

THE AQUAPRODUCTS IN KHULNA METROPOLITAN URBAN AND PERI-URBAN AREAS



A Project Thesis

By

Mst. Laboni Ahmed

Examination Roll No: MS- 050602

Session: 2004-2005

A project thesis submitted in partial fulfillment of the requirements

For the Degree Masters of Science in Fisheries and Marine Resource Technology

UNDER

Fisheries and Marine Resource Technology Discipline

**Khulna University
Khulna, Bangladesh**

August, 2007

THE AQUAPRODUCTS IN KHULNA METROPOLITAN URBAN AND PERI-URBAN AREAS

Approved as to style and content by



Dr. Khandaker Anisul Huq
Professor and Head
Fisheries and Marine Resource Technology Discipline
Khulna University
Khulna

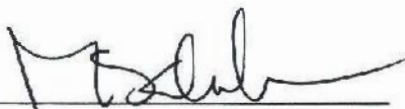
Declaration

The aquaproducts in Khulna metropolitan urban and peri-urban areas

The results presented in the thesis with the above mentioned title are entirely of the candidate's own investigations and no part of the results has been accepted for any degree nor is it being concurrently submitted for any degree.



Mst. Laboni Ahmed
Examination Roll No: MS- 050602
Session: 2004-2005



Dr. Dd. Saifuddin Shah
Professor
Fisheries and Marine Resource Technology Discipline
Khulna University, Khulna, Bangladesh

August, 2007

Dedicated To

My Beloved Parents

ACKNOWLEDGEMENT

At first, all my praises are due to the Omnipresent and Almighty ALLAH Who enabled me to pursue my education and complete as well as submit the project thesis. I remember Him at first from the core of my heart.

I also gratefully express my gratitude, heartfelt appreciation and indebtedness with due solemnity to my venerable supervisor Prof. Md. Saifuddin Shah, Professor, Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna, Bangladesh for his scholastic guidance, constructive criticism and continued and effective help to execute this thesis work successfully and for patience in going through the manuscript.

I would like to express my profound gratitude to Professor Dr. Khandaker Anisul Huq, Head, Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna, for his helpful motivation to complete this project thesis.

I recall with warm appreciation and great indebtedness for the support, assistance and suggestion extended to me by all of my respected teachers in Fisheries and Marine Resource Technology Discipline, Khulna University.

I like to bestow my appreciation to all of my friends especially to Ripon for his sincere help during collection of the research data for this research work.

Finally, I would like to express my deepest sense of gratitude and cordial thanks to my parents for their encouragement, sacrifices, affections and blessing that paved the way for my higher education.

Mst. Laboni Ahmed
Khulna University
August, 2007



ABSTRACT

Bangladesh has vast potentials for fertile land, water and human resources. It is the third richest country in the world with respect to freshwaters after China and India. The aquatic habitats in the form of ponds and wetlands around the metropolitan cities in the country support the growth of various aquatic vegetable plants and fishes of nutritional importance. A number of poor city dwellers earn their livelihoods through supplying these products as food to the people of the metropolis. Various types of aquatic vegetable plants and fishes are produced either naturally or by culture from ponds and wetlands from around the Khulna Metropolitan city. The products of these kind which hitherto remain unconventional in the market place; the information on their range of types, seasonality, volume of harvest, annual price and the people engaged in the occupation is very scanty. The present study was aimed at evaluating the importance of the various aqua-products that come in Khulna city market and to see their role in food security and poverty alleviation. Data were collected from 50 selling men/women from 8 different urban markets of Khulna metropolitan city through a questionnaire survey. Information were collected on types of plant and fishes collected, their season of availability, volume of harvest, selling price and the marketing channel of the products. A total of 10 different types of aquatic vegetable plants and a number of small indigenous species of fish were seen to be harvested and sold in the markets of the metropolis. Most of the vegetables were available throughout the year; however, the peak season was during August-December. Depending upon the collection and demand in the market, on an average, up to 12 Kg vegetables and 2 Kg fish were sold daily. The supply of the peri-urban aquatic plants and fishes to the urban markets was informal, though, it played an important role in food security, nutrition and poverty alleviation of a section of poor people in the urban areas. This production venture could be organized and upgraded through motivation, training and credit support to the collectors for it to make meaningful contribution in the livelihoods of the poor.

Table of Contents

Acknowledgement	I
Abstract	Ii
Table of contents	Iii
List of tables	Iv
List of figures	V
Chapter 1	Introduction
	<i>1.1. Background of the study</i>
	<i>1.2. Problem Statement</i>
	<i>1.3. Hypothesis Setting</i>
	<i>1.4. Objectives of the study</i>
Chapter 2	Methods and Materials
	2.1 Site selection
	2.2 Data collection process
	2.3 Types of data collection
	2.4 Sources of secondary data
Chapter 3	Results and Discussion
	3.1 Livelihood condition of the seller
	3.1.1 Sex
	3.1.2 Age structure
	3.1.3 Education
	3.1.4 Family size
	3.1.5 School going children
	3.1.6 School drop-out children
	3.1.7 Condition of living house
	3.2 For vegetable plant seller
	3.2.1 Types of vegetable plant
	3.2.2 Source of vegetable plant
	3.2.3 Collectors
	3.2.4 Women participation in collecting and selling
	3.2.5 Source of income

	3.2.6 Off season income	20
	3.2.7 Marketing channel	21
	3.2.8 Means of transportation	22
	3.2.9 Transportation cost	22
	3.2.10 Necessity of preservation	23
	3.2.11 Role of middlemen	23
	3.2.12 Consumer preference	23
	3.3 For fish seller	
	3.3.1 Types of fish	27
	3.3.2 Source of fish	31
	3.3.3 Collectors	32
	3.3.4 Women participation in collecting and selling	33
	3.3.5 Source of income	33
	3.3.7 Marketing channel	34
	3.3.8 Means of transportation	34
	3.3.9 Transportation cost	35
	3.3.10 Necessity of preservation	36
	3.3.11 Role of middlemen	36
	3.3.12 Consumer preference	36
	3.4 Problem faced by fish and vegetable seller	37
	3.5 Necessity of credit facilities	38
Chapter 4	Conclusion and Recommendations	39
Chapter 5	References	41
	Appendixes	43

List of Tables

Table No.	Title	Page
1	Age structure of the sellers	9
2	Educational status of the sellers	10
3	Types of vegetable collected by an individual seller	18
4	Seasonality of various vegetable plants	20
5	Transportation cost for different vehicles	23
6	Transportation cost for different vehicles	35



List of Figures

Figure No.	Title	Page
1	Percentage of sex distribution of the collectors	8
2	Age structure of the sellers	9
3	Education of the seller	10
4	Cause for school drop-out children	11
5	Housing condition of the sellers	12
6	Seasonality of the vegetable plants	13
7	Age group distribution of the collectors	19
8	Women participation in collecting and selling	19
9	Vegetable plant marketing channel from collector to consumer	21
10	Means of transportation of the of the products	22
11	Average sell/day/seller of aquatic vegetable plants in Khulna city markets	24
12	Na concentration (mg/100g) of different aquatic vegetable plants (Source: Anon)	25
13	K concentration (mg/100g) of different aquatic vegetable plants(Source: Anon)	25
14	Fe concentration (g/100g) of different aquatic vegetable plants (Source: Anon)	26
15	Zn concentration (g/100g) of different aquatic vegetable plants (Source: Anon)	26
16	Vitamin A concentration (µg/100g) of different aquatic vegetable plants (Source: Anon)	26
17	Vitamin C concentration (mg/100g) of different aquatic vegetable plants (Source: Anon)	26
18	Sources and types of water body from where fishes are supplied in the market	32
19	Sex ratio of the people involved in collecting of fish	32
20	Marketing channel of the fish collected by poor in the Khulna city markets	34
21	Means of transportation of fish to the market	35
22	Percentage of consumer preference of small indigenous fish	37

Chapter 1

Introduction

1.0 INTRODUCTION

1.1 Background of the study

Bangladesh has one of the most vulnerable economic characteristics by an extremely high population density, low resource base and high incidence of natural disasters. These have adverse implications for long term savings, investment and growth. Such defining features impart certain uniqueness to the formation of the poverty reduction strategy of the poor. The world is being urbanized at a rapid pace. The UN estimated that by the end of 2005, more than half the earth's population will live in areas defined as "urban" though definitions of what "urban" varies from country to country. With the increasing rate of urbanization, poverty in cities is also rapidly expanding. Many of the world's poor are migrating to cities in search of income and earning opportunities. The urban poor often suffer from malnutrition, mostly due to lack of purchasing power and high food prices. Urban poverty and the related issue of urban food security are therefore of prime concern. Because poverty is a multi-dimensional problem which paralyses the economy of the country and acts as the major impediment to the development and progress of a country. It is the breeding ground of diseases, drought, civil-war, mal-nutrition, hunger and also crimes. Without the alleviation of poverty no nation can achieve its goal. According to a report "Food into cities" by FAO, 2001, given the rapid rate of urbanization, the importance of efficient food supply should be recognized by all stakeholders as a means of adequately feeding cities and an important determinant of food security for the urban and peri-urban poor. Furthermore, the pressure put on land and water by the urbanization process puts urban and peri-urban food production increasingly at risk. This situation requires increased attention to maintain suitable land and water for food production. (FAO, 2005)

The floodplains of Bangladesh represent one of the world's most important wetlands. It is home to hundreds of species of fish, plants, and wild lives. Fish and Fisheries are part of our life and culture. Bangladesh is 5th in terms of production and 7th in terms of value of fish and fishery products in the world. (Online)

For culture and capture fisheries Khulna is known as the “Kuwait” of Bangladesh. Most of the Bangladeshi cities are located near one or more rivers. Khulna city is also situated on the bank of the river “Bhairab”. Inside the Khulna metropolitan city and in the periphery there are many ponds, lakes and open water bodies. In these urban and peri-urban water bodies various types of aqua products both plants and fishes are produced either naturally or by culture practice. These aqua products involving different types of vegetables or “shak”, different indigenous or exotic fish species are specially collected and sold by the poor people for their livelihood. People in these areas, often located on river deltas, continue to rely on rice and fish as staple foods.

1.2 Problem statement

There is a pressing need to increase the productivity and profitability of farming in developing countries like Bangladesh. In the study of FAO (1981) reported that in the year 2000, the demand for agricultural products for third world countries would become double due to over population. Small-scale farmers comprise the bulk of population of the developing countries that could lead the productivity per unit of capital input to declining arable land per person. So environmentally friendly but plentiful productive systems should be evolved and practiced in sustainable basis. Therefore, there is a need to improve the efficiency of utilization of the limited resources through the promotion of integrated farming to improve their diet, balance risk among various farming subsystems, provide fuller employment and generate

surplus sustainable third-world agriculture with minimal adverse environmental impact.

Historically, wetlands in Bangladesh provide a well-protected sanctuary for various species of fish, indigenous rice and a wealth of biodiversity. Currently these support major rice growing industry, subsistence and commercial fisheries, and abundant natural aquatic vegetation which provides a source of food, fuel and fertilizer for local people (Karim, 1993; Islam 1996; NERP 1996).

Urban and peri-urban aquatic ecosystems are highly vulnerable because of the rapid rate of urbanization and the impact of human activities can be profoundly damaging on them. Damage to natural resources hurts not only the environment but also the income of the poor. For example, the number of fish species and the average fish catch has decreased drastically. This reduces the income of the very poor that depends on fish for protein and their livelihood. In the forests, loss of biodiversity and products means less food, fodder, medicine and shelter for the poor. It is clear that feeding the growing urban population of Bangladesh is a matter of utmost urgency. More people in these expanding urban areas have led to increasing opportunities for production and trading of food.

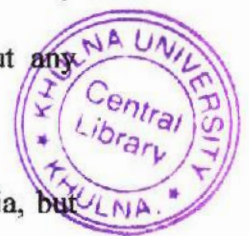
1.3 Hypothesis testing

Aquaculture is increasingly being recognized as the generation of good income for household, particularly cash income to subsistence and semi-subsistence households in rural and urban farming settings. The present study may be useful and expected to provide some valuable information to the sellers dealing with appropriate institutional support for diversification of products and trade and necessary integration of the

production system development and input supply, post-harvest and value chain of the activities.

A baseline survey was carried out through a prestructured questionnaire of 50 sellers from 8 fish and vegetable markets in Khulna metropolitan city covering a wide range of information, which included all aspects of livelihoods. The baseline provided an ample opportunity to understand the critical role of these urban and peri-urban aquatic products as a source of their additional income and also nutrition. Collecting and selling of these aquatic products enable the sellers to remove their financial problem up to a certain level. Because, on an average, a fish seller can sell 2 kg fish per day and a vegetable plant seller can sell 12 kg vegetable plant per day without any investment.

Aquatic vegetables are a particular feature of urban produces in Southeast Asia, but have often been ignored by scientists and policy-makers. A successful work have done by PAPUSSA (Production in Aquatic peri-urban Systems in Southeast Asia) in Thailand, South Vietnam and Cambodia where morning glory, water mimosa and lotus were produced as aquatic plants and hybrid catfish, snakehead, mixed tilapia and carps as aquatic animals were produced by culture under the supervision of poor metropolitan city communities. By doing this practice with the help of institutional involvement the poor metropolis of these Southeast Asian countries alleviated their poverty. Although it's a new concept in our Bangladesh and no particular work about this field have yet been done, so the principles of the study was to evaluate the importance of these aqua products and their role in food security and poverty alleviation.



1.4 Objectives of the study

The overall objectives of the study were:

- To know the livelihood status of the urban and peri-urban aqua products sellers.
- To know the types of aqua products that are mainly produced in Khulna metropolitan urban and peri-urban areas.
- To know the types of people who are especially involved in the collection and selling of such types of aqua products.
- And finally to explore the steps that should be taken for the improvement of the livelihood patterns of the urban and peri-urban poor.

Chapter 2

Methods and Materials

2.0 METHODS AND MATERIALS

2.1 Selection of site

Major sites of production of important aquatic food products in the urban and peri-urban area of Khulna metropolitan were identified through preliminary survey of the main wholesale and retail markets of the Khulna metropolitan. The sellers of the markets were selected randomly.

2.2 Data collection process

The duration of the survey was from 20 August to 15 December when these aqua products were available in the market. A prepared questionnaire was used for collecting the data through interview.

2.3 Types of data collection

Information related to collection place, amount of collection daily, family status of the seller, source of income, season of availability of these aqua products, ownership of the water body from where these were collected and the condition of the water body was collected through interview of the sellers.

Other information like means of transportation, transportation cost, preservation technique, consumer preference, market price of these aqua products, amount of family consumption were also collected.

Information regarding types of problem they faced and role of middlemen during marketing was not left uncollected.

2.4 Source of secondary data

Information was also collected from different project papers and literature was collected from central and seminar library of Khulna University. Collected data was processed and analyzed by simple statistical test.

Chapter 3

Results and Discussion



3.0 RESULTS AND DISCUSSION

3.1 Livelihood conditions and socio-economic status of the seller groups

A total of 50 sellers (25 vegetable plant sellers and 25 fish sellers) were interviewed in 8 fish and vegetable markets at Khulna metropolitan city. Verities information relating to livelihood status and socio-economic conditions of the sellers were collected. These included sex, age structure, marital status, education, family size, school going children, school drop-out children, and condition of living house.

3.1.1 Sex

The survey revealed that, among the 50 sellers (both plant and fish sellers) of these markets 15 sellers were female, 23 sellers were adult male and 12 sellers were boys under fifteen years. But the number of female vegetable sellers (13) was more than the number of male vegetable sellers (8). On the other hand the number of male (15) and boys (8) fish sellers was more than the number of female fish sellers (2).

Almost all of the male and female fish and vegetable sellers were married.

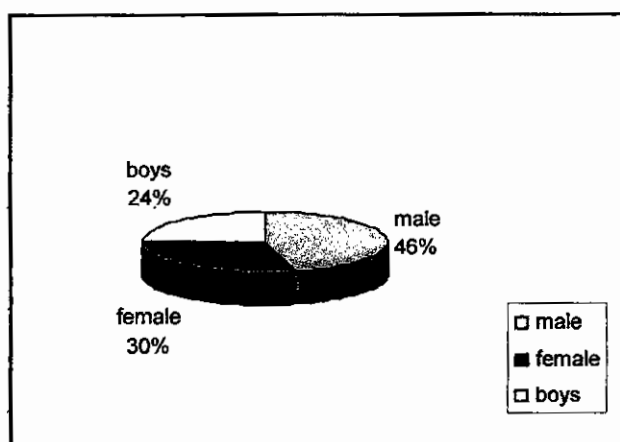


Figure 1. Percentage of sex distribution of the collectors

3.1.2 Age structure

Age group of all the sellers surveyed in the city markets were ranged from below 15- above 51. It was found that 12 sellers age were below 15, 8 sellers were belong to age group between 16-30, 23 were between 31-50 and rest 7 sellers were more than 50 age group. Results showed that the highest number of sellers were between 31-50 age group indicating middle age people to be more involved.

Table 1. Age structure of the sellers

Age group	Number	Percentage (%)
Below 15	12	24
16-30	8	16
31-50	23	46
Above 50	7	14
Total	50	100

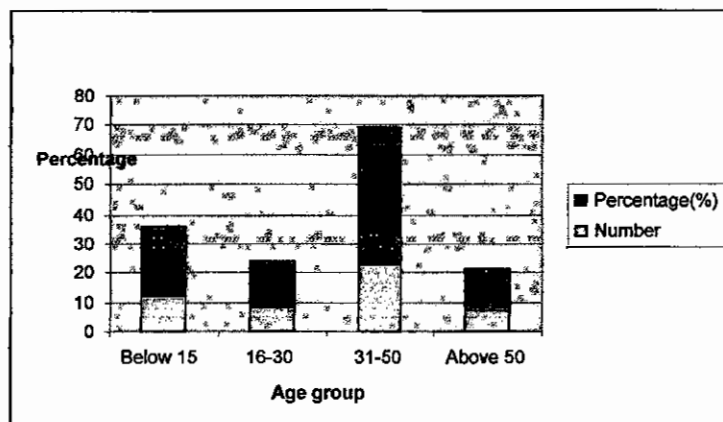


Figure 2. Age structure of the sellers

3.1.3 Education

It was obtained that large majority of the sellers were educated belonging to the education group of class one-five. 22% sellers were belonging to the education group of class five-ten were found in the survey. None of these sellers completed their secondary school education. Most of the sellers specially women sellers had to leave their school because of poverty and early marriage.

Table 2. Educational status of the sellers

Educational status	Number	Percentage
Illiterate	9	18
Class one-five	30	60
Class five –ten	11	22
Total	50	100

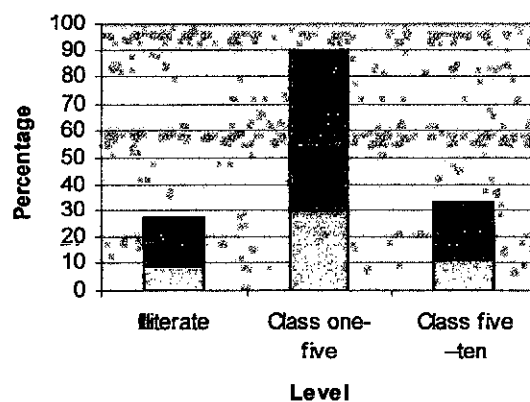


Figure 3. Education of the seller

3.1.4 Family size

The results revealed that there were a total of 250 members in the 50 sellers households surveyed of which 140 were male (56%) and 110 were female (44) members. The size of average households was 5.

3.1.5 School going children

From the interview it was found that the children (below 12 years old) of all the sellers were in education because now-a-days they realized the importance of education. Out of the total school going children 60% were boys and 40% were female.

3.1.6 School drop-out children

It was found that 30% boys and 70% girls were dropped out from school. The number of school drop-out children was few among which the number of girls were more than the number of boys per household. The causes of school drop-out were 60% for economic problem, 30% for involvement in income generating job and 10% due to without any cause.

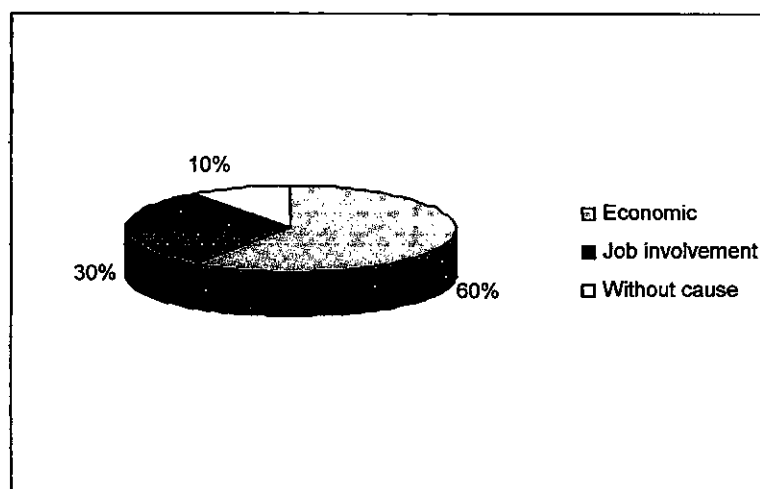


Figure 4. Cause for school drop-out children

3.1.7 Condition of living house:

On the basis of collected information it was found that among the 50 sellers, 64% were living in Kancha house, 26% were living in semi pucca use and 10% were living in pucca house.

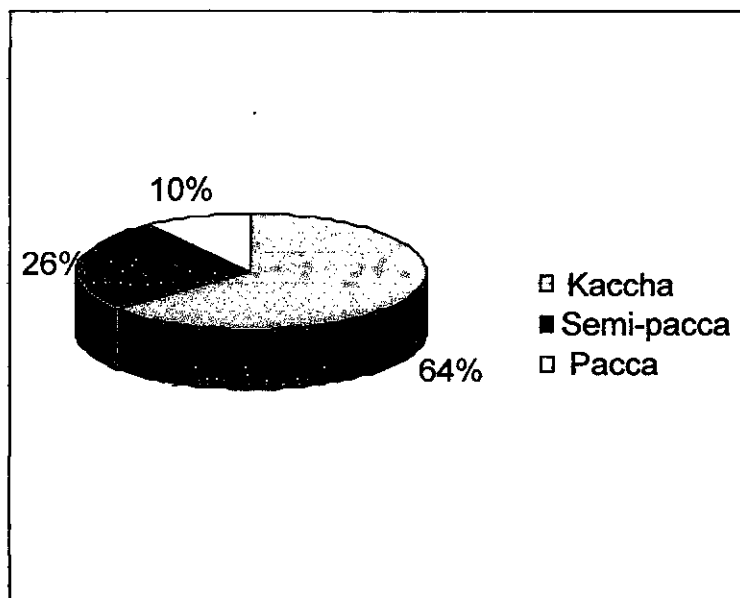


Figure 5: Housing condition of the sellers

3.2 VEGETABLE PLANT SELLER

3.2.1 Types of vegetable plant

A total of 10 different vegetable plants were found being sold in different markets of the Khulna metropolitan city. These vegetable plants are produced naturally and harvested by the urban and peri-urban poor (especially poor women) and sold as a support of their income. Among the 25 vegetable sellers only 7 sellers were reported to take some management measures like, spraying pesticide/insecticide in their own water body with plants for better production. The vegetables were available in the

markets almost throughout the year; some though, were found in some restricted periods (July-September) of the year. Among the 10 vegetable plants 3 were found in the restricted period of the year and the rest 7 were found almost throughout the year.

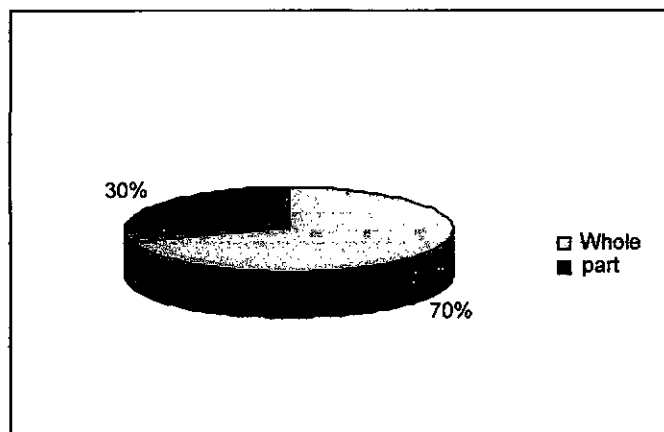


Figure 6. Seasonality of the vegetable plants

The vegetable plants were sold in bundles weighing up to 150-250g and the price /bundle often varies and ranges between Tk. 2-3/bundle. The vegetables came to the market from around 10-15Km radius from the metropolis. Depending upon the collection and demand in the market, on an average, up to 12 Kg vegetables were sold daily.

The following plant vegetables were found to sell in the city markets. The classification of these vegetable plants is given below respectively:



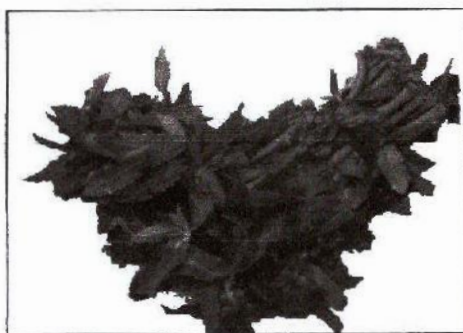
Family: Umbeliferi
 Genus: Hydrocotyl
 Scientific name: *Hydrocotyl rotundifolia*
 Local name: Gima shak



Family: Convolvulaceae
 Genus: Ipomoea
 Scientific name: *Ipomoea aquatica*
 Local name: Kalmi shak



Family: Amaranthaceae
 Genus: Alternanthera
 Scientific name: *Alternanthera philoxeroides*
 Local name: Maloncho



Family: Compositae
 Genus: Enhydra
 Scientific name: *Enhydra fluctuans*
 Local name: Hinch/Helencha



Family: Haloragaceae
 Genus: Nymphaea
 Scientific name: *Nymphaea nouchali*
 Local name: Shapla



Local name: Telacucha
 Scientific name: *Coccinea cordifolia*



Family: Araceae
 Genus: Colocacea
 Scientific name: *Colocacea esculanta*
 Local name: Kochu/pani kochu

Detail information about these plant vegetables that were collected from the city markets are in the following:

3.2.2 Source of vegetable plant

Almost all of these vegetable plants are grown in shallow and stagnant water on the margins of beels, ditches, pools, ponds, jheels, haors and river banks. These can also grow in wet low land. All of these can be found all over the country. The sellers of the survey market mentioned that the main source of these vegetable plant were all the water bodies of Khulna metropolitan including public and private water bodies, especially the ghers. But the collection from private water body was more hygienic than the collection from public water body. Because private water bodies were always in culture condition and managed well and also protected from any pollution. The amount of collection from public water body was more than private water body, because the area of public water body was large than the area of private water body. The sources of these vegetable plants were different for different markets which were collected from 10-15 km radius of the metropolis.

The public or private water bodies from where the collectors or sellers collect their products were Koiya, Botiaghata. Dumuria, Hogladanga, Kathal tola and Khornia

(under Dumuria thana), beel Dakatia, Lobon chora, Tero khada, Rupsha and also from all types of water body and ghere located in and around the Khulna metropolitan city.

3.2.3 Collectors

The survey showed that out of 25 sellers, 8 of them were not the collector and also vice-versa however, maximum of the collectors (17 sellers) sold their products by themselves. Especially the urban and peri-urban poor and deprived women were engaged for collection of such types of products. It was also found that some collectors sold their products to other sellers who were generally engaged for permanent business. Not all types of vegetable plant were collected or sold by one seller or collector in a day. On an average, 3 types of vegetable plants were collected or sold by an individual collector or seller. The following table showed the types of vegetable plant collected or sold by an individual seller or collector and the age group of 25 sellers.

Table 3. Types of vegetables collected by an individual seller

No. of seller	Vegetable types	Age group
14	3	30-45
4	4	30-50
2	1	>45
5	2	12-40

Aquatic plant vegetables are not in cultured in Bangladesh. An ample amount of aquatic vegetable plants are found in the markets in rainy season (June- September). The local people of different age collect these vegetable plants and sell in local the markets. The following figure shows the people involved (different age) in collecting these products.

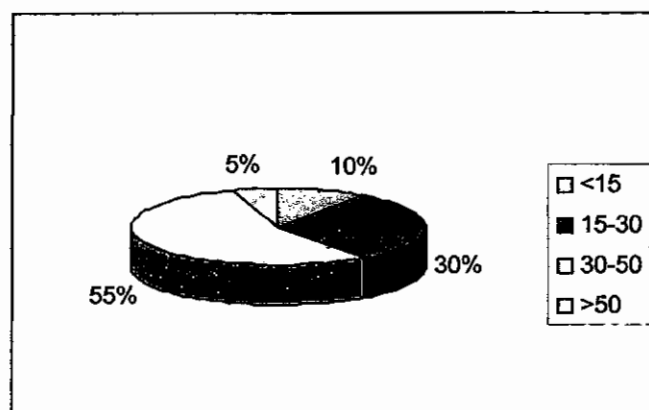


Figure 7. Age group distribution of the collectors.

3.2.4 Women participation in collecting and selling

The survey revealed that cent percent of the aquatic plant vegetable seller were women. Only a few numbers of men and boys (under 12) were seen with these products for sell. It was also analyzed from the survey that women participation in collecting these aquatic plant vegetable was 90% and for selling it was 80%.

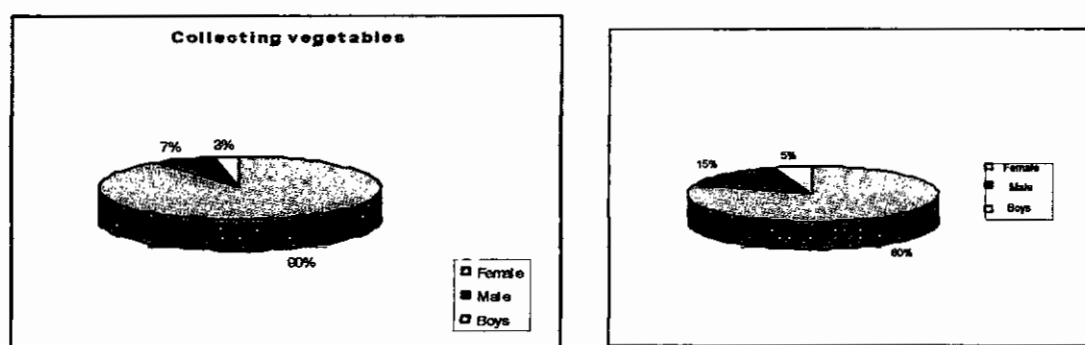


Figure 8. Women participation in collecting and selling.

3.2.5 Sources of income

Out of 25 vegetable plant sellers 17 had no permanent source of income. Selling these products was a part of their daily income and not a regular job either. One seller may not be seen in another day. Most of them (20 sellers) had diversity of their income sources. But for that sellers (5 sellers) who sold a variety of plant and leafy vegetables did not change their business, because they made it as a permanent business.

3.2.6 Off season income

According to the answer given by the seller through interview, it was found that the source of income of 20 sellers out of 25 sellers depended on the season of availability of the products; there were peak season and off peak season. That means they sold the products which have availability in that season. Some of the sellers (20 sellers) caught fish, sold other products, worked as labor as a source of their off season income. The following table illustrates clearly about the peak season and off peak season of various aquatic vegetable plants.

Table 4. Seasonality of various vegetable plants

Types of vegetable plants	Seasonality
Gima shak	August-February*
Kolmi shak	July-February
Helencha shak	July-February
Maloncho shak	July-February
Thankuni pata	September-February*
Kochu	All the year round
Kochur loti	August-January

The sign (*) represents the peak season of the products.

3.2.7 Market

The survey revealed that like other commodities there was no complexity for the marketing of such types of aquatic vegetable plants. Out of 25 sellers 18 were the collectors of their own products and their collection was in small amount that is from 3-8 kg.

But in case of large scale collection that is when the collection was from 8-20 kg then there was a need of wholesaler and retailer. Here wholesaler are the middlemen who collect these products from different collectors and sold these products to the retailers who especially engaged in selling such types of products in different retail markets in the Khulna metropolitan city. The marketing channel for small scale and large- scale collection was like the following:

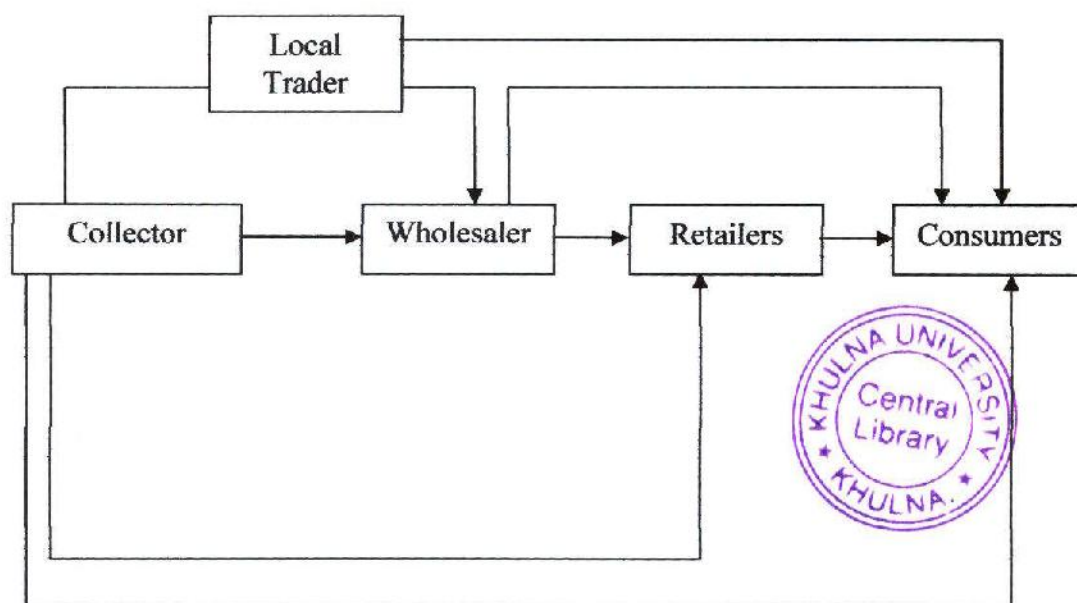


Figure 9. Vegetable plant marketing channel from collector to consumer

3.2.8 Means of transportation

The collected vegetable plants were brought to the nearest market by many ways, because it was dependent on the amount of collection and also on the market situation. When the collection was less (about 2-3 kg) and the distance from collection area to the market place was small (1-5 km.), then the collectors came the nearest market on foot. But when the collection was large (3-20 kg) and the distance from collection area to the market place was more (5-15 km.), then they brought these products in the main and big markets of Khulna metropolitan city by van, bi-cycle, rickshaw, tempu, boat (for passing river) and also bus as a means of transportation. 85% of the sellers transported their products by van. It was also found that all the sellers had a tendency to bring their products in that market where they could sell all their products and could make maximum profit.

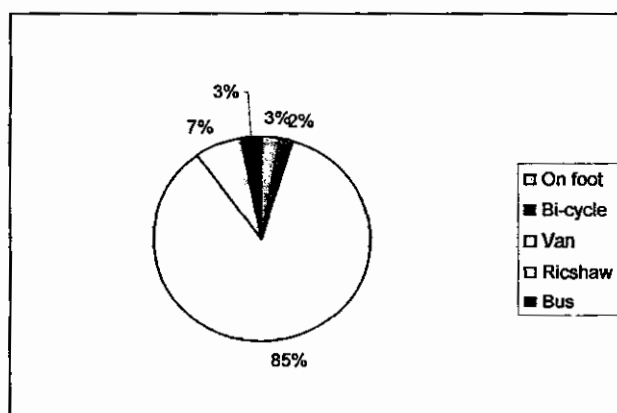


Figure 10. Means of transportation of the of the products

3.2.9 Transportation cost

Transportation cost was to depend on the means of transportation and also on the distance between collecting point and market place. A quite sum of money earned by selling these products was spending in transportation cost. On an average, for a plant vegetable seller transportation cost was 35 Tk/ day (for up-down travel) when the

actual consumer of these products. Consumer preference inspired the business. Though the collection and selling of aquatic plant vegetables was remained as informal yet no step had been taken for the improvement of culturing these products, so these aquatic vegetable plants was used as alternative of agricultural vegetables. But its demand was increasing day by day. In city area their demand and price was relatively higher than in the rural area. The following figure showed the demand or consumer preference of aquatic plant vegetable in the Khulna metropolitan city market of average sell in kg/day/seller.

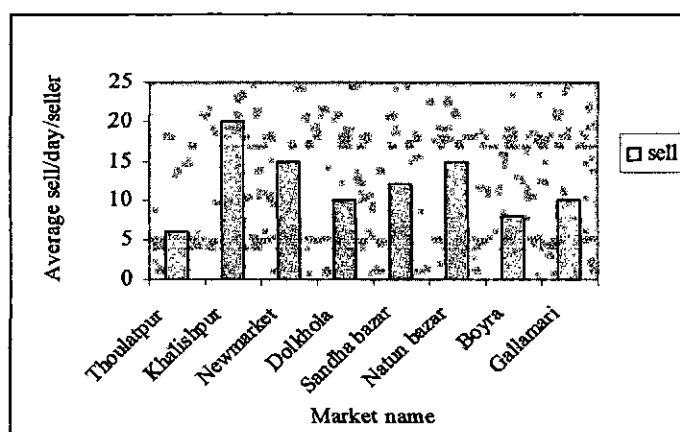


Figure 11. Average sell/day/seller of aquatic vegetable plants in Khulna city markets

The foremost reason for preference of such types of products was that the consumer can fulfill their nutritional requirements at low cost. These aquatic vegetable plants contain various types of nutrients and minerals. These aquatic vegetable plants contain the following concentration of minerals (Na, K are in mg/100g and Fe, Zn are in g/100gm) and vitamins (Vitamin A concentration $\mu\text{g}/100\text{g}$ and Vitamin C concentration mg/100g).

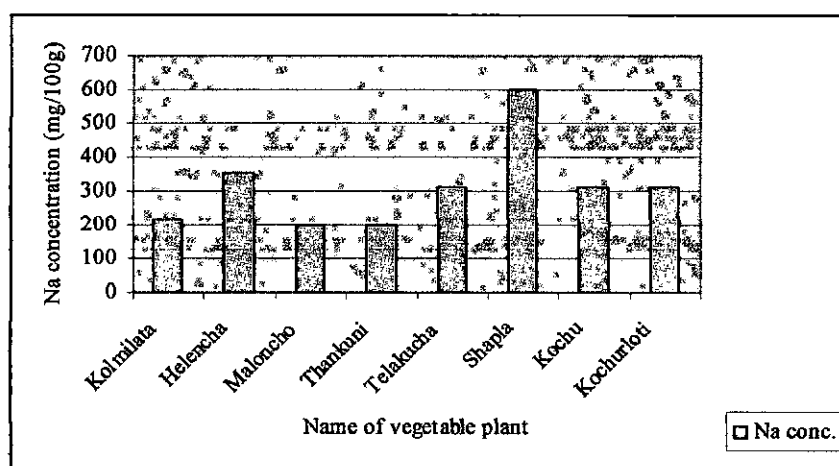


Figure 12. Na concentration (mg/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

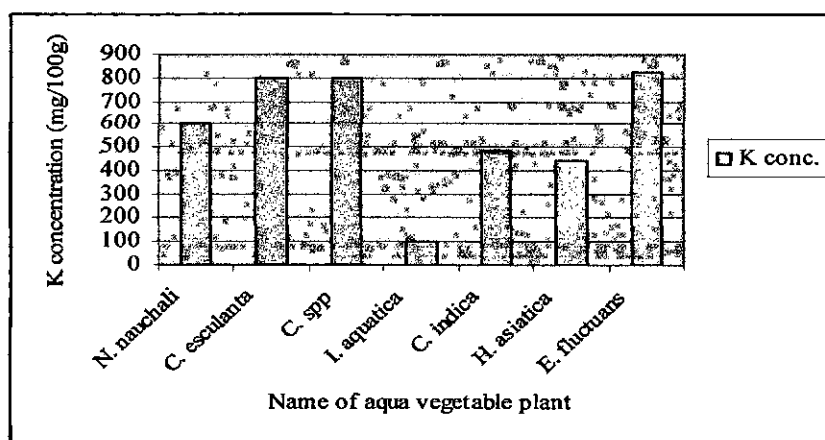


Figure 13. K concentration (mg/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

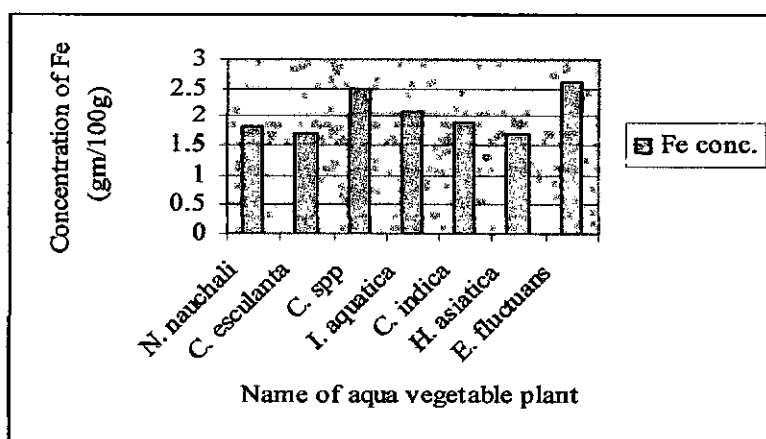


Figure 14. Fe concentration (g/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

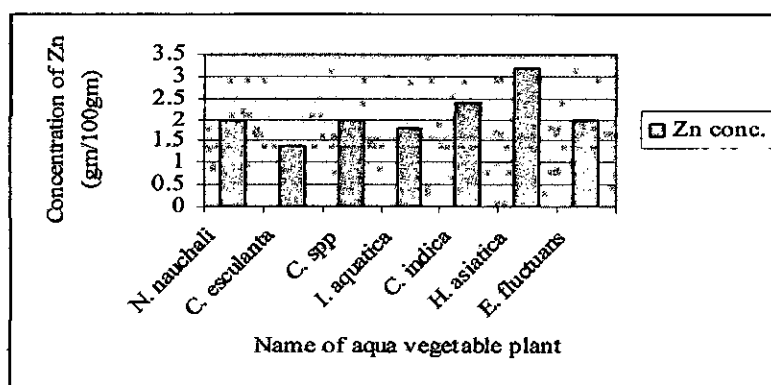


Figure 15. Zn concentration (g/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

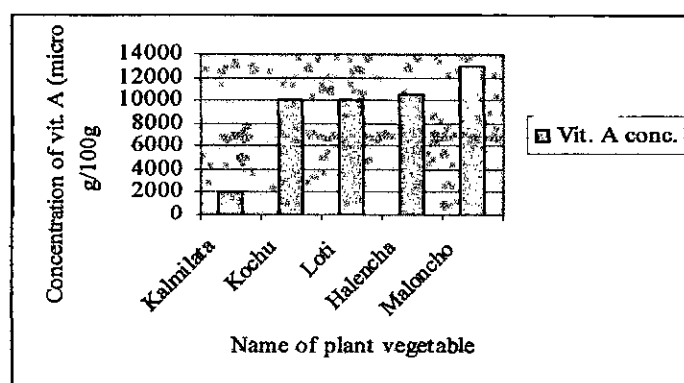


Figure 16. Vitamin A concentration (μ g/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

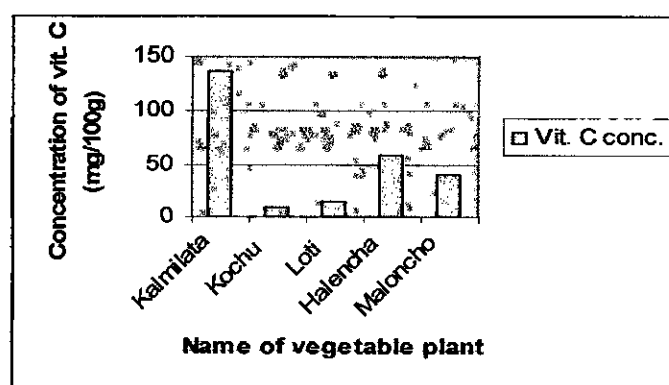


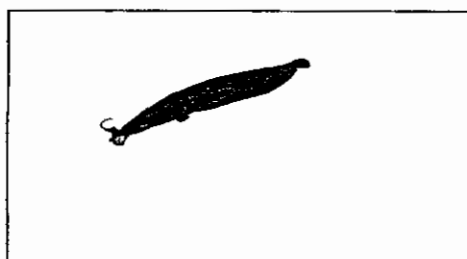
Figure17. Vitamin C concentration (mg/100g) of different aquatic vegetable plants (Source: Akobundu I.O. 1987)

3.3 FISH SELLER

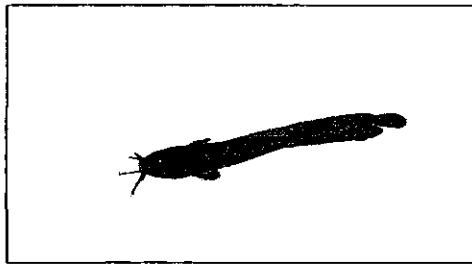
3.3.1 Types of fish

Like aquatic plant vegetables, a number of 12 different small indigenous fish species were also found in the Khulna metropolitan markets for sale that were collected traditionally by the urban and peri-urban poor. All the species can be seen all the year round but the availability was more in the dry season. Out of 12 indigenous fish species 4 of them (33%) (Koi, Magur, Sing, Baim) were found more in the markets in dry season that from September to February and the rest 8 species (67%) were found all the year round in the market.

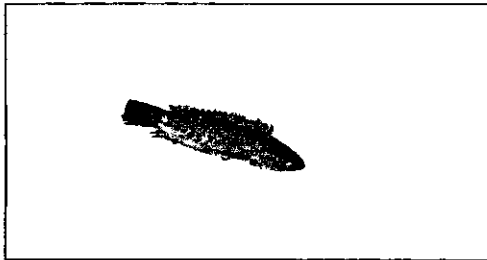
These fish species were sold as mixed group in lots. Depending upon the collection, on an average, up to 2 Kg fish were found being sold daily in the markets. The following small indigenous fish species were found to sell as lots at the Khulna city markets. The classification of these small indigenous fish species were as the following.



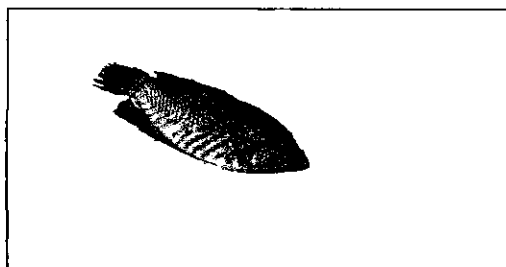
Order: Cypriniformes
Family: Heteropneustidae
Genus: Heteropneustes
Scientific name: *Heteropneustes fossilis*
Local name: Shing



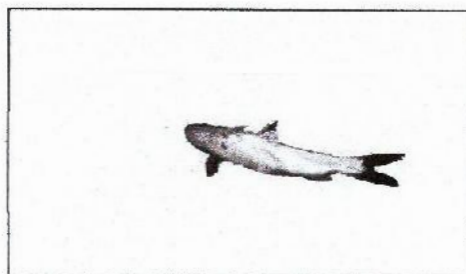
Order: Cypriniformes
 Family: Claridae
 Genus: Clarius
 Scientific name: *Clarius batrachus*
 Local name: Magu



Order: Perciformes
 Family: Anabantidae
 Genus: Anabus
 Scientific name: *Anabus testudineus*
 Local name: Koi



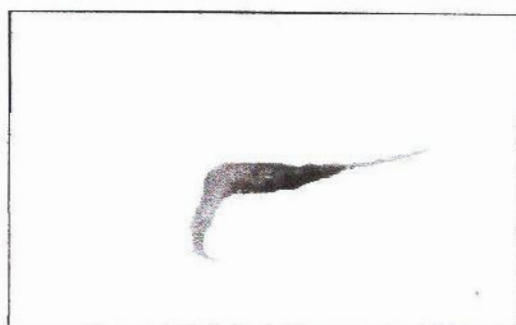
Order: Perciformes
 Family: Anabantidae
 Genus: Colisha
 Scientific name: *Colisha spp.*
 Local name: Khailsha



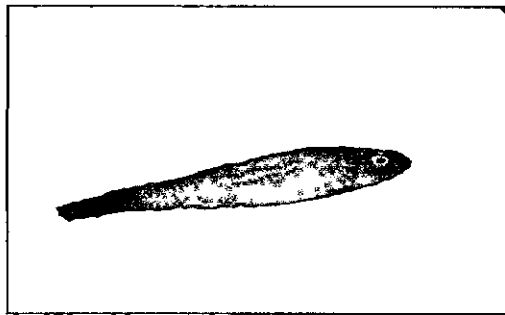
Order: Cypriniformes
 Family: Bagridae
 Scientific name: *Tengara spp*
 Local name: Tengra



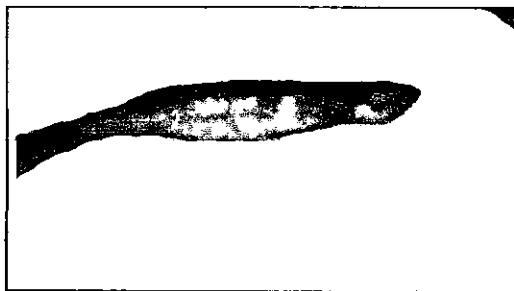
Order: Channiformes
 Family: Channidae
 Genus: Channa
 Scientific name: *Channa punctatus*
 Local name: Taki



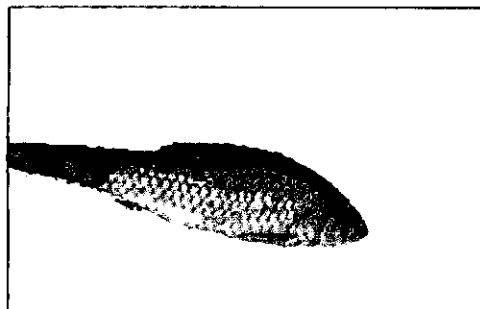
Scientific name: *Penaeus spp.*
 Local name: Chingri



Order: Perciformes
 Family: Gobidae
 Genus: Glossogobius
 Scientific name: *Glossogobius giuris*
 Local name: Bele/Baila



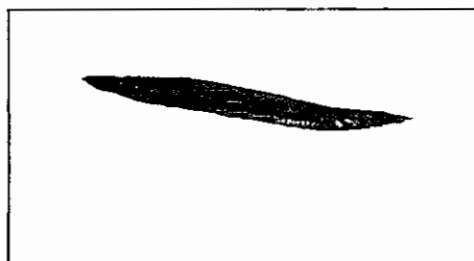
Order: Cypriniformes
 Family: Cyprinidae
 Genus: Amblypharyngodon
 Scientific name: *Amblypharyngodon mola*
 Local name: Mola



Order: Cypriniformes
 Family: Cyprinidae
 Genus: Puntius
 Scientific name: *Puntius spp*
 Local name: Puti



Order: Cyprinodontiformes
 Family: Cyprinodontidae
 Genus: Aplocheilus
 Scientific name: *Aplocheilus panchax*
 Local name: Kanpona



Order: *Perciformis*
 Family: *Mastacembelidae*
 Genus: *Macrornathus*
 Scientific name: *Macrornathus aculeatus*
 Local name: Baim

Collected information about these fish species are the following:

3.3.2 Source of fish

The collected information showed that all types of water bodies were the source of various types of small indigenous fish species and these fish species can be seen in all the fish market all the year round. Ninety percent of the fishes were collected from peri-urban sources of which 70% were collected from beels, 15% from gher and 5% from derelict ponds, lake, ditches and swamps. The rest 10% fishes were collected from urban water bodies like small pond, reservoir and ditches.

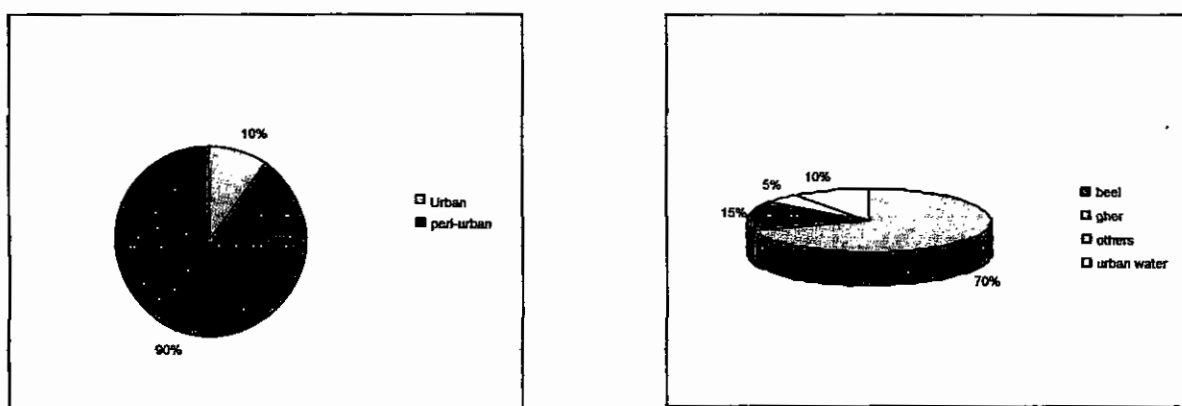


Figure 18. Sources and types of water body from where fishes are supplied in the market

3.3.3 Collectors

From the survey it was found that, 80% of the collectors were male, 5% were female and 15% were boys under 15 years of old. Especially in the dry season (November-February) when water level in most of the water bodies become reduced and of dried then the urban and peri-urban poor harvest the fishes from these water bodies. Sometimes they consume this fishes in the family and also bring to the urban markets for sell which support them as a source of income.

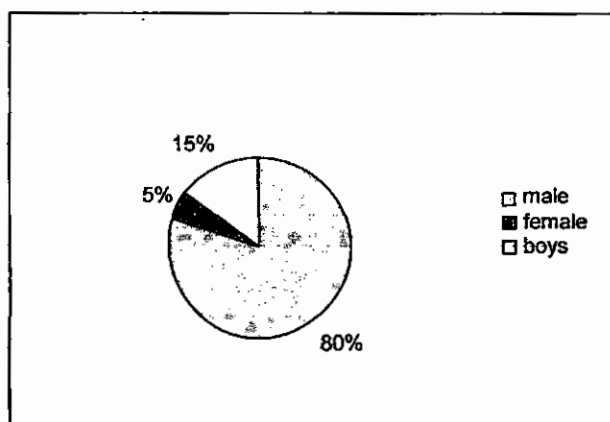


Figure 19. Sex ratio of the people involved in collecting of fish

3.3.4 Women participation in collecting and selling

The survey revealed that participation of women in collecting and selling of fishes was less (2 seller) than the participation of women in collecting and selling of aquatic plant vegetables (13 sellers). According to the opinion received from the women sellers it was found that the collecting and selling of aquatic plant vegetable was easier for them than for collecting and selling fishes. Only when there was less supply of aquatic vegetables then the women sellers (7 sellers) collect and sell fishes as a source of their off season (when there was unavailability of aquatic vegetable plants especially from the month February- may) income. Some women sellers were reported to catch fishes during peak season (dry season from the month December-April) for their family consumption only. Seventy percent of the female sellers consume their collected fish and 30% female sellers sold their collection for need of money.

3.3.5 Source of income

The survey showed that the source of income of 80% of the sellers was seasonal (from September-February), that means they had no permanent source of income. The rest 20% sellers were involved in fishing and selling of fish. Selling these products was a part of their daily income and of course an irregular job. One seller may not be seen in another day. Most of them had diversity of their income sources. That means they sold the products which had availability in that season concerned. Some of the sellers pull vans or rickshaw, sold other products (vegetables, leafy plants, agricultural products) and worked as labor as a source of their off season income (when they can not catch these small indigenous species).

3.3.6 Marketing channel

From the survey it was found that the collection of wild harvested fish was not so high. The average collection of 25 sellers was ranged from 2-4 kg/day. So there was, in effect, no existence any formal marketing system for these harvest. According to the sellers when they caught more than 4 kg of fish then they sold (5 sellers) their collection to the wholesaler or retailer because of lack of preservation technique. Out of 25 fish sellers, 20 of them sold their catch (when the catch is from 1-2 kg) directly to the consumers. Here the wholesalers are the middlemen who collect fish from different collectors and sold these products to the retailers who especially engaged in selling fish in different wholesale and retail markets in the Khulna metropolitan city. The marketing channel of the fishes collected by the poor people is as follows:

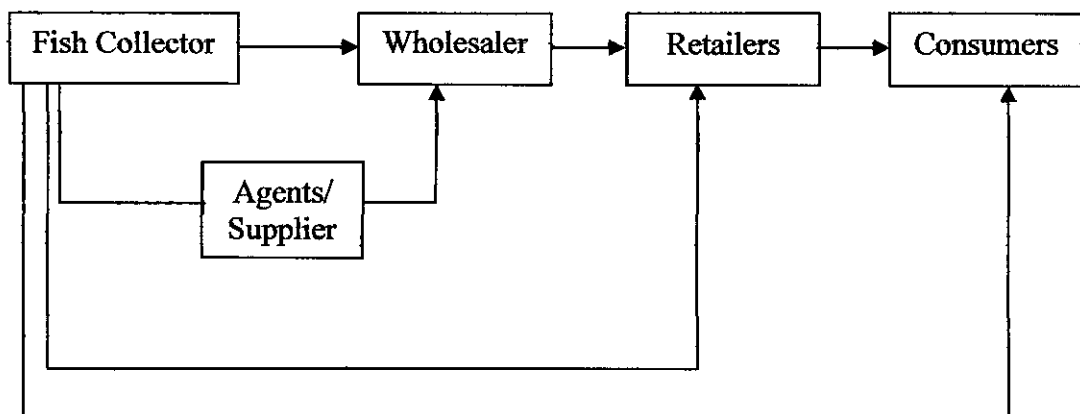


Figure 20 . Marketing channel of the fish collected by poor in the Khulna city markets

3.3.7 Means of transportation

From the survey it was revealed that 92% of the sellers transported their harvested fish to the markets by means of van. When the collection was from urban water

bodies then they brought those on foot but when the collection was from peri-urban sources then they transported their collection to the markets by van, rickshaw or bi-cycle. Five percent of the fish were transported by rickshaw and rest 3% by bi-cycle. Every seller has a normal tendency to sell all their collection and can make a better profit by a considerable less amount of transportation cost.

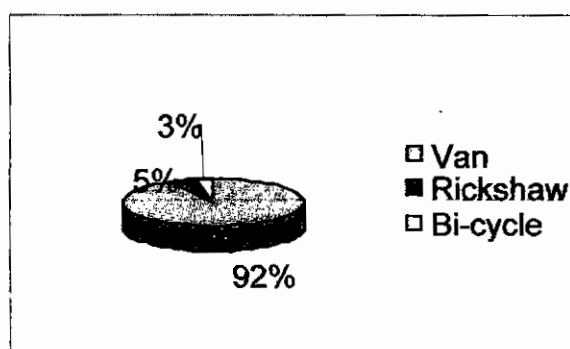


Figure 21. Means of transportation of fish to the market

3.3.8 Transportation cost

It was found that the transportation cost depended on the means of transportation and also on the distance between harvesting point and market place. A lot of money earned by selling these products was spent in transportation cost. On an average, 30-40 taka (for up-down) was needed for fish sellers in transportation cost when the transportation medium was van and the range of distance is from 5-10 km. But when the transportation medium was other than van then the cost was higher

Table 6. Transportation cost for different vehicles

Transportation way	Range of distance (km.)	Taka/Up-down
Van		35
Ricshaw	5-15	45
Bus		50

3.3.9 Necessity of preservation

Since the amount of harvest from natural waters was not so high so there was hardly any necessity for preservation of the products for even any shorter duration of time. Small indigenous fish species have a great market demand. According to the sellers they can sell all their products when the supply is low, but when the supply is high and market demand is low then they had to preserve their products. Generally ice was used mostly as a preservative to preserve the fish. The sellers mentioned that when there was unavailability of preservatives then they either sold their products at low cost or sold to the fish traders.

3.3.10 Role of middlemen

From the survey it was found that the middlemen could not play a major role for the marketing of such types of fish species. Because, most of the harvester sold their harvested fish by themselves without any help of middlemen but when the amount of harvested fish was large and the collectors had no way to sell their harvest in the market; they had to depend on the help of the middlemen.

3.3.11 Consumer preference

According to the information collected from the fish sellers it was gathered that small indigenous fish species had a great market demand. All types of buyers were the consumers of such types of fish species. The level of consumer preference showed that 40% is for high class, 50% for low class and rest 10% for poor people. Because of high consumer preference some urban and peri-urban poor were inspired to continue their collecting and selling of the fishes. It is known that fish supply 63% of

animal protein in the diet of our people and with its other nutritional requirement is also fulfilled by consumption of small indigenous fish species.

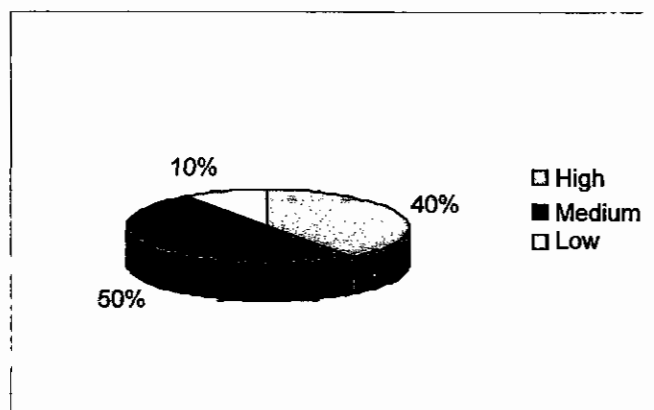


Figure 22. Percentage of consumer preference of small indigenous fish

3.4 Problem faced by fish and vegetable seller

The survey showed that almost all of the sellers had a lot of problems in the activities they perform; however, the problems were not related to their collection. Eighty percent of the sellers collected their products from the urban and peri-urban ghers and 20% sellers collected their products from other water body. The quality of the water was not good in 60% of the waters. The poor water quality often caused health problems like skin diseases. Various harmful insects (like leaches, snakes) hindered them from their collecting the products from such waters. Sometimes the owners of the waters did not allow other people for collecting these products. Besides all of these problems, according to the opinion of 23 sellers out of 25 sellers, money problem was the most serious one for them.

3.5 Necessity of credit facilities

Almost all of the sellers felt the need of credit facilities. Because, fund problem was the principal one in the venture, the seller was hindered from culturing these aqua products. According to the opinion given by 10 sellers, especially the women sellers, they were eager to culture these aqua products with the help of necessary credit facilities as a source of their permanent income and for their improvement of livelihoods.

Chapter 4

Conclusion and Recommendations



4.0 CONCLUSION AND RECOMMENDATIONS

As most of the people of our country live below the poverty level and since in this study mainly the poor people were engaged in the collecting and selling of various urban and peri-urban aquatic products of plant and animals, so steps should be taken for these poor people for mobilization and motivation of these folks for involvement in the practice in a formal way for finding out a way for enhancement of the livelihoods of the very poor sectors of the urban/city dwellers. In spite of socio-economic constraints, most of the sellers were reported to have achieved considerable help in their livelihoods in the process of selling these aqua products. There is ample scope for making the enterprise formal and popular among the poor city dwellers for engaging them in culture of the vegetable plants and the fishes in the various public and private waters with little training, and technical and financial supports.

The study, it is believed, will provide some information in this regard and the various agencies on Development Assistance/NGOs will come forward in materializing the goal; they can find ways to ensure that the benefits from these aqua products can be made more wide, especially to the poor city dwellers to whom food security is a special challenge. These people (including women in the households) can be involved in every stages of the production cycle of the products – cultivating, processing, transporting and retailing. This will not only increase the total food production of the metropolis areas country, it will also help in using the urban and peri-urban waters in a eco-friendly way, creating employment, reducing the financial and nutritional poverty of urban and peri-urban poor.

Specific suggestions for improving the livelihoods of these metropolitan poor through improving the marketing system of the various urban and peri-urban aquatic products:

- Introduction of culture system of these aqua products in a systematic way.
- The private sector should create appropriate stakeholder associations to enable an effective production, preservation and marketing system.
- The private sector should also consider entering into partnerships with local authorities for facilitating investments required in building infrastructures and services for urban and peri-urban aquaculture and take responsibility for the environmental costs of their operations.
- Ensure the participation of women in such associations as a source of their income.
- There must have some alternative source of income during off season.
- And finally, to address the food security and poverty alleviation questions, more serious, national policies should be taken to provide increased institutional and infrastructure support for diversification of production and trade, and integration of production systems and development of backward (input supplies) and forward linkages (post-harvest and value added activities) for the resource-poor households in the metropolis areas of the country.

Chapter 5

References

References

- Amin, M. N. 1998. Importance of institutional education in management of fisheries resources. In *Matsha Saptah*. Department of Fisheries. Ministry of Fisheries and Livestock. 13pp.
- Basar, S.A. (1998). Bangladesher shak sabgi. Boi patro, 38/4 bangla bazaar, Dhaka-1100. 14 p.
- Chowdhury, A. K. M. 1993. Dynamics of Rural Poverty: An Overview, BIDS. In Poverty Issue in Bangladesh: A Strategy Review, DFID-Bangladesh.
- DOF. 1993 Socio-economic report. Third Fisheries Project. Bangladesh centre for advanced studies. Dhaka, Bangladesh.
- DOF. 2000. Brief on Department of Fisheries, Bangladesh. Poverty alleviation through Integrated Aquaculture Project. Ministry of Fisheries and Livestock. Dhaka, Bangladesh.
- DFID. 2000. Introduction to sustainable livelihood and its relationship to project work.
- Humayun, M. N. 2003. The situation of fisheries species in Bangladesh. In: *Matsha Paskha*. Department of Fisheries. Bangladesh. 91-94pp.
- Hasan, M. A. 2000. The importance of plant in human life. In: Higher Secondary Botany. Department of Botany, Dhaka University, Dhaka. 379-411pp.
- Islam, M. S. 1996. Manual on Socio-economic analysis in Aquaculture research. Fisheries Research Institute. Mymensingh.
- Islam, M. & Hossain, M. Livelihood development of urban poor through urban and peri-urban aquaculture. Faculty of Fisheries, BAU, Mymensingh.

Kkan, M. S. & Mahbuba Halim.1987. Aquatic Angiosperm of Bangladesh

Khan, M. S. & Mahbuba Halim. 1985. Hydrocharitaceae, Flora of Bangladesh. 1-15 pp.

Karim, S.M.R. and Kabir, M.S. (1995). Bangladesher agacha parichiti. Text book division, Bangla Academy press, Dhaka. 400-419 pp.

Production in Aquatic Peri-urban Systems in Southeast Asia.. 2003. State of the system report: Thailand

Production in Aquatic Peri-urban Systems in Southeast Asia. 2003. State of the system report: South Vietnam

Production in Aquatic Peri-urban Systems in Southeast Asia. 2003. State of the system report: Cambodia

Rahman, A. K. Ataur. 2005. Freshwater Fishes of Bangladesh. Zoological Society of Bangladesh, Dhaka.

Riemer, D.N. (1993). Introduction of freshwater vegetation. Krieger company, Melbourne, Florida.1-800-724-0025. 218 p.

SUFER. 2002. A Livelihood Assessment of Four Communities in Southwest Bangladesh. Department for International Development. Dhaka, Bangladesh.

UNDP 1999. Human Development Report, Newyork.

Appendices

Appendix-1: Photograph of selling of different aquatic vegetable plants



