

The Role of Aqua Farming in Feeding African Cities

Rapid urbanisation in Africa (of about 7-10% per year), unemployment, food insecurity in urban and periurban zones and declining fish supplies are major issues that have to be addressed by local and national governments in the region. These issues are occurring against a backdrop of changing economic forces and trade patterns in national and international food markets in the region, causing significant proportions of the urban poor to engage in farming as a livelihood and household food security option.



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Large catfish farmed near Ibadan, Nigeria fetch premium prices in city markets

Research confirms the significance of urban and periurban agriculture for employment, food security and income generation (Drechsel et al., 2001; FAO, 2000). However, almost all studies relating to African urban agriculture in the past few years have excluded aquaculture (Spies, 1998; Jarlov, 2000). Consequently, its significance in and around African cities is largely unknown, but ad hoc information, especially in Nigeria, suggests it is a growing phenomenon.

Aquaculture is regarded as being uniquely placed to reverse declining supplies from capture fisheries (mean caput fish availability in Africa declined 20% between 1990-96) and the activity has notable potential for new livelihood opportunities. It can provide the mechanism for lower-priced fish, enhanced nutritional security and employment for poor communities by servicing urban markets (Jagger and Pender, 2001). Aquaculture also provides an important opportunity to recycle wastes generated by zero grazing and other agriculture practices increasingly common in the region's urban and periurban zones. In this way it can contribute positively to growing urban waste disposal issues and add value to scarce water resources (Asomani-Boateng and Haight, 1999). Failure to engage in such opportunities could increase social costs and environmental risks, and worsen trade balances.

FISH PRODUCTION

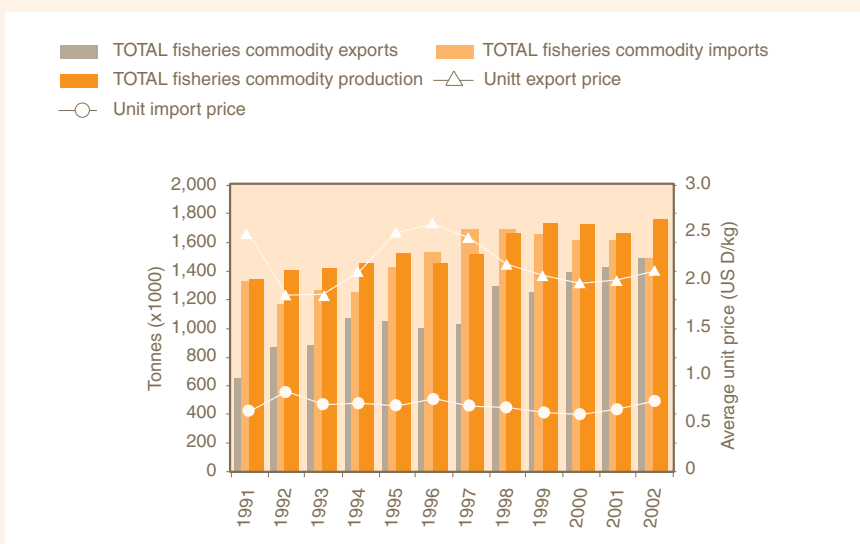
Figure 1 highlights the growth in exports of fish products from Sub-Saharan Africa (SSA), which takes fish away from local consumption, and increases reliance on imported fish products to supplement indigenous supplies. Although the potential of aquaculture in the region and the changing impacts of urbanisation are noted, the lack of a realistic knowledge base to inform policy and planning processes to promote aquaculture is a severe constraint.

One of the challenges facing local and national planners is provision of the infrastructure and services needed to facilitate and secure food supplies for the burgeoning cities. In assessing the potential role of aquaculture to supply these open markets one needs to be realistic and to take into consideration current fish supplies, prices and products demanded.

Fishery production in SSA reached 5.3 million tonnes in 2002 with five countries

accounting for 50% of production; but including a significant proportion for non-human consumption. Following globalisation in trade, however, much of the fish extracted from African waters is being exported. Exports doubled from USD 1.6 billion in 1990 to over USD 3.2 billion in 2002 whilst the value of imports remained static. SSA countries are exporting higher unit-value commodities and are importing lower unit-value products, especially cheaper frozen fish, to meet demand. Average unit prices of exports varied between USD 2-2.5/kg while the value of imported fish was only around 20-25% of this price (Figure 1).

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If aquaculture is to meet (local) urban demands, producers will have to consider the comparative advantage of what they might produce, especially its competitive price position. Frozen herring and mackerel and other frozen fish dominate the imports, accounting for around 60-75% of total imports in 2002 (in Nigeria, Ghana, Ivory Coast and Egypt). One explanation for their popularity is their low price (USD 0.4-0.6/kg), which may well influence the cost ceiling of any aquaculture activity, and certainly if it is aimed at mass markets.

One other major constraint to the development of urban/peri-urban aquaculture in SSA has historically been the almost "tunnel-vision" focus of both large and small scale aquaculture development projects on the importance of promoting rural aquaculture primarily as a vehicle for poverty alleviation amongst poorer rural communities. As many know the results and outcomes from this developmental strategy have been mixed to say the least with many infrastructural problems resulting in low overall uptake.

It is highly likely that as long as these conditions prevail aquaculture producers in (peri)urban zones will not be able to compete with cheap imports and therefore fish farmers may have to focus on niche markets for large, live or fresh fish depending on their productivity, market preferences and investment risks of their money and time.

THE ROLE OF URBAN AQUACULTURE

In several African countries the potential of aquaculture for urban employment, income generation and food security is being increasingly recognised, but the markets for aqua products, economic viability, typology and locations of these activities are largely undocumented. Recently, DFID (the UK Department for International Development) through its research arm, the Aquaculture and Fish Genetics Research Programme, funded a project to establish the potential role of aquaculture in selected U and PU zones in SSA. This project is being conducted jointly by the Institute of Aquaculture and World Fish Centre in Egypt with partners from Nigeria, Cameroon, Uganda, Tanzania, Malawi and South Africa. The primary focus of this

collaboration is to: (i) understand the macro- and micro-economic and social environments in urban centres of demand for aquatic products, (ii) assess the market structure and aquatic products to establish the current conduciveness of urban and periurban zones for aqua farming and (iii) establish whether aqua-farmed products can compete in the marketplace. As part of this initiative the role of local institutions will be appraised, with particular regard to the policy and planning process for aqua farming.

In Nigeria, the culture of large catfish in urban and periurban zones is carried out by local residents including civil servants, teachers, engineers, and trained unemployed youth, who have developed home-grown tank and other technologies. This semi-intensive or intensive catfish farming takes place in

that fish are commonly fed on homemade feeds using local ingredients and equipment, although the lack of a viable commercial feed industry has forced some operators to use imported

Many fish farmers in Dar Es Salaam considered rearing fish in ponds as an activity that increases their social status

feeds. Although catfish are also produced in ponds in periurban zones, the problems of theft and high land costs have constricted the uptake in urban and periurban zones. Development of recirculation systems over the last decade and growing market demand has generated considerable interest even though initial capital costs are relatively high and has attracted many to invest their personal savings in catfish farming.

Table 1. Characterisation of aquaculture activities by municipality in the city of Dar es Salaam, Tanzania*

Municipalities	Number of farmers**	No. of fish ponds	Total area of ponds (m ²)	Average area (m ²) per pond (range)
Kinondoni	14	18	24,315	135 (10-10,000)
Ilala	5	6	3,530	294 (80-2,400)
Temeke	13	24	21,100	879 (65-10,000)
Total	32	48	48,945	
Average	10	10	15,365	1,653

*Data are based on a field survey conducted from the 20-30 June 2002.

** Farming groups are considered as one entity.

small land areas in and around cites such as Lagos. Interestingly, many of these entrepreneurs are women with no previous knowledge of aquaculture but an enthusiasm to learn and be trained.

In these cities catfish is cultured mainly in tanks of varying sizes ranging from 1-50 m³, which are linked to recirculation systems of varying degrees of sophistication and in earthen ponds. Since catfish are air-breathing fish they can be stocked at high densities, and these were observed to range from 10-200 kg/m³. A further cost advantage is



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Trout processing facility near Cape Town, SA

Aqua farming in Dar es Salaam, Tanzania, is not as well developed as in Nigeria and it differs in that tilapia is the predominant species of culture in (peri)urban areas. This may be attributable to the scarcity of and limited access to land within the Dar es Salaam metropolitan areas and lack of cost-efficient tank systems and technical know-how. A preliminary survey in three geo-political municipalities of the city of Dar Es Salaam, viz. Kinondoni, Ilala and Temeke, suggested that around 50 ha of land is used for fish farming activities. Pond size ranged from about 10 m² to 10,000 m².

In the periphery of Dar es Salaam, city aquaculture is growing fast albeit in a novel form. Periurban fish culture is combined with commercial interests with a passion for aestheticism. More than half (55%) of fish farmers interviewed considered rearing fish in ponds as an activity that increases their social status, but also one that produces tangible rewards (through selling the fish) to

supplement their income. These farmers were mostly senior (and in some cases retired) government and military officials, business personnel and elite individual farmers. This category of farmers considered fish culture as a small-scale income-generating activity but not necessarily as an important livelihood option. Local pub owners, however, believed that if they established fish ponds nearby they could supply fresh fish to their customers for immediate consumption.

Although aquaculture development in South Africa is in its infancy, many city municipalities have recognised the potential role of aquaculture in livelihood options. Several cities, such as Durban, have formulated an urban agricultural policy that includes aquaculture as an economic activity. Ornamental fish rearing is considered a possibility and trout farms are being established by disadvantaged groups in periurban zones. In view of its rich marine resources South Africa has a well-established formal and informal marketing structure. To encourage economic activity, improve sanitary conditions and encourage the distribution and sale of fish, many municipalities have constructed fish marketing sites. Recent surveys have indicated that traders are receptive to

aquaculture products provided quality and price expectations are met.

A problem identified in most cities is the quality and suitability of available water for aqua farming. In the case of Dar es Salaam some water bodies may be contaminated with heavy metals such as lead and cadmium and therefore these sites may not be suitable for aqua farming. In addition in most of these zones city by-laws are not conducive for both aquaculture and agriculture. Efforts will have to be focused on local institutions to create an enabling environment to encourage ordered expansion of aqua farming to meet the rising demands from cities.

CONCLUSION

The above case studies of urban and periurban aquaculture show that it has the potential for playing an important role within the growing urban markets in SSA. Evidence suggests that there is quite diverse recognition and interest in the potential contribution of aquaculture to local food supplies, especially in market segments with comparatively few alternative competitors. Whilst the wider availability of imported frozen low unit-value pelagic species is likely to remain a serious constraint to the expansion of high volume, low-cost-focussed production systems, their very

presence may well provide the financial incentive and stimulus for some expansion of current activities in the future.

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Tilapia Culture in Homestead Concrete Tanks in Periurban Nigeria

This is a shortened version of the full article, which is available at www.ruaf.org

Two major constraints to the establishment of fish culture enterprises in Nigeria include lack of initial capital input and the acquisition and ownership of land. The rental price of land suitable for modern and conventional pond fish culture becomes prohibitive and unaffordable especially in urban centres because of competing and conflicting uses. Family-scale (backyard) aquaculture in periurban areas has been recommended in Nigeria as an economical method of producing fish. The homestead concrete tank has been developed as an alternative and suitable enclosure for backyard fish culture.

to establish; little land space and little costs are required. It is easy to maintain and can be as functional and as productive as earthen ponds. The sites required for establishing homestead tanks demand no acquisition costs and



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Simple backyard tank for catfish in Lagos, Nigeria

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There is considerable potential for achieving Nigeria's objective of increasing fish protein production, especially in urban centres, by farming tilapia in homestead concrete tanks. The homestead concrete tank is not expensive



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Informal markets selling locally produced smoked trout near Cape Town, SA

are not dependent on factors such as natural water source, topography, clay content and alkalinity of soils. Commencement of construction is possible irrespective of the prevalent season as opposed to construction of earthen ponds which takes place preferably during the dry season. Total drainage is possible and the water level is easily controlled without using additional labour during harvesting. All fish harvested are either consumed or sold locally. The enterprise can be expanded or discontinued as desired at little additional costs.

Tilapia is the most important fish used in aquaculture in Nigeria because of its hardiness and fast growth. Tilapia culture in Nigeria in tanks is a recent practice, hence there is little information available on it. The economics of this practice, especially the returns on investment, was studied by the authors to assess and determine its viability for possible development into large-scale enterprises under the "Poverty Alleviation Programme" for urban dwellers implemented by the Nigerian government. Two concrete homestead tanks were designed and constructed to study the economic and technical feasibility of hybrid tilapia culture in periurban Lagos, Nigeria.

Two leak-proof, above ground, homestead concrete tanks (6m x 4m x 1.3m) were designed and constructed at the backyard of a family house in suburban Lagos, and this was used for the study. The materials used for construction were reinforced cast concrete and cement blocks. Drainage outlets were elbow-joint PVC stand-pipes installed at the side of the tank. The tank bottoms were lined with a layer of river sand to a depth of 3 cm, with broken blocks and gravel to serve as biological filter and to maintain a stable pH of 7-8. The tanks were subsequently flooded with municipal (pipe-borne) water to a

depth of 1.2 m. Water in the tanks was completely drained and refilled at the end of every month to maintain good water conditions for tilapia growth.

Due to small size and shallowness of concrete homestead tanks, the carrying capacity is low and therefore mono-sex (hybridised) tilapia fingerlings (< 50 g) were stocked at 6 fish/m² into the concrete tanks, and were cultured for 120 days (which is a one cycle of production). Hybrid tilapia was selected because of its hardiness, adaptability to overcrowding and availability from government fish seed multiplication centres at moderate costs. Next to indirect fish feed, poultry wastes (900 kg/ha/wk) served as organic fertiliser by spreading it over water surface. Soybean cake was used as supplementary feed and fed once daily at 5% of the total fish body weight. Complete harvesting was carried out after both tanks were drained after each production cycle lasting 120 days. Water temperature and pH in the concrete tanks were monitored throughout the culture period.

The full article will be available at the ruaf website, including data on growth, survival and yield, etc. The hybrid tilapia used in this study are fast growing and with their omnivorous feeding habit, attained market size of > 180g after each production cycle lasting 120 days. The economic viability of the system was evaluated and a sensitivity analysis was conducted on the impact of changes in input prices and productivity on the

internal rate of returns. The latter was more than 95%, and compared with bank loan interest rates of between 23% and 25% in Nigeria, the yield is higher by a very wide margin. These are substantial incentives for investment in such a project. Technically, the system could be easily adopted by urban dwellers, but it would need proper management.

The study revealed that tilapia can be successfully cultivated in peri-urban homestead concrete tanks and can be both economically and technically viable. This practice could greatly enhance the current low per-capita fish protein intake, and when widely accepted and extensively practised could reduce the existing deficit between fresh fish supply and demand in Nigeria. There is a need to introduce and encourage the practice nation-wide and it should be backed with adequate extension service and publicity with the aim of creating awareness.

Some Basic Assumptions for Computing Costs and Returns

- The projected amount of sales is not more than 90% of the production for the period.
- Fish mortality and loss of fish were put at 10% of stock.
- Market-size of adult tilapia was estimated to be 180 g.
- Output was estimated based on three crops of tilapia per year.
- Sales of table-size tilapia was estimated at 100/kg (US\$ 1/kg) which is very conservative.
- Approximate weight of fish is obtained by average weight x total number of fish produced.
- Cost of fingerlings was calculated at current market prices.
- Poultry waste was obtained free, only transportation cost was computed.
- Increase in cost of soybean cake (feed) will take care of inflation and price changes.
- Personnel cost was not included, as household labour was readily available at no cost.
- Expected life span of homestead concrete tank was taken to be ten years.
- Cost of capital (interest rates) in Nigeria is 23-25% on loans granted by commercial banks.

Periurban Aquaculture in Ghana

Fish farming was taken up enthusiastically in the late 1970's by the Accra Metropolitan Assembly (AMA) as an alternate income-generating venture. It was seen as an important part of the "Operation Feed Yourself" (OFY) that was launched by the then government. Efforts were made to develop fish farms on all available land that could not be used for farming at that time and where water was readily available. A few of the fish farmers made successes, but due to lack of training and information the majority ran

into management problems. The fish farming programme to reduce poverty in the urban and periurban community failed. Within the last five years also, fish

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Pacific Farms

farming or aquaculture as an enterprise is becoming acknowledged by both urban and rural communities, but is gaining ground especially in urban centres.

The fish farming programme could be seriously taken up again through the creation of an enabling environment and training on the right and appropriate methods to get this industry sustained. For the periurban areas, it is necessary to

facilitate the integration of urban agriculture to local government programmes, which should involve all categories of urban farmers and other stakeholders. In addition it would be



necessary to treat the rivers and streams flowing through the metropolis which are currently polluted through the dumping of waste (liquid and solids). Proper zoning and locating ponds/dams together with vegetable farms would enable mutual benefit and a maximum use to be derived

from the treated water. Furthermore, training of fish farmers and of Agricultural Extension Agents (AEA's) should be considered and the subsequent provision of the necessary tools and equipment will enhance their ability to extend efficient services to the fish farmers. This was the essential part that was virtually missing from the fish farming package that was brought in when the programme took off in the earlier 1970's. Urban marine fishers (as the owner of Pacific farms) could be supported to diversify during closed seasons, which will also positively impact the decline of scarce marine resources. Although not many ex fishermen tend to turn to fish farming, because of the difficult situation with land ownership. The metropolitan authority has an important role to play to facilitate recycling of urban wastes, education and training, poverty reduction and employment generation for both the

NANA KWAKU SAIW , A SUCCESS STORY

Martin Kumah is in his Ghanaian community better known under his traditional stool name Nana Kwaku Saiw. Martin started farming at the age of 11 but was trained at the Kumasi Technical Institute as Auto-mechanic which allowed him to take up a job at Kumasi University where he become the University's Transport Officer thanks to his dedication, good overview and hard work. But Martin also continued his agricultural pursuits. He acquired a farm, and started with poultry, rabbits, and different crops. In 1998, he received the award of the Best Urban (Metropolitan) Farmer of Kumasi during the annual Farmers Day celebration. In 1999, Martin was even the Best Regional Aquaculture Farmer of the whole Ashanti Region and resigned from his job at the university. With more time for farming, he received in 2002 the award for the Best National Aquaculture Farmer, and topped this in 2004 with the second highest award possible in Ghana as the first runner up to the overall Best National Farmer. Hard work and diversification has paid off!

Both, urban farming and aquaculture were milestones on Martin's carrier path. As a celebrity, he presented two papers on behalf of Ghana's farmers at the UN World Summit on Sustainable

Development in South Africa in 2002, on invitation by IWMI, and was supported by FAO to undertake training in Uganda and Thailand.

There are about 700 fishponds in the Ashanti region producing fish, many in valley bottoms unsuitable for construction. These ponds are mainly earthen with few being concrete. Both extensive and semi-intensive systems of fish culture are practiced but semi-intensive is the most dominant either of monoculture or more often polyculture. All fish farmers practice supplementary feeding. Feed is obtained from the local markets and these include maize bran, brewery waste, groundnut husk, groundnut paste, green leaves, coconut fibres etc. Fish feeds differ from region to region depending on staple crops grown. In our interview, Martin mentioned that specified formulated fish feed is lacking, and farmers use what is locally available. On the other side, this allows also for flexibility and independence of supply services. The most crucial part is timing of sales. In contrast to urban vegetables, free fish is abundant during the dry seasons when it is easy to catch in temporary or slow flowing water bodies. Thus without any investment in fish farming many non-fish farmers can make good business, as Martin explained. But in



the rainy season, the situation turns around, and aquaculture becomes highly competitive.

Today, Martin is specialized in fingerling breeding for other farmers starting up in aquaculture. He is specialized in tilapia and catfish and is using the water from the ponds for vegetable irrigation during the dry season. Asked which parts of his business he would drop in economic crises or when he gets old, aquaculture was not mentioned.

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youth and women in the metropolitan community. Favourably to (peri)urban aquaculture producers in Accra are the high demand of fresh urban fish, better prices, and the availability of information on markets and production. An example is Pacific Farms, near Accra (see box).

PACIFIC FARM

Mr Bonney started Pacific Farms after early retirement from former national Shipping Company, the Black Star Line. Pacific farm is located at about 22 km

from Accra Central, on the Nungua - Ashiaman road. It started with three earthen (non-drainable) ponds, but quickly expanded to nine ponds in 3 years and a piggery and ducks.

Because the pond cannot be drained, harvesting has always been partial. The water used is a combination of groundwater and rain floods. Pig manure mixed with urine is allowed directly into ponds.

The main harvest for the year scheduled to coincide with low fish production from

marine sources (i.e. December – March/April). The farm receives continuous free technical advice from the Directorate of Fisheries and the Institute of Aquatic Biology (now part of water Research Institute), which together with the availability of good markets form the advantages of Pacific Farms.

Theft is a major problem. The farm has expanded into onions, cattle and ostrich farms-which are now the flag –ship commodities of the farm.

Urban Agriculture in Istanbul, Turkey

Turkey has been defined as a bridge between Asia and Europe. These two continents and their civilizations have left many marks on Turkey and the Turkish people. For thousands of years in Anatolia (Asian part) and Thrace (European part) life has been mostly based on agriculture. Istanbul, situated on this bridge, is growing rapidly as it attracts immigrants from rural areas. It is there that this initiative on urban agriculture is situated.

Although Turkey is developing rapidly, its population of nearly 30 million people is actively connected to agriculture and rural production. But in the rapidly growing cities one finds the setting for the most important problems facing Turkey today. Turkey's unemployment rate has not dropped below 6% for the last 15 years and associated problems such as migration to the city, social adaptation of these people to city culture, adequate planning and design, and environmental pollution are especially apparent in Istanbul. Istanbul is one of the largest and oldest cities of the world with a population of nearly 12 million. And although urban agriculture is an old tradition in Istanbul, there are currently only a few examples known of food production within the city limits. One main problem the inhabitants of Istanbul face is securing access to food. Furthermore, there are other problems, in Istanbul as well as many other cities, affecting further development of urban agriculture, like the prohibitive costs of renting land and the lack of access to (clean) water and other inputs. A first official urban agriculture project

started in Turkey in early 2004. It is coordinated by the Ulaşılabilir Yaşam Derneği, UYD (Accessible Life Association), which is one of the prominent NGOs of Turkey. UYD was founded soon after the big earthquake in the orth-western part of Turkey in 1999, and it has been implementing various projects on rehabilitation of people under risk, employment of disabled people, and social integration of cultural minorities (Gypsies, Syrian Orthodox people, etc.). The urban agriculture project in Istanbul is seen as a model for Turkey rather than an isolated project activity. The project has started on a 40 dekar (4 ha) field in Gürpınar, which is a municipality under the larger city of Istanbul. The main target of the project is to support and train unemployed, poor women of Gürpınar in developing agricultural activities and to sustain these urban agricultural activities in the future. Twenty-five women have so far been trained in organic agriculture, composting, processing and marketing, and organisation (of cooperatives for example). They have organised themselves and agreed on the production plan, which is currently being implemented in the field. After

the first cultivating activities, which will take place this summer until August, all of the profit gained from the crops will be distributed among the target group. In August these initial results will be presented in a national seminar in Istanbul.

This project is a good example of (international) cooperation and participatory work. The EU is supporting this project within the framework of the "Active Labour Market Strategy Project, the New Opportunities Programme" financed by the CFCU (Central Finance and Contract Unit). ETC is collaborating with UYD by providing advice on project implementation and monitoring, and by helping to disseminate information (a first issue of the UA Magazine in Turkish has been produced by UYD). Also, ISKUR (the Government Employment Office of Turkey) has been monitoring and evaluating the project. The municipality of Gürpınar is playing a very important role in this project by allocating the field and machinery needed. Through this project and with the support of the municipality, the women farmers, and others, UYD aims to provide a strong example of the potential of urban agriculture and a realistic hope for many poor people in Istanbul and other cities in Turkey.



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