


AQUACULTURE III

14. WEEK


Sustainable Aquaculture Techniques

WEEKLY TOPICS


Week	Topics
1. Week	Aquaculture Science and Aquaculture Engineering
2. Week	Aquaculture: Economic and Environmental
3. Week	Aquaculture: Innovation and Social Transformation
4. Week	Aquaculture: Food Ethics
5. Week	Shellfish Aquaculture and the Environment
6. Week	Advances in aquaculture hatchery technology
7. Week	Recirculating Aquaculture
8. Week	Selection and Breeding Programs in Aquaculture
9. Week	Ecological and Genetic Implications of Aquaculture Activities
10. Week	Aquaculture: Biotechnology
11. Week	Aquaculture nutrition: gut health, probiotics, and prebiotics
12. Week	Mucosal Health in Aquaculture
13. Week	Off-Flavors in Aquaculture
14. Week	Sustainable Aquaculture Techniques

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- Over the last decade, the world has witnessed spectacular growth in the aquaculture industries of many developing countries. It is unequivocally agreed that global aquaculture production will continue to increase, and much of this will occur in the developing countries of Asia and Africa, through the expansion of semiintensive, small-scale pond aquaculture. Nutrition and feeding play a central and essential role in the sustained development of aquaculture and, therefore, fertilizers and feed resources continue to dominate aquaculture needs. This paper reviews a number of specific issues in the fields of aquatic animal nutrition and feeding which are critical for sustainable aquaculture production in both industrialized and developing countries, e.g.: nutrient requirements of fish and their supply under practical farming conditions, availability and supply of feed resources and their implication on development of aquafeeds, forecasting of demand and supply of marine resources, and maintenance of environmental quality and sustainability of aquaculture systems.


Hasan, M. R. (2000, February). Nutrition and feeding for sustainable aquaculture development in the third millennium. In *Aquaculture in the third millennium*. Technical proceedings of the conference on aquaculture in the third millennium, Bangkok, Thailand (Vol. 20, p. 25).

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- While discussing the nutrient requirement of fish under farming conditions, the possibility of accessing existing databases on nutrient requirements is examined, along with their application for establishing general nutritional principles. Particular emphasis is placed on understanding the contribution of naturally available food in semi-intensive aquaculture and its role on the development of on-farm feed management strategy. Other issues such as nutritional effects on immunocompetence and disease resistance of fish, understanding of broodstock and larval nutrition, role of nutrition on fish quality, and development of regional nutritional databases for aquaculture development are also discussed. Recommendations for improvement of nutrition and feeding protocols in support of sustainable aquaculture development in the third millennium are also made.

Hasan, M. R. (2000, February). Nutrition and feeding for sustainable aquaculture development in the third millennium. In Aquaculture in the third millennium. Technical proceedings of the conference on aquaculture in the third millennium, Bangkok, Thailand (Vol. 20, p. 25).

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- ▶ As experience with aquaculture grows worldwide, the concept of sustainable aquaculture is increasingly recognized to incorporate both spatial and temporal dimensions of environmental, economic, and social parameters. Practitioners have discovered that sustainable aquaculture must not only maximize benefits, but also minimize accumulation of detriments, as well as other types of negative impacts on natural and social environment. Therefore, sustainable aquaculture development must be advanced in a manner that is environmentally sustainable and that protects the quality of the environment for other users, while it is equally important for society to protect the quality of the environment for aquaculture. This paper provides a brief review of the worldwide aquaculture development in the last decade, and gives a few examples of sustainable aquaculture activities in the coastal areas that are using natural coastal habitats and ecosystems. Based on already existing national and international efforts to promote sustainable aquaculture, key recommendations are provided, including what should be the next proactive steps.


Frankic, A., & Hershner, C. (2003). Sustainable aquaculture: developing the promise of aquaculture. *Aquaculture International*, 11(6), 517-530.

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- ▶ This paper aims to review the development of scientific concepts of microecology and ecology of microbes and the role and functions of beneficial microorganisms in aquaculture and mariculture. Beneficial microorganisms play a great role in natural and man-made aquatic ecosystems based on the co-evolution theory in living biosphere on earth. Their functions are to adjust algal population in water bodies so as to avoid unwanted algal bloom; to speed up decomposition of organic matter and to reduce COD_{mn}, NH₃-N and NO₂-N in water and sediments so as to improve water quality; to suppress fish/shrimp diseases and water-borne pathogens; to enhance immune system of cultured aquatic animals and to produce bioactive compounds such as vitamins, hormones and enzymes that stimulate growth, thus to decrease the FCR of feed.


Zhou, Q., Li, K., Jun, X., & Bo, L. (2009). Role and functions of beneficial microorganisms in sustainable aquaculture. *Bioresource Technology*, 100(16), 3780-3786.

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- ▶ Aquaculture is the fastest growing food-producing sector in the world. It is developing, expanding and intensifying in almost all regions of the world. The global population is increasing, thus, the demand for aquatic food products is also increasing. Production from capture fisheries has levelled off and most of the main fishing areas have reached their maximum potential. Sustaining fish supplies from capture fisheries will, therefore, not be able to meet the growing global demand for aquatic food and aquaculture is considered to be an opportunity to bridge the supply and demand gap of aquatic food in most regions of the world. However, in our efforts to achieve this potential, the sector will face significant challenges. Key development trends indicate that the sector continues to intensify and diversify and is continuing to use new species and modify its systems and practices.


Subasinghe, R., Soto, D., & Jia, J. (2009). Global aquaculture and its role in sustainable development. *Reviews in Aquaculture*, 1(1), 2-9.

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- ▶ Markets, trade and consumption preferences strongly influence the growth of the sector, with clear demands for the production of safe and quality products. As a consequence, increasing emphasis is placed on enhanced enforcement of regulation and better governance of the sector. It is increasingly realized that sustainable development and responsible production of aquaculture, in the long run, cannot be achieved without the full participation of the producers in the decision-making and regulation process, which has led to efforts to empower farmers and their associations and move toward increasing self-regulation. These factors are all contributing to an improvement in the management of the sector, typically through the promotion of 'better management' practices of producers. This review discusses the role of aquaculture, as at large a small-scale farmer driven production sector, in the quest for sustainable development, reducing poverty and improving food security on a global scale.

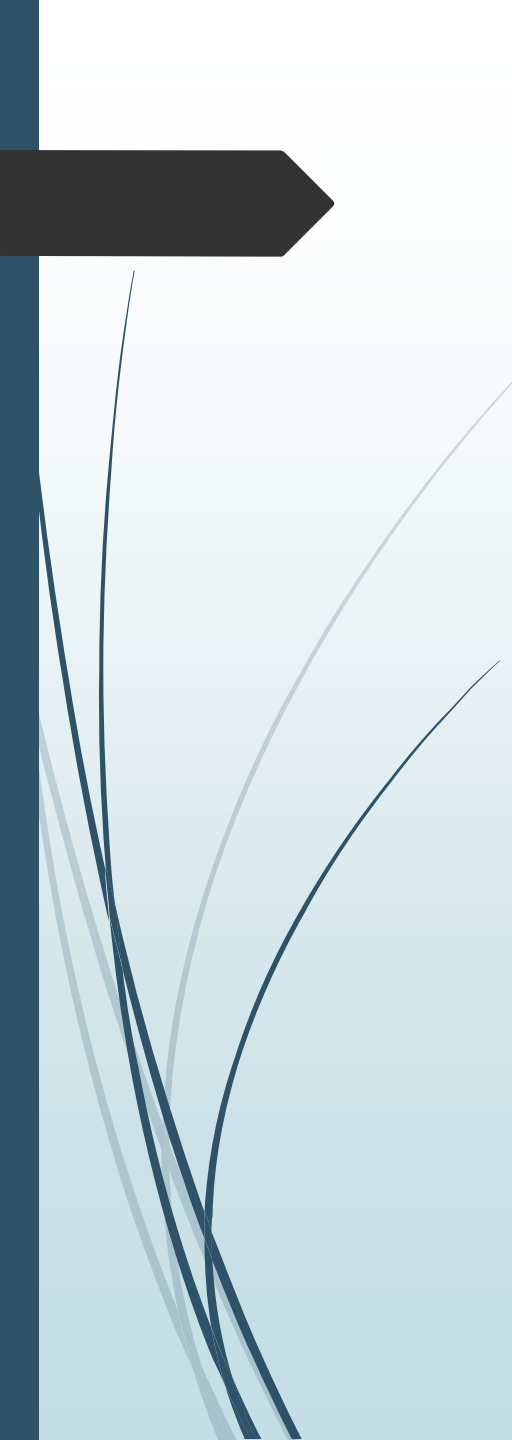
Subasinghe, R., Soto, D., & Jia, J. (2009). Global aquaculture and its role in sustainable development. *Reviews in Aquaculture*, 1(1), 2-9.

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- ▶ The dual objective of sustainable aquaculture, i.e., to produce food while sustaining natural resources is achieved only when production systems with a minimum ecological impact are used. Recirculating aquaculture systems (RASs) provide opportunities to reduce water usage and to improve waste management and nutrient recycling. RAS makes intensive fish production compatible with environmental sustainability. This review aims to summarize the most recent developments within RAS that have contributed to the environmental sustainability of the European aquaculture sector. The review first shows the ongoing expansion of RAS production by species and country in Europe. Life cycle analysis showed that feed, fish production and waste and energy are the principal components explaining the ecological impact of RAS.

Martins, C.I.M., Eding, E.H., Verdegem, M.C., Heinsbroek, L.T., Schneider, O., Blancheton, J.P., d'Orbcastel, E.R. and Verreth, J.A.J., 2010. New developments in recirculating aquaculture systems in Europe: A perspective on environmental sustainability. *Aquacultural Engineering*, 43(3), pp.83-93.

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- Ongoing developments in RAS show two trends focusing on: (1) technical improvements within the recirculation loop and (2) recycling of nutrients through integrated farming. Both trends contributed to improvements in the environmental sustainability of RAS. Developments within the recirculation loop that are reviewed are the introduction of denitrification reactors, sludge thickening technologies and the use of ozone. New approaches towards integrated systems include the incorporation of wetlands and algal controlled systems in RAS. Finally, the review identifies the key research priorities that will contribute to the future reduction of the ecological impact of RAS. Possible future breakthroughs in the fields of waste production and removal might further enhance the sustainability of fish production in RAS.

Martins, C.I.M., Eding, E.H., Verdegem, M.C., Heinsbroek, L.T., Schneider, O., Blancheton, J.P., d'Orbcastel, E.R. and Verreth, J.A.J., 2010. New developments in recirculating aquaculture systems in Europe: A perspective on environmental sustainability. *Aquacultural Engineering*, 43(3), pp.83-93.

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