

The role of aquaculture in rural development

Rural development has various dimensions but it is particularly the development of the agricultural sector, which is widely believed to provide the main impetus not only for reducing poverty and hunger but also for ensuring food security for all. The various types of aquaculture form an important component within agricultural and farming systems development. This paper covers both inland areas and coastal zones with emphasis on developing countries.

Hunger and malnutrition remain amongst the most devastating problems facing the world's poor. The FAO State of Food Insecurity Report 2002 estimates that 799 million people in 98 developing nations are not getting enough food to lead normal, healthy and active lives. Food demand, and in particular the demand for fish, has continued to rise, and it is forecasted that expanding populations and changing eating habits will make a doubling of food output imperative in the next thirty years. This demand mainly has to be met from local food production systems. Aquaculture contributes to poverty alleviation as it provides employment to millions of people, both in the sector itself as well as in support services. It also generates income, and as prices for most food commodities fall, fish prices are expected to rise reflecting the imbalance between demand and supply.

Contribution of aquaculture to rural development

Aquaculture comprises diverse systems of farming plants and animals in inland and coastal areas and often complements other food production systems. In the context of the rural poor, aquaculture often complements catches from traditional fisheries. Often, the capture or culture of

aquatic species forms the basis of food security, enabling the use of livestock or cultured fish as a source of income generation. Aquaculture becomes an attractive and important component of rural livelihoods in situations where increasing population pressures, environmental degradation or loss of access limit catches from wild fisheries.

Aquaculture production intensity, risks, and benefits. Extensive to semi-intensive aquaculture systems still produce the bulk of aquaculture products. The system found most frequently is the farming of fish in ponds, however rice-fish farming or the stocking of fish into natural or impounded water bodies are also common.

It is extremely difficult to estimate the contribution of these types of aquaculture production since small-scale and dispersed production data do not appear in official statistics and the produce is typically consumed or traded locally. Specific examples of aquaculture activities that have positive impacts on the rural poor include: fry nursing and the development

Aquaculture is growing rapidly, mainly in Asia.



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of nursing networks, the integration of fish farming with rice crops in floodplains and the more remote mountainous areas in Asia, sustaining and restoring aquatic biodiversity through simple management methods. In coastal areas, the farming of mudcrabs, oysters, mussels, cockles, shrimps, fish and seaweeds provides employment for the rural poor mainly related to labour inputs as well as seed and feed collection.

Intensive aquaculture systems yield more output from a given production unit, which is achieved through the use of technology and a higher degree of management control. Intensive inland and coastal cage aquaculture of high-value salmonids has been encouraged and supported to develop remote rural areas in Europe and South America. Similar systems have emerged in Asia and Australia for warm-water piscivorous fish such as groupers, yellowtail, snappers and sea bass. Coastal

Indirect benefits include an increased availability of fish in local rural and urban markets and concomitant reduction in household expenditure through sparing consumption of other income generating farm products. Aquaculture can also offer benefits from the utilization of common resources, particularly for the landless, through cage culture, culture of molluscs and seaweeds, and enhanced fisheries in communal water bodies.

An important, though often overlooked benefit which is particularly relevant for integrated agriculture-aquaculture systems is their contribution to increased farm efficiency and sustainability. Agricultural by-products such as manure from livestock and crop residues can serve as fertilizer and feed inputs for small-scale and commercial aquaculture. Fish farming in rice fields contributes to integrated pest management and integrated management of vectors of human medical

importance. Ponds become important as on-farm water reservoirs for irrigation and livestock in areas where there are seasonal water shortages.

In view of all these benefits it is perhaps

not surprising that aquaculture production has grown rapidly since the 1970s, and has been the fastest growing food production sector in many countries for nearly two decades; the sector exhibiting an overall growth rate of over 11.0 percent per year since 1984. By 2002, the production of all cultured aquatic organisms had reached 51.4 million tons. More than 260 fish, crustacean, and mollusc species rep-

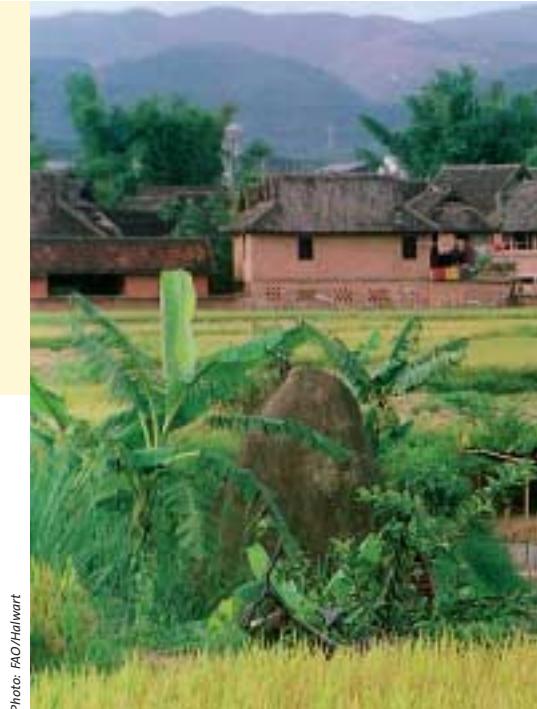


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resenting the most important animals used in aquaculture world-wide have been listed. Although not all aquatic organisms may be suitable for culture, the variety of cultured species is still increasing. Freshwater finfish account for the greatest share of total aquaculture production. This is followed by molluscs and aquatic plants, the majority of which comes from China.

How to increase the role of aquaculture in rural development

Aquaculture intensification and expansion. The current trend of increasing production can be maintained either through intensification or expansion of area under aquaculture production. The expansion of land-based culture systems in inland areas has the greatest potential because aquaculture can be integrated with agriculture on current agricultural land in smallholder and commercial farms. Considerable potential lies in the integration of aquaculture and irrigation systems, and aquaculture can also make use of land that is unsuitable for agriculture such as swamps or saline areas.

In addition, there is a wide diversity of inland and coastal aquatic resources that provide opportunity for the integration of aquaculture into rural development. This requires cross-sectoral planning and institutional coordination which are often difficult to achieve and can entail significant costs. The difficulties and costs relate to the often cumbersome bureaucratic structures and procedures of government agencies; the complexity of the scientific, technical and economic issues involved; and the potentially large number of

Improving generic technologies

Generic technologies for sound aquaculture production exist. Some of the indigenous systems require to be studied and documented in more detail. More emphasis should be given to

- systems using readily available culture species and local materials,
- decentralized seed production and seed nursing and trading networks,
- improving the culture systems for aquatic species feeding low in the food chain and that are preferred for local consumption,
- assessing and developing native fish species for aquaculture, and
- adapting and improving these systems through farmer-based learning, and promoting the results through participatory approaches.



Integrated agriculture-aquaculture systems can contribute to more farm efficiency and sustainability, if applied carefully.

informed decisions that need to be taken. Increasing yields through intensified production requires an increased use of feeds and fertilizers, which may be derived from on- or off-farm sources, or a combination of the two. Development of infrastructure reduces costs and increases availability of feed and fertilizers and in some cases allows farmers to intensify production. Since this requires increased investment in the production system, other enabling features include the development of markets and access to finance.

Many of the technical aspects of aquaculture are relatively well developed, however there is a knowledge gap between what is known globally and what is available to farmers. Weak extension systems and lack of local examples of intensified aquaculture also limit farmer's ability and willingness to risk intensification.

Biotechnology in aquaculture represents a range of opportunities to increase the growth rate in farmed species, improve nutritional value of aquafeeds, improve fish health management, restore and protect environments, extend the range of aquatic species and to improve the management and conservation of wild stocks. There is significant potential to improve production through genetic improvement programmes. Selective breeding programmes have yielded significant and consistent gains of 5 to 20 percent per generation in species of inter alia Atlantic

salmon, catfish, and tilapia. Improved breeding capabilities, larval nutrition, and advances in genetic technologies now permit a wide range of genetic manipulations to be performed on aquatic species. Modern biotechnologies are usually developed for farming systems with high inputs of feed, labour, and husbandry. Many biotechnologies could also be directed at low-input systems, farming systems in marginal areas, or to meet other needs specific to a given rural community, however the requirement for recouping development costs of many forms of biotechnology generally puts this approach to aquaculture out of reach of most aqua-farmers. Furthermore, the application of biotechnologies often also requires a certain level of capacity and resources. Small hatchery operations increase the local supply of fingerlings and can enable farmers to enter aquaculture as an activity. These small hatcheries are essential for the development of rural aquaculture but often have limited pond areas or water availability, hence may be unable to maintain the genetic quality of their broodstock and over a period of time lose genetic quality and performance. In this situation the intervention of government hatcheries or of a larger scale commercial hatchery is required. In each case, consideration must be given to the specific stage of rural development in a given area, extension programmes and how to integrate such activities within prevailing livelihood strategies.

The introduction of exotic species is another strategy used to increase value from farming systems in rural areas, for example, tilapia production is much higher in Asia than in its native Africa. Introduced species often are genetically improved or domesticated species, to some extent. It is imperative, however, that environmental risk assessment and other applicable regulations are followed since introductions may pose a risk to the environment and the local biodiversity.

The way forward

Aquaculture's potential for contributing to global food production is far from being fully realized. The decision to establish the Sub-Committee on Aquaculture under the Food and Agriculture Organization's (FAO) Committee on Fisheries (COFI), during 2001, reflects the importance that FAO Member Governments attach to aquaculture as a tool for national development. Many recent international gatherings recognized the role that aquaculture can play in national economic development, global food supply and achievement of food security, and

Further emerging issues

As aquaculture continues to expand the issue of guidelines and best practices for various culture systems, including for organic aquaculture, will become more important, particularly in the areas of the sustainability of fish feeds and management of fish health. Further efforts towards minimizing environmental impacts and ensuring sustainable aquaculture development within the framework of the FAO Code of Conduct for Responsible Fisheries will enhance the sectoral contribution to food security, poverty alleviation and rural development.

declared that the sector has the potential to continue to contribute even more to peoples' livelihoods.

Land-based culture systems in inland areas have the greatest potential because aquaculture can be integrated with the existing agricultural practice of small-scale farming households. Coastal aquaculture also contributes to rural development by alleviating poverty and enabling livelihood diversification of subsistence fisherfolk. Social, economic and institutional issues have been recognized to be the most important constraints to greater contributions by aquaculture to rural development.

To attain its full potential, the aquaculture sector will require new approaches in the coming decades. These will undoubtedly vary in different regions and countries, and the challenge is to develop approaches that are realistic and achievable within each social, economic, environmental and political circumstance. In an era of globalization and trade liberalization, such approaches should not only focus on increasing production, they should also focus on producing a product that is affordable, acceptable and accessible to all sectors of society.

Integration of aquaculture into national development. Aquaculture needs to become part of national development plans, developed in consultation with stakeholders and ensuring feedback mechanisms allowing the poor to influence development. Aquaculture planning also needs to be integrated with water resource management planning for inland areas and coastal management planning in coastal areas as well as into other economic and food security interventions for rural areas. This may be done through the establishment of a multi-sectoral co-ordinating process both at sectoral policy formulation level and at the extension service level.



Photo: FAO/ide Bottegi

Furthermore, aquaculture should be pursued as an integral component of community development, contributing to sustainable livelihoods, promoting human development and enhancing social well-being of poorer sectors. Aquaculture policies and regulations should promote practical and economically viable farming and management practices that are environmentally sustainable and socially acceptable.

Aquaculture development should complement wild fisheries to the extent possible. Aquaculture has an important role to play with regard to the conservation and sustainable use of endangered fish as the culture of valuable native fish species can take pressure from wild populations.

Public-private sector partnership and regional cooperation. Public-private partnerships in aquaculture and the establishment of aquaculture networks have shown to be able to contribute considerably to the sectoral development. Although the establishment of such partnerships and networks may be a time-consuming, costly and difficult task, they make it possible to address constraints and opportunities in a manner what otherwise would not have been allowed. Cooperation between governments, NGOs and civil society further provides

In coastal areas aquaculture not only provides employment but also yields more output from a given production unit.

opportunities for awareness raising, targeting and creating dialogues between the various stakeholders. Regional cooperation between aquaculture farmers, producers and marketing associations, research institutes and governments is essential. South-South Cooperation between Asian countries and those in Africa and Latin America is a useful tool to disseminate these experiences.

A supportive institutional environment involving public and private sectors is required for aquaculture to contribute to improved livelihoods. The rural poor need to be provided, at least initially, with public sector support, while commercial aquaculture requires less intervention. In the longer term, aquaculture has to function on a self-financing basis within the private sector.

Necessary action includes to focus limited public resources on strategic government infrastructure and flexible and efficient

extension services that meet producers' needs, to promote and facilitate the private sector production of feed and seed, to encourage credit for medium- and large-scale producers, to facilitate the formation of farmers' associations and encourage community production, and to encourage investment in building the institutional capacity and knowledge base concerning sustainable aquaculture practices to manage the sector.

Information, awareness raising and capacity building. There is a need for assessing and documenting information on experiences and application of good practices, and for raising awareness and advocating products and benefits derived from aquaculture. Information exchange and transfer through collaboration and co-ordination between national and regional aquaculture institutions and agencies should be promoted. Experiences from traditional and other aquaculture systems that have proven to be sustainable and the lessons learnt should be promoted and disseminated as part of strategies for an effective transfer of aquaculture know-how into areas and regions where it has no tradition. Capacity building should be based on a participatory farmer-focussed and needs-based approach similar to Farmer Field Schools.