STATUS OF CATFISH PRODUCTION IN MALAWI

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ABSTRACT

Malawi capture fisheries have drastically declined. The focus of the nation is now on aquaculture as a viable option to increase fish production. The commonly cultured fish, tilapia species, have been blamed for slow growth largely because of precocious breeding habits. Introduction of fast-growing exotic culture species has been restricted due to a fear of their potential negative impact on the biota and complex ecosystems of Lake Malawi. The main focus is to screen fast-growing indigenous species for aquaculture. Catfish has been identified as a promising fish for aquaculture because of its rapid growth rate. There are five catfish species found in Malawi including, *Clarias gariepinus, Clarias liocephalus, Clarias ngamensis, Clarias stappersii* and *Clarias theodore,* of which *Clarias gariepinus* is the most popular catfish species cultured. Catfish species are cultured in polyculture with tilapia. The current production of cultured catfish is constrained by the inadequate supply of fingerlings. There are very few hatcheries producing catfish fingerlings and the survival rates in these hatcheries are very low. Prospects for catfish culture are encouraging, following existing high market demand, development of secondary industries such as the manufacturing of fish feed, and commitment from the government of Malawi to promote its development. Despite these prospects, there is an urgent need to perfect the technologies for nursing the hatchlings and ensuring grow-out for marketing. In addition, catfish production should go in tandem with a breeding program that will improve its performance under various culture environments. Past and current research activities are highlighted in the paper. Priority areas in catfish culture include promotion of its production, encouragement of private sector involvement in fingerling production and grow-out fish production, as well as the development of a brood stock management and breeding program.

INTRODUCTION

Fish play a very important role in the socioeconomic development of Malawi, providing much needed protein and generating employment for those engaged in fishing and fisheries-related activities. Fish contribute about 60–70 percent to the nation's annual animal protein supply and provide livelihoods to over 10 percent of the nation's population. However, fish from capture fisheries have declined significantly. In light of this, the focus of attention is now on developing aquaculture as a viable option to increase fish production. However, the aquaculture sector in Malawi contributes about 2 percent to national fish production and an average productivity of 700 kg/year is very low (Malawi Government 2005). The commonly cultured fish, comprising the tilapia species, have been blamed for slow growth largely because of their precocious breeding habits. The introduction of exotic culture species has been restricted for fear of their accidental entry into Lake Malawi and their potential impact on the biota and complex ecosystems of the lake. Therefore, emphasis has turned to the development of other indigenous species with an aquaculture potential, such as African catfish. *Clarias gariepinus* was identified as the most promising candidate for Malawian aquaculture with potential yields of more than three times the fastest growing tilapia species such as *Oreochromis niloticus* (Haylor 1992). Catfish species are now one of the four commonly cultured fish species in Malawi.

OVERVIEW OF COUNTRY PRODUCTION

Aquaculture production in Malawi was estimated at 800 tonnes in 2002 and catfish contributed 5 percent to the total production (Malawi Government 2005). Yields ranging from 4.47 to 4.75 tonnes per hectare were obtained in the Northern region of Malawi from polyculture with tilapia cultured in a semi-intensive system and fed maize bran at 3 percent of body weight (Maluwa et al. 1995). The national production of catfish has been increasing, from 5 tonnes in 1996 to 17 tonnes in 2003 (Table 1).

CATFISH BREEDING

Currently, there is no catfish breeding program in Malawi. However, proper management of catfish brood stock has now been planned to be one of the activities at the National Aquaculture Center. Other stations have infrastructure that would facilitate participation in a catfish breeding program. Such facilities are found at the Bunda College Aquaculture Farm, Mzuzu Fish Farm and Kasinthula Fish Farm.

CATFISH FINGERLING PRODUCTION SYSTEMS

Three governmental hatcheries at the National Aquaculture Center, Mzuzu Fish Farm and Kasinthula Fish Farm have the capacity to produce catfish fingerlings. However, the number of fingerlings produced in these government hatcheries is still very low. The major challenge at these hatcheries is the low survival rate from the fry to fingerling stages. A low survival rate of less than 10 percent has been very common. In 2000, the National Aquaculture Center with technical support from a JICA Aquaculture Project, improved the survival rate to about 30 percent and produced over 20,000 fingerlings in 2000 (JICA 2001) and 16,905 in 2001 (ADiM 2005a). Despite technical support from a number of development partners to promote the development of catfish in Malawi, no significant take off occurred in the culture of the species. Most of the efforts were limited to spawning and not much was done to develop nursing technologies that would improve the survival rate of fry. Currently, the government, with technical support from FAO, is supporting the establishment of privately owned small-scale hatcheries in all three regions of the country.

CATFISH PRODUCERS

Catfish species are the fourth type preferred by fish farmers. Other popular fish include *Oreochromis karongae, Oreochromis shiranus,* and *Tilapia rendalli.* Catfish species are favored because of their large size and high price (ADiM 2005a). However, information on catfish producers in Malawi is very limited. There are no reports on large-scale catfish producing enterprises in Malawi. Catfish species are cultured by small-scale fish farmers instead. The survey by JICA (2004) indicated that catfish were farmed by 16 percent of the farmers in the Southern Region of Malawi. These farmers obtain their fingerlings from government stations and from the wild. Sometimes catfish are unintentionally introduced into the fish ponds.

PRODUCTION SYSTEMS

The culture of catfish in Malawi has been restricted to extensive pond culture. Catfish species are mainly cultured in combination with Malawi's major cultured tilapia species, namely *Oreochromis shiranus, Oreochromis*

Table 1: Estimated production levels (tonnes) and value (US$) of catfish (Clarias gariepinus) in Malawi between 1996 and 2003

Estimated units	Year							
	1996	1997	1998	1999	2000	2001	2002	2003
Production (tonnes)	5	7	10	12	15	18	10	17
Value (US$, '000)	5.5	7.7	12.0	14. 4	18.0	18.0	11. 2	17.0

Source: FAO 2003.

karongae, Oreochromis mosambicus and *Tilapia rendalli*. The mean body weight of *Clarias gariepinus* in polyculture with *Oreochromis karongae* at the Mzuzu Fish Farm was only up to 100 g after 168 days of culture when fed with maize bran (Maluŵa et al. 1995). Unpublished reports at the Kasinthula Fish Farm indicate that catfish stocked at a very low density of 1,000 fish/3.4 hectares attained a body weight of 1.5 kg after one year when existing in polyculture with *Oreochromis mossambicus* (JICA 2004).

MARKETING SYSTEMS

There is a paucity of information as far as catfish marketing is concerned. Demand for catfish exists in most markets, except in a few isolated communities where religious beliefs and attitudes restrict its consumption. Cultured catfish are usually sold fresh at the farm gate and are purchased by local people living within the vicinity of the pond. The prices range from MK80 to MK100 (Department of Fisheries unpublished Monthly Reports) and vary from one place to another. However, the price is very high if sold smoked. This implies that if catfish production is to be profitable, considerable work should be done on the marketing aspects, with an emphasis on adding value to the product.

CONSTRAINTS TO CATFISH PRODUCTION

The limited supply of fingerlings has been a major constraint to catfish production. A survey conducted by ADiM (2005b) found out that 98.6 percent of the fish farmers had difficulties obtaining fingerlings.

Appropriate feed for the culture of catfish posed another challenge to the culture of catfish in Malawi. In 2005, the cost of imported fish feeds was as high as $450 per tonne (ADiM 2005b). The private company, MALDECO, has installed a fish feed manufacturing plant to produce mainly tilapia feed. It is uncertain whether the production capacity of the plant would satisfy the sector's demand. Several other small-scale feed manufacturing units are being established country-wide. However, these small-scale fish feed producers lack basic feed formulations. In addition to the availability of appropriate fish feeds on the market, the existing feeds are expensive. The cost of fish feed is around MK100/kg and the feed conversion ratio of around two obtained with tilapia suggests some refinement in the feeds. In fact, fish feed comprises about 70 percent of the total cost of fish production.

PAST AND CURRENT RESEARCH ON CATFISH

BIOLOGY: ALL ASPECTS RELATED TO THE BIOLOGY OF CATFISH SPECIES

Early observations made on catfish species in Malawi found that the fish can attain large sizes with an angling record of 16.1 kg (Skelton 2001). The fish tolerate a wide range of environmental conditions, such as salinity ranging from 0 to 12 ppt and temperatures from 8°C to 35°C. Trials in Northern Malawi showed that the growth rate was not affected even at temperatures below 21°C (Maluŵa et al. 1995). It has wide tolerance of pH, turbidity and densities (Hecht et al. 1988). In fact, some catfish species were the last remaining in dry water bodies when Lake Chilwa dried up in 1996 (EAD 2000). For example, *Clarias gariepinus* is capable of breathing atmospheric air through a subranchial organ and can survive for days in air as long as it is in a moist place. The fish can move overland under damp conditions by extending its pectoral spines and crawling (Teugels 1995).

CATFISH SPECIES, STRAINS OR POPULATION FOUND IN MALAWI

Catfish species found in Malawi mainly belong to Bagridae and Clariidae with most of the cultured catfish belonging to the latter. The external morphology of clariid catfish is characterized by an elongated body with long dorsal and anal fins and the presence or absence of an adipose fin supported by elongated neural spines (Teugels 1983).

Five catfish species are widely distributed in Malawi and these include *Clarias gariepinus, Clarias liocephalus, Clarias ngamensis,*

Clarias stappersii and *Clarias theodore* (Snoeks 2004). *Clarias gariepinus* is, however, the most popular cultured catfish species in Malawi. Other species are found in ponds in isolated cases in Northern Malawi and Lower Shire River in the Southern Region of Malawi. Most of these were unintentionally introduced through pond inlets.

BREEDING OF CATFISH

Breeding of catfish is related to water temperature. Spawning takes place at temperatures above 18°C, usually above 22°C (Hecht et al. 1988). The size at sexual maturity varies from 150 to 800 mm in total length at an age of one to three years (Hecht et al. 1988). Gonadal maturation is associated with increasing water levels in temperatures and the photoperiod. Spawning occurs during summer dark nights, usually after a rain. *Clarias* produce between 50,000 and 200,000 eggs (Hecht et al. 1988). In Malawi, the spawning period observed spans from October to March (JICA 2001 and 2004).

Since the fish do not reproduce easily in captivity, several methods have been applied to help the fish to breed. Small-scale fish farmers in Malawi were able to breed catfish using natural methods (personal observation). In addition, artificial propagation with hormones has been successful at the Kasinthula Fish Farm (JICA 2004). Its wide application in Malawian aquaculture has been difficult because of the high cost of hormones, mostly fish gonadotropins; acetone-dried carp pituitaries sold at $279 per gram (JICA 2004). The most cost-effective synthetic releasing hormones (LHRHa and GnRHa) (Harvey and Carolsfeld 1993) might be a practical choice in Southeast Asia, but they are not popular in Malawi because of the high cost of importing the hormones. The National Aquaculture Center utilized pituitary glands from the common carp kept at the center (JICA 2001). Although the use of the common carp pituitary in catfish breeding was cost-effective, the efficacy of the pituitaries varied for various reasons, such as the variation in the manual removal of the pituitary gland, improper drying of the gland, and presence of harsh climatic conditions during storage. The JICA Aquaculture Project successfully applied and developed the procedure for spawning the fish by using fresh male catfish pituitary glands (JICA 2004). However, the wide application of the method is limited due to the need for a large number of male catfish to be sacrificed for their pituitary glands.

FEED AND NUTRITION

Clarias gariepinus is omnivorous and scavenges on virtually any available organic food source including other fish, birds, frogs, small mammals, reptiles, snails, crabs, shrimp, insects and other invertebrates, as well as plant matter such as seeds and fruit. It is even capable of straining fine plankton (Skelton 2001). The growth performance of this catfish species is not related to warm water as is the case with most other fish cultured in Malawi. This suggests that the fish is capable of growing under low temperature conditions as long as food is available. However, very little work has been done on the chemical analysis of the locally available animal feeds because of the lack of adequate and reliable laboratory facilities (Safalaoh 2002).

LOCAL FEED RESOURCES FOR CATFISH FEED PRODUCTION

AGRICULTURAL BY-PRODUCTS FOR CATFISH FEED

Agricultural by-products (from both crops and livestock) provide potential locally available sources of catfish feed. The national production of selected agriculture products whose by-products could be utilized in formulating catfish feed is summarized in Table 2. In addition, livestock and fish products are potential sources of animal protein in catfish production. Malawi has a total population of 765,000 cattle, 1.7 million goats, 500,000 pigs and 120,000 chickens (Government of Malawi 2004).

Table 2: Agriculture production during the 2001–2002 growing season

Commodity	Scientific name	Quantity ('000 tonnes)
Maize	*Zea mays*	1,625,985
Rice	*Oryza sativa*	94,215
Sorghum	*Sorghum bicolour*	39,155
Cotton	*Gossypium hirsutum*	41,463
Wheat	*Triticum aestivum* L.	1,520
Ground nuts	*Arachis hypogaea*	759
Soya beans	*Glycine max*	31,373
Pigeon pea	*Cajanus cajan*	105,315
Cowpeas	*Vigna unguiculata*	26,119
Bambara nuts	*Vigna sub terranean*	7,039
Chickpea	*Cicer arietinum*	1,811
Sunflower	*Helianthus annuus*	4,107

Source: Guide to Agricultural Production and Natural Resources Management in Malawi, 2002.

CATFISH FEED INGREDIENTS

Fishmeal is one of the commonly used animal protein sources in catfish feeds. Fishmeal production in Malawi is very low. Dwindling fish catches from natural waters do not satisfy the increasing demand and not much fish remnants are available for fish feed. As such, fishmeal is very expensive. Safalaoh (2002) reported a fishmeal unit cost of $0.46/kg compared with $0.25 for full fat soya bean meal. Assuming the crude protein content of 60 percent for fishmeal and 38 percent for full fat soya bean meal, protein from these sources cost $0.77 and $0.66 per kilogram, respectively. Most of the fishmeal used is imported from other countries such as South Africa and Chile.

Use of animal by-products from processing plants and slaughter-houses, such as blood, meat and bone meal is limited due to the low supply (Safalaoh 2002).

Soya bean meal is the most popular source of protein in fish feeds. Soya bean production in Malawi was low in 1990 because of the low price of the commodity on the market. However, in recent years, the production has perked up significantly, following the high demand for it by animal feed producers. Fish farmers are realizing the importance of feeding fish with soya bean-based feeds. They are advised to combine one part of soya bean meal to nine parts of cereals (maize bran). Trials are underway to develop plant-based fish feed formulations using soya bean as one of the main sources of protein.

Other oilseed meals and grain legumes that could be utilized in catfish feed include sunflower cakes, cottonseed cakes and groundnut cakes, pigeon peas, cowpeas and chickpeas. However, their use could be limited by inadequate supply.

PRIORITY AREAS AND LIKELY FUTURE DIRECTIONS

PROMOTION OF CATFISH PRODUCTION

The special air-breathing characteristics, together with extra hardiness and rapid growth to large size, make the fish an extremely suitable species for aquaculture development in Malawi. Catfish is one of the four fish species promoted for culturing in Malawi. Since most fish farmers are sparsely distributed, the ability of catfish to utilize atmospheric air enables transportation of this fish over long distances without a special oxygen-supplying facility. The catfish's ability to prey on other fish could be used as a means to control tilapia reproduction to avoid overcrowding in fishponds. Once the problem of nursing fry to the fingerling stage is solved, catfish production is likely to boom significantly.

PRODUCTION SYSTEMS

Malawi is committed to implement research programs on this species. The major focus will be on developing breeding and rearing technologies, conducting research on catfish feeds, and on growth performance of catfish in polyculture systems with tilapia species. Project results by ADiM (2005a) indicate that the polyculture of *Clarias gariepinus* with *Oreochromis shiranus* leads to larger *Oreochromis shiranus* as a result of reduced competition for food and an increased production of *Clarias gariepinus*. The National Aquaculture Strategic Plan (2006–2011) (Government of Malawi 2005) recommended aggressive promotion of the polyculture of *Clarias gariepinus* and *Oreochromis shiranus* as a future viable alternative aquaculture production system for Malawi. It further recommended the

National Aquaculture Center to initiate on-farm participatory trials to produce fingerlings.

HATCHERY OPERATIONS

The government encourages private sector participation in catfish fingerling production. It needs to develop guidelines that will guide hatchery operations nation-wide in order to accredit catfish fingerling hatcheries. The government of Malawi, with support from FAO, implemented a technical cooperation program to support small-scale catfish fish farming enterprises as one such effort to develop small-scale catfish hatcheries. Future directions will need to scale up the hatchery and grow-out activities for catfish.

BREEDING

The promotion of catfish production will be pursued in parallel with the development and implementation of a national catfish breeding program.

CONCLUSION

Catfish species offer a promising opportunity to contribute to food security and socioeconomic development of the nation. However, incorporation of catfish production into aquaculture in Malawi has been relatively slow. Prospects for its development are encouraging because of the existing high market demand, development of secondary industries such as fish feed manufacturing, and commitment from the government to promote its development. Despite these prospects, however, there is an urgent need to perfect the technologies for on-farm production. In addition, catfish production should go in tandem with a breeding program that will improve its performance under various culture environments.

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