The numerous plots located around wetlands in peri-urban Phnom Penh, are important sources of edible aquatic vegetables and fish for the city and other areas of Cambodia. These areas are fertilised by domestic sewage/wastewater discharged from the city. The activities relating to these production systems are intrinsically linked with the livelihoods of many poor people living in and around the city.

A study and appraisal of the value and impact of these systems was carried out in 2003 as part of an EC funded study in order to understand their sustainability within the overall future development of the city. Four major study areas in and around Phnom Penh were identified as indicative of peri-urban communities where fish and aquatic plants are cultivated. Kbal Tumnub and Thnout Chrum are two of the main villages located about 5 kilometres from the city centre around the city’s largest wastewater-fed lake (Boeung Cheung Ek, 3403 hectares). Up to 80% of Phnom Penh’s domestic wastewater is pumped into the lake, as well as industrial and chemical effluents from a growing industrial sector, which is also located around the lake. Both villages are known for the cultivation in the lake of considerable volumes of edible aquatic vegetables, especially water spinach (Ipomoea aquatica) – commonly known as morning glory, and water mimosa (Neptunia oleracea). Boeng Kok lake is a smaller urban wastewater-fed lake located closer to the city centre, where residents of the adjacent village raise snakehead (Channa striata), walking catfish (Clarias batrachus) and river catfish (Pangasianodon hypophthalmus) in net pen enclosures often located under their houses, which are built on the banks of the lake. The same fish species are also raised in ponds and cages in a more peri-urban community (Prek Phnov) situated about 10 kilometres to the north of the city close to the suppliers of trash fish from the Great Lake, which are used as a seasonal input into fish feed for the farmers’ production.

Commercial production of aquatic vegetables in the city was first established prior to the country’s civil war (pre-1970) when Phnom Penh was known as “The Peaceful Island”, but expansions in production were hampered by poor market access. It became re-established on a more commercial scale after the Pol Pot era (1975-1979), when many people returned to both Phnom Penh and the surrounding areas after almost 10 years of relocation and severe war. Aquatic vegetables, especially water spinach, began to replace rice in Boeung Cheung Ek Lake using the city’s increasing supply of sewage and as markets became re-established.

Aquatic vegetables are now intensively cultivated throughout the year. Wastewater provides most of the nutrients, but additional fertilisers and pesticides are also heavily applied. In Boeung Kok Lake, fish farmers feed canteen and restaurant waste, as well as rice and vegetable by-products, to their fish in pens. Pig pens and household waste water pump

\[\text{Morning Glory growing in waste water-fed lake}\]
Feeding fish along the lake

On the majority of the plants are grown in

consumers can eat it fresh and cooked; it is an important aquatic vegetable product sold

markets in the city to take fish and

Retailers from the provinces come to the

transportation from farm to market.

increasingly use small trucks for

product by motorbike directly to the

wholesalers as they transport their

the producer to consumer through

Aquatic food products flow from

of vegetables in Phnom Penh.

Water spinach seed is obtained from the

other villagers. When the water dries up

in some parts of the lake people grow

water spinach on the land. These plants

will then be used as the subsequent seed

stock for growing on in water. River
catfish seed originating from natural

sources and hatcheries in Vietnam are

obtained through traders. Hybrid Clarias
catfish seed also mainly come from

Vietnam.

The aquatic vegetables and fish produced

by these communities are mostly sold

fresh in marketplaces both inside and

outside the city. Collectors transport

these products to the marketplace where

various traders are involved in buying

and selling them. Aquatic vegetables

account for nearly half of the total sales

of vegetables in Phnom Penh.

Aquatic food products flow from

producer to consumer through

middlemen or the wholesalers.

Sometimes the producers themselves are

the wholesalers as they transport their

product by motorbike directly to the

markets in the city. The middlemen

increasingly use small trucks for

transportation from farm to market.

Retailers from the provinces come to the

markets in the city to take fish and

aquatic vegetables back to the provinces.

Water spinach is by far the most

important aquatic vegetable product sold

for human consumption. Urban

consumers can eat it fresh and cooked;

the majority of the plants are grown in

wastewater. Lower-quality water spinach

is also used to feed livestock (mainly pigs)
during the dry season. Some urban

consumers prefer cultured fish raised

around the city, since it is often sold at

lower prices than other types of fish. The

major species are river catfish, walking

catfish and snakehead. Although the price

of pangasius (river catfish) is lower, there

is still little demand for this fish among

higher-income consumers in Phnom

Penh because of a widespread perception

that it is raised in latrine ponds and pens

using wastewater.

Recent studies indicate a number of

health-related impacts of urban

aquaculture within these communities

especially affecting the poorer sections

which have a seasonal dimension. These

include diarrhoea and skin infections,

which are at their most prevalent from

April – June) at the end of the dry season

and beginning of the rainy season. These

problems are probably due to decreasing

water levels in the lakes leading to the

accumulation and concentration of waste

products resulting in poor water quality;

this starts in January and becomes acute

by March. Fishing and fish trading by

people with lower incomes decline during

this time of year and these people are

then more likely to seek off-farm

employment in construction, transportation

and the logging industries. Fish

farms also tend to sell their fish at

this time. The critical season for this latter

group is at the onset of the cooler months

(October to November) when fish disease

is most likely. In the communities in

which aquatic vegetables and fish are

important, livelihoods are much more

diversified. Employment in local factories,

motor taxi driving and the rearing of

livestock are also all important sources

of local household income.

Declining value of aquatic vegetables and

availability of affordable credit are the

major problems for aquatic vegetable

producers. Many of them take credit from

NGO micro-credit schemes administered

by small associations within the

communities. A large proportion of

producers also take credit from private

lenders at high rates of interest. Some fish

farmers are also in debt to private lenders

or friends and relatives. Their fish farming

systems require relatively high levels of

inputs, and as result credit is very

important for them.

Although periurban areas are directly

administered by Phnom Penh

Municipality, there are a number of other

institutions which have roles and

responsibilities in these areas. There is a

lack of clarity about the role of some

institutions with respect to urban

aquatic systems in Phnom Penh,

especially those concerned with, and

relating to, aquatic vegetable production.

These institutions usually work

independently and are separate from the

communities. The local people do not

participate or have a voice in the

planning process. The government has a

policy to promote aquatic production

through recycling of wastewater by using

natural water bodies such as Boeung

Cheung Ek. However this in not reflected

in any effective zoning as there are an

increasing number of factories and

growing industrial sector around the

lake, making the future livelihoods of the

people who live around and depend on

the lake uncertain. Increasing urban

population and demand for residential

construction may also pressurise the
government to implement plans to fill up

Boeung Kok lake to make room for the

construction of residential housing, which

in turn would increase the volumes of

waste disposal and night soil. In

contrast, fish farming in non-wastewater

in Prek Phnov is likely to continue to

grow in the near future as there are no

immediate demands for the land and the

systems are responding to high demand

in the urban markets and are supported

by good access to a relatively good

quality water supply, and reliable

supplies of fingerlings and feed.

The livelihoods of the people who depend on the lake are uncertain

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tus of peri-urban aquatic food production systems.
Water spinach producer in Beoung Cheung Ek Lake, Phnom Penh

Mrs. Kim Bunthach is one of the water spinach farmers in Kbal Tumnob village (Beoung Cheng Ek area, Phnom Penh). During the Pol Pot era, she moved from the city to a refugee camp near Thailand’s border (Saiy B). She repatriated from Saiy B to live in Kbal Tumnob Village in 1991. At 40 years of age she has seven children, four of whom attend a local public school. Two of her sons have dropped out of school to help her with her farming activities and business, whilst the two youngest (a 5-year-old daughter and a 2-year-old son) are not yet of school age. She spends a lot of her time working in order to support her family and pay her children’s studies. In the past she has requested permission for her children to study in a local NGO-funded school, but this was not permitted because her living standard is considered good enough to support them. Her husband is a government worker, who uses his free time to help in the water spinach farm. Mrs. Bunthach rents a 2500 m² area plot on the lake located 400 metres from her house.

Generally she spends 6 hours per day harvesting water spinach. During periods when her aquatic vegetables are not growing well and she therefore cannot collect them, she spends about 2-3 hours taking care of the plot. In general there are 2-3 cropping cycles per year, because the water spinach can be destroyed by disease, bad weather or lack of water during the dry season which causes the plot to dry up. The rest of her time is spent tending to a small business at home, however when she is busy harvesting water spinach she has no time for this, so one of her children is left in charge of the business.

Mrs. Bunthach can collect 300-400 bunches (0.3 kg per bunch) of water spinach per day, which she can do continuously for up to a week. After a week the quality of the remaining crop deteriorates, and the plants need to be sprayed to allow regeneration and new growth. Mrs. Bunthach can then begin harvesting again after a further two weeks. Besides harvesting, which is her main daily activity, she has to remove unneeded aquatic plants, keep the water spinach floating rafts in order, and routinely spray chemicals and pesticides. She has been farming water spinach since 1991, when the aquatic vegetable had a much lower value than it does now. Water spinach is sold by weight (3000 Riel per 10 kg – 1 USS = 4300 Riel). Since 2000 demand for the crop, and consequently its selling price, has been increasing. Mrs. Bunthach thinks this is because many new garment factories are being built locally, thereby increasing the demand for food and vegetables from the growing workforce. The price of one bunch of water spinach ranges from 100-350 Riel depending on the season.

The price is highest in the dry season from December to July, because of low water levels and hence poor water quality in the lake. As a result, the overall quality of the water spinach also decreases. To marginally improve the quality of the plants in the dry season, she can pump water from the other part of lake, which does not dry up, into her water spinach plot and also spray the plants with chemicals. This lower quality water spinach can also be sold at a lower price for livestock (mainly pig) feed.

During harvesting Mrs. Bunthach often hires 2-3 persons for an average of 2-3 days per month to help her. Daily payment for hired labour depends on the external worker’s effort: the more bunches they can collect, the more they earn. Generally the workers are paid 7000 Riel for 100 bunches.

Her water spinach is generally sold to regular customers, however, some is also sold to other customers when the price offered is higher. Two months ago the owner of Mrs. Bunthach’s plot chose to stop renting it out, so she has had to stop farming for a while, until she can find another plot to rent. She pays 40,000-50,000 Riel for the chemicals needed to spray her aquatic vegetables. This provides her with enough chemicals to spray the crop 3-4 times. Since they generally need to be sprayed twice a month, this amount will last two months.

Mrs. Bunthach faces many challenges in her daily life both as a mother of many children, a working farmer and also a local business owner. Since she does not own any land and the land owner can take back her plot with little prior warning, it is risky to invest her own time and money in planting and caring for the water spinach. Competition for available land and as a result plot rental prices are also increasing. Moreover, plant diseases and poor water quality in the dry season can damage her crops, as well as storms in the rainy season, which can cause widespread flooding in the village, also making it more difficult for farmers to transport their produce to market.

When asked about the future Mrs. Bunthach believes that the future of water spinach farming in peri-urban areas, especially at Beoung Cheng Ek lake, is in the hands of the government. If the government chooses to develop this area for other urban development purposes e.g. construction of residential or industrial sectors, then the cultivation of water spinach will gradually disappear.