

Potential for the development of aquaculture in Africa

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Abstract

Aquaculture production in Africa has remained low despite the huge potential that exists on the continent. In order for this potential to be realized, it is necessary to refocus the direction of aquaculture development. This paper concludes that for further growth to occur it is necessary to: (i) widen the range of production systems; (ii) increase production intensities and efficiencies; (iii) develop management technologies for indigenous species that target local niche markets; (iv) put more emphasis on marketing and processing of high value products; (v) promote policy research on how aquaculture production can respond to changing macroeconomic policies; and (vi) accelerate the disengagement of government from activities that can best be done by the private sector.

Introduction

Aquaculture in Africa has come a long way since it was first introduced. However, in comparison to the rest of the world, aquaculture production in Africa is still insignificant at the global level and accounts for about 0.9 per cent (404 571 t) of the total global aquaculture production in 2000 (FAO 2003). Nonetheless, aquaculture in Africa is going through an exciting phase of evolution and growth after numerous false starts that did not result in any meaningful aquaculture development. This lack of development exists against a backdrop of conditions that would benefit greatly from the rapid development of aquaculture on the continent, namely, high incidence of poverty, malnutrition and unemployment (Hecht 2000). The reasons for the lack of growth have been reviewed elsewhere (Brummett and Williams 2000; Huisman 1990; Harrison 1995) and include overzealous and unplanned promotion of aquaculture that placed emphasis on technical research and technology transfer without regard to the natural resource base and the socio-cultural and economic context within which the technologies were being promoted. It became apparent that technical research and technology transfer had to fit within the local conditions (natural resources, socio-cultural and economic) of the specific area where aquaculture development was being planned.

Since the early 1980s, some international development agencies and advanced

research institutes have been promoting aquaculture within the context of integrated agriculture and have begun addressing socio-cultural and economic factors that have been impeding aquaculture development. This approach resulted in sustained aquaculture growth in some African countries, such as Côte d'Ivoire, Egypt, Ghana, Malawi, Nigeria and Zambia. The development of domestic and export markets for fish, changing macro-economic environments and the stagnation of inland capture fisheries in sub-Saharan Africa has made investment in aquaculture attractive. Private investment in commercial aquaculture production and growth of this sector have been reported in Egypt, Kenya, Namibia, Nigeria, Malawi, South Africa, and Zimbabwe. In order for aquaculture to register further growth and meet its potential of bridging the gap between fish supply from capture fisheries and the demand for fish, the direction of aquaculture development in Africa will have to be refocused. This paper explores the potentials of aquaculture in Africa and proposes future directions for the implementation of aquaculture research and development in the continent. The paper concentrates on four issues, namely, production systems, culture species, marketing and policy.

Production systems

A wide variety of production systems, such as cages, ponds, tanks and raceways, are being used for aquaculture in agriculture, freshwater and marine environments in Africa. These systems are

being used in small, medium and large-scale operations and at various levels of intensity (Machena and Moehl 2001). Currently, earthen ponds are the dominant production system in Africa. A major proportion of public sector research and development effort has been directed towards increasing the productivity of pond systems. In contrast, very little public sector research and development has been geared towards improving and understanding other production systems such as brushparks, cages, and culture-based enhancement fisheries in floodplains, rivers and lakes. In order to increase the production potential of aquaculture in Africa, research and development should focus on a wider range of production systems for fish farming and on increasing the intensity of production in fishponds to help farmers achieve higher yields.

Production intensity and efficiency

The future of aquaculture in Africa lies in increasing production efficiencies and intensities so as to produce more fish using less land, water and financial resources. In order to achieve this, research on genetic enhancement of aquaculture species to allow for faster growth and more efficient use of feed is needed.

The species used in African aquaculture are in the early stages of domestication and, therefore, their response to improved management is limited. For meaningful production gains to occur,



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The utilization of perennial streams to establish ponds is an option for small-scale farmers to diversify activities and have a year-round supply of fish for home consumption and income, east of Zomba, Malawi

emphasis should be placed on developing better performing strains through genetic enhancement. Genetic enhancement methods such as those used to produce the GIFT strain Nile tilapia (Eknath et al. 1993) should be widely disseminated in Africa to accelerate national genetic enhancement programs. In addition, development and application of improved broodstock and hatchery management techniques are required to avoid inbreeding, interspecific hybridization, and contamination of improved strains through introgression from feral species and vice versa.

One way of achieving high production intensities is through the use of recirculating aquaculture tank systems (concrete or fiberglass). These systems require aeration and complete feeds to support the high stocking densities. Moreover, they rely on organized urban markets to move the products (directly or through brokers and middlemen). Use of these systems is increasing in the urban and peri-urban areas of West Africa where land availability is a major constraint to investment in aquaculture. For example, in Nigeria intensive recirculating systems are being used to culture African catfish (*Clarias gariepinus*). Intensive recirculating systems are likely to be important in the production of fish for the peri-urban and

urban areas to meet the demand from the growing urban populations.

Fish Nutrition

As aquaculture production becomes more and more intensive, fish feeds will be a significant factor in increasing the productivity and profitability of aquaculture. Feed management determines the viability of aquaculture as it accounts for at least 60 per cent of the cost of fish production. At present, the high cost and low quality of fish feeds are major factors limiting the development of aquaculture in Africa and are likely to remain so in the near future. Therefore, nutrition research that helps to reduce the cost of fish feeds without reducing their efficacy will be crucial to the successful development and commercialization of aquaculture in Africa.

So far, nutrition research has concentrated on the replacement of animal protein by plant proteins with a view to reducing the cost of supplemental feeds (de Silva 2001). Hecht (2000) contends that research on inexpensive feed ingredients has not contributed greatly to aquaculture development in Africa and suggests that more effort should be put into research on how plant proteins can best be used in the

feeding of fish. Recognizing that ponds will remain the major aquaculture production system in Africa for the foreseeable future, developing nutrition strategies that maximize the contribution of natural and supplemental feeds in fishponds would help to expand aquaculture production. This requires the development of revolutionary feed and fertilization regimes that increase the nutritive value of fish diets (both supplementary and natural), and increase profitability and productivity without degrading the environment. Recent work on staged pond inputs in Thailand (Brown et al. 2001; Yi and Lin 2000) where feed costs are reduced by delaying the timing of supplemental feeding without reducing fish yields provides a framework for application and adaptation to aquaculture in Africa.

Species for aquaculture

Aquaculture research and development in Africa have concentrated on several tilapia species and on the African catfish. The tilapias have been more widely promoted for fish farming and now dominate aquaculture production. Other indigenous fish species that have a high local demand in the different countries also have a tremendous potential to contribute to higher aquaculture production. For example, clariids such as the African catfish (*C. gariepinus*) have overtaken tilapia as major culture species in Nigeria (FAO 1999), and common carp (*Cyprinus carpio*) production in Egypt is in decline in preference to the indigenous Nile tilapia (*Oreochromis niloticus*) (Brummett 2000). This trend of market demand dictating the choice of indigenous fish species for culture is likely to continue in the future and will direct aquaculture expansion towards the production of fish for niche markets. Therefore, efforts should be made to develop production and management technologies for indigenous species that have a high local demand. The development of production techniques for local species and their successful culture may also help to protect natural fish populations, which are threatened in many cases due to unsustainable fishing practices.

Culture of marine species is underdeveloped in Africa. Except for the culture of a

few species such as oysters, seaweed, and sea bass in Egypt, Namibia, South Africa, and Tanzania, very little effort has been spent on promoting this sector. Focused attention on the development of this sector has a potential to generate employment and take advantage of the opportunities that exist for export-oriented production.

Floodplain aquaculture and culture-based fisheries

Although earthen ponds will continue to be the dominant aquaculture production system in Africa, the potential of other production systems such as culture-based fisheries in floodplains, lagoons, and small water bodies needs to be fully explored. Simple management interventions in floodplains can increase fish yields. For example, fish yields ranging from 300 to 1 700 kg ha⁻¹ have been reported from floodplain fish culture systems in Bangladesh, Malawi, and Vietnam (Dey and Prein 2002; Chikafumbwa et al. 1998). Culture-based fisheries in the form of brushparks also have a long tradition in West Africa and recent studies conducted in Malawi (Jamu et al. 2003) suggest that brushparks could be a viable technology for fish production in other parts of Africa.

The high production potential of floodplain aquaculture and culture-based fisheries, their accessibility to the rural poor and landless people, and the fact that little initial capital investment is required to implement aquaculture in floodplains compared to proprietary land-based aquaculture (Lorenzen et al. 2001), provide a good option for supplying high quality protein and additional income to the rural poor. To realize this potential, the traditional aquaculture technologies that are practiced in African floodplains need to be aggressively reviewed and refined to allow for better control of production and management. Development of aquaculture in floodplains should concentrate on introducing simple management interventions, e.g., stocking, and supplemental feeding of fish in enclosures, temporary pools, channels, etc., as well as on testing different co-management arrangements that maximize the social and economic benefits to the communities using these resources.

Cage culture

Existing cage culture operations in Africa indicate that cage culture is viable and has tremendous potential to produce high quality fish products for domestic and export markets (Windmar et al. 2000). However, the dependence of these production systems on formulated feeds, intensive land-based hatcheries, and initial high capital outlay all suggest that commercial cage culture operations can only be undertaken by industrial investors. Since most of the information and technology on the operation of cage culture systems are in industrialized countries, the potential of this sector to contribute to fish production will depend on the formation of partnerships between developing country operators and developed country investors.

Research on small-scale cage culture operations in irrigation canals, rivers, and lakes is still in its infancy in Africa, but these systems have the potential to contribute to rural incomes and fish production (Mikolasek et al. 1997). For example, experience in Asia indicates that small cages can provide rapid returns to the rural poor who do not have access to land for pond aquaculture (Hambrey et al. 2001). To develop small-scale cage culture operations, the focus should be on consolidating research on small-scale cage

operations in rivers and small water bodies, establishing management and institutional guidelines for the use of cages in water bodies, and generating information on the costs and profitability of small-scale cage culture.

Marketing

Markets and marketing are essential for the development of aquaculture (Huisman 1990). Small-scale aquaculture development efforts in the past have emphasized the importance of aquaculture for food security without focusing on the commercial dimensions of fish farming (Hecht 2000). However, the FAO Strategic Assessment of Aquaculture and a review of the literature suggest that there is a high market demand for fish that will support commercial fish farming in Africa (Aguillar-Manjarrez and Nath 1998). In order for small-scale aquaculture to take off in Africa, future research and development should emphasize both the development of aquaculture for income generation and the production of more affordable fish for the rural and urban poor. The demographic shifts that will result in 61 per cent of the African population residing in urban areas by 2025 (de Nigris 2000) suggest that there is also a need to focus on urban markets. While small-scale aquaculture will still continue to produce for the rural markets,



A low-risk option for farmers to start growing fish on their farms and gain experience and skills through rice-fish farming

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Harvesting of small-scale tilapia ponds in Northern Zambia

these demographic shifts indicate that there will be a market for small-scale and large-scale commercial farmers to produce high quality fish and processed fish products for the urban markets. Research is required to study market demand and supply, with projections for the future, and how farmers should target consumer groups for the future success of the industry in Africa.

Small-scale farmers have fragmented production units that require collective production and marketing to ensure that fish are delivered to markets at a cheaper price. This requires the formation of producer groups or associations. Although there is very little information on group formation by commercially-oriented small-scale aquaculture producers, experience of other market-oriented agricultural products such as cocoa, coffee, horticulture products, milk, and tobacco suggest that producer associations are beneficial for the collective procurement of inputs and marketing of products. Producer groups and associations would benefit small-scale aquaculture through high volume purchases of inputs, including feed, fertilizers, and fingerlings, and ensuring lower marketing costs. Currently, extension services to individual farmers are focused on improving production, while neglecting marketing, processing (cold chains, live marketing, smoking and valued added products), socio-economic factors, and the adoption of aquaculture. However, future development will depend on how African fish farmers are prepared to meet the challenges of market orientation and, hence, the identification of effective aquaculture adoption and dissemination strategies.

Policy

Aquaculture development in many African countries is hampered by the lack of sector-specific development policies and plans. The policy environment under which aquaculture development has been promoted has actually received very little attention compared to the development of production technologies. To ensure an increased contribution by aquaculture to food security and incomes, issues such as credit availability (to farmers, producers and local marketing chains), facilitation and promotion of aquaculture enterprises, aquaculture technology adoption and dissemination processes, the protection of the environment, and biosafety need to be addressed.

African governments are promoting democracy, trade liberalization, and decentralization. These changes are affecting the way that aquaculture development is facilitated. For example, the Nigerian government is disengaging itself from direct production of fish by promoting the development of aquaculture through the participation of all stakeholders, with the government guaranteeing loans to groups of fish farmers. Uganda is privatizing agricultural extension services and giving farmers the choice of extension advice by providing them with government money to buy the advisory services they want (NARO/MAAIF 2002). Research on the impact of national policies on aquaculture development needs to be undertaken in order for aquaculture development plans to respond better to macro-economic policies.

One of the major policy issues that should be addressed in Africa is the role of government and government stations in the promotion and development of aquaculture. Until recently, the model for aquaculture development in Africa involved the construction of government stations to produce fingerlings and table fish for sale to farmers and the general public. This model has proved to be unsustainable (Moehl 1999) and has resulted in the privatization of fingerling production in Madagascar (van den Berg 1996). The stations now have a new role as sites for participatory technology development and maintenance of improved strains of fish, as is the case for

Malawi and Nigeria. The experience of Malawi on the efficacy of participatory aquaculture research and extension is currently being documented. However, the lack of documentation of successful privatization and redefined roles of government stations make it difficult to use them to influence policy change in the African continent. Documenting the processes and impacts of successful aquaculture policies will provide information that can be used in the formulation of similar policies in other African countries. Accelerating the disengagement of governments from functions that can be done efficiently and profitably by private farmers will allow governments to concentrate on delivering quality services that cannot be undertaken by the private sector, e.g., the genetic improvement of fish and maintenance of improved fish strains.

Conclusion

Aquaculture is now a known food production enterprise in Africa and has become established in a number of countries. However, in order to realize the full potential of aquaculture in Africa there is an urgent need to develop and promote aquaculture technologies that increase intensification of production; make it accessible to the poor and the majority of the African population through the use of culture in resource systems such as floodplains, rivers, and small water bodies; and develop production and marketing strategies that allow farmers to respond better to changing consumer demands. The public sector should devote more resources to policy research on the facilitation and promotion of aquaculture, as well as the response of aquaculture enterprises to changing macro-economic policies.

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