breeding, disease control, and feed delivery efficiency are now being used with significant innovations in fish farming technology. This can allow the promoting of open data acquisition, interoperability, and cross-sector knowledge sharing and even blockchain tracking to evaluate fish and shrimp production and traceability from the farm to the retailer and eventually to the consumer.

2.3. Feeds, Ingredients and Sustainable Diets

Feeding in aquaculture amount to over 50% of production costs and is of paramount importance and research emphasis towards developing economically effective and balanced diet formulations. The reliance on marine ingredient sources such as fish meal and oils as well as soybean meal needs to be urgently addressed, and current research is establishing novel sources of alternative but sustainable ingredients to mitigate use of marine derived materials and specific terrestrial proteins like soybean meal that may be considered finite and unsustainable resources in the future. This is a major drive to underpin the development of the longer-term aquaculture industry. In the next decade, novel technologies such as insect meal production and application of algal and single cell microbial and bacterial proteins will become mainstream ingredients in diets for fish and shrimp. Efforts are being made to redefine nutritional requirements for different species and to obtain more precision in meeting nutrient specifications. Additionally, functional dietary supplements and additives are increasingly being utilised in aquatic feeds to enhance fish and shrimp health and welfare. These consist of phytobiotics, prebiotics and probiotics and various herbal extracts that can stimulate immunity and gut health through their influence on the microbiota. In such a manner we can increase disease resistance against a host of pathogens and mitigate their effects.

2.4. Diseases, Pathology, Diagnostics and Prevention

Farmed fish and shrimp can encounter a myriad of diseases and are hosts to a plethora of infectious pathogens, such as bacteria and viruses as well as a vast range of parasites from protozoa, nematodes and cestodes. For example, parasitic crustacea like sea-lice are a major threat to farmed Atlantic salmon in Scotland and Norway. One of the major disciples in aquaculture is disease recognition and routine diagnostics, treatment and prevention. This is now a core area of active research and development. Aquatic veterinary medicine involves the development of chemotherapeutics and also specialised vaccines against the most common diseases in aquaculture. JARI will be supporting the contributions being made to such endeavours to combat, treat and prevent fish and shrimp diseases through innovative technologies.

2.5. Advances in Breeding and Genetics in Aquaculture

The aquaculture industry is reliant on viable and healthy fish stocks from grow-out to harvest. A breeding programme is essential in aquaculture production to improve fish traits such as growth rate, disease resistance, feed efficiency, and environmental tolerance. By controlling and enhancing genetic traits, breeding programmes help increase productivity, sustainability, and profitability in aquaculture. Selective Breeding involves choosing parent fish with desirable traits to produce offspring with improved performance. For example, selectively bred Atlantic salmon show faster growth and better survival rates. Additionally, the controversial use of Genetically Modified Organisms, including fish (GMO Fish) that have been genetically engineered for specific traits and other characteristics can be superior for improved production efficiency. A well-known example is the AquaAdvantage™ salmon, which grows twice as fast as conventional salmon due to the insertion of a growth hormone gene from Chinook salmon, and a cold-water temperature tolerance gene from the Arctic pout species. GMO fish can meet market demands for more efficient production, although their use is often subject to regulatory and ethical concerns. Alternatively, CRISPR is a modern gene-editing tool that allows precise modification of DNA. In aquaculture, CRISPR has been used to create fish resistant to diseases or to induce sterility, preventing GMO fish from breeding in the wild. For instance, CRISPR has been applied to tilapia and catfish to improve growth and disease resistance. JARI will be highlighting and exploring such advanced topics in this exciting and progressive application of molecular biology. There are also great opportunities to disseminate the novel research and innovations in hatchery operations such as with live feeds, larval feed substitutes, biofloc system applications and their management.

2.6. Resilience and Climate Adaptation

With rising global temperatures and elevated atmospheric carbon dioxide CO_2 levels, it is now imperative to advance climate-resilient species of fish, shellfish and crustaceans as well as algae and seaweeds to become more suited to change. These will entail responsive infrastructure, and farming practices. It will become necessary to study the impacts of ocean acidification, temperature shifts, and extreme weather on production systems. In this manner, innovation of suitable methods for the adaptive management frameworks for risk mitigation will be at the forefront of research strategies. JARI will be encouraging articles that link climate change and different abiotic factors that can impinge on aquatic animal and plant biology and production.

2.7 Role of JARI in providing a new academic and educational platform for the aquaculture sciences

JARI will serve to link research and innovation to meet these goals. It will encourage and foster a much greater appreciation of the aquaculture sector and its major contribution to the seafood domain. It will provide leadership and a forum for sharing advanced research findings for multidisciplinary topics embracing aquaculture.

In this regard our core values include:

- Disseminating science research in our leading peer-reviewed journal—and ensuring it impacts strategic aquaculture research that requires a thoughtful approach that combines scientific rigor, relevance, visibility, and engagement.
- Defining a comprehensive roadmap to achieving that goal may include such aspects as Alignment of Research with Strategic Priorities in Aquaculture. This will be very important for all stakeholders such as academia, research institutions and government agencies. It will address the needs of legislative bodies as in the food industry, for monitoring safety, toxicological and environmental impact of aquaculture.

3. Outlook

To make meaningful impact, research would ideally address the core challenges and innovation gaps faced by the aquaculture industry and policymakers today. These can include:

- Sustainable intensification and low-impact production systems
- Aquatic animal health, disease prevention, antimicrobial resistance and welfare
- Alternative feed development and novel ingredients
- Broodstock selection and advanced breeding technologies and hatchery procedures
- Development of RAS and related technologies and engineering
- Climate resilience and carbon neutrality
- Socioeconomic inclusion and governance

Modern aquaculture research and innovation must be driven by an integrated vision that aligns sustainability with enterprise development. To meet the growing demand for aquatic food while safeguarding ecosystems and livelihoods, researchers and innovators must prioritize interdisciplinary collaboration, technological integration, and responsible business practices. These efforts will ensure that aquaculture evolves not only as a productive industry but also as a resilient, ethical, and forward-looking contributor to global food systems and food security.

Join us in shaping the future of aquaculture through innovation, research findings, and collaboration.