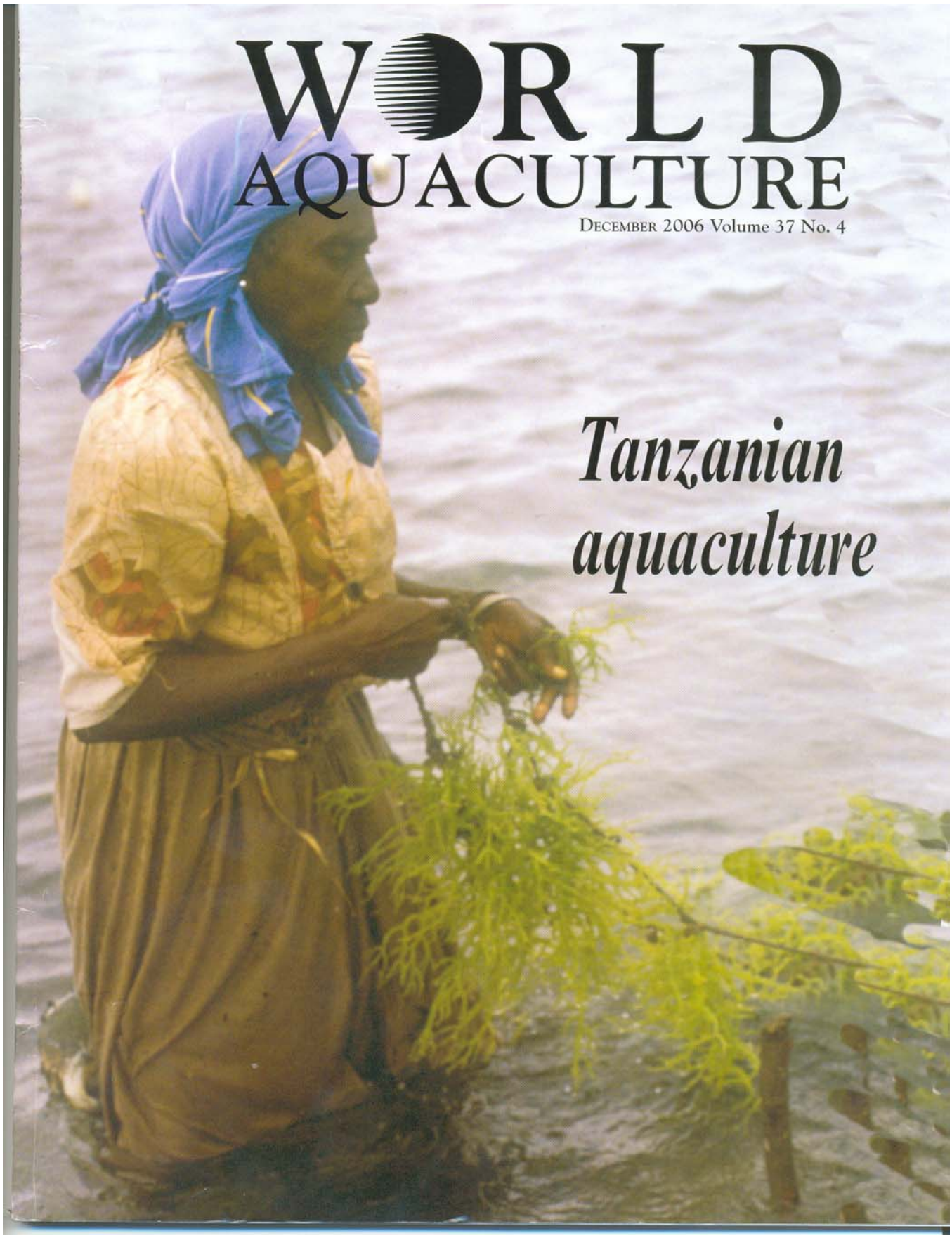


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Tanzanian aquaculture

Aquaculture in Tanzania

MICHAEL A. RICE[1], AVITI J. MMOCHI[2], LUGAZO ZUBERI[3] AND REBECCA M. SAVOIE[3]

Tanzania in East Africa claims over 2,300 km of coastline[4] along the Indian Ocean (Figure 1). The country has 945,087 km² of land area with an estimated population of 36,588,000 people as of June 2004, with a median population age of 17.8 years. About 50 percent of the Tanzanian annual gross domestic product (GDP) of US$21.6 billion is derived from agricultural production, with about 80 percent of the employment reported as agricultural (CIA 2004, Torrell *et al.* 2004). According to the Tanzanian National Bureau of Statistics[5], between 1967 and 2000 the population density along the coast more than doubled from14 to 36 people/km². Coastal regions in Tanzania are among the poorest in the country; 85 percent of coastal villagers are currently living on less than US$1 per day. Yet in the 1980s and early 1990s, these coastal regions contributed over 30 percent to the GDP, indicating a role for aquaculture industry development as a way to support economic growth in Tanzania. Coastal districts and city councils are beginning to acknowledge the need for strong coastal zone management, including the accommodation of aquaculture projects. As a result of the efforts of numerous organizations, local governments are beginning to implement strategies for the sustainable development of aquaculture activities and for preserving the numerous cultural and historic sites along the coast.

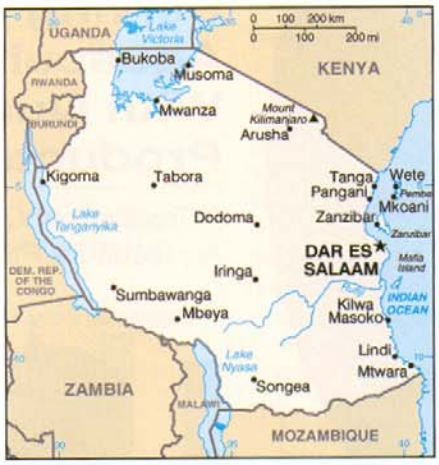


Fig. 1. Map of Tanzania showing major cities and offshore islands (CIA 2004)

Historically, Tanzania has a rich maritime trading history back to the 1200s when Arab and Persian traders established outposts along the ancient trading routes on the mainland in the towns of Tanga, Kilwa, Bagamoyo, and Mikindani and the offshore islands of Pemba, Zanzibar and Mafia. Sailing *dhows* from the Arabian Sea and the Persian Gulf, traders would ply the East African coast trading for gemstones, spices, ivory and other commodities utilizing the seasonally changing trade winds to propel the enterprise. Many of the coastal town and islands have relied heavily on fishing as the primary source of income. The exception is Zanzibar, which remains a vibrant tourist and trading center and is now the center of Tanzania's approximately US$1.5 million/year aquaculture industry.

Aquaculture began in Tanzania in the 1950s with the pond culture of tilapia species native to the region, includingMozambique tilapia (*Oreochromis mossambicus*), Nile tilapia (*O. niloticus*) and Zanzibar tilapia (*O. urolepis hornorum*). According to UN-FAO reports, international donor-funded projects were responsible for establishing an estimated 8,000 to 10,000 ponds with a total water area of about 1,000 ha, producing about 2,000 t of fish per year (Maar *et al.* 1966). The number of ponds fell to less than 2,000 in 1975 and to less than 1,000 by 1985 (Balarin 1985). At present, the UN-FAO reports that less than 200 t of tilapia are produced by pond culture, with most of the ponds in the regions of Arusha in the north and Mbeya, Iringa and Ruvuma in the south, with about half of the country's ponds located in the Ruvuma River valley along Tanzania's southern border (FAO 2001). A number of reasons are given for the decline of tilapia culture in Tanzania since the 1960s, including lack of proper management, the use of inappropriate technology, inadequate extension efforts, inadequate marketing due to poor transportation infrastructure, as well as competing sources of tilapia from active capture fisheries in Tanzania's western Great Lakes.

Despite a decline in pond tilapia production in the interior regions of Tanzania, pond culture of tilapia is now viewed as a possible source of livelihood for farmers in the coastal zone that are in closer proximity to the urban markets of Dar es Salaam. A joint pilot-demonstration project to raise tilapia is underway approximately 40 km south of Dar es Salaam in the Mfuru-Mwambao village area in the Mkuranga District. Project partners include the Tanzanian Fisheries Research Institute, the Tanzanian Coastal Management Partnership (TCMP) with United States Agency for International Development (USAID) funding, Institute of Marine Sciences of the University of Dar es Salaam (IMS-UDSM) with international non-governmental organization (NGO) funding, a local village partner NGO and Mr. Boniface Umella, a farmer cooperator who has been growing passion fruit, vegetables and ruminant livestock (cattle and goats) on his farm. The pond was constructed with 750 m² of surface area with a mean depth of 1 m, filled with water from the nearby Kinyembanyemba River, and stocked with 1,500 *O. niloticus* fingerlings. Management of the pond includes introduction of manure from the ruminant livestock and ducks maintained in a pen above the water (Figure 2). To control excessive breeding, typical of tilapia, a small number

of clariid catfish were introduced in mid-production cycle to control the fingerling population. First harvest from this project was scheduled for September or October 2005.

Bio-prospecting for various organisms suitable for aquaculture has been an important activity in Tanzania. For example, *O. urolepis hornorum* that have been used commercially as broodstock for the production of all-male offspring for monosex culture, originated in the Wami River of north-central Tanzania (Hickling 1960). Another species of tilapia, *O. karongae*, native to Lake Nyasa (Lake Malawi) in the southwestern part of the country is generating interest as a new aquaculture species because of its very rapid growth to marketable size (Msiska and Costa-Pierce 1999). As interest grows in the genetics of tilapia and improvements to genetic lines to enhance growth, cold tolerance, disease resistance and other characteristics to enhance their potential for culture worldwide, the ability to tap into the diverse natural pool of tilapiine fish genes becomes very important. Because Tanzania is a region with very high natural tilapiine fish diversity (Trewavas 1967, 1983), there is great potential for international scientific and commercial cooperation in the area of tilapia genetics and breeding.

Today, the major aquaculture crops are the carrageenophyte seaweeds *Eucheuma denticulatum*, commonly known as 'spinosum' and *Kappaphycus alvarezii*, commonly known as 'cottonii' from their former scientific names. These two species of seaweeds are sources of iota and kappa carrageenans, respectively, which are important worldwide as food additives and thickening agents in a number of commercial products. The global demand for carrageenan is increasing 5-7 percent per annum, so supporting the continued development of the Tanzanian seaweed industry is viewed as a good investment. Seaweed farming began in Tanzania in the mid-1970s with experiments by Prof. K.E. Mshigeni of the Botany Department, University of Dar es Salaam to culture *E. denticulatum* that he introduced from the Philippines on Zanzibar and Pemba Islands and Kigombe, Tanga on the mainland coast (Mshigeni 1976, Senei and Msigeni 1977). An extension manual on seaweed farming was published in 1983 in Swahili, the local language (Mshigeni 1983) and subsequently, a number of reports of the success of the pilot trials prompted increased investment by international carrageenophyte buyers (Mshigeni 1992). In the early 1990s, the relatively more valuable *K. alvarezii*[6] was also introduced from the Philippines and has been shown to grow successfully at a commercial scale in Tanzanian waters (Lirasan and Twide, 1993). Until recently, most seaweed production occurred on the offshore islands of Zanzibar and Pemba because of their close proximity to the seaport. However, within the last five years, exporters have invested heavily to initiate production of seaweed to suitable sites along the mainland coastline where there are large numbers of potential producers. A zoning system, demarcation of designated seaweed areas, to reduce coastal zone user conflicts was initiated 1998/99 in the three coastal districts of the Tanga Region. To date, some 37 ha of coastal zone have been zoned specifically for seaweed farming in that region (Lugazo 2000).

Peak production of seaweeds occurred in 1999 with production of about 7,000 t (Figure 3). Since that time, production has been steady with several factors contributing to the lack of growth in the industry. Production problems in recent years have been attributed largely to the onset of the so-called ice-ice disease that is likely to be of bacterial (*Vibrio* sp.) origin (Largo *et al.* 1998). The onset of ice-ice disease in Tanzania is more prevalent in *K. alvarezii*. Because *K. alvarezii* is more sensitive to salinity fluctuation than *E. denticulatum* during rain events, the former is usually cultured in deeper, more saline waters (Hurtado and Agbayani 2002). Epiphytic filamentous algae (EFA) are another serious threat to the health and productivity of seaweed but the problem is seasonal. Farmers also report stunted growth in the warm months of the year, December to February. The stunting phenomenon is thought to be caused by the introduced seaweeds being poorly adapted to the relatively high water temperatures of Tanzania (Ask *et al.* 2003).



Fig. 2. Tilapia pond with poultry pen at the Umella Farm at Mfuru-Mwambao in the Mkuranga District 40 km south of major markets in Dar es Salaam. Looking at the pond is Ms. Joice Kulekana aquaculture expert from Tanzania Fisheries Research Institute (TAFIRI). (Photo by Michael A. Rice)

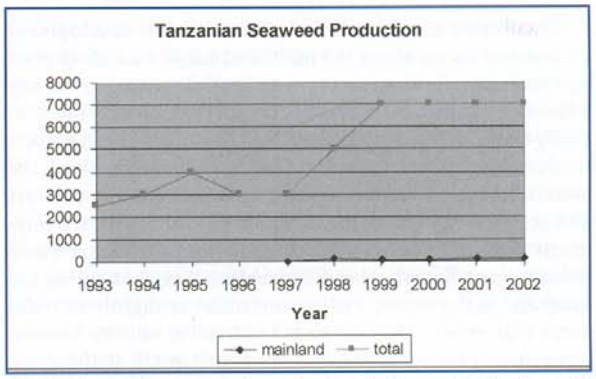


Fig. 3. Growth in seaweed production in Tanzania. The bulk of the approximately 7,000 t of seaweed produced in Tanzania is produced on the offshore islands. Data on mainland production is from the Tanzanian Fisheries Department, and data on total Tanzanian production is from UN-FAO.



Fig. 4. Experimental Raft culture system for Kappaphycus alvarezii at Moa and Kijiru villages of Muheza District, Tanga Region. (Photo by Lugazo Zuberi)

There are a number of reasons for the slow development of seaweed farms along the mainland coast, including poor transportation infrastructure with long distances to the key wholesale markets. All seaweed export operations are currently only on Zanzibar (Pettersson-Loftquist 1995). Efforts to develop seaweed farms in Tanzania have involved the establishment of marketing contracts between the growers and seaweed exporters that included provisions for the buyers to pick up dried seaweed directly from the farms. Farm management has also been a problem. Seaweed farms are generally in the warm, shallow intertidal or slightly subtidal areas that expose the seaweeds to stressful salinity fluctuations during the rainy season. The farms are in shallow water because the key producers are coastal women who generally do not swim.

Moving the seaweed farms into deeper waters is a critical component to increase production in Tanzania. One option is a method of floating raft culture currently used by some farmers for seed stock maintenance during the rainy season (Figure 4). The rafts are maintained offshore when the intertidal areas become subject to the influx of freshwater. This method was tested as a standard growout method at Kigombe, Moa and Kijiru with yields of *K. alvarezii* higher in comparison to yields from traditional intertidal peg and line methods. Despite promising experimental trials, the raft method has not been adopted for commercial production because of the general unavailability of bamboo for float construction and high materials costs for substitute float materials, such as plastic pipe.

In a few villages, such as Ushongo, seaweed farming is shifting into a family business so that men who are adept at working in deeper waters or have boats would assist in seaweed farming, making possible the more lucrative deeper-water culture methods. Other recommendations are developing a habit of business planning and record keeping among farmers and the formation of village producer associations to contract with seaweed buyers or other venture capital sources to better provide farm financing (TCMP 1999). SEEGAAD Project staff, with funding from USAID, is testing various basic business skills training models at the village level in coordination with district staff that will address these training needs and help form a business-oriented mariculture community. Association development is also being piloted in the Tanga Region. Eventually, seaweed associations could lead to in-country processing of carrageenan and other extracts as value-added products, which is a development that has successfully occurred in other carrageenophyte producing countries (FAO 2003).

One of the problems encountered by seaweed farmers in Tanzania is loss of their crop from grazing by rabbitfish (*Siganus* spp.) and other fish. Fishermen from seaweed farming villages often work around the seaweed farms and there is a strong market for rabbitfish in urban markets and consumers in the local villages readily accept the fish. Small scale cage and net pen culture of *Siganus sutor,* originally identified as *Siganus canalicullatus,* was conducted in the early 1980s and an extension manual in Swahili was developed (Bwathondi 1982). As recently as 2003 and 2004, staff of the Mafia Island Marine National Park initiated a rabbitfish aquaculture demonstration project. Despite their efforts, the culture of rabbitfish has not been adopted commercially in local communities. Problems identified included difficulty in maintaining fouled nets and cost of the gear. Although biologically feasible, costly cage culture systems cannot be adopted without greater extension efforts, financial support and an economic incentive to justify the effort in light of active and successful rabbitfish capture fisheries. One possible economic incentive for rabbitfish culture may provide alternative markets for seaweed as fish feed when the seaweed prices are low.

Because over 90 percent of commercial aquaculture production and sale in Tanzania is dried carrageenophyte seaweed, Tanzanian government policy in the last decade has been to encourage the development of alternative aquaculture species for both a source of foreign exchange and as livelihood opportunities in coastal villages. Pond culture of penaeid shrimp was one of the first to be considered in 1986 with a cooperative project between a Norwegian Aquaculture Company, the Bartz Group and the Bagamoyo Development Corporation. The plan was to develop a medium-sized semi-intensive shrimp farm in salt flat areas behind mangroves in the Ruvu River delta north of Bagamoyo. The project failed as a result of a land use rights dispute at the project site (Bryceson 2002).

In 1996-97 a large-scale (19,000 ha) shrimp farming project was proposed to be established in the Rufiji River delta region south of Dar es Salaam, which was touted to become the largest single shrimp farming operation in the world. Aside from the scale of the project, there were alleged questionable international financing arrangements, but the project happened to be proposed in an established mangrove forest conservation area. In 1998, the Tanzanian government granted the permits for the farm, which energized the Tanzanian and the international environmental community. After two years of public protest, intense investigation of

the project financing and the permitting procedure, and a lawsuit brought by the Lawyers' Environmental Association of Tanzania, the project was eventually halted and the Rufiji delta resumed its status as a protected mangrove conservation area. The experience with the Rufiji mega-shrimp farm project resulted in the development of a national investors guide to mariculture[7], favoring small to medium-sized shrimp farming operations, an increased level of oversight and routine monitoring. Early in 2005 a commercial shrimp hatchery (Alpha Group, Ltd.) after more than two years in the process, received permits to begin operations on Mafia Island with a target production of 50 million *Penaeus monodon* postlarvae per annum. The hatchery is designed to supply 112 ha of ponds permitted for growout operations on the island. There are strong markets for penaeid shrimp in Tanzania, particularly in establishments servicing the tourism industry, but most of the Alpha Group's shrimp production is planned for export.

Along the mainland coast as well as on Zanzibar, there are a few salt-making operations either operated by private individuals or by village cooperatives. These salt evaporation facilities are typically located in estuaries using the traditional method of large reservoir ponds that lead into a series of condenser and evaporation ponds to precipitate gypsum, potassium chloride and Epsom salts followed by numerous shallow crystallization ponds for final salt formation. In at least six instances the operators of these salt-making facilities have begun experimenting with the integration of aquaculture into their operations, including the culture of milkfish (*Chanos chanos*), known locally in Tanzania as *mwatiko* or *mkuyui*, in reservoir ponds and brine shrimp (*Artemia* spp.) in evaporator ponds. In one case, the Kirago Saltpans Company, a village cooperative venture located near Mpafu Village in the Mkuranga District, has undertaken the task of redesigning three reservoir ponds to accommodate the culture of milkfish and possibly shrimp from excess PL production from the Mafia Island hatchery. In a November 2004 pilot trial, 8,000 milkfish fry collected in the nearby estuaries were stocked into the three ponds with a total area of 2.2 ha. The ponds were managed with varying fertilization and feeding protocols to determine optimum future management strategies for their site. The ponds had nearly free exchange of water with the outside estuary and minimal predator control screening. As a result, by January 2005 the number of recovered milkfish by sample seining was very low and *cheche*, the Indo-Pacific tarpon (*Megalops cyprinoides*), a milkfish predator, could be found instead. Mr. Kirago and members of his cooperative in association with TCMP and Sustainable Communities and Ecosystems of the Coastal Resource Centre and partners are working on improvements on the flood gate designs for better predator exclusion. North of Tanga along the mainland coast, another salt-making company, Chongoleani Salt Farm, is undertaking pond modifications to the culture of *P. monodon*. Modification of the ponds includes the redesign of flood gates for better predator exclusion following practices used in Southeast Asia that allow mixed seasonal salt making and aquaculture using the same ponds. In addition to direct pond culture, the Mbegani Fisheries Research Institute is experimenting on cage culture of milkfish in reservoir ponds (Dubi *et al.* 2004).



Fig. 5. Saltpans at Makoba, Zanzibar converted to fishponds. (Photo by Michael A. Rice)

The SEEGAAD Project staff is assisting in the modification of salt making operations to incorporate culture trials of brine shrimp in their salt crystallization basins. Inoculation trials were initiated at four salt farms: Jasini, Kibo and Fakhri salt farms north of Tanga and Maere salt farm south of Tanga. All the trials have been halted because the brine shrimp failed to reproduce. Given that salt production is one of the key active economic activities in the Tanzanian coastal zone, relatively simple improvements in this industry to facilitate the dual use of the structures used for salt making and aquaculture could increase profitability. Further work is necessary to better modify salt crystallization ponds to help induce brine shrimp reproduction because production of brine shrimp in crystallization ponds is not only known to provide a secondary income for salt producers, but also improves the quality of the salt produced (Baert *et al.* 1997, Davis 2000).

On Zanzibar, a cooperative project among IMS-UDSM, and the Zanzibar Prisons Department, with cooperation of international institutions and funding agencies has been working on experimental integrated mariculture pond systems of finfish, shellfish and seaweed at Makoba (Mmochi *et al.* 2001). After a lengthy environmental impact assessment, which began in 1994 in preparation for the project the pond construction started in 1996 and in 1998, two series of three integrated mariculture pond systems were stocked with finfish (*Siganus canaliculatus*), shellfish and seaweed (Figure 5). Despite successful culture of rabbitfish, it was noted that milkfish coming in with the tide survived better in the ponds than rabbitfish. Early attempts to farm shellfish and seaweed in the ponds failed. After 2000, culture of milkfish along with mullet and salinity tolerant tilapia was conducted in the ponds. Studies at Makoba included investigation of stocking rates, feeding rates, feed formulation trials utilizing locally available materials (Mwangamilo and Jiddawi 2003) and polyculture of finfish, shellfish and seaweeds (Dubi *et al.* 2004). From October 2001 to August 2004, several stud-

ies were conducted in the Makoba earthen ponds to determine the availability, abundance, types and variations in potential live food for fish fry and fingerlings (Kyewalyanga 2003). The results indicated that earthen ponds at Makoba could be used to produce a significant amount of live food, especially when manipulated (Kyewalyanga and Mwandya 2004). Salinity plays a significant role in the succession of zooplankton in the earthen ponds. It was found that moderate salinity between 20 and 30 ppt coupled with fertilization produced the best results. Rotifers were found to be more abundant during the rainy season, while protozoa and copepods were more abundant during the dry period (Kyewalyanga 2003). Algal mats could be found throughout the year (Kyewalyanga *et al.* 2004).



Fig. 6. Mr. Hamad Khatib , Statistics Officer, Zanzibar Fisheries and Natural Resources Department, Zanzibar, Tanzania showing a giant clam held in an intertidal growout corral in the village of Fumba. (Photo by Michael A. Rice)

Studies undertaken in support of developing sources for milkfish and mullet culture included a survey of nursery grounds and fry/fingerling collection areas (Dubi *et al.* 2004). Sampling using a beach seine was conducted in nursery areas near mangrove stands at Maruhubi, Chwaka Bay, Mkokotoni and Nungwi. At Makoba a few holes of about 1.5-2 m diameter and 0.5 m depth were dug near the mangrove stands and the abandoned salt pans to trap water during the high spring tides and a piece of cloth or a scoop net was used to collect the fry and fingerlings. The fry were abundant during the full and new moons (spring tides) coinciding with rainy periods. Up to 500 fingerlings could be collected in the low spring tide period. The Mlalangaoni area was found to be a favorable place for fry collection for both mullet and milkfish and has a potential of being the supplier of fry for future farms in Tanzania.

Another study was done on the occurrence and seasonality of adult milkfish and mullet that could be used as broodstock for hatcheries. Adults are mostly caught with bottom set gill nets during the northeast monsoon, November to March, during spring tides, new moon and full moon and during the rainy period, March to May. In the landings study the milkfish were reported to occur throughout the year, with more catches in March to June when they come closer inshore to breed. The mean weight of the milkfish spawners was 12 kg.

There have been a number of projects undertaken to demonstrate the feasibility of culturing bivalve molluscs in Tanzania. Mr. N.A. Kayombo of the Tanzanian National Museum demonstrated the biological and technical feasibility of ark clam (*Anadara antiquata*) aquaculture along the southern coasts of Dar es Salaam using methods similar to those used in peninsular Malaysia and southern Thailand to culture a closely related species (Kayombo 1991). Despite the demonstration of biological and technical feasibility of growing ark clams, the practice was not adopted commercially because of a weak domestic market for the bivalves and insufficient production to gain access to international markets.

Mangrove oysters, *Saccostrea cucullata*, are abundant in Tanzania and are a potential culture species. A pilot oyster aquaculture project was conducted at Mwandusi village, 40 km north of Tanga in the Muheza District (Lugazo 1999). This pilot project demonstrated the feasibility of using artificial spat collectors to collect oysters and grow them to market size, but as in the case of the ark clams, the practice was not adopted in the local villages because of weak markets for the product and an abundance of wild oysters.

Bivalve shellfish were also cultured in the Makoba fish ponds on Zanzibar. The bivalves were grown together with fish inasmuch as they are filter feeders and assist in cleaning the water in polyculture operations. To stock the ponds, bivalve spat were collected from the village of Unguja Ukuu. *Pinctada margaritifera, Isognomon isognomon* and *Modiolus uariculatus* were put in hanging trays of 0.25 m^2. The bivalves grew well though mortality during the rainy period was high. The optimum density was found to be 1,500 bivalves/m^2. This kind of mariculture is expected to benefit local farmers, especially women who, in Tanzania, are the prime collectors of bivalves in the wild. There is potential for the introduction of bivalve farming to seaweed farmers.

Following the pilot studies at Makoba, demonstration mollusc culture projects were initiated in the villages of Fumba, Bweleo, Nyamanzi, and Unguja Ukuu on Zanzibar in cooperation with the staff of IMS-UDSM. These projects aim to demonstrate the culture of giant clams (*Tridacna maxima*) and other bivalve juveniles such as *Pteria penguin,* and *I. isognomon* and others gleaned from fringing reef flats at low tide. Throughout coastal Tanzania, women regularly collect from reef flats at low tide, shellfish that are frequently juveniles with little market value. The demonstration projects involve the construction of intertidal corrals (approx 15 m^2 each; Figure 6) from stones or mangrove wood that are owned and tended by individual women (Kite-Powell *et al.* 2005). These corrals allow for the gleaning of shellfish from the reefs, but also allow for holding the shellfish until they reach marketable size and potentially reproductive maturity. The success of these intertidal corrals as an aquaculture method in coastal villages depends upon the ability of the village to grant ownership over the shellfish to the women and to successfully

adjudicate cases of poaching or ownership disputes that might arise.

Given the importance of international tourism to the Tanzanian economy, aquaculture-tourism and production of aquaculture products for tourism-related markets may be viable economic options. For example, tours are arranged to visit villages conducting seaweed farming activities by resorts in the Mafia Island Marine National Park. Staff of the marine park itself, in partnership with Australian experts, began in 2002 to experiment with the culture of pearl oysters, *Pinctada margaritifera*. Half pearls were produced by insertion of a hemispherical nucleation bead between the shell and the mantle and the first crop was harvested late in 2004, demonstrating technical feasibility (Figure 7). Plans are underway by the park staff to expand the demonstration project and work with artisans to develop local markets for the pearls produced in the park.

Finally, in the three coastal districts of Tanga (Pangani, Muheza and Tanga) the SEEGAAD Project with technical support from CORDIO[8] are conducting field trials to demonstrate the feasibility of capturing and raising juvenile mud crabs (*Scylla serrata*) to market size (Figure 8). Juvenile crabs are captured, placed in mangrove wood enclosures and fed a mixture of fish offal, estuarine gastropods and oyster meats, using techniques developed in Philippines, Thailand and elsewhere in Asia (Agbayani *et al.* 1990, Rattanachote and Dangwattanakul 1992). Preliminary results suggest that growth and molting rates of the crabs in these pilot projects are similar to those reported from the same species held in fattening pens elsewhere. Efforts are underway to investigate the use of prepared feeds as a substitute for the fresh feeds currently used in an effort to reduce production costs. There are currently live and frozen crabs exported from Tanzania and exporters are interested in developing systems at the village level that will ensure long-term sustainable yields of the high value crabs.

In conclusion, there are a number of diverse projects underway in Tanzania to expand and diversify aquaculture production as well as to expand the aquaculture research and extension capacity within the country. With the an increased emphasis on market development and increased foreign investment in recent years, there is reason for optimism that ecologically sound and socially acceptable aquaculture projects will be an integral part of the building of a strong Tanzanian economy and serve as a means of livelihood for increasing numbers of ordinary Tanzanian villagers.



Fig. 7. Example of the first crop of Pinctada margaritifera half pearls that were produced by staff of the Mafia Island National Park in 2004. (Photo by Rebecca M. Savoie)



Fig. 8. Extension Agent Ms. Frida Urio working with villagers in Muheza on their project to raise mud crabs, Scylla serrata Forskaal, in mangrove wood enclosures. (Photo by Michael A. Rice)

Notes

Department of Fisheries, Animal and Veterinary Science, University of Rhode Island, 9 East Alumni Ave., Kingston, RI 02881 USA.

[2]Institute of Marine Sciences, University of Dar es Salaam. P.O. Box 668, Zanzibar, Tanzania.

[3]SEEGAAD Project, ACDI/VOCA. Room B202, Bandari House, P.O. Box 829, Tanga, Tanzania, headquarters: 50 F Street, NW Ste. 1100, Washington, DC 20001.

[4]There are several estimates on the length of the coastline of Tanzania ranging from 800 to 2300 km depending on the definition of 'coastline'.

[5]National Bureau of Statistics, Tanzania, 2003. www.nbs.go.tz

[6]In early 2005, average farmgate prices for dried 'spinosum' as 70 TSH/kg, with 'cottoni' at about 200 TSH/kg (TSH~1050/$US1).

[7]Available from: http://www.crc.uri.edu/download/TAN_0044.PDF

[8]CORDIO-Coral Reel Degradation in the Indian Ocean, for more information see www.cordio.org

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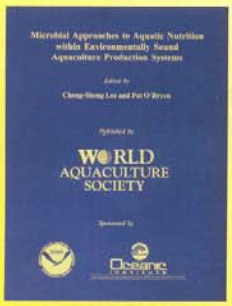
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