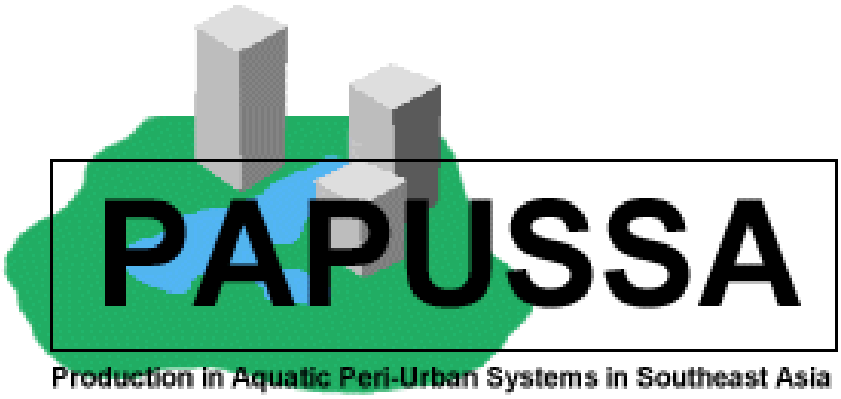


INCO: International Scientific Cooperation Projects (1998-2002)

Contract number: ICA4-CT-2002-10020

Report on Baseline and Monitoring Survey in aquatic producer households in peri-urban Hanoi

(Survey duration 14/4/2004 to 29/1/2005)

by

Nguyen Thi Dieu Phuong

Pham Anh Tuan

Nguyen Thi Hanh Tien

Pham Bau

Ho Kim Diep

Nguyen Thi Tan

Keywords: Baseline, Monitoring survey, livelihood, peri-urban aquatic food production systems, Southeast Asia, Hanoi, Vietnam

Project homepage: http://www.papussa.org

Acknowledgement

We would like to give special thanks to Mr. William Leschen for his time contribution in comments in advance, grammar correction to achieve quality for this report and completion.

Thank you very much Dr. Francis Murray, William Leschen (Stirling University), Albert Salamanca (Durham University) for your very good training with the Access database. It is truly difficult at first, and then we understand this powerful program and practice how to manage it now in order to pull out survey results.

We would like to give thanks to all 209 households in Bang B, Tran Phu (Hoang Mai district), Dong My (Thanh Tri district) and Duc Tu (Dong Anh district), who stopped their work to spend time with us during 100's of separate visits to answer questionnaires for the Baseline and Monitoring surveys which greatly helped us get all the essential information towards building this report. Thank you Mr. Luu Bach Hoa - Deputy Head of Bang B village, Mrs. Luu Thi Sen -Head of Agriculture Cooperative in Hoang Liet, Mr. Nguyen Manh Son – Deputy Head of village 5 in Dong My commune, Mr. Do Duc Phuc – Head of Agriculture Cooperative in Duc Tu commune for your very helpful key informants as well as your guide to visit individual households.

Thanks for the enthusiasm of our team working for PAPUSSA at RIA1– we did work well. Sorry Mrs Diep and Mr Bau for your hard work, dangerous accidents damage during transport far from your home to survey villages and under hot sunshine in summer time. At your age now (50-70 years olds) you should be relaxing with your grandchildren. With your considerable life experience, patience and good people skills in interacting with so many different people you were able to get such good results. Whereas the younger members of the team (25-30 year olds), hard working women with character, enthusiasm and your full efforts in surveying in the field, good contact with producers, good at computer, etc we do hope that Ms. Tien, Mrs. Tan and Mrs Phuong can develop into good researchers. We made a nice team!

Finally but not last, we would like to thank you Dr. David Little and Dr. Pham Anh Tuan for your success making "Production in Aquatic Peri-urban Systems in Southeast Asia" a special project. We truly love PAPUSSA, and by each member working in this project we have gained many benefits and developed not only in research methods, but also improving our language skills, and interaction with overseas researchers from both other neighbouring SE Asian countries as well as European partners which we can readily develop in the other future work and projects.

On behalf of our team,

Nguyen Thi Dieu Phuong

ABBREVIATIONS

AFPS	Aquatic Food Production Systems (including both fish and aquatic plants)
HHH	Household head
HHs	Households
MG	Water Morning Glory
Mill. VND	Million Vietnamese Dong – currency of Vietnam
Non-ww	non-waste water
P&P	Progress and Planning meeting
PAPUSSA	Production in Aquatic Peri-urban systems in Southeast Asia
RIA1	Research Institute for Aquaculture No. 1
VAC	Term in Vietnam "Vuon – Ao – Chuong" or Garden – Pond - Livestock integrated
WC	Water Cress
WD	Water Dropwort
WM	Water Mimosa
ww	Waste water

CONTENTS

List of Tables

List of Figures

Abstract

A baseline and three monitoring surveys were carried out from 14/4/2004 to 29/1/2005 in 209 households involved in producing fish and aquatic plants in four communities in Bang B, Tran Phu, Dong My and Duc Tu in peri-urban Hanoi.

The objective of these surveys was to understand better the different livelihoods aspects of aquatic food production households and to determine their problems and challenges and to predict the future development of aquatic food production systems (AFPS) in peri-urban Hanoi.

Production of fish and aquatic plants is contributing to local jobs and livelihoods of households (HHs) in peri-urban Hanoi. 61.9% of HH members in our survey were involved in producing fish, aquatic plants, vegetables, rice or livestock activities. Proportionately, there are more women involved in producing aquatic plants than men. More men tend to be involved in fish farming.

The respondents of the surveys were Vietnamese household heads living or working in the commune. 70.4% of the HHs surveyed in all 4 communities did not take out loans from any sources of credit. But among those who did, borrow money to invest in shrimp and aquatic plants farming. The fish farmers use the money they loaned to buy feeds, fingerlings and equipment. These investments are important in areas newly converted to aquaculture such as Dong My and Duc Tu.

In the communes of Bang B and Tran Phu where wastewater is used and recycled in the aquatic plant and fish farming production systems, a higher proportion of skin, back problems, eye problems, fever, necrosis and fungus of nails were reported. It was significant that an average of 4 and 6.7 health problems per HH was reported in Tran Phu and Bang B, respectively, both using urban wastewater compared to the non-wastewater commune, Duc Tu, where there was only an average of 2.8 health problems per HH.

AFPS production in Hanoi is seasonal except for, water morning glory (*Ipomoea aquatica)* which is produced throughout the year averaging 142.96 tons/ha/HH in wastewater. During summer, morning grlory farms are rotated with water mimosa (*Neptunia oleracea)* and water dropwort (*Oenanthe stolonifera)* and water cress (*Rorippa nasturtium-aquaticum)* produced in winter to produce between 78.5 to 221.29 ton/ha/year and higher net income of 5,980.03 US$/ha – 7,828.65 US$/ha compared to a single production of morning glory of 1,193.66 US$/ha -5,875.60 US$/ha. However, to produce aquatic plants most growers manage smaller plots averaging from 153.82 m^2 to 852.65 m^2 for easy management compared to fish farmers who use 1,620 m^2 - 108,000 m^2. By-products from morning glory production are used to

feed grass carps by 37.8% of HHs in Dong My and 36.6% of HHs in Duc Tu. For peri-urban fish production, the main species cultured are grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), the Indian major carps (mrigal, *Cirrhinus mrigala*; rohu, *Labeo rohita*), bighead carp (*Aristichthys nobilis*), and increasingly tilapia (*Oreochromis niloticus*) contributing food for the city that averages from 2.5 ton/HH/year (Bang B) to 32 ton/HH/year (Tran Phu) depending on the pond size noting that some of this production is also sold to outside provinces. Average yield from wastewater fish polyculture ranges from 5.89 ton/ha/per year - 6.66 ton/ha/per year and the highest average net income per hectare 2,953.80 US $ due to those fish farmers who have large production areas (i.e., 18.25 ha ponds). Producing 0.94 ton/ha of fish in non-ww rice fields within 6 months is significant in giving a net income of 156.54 US$/HH per hectare in large land area 70,307 m^2/HHs compared with non ww fish polyculture average 4.4 ton/ha per year with 930.45 US$/HH per hectare in small pond area of 4,549 m^2/HH .

The main difficulties encountered by aquatic producers in all 4 communes were lack of water for production due to different water levels of canals and rivers acting as receivers of wastewater from the city supplying AFPS fields. The water supply is also affected by the pumping station operation which is mainly supplying waster for rice fields and land vegetables. Other difficulties reported include lack of capital, diseases of fish and aquatic plants, wastewater quality, and fish seed quality.

The producers perceived that AFPS communities far from Hanoi (Duc Tu, Dong My) will, in the future, change to cultivating high value species and increased the intensity of production. There are some, however, who expect no change in their current status. However, with urbanization closing in especially in Bang B and Tran Phu communes, the perception from producers these areas is that AFPS will be reduced in the near future.

Part 1 Introduction

Hanoi, the capital of Vietnam, is the cultural and political centre of the Vietnamese nation. With a total area of 920.97 km² and a population of nearly 3.08 million people and more than 1 million visitors annually, it is one of the most densely populated cities in the world, with an average population density of 3,000 persons per km² (General Statistics Office, 2004).

This large number of people and high population density consequently produce a large volume of wastewater. Hanoi city discharges nearly 500,000 m^3 of domestic sewage daily and by night, and 25,000 m^3 – 300,000 m^3 wastewater /daily and night coming from industries and services (Ministry of Science and Environment, 2003). This currently flows directly through the To Lich, Kim Nguu, and Nhue rivers to the south of Hanoi city and beyond into Ha Tay province. This nutrient-rich wastewater is used for fish culture and the cultivation of aquatic plants in Thanh Tri district of Hanoi.

Previous results of Participatory Community Appraisals (available at Papussa website www.papussa.org) carried out in 2003 have been obtained by the PAPUSSA project as being indicative for peri-urban aquatic food production in Hanoi: Hoang Liet and Tran Phu communes are close to the main wastewater canals and use high volumes of the city's wastewater. Dong My commune is located in the same district but is further away from the source of sewage and less dependent on it. Duc Tu village in Dong Anh district was chosen as a control commune as it uses relatively cleaner water from the Ngu Huyen Khe River (Branch of the Red river system) and has completely no access to Hanoi city's wastewater source.

To better understand aquatic production and livelihoods of households involved in aquatic production in Hanoi, The Research Institute for Aquaculture No. 1 (RIA No.1) implemented a Baseline and 3 Monitoring household surveys in those 4 communes of peri-urban Hanoi.

Part 2 Objectives of Surveys

The overall objective of this study was to produce in detail a holistic overview of households who are primary stakeholders involved directly in any Aquatic Food Production Systems (AFPS -fish and aquatic plants) in Hanoi.

The more specific objectives of the study were:

- To understand better the different aspects of the livelihoods of the households involved.
- To identify the actual needs of AFPS households in their production activities
- To determine the actual problems and challenges that AFPS households are facing
- To predict the future development of AFPS's in peri-urban Hanoi
- To disseminate to the city authority the status, importance, benefits and constraints of AFPS and involved households' livelihoods for appropriate actions to be taken.

Part 3 Methodology

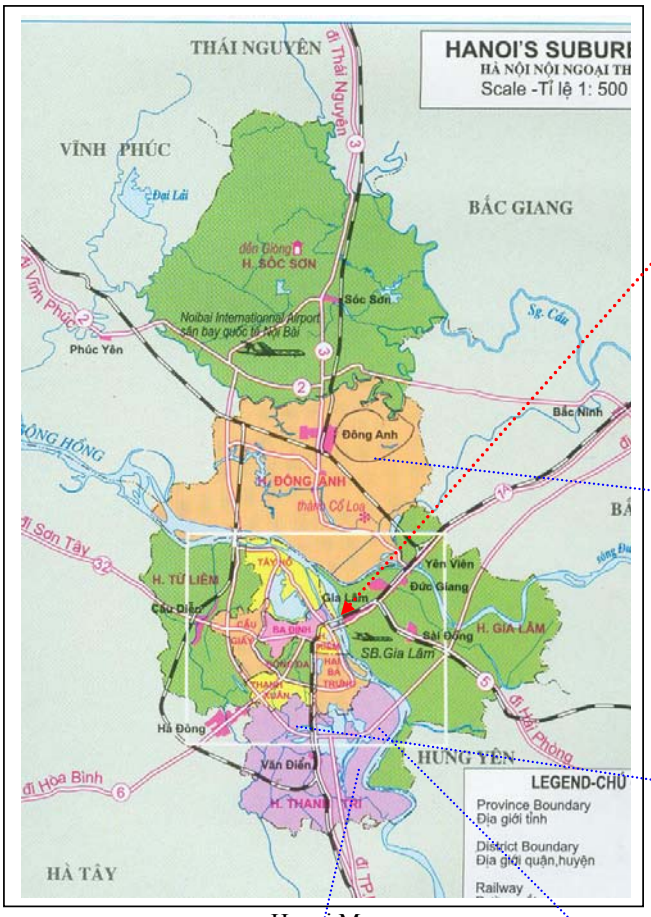
3.1 Choice and criteria of choosing communities and Households (HHs)

Based on the results of a Progress and Planning workshop from 14th - 15th December 2003, the criteria, as shown in Table 1, for choosing communities were discussed.

Table 1 Outline matrix for production systems investigation

Commune	Estimated Distance from centre of Ha Noi (kms)	Fish Culture		Aquatic plants culture	
		Waste water (ww)	non-waste water (non-ww)	waste water (ww)	non-waste water (non-ww)
Tran Phu	10	+		+	
Hoang Liet(Bang B)	5			+	
Dong My	20	+			
Duc Tu	25		+		+

Tran Phu is located 10 kms from the city centre where both fish and aquatic plants are grown using waste water from Kim Nguu River. Hoang Liet is located closer to the city (5 kms) where aquatic plants are cultured using waste water from the To Lich River. Dong My where fish are grown using waste water also from Kim Nguu river is 20 km from the centre of Hanoi. And the control Duc Tu commune where fish are grown using non waste water from the Red river system. It was proposed from these communities that at least 200 households (HHs) indicative for different aquatic production systems would be surveyed.



Hanoi Map

South East Asia map

1. Duc Tu: fish in non-ww, 25 km from Hanoi

2. Bang B: aquatic plants, 5 km from Hanoi

3. Tran Phu: fish, aquatic plants in wastewater, 20 km from Hanoi

4. Dong My: fish in dilute wastewater, 25 km from Hanoi

Figure 1 Map of Hanoi and pictures of representative commune activities

3.2 Workshop formulation of questionnaires and initial database training

The workshop formulation of questionnaires and initial database training was carried out from 8th - 14th February 2004 at the Asian Institute of Technology, Bangkok, Thailand. Questionnaires for survey including two sets: baseline and monitoring. These are summarized in Table 2. The full questionnaires are available for download on the project website at www.papussa.org. The workshop also introduced Access databases to staff in order that they were familiar with the process of data entry.

Table 2 Structure and contents of baseline and monitoring questionnaires

No.	Baseline questionnaire		Monitoring questionnaire	
	Issue interview	**Questionnaire Number**	**Issue interview**	**Questionnaire Number**
1	Interview details			
2	Household detail	HH1-HH10	Migration	M1-M13
3	Migration	M1-M13	Household activities	HA1-HA10
4	Institutions	IB1-IB9	Land monitoring	LM1-LM10
5	Housing and infrastructure	HI1-HI22	Aquatic production systems	F1-F12 (Fish) P1-P12 (Plants)
6	Land	HL1-HL18	Labour	L1-L12
7	Water	W1-W7	Household food consumption and marketing	CM1-CM8
8	Economic	E1-E3	Institutional monitoring	IM1-IM6
9	Credit	C1-C5	Health and well being monitoring	HW1-HW17
10	Production systems	PS1-PS16		
11	Health and consumption issue	HC1-HC20		
12	About the future	FT1-FT5		

3.3 Translation of questionnaires, piloting of questionnaires

From March to April 2004 we translated the questionnaire from English into Vietnamese and then piloted questionnaires with 10 HHs in 2 communes by Vietnamese language. Feedback from the pilot questionnaires was used to help revise the finalized questionnaires.

3.4 Baseline and Monitoring Surveys

The survey was carried out by the RIA1 PAPUSSA team: Ms. Nguyen Thi Dieu Phuong, Ms. Nguyen Thi Hanh Tien, Mr. Pham Bau, Ms. Ho Kim Diep and Ms. Nguyen Thi Tan. Each staff had responsibility to manage carrying out the interviews in one commune and also Ms. Phuong had responsibility and overall management of the survey and progress.

The Baseline with 209 HHs and the first Monitoring with 209 HHs were carried out at the same time with HHs from 14th April to 17th June 2004 which is representative for the spring-summer crops production, normally within both the dry and rainy season when the temperature is from 20°C - 25°C and rainfall is 80mm-230mm per month. The second monitoring with 208 HHs (1 household refused) was carried out from 2nd August to 30th September 2004 which is representative for autumn - winter crops production and when the temperature is from 26°C-28°C and the highest rainfall of the year from 240mm-340mm representative for rainy season. And the third monitoring with 206 HHs (2 households refused) was carried out from 6th – 29th January 2005 which is the time HHs are harvesting/have harvested AFPS crops and when the temperature is lowest in the year (16°C) and rainfall level of only 20mm. It is shown below in Figures 2 and 3.

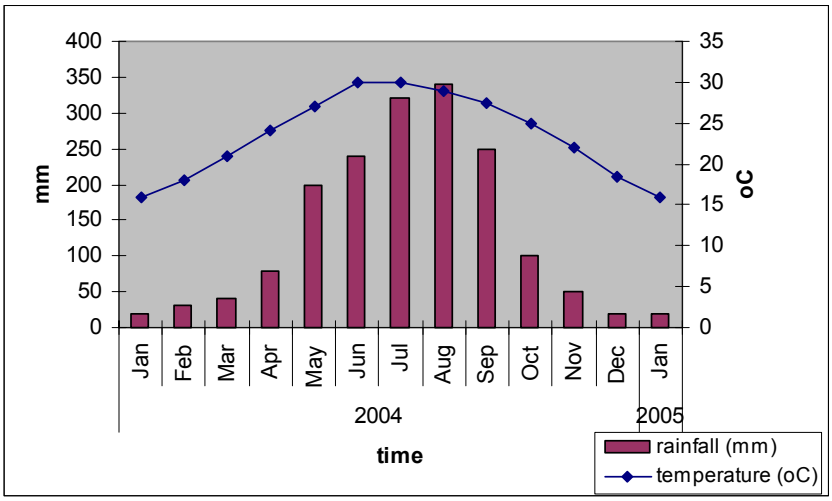


Figure 2 Average annual temperature and rainfall in Hanoi city

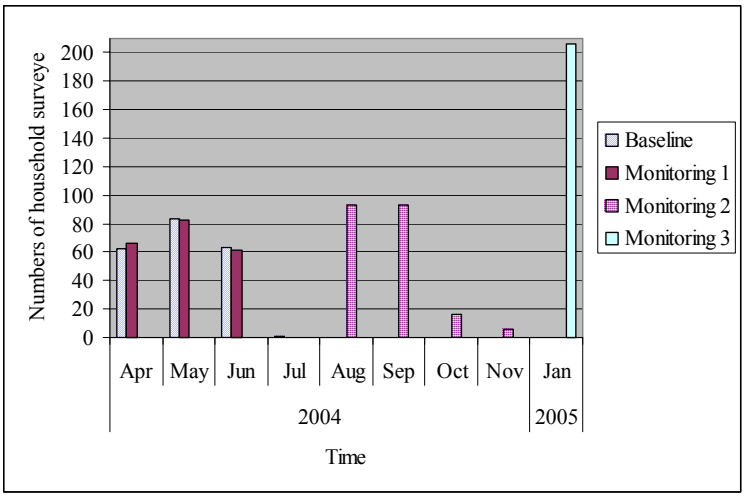


Figure 3 Number of HHs surveyed in different time periods

Bang B with 30 HHs surveyed mainly produce aquatic plants such as Morning glory, water mimosa, water dropwort and water cress in relatively strong wastewater which is pumped from the To Lich River. Tran Phu - 53 HHs surveyed - mainly produce fish and aquatic plants (water morning glory, water cress) in wastewater which is pumped via a canal from a branch of the Kim Nguu River. Dong My commune with 66 HHs, uses more dilute wastewater from a branch of the Kim Nguu river system to produce fish, and Duc Tu communes mainly produce fish in non-wastewater originating from the Ngu Huyen Khe river - a branch of the Red river system. This is shown below in Table 3.

Table 3 Household sample size for each of the selected communities

Commune surveyed	**AFPS representative**	**No. HHs surveyed**
Bang B	Aquatic plants in ww	30
Tran Phu	Fish, Aquatic plants in ww	53
Dong My	Fish in dilute ww	66
Duc Tu	Fish in non-ww	60

The samples sizes are different for different communities dependent on the total number of households involved in AFPS and reflect the popularity of aquatic production activities in particular places. During this period, the database was also established for data entry, management and analysis.

3.5 Access database training

With help from Stirling and Durham Universities, data entry training using MS Access was carried out from 11th to 15th October 2004 in RIA1, Hanoi and database analysis training from the 4th - 8th July 2005 in Siem Reap, Cambodia.

3.6 Questionnaire data entry and checking

All data from Baseline and, Monitoring survey 1 were basically entered from 2nd to the 25th October 2004; Monitoring survey 2 data entry from 8th May -25th November 2004. Data of Monitoring 3 was entered from 10th January to 13 February 2005. The database was checked 3 times for cleaning by going through very carefully each questionnaire of each of the 209 households in the 4 communes.

3.7 Data analysis

Methods of analysis used are Microsoft Access and Microsoft Excel.

Primary data analysis was carried out to make a presentation for the project Progress and Planning meeting in Penang, Malaysia from 20th to 29th November 2004. Further data analysis for reports writing was carried out from August to September 2005. However, there are some limits and constraints to the findings we can draw from our analysis because of problems with methodology used in that Access was not initially a well known program for the Hanoi staff so it was hard to catch up and develop analysis.

Part 4 Results of Baseline and Monitoring surveys and discussion

4.1. HOUSEHOLD INFORMATION

4.1.1 Household members and Household head

Household and HHs members compare to cells of a society. The well-being of each HHs indicates well-being of the commune, district, province and country. There were a total of 209 HHs surveyed in 4 communes with a total of 1023 persons of which 52% were male (n=537) and 48% female (n=486). On average, the HH sizes ranged from 4.5-5.6 people (Figure 4). This includes the parents and an average of 2 - 4 children.

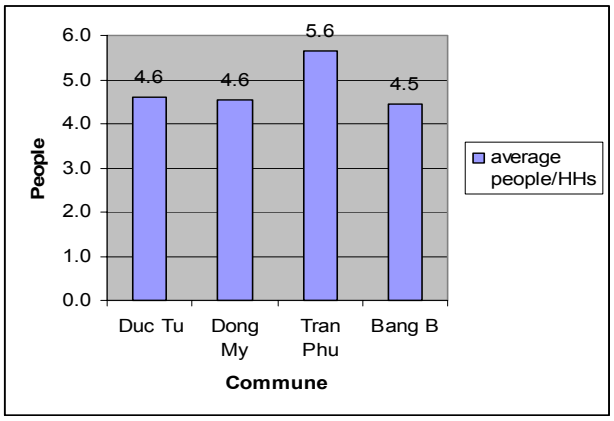


Figure 4 Average HH membership number in each commune

Relationships of HHHs and members are shown in Table 4. Family relationships within HHs in Tran Phu and Dong My are more complex than in Duc Tu and Bang B with extra persons from outside villages, paying lodgers and tenants residing in the houses. Whereas in Bang B village HHs tends to be more family orientated.

Table 4 Average age (years) of HH members and relationship to HHH

Relation with HHH	Duc Tu	Dong My	Tran Phu	Bang B
Child of HH head/spouse	17.16	17.07	21.76	19.52
Grandchild of HH head/spouse	6.45	3	6.03	4.62
Household head	46.81	44.66	51.26	48.48
Nephew/niece of HH head/spouse	35	20	15	-
Other extended family	26	27	37.5	-
Parent of HH head/spouse	77.8	80.77	71.72	82
Sibling of HH head/spouse	28	50	30	-
Spouse of household head	42.84	41.92	44.65	41.39
Ex-Village	-	40	32.17	-
Paying lodger	-	27	-	-
Tenant or tenants relatives			24.33	-

Household heads (HHHs) are often playing the role as the main labour involved directly in AFPS activities. On average, the youngest HHHs can be seen at Dong My and Duc Tu communes where many farmers have converted from rice fields into aquaculture as integrated pond-livestock and garden (VAC) systems. The data also indicates that Tran Phu and Hoang Liet communes have older HHHs where aquaculture activities are more traditional in older villages producing fish and aquatic plants in ww. Thus aquatic food production activities are more likely to be managed and carried out by older people with the younger HH members being drawn away and involved in other occupations.

4.1.2 Ethnicity and religion

"As with other countries, the Vietnamese have several popular beliefs, such as animism and theism. The most widespread popular belief among the Vietnamese is the belief in ancestor-worship" (Vietnamese Embassy in USA, 2006). From our survey, 98.56% (206 HHs) practice ancestor-worship and Buddhism and only 1.44% (3 HHs) are Catholics.

Following Vietnamese Embassy in USA (2006), "In regard to the major world religions, Vietnam is a multi-religious state, and Buddhism is the largest of the major world religions in Vietnam, with about ten million followers. It was the earliest foreign religion to be introduced in Vietnam, arriving from India in the second century A.D. in two ways, the Mahayana sect via China, and the Hinayana sect via Thailand, Cambodia, and Laos. The second largest foreign religion in Vietnam is Catholicism, with about six million followers. Catholicism was introduced to Vietnam by the Spanish, Portuguese, and French missionaries early in the 17th century".

100% of the HHs surveyed were Vietnamese and only Kinh group ethnic (largest ethnic group), This also indicates that Hanoi, Vietnam - unlike some of the other PAPUSSA cities for example where a significant proportion of those working in aquaculture, particularly fish culture in Phnom Penh, Cambodia are migrant Vietnamese (source PCA report Phnom Penh 2004). However, this is most definitely not the case in Hanoi.

4.1.3 Gender

The sex ratios (calculation as a number of males per 100 females) in population of 4 communes peri-urban Hanoi surveyed were 110.28 which is shown in Table 5.

This ratio 110.28 from our data is higher than sex ratios 96.6 of population Vietnam in the same year surveyed 2004 and also percentage female of total population of Vietnam were 50.9% is higher than our data 47.55. As it is normal in Vietnam for the percentage of females in the population to be slightly higher than that of males (Vo Anh Dung et al, 2005).

Table 5 Sex ratio and percentage female in total survey population by study community

Commune	Characteristic of community	People (n)		Sex ratio	Percentage (%)	
		Male	Female		% Male	% Female
Duc Tu	Fish, 25 km from city centre	140	136	102.94	50.72	49.28
Dong My	Fish, 15 km from city centre	163	141	115.60	53.62	46.38
Tran Phu	Fish, AP, 10 km from city centre	160	144	111.11	52.63	47.37
Bang B	AP, 5 km from city centre	73	65	112.30	52.90	47.10
Population in 4 communes surveyed		536	486	**110.28**	**52.45**	**47.55**
Vo Anh Dung *et al, 2005*				***96.6***	***No data presented***	***50.9***

However, Vo Anh Dung et al (2005) indicated that sex ratios (calculation as a number of males per 100 females) in urban areas are higher than provincial level, which illustrated that sex ratio of Hanoi is higher than that whole country Vietnam. Possibly people in Hanoi have higher education levels in urban areas compared to the provinces, also more convenient local health service and therefore access to advice and dissemination methods of birth control. Parents expect "to have a boy rather than a girl", according to orientation perception, but today with a new busy life in the city that perception is not so strong compared to rural areas.

Also calculation of gender by all HHs members involved in AFPS from our survey shows that more women are involved in aquatic plants production compared to men – whereas more men are involved in fish farming. The data in Figure 5 shows fish farming with 58.93% male (188 people) and 41.07% female (131 people) but in aquatic plants farming with 33.92% male (58 people) and 66.08% female producers (113 people).

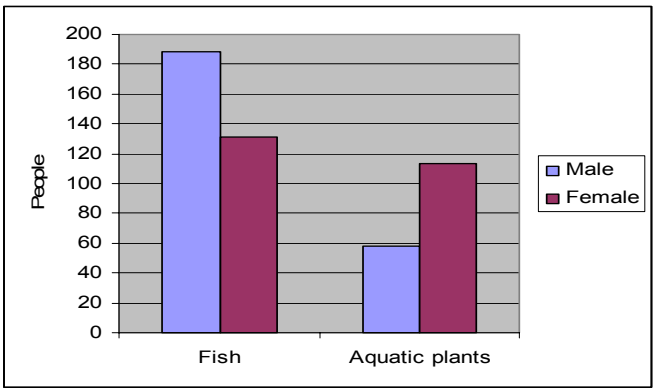


Figure 5 Proportion of gender of all HHs members working in fish and aquatic plants culture.

By heaven given natural characteristics of men and women, men producers are more suitable for pond protection, netting to produce fish and women more suitable with working in a longer time for harvesting vegetables, and looking after aquatic plants everyday.

Figure 6 Ms. Tien in interview baseline questionnaires women in Dong My

4.1.4 Education Status

Education in Vietnam has been reformed, and promoted and is a regular special concern at all government levels. Almost all Vietnamese learn by heart " by benefit 10 years to plant tree and by benefit 100 years to educate people" – the sentence being fully aware of the renovations in education from Ho Chi Minh - leader of Vietnam, as a result, usually education is mentioned in public meetings at the Annual Progress and Planning meetings at commune, district, province, city and government levels. Hanoi is the capital of Vietnam and a centre in policy, science and economic education of the country. With 39 universities and junior colleges, 34 technical secondary schools, over 200 research institutes, 600 research centres, etc (Atlas Geographic Information Hanoi, 2002) so people in urban and peri-urban Hanoi benefit more from this special concern from the city and government .

In terms of education, secondary and further education are popular in all 4 communes in peri-urban Hanoi: Duc Tu, Tran Phu, Dong My and Bang B (Figure 7). Tran Phu commune seems to have a higher educational status than others with 29% (n=87 people) in further education and 6% (n=18 people) people in college and university, this is probably because of urbanization occurring in Tran Phu earlier than other communes. Tran Phu is similar with Bang B village, urbanization has more of an effect on education where local government investment and also people in commune are more concerned with education compared to the more peri-urban communes like Dong My and Duc Tu where most HHs still depend on rice farming. However, ANOVA ($p>0.05$) results show no significant difference.

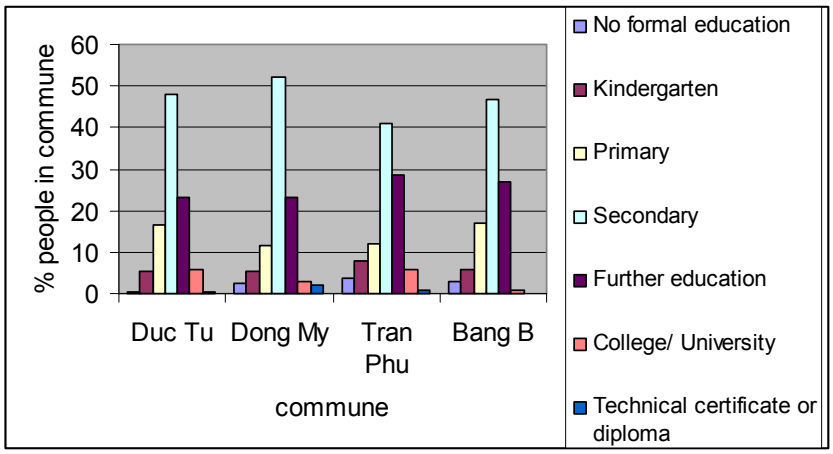


Figure 7 Status of education by commune of Percentage of all HH members

Surprisingly and contrary to our research hypotheses, fish farmers are generally of a lower education status than those growing aquatic plants as we can see in Figure 8 and Table 6 with 37.14% (n=182) of aquatic plant growers involved in secondary school, 6.12% (n= 30) in lower secondary and 13.06 % (n=64) in upper secondary whereas for fish farmers these figures are 16.53% (n=81), 3.27% (n=16) and 5.51% (n=27), respectively.

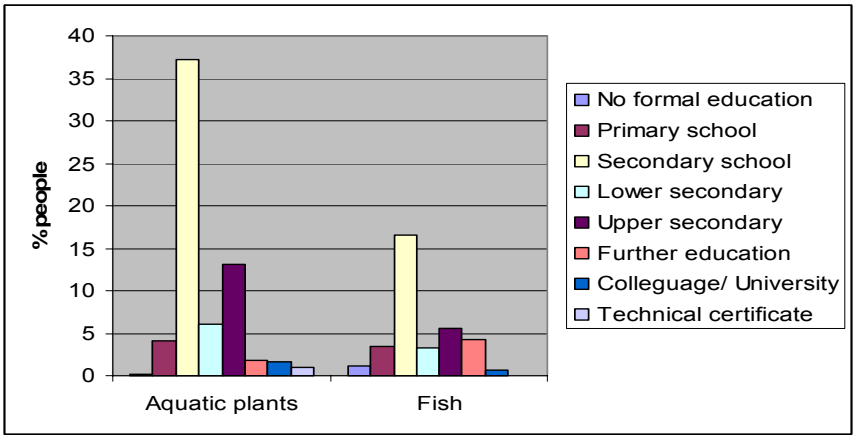


Figure 8 Education statuses of all HHs members who are working in fish and aquatic plants producers

Table 6 Education of fish and aquatic plants producers

Education levels	Fish		Aquatic plants	
	n	%	N	%
No formal education	6	1.22	1	0.20
Primary school	17	3.47	20	4.08
Secondary school	81	**16.53**	182	**37.14**
Lower secondary	16	3.27	30	6.12
Upper secondary	27	5.51	64	**13.06**
Further education	21	4.29	9	1.84
College/ University	3	0.61	8	1.63

The secondary school category indicated pupils within the age of 14-15 who studied class 9 and passed exams for graduate secondary level. Lower than secondary school indicated pupils within the age of 11-14 who studied class 6-8 but did not pass exam then did not graduate secondary. They are usually born in poorer families and some of them have to stop studying to work. Upper secondary school indicate pupils within the age of 15-17 who studied class 10-12 but did not pass exam in high school then did not graduate high school.

Secondary school education is popular in Hanoi, and most of the aquatic plants growers we surveyed who lives in Bang B village and Tran Phu commune are affected by urbanization so they have higher educational status than in Dong My and Duc Tu communes. But then, this is not

a surprising finding that aquatic plant growers have higher education levels compared to fish growers, however despite this aquatic plant growers are normally of a lower income and lower socio-economic status than other occupations.

4.1.5 Migration status of HHH and HH members

From our survey, almost all (96.65% n= 202) HHHs were born in their present location and only small proportion 3.35% (7 HHHs were born from outside). It is interesting to see from our data that it strongly suggests that aquatic plants and fish culture have not been taken up as an income earning opportunity by new migrants to the city but rather it is almost exclusively practiced by original residents who have lived there all of their lives. For those HHHs who did move into the city the reasons they migrated were marriage (3 HHH), bought land (2 HHH), follow and join family (1 HHH) and adventure (1 HHH).

Compared to the Cambodian situation in Phnom Penh where there were a number of those working in AFPS who had migrated from Vietnam (Reference from Baseline and Monitoring report of Phmom Penh city, PAPUSSA project, 2006). It is not surprising because the Red River Delta, with 19.4% of the total national population, including Ha Noi, has by far the highest population density (averaging 1173 persons per square kilometer) (Socio-economic Vietnam – Atlas, 1999) and Vietnam is a net labour exporting country for jobs to many other countries such as Russia, Germany, Malaysia, Korea. In general those who migrated to Vietnam from other countries (Russia, Japan, America, France, etc.) are almost all working in higher paid jobs in cities or in provincial capitals as consultants for the government or involved in the development of private factories, e.g., Haiphong industrial corridor.

Figure 9 Mr Bau (left) survey to know if HHHs were born in Duc Tu commune

Figure 10 Gardening fruit and produce fish by local people in Duc Tu

4.1.6 Occupations of HH members surveyed

The occupation "picture" of 1529 HHs members in 209 HHs surveyed in Tran Phu, Dong My, Bang B and Duc Tu communes in peri-urban Hanoi is shown below in Figure 11.

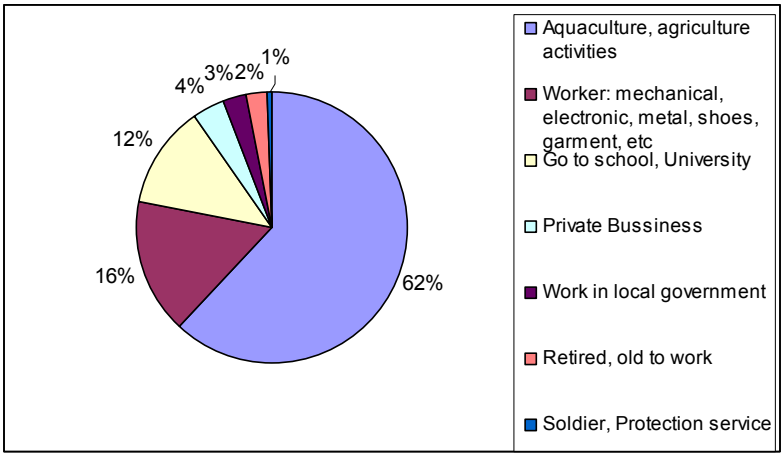


Figure 11 Contribution of occupation of all HHs members surveyed

Data from the interviews shows that the majority of HHs members 947 (61.94%) were involved in activities like aquaculture (producing fish, aquatic plants) and agriculture (vegetables, rice or livestock) as a part of their occupation since the first, second or third occupation was answered. A smaller proportion of HH members (247) surveyed were workers employed in government or private companies such a mechanical, electronics, metals, shoes makers, garment or textile workers, etc. Those 247 HHs members contributed 16.15% of total HHs members interviewed. The third part of occupation of HH members surveyed was 187 HH members (12.23%) who were attending primary, secondary, high schools or study in universities. That is a good signal of Hanoi socio-economic conditions in the future for development.

The rest (58 HH members 3.79%) were working in private business. But people working in local government like leaders of commune, health care, leaders of agriculture co-operative or farmers union, etc contributed 2.75% equal 42 HH members. Most of 38 people who retired with pension or too old to work contributed 2.49% of total HHs membership.

Figure 12 Making fish traps in Dong My: a suitable

job for older people

This strongly indicates that in Hanoi, people come into city from outside, ie new migrants either from other provinces or other countries are not involved in producing aquatic food production. As the master plan of Hanoi city dictates, the economy should move toward industry, service and modernize agriculture respectively. And such factories bloom and mushroom in peri-urban areas and districts outside Hanoi city. Working in a factory and new environment seems to be more attractive work for young people rather than working in commune with agriculture activities in which their parents and grand parents spent all their life. Job diversity and diversity of income earning activities appear popular in almost every family (more than 2 jobs or income sources). For example in the family of Ms. Luu Thi Hoa (household code 78-33) who lives in Bang B village, with a boy and 2 girls aged from 21-25 years old, her children all work in factories and private business, whereas their parents at the age of 49-50 are both still happy working, growing, and selling aquatic plants in the village. Working in non-agriculture in some jobs like daily sellers in shops, hired labourers working in construction maybe not get higher income than producing AFPS, maybe they have to work harder, in a toxic or dangerous environment or salary is just enough for daily expenditure but this is ok – younger people accept such jobs with another reason for looking to marry in the future and change their occupation. Almost all young people who are working within agriculture have a strong perception of escaping from agriculture activities, moving to the city to get married with a person who does not work in agriculture and then they will have a free and flexible life. This trend of people escaping agriculture activities is also similar with other cities and countries for reason of migration e.g in European and Middle Eastern countries, people can hire labour from the other Asian countries at low wage rates. This is still good and attractive for the migrant hired labourers because of high currency rates compared to the salary they can earn working in their own country.

Figure 13 Rearing pigs -one of the income earning sources of PU HHs

Figure 14 Mr Cuc (left) answering occupation questionnaire by Ms Diep (right)

4.1.7 Electricity

From our survey most households had mains electricity, (100% of mains electricity supplied by the government). This was the case in Duc Tu, Tran Phu and Bang B communities however in Dong My 86.36% (n=57) of HHs used mains electricity, 4.55% (n=3) HHs use tapped electricity from another house and 9.09% (n=6) HHs were using kerosene. This is because Dong My is a relatively new area converted from former low land rice fields into aquaculture and thus does not have an electricity supply yet to some of the newly constructed houses which are often built right on the banks of the new ponds.

4.1.8 Toilets

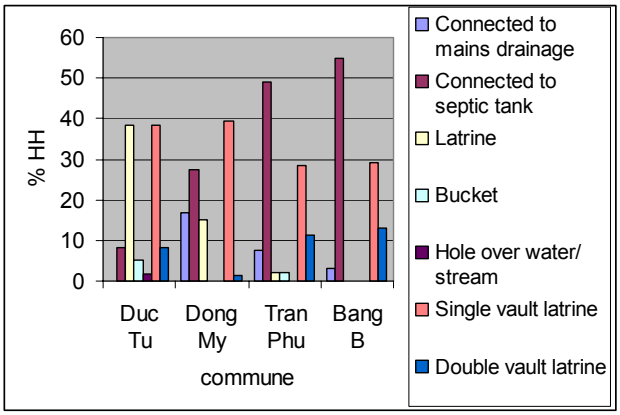


Figure 15 Type of toilet

Figure 15 shows the common type of toilets in the 4 communes. Duc Tu (25 km from Hanoi) and, Dong My (20 km from Ha Noi) have a higher proportion of latrine and single vault latrine which are a good source of fertiliser for integrated fish-garden-livestock systems whereas Tran Phu (10 km) and, Bang B (5 km) have a high % of HHs connected to septic tanks because they are more urbanised communities closer to the city centre where disposal of wastes is more regulated and the people themselves follow the norm of their neighbours in having a cleaner, more hygienic and self-contained septic tank.

4.1.9 Land use for residencies

95.24 % of HHs owned the land their houses were built on. Land resident HHs owned (n=199 HHs) whilst only 4.76 % HHs share land resident with their parents (n=10 HHs). The average area of those HHs who own residential land is largest in Dong My at 260 m²/HH, then

in Duc Tu with 251 m²/HH, then Tran Phu with 180 m²/HH then in Bang B with 150 m²/HH. This is shown below in Table 7.

Table 7 Average area of land for residencies owned by HHs in each communes

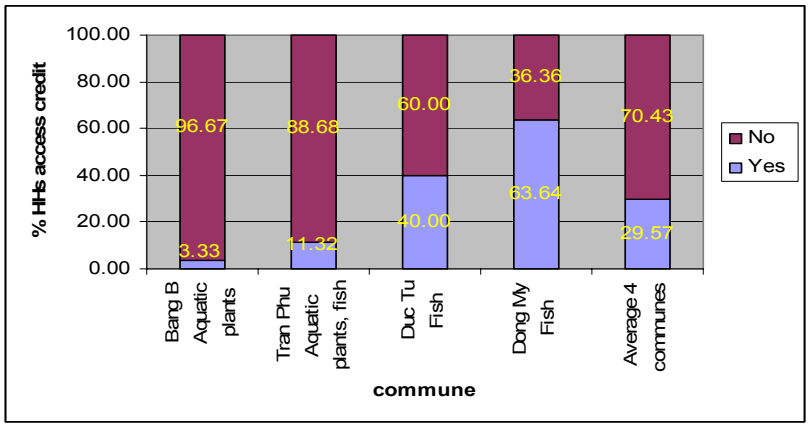
Item	Bang B (5 km from city centre)	Tran Phu (10 km from city centre)	Dong My (20 km from city centre)	Duc Tu (25 km from city centre)
Average land house resident (m²)	150	180	260	251
SD	88	130	209	169
max (m²)	500	1000	926	1100
min (m²)	56	40	69	58
No. HHs share house resident per total HHs surveyed	1/30	8/53	0/66	1/60

This trend fits in with the level of urbanization in each commune and their distance (km) from the centre of the city to communes. People living further out of Hanoi have larger land plots for their houses because there has been less pressure on them to sell some of this land to others to build new houses. However with increasing pressures of urbanization and land in Tran Phu and Bang B the people's house plots are smaller.

Figure 16 Ms Phuong interviewing couple of Mr. Hong about land residency status

4.1.10 Credit

Accessibility to credit sources is an important factor which can affect farmers' production activities. Figure 17 shows that a total of 70.43% HHs in all 4 communities surveyed did not take out loans from any source of credit for their AFPS, and only 29.57% HHs did. Bang B (3.33% yes) and Tran Phu (11.32% yes) where there are increasingly more high buildings and new factories being constructed with urbanization. Conversely in Dong My and Duc Tu communes they have the highest percentage of HHs using credit for their AFPS with 63.64% and 40% HHs respectively responding yes to using credit respectively and with support from local government (district, commune level) for the development of those areas which have been converted from low land rice fields into aquaculture.



Urban----------→ Peri-urban ------→ Rural

Figure 17 Use of credit by HHs in different communities

Figure 18 below shows fish polyculture in wastewater and fish polyculture in non wastewater are systems which have the highest proportion of HHs who responded to using credit. 48% HHs (n=61) used loans for fish polyculture in wastewater and 13% HHs (n=17) used loans for fish polyculture in non wastewater. Fish seed, integrated fish + livestock (VAC system) and rice cum fish systems used less credit (at 12% HHs responded equal n=16, 10% equal n=13 and 9% equal n=12 respectively). And the rest of 3% HHs (n=5) who responded used borrowed money for shrimp and aquatic plants farming. In this analysis with the fact responded from farmers we should understand that within HHs producing fish polyculture in wastewater and non wastewater they may also have fish seed ponds and that farmers also use money they borrowed for fish seed but may not have reported this, in another words farmers borrowed money to invest possibly for one or more than one production systems if they have them.

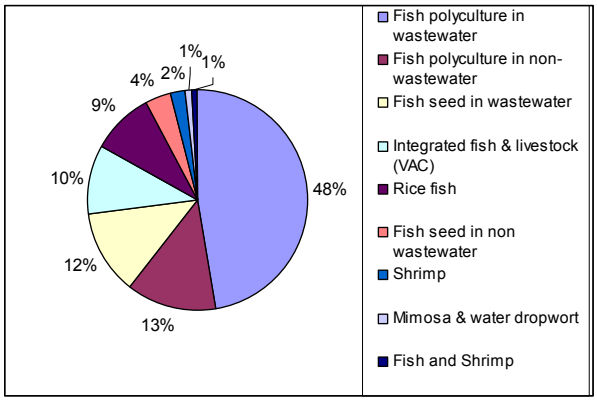


Figure 18 Proportion of each AFPS had invested by money borrowed of HHs

The remainder of HHs which did not borrow money responded they had "no requirement for credit" (n= 110 equal 71.43 %) indicating that they themselves had enough money to support their AFPS. However others quoted "unacceptable terms" (n=20 equal 12.99 %) from the bank or that they were considered "not credit worthy" (n=11 equal 7.14%). "Credit facilities not available" (n=9 equal 5.84%) and "unacceptable risk" (n=4 equal 2.60%) was also a situation in communes.

The above analysis demonstrated the significance of credit or borrowing money for development of integrated fish-garden-livestock in Dong My and Duc Tu communes. This is a part of contribution in household's livelihoods in communes and development aquaculture in peri-urban Hanoi.

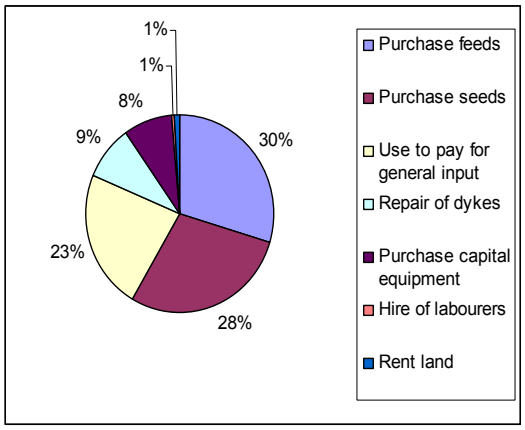


Figure 19 Reason using credit by farmers

Figure 20 Credit has been use for buying fish feed

Farmers borrowed money to invest in their production systems the highest proportion being to purchase feeds (30%), purchase seeds (28%), and use to pay for inputs in general (23%). In the early stages of the new crop in spring (January) or after harvest the final crop in the year in winter (December) some of 9% HHs have to repair pond dykes for better and more sustainable dykes for example dykes built with brick, cement, etc and also 8% purchase capital equipment such as nets for fish harvesting or pumps..

We found that fish farmers in general use more credit than aquatic plant growers producing aquatic plants is relatively cheap in Hanoi and requires low inputs such as seed, fertilizers and pesticides whereas fish farmers need to invest in inputs for each day, labour costs, fish feed, to money to buy fish seed. For more information, please see Table 8.

Table 8 Purposes of Credit used for AFPS

Purpose use credit	System used by credit	Nos of responses	% respond
Purchase feeds	Integrated fish & livestock (VAC)	8	5.97
	Fish polyculture in wastewater	28	20.90
	Fish seed in wastewater	4	2.99
Purchase seeds	Fish seed in wastewater	11	8.21
	Fish polyculture in non-wastewater	10	7.46
	Fish polyculture in wastewater	9	6.72
	Rice fish	4	2.99
	Integrated fish & livestock (VAC)	2	1.49
	Livestock	1	0.75
	Mimosa & water dropwort	1	0.75
Use to pay for general inputs	Fish polyculture in wastewater	13	9.70
	Integrated fish & livestock (VAC)	4	2.99
	Rice fish	4	2.99
	Fish polyculture in non-wastewater	2	1.49
	Fish seed in non wastewater	2	1.49
	Fish seed in wastewater	2	1.49
	Shrimp	3	2.24
	Fish and Shrimp	1	0.75
Repair of dykes	Fish polyculture in non-wastewater	4	2.99
	Rice fish	4	2.99
	Fish seed in non wastewater	3	2.24
	Fish seed in wastewater	1	0.75
Purchase capital equipment	Fish polyculture in wastewater	7	5.22
	Fish seed in wastewater	4	2.99
Hire of labourers	Fish polyculture in wastewater	1	0.75
Rent land	Fish polyculture in wastewater	1	0.75
Total		**134**	**100**

There were 5 main sources of credit reported: (1) community or rotating savings scheme, (2) relatives, (3) Farmers Union, (4) Commercial Bank and (5) neighbours or friends those farmers can more easily access. The main reasons farmers can accept is the low rate of return for interest, due to a new policy of the Farmers Union and Commercial Bank for supporting economic development of communes and develop agriculture and aquaculture activities which is shown in Table 9.

Table 9 Credit source

Credit source	Number of responses	% respond
Community or rotating savings scheme	27	21.6
Relatives	25	20
Farmer Union	23	18.4
Commercial Bank	21	16.8
Neighbours or friends	16	12.8
Women's Union	4	3.2
Private lender	3	2.4
Employer	3	2.4
Store or shop	2	1.6

Credit co-operative	1	0.8
Total	*125*	*100*

4.1.11 Health status of HHs

Health problems along with coping strategies and availability of health care services are sensitive topics for asking any person especially occupational health problems that are caused by farmer's exposure to waste water,

Back, skin, respiratory, fever, eye and rheumatic problems are the main health problems that farmers in the 4 surveyed communities Duc Tu, Dong My, Tran Phu and Bang B faced and seem to be related with their occupation which is shown in Figure 21.

Briefly here Duc Tu was a study community using non wastewater for its fish production system compared to the other two communes Bang B, Tran Phu which use strong wastewater from the To Lich and Kim Nguu rivers for producing aquatic plants and fish and also compared to the rest of the communes Dong My which uses dilute wastewater for fish integrated with livestock and garden/vegetable production..

There is significance in ANOVA analysis in health problems (HP) per HH in communes ($P<0.05$). Data surveyed during April 2004 to January 2005 showed that Duc Tu – a non wastewater using community had a significantly lower number of reported health problems (31HPs) at an average of 2.8 HPs per HHs compared to the other three wastewater using communities. The highest of 637 HPs presented in Bang B (6.7 HPs per HH) where farmers use direct ww from the To Lich River for their aquatic plants cultivation. And second highest was Tran Phu commune with 207 HPs reported at an average of 4 HPs/HH which use ww from the Kim Nguu river and then thirdly in Dong My commune with 185 HPs at an average of 2.8 HPs/HH where farmers used diluted ww originating from a branch of the Kim Nguu River. In this calculation, HPs were the sum of all health problems reported including back problem, skin, respiratory, fever, eye, rheumatic, stomach, flu, etc problems.

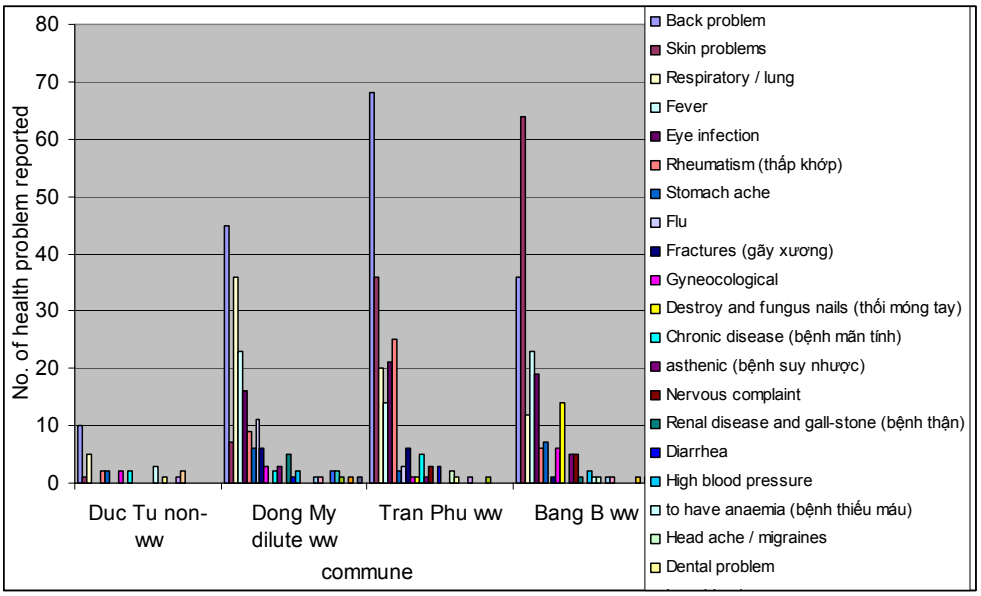


Figure 21 Numbers of health problems reported

Figure 22 below shows the percentage of individual health problems reported by community. In the non-waste water (non-ww) - commune of Duc Tu, back problems, respiratory problems, rheumatism, stomach, etc. were the main health problems faced by HH members. Conversely, in the wastewater (ww) communes Bang B and Tran Phu a higher proportion of skin, back problem, eyes, fever, necrosis and fungus of nails (thối móng tay) was reported. This data suggests a relationship with occupational activities and health because significant proportions of those working in contact with strong ww on a daily basis ie those growing aquatic plants in Bang B are reporting higher levels of skin problems than the other weaker or non ww using sites. As regards to Tran Phu where strong waste water is used the % with skin problems is slightly less as many of those interviewed in this commune were working in fish farming and thus would not be working with such regular daily contact with ww compared to aquatic plant growers, whose duties demand that they are often immersed up to their thighs and even waists in waste water for up to 8 hours per day. However this data should not be taken as conclusive since there could be other confounding variables present in each of the communities which could also affect the people's health eg air pollution, quality of drinking and domestic water supplies etc. Further research comparing AFPS and non AFPS occupations in each of the same communities is required to determine if working in ww is a definite occupational hazard.

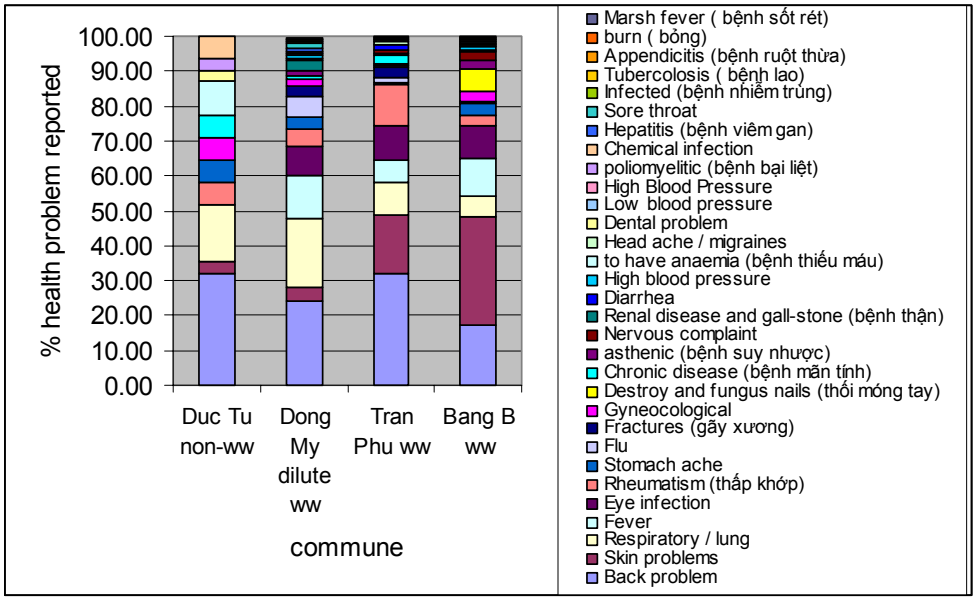


Figure 22 Proportion of individual problems reported within total health problems

4.2 Information on Production Systems

4.2.1 Aquatic production systems in Hanoi affected by seasonality of climate

The climate in Hanoi is generally subtropical and monsoonal. However, it has 4 distinct seasons. The annual average temperature is about 23-24°C but ranges from a monthly average of 16-17°C in January to monthly averages of over 27°C from May to September, with a minimum of 7-9°C to a maximum of 38-39°C in certain years. The rainfall usually occurs in a 6-monthly rainy season from May to October. Hanoi lies in a region of typhoons with heavy winds and rains which can cause flooding, these seasonal variations in climate shapes and affects the different types of aquatic production systems in Hanoi as shown in Table 10, especially the cultivation of different aquatic plant species during the different seasons.

Table 10 Seasonality of AFPS in Hanoi throughout the year

Aquatic production system	**Period of cultivation**
Water mimosa	15 April – 30 August
Water morning glory	Main season: March - December Extra winter season: Dec- Feb next year
Water dropwort and	1 September – 30 March

(autumn and winter season)	
Water cress (autumn and winter season)	1 September – 30 March
Fish seed production	Jan-April or can be later for bigger size fingerlings
Food fish production	One harvest/year: March-December or until February of the coming year. Two harvests /year: Feb- Jul and Jul –Feb

In spring from February after traditional Vietnamese "tet" holiday, fish farmers are almost all busy in harvesting the remaining food fish in their ponds to sell in markets whilst also repairing and preparing ponds for a new fish culture cycle. By that time people who produce fingerlings are also busy looking after fingerlings or nursing in order to sell them to fish farmers by the end of March or April. But by this time aquatic plant growers seem leisurely in their occupation activities due to late water dropwort and water cress finishing from the winter (colder) season due to slow growth and low price in the markets.

From the end of March or normally in the month of April fish farmers are looking for fish seed or fingerlings of traditional fish species like common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), Indian major carps (mrigal, *Cirrhinus mrigala*; rohu, *Labeo rohita*), bighead carp (*Aristichthys nobilis*), tilapia (*Oreochromis niloticus*), etc. in order to stock fish in the spring season. At that time, aquatic plant growers start to prepare for water morning glory and water mimosa cultivation in the summer season.

If fish farmers can harvest fish after 4-6 months after stocking fish then they harvest by the end of July or August to sell to the market. By this time, aquatic plant growers are busy in harvesting water morning glory and water mimosa every day – as they have many small plots of aquatic plants. The season for producing water mimosa continues until the end of August but for water morning glory cultivation and harvesting can continue until the end of December.

By July, if fish farmers harvest their fish then they can stock a new cycle of fish so they can harvest again by the end of February before "tet" holiday or by March that is after "tet" holiday. At this time prices are generally higher due to the holiday season and more people are eating fish.

In September, aquatic plants growers begin to cultivate new water dropwort and water cress crops for the winter season. They are busy looking after and harvesting water dropwort and water cress until March.

If the fish farmer cultures fish and plans to harvest one time a year then they can harvest in December before cold weather and cold winds in Hanoi. This is especially significant if farmers produce tilapia and Colossoma *(Colossoma macropomum*) as these fish species cannot stand low temperatures.

Following this general description of the dynamic picture of aquatic production systems within the 4 seasons the next section describes further about water sources, average land area, land use status, estimates of production, productivity, etc of each individual AFPS.

4.2.2 Water source

Water sources have a significant contribution to the success of farming aquatic food production systems particularly in cities. Here in Hanoi by understanding communities and AFPS our staff have openly discussed with farmers during the surveys and we divided water sources for the different AFPS into wastewater and non-wastewater or dilute wastewater. Figure 23 shows the 4 communes surveyed generally use one water source however a small % of HHs in Duc Tu and Tran Phu also use a second source.

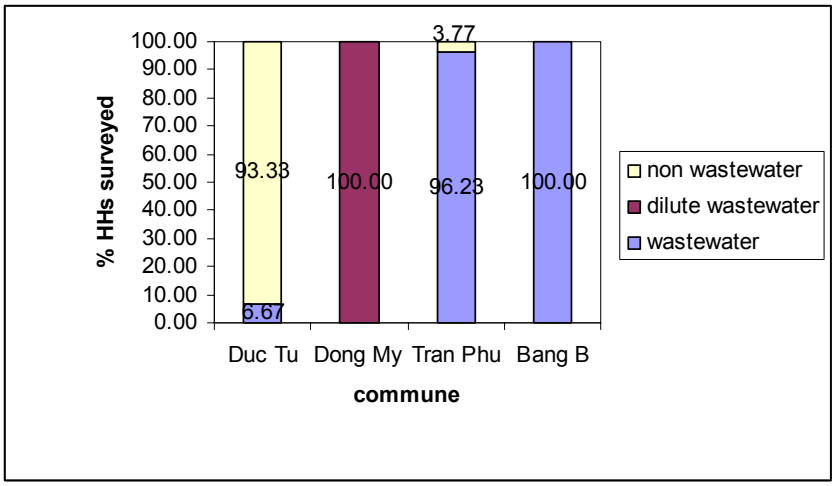


Figure 23 Percentage of wastewater, dilute and non wastewater used for AFPS in 4 communities

In Duc Tu commune, 25 km from Hanoi city centre, farmers (93.33% HHs) mainly use completely non-ww with from the Ngu Huyen Khe River (Red River branch) for most of their AFPS, but 6.67% HHs farmers also use wastewater from local domestic sources to produce fish such as silver carp (H*ypophthalmichthys molitrix*), mud carp (*Cirrhinus molitorella*), Indian carp

(Rohu, Mrigal), Tilapia (*Oreochromis niloticus*), common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idellus*) or Colossoma *(Colossoma macropomum*) within big ponds in communes. Tran Phu commune 10 km from the city centre is geographically divided by a large Red River dike to prevent water from the Red river entering into central Hanoi during the flood season. People living outside the dike then use non-ww from Red River to produce fish or morning glory with 3.77% HHs surveyed. However the main water source for Tran Phu is waste water from the nearby Kim Nguu River which originates from a mixture of domestic and industrial wastewater flowing from the city and then pumped into big district canals to be used as irrigation and supplying wastewater for agriculture in general. Dong My is 20 km from the city centre and is also using pumped wastewater in irrigation systems like Tran Phu through feeder canals however with the distance from the city centre this ww is more dilute so is used by 100% HHs for their AFPS, primarily polycultures of such as mud carp (*Cirrhinus molitorella*), Indian carp (Rohu, Mrigal), Tilapia (*Oreochromis niloticus*), common carp (*Cyprinus carpio*), silver carp (H*ypophthalmichthys molitrix*) or Colossoma *(Colossoma macropomum*). Bang B is located closest to Hanoi city centre just 5 km, and pumps wastewater for its AFPS directly from the adjacent To Lich River which also originates from domestic and industrial sources.

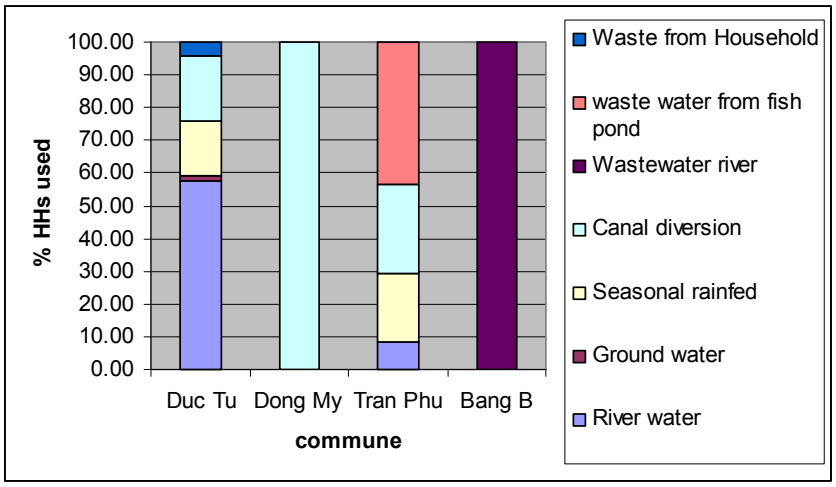


Figure 24 Source and method of delivery of water used in production system

Figure 24 shows that Duc Tu, Tran Phu commune have more than one water body source to supply their AFPS's. Because of specific characteristics of water source for AFPS as mentioned above some of the HHs can have more than two water body sources such as one HH in Duc Tu commune can produce fish in non ww with water supply from the river and also produce morning glory in seasonal rainfed ponds. Similarly, in Tran Phu commune fish farmers produce fish from

waste water which is pumped via a canal and also produce water morning glory from reused ww from a fish pond. But in Dong My and Bang B 100% HHs used canal diversion and river wastewater respectively.

4.2.3 Land rights status

Land rights in agriculture are an important issue for each country and their direct effect to development of economic and productive agriculture. Land rights in Vietnam with its history, in this first section we would like to summarise the most important dates that make clear the status and perceptions about land law in Vietnam. According to Quy Toan and Lakshmi Lyer (2002), there are three key dates:

(1) In 1954 marked the independence of the country from the French and its division into two parts, North and South;

(2) in 1975, the so-called "Viet Nam war" ended with the reunification of North and South Viet Nam, and

(3) in 1986 corresponds to the implementation of sweeping economic reforms (the "Doi Moi" policy) and a move towards a market-oriented economy, which continues to the present day.

So "As far as land rights are concerned, the regulatory environment witnessed two major changes. In 1988, the collective system was abandoned in favour of private ownership. While land strictly speaking still remains the property of the State (Land Law 1993, Article 1), rights to use the land were assigned to individuals over a period of up to fifteen years. However, such rights were not tradeable. In 1993, a new land law was enacted and in addition to an increased lease term, land-use rights could now be inherited, transferred, exchanged, leased and mortgaged. The law of 1993 is therefore seen as setting the foundations of a formal market for land" (Quy Toan, 2002).

Figure 25 Land for rice had converted to produce aquatic plants in Bang B

"Resolution 10" of the 1988 land law had been transferring control of land agriculture from the co-operative to the individual household farmers. And the most important is "land was allocated to households with a fifteen-year security of tenure and tacit renewal, output markets were privatized and investment decisions were decentralized and left to households." Private property was virtually

instituted.

"However, as land-use rights were given to families without the possibility to trade such rights, a proper land market did not develop despite some informal transactions" (Quy Toan, 2002). By understanding basic land history and the important events above then we can now describe the detailed status of land rights from our survey in 2004.

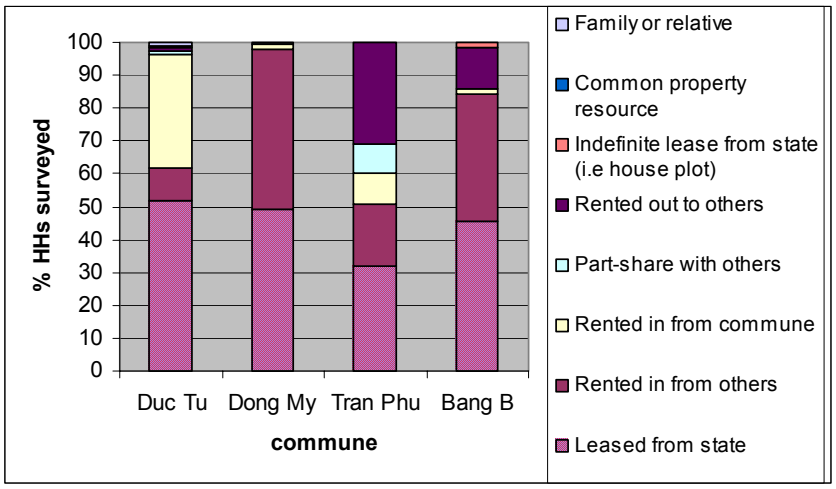


Figure 26 Land rights statuses in 4 communes

Land ownership is quite dynamic in Hanoi. Figure 26 shows land leased from the state is the most common category for AFPS HH's in Duc Tu (51.79% HHs), Dong My (49.24% HHs), Tran Phu (32% HHs) and Bang B (45.31% HHs). Which in Tran Phu, Dong My, Duc Tu and Bang B communes is the divided agricultural land following "Resolution 10" with a number of people in each household originally receiving the same defined areas (by square metre) of land for AFPS from their local commune land's budget at the time local communes were allocating commune land out under land law in 1988 and 1993 as described above. Following this each HH could have 2 or 3 different small plots (possibly from 20 m² – 360 m² for agriculture as rice production. Following 1993 many farmers exchanged and "sold" in "informal deals" their production land plots to each other where their land plots were near or close together so that it was easier for them to take care of their vegetable and rice fields. This meant that at a commune level following 1993 although there was an equitable distribution of land certain individuals began to buy up and accumulate agricultural land from other commune members – this was something of a reversal of previous land tenureship at commune level. In peri-urban areas of Hanoi this informal sale/transfer of agricultural land marked the beginning of certain HH's or

individuals within the commune "going away" from the land in terms of their occupations and livelihoods ie they took up other more urban related income earning activities such as factory work, small scale manufacturing – metal plating – as illustrated in the Hanoi PCA's (PCA s in 4 peri-urban communities Hanoi 2004), also trading, and working in government and administrative positions. This dynamic shift in the occupational background of the commune members (often those of younger ages) in areas undergoing urbanization has classically been repeated in developing cities throughout the world. Although this could be perceived as being a negative trend towards the continuation and future sustainability of AFPS's and agriculture in peri-urban areas , its outcome more positively is to concentrate and specialize agricultural land use to those particular individuals who are interested and have the drive to develop and diversify this land for more lucrative types of agricultural production eg converting low lying rice fields into fish and aquatic plant production, VAC systems, ornamental trees etc. This trend has in general resulted in productivity and thus income per hectare of peri-urban land increasing dramatically since the above mentioned land reforms.

Fish and aquatic plant producers also rented other land in from other HH's who live within their commune in order to increase their production especially in Dong My and Bang B (48.48%, and 39.06% HHs respectively). Fish farmers in Tran Phu and Duc Tu communes rented in extra land from the commune itself on shorter 5 year leases. However they only used it for 6 months a year in the flooding season from June to December to produce fish rather than the lower income they could get from growing lowland rice. In Tran Phu some HHs part - shared leases on land with other households to produce fish in wastewater fed polyculture systems using large areas average 14,263.01 m^2 or maximum to 182,520 m^2. And also those who rented lands out to others is also common in Tran Phu and Bang B since these HHs were involved in other possibly more lucrative occupations.

4.2.4 Estimation of aquatic production in the main systems surveyed from April 2004 to January 2005

Fish production

Analysis on average HH production of fish (kg), average production area (m^2), and average yield fish (ton/ha) per year and average net income after meeting production costs (US$/ha) in the main fish production systems surveyed is presented in Table 12.

Fish polyculture systems in wastewater had the highest numbers of HHs involved (86 HHs) in all 4 communes with average production variation from 2,500 kg per year (Bang B) to 32,031 kg per year (Tran Phu) fish per HH depending on their pond area. Households in Dong

My had an average yield from waste water fish polyculture systems in 2003 of 6.66 ton/ha per year. Fish polyculture in non wastewater and waste water in Tran Phu had the highest overall average net incomes at 4,226 and 2,953.80 US $[1] respectively due to most of the fish farmers in this commune using such very large production areas (ie 18.25 ha ponds) for growing their fish.

Figure 27 New converting low land rice field into integrated VAC system

Figure 28 Harvesting wastewater fed fish

Production of fish seed in wastewater is very significant to supply fingerlings for grow out ponds of the farmers in Dong My. As such 69.70% of the HHs we surveyed in Dong My save and use small ponds (average 1,841m^2) for nursing fry to fingerling to bigger fish in order that they can continually supply and stock their own ponds. They also sell their fingerlings to their neighbours when they have plenty of seed and in this case yield and ton/ha are non predictable and only few of them in Dong My (3/66 HHs) sell to others. In contrast, production of fish seed in non ww in Duc Tu seems less important with only 26.67% HHs surveyed involved in producing seed, and also within 8 HHs produce fish seed for home consumption. This is probably indicative of the lower level of development and specialisation of fish farming in the more peri-urban/rural community of Duc Tu, which can be backed up by the lower productivity, and also income and profit figures of the non waste water systems compared to those using waste water located closer to Hanoi (Dong My and Tran Phu) shown below in Table 11.

[1] 1US$ = 15,967 VND according to Vietcombank date 18/5/2006

Table 11 Analysis average yield, area, ton/ha and profit by household of fish production systems

Fish production system	Commune	No. HHs	Average HH production (kg/yr)	Average Area (m²)	Average (ton/ha)	Average overall net income by household by year		Theoretical* Average net income per hectare per household per year	
						Mill VND	US$	Mill VND	US$
Fish polyculture in wastewater	Tran Phu	20	32,031.25	57,805.11	5.89	**47.19**	**2954**	0.8	51.2
	Bang B	2	2,500.00	5,220.00	4.77	22.50	1408	43.0	2699
	Dong My	61	4,571.67	5,805.18	**6.66**	13.85	867	23.8	1494
	Duc Tu	3	2,633.33	16,100.00	2.61	9.67	605	60	3763
Fish seed in wastewater	Tran Phu	1	5,500.00	2,520.00	21.83	**40.00**	**2504**	**158.6**	**9941**
	Bang B	3	633.33	2,880.00	2.56	8.33	521	28.9	1812
	Dong My	46	NP	1,841.33	NP	HHs use			-
	Dong My	3	NP	3,989.33	NP	7.33	458	18.4	1151
	Duc Tu	2	NP	1,620.00	NP	HHs use			-
Fish polyculture in non-wastewater	Duc Tu	45	1,538.93	4,549.07	4.44	6.76	423	14.8	930
	Tran Phu	2 share	50,000.00	108,000.00	4.63	**67.50**	**4226**	6.2	391
Fish seed in non wastewater	Duc Tu	8		4,042.50	NP	6.50	407	16.0	1007
	Duc Tu	8	NP	2,610.00	NP	HHs use			-
Rice fish	Duc Tu	13	6,635.00	70,307.69	0.94	**17.57**	**2000**	**2.5**	**156**

Note: NP = Non calculable – eg we didn't have the data to calculate.
* Note this is a theoretical figure for those systems which have land areas of less than one hectare – and should be used as a relative comparison indicating the degree of intensivity between the different production systems

At the lower end of the income scale 75% of HHs surveyed in Duc Tu carry out fish polyculture using non ww with average annual yield per household being 4.44 ton/ha and average annual net income 423 US$ per HH. In the case of the just 2 fish polyculture farmers in Tran Phu who share a large pond (10.8 hectares) located adjacent to the Red River using non ww from the Red River they stock polyculture and spend more time and income for feeding which although it results in a relatively low net annual income of 391.43 US$ per hectare, however due to the very large area of the pond gives them a very good overall income and net profit of 4226 US$.

In Duc Tu commune, fish production in rice fields has the highest average annual net income (17.5 million VND, 2000 US$) for fish production systems compared with fish polyculture in non ww and also fish seed production in non ww. 13 HHs (21.67% of the surveyed HHs) were awarded a 5 year land lease by the commune to use low land rice fields in the rainy season from July to December in 6 months to extensively produce fish in large land areas

averaging 70,307 m^2/HH. Although their production only averaged 0.94 ton/ha of fish, due to their large land areas their average annual net income was 17.57 million VND (2000 US$).

It should be noted that the production figures collected from many households were often based on estimated figures since many farmers did not keep accurate records of their fish farming activities. Also the subject of how much production and profit a farmer is achieving is often quite sensitive and difficult for the survey questioners to ask. However due to this, during the surveys the questioners had to use a variety of methods in order to obtain such information.

Aquatic plants production

Table 12 Analysis average yield, area, ton/ha and net income of aquatic plants

Aquatic plants system	Commune	No. HHs	Average production per HH (ton per yr)	Average Area (m^2) per HH	Average Yield per HH (ton/ha)	Average overall net income by household by year		*Theoretical Average net income per hectare per household per year	
						Mill VND	US$	Mill VND	US$
Morning glory – wastewater	Dong My	25	for fish	612.10					
		6	3.75	822.00	45.62	1.57	98	19.05	1194
	Tran Phu	39	9.71	563.13	172.39	**5.38**	**336**	95.4	5980
	Bang B	24	6.40	535.63	119.49	5.03	315	93.7	5875
Morning glory – non wastewater	Duc Tu	22	For fish	243.33					
		2	0.60	630.00	9.52	2.30	144	36.4	2286
	Tran Phu	1	27.00	1,440.00	187.50	12.00	751	83.3	5219
Morning glory & water dropwort	Tran Phu	11	3.05	153.82	198.09	2.62	164	*170.1*	10660
	Bang B	2	5.18	306.00	169.12	5.95	372	*193.1*	12178
Morning glory & water cress	Tran Phu	14	3.62	238.00	**243.93**	3.04	190	*175.4*	*10994*
	Bang B	3	1.64	121.33	134.75	1.77	111	*145.5*	*9119*
Mimosa & water dropwort	Bang B	20	10.37	852.65	121.60	**16.06**	**1005**	*188.2*	*11796*
Mimosa/water cress	Bang B	4	11.90	537.75	221.29	9.00	563	*167.2*	*10482*
Mimosa/dropwort/ cress	Bang B	5	10.25	724.80	141.39	10.20	638	*140.7.*	*8813*
Morning glory & mimosa	Bang B	1	6.30	720.00	87.50	9.00	563	*124.9*	*7828*
Fish and aquatic plant	Tran Phu	1	18.20	1,800.00	101.11	20.00	1252	11.0	6958
Water dropwort and fish	Dong My	5	No data	2,083.20		6.75	422	32.4	2029

* Note this is a theoretical figure since all HHs aquatic plant systems plots have land areas of less than one hectare – and should be used as a relative comparison indicating the degree of intensivity and rate of return between the different production systems

Table 12 shows that the production of aquatic plants in peri-urban Hanoi involves a diversity of plant species compared to the other study cities Ho Chi Minh City, Bangkok and Phnom Penh where it is primarily morning glory and mimosa being produced. This is due to the seasonal variations in climate in Hanoi where the colder winters are more suitable and financially viable for growing water dropwort and watercress

Almost all the 4 communes' surveyed were involved in producing aquatic plants in order to sell for income earning or home consumption or for fish or pig food. Morning glory (MG) production was the most popular amongst our surveyed HHs with 59.80% (119 HHs) within 209 HHs surveyed producing Morning glory either in ww (Tran Phu, Bang B, Dong My) or non-ww (Duc Tu, Tran Phu). This production of MG contributes considerably every day to Hanoi's markets for the whole city population's morning glory consumption. For a single crop of MG those 72 HHs produced an average of 9.49 tons/HH/year. These 72 HHs have a total MG production of 683.39 tons/year which is worth a total overall income for those 72 HHs of 820.06 Mill VND/year or 51,360 US$/year. Morning glory produced in ww and non-ww mentioned above did not include production of the remaining morning glory which was used for feed for fish, pigs, and chicken as well as for the individual HHs own home consumption. MG production was significant for feeding grass carp in HHs fish production. It is popular in the fish farming community of Dong My (37.88%HHs surveyed in Dong My) and Duc Tu (36.67% HHs surveyed in Duc Tu) in which average land area for MG is 612.10 m^2 and 243.33 m^2 respectively. However the yield of MG of those HHs supplying feed for their fish every day has not been calculated.

Rotation of aquatic plants by seasons in Hanoi also increases growers incomes. If they produce MG only (in Tran Phu) then they can earn average annual net incomes of 336 US$ from an average plot size of 563m² which is the equivalent to 5,980.03 US$/ha. But by rotation of aquatic plant species their average net incomes are significantly higher at 1005 US$ per year for water mimosa and water dropwort which equates to a much higher income per hectare of 11,7969 US$/ha. There are 80 HHs contributed 40.20% aquatic plants growers surveyed actually rotating their production and growing more than one species. According to producers in Bang B (2005), in the past most aquatic producers in Bang B only produced water morning glory but recently producers have been producing more rotating seasonal aquatic species. However to produce water mimosa they need more wastewater for production and to produce water dropwort need more labour for cleaning vegetables compared to producing morning glory only. Aquatic plants are grown and managed in relatively smaller plots, averaging from 153.82 m^2 to 852.65 m^2 for easy management compared to fish culture.

Table 13 Comparison of relative areas, productivity and incomes from selected fish and aquatic production systems in peri-urban Hanoi.

Production system	Commune	No. HHs	Average production per HH (ton per yr)	Average Area (m^2) per HH	Average Yield per HH (ton/ha)	Average overall net income by household by year		*Theoretical Average net income per hectare per household per year	
						Mill VND	US$	Mill VND	US$
Fish polyculture in non waste water	Duc Tu	45	1,538.93	4,549.07	4.44	6.76	423	14.8	930
Fish polyculture in waste water	Tran Phu	20	32,031.25	57,805.11	5.89	47.19	2954	0.8	51.2
Fish seed in waste water	Tran Phu	1	5,500.00	2,520.00	21.83	40.00	2504	158.6	9941
Morning glory and water dropwort	Bang B	2	5.18	306.00	169.12	5.95	372	*193.1*	12178
Mimosa & water dropwort	Bang B	20	10.37	852.65	121.60	16.06	1005	*188.2*	*11796*
Morning glory in waste water	Tran Phu	39	9.71	563.13	172.39	5.38	336	95.4	5980

From the above comparative table, we can see that although Hanoi's peri-urban fish farmers are earning higher overall incomes than the aquatic plant growers, they are utilizing much larger land areas and their productivity and thus income per hectare are, in fact, considerably lower. The final column indicating theoretical income per hectare which takes into account the fact that aquatic plant growers have considerably smaller plot sizes and also sell their produce at much lower unit prices per kg than fish farmers still shows that, in terms of peri-urban land use, aquatic plant cultivation, particularly systems that seasonally rotate aquatic plant species, can generate much higher income per unit land area than fish farming. This is an important point for reference to policy makers to encourage optimal use of agricultural land in and around Hanoi.

4.3. INSTITUTIONS AND POLICIES

4.3.1. Institution membership

Almost all of the fish and aquatic plant farmers in the survey were found to be involved in some form of institution like the Farmers Union, and Joint co-operation organizations. Almost all women were involved in the Womens union, more elderly people involved in the Elderly Union and the youth involved in the Youth Union. There was no significant difference found in

institutional membership between fish farmers or aquatic plants growers and no difference between the different production systems. In general almost all people in the 4 AFPS communes surveyed were involved in between 2-3 institutions. 100% of the Household heads in the 209 HHs surveyed have membership of at least one institution.

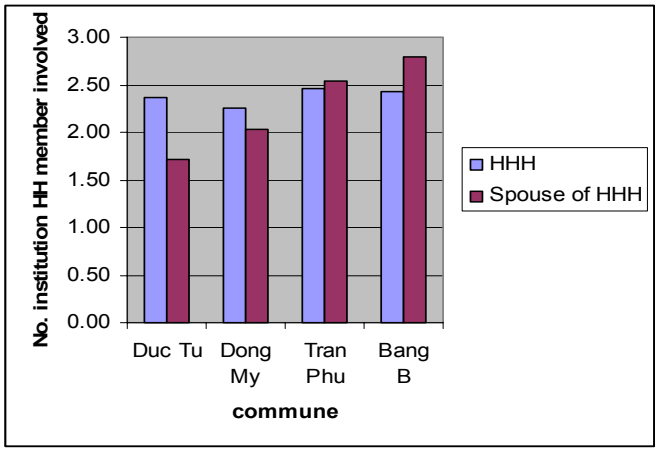


Figure 29 Average institution membership of HHH and spouse of HHH

In general the Household head (HHH) and spouse of HHH are the two most important persons in each family who make the important decisions in the household. Figure 29 shows that the HHHs on average were involved in 2.38 institutions with little difference between communes. However the spouses of HHHs on average were involved in 2.27 institutions but in their case there were clear differences between the communes. Almost all the spouses of HHHs who are living near the city in more urban communities such as Bang B and Tran Phu communes 5-10 km from the city centre, these women were more involved in institutions with an average of 2.80 and 2.55 institution memberships respectively per spouse. Possibly these women have more access to social life and to joining different organizations and clubs. In contrast, in Dong My and Duc Tu, two more peri-urban/rural communes 20-25 km far from the city centre female spouses of HHHs are only involved on average in 2.03 and 1.72 institutions respectively. This could be also because in these more peri-urban/rural communities women are much busier during the day with work/agricultural related activities thus have less time for institutions/meetings etc.

4.3.2 AFPS training and Information

Table 14 and Figure 30 show most of the HHs surveyed in the 4 communes (66.67%-87.88% HHs) had had training in AFPS. This illustrates a well being of extension and producers look forward and are happy and trust to learn new techniques from the district extension service,

and the Farmers union. The original question we asked is "What training have you or any member of your household been involved in relating to your AFPS?" so that we cannot show which institution the training comes from particularly like Farmers Union, Womens Union, etc, but the most popular situation is any training from government or NGOs organization want to give a training e.g. IPM or chemicals spraying… most all contact through Commune's People Committee and Farmers Union.

Table 14 Percentage HHs involved in AFPS training in 4 communes

Commune	No. HH surveyed	HHs had training		HHs have not had training	
		n	%	N	%
Duc Tu Fish	60	40	66.67	20	33.33
Dong My Fish	66	58	87.88	8	12.12
Tran Phu Fish, Aquatic Plants	53	44	83.02	9	16.98
Bang B Aquatic plants	30	22	73.33	8	26.67

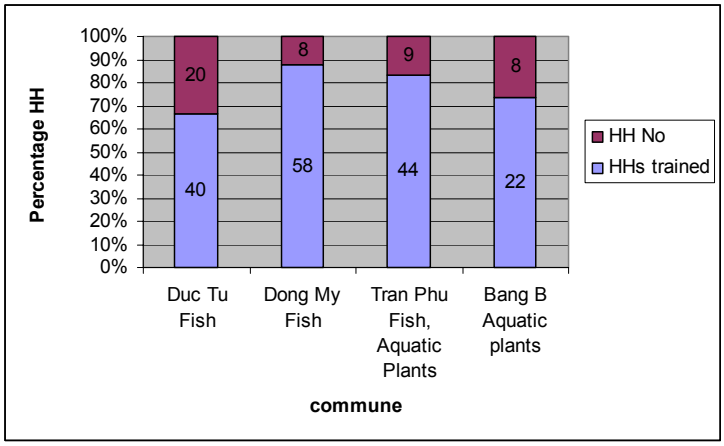


Figure 30 Percentage HHs trained in AFPS techniques in the 4 communes

Fish producers are more likely to have technical training in their area of expertise than aquatic plant growers. 180 participants from 209 HHs surveyed were involved in some form of training whether one or two times in each HHs and within the participants there were 67.22% (121 participants) trained in fish farming and hatchery operation and VAC systems, and the rest of 32.78% (59 participants) were trained in IPM (Integrated Pest Management), pesticide/ fertilizer application, or vegetable management which is shown in Figure 31.

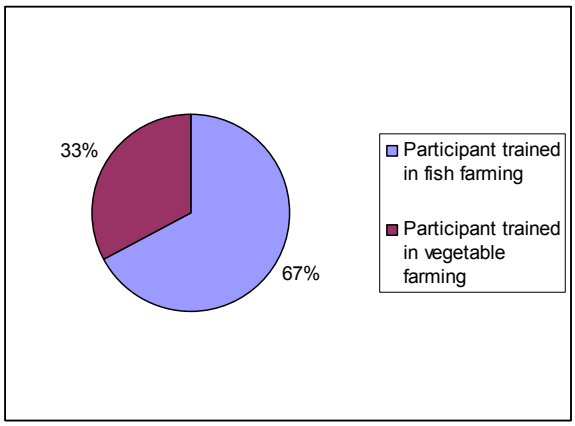


Figure 31 Proportion of Participants who had training divided into fish and vegetable trainings

The original question we asked was "What training has you or any member of your household been involved in relating to your AFPS?" so the results of the analysis presented here is not only HHHs but maybe the wife, children or parents of HHHs. Normally, fish farmers have training in fish culture and vegetable farmers are trained in vegetable cultivation, but in the case of our survey participants this is not completely true because of the diversity of income earning activities of HHs in Hanoi means that one HH can be both fish or vegetable grower or more than that.

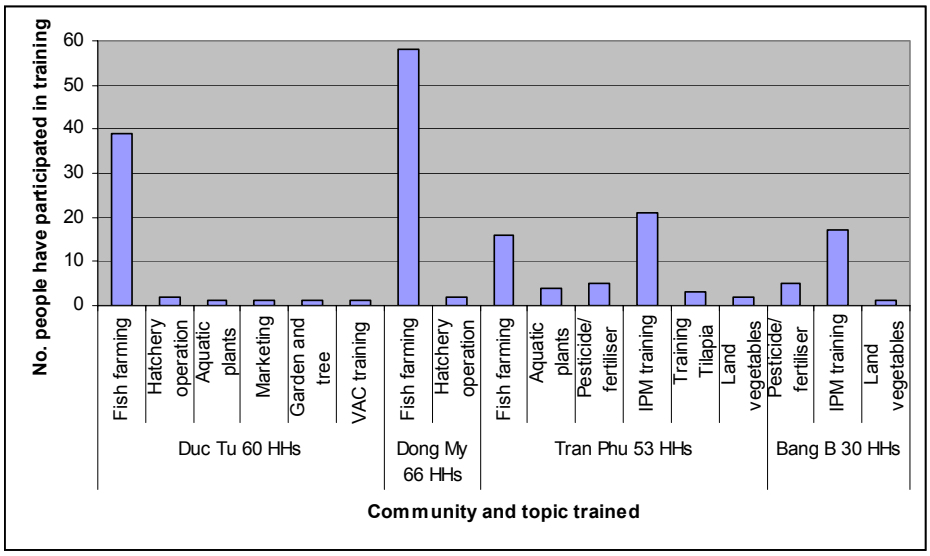


Figure 32 Training in 4 communes participated by farmers

Training is often a significant benefit for the people who are involved in institutions like the Farmers Union or Joint co-operative organization in agriculture programmes in communes. Tran Phu and Dong My have a high proportion of farmers who had participated in training (96.23% and 90.91% HHs respectively), whilst in Bang B (76.67%) and Duc Tu (75.00%) this involved a lower proportion. Figure 32 shows a high proportion of people trained in fish farming. It was 32% in Dong My and 22% in Duc Tu, 9% in Tran Phu but 0% in Bang B. Certainly, farming aquatic vegetables is important in Bang B and Tran Phu so that 13% and 18% HHs respectively surveyed received training in pesticides, fertilizers, IPM and farming land vegetables. Women were more likely to be involved in vegetable management training but men more involved in training in fish culture. The age range for training was between 18 to 60 years old.

4.3.3 Government institutions: contact by farmers

By asking "Have you had to deal with any government agencies in the last 3 months?" this means that the farmer has spoken/ had dealings with a government agency or can be from his own efforts or maybe from the government agency first contacting him/her. Information shows that AFPS farmers seem to have been well connected with institutions. The number of HHs we surveyed who deal with any form of state or government agencies in the last 3 months is shown in Figures 33, 34 and Table 15. Within our response, 67% of HHs in Duc Tu and 30% in Dong My have dealt with government agencies over the period of our surveys. This compares to only 3% of HHs in Tran Phu and 0% HHs in Bang B. From this data, it appears that AFPS HHs in Ha Noi's more farther peri-urban communes are more likely to deal with government agencies concerning their AFPS than those closer to the city centre. The reasons for this are not immediately clear but might be the result of a more pro-active government agriculture/fisheries extension service in more rural communes. The proportion of HHs dealing with government agencies such as welfare, fisheries extension, agricultural extension, legal, planning and health are similar ranging from 10.14% to 14.20% HHs responded is shown in Figure 34.

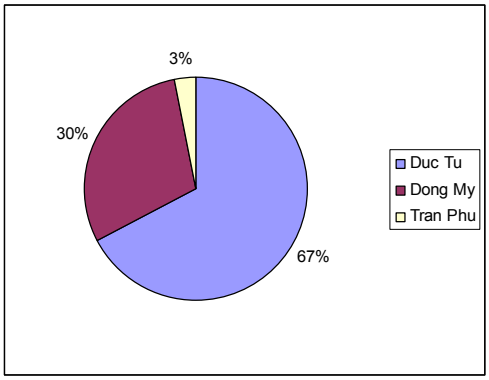


Figure 33 Percentage of HHs response have contacted to government agencies

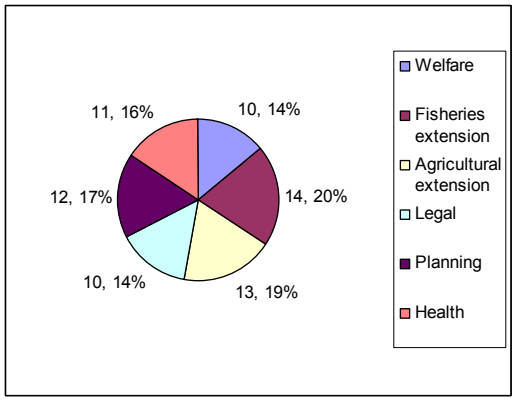


Figure 34 Proportion of HHs contact to government agencies

Table 15 Number of HHs contacted agencies within 3 months monitor

Commune	Government agency	Nos of HHs deal within 3 months in 2004	% HHs in each commune
Duc Tu n=60	Welfare	5	8.33
	Fisheries extension	9	15.00
	Agricultural extension	9	15.00
	Legal	5	8.33
	Planning	9	15.00
	Health	8	13.33
Total		45	75.00
Dong My n=66	Welfare	2	3.03
	Fisheries extension	5	7.58
	Agricultural extension	4	6.06
	Legal	3	4.55
	Planning	3	4.55
	Health	3	4.55
Total		20	30.30
Tran Phu n=53	Legal	2	3.77
Total		2	3.77
Overall Total		67	32.06

For what reason or concern did HHs and farmers approach or deal with government agencies? Figure 35 shows that most of the HHs (82.46%) participated for extension support for training for both fish or vegetable farming. Farmers were more concerned in learning new techniques for higher and more intensive production. 48.27% HHs deal with government agencies for voting the Head of commune or district or province level every 5 years. 24.14% HHs co-

ordinating farming activities like preventing bird flu symptoms or the H5N1 virus. 14.8% HHs contacted to check health matters and all children can drink vitamin A for free. Starting in 2005 in Viet Nam, all children under six receive free health care in public health facilities (1994 Law on Protection, Care and Education of Children). Each child under-six is provided with a health care card based on a computerized database which is regularly updated to generate precise and valid data to ensure children's rights to health care, especially for children who are just a few months old (Vo Anh Dung et all, 2005). The remainder (9.5%) contact government agencies for access to micro-credit loans, subsidized production inputs and cultural reasons.

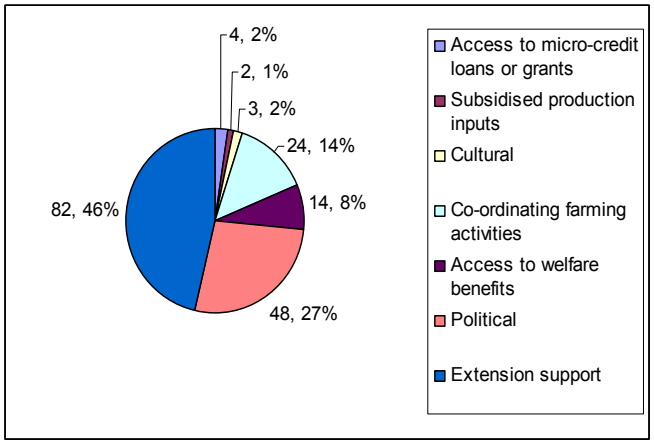


Figure 35 Reasons HHs contact government agencies and their relative proportions

4.4 Difficulties of producers and their future plans

4.4.1 Difficulties of aquatic producer

The difficulties faced by most of the aquatic producers are shown in Table 16 which were in order of importance lack of water for production (24.08%), lack of capital (11.46%), increasing input costs (11.46%), and diseases of fish and aquatic plants (10.68%). The water supply for AFPS's basically depends on the water pumping stations (Bang B - ww and Duc Tu – non ww) which are managed by the Agriculture Cooperative of Communes, and canal systems (Tran Phu, Dong My – both ww) operation effected by management of commune, district and city as related to flood resistance for Hanoi city in special emergencies. There is a main dependence on pumping frequency of waste water from the Agriculture Cooperative for rice and vegetable cultivation so this often results in shortfalls and lack of water for those producing other foodstuffs eg aquatic plants and fish from aquaculture. Also due to improvement in the wastewater rivers following "The study on urban drainage and wastewater disposal system in Hanoi city" of the Japanese

International Cooperation Agency (JICA) program, water levels in the rivers in the inner city are deeper than water levels by the time they reach the peri-urban canals causing AFPS producers a long term lack of water for production which can only really be met by waiting for rain. In the rainy season, this is not a problem but by the dry season from November to March AFPS producers suffer water shortages and also more concentrated and potentially contaminated waste water resulting in the quality of their products, both fish and aquatic plants, to deteriorate.

Table 16 Reported Difficulties of aquatic producers by community

Difficulty	**Tran Phu Fish, Aquatic plants**	**Dong My Fish**	**Bang B Aquatic plants**	**Duc Tu Fish**	**Total (n)**	**%**
Lack water for production	**42**	**43**	**22**	17	124	**24.08**
Lack of capital	6	**36**	-	17	59	11.46
Increase input cost	**42**	2	11	4	59	11.46
Disease (fish & plants)	4	6	13	**32**	55	10.68
water quality	6	-	**18**	9	38	7.38
Low quality seed	12	-	1	**19**	32	6.21
Bad local road (infrastructure)	1	**27**	-	-	28	5.44
Fall market price	18	3	4	-	25	4.85
Lack of techniques	1	1	-	21	23	4.47
Short time auction (land)	8	-	-	13	21	4.08
Lack access to market	6	3	2	3	14	2.72
Police& market management	7	-	5	-	12	2.33
Loss land use	-	-	6	2	8	1.55
Tree less fruit (quality seed)	-	-	-	5	5	0.97
Loan /complex administration	2	-	-	3	5	0.97
Household health	1	-	2	-	3	0.58
lack suitable equipment	1	-		1	2	0.39
Unemployment	-	-	2	-	2	0.39
Total	157	121	86	146	515	100

Lack of capital normally appears in new areas converted from low land ricefields into aquaculture like Dong My and Duc Tu. Truly, they need money for investment in setting up their new system and with local commune policy encouraging economic development at household levels most of the HHs in Dong My and Duc Tu get loans from local organizations. However, input costs for production are increasing following market forces which combined with minimal increases in the unit prices of their produce results in their net incomes eroding. Following these other difficulties are fish and plant diseases, water quality, low quality of seed, and bad local roads.

4.4.2 Future plan of HHs

We asked farmers how they think their production systems will change in the next 5 years in order to understand their future perceptions and how optimistic in the future they are of maintaining or even increasing output from their production systems. Data is shown below in Table 17.

Table 17 Aquatic production systems trend in the next five years: perceptions of any HHs members who answered questionnaire.

AquaTrend	Duc Tu[2]	Dong My[3]	Tran Phu[4]	Bang B[5]	Total	%
No change	17	**27**	**31**	11	86	25.00
Change to high value species	14	**32**	**19**	16	81	23.55
Increase intensity	**35**	32	5	2	74	21.51
Decrease production area	0	0	**17**	**20**	37	10.76
Diversify production system	15	6	2	4	27	7.85
Diversify species	12	5	0	1	18	5.23
Increase production area	5	2	4	1	12	3.49
Decrease intensity	3	1	0	0	4	1.16
More Government support	0	2	1	0	3	0.87
More fish and decrease in rice	1	0	0	0	1	0.29
Do not work in fish culture	0	1	0	0	1	0.29

25% of the farmers overall interviewed in Duc Tu, Dong My, Tran Phu and Bang B expect no change with their current status and activities in aquatic production with change to cultivating a high value species for a higher income or increased intensity of production being the next most popular perceptions. In general, this shows an optimism for the future within those surveyed. However, if we look at the proportion of farmers who believe that their production areas will actually increase these figures show that many of them are not thinking of this or are not actually able to increase the sizes of their farms.

Perhaps confirming this, farmers in Duc Tu and Dong My communes (20 and 25 kms, respectively, from the centre of Hanoi) have financial support from local government for converting low land ricefields into aquaculture and have comparatively much greater perceptions that their production systems will increase in intensity (not area) in the next 5 years. Especially in Duc Tu where farmers think that diversifying production systems and species will occur in the near future. In contrast, day by day many plans and projects have been carrying out development for urbanization in Bang B, Tran Phu, Dinh Cong, Yen So, Thanh Liet etc, with

[2] Duc Tu: 25 km from centre Hanoi where commune converting from low land rice field to aquaculture
[3] Dong My: 20 km from centre Hanoi where commune converting from low land rice field to aquaculture
[4] Tran Phu: Urbanization, 10 km from centre Hanoi
[5] Bang B: Urbanization, 5 km from centre Hanoi

more high buildings namely Linh Dam, more residential villas, more and more great urban centres, more business enterprises, more government institutions and small industrial areas/parks, etc (Long-term program of Hanoi city, People's Committee of Thanh Tri district, 2001). These factors are very much affecting the perceptions and aspirations of fish and aquatic plants farmers resulting in a number of them thinking that decreases in production areas are inevitable and as a result wanting to learn more about making their production more intensive in smaller areas..

Part 5 Conclusion

5.1 Households practicing AFPS in Hanoi

Production of fish and aquatic plants play important roles in local job creation and livelihoods of households in peri-urban Hanoi. In the 209 HHs surveyed in 4 communes the average HHs size ranges from 4.5-5.6 people and sex ratio (calculation as a number of males per 100 females) is 110.28 higher than 96.6 of population in Vietnam (General Statistics Office, 2005). However, more women are involved in aquatic plants production whereas more men are involved in fish farming since it involves physical work and time contribution to housework. All (100%) of the HH we surveyed in peri-urban Hanoi were Vietnamese with 98.56% practicing ancestor-worship and Buddhism and only 1.44% catholic. There was no marked difference between ethnicity or religion between communities growing aquatic plants or fish producers.

From our study, it was shown that aquatic food production systems in Hanoi are almost exclusively carried out by native Vietnamese who were born there and have been living or working in Hanoi for their whole lives. It appears that this analysis with our strong data on almost 96.65% HHHs being born and lived at their present location communities with only a small proportion (3.35%) HHHs born or moving from outside the city. Thus in peri-urban Hanoi it appears that aquatic plants and fish culture have not been taken up as an income earning opportunity by new migrants' coming to the peri-urban areas but rather it is almost exclusively practiced by original residents. However the slightly younger average age of household heads in Dong My (45 years) and Duc Tu (47 years) which are new areas converting low land rice fields into aquaculture are promoting changing ideas towards changing production systems and are more open to investing money into these new systems.

Secondary and further education are popular in all 4 communes in peri-urban Hanoi. In fact, education systems have been reformed and are of significant concern to the local government. Tran Phu and Bang B commune seem to have a higher educational status than Dong My and Duc Tu where in the latter two more peri-urban communities most HHs depend on rice

farming. Possibly, urbanization has more of effect on education with local community/government investment higher in more urban communities.

The majority of people surveyed were involved in aquaculture and agriculture since this is the main criteria we chose for choosing the households for this study. Within the total number of household members we surveyed 61.94% are involved in aquaculture (producing fish and aquatic plants) and agriculture (producing vegetables, rice or livestock) activities. 16.15% of HHs member are working in government or private companies such a mechanical, electronics, metal, shoe makers, garment or textile workers, etc. 12.23% HHs members are studying in primary, secondary, high schools or study in universities. The remainder 9.68% are working in private business (food shops, cloth shops, electric shops, etc.), leaders of commune, health care, and retired soldiers.

95.24 % of HHs owned the land plots that their houses were built on and 4.76 % HHs shared with their parents. People living further out of Hanoi (Dong My and Duc Tu) have larger land plots for their houses than people living in Tran Phu and Bang B because there has been less pressure on them to sell some of this land to others to build new houses. This trend fits in with the level of urbanization in each commune and their distance (km) from the centre of the city to communes.

On average the majority of HHs (70.43%) surveyed did not take out loans from any source of credit for their AFPS because most of them had "no requirement for credit" or "unacceptable terms". However of those who borrowed money 97% were practicing fish farming, and only 3% aquatic plants farming. Fish farmers purchase feeds, fish seeds, repair dykes for ponds or purchase capital equipment. Fish farmers in general use more credit for investment in fish seed and feeding for fish every day compared to those who borrow money for aquatic plants production.

In communes 20-25 km far from the city there are a higher proportion of latrines and single vault latrines which are a good source of fertiliser for integrated fish-garden-livestock systems whereas communes closer 5-10 km from city centre have a high percentage of HHs connected to septic tanks because they are more urbanised communities.

Health problems per HH increased respectively for those HHs using non wastewater, dilute ww and strong wastewater respectively for their aquatic production systems. In non-waste water (non-ww) – Duc Thu commune, the important health problems are back problems, respiratory problems, rheumatism, stomach, etc. Conversely, in the wastewater (ww) communes a higher proportion of skin, back problem, eyes, fever, necrosis and fungus of nails were reported. This apparent difference in the number and types of health problems between the different AFPS

communities could be related to household members working in either strong, dilute waste water compared to fresh water. However we cannot definitely make the conclusion with these communities that working in waste water compared to non waste water is the sole determinant for having more health problems since there could be a number of other non related confounding factors in each community which might affect this outcome eg proximity to local industry, airborne pollution, different qualities of drinking water supply etc. Further studies would need to be carried out comparing the health status of waste water AFPS producers with other commune members who worked in other occupations.

5.2. Production Systems

To adapt with seasonal variations in climactic conditions in Hanoi, farmers produce different aquatic plant species during the different seasons. Water morning glory can be produced throughout the year, water mimosa in the summer and water dropwort and water cress in the winter. Food fish are produced from 6-12 months with farmers harvesting normally once or twice a year. Water sources supplying the AFPS surveyed are mainly from rivers: Ngu Huyen Khe River (non-ww) which is a branch of the Red River, and both ww of the To Lich and Kim Nguu Rivers.

Land (agricultural) leased from the state is the most common category for AFPS HHs in Hanoi (43.67% responded). According to "Resolution 10" of the 1988 Land Law, land for agriculture had been transferred from the cooperatives to the individual household farmers, land was allocated to households with a fifteen-year security of tenure and more importantly that land-use rights were given to families without the possibility to trade such rights. As such, renting land in from other or renting land out to other HH's for the remaining of fifteen-year security – in fact some form of land marketing appeared to be illegal however the in case of private HHs exchange of this land (sale of right of land use) appeared to be developing as a mutually acceptable process. Other land rented in from the local commune and part shared land with other individuals for 5 years joint contracts was also occurring as the situation and market for land in peri-urban Hanoi has been gradually changing over the last 10 years. However perceptions of land ownership of the North Vietnamese people appears to be different from the South Vietnamese people in that in our surveys Ho Chi Minh City 68.26% responded they actually own their land AFPS (Huy H.P.V and L.T.Hung, 2006). At present theoretically land ownership in Hanoi and Ho Chi Minh are operating under the same land code and land laws. However the difference in perceptions of land ownership we found in our surveys between farmers in Hanoi and HCMC could be reflected in the different histories of

the two cities. In Hanoi, the Vietnamese government took control of land from 1954 onwards through Agriculture Cooperatives, following which there were significant land reforms in the late 1980s, and the revised land law in 1993. But in contrast, in Ho Chi Minh City private land ownership was normal through to the mid-1970s. Following re-unification when the two countries became one although the Vietnamese government tried to apply land control through the introduction of Agriculture Cooperatives in peri-urban HCMC and the Mekong Delta, similar to the system in Hanoi, however this was largely unsuccessful and did not last long, with the concept of private ownership enduring and in fact strengthening further.

Fish polyculture systems in wastewater growing Indian carps (Rohu, Mrigal), mud carp (*Cirrhinus molitorella*), common carp (*Cyprinus carpio*), Nile tilapia (*Oreochromis niloticus*), silver carp (*Hypophthalmichthys molitrix),*and Bighead carp (*Aristichthys nobilis*) had the highest numbers of HHs involved (86 HHs) in all 4 communes with average annual production per system ranging from 2.5 tons to 32 tons fish per HH per year depending on their pond area. Average yield per hectare of ww fish polyculture systems was from 5.89 ton/ha to 6.66 ton/ha.

Production of fish seed in wastewater was significant in farmers supplying their own fingerlings for growing on into food fish. The Fish farmers themselves also sell their fingerlings to each other and their fish farming's neighbours when they have plenty of seed and in this case yield and ton/ha are non predictable and only few of them sell to others.

Our analysis showed that although fish farmers were generally earning higher incomes than aquatic plant growers by using much larger pond/plot areas, aquatic plant cultivation particularly the increasing trend towards seasonally rotating aquatic plant species was giving much higher yields per unit area (kg per hectare) due to the continual cropping and rapid regrowth of the stems of the likes of morning glory and water mimosa compared to fish culture where harvesting took place once or at the most twice a year. From our further analysis, we showed that despite the significant difference in unit price (VND per kg) between aquatic plants and fish, the annual income per hectare from growing aquatic plants using waste water, particularly by rotation, is potentially considerably higher than fish. This is an important finding from this survey for policy makers and urban planners in order to identify and optimize the best use for maintaining peri-urban agricultural land as well as developing a viable, cost effective and even income generating system of treating the city's waste water.

5.3 Institutions and Policies

Almost all of the fish and aquatic plant farmers in the survey were found to be involved in some form of institution like the Farmers Union, and Joint co-operation organizations. Almost

all women were involved in the Womens union, more elderly people involved in Elderly Union and the youth involved in the Youth Union. Almost all people in the 4 AFPS communes surveyed are involved in between 2-3 institutions. Fish producers (67.22% people) are more likely to have technical training (fish farming, hatchery operation, VAC) in their area of expertise than aquatic plant growers 32.78% people trained in IPM, pesticide/ fertilizer application, or vegetable management. Compared with secondary data from the other study city's Baseline and Monitoring reports, about 85.64% HHs surveyed in Hanoi were involved in training compared to only 5.66% (12 HHs in Nongpraongai village within 212 HHs surveyed) in peri-urban Thailand who had attended the government training activities (Saelee et al, 2006) or 13%HHs surveyed trained in aquatic plants and fish techniques in Phnom Penh (Kuong et al. 2006). This marked difference between countries could be related to the strong cultural and political traditions in North Vietnam of the state's strong local commune level infrastructure and organization which was historically often targeted towards increasing and improving the efficiency of agriculture at local levels.

This appears that farther communes from the city are more likely to deal with government agencies concerning their AFPS than those closer to the city centre and might be the result of a more pro-active government agriculture/fisheries extension service in more rural communes. And for the proportion of HHs who deal with government agencies such as welfare, fisheries extension, agricultural extension, legal, planning and health these are in similar proportions from 10.14% to 14.20% of the HHs who responded. The reason farmers deal with government agencies are mainly extension support for training which both for fish or vegetable farming, voting for local government leaders, co-ordinating farming activities, and checking health.

5.4 The future of AFPS?

Overall the HHs interviewed expected no change with their current status of aquatic production or to change to cultivating a high value species for a higher income or increased intensity. In general, this shows optimism for the future within those surveyed, however, the future of peri-urban AFPS strongly depending on how policy makers of city and government react in the future. In the past, Bang B and Tran Phu belong to management of Thanh Tri peri-urban district but after 16 November 2003 (Vietnamese prime minister signed) geography decided those communes we surveyed Bang B and Tran Phu become urban districts. By this new division, at present producing aquatic plants and fish in Bang B and Tran Phu (Hoang Mai) generates significant employment

of farmers within urbanization as well as producing fresh aquatic food and a green environment inside the city.

How then the future of AFPS peri-urban Hanoi? We should ask the authorities, policy makers and stakeholders to think about the answer(s). Initially, new peri-urban Hanoi will be expanding towards Ha Tay and Vinh Phuc provinces according to the Master Plan Hanoi city to 2010 (Hanoi Peoples Committee, 2003), and we thought that probably in the future AFPS Hanoi will be more diverse and development coming out of Hanoi city as in the lesson we learnt from Bangkok (Thailand) as peri-urban aquatic produce from AFPS's comes from 40 km for sale in central Bangkok markets (Saele et al, 2006).

The objective of this report was to produce an overview and understanding at a household level of the people who are involved in AFPS, information of production systems, institutions and also policy regarding AFPS. Information given in this report should be considered by policy makers and wide audiences who are direct or indirect stakeholders in urban aquaculture.

Part 6 How well the surveys went and what we could have improved?

6.1 Time and the validity of data

The time to carry out monitoring survey 3 was the whole of January at which time a proportion of fish producers have not totally harvested. Therefore fish production presented in this report will lower than the reality. We probably should have carried out monitoring survey 3 from February to March. And also it is sensitive when asking about income, economic and health aspects, so that we should understand that the answer and data we get could well be lower than the facts and reality.

6.2 Methodology

In terms of methodology and particularly objective of this research which was aimed at aquatic producers so HHs were chosen and data presented in this report above all mentioning and limited to livelihood of aquatic producers in peri-urban Hanoi. Therefore, it is not representative for the livelihoods of the whole peri-urban population. Possibly, for future research, when we make plans we should choose HHs of non producers of AFPS at one third of the total HHs

surveyed in each commune. Then it is easier to compare aquatic producers and non-producers and we can have a bigger picture of the overall livelihoods of general people in peri-urban Hanoi.

6.3 Choice of community

The choice of the 4 communities was good. Those 4 communes represents key AFPS production sites in the peri-urban of Hanoi. The choice of communes met representative diversity of all aquatic food production systems. Communities we chose were sustainable for the monitoring surveys. However in order to understand other aspects effect of "urbanization" the livelihoods of aquatic food producers, we need to answer the following questions: how fast is the land use change? What really happened inside the commune? What kind of jobs they have to learn to deal with unemployment? What do old people do? What do young people do? What do they do with the amount of money they received from government for their compensation for land production, land house etc.? If we have another survey, we suggest we chose another on the cusp of change from peri-urban to urban. However, we will surely face difficulties asking people questions for about 30-45 minute like in the baseline survey. They are busy with other jobs and not interested to talk about aquatic production which their communes have lost..

References

Hanoi People's Committee.2003. Department of Scientific and Environment of Hanoi City. Report on status environment of Hanoi City in 2003. Hanoi, May 2005.

Hanoi People's Committee. 2006. Long-term program of districts in Hanoi. http://www.hanoi.gov.vn/hanoi/tag.idempotent.render.userLayoutRootNode.target.n557.uP?uP_root=me&cw_xml=http://www.hanoi.gov.vn/hanoiwebs/ktxh/ttquyhoach/index.htm . Search 15/6/2006.

General Statistics Office. Number of administrative units as of 31 December 2004 by province. http://www.gso.gov.vn/default.aspx?tabid=387&idmid=3&ItemID=3161 search 20/6/2006

Huy H.P.V and L.T.Hung, 2006. Baseline and Monitoring Survey Report HCMC. PAPUSSA report 2006.

Kuong. K., D. Little and W. Leschen. 2006. Household baseline and monitoring survey report on production in aquatic peri-urban system in Phnom Penh, Cambodia. PAPUSSA report 2006.

People's Committee of Thanh Tri District, 2001. Summary report: General long-term program to develop socio and economy of Thanh Tri district stage from 2001 to 2010. Hanoi October, 2001.

Quy-Toan Do and Lakshmi Lyer,2002. Land rights and economic development: evidence from Vietnam. http://www-wds.worldbank.org

Socio- economic atlas of Vietnam: a depiction of the 1999 population and housing census. Trung tam Quoc gia Nang luc nghien cuu Bac Nam Thuy Sy (NCCR). Section of General Demographic Characteristics. Page 45. Or can be in web site www.agroviet.gov.vn/html/BandoKT-XHVietnam/Contents.asp.

Vo Anh Dung, Phuong Thi Thu Huong,Nguyen Ngoc Huyen, Le Thanh Son. 2005. Sex ratios at birth in Viet Nam and some localities: Current situation and comments. CEPED-CICRED-INED Seminar on Female Deficit in Asia: Trends and Perspectives, Singapore, 5-7 December 2005. Draft paper before publication.

Vietnam embassy in USA. 2006. Beliefs and religions. http://www.vietnamembassy-usa.org/learn_about_vietnam/culture/beliefs_and_religions/ search 20/6/06

Appendix Questionnaire

Please see Baseline and Monitoring questionnaire in project web site: www.papussa.org