

# Production and Marketing Systems of Aquatic Products in Ho Chi Minh City

Ho Chi Minh City (HCMC) is the second city of Vietnam located in the South-Eastern part of the country. With an area of 209,370 ha, HCMC is currently inhabited by almost 6 million permanent residents. About 83.3% of the population lives within the urban area, creating a very high population density with a diverse and dynamic economic environment. Aquaculture is an important component of the city's economy, but increasingly so in the periurban areas.



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People are involved intensively in morning glory pre-processing

**T**he contribution of the agriculture-aquaculture sector in GDP of the city's economy has been continuously decreasing from 2.2% in 2000 to 1.4% in 2005 and is predicted to be only 0.8% in 2010 (HCMC website). Industrial and service sectors are more important, and will increase further according to the city's development plans. Also the area available for the agriculture sector has been reduced from 128,760 ha in 2000 down to 121,235 ha in 2005 and is expected to decrease even more to 107,465 ha by 2010.

All these figures indicate that more and more pressure will be placed on urban agriculture as well as aquaculture activities in HCMC in the near future. Although the decline of agriculture and aquaculture within the "intra-urban" areas is perhaps inevitable, there is however a corresponding increase in aquatic production in "periurban" areas on the outskirts of the city. Further development in aquatic production in these areas requires the active involvement of those growing fish and aquatic plants in future urban development plans. Until now, these stakeholders have received very limited

support in this area from the government and from the City Authority.

## TWO MAIN SYSTEMS

Periurban aquaculture in HCMC can be classified into two major types: wastewater-fed and non-wastewater fed systems. Wastewater-fed aquaculture systems are more common because most wastewater from the city goes directly to the Saigon River, which is the main water source for the city's current aquaculture areas. The nature of the wastewater drainage system has created a wide and diffuse dispersal system of wastewater and wastewater fed aquaculture.. These aquaculture systems are usually located in lowland areas of the city, into which most of the wastewater from the city eventually flows. Without a specific and functionally constructed drainage system, this source therefore provides very good nutrient-rich wastewater especially rich in organic matter, which can be used for many types of aquatic production systems. Non-wastewater systems are located mainly in more elevated land areas of the city. Both fish and aquatic plants are cultured in these periurban aquaculture systems. Periurban aquaculture in HCMC can be

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classified into different systems based on species cultured and level of intensity. Fish are commonly raised in **monoculture** or **polyculture** pond systems. Aquatic plants including water spinach (*Ipomea aquatica*) and water mimosa (*Neptunia oleracea*) are also grown in pond systems. Both fish and aquatic plant systems can be either wastewater or non-wastewater fed.

Traditionally people in HCMC have been using untreated wastewater mainly for tilapia seed production whilst the Hanoi systems uses sewage for fish culture in a range of different aquaculture systems. Furthermore Hanoi sewage fed aquaculture is concentrated mainly in one lowland district where sewage is transferred into, whilst the wastewater of Ho Chi Minh City is discharged into many lowland districts around the city through the complicated river channels system. These distinctions between the two cities imply that HCMC may need greater effort for the future good management and planning of wastewater aquaculture.

#### CONSTRAINTS

Industrial contamination of the city's wastewater from small scale-industries located within domestic areas is a major constraint to the continued viability of aquaculture in some areas.. The City Authority have attempted to relocate some of these industries into industrial parks/industrial zones located outside the city where there are properly designed and functioning wastewater treatment systems. Through these efforts, the situation has improved in some periurban areas. Da Phuoc Commune, a study site of the PAPISSA project, is a very good example. In this commune wild fish, which had disappeared a long time ago due to pollution and over-fishing, are now starting to come back to farmers' fields. According to the farmers, fish are coming back to their fields due to water quality improvements, resulting in the relocation of these household industries.

Flooding is another constraint that farmers face every year. Aquaculture, especially wastewater-fed, is commonly practiced in lowland areas of the city where water levels change with the daily tidal regime of HCMC. In the rainy season, the impact of this tidal regime is exacerbated by considerable volumes of

rainwater, causing flooding particularly in Phong Phu and Da Phuoc Communes in Binh Chanh District. (study sites of the PAPISSA project). Flooding doesn't only cause stock losses for periurban fish farmers, it can also lead to unmanageable pollution of ponds, which has in the past caused significant fish kills. Farmers in areas which flood cannot afford to take major preventive measures against flooding other than to set up nets around their ponds which although preventing fish losses from overflows, cannot limit uncontrolled inflows of wastewater.. Support from the government is needed to help with this problem.

Although the City Authority has designated some regions of the city for agriculture/aquaculture development, aquaculture areas in many other places within the city are being developed into residential zones and used for public construction projects. Land use priority is rarely given for aquaculture purposes. Periurban aquaculture is not really on the agenda of the City Authority. This leads to uncertainty regarding the future of urban aquaculture development. Farmers also receive limited information about future city planning and thus are reluctant to take the high risk of investing further in their aquaculture activities. This lack of investment into inputs and infrastructure very definitely holds back aquaculture within the urban development process. Availability of hired labour is also a constraint in many places (e.g Da Phuoc, Phong Phu, Dong Thanh Communes) where there is a common trend that only older household members are involved directly in aquaculture activities whilst the younger generations are drawn to other non-agricultural jobs. This does create a problem of labour scarcity, especially during harvesting periods. Fish farmers in Da Phuoc Commune have to hire labour from other outside districts (e.g. Nha Be District) at higher rates. Conversely there is high availability of hired labour in Thu Duc District where water spinach growers can easily find labourers for their harvesting and preliminary processing before sale. Though this is relatively low paid labour, it is considered attractive work by local people in the District and as a result confers a relative advantage for water spinach farmers and their future in the District.

#### TILAPIA SEED PRODUCTION

Tilapia seed production in HCMC started very early in the 1960s in District 6, but had disappeared from this district by 1985 due to the pressures of urbanisation. Seed production moved to District 8 where it developed slowly over the years until its peak in 1998. At that time the total area of tilapia seed production in the district was nearly 200 ha, with a total of more than 100 households involved in the activity. Since then the total area and number of farmers involved has again been declining due to urbanisation and industrialisation, including wastewater pollution, changing farmers' aspirations (farmers want to improve their living conditions and sell their land for money instead of keeping it for aquaculture), increasing land prices, and the pressure of the government's urbanisation projects. As a result, tilapia seed production has now become a more minor income-earning activity in District 8, and Binh Chanh, a district located farther away from the city centre, has now evolved into the main place for wastewater-fed aquaculture systems, including tilapia seed production but also many other aquaculture products. The estimated total production of tilapia seed in this area is based on the production of about 600 tons of fingerlings, which is equivalent to 150 – 200 million tilapia seed. This is enough to meet 90% of the demand for tilapia seed in South Vietnam (Hung, 2000). These farmers not only supply tilapia seed for the south of Vietnam but also for the entire country. The "black" strain of tilapia is traditionally and commonly produced though other strains have been introduced to periurban farmers including GIFT and hybrid red tilapia strains.

Wastewater is utilised very efficiently in this type of production system. Tilapia fry are produced in plankton-rich pond water fed by nutrients from wastewater. Before stocking the fish, wastewater is usually supplied to the pond by gravity for 2 – 3 weeks allowing the water colour to change to a green colour indicating it is rich in phytoplankton. Taking advantage of the short breeding cycles of tilapia, farmers annually produce four cycles of seed and one crop of table fish per year. Brood fish are renewed by selection from newly produced seed. Using this technique the total number of

ponds for individual farmers practicing seed production is at least four and thus it requires more land than other systems. The products from this type of system are not only tilapia seed but also table fish. With high productivity and diversity of products, this system gives farmers opportunities to improve their living conditions and to stabilise their livelihoods. However, as wastewater is becoming increasingly polluted, seed producers have to manipulate the water supply to avoid production losses due to fish kills.

### FISH POLYCULTURE

Many fish species with different feeding behaviours are stocked in a pond to feed on natural foods at all different layers of the pond water column. This system maximises the natural food utilisation in the culture system and therefore supplemental feeds are used very sparingly. The most commonly cultured

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fish species in this system are tilapia, common carp, grass carp, silver carp, pangasius, and catfish, of which tilapia is the most preferred species. This fish polyculture system is very popular in both wastewater-fed areas (Da Phuoc, Phong Phu Commune, Binh Chanh District) and non-wastewater areas (Long Thanh My Ward, District 9; Dong Thanh Commune, Hoc Mon District). While wastewater is used as a major nutrient source, animal manures, which originate from household integrated livestock systems, e.g. from pigs, ducks, or from collection are the main sources of nutrient in non wastewater fed systems. Farmers carry out different species composition and stocking densities within their ponds based on their own knowledge and experience, and as a result their productivity and returns vary greatly between different households.

### FISH MONOCULTURE

With a higher stocking density, this model can be considered as a more intensive and relatively recently new pond based system which has been driven by increasing purchasing power, in which high quality supplemental feed is required as natural foods are not able to supply the total nutrient requirement

of the fish. High value fish species such as red tilapia, hybrid catfish, giant gourami, etc., are cultured in these systems using manufactured pelleted feeds. Tilapia and red tilapia are the most commonly cultured species in Phong Phu, Da Phuoc Commune, Binh Chanh District; Long Thanh and My Ward, District 9. Catfish are also used for monoculture systems in some households in Da Phuoc Commune, Binh Chanh District, in which catfish monoculture ponds are fed with trash fish and slaughterhouse waste. Giant gourami is another preferred species for monoculture systems in Dong Thanh Commune, Hoc Mon District. However, because the feeding behaviour of this species is different, nutrient sources for giant gourami monoculture ponds are mainly plant-based materials, including duckweed and grass (in Dong Thanh Commune) or water spinach leaves (in Tam Phu Commune, Thu Duc District).

### WATER MIMOSA CULTURE

This type of system is usually found in two main areas in HCMC, Binh Chanh District and District 12, where the water quality has been found to be suitable for water mimosa. Low investment and simple cultivation techniques help farmers to generate high levels of income from growing water mimosa. Water mimosa needs duckweed (*Lemna sp.*) in the pond to shade the water in order to prevent competitive phytoplankton growth. Many farmers in Binh Chanh District (Phong Phu Commune) are combining water mimosa with fish culture but in separate ponds. Fish culture can utilise the duckweed better and improve the profit of combined systems. For these farmers, water mimosa is a daily income source and fish is a longer-term income source. Tilapia is the dominant species in these systems, while kissing gourami is cultivated to maximise the potential for duckweed consumption by the fish. In Thanh Xuan ward, District 12, migrants, especially from the North, are involved in water mimosa production, which indicates that this is an attractive and lucrative source of income. Water mimosa is grown widely throughout periurban areas of HCMC, however the systems appear to be particularly affected by industrial contamination of wastewater. Disease of this vegetable is a problem and as yet there is no apparent support and research to alleviate this problem.



Water mimosa culture in District 12

Farmers therefore lack technical knowledge especially on water mimosa diseases. Water mimosa cannot be grown in heavily polluted water, so this type of aquaculture practice may collapse if water quality continues to decline through industrial pollution.

### WATER SPINACH CULTURE

Morning glory is suitable for cultivating in the wastewater environment, and may also provide a good income source for farmers, especially in Tam Phu Commune, Thu Duc District. In this commune there are many lowland fields with high acidity and polluted wastewater, which are unproductive for either rice or fish culture. This large area of water spinach cultivation supplies a considerable amount of produce to the city's markets. Rice fields have been gradually converted into water spinach fields by the farmers themselves, which are more profitable. This changing land use has also led to declining rice yields in the remaining areas of rice fields that face a corresponding increase in rice field predators such as rodents, birds and snakes. Although the farmers in this commune are ambivalent about the benefits of wastewater, they do use it to fertilise their water spinach ponds since it is the only source of water supply available. This wastewater-fed aquatic production system plays a considerable role in the livelihoods of many people living in these periurban areas.

Some households combine fish culture with water spinach cultivation but in different ponds and/or places. The by-products i.e. the water spinach leaves are used as a feed input for nearby fish ponds. Because these leaves are used as the main food source for fish culture, the fish species cultured are quite different than in other systems in Binh Chanh District. The main species are giant



## SWOT ANALYSIS FOR THE DEVELOPMENT OF PERIURBAN AQUACULTURE IN HO CHI MINH CITY

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>- Strong interest from most of the farmers involved</li> <li>- Technically simple and easy to practice</li> <li>- Low inputs required</li> <li>- Good way of natural resource utilization</li> <li>- Good way of wastewater processing, environmentally friendly activity</li> <li>- Farmers' main occupation</li> <li>- Farmers involved have strong capability</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>- Industrial contamination of wastewater sources</li> <li>- Little concern by government</li> <li>- Low contribution in the City's economy</li> <li>- High level of vulnerability from production losses</li> <li>- Limited choice for water supply and uncontrollable water quality</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- High and increasing demand for aquatic food products from the city</li> <li>- Large potential future markets for aquaculture products</li> <li>- Ornamental fish culture – new aquaculture practice encouraged by local government to resolve the land use constraint in periurban areas</li> <li>- Development of proper sewerage system may reduce industrial wastewater contamination and create new places for sewage-fed aquaculture</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>- Pressure from urbanisation and industrialisation on land use</li> <li>- Industrial waste contamination</li> <li>- Untreated wastewater usage</li> <li>- Presently unknown and unquantified risks for human health</li> <li>-- Competition and attraction of high price of land</li> <li>- Availability of other food sources for the city</li> <li>- Availability of alternative jobs for the young generation</li> <li>- Development of sewerage system</li> </ul>

gourami (*Osphronemus gouramy*) and kissing gourami (*Helostoma temmincki*), which can digest and utilise aquatic plants most effectively. Because it takes a relatively longer time for giant gourami to reach marketable size (18 – 24 months), farmers also add some other species such as tilapia, grass carp and pangasius into their ponds in order to have partial harvests which supplement their household income and food supply.

### MARKETING

Collectors transport fish and aquatic vegetables from the producers to consumers in HCMC, although many other actors are significantly involved in the distribution process. Wholesalers are the key link between producers and retailers, whilst retailers are the vital link between wholesalers as well as collectors and consumers. Wholesalers are the main customers of collectors and they sell products mainly to retailers. About 66% of fish and aquatic plants produced in periurban areas are sold to consumers by retailers. Seasonal fluctuations of price occur between the in-season and off-season production periods, especially for aquatic vegetables. Prices of water spinach may increase from a low of 400 VND/kg in the rainy season (May–October) to a high of 3000VND/kg during the dry season (November -

April), when it is much more difficult to produce. Conversely the price of fish rarely fluctuates between seasons as fish can be cultured year round and because a high proportion of supplies originate from outside of the periurban zone.

### CONCLUSION

Aquaculture activities in periurban areas of HCMC are still widely and actively practiced and are important in a number of periurban communities with a variety of different aquatic production systems. However, they increasingly face constraints as the city develops. Under pressure from urbanisation, aquaculture will have to move further out from the urban areas, which will require more active and constructive efforts from both the government/city authorities and also from the farmers themselves. In the near future, the term “periurban” has to be understood in a wider context – not just limited to within the city's demarcated area but perhaps further out to parts of the neighbouring provinces.

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