

Article

Fish market infrastructure in Khulna city, Bangladesh

Nahin Ferdous Really and Subrata Mondal

Department of Fisheries and Marine Bioscience, Faculty of Biological Science and Technology, Jashore University of Science and Technology, Jashore-7408, Bangladesh

*Corresponding author: Subrata Mondal, Department of Fisheries and Marine Bioscience, Faculty of Biological Science and Technology, Jashore University of Science and Technology, Jashore-7408, Bangladesh. E-mail: subrata.fmb.just@gmail.com

Received: 15 October 2019/Accepted: 28 November 2019/ Published: 31 December 2019

Abstract: An investigation was carried out on fish market infrastructure of Khulna district to identify the infrastructure facilities of domestic fish market including species traded along with price and also to detect the constraints at different levels of trading recommending possible solutions according to standards. The investigation was conducted from November 2016 to June 2017 in three different markets of Khulna district namely Sandhya Bazar fish market, Aranghata Bypass Bazar fish market and Baikali Bazar fish market. In Khulna, a large number of people are involved in fish marketing. Market infrastructures of Khulna had grown up according to various influencing factors that controls the total system involved. The study was based on observation and field survey. Data were collected through eye observation, questionnaire interviews and focus group discussions. Several number of market agents including wholesalers, retailers were selected for questionnaire interviews and aratdars and fishermen were selected for focused group discussions. It was revealed that the infrastructure facilities were inadequate and poorly maintained. Fish sheds were not enough hygienic to protect the fish from contamination. Surface water drainage system was open and this situation degraded further environmental condition of the markets. Electricity maintenance was not up to the mark and there were no distillation process for the supplied water. This infrastructural condition does not support a hygienic condition for fish marketing to provide edible and quality fish. Total number of freshwater fish species traded in different markets was found 60 including 12 SIS, 34 culture and 14 capture. On the other hand 41 brackish and marine water species were found and 14 crustacean species of which 5 were freshwater prawn, 6 brackish water shrimp and 3 crabs. Therefore domestic market infrastructure is on a developing stage as being controlled by Khulna City Corporation (KCC). Establishment of ice factory, improvement of fish transport facilities, introduction of fish quality control measures were suggested to improve the fish marketing in the study area.

Keywords: fish selling establishment; fish species; marketing channel; Khulna city

1. Introduction

Bangladesh is a densely populated agro-economy based country in Southeast Asia, with a population of 164,931,423 cores and an area of 147,610 square km (Worldometers, Bangladesh-2017). The average per capita accessible land resources are limited for agricultural production. Fisheries are now considered as the most effective sector for employment generation, 63% of the total protein consumption and are the second highest export earning sector of the country (DoF, 2015-16). Inland water resources of Bangladesh are considered to be one of the richest in the world both in area and potential for fisheries development. Being fortunate with these natural gifts the country abounds in a large varieties of fish species that is 260 of freshwater fish species, 24 inland water prawn species, 486 species of marine fish, 36 species of marine shrimp and 12 species of exotic fishes (DoF, 2015-16). Bangladesh produced 3.68 m MT fish in the fiscal year 2014-15 and ranked 4th as major

inland water capture fish producing country and also ranked 6th among top 25 farmed fish producing country in the world (FAO, 2016). Fish reach to millions of consumers of whole Bangladesh via wholesale markets, retail markets and landing centers of Khulna district. Infrastructure of these fish markets should be hygienic and suitable for protecting from perishable condition. The infrastructure facilities for domestic marketing of fish and fishery products are still in very poor shape in Khulna district. Although Khulna City Corporation has established some kind of infrastructure facilities like space, shed, and pucca (concrete) floor etc. but the system has yet to be developed for proper management, cleanliness and upkeep of the facilities. There are about 289 species of fish found in rivers and their tributaries, canals, floodplains, beels, haors and baors of Bangladesh belonging to the 13 order and 61 families (DoF 2012). About 360 species of fish and 36 species of marine shrimp are found in marine water bodies of Bay of Bengal, some marine fish species can tolerate wide range of salinity fluctuation and as well as there are some species which are migrate to coastal area for breeding and nursing. As a result the availability of fish is very high in coastal estuarine region of Khulna. Because coastal estuary support huge nutrient and productive water body for fish and other aquatic animals. Considering the market present investigation is conducted to observe the present infrastructural condition of the selected fish markets in Khulna City Corporation area; and to record the fish species traded in different important fish markets under the Khulna City Corporation area.

2. Materials and Methods

2.1. Study area and periods

Three different fish markets namely Sandhya bazaar, Aranghata bypass bazaar and Baikali bazaar fish markets of Khulna district affiliated by Khulna city corporation (KCC) were selected as the study area targeting three groups, namely Bepari, Aratdar and Retailer. The data were collected for a period of three (03) months from March 2017 to June 2017 (Figure 1).



Figure 1. Map of Khulna sadar, 'stars' indicating the location of sampling markets.

2.2. Target groups and sample number

A total number of 60 fish retailers (20 in each market) were selected for questionnaire interview in three different markets. It is noted that in each market around 20-65 retailers were involved. Among them 20 were selected for questionnaire interview through simple random sampling method.

2.3. Data collection

Primary data were collected by 3 steps. These are questionnaire interview with fish retailers, focus group discussion with intermediaries and cross-check interview with key informants. Secondary data were gathered from different sources like, teachers, local leaders, District Fisheries Officer, Senior Upazila Fisheries Officer and relevant NGO workers.

2.4. Data processing and analysis

After collection of data from the field, these were verified to eliminate errors and inconsistencies. Some of the collected data were in local units due to respondent's familiarity with those units. Data of local units were converted into international units before transferring to the computer. Preliminary data sheets were compared with the original questionnaire and result sheets to ensure the accuracy of the data entry. Data were processed and finally analyzed using Microsoft Excel Software.

3. Results

3.1. Nature of Infrastructure of the selected fish markets

3.1.1. Type of the markets

The type of the fish markets surveyed in Khulna district are listed in Table 1.

Table 1. Fish market types in study area.

| Markets | Types | Market days |
|------------------------|-------------------------|-------------|
| Sandhya Bazar | Retail market | Everyday |
| Aranghata Bypass Bazar | Wholesale and retailing | Everyday |
| Baikali Bazar | Retail market | Everyday |

3.1.2. Market control

All of the three markets of Khulna surveyed (Sandhya Bazar, Aranghata Bypass Bazar and Baikali Bazar) are generally controlled by the city corporation of Khulna.

3.1.3. Market access

The communicatory access points of the three different markets are listed in Table 2.

Table 2. Market access in study area.

| Access Points | Sandhyabazar | Aranghata bypass bazar | Baikali bazar |
|-------------------------|------------------------|---------------------------|-----------------------------------|
| Nearest landing center | Rupsha landing center | Bypass landing centre | Rupsha landing center |
| Nearest railway station | Khulna railway station | Daulatpur railway station | Junction railway station |
| Nearest Bus station | Sonadanga bus station | Daulatpur bus station | New market/Notunrasta bus station |
| Nearest airport | Jashore airport | Jashore airport | Jashore airport |

3.1.4. Market time

Market timing is controlled according to demand of people and fish quality maintenance. The three different markets maintain different times for selling. These are listed in Table 3.

Table 3. Time of the fish markets in study area.

| Name of the markets | Time |
|------------------------|------------------|
| Aranghata Bypass Bazar | 6 am to 9 am |
| Baikali Bazar | 9 am to 1 pm |
| Sandhya Bazar | 5 pm to 11.30 pm |

3.1.5. Market area

According to the survey, the Aranghata bypass fish market of daulatpur, is the largest market among the three markets and it comprises an area of about 1 acre or 3 bigha or 99 decimal. The second largest market is the Sandhyabazar market comprising an area of 1 bigha or 33 decimal. Baikali bazar comprises an area of about 22 decimal (Figure 2).

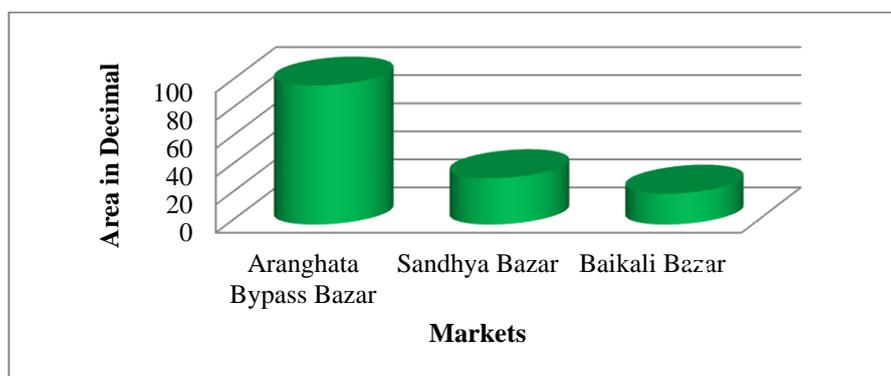


Figure 2. Total area of the fish markets.

3.1.6. Floor of the markets

All of the three markets possess concreted or cemented floors as controlled by Khulna City Corporation.

3.1.7. Roof of the markets

Concrete and tin shade roofs were found in the fish markets but in baikali bazaar fish market, some fishermen sell fishes in some open areas where clothes are used as roof to protect from the heat of the sun and rain inside the general passage of the buyers (Table 4).

Table 4. Condition of roofs of the markets in study area.

| Markets | Roof condition |
|------------------------|------------------------|
| Aranghata Bypass Bazar | Concrete and Tin shade |
| Sandhya Bazar | Concrete roof |
| Baikali Bazar | Concrete and Tin shade |

3.1.8. Electricity supply

Among the three markets surveyed in Khulna, both Baikali Bazar and Aranghata Bypass Bazar fish market don't need electricity at all because both the markets sit very early in the morning. Sometimes Baikali Bazar fish market sits in the evening and lasts up to night but that's very rare and depends on consumer's interest. During this night time electricity supply isn't sufficient because it's generally a morning market and as a result authority doesn't pay hid to electricity during night time purchase.

3.1.9. Platform status of the markets

It was observed that the platforms are almost well developed of the markets ensuring proper consumer activities. The platform height of sandhyabazar is about 50 cm whereas the platform height of aranghata bypass bazaar is about 15 cm as open auctioning systems are followed here using tables. The platform height of baikali bazaar is about 45 cm (Figure 3).

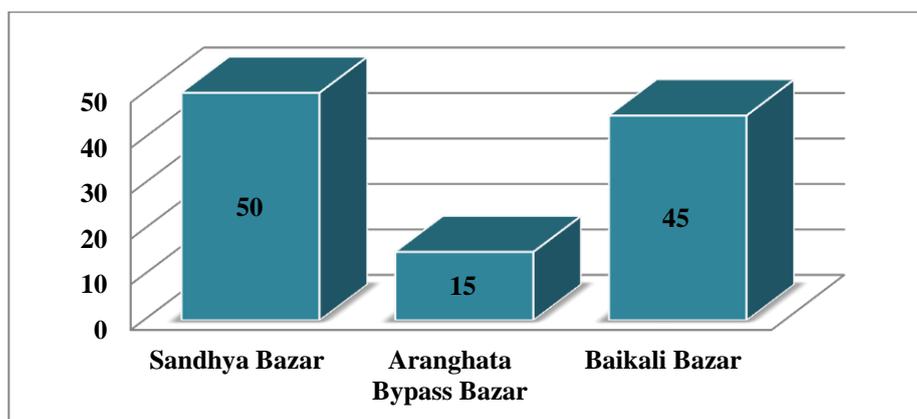


Figure 3. Platform status of the markets.

3.1.10. House rent

As all of the three markets are controlled by Khulna City Corporation, they have to pay 3% commission for markets.

3.1.11. Water supply

It was found that approximately 70-80 liters of water were used for cleaning market premises in both Sandhya bazaar and Aranghata Bypass Bazar. Women are generally engaged in water supply by collecting water from the nearest tube wells in round shaped jars (locally known as Kolshi). But in Baikali Bazar fish market, supply of water wasn't sufficient having unhygienic condition. Water supply status and water sources of the markets are listed in Table 5.

Table 5. Water supply quality and water sources of the fish markets.

| Markets | Source of water | Water supply |
|------------------------|-------------------|--------------|
| Sandhya Bazar | Tube well and Tap | Sufficient |
| Aranghata Bypass Bazar | Tube well | Sufficient |
| Baikali Bazar | Tube well | Insufficient |

3.1.12. Drainage system

As drainage system ensures the hygienic condition of the fish markets, it's one of the major concerns. Sufficient space is needed for the drainage systems which were found in both Sandhya Bazar and Aranghata Bypass Bazar but in Baikali Bazar fish market, drainage quality was not up to the mark. Status of drainage system of the markets are listed in Table 6.

Table 6. Drainage system of the fish markets in study area.

| Markets | Drainage System |
|------------------------|-----------------|
| Sandhya Bazar | Well developed |
| Aranghata Bypass Bazar | Developed |
| Baikali Bazar | Poor |

3.1.13. Numbers of market agents

An average no. of market agents found in the fish markets are listed in Table 7.

Table 7. Number of market agents in the fish markets in study area.

| Market agents | Fish farmers | Aratdars/Wholesalers | Dalals | Retailers | Consumers |
|------------------------|--------------|----------------------|--------|-----------|-----------|
| Sandhya Bazar | Absent | 20-30 | 10-20 | 30-40 | 100-200 |
| Aranghata Bypass Bazar | 40-50 | 30-40 | 20-30 | 40-50 | 100-150 |
| Baikali Bazar | 10-20 | 15-16 | 10-15 | 20-30 | 50-100 |

3.1.14. Ice supply

Ice supply stage of different markets are listed in Table 8.

Table 8. Ice availability of the markets in study area.

| Markets | Ice supply | Source |
|------------------------|--------------|---------------------|
| Sandhya Bazar | Sufficient | Rupsha Ice Mills |
| Aranghata Bypass Bazar | Sufficient | Daulatpur Ice Mills |
| Baikali Bazar | Insufficient | Absent |

3.1.15. Toilet facilities

Present toilet facilities observed in the fish markets are listed in Table 9.

Table 9. Toilet facility status in the markets in study area.

| Markets | Toilet facilities | Toilet Type |
|------------------------|-------------------|--------------------|
| Sandhya Bazar | Present | Concrete tin shade |
| Aranghata Bypass Bazar | Absent | Absent |
| Baikali Bazar | Present | Concrete tin shade |

3.1.16. Cold storage facilities

Cold storage facilities of the fish markets observed are listed in Table 10.

Table 10. Cold storage status in the markets in study area.

| Markets | Cold storage facilities |
|------------------------|-------------------------|
| Sandhya Bazar | Present |
| Aranghata Bypass Bazar | Absent |
| Baikali Bazar | Absent |

3.1.17. Equipments

Some general equipment that were used in the markets are listed in Table 11.

Table 11. Equipments used in the fish markets in study area.

| Markets | Equipments |
|------------------------|---|
| Sandhya Bazar | Weighing scales, physical & balance |
| Aranghata Bypass Bazar | Auction table, Physical balance |
| Baikali Bazar | Weighing scales, Fish trays, physical balance |

3.2. Some general activities of the local fish markets (Functional structure)**3.2.1. Landing of fish**

Fishes are landed from different places in the market both of nearby and distant sources. The sources of fishes in the fish markets are given in Table 12.

Table 12. Sources of fishes found in the markets in study area.

| Group of fishes | Sources |
|---------------------------|--|
| Hilsa | Barisal |
| Indigenous carps(capture) | Shahpur, Krishnanagar, Dumuria |
| Indigenous carps(culture) | Jashore, Jhikargachha, Navaran |
| Catfish | Daulatpur, Dumuria, Aranghata |
| Exotic fish | Rupsha, Daulatpur, Shahpur, Krishnanagar, Rayermahal |
| SIS | Shahpur, Sundarmahal, Rayermahal, Rupsha, Dumuria, Krishnanagar |
| Indigenous fishes | Daulatpur, Dumuria, Krishnanagar, Rayermahal, Sundarmahal, Shahpur, Dakaterbeel, Gopalganj |
| Shell fishes | Dumuria, Daulatpur, Paikgacha, Koyra, Rupsha, Satkhira |

3.2.2. Fish transportation

Fishes are brought to the markets generally from both distant and nearby places. As a result all types of transport vehicles are used, for example, bus, truck, rickshaw, van, nasiman, easy bike, cycle, trawler etc. oxygen supply facilities are also found in some cases generally in distant transportations.

3.2.3. Selling and buying of fishes

Selling and buying system of the fish markets are listed in Table 13.

Table 13. Selling and buying system of fishes in the markets.

| Markets | Selling system | Daily approximate sell in Score (Mon) | No. of buyers |
|------------------------|----------------------|---------------------------------------|---------------|
| Sandhya Bazar | Wholesale and retail | 20-30 | 100-200 |
| Aranghata Bypass Bazar | Open auctioning | 40-50 | 100-150 |
| Baikali Bazar | Wholesale and retail | 10-20 | 50-100 |

3.2.4. Aeration of fish during market time

The fishes were aerated during the market times to supply oxygen and it was found that hands were generally used for this purpose. Pangus and carp fishes were found aerating during the visit time.

3.2.5. Service for buyers

Fishermen of sandhya bazaar and baikali bazaar fish market give some additional services to the buyers. They cut or process the fish for the buyers.

3.2.6. Preservation of fish

In all of the three fish markets fishes are preserved by the wholesalers and retailers. Mainly two types of preservation methods are followed; namely, live fish preservation and Icing.

Different containers are used for this purpose such as large aluminum pots (known as hari), tin made drum, bamboo basket, plastic drum etc.

3.3. Infrastructural analysis of the three different fish markets

3.3.1. Use of space in several sections in Sandhya bazar fish market

The waste management system of sandhya bazaar is good and hygienic. The drainage system is also well-developed maintained properly. But there are no separation objects among the fish sheds for which buyers face several problems while purchasing due to huge involvement of all the traders to buy their commodities at a single time (Figure 4).

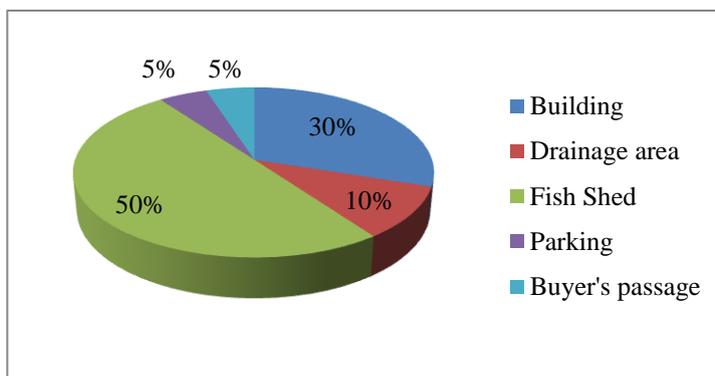


Figure 4. Percentage wise use of space of Sandhya bazar fish market.

3.3.2. Use of space in several sections in Aranghata bypass bazar fish market

In Aranghata bypass bazar fish market, open auction system is generally followed to sell fishes at very early hours in the morning. Fishes are kept in the auction tables randomly and auctioning starts. It's a crowded place and fishes are sold fresh as taken here just after catch. But the buyers face difficulties due to narrow area of passage while purchasing fishes. Again there are no separation objects among the fish sheds (Figure 5).

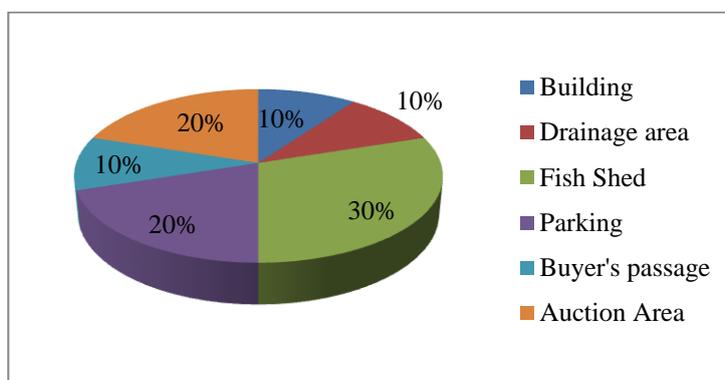


Figure 5. Use of space in Aranghata bypass Bazar fish market.

3.3.3. Use of space in several sections in Baikali bazar fish market

The drainage system of Baikali bazar fish market is not up to the mark. Again offals are thrown to nearest area that causes serious degradation of environmental condition. Along with fish sheds, there are also some open area where farmers sit to manage selling of fishes by keeping them in earthen and metal pots, fish trays etc. plastic or clothes are used here as sheds (Figure 6).

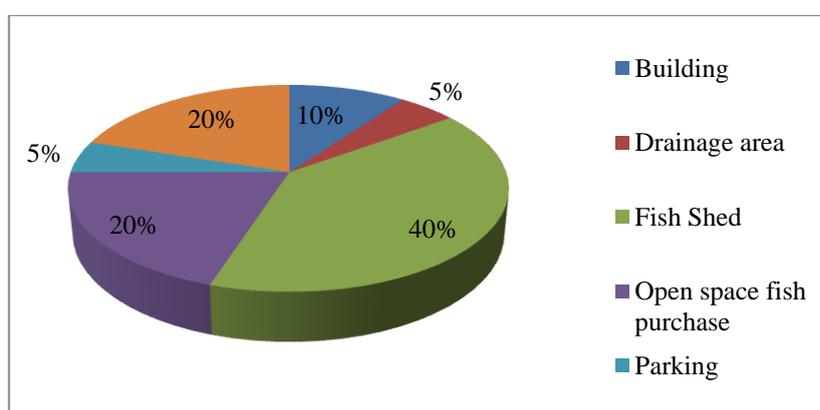


Figure 6. Percentage wise use of space in Baikali bazar fish market.

3.4. Species recorded that are generally traded in the three different markets

Different species recorded from three markets are listed in Table 14.

Table 14. List of species traded in the three different markets of Khulna.

| Fresh water capture fish species | | | |
|----------------------------------|---------------------|--------------------------|---------------------------------|
| SL No. | Local name | English name | Scientific name |
| 1 | Air | Giant river catfish | <i>Sperata seenghala</i> |
| 2 | Boal | Fresh water shark | <i>Wallago attu</i> |
| 3 | Bata | bata | <i>Labeo bata</i> |
| 4 | Baila | Scribbled goby | <i>Awaous grammepomus</i> |
| 5 | Bacha | - | <i>Eutropiichthys vacha</i> |
| 6 | Batasi | Indian potasi | <i>Neotropius atherinoides</i> |
| 7 | Bhadipunti/jatpunti | Pool barb | <i>Puntius sophore</i> |
| 8 | Koi | Climbing perch | <i>Anabus testudineus</i> |
| 9 | Koi | Spiketail paradises fish | <i>Pseudosphromenus cupanus</i> |
| 10 | Kajuli | Gangeticailia | <i>Ailia coila</i> |
| 11 | Khailsha | Banded gourami | <i>Trichogaster fasciata</i> |
| 12 | Shing | Stinging catfish | <i>Heteropneustes fossilis</i> |
| 13 | Magur | Walking catfish | <i>Clarias batrachus</i> |
| 14 | Bheda/mini | Gangeticleafish | <i>Nandus nandus</i> |
| 15 | Chital | Clown knifefish | <i>Chitala chitala</i> |

| | | | |
|--|---------------|-------------------------|--|
| 16 | Foli | Bronze featherback | <i>Notopterus notopterus</i> |
| 17 | Gulsatengra | Gangeticengra | <i>Mystus bleekeri</i> |
| 18 | Nunatengra | Long whiskers catfish | <i>Mystus gulio</i> |
| 19 | Tengra | Striped dwarf catfish | <i>Mystus vittatus</i> |
| 20 | Guratengra | Hummingbird catfish | <i>Rama chandramara</i> |
| 21 | Shillong | Silond catfish | <i>Silonia silondia</i> |
| 22 | Pangas | Pangas catfish | <i>Pangasius pangasius</i> |
| 23 | Taki | Spotted snakehead | <i>Channa punctata</i> |
| 24 | Chang | Walking snakehead | <i>Channa orientalis</i> |
| 25 | Shol | Snakehead murrel | <i>Channa striata</i> |
| 26 | Gozar | Great snakehead | <i>Channa marulius</i> |
| 27 | Dorgi | gobi | <i>Apocryptes bato</i> |
| 28 | Gusibaim | Barred spiny eel | <i>Macrogathus pancalus</i> |
| 29 | Tarabaim | One-stripe spiny eel | <i>Macrogathus aral</i> |
| 30 | Baim/shalbaim | Zig-zag eel | <i>Mastacembelus armatus</i> |
| 31 | Kakila | Asian needlefish | <i>Xenentodon cancila</i> |
| 32 | Gonia | Kurialabeo | <i>Labeo gonius</i> |
| 33 | Chewa | Bearded eel goby | <i>Teanioides cirratus</i> |
| 34 | Pabda | Pabdah catfish | <i>Ompok pabda</i> |
| SIS (Small Indigenous Species) | | | |
| 1 | Chela | Large razorbelly minnow | <i>Salmophasia bacaila</i> |
| 2 | Mola | Molacarp | <i>Amblypharyngodon mola</i> |
| 3 | Dhela | - | <i>Osteobramacotio</i> |
| 4 | Teri punti | Onespot barb | <i>Puntius terio</i> |
| 5 | Tit punti | Ticto barb | <i>Puntius ticto</i> |
| 6 | Rani/boumach | Bengal loach | <i>Botia dario</i> |
| 7 | Chebli | Giant danio | <i>Devario aequipinnatus</i> |
| 8 | Lombachanda | Elongate glass-perchlet | <i>Chanda nama</i> |
| 9 | Rangachanda | Indian glassy fish | <i>Parambassis ranga</i> |
| 10 | Darkina | Flying barb | <i>Esomus danricus</i> |
| 11 | Gutum | Guntea loach | <i>Lepidocephalichthys guntea</i> |
| 12 | Chunakhailsha | Honey gourami | <i>Trichogaster chuna</i> |
| Freshwater culture species | | | |
| 1 | Rui | Indian major carp | <i>Labeo rohita</i> |
| 2 | Catol | Catla | <i>Catla catla</i> |
| 3 | Mrigal | Mrigal carp | <i>Cirrhinus cirrhosus</i> |
| 4 | Silver carp | Silver carp | <i>Hypophthalmichthys molitrix</i> |
| 5 | Grass carp | Grass carp | <i>Ctenopharyngodon idella</i> |
| 6 | Tilapia | Nile tilapia | <i>Oreochromis niloticus</i> |
| 7 | Thai pangas | Striped catfish | <i>Pangasianodon hypophthalmus</i> |
| 8 | Bighead carp | - | <i>Aristichthys nobilis</i> |
| 9 | Kalibaus | Orange-fin labeo | <i>Labeo calbasu</i> |
| 10 | Chinese punti | Olive barb | <i>Barbonymus gonionotus</i> |
| 11 | Common carp | Common carp | <i>Cyprinus carpio</i> |
| 12 | Minar carp | Mirror carp | <i>Cyprinus carpio var. specularis</i> |
| 13 | Black carp | - | <i>Mylopharyngodon piceus</i> |
| 14 | African magur | African catfish | <i>Clarias garipinus</i> |
| Brackish and marine water species | | | |
| 1 | Baghair | Goonch | <i>Bagarius bagarius</i> |
| 2 | Bishtara | Spotted scat | <i>Scatophaga argus</i> |
| 3 | Bhetki/Coral | Barramundi | <i>Lates calcarifer</i> |
| 4 | Bommaitta | Tuna | <i>Euthynnus affinis</i> |
| 5 | Borguni | Jarbuaterapon | <i>Terapon jarbua</i> |
| 6 | Chewa | Torpedo trevally | <i>Taenoides anguillar</i> |
| 7 | Chapila | Indian river shad | <i>Gudusia chapra</i> |
| 8 | Churi | Smallheadhairtail | <i>Eupleurogrammus muticus</i> |
| 9 | Churi | Savalanihairtail | <i>Lepturacanthus savala</i> |
| 10 | Churi | Ribbon fish | <i>Trichiurus haumela</i> |
| 11 | Dhela | Coromondelilisha | <i>Ilisha filigera</i> |

| | | | |
|---------------------------|---------------------|--------------------------|-------------------------------------|
| 12 | Dhela | Bigeyeilisha | <i>Ilisha megaloptera</i> |
| 13 | Ghagra | Ghagra catfish | <i>Arius gadora</i> |
| 14 | Ilish | Hilsa shad | <i>Tenuolosa ilisha</i> |
| 15 | Chandanilish | Toli shad | <i>Tenuolosa toli</i> |
| 16 | Kakila | Asian needlefish | <i>Xenentodon cancila</i> |
| 17 | Khorsula | Corsula | <i>Rhinomugil corsula</i> |
| 18 | Kawa | Hardtail | <i>Megalapsis cordyla</i> |
| 19 | Lakhua | Indian salmon | <i>Polynemus indicus</i> |
| 20 | Lattia | Bombay duck | <i>Harpadon nehereus</i> |
| 21 | Lambapoa | Long jewfish | <i>Sciaenoides brunneus</i> |
| 22 | Lalpoa | Silver jew | <i>Johnius argentatus</i> |
| 23 | Poa | Pama croaker | <i>Otolithoides pama</i> |
| 24 | Mullet | Flathead grey mullet | <i>Mugil cephalus</i> |
| 25 | Med | Giant sea catfish | <i>Katengus typus</i> |
| 26 | Maitya | Jack and pompanos | <i>Cybium guttatum</i> |
| 27 | Nunabaila | Bumblebee goby | <i>Brachygobius nunus</i> |
| 28 | Nunatengra | Long whiskers catfish | <i>Mystus gulio</i> |
| 29 | Phasa | Gangetichairfin anchovy | <i>Setipinna phasa</i> |
| 30 | Potka | Green pufferfish | <i>Tetraodon flaviatilis</i> |
| 31 | Rupchanda | Chinese pomfret | <i>Pampus chinensis</i> |
| 32 | Rupchanda | Black pomfret | <i>Parastromateus niger</i> |
| 33 | Falichanda | Silver pomfret | <i>Pampus argenteus</i> |
| 34 | Ruppan | Japanese threadfin bream | <i>Nemipterus japonicus</i> |
| 35 | Rupsha | Skipjack tuna | <i>Katsuwonus pelamis</i> |
| 36 | Samudra chela | - | <i>Thryssa purava</i> |
| 37 | Samudra koi | Atlantic tripletail | <i>Lobotes surinamensis</i> |
| 38 | Sagorrita | Whale catfish | <i>Rita rita</i> |
| 39 | Saplapata | Pale-edged stingray | <i>Dasyatis zugei</i> |
| 40 | Tulardadi | Lady fish | <i>Sillaginopsis panijus</i> |
| 41 | Tapasi | Paradise threadfin | <i>Polynemus paradiseus</i> |
| Crustacean species | | | |
| 1 | Golda chingri | Giant fresh water prawn | <i>Macrobrachium rosenburgii</i> |
| 2 | Dodachingri | Goda river prawn | <i>Macrobrachium scabriculum</i> |
| 3 | Dimuachingri | Dimua river prawn | <i>Macrobrachium villosimanus</i> |
| 4 | Kunchu/gurachingri | Kuncho river prawn | <i>Macrobrachium lamaerrei</i> |
| 5 | Chatkachingri | Monsoon river prawn | <i>Macrobrachium malcolmsonii</i> |
| 6 | Bagdachingri | Giant tiger shrimp | <i>Penaeus monodon</i> |
| 7 | Sada/Bagtarachingri | Green tiger shrimp | <i>Penaeus semisulcatus</i> |
| 8 | Chaptachingri | White shrimp | <i>Penaeus indicus</i> |
| 9 | Harinachingri | Brown shrimp | <i>Metapenaeus monoceros</i> |
| 10 | Harinachingri | Yellow shrimp | <i>Metapenaeus brevicornis</i> |
| 11 | Chamuachingri | Brown shrimp | <i>Metapenaeus pinulatus</i> |
| 12 | Shelakakra | Mud crab | <i>Scylla serrata</i> |
| 13 | Sagorkakra | Horseshoe crab | <i>Carcinoscorpius rotundicauda</i> |
| 14 | Satarukakra | Swimmer crab | <i>Neptunus sanguinolenta</i> |

3.5. Some common species and their price variations in the three different markets

It had been found from the survey that some species that are common in all the three markets and they also possess high demand among the consumers (Table 15).

Table 15. Some common species and their price variations in the three different markets in Khulna.

| Price (USD/kg, Average 1 USD=77.53 BDT) in different fish markets | | | |
|---|---------------|------------------------|---------------|
| Species/local names | Sandhya bazar | Aranghata bypass Bazar | Baikali bazar |
| Ilish | 12.25 | 10.32 | 12.89 |
| Tilapia | 1.81 | 1.61 | 1.55 |
| Bagda | 7.74 | 7.74 | 5.80 |
| Golda | 10.32 | 8.77 | 7.74 |

| | | | |
|-------------|------|------|------|
| Rui | 3.87 | 3.22 | 1.93 |
| Catla | 2.58 | 1.81 | 1.93 |
| Koi | 2.32 | 1.68 | 1.93 |
| Taki | 5.16 | 6.45 | 3.22 |
| Mrigel | 2.58 | 1.42 | 2.32 |
| Maya | 4.51 | 3.87 | 1.55 |
| Tengra | 6.45 | 5.16 | 3.87 |
| Pangus | 6.45 | 3.87 | 5.16 |
| Chitol | 6.45 | 7.09 | 5.80 |
| Phasa | 7.74 | 3.87 | 3.22 |
| Shol | 6.45 | 5.16 | 3.87 |
| Mola | 3.87 | 2.06 | 2.58 |
| Puti | 5.16 | 2.58 | 320 |
| Silver carp | 2.58 | 1.42 | 1.93 |
| Bata | 3.87 | 1.93 | 2.58 |
| Shing | 8.38 | 5.16 | 7.74 |
| Kholisha | 3.87 | 1.03 | 2.58 |

4. Discussion

Infrastructure is the basic physical systems of a business or nation. In case of fish marketing, transportation, communication, sewage, water and electric systems all are examples of infrastructure. These systems tend to be high cost investments. However, they are vital to a country's economic development and prosperity. The market sizes were not the same. The markets in ascending size were descending Aranghata bypass baza, Sandhya bazar, and Baikali bazar. Sandhya bazar is the oldest fish market among the three different market of Khulna followed by Baikali bazar and aranghata Bypass Bazar. Sandhya Bazar was established during the British colonial period and got acquaintance as wholesale market at about 1800 AD. Baikali Bazar and Aranghata Bypass Bazar were established in 1989 and 1997. Respectively markets were different in operating system also. All of the three markets were affiliated by Khulna City Corporation (KCC). Both producers and consumers of fish including production, processing and delivery systems are considered as important issues to public health for fish intake. After observing the markets it was revealed that there were similarities with the findings of Hussain *et al.* (1994). It was found that the infrastructural facilities of the markets are poor and unhygienic often possess serious threats to the public health. It was also found that the fishes were sold under tin shed or plastic roofs and often under open sky which is not scientific to get quality fish by any means. Although market size and arrangement were different but the space management are more or less same. The drainage systems were opened and fish offal was dumped nearby that cause serious environmental degradation. As a result animals and birds roam here and there in the markets. Fishes are generally kept in bamboo made pots, earthen and metal pots, fish trays etc. accurate weight measurement is generally absent due to improper use of balance and absence of electrical balance. Cold storage facility was found only in Aranghata Bypass Bazar fish market. Ice was not sufficient or hardly used in Baikali Bazar fish market (Leela *et al.*, 2018). Buyer's passages were not up to the mark according to fish supply and demand of fishes. It hampers the purchasing activities. Joined platforms were found in several fish markets with no separation objects. In Sandhya Bazar fish market, light illuminations were not up to the mark (Rahaman *et al.*, 2015; Islam *et al.*, 2017). Electricity supply was good but not sufficient according to the platforms and electrical wires were needed to be repaired as being in a crucial stage (Islam *et al.*, 2014; Asif *et al.*, 2015; Islam *et al.*, 2015; Sharif *et al.*, 2015; Hossain *et al.*, 2016; Asif and Habib, 2017; Mondal *et al.*, 2018a; Adhikary *et al.*, 2018; Mondal *et al.*, 2018b; Islam *et al.*, 2017; Zaman *et al.*, 2017; Vaumik *et al.*, 2017). High dosage of formalin usage were reported previously in Sandhya Bazar fish market to keep the fishes fully fresh till late hours at night. Floors are concreted and platform height was up to the mark. But there were no enclosures found to protect the fishes from the attacks of flies, insects, rodents etc. the slopes for drainage were not up to the mark as a result waste and polluted water gathers in one place and odor spread everywhere in the markets, which is very relevant with the study of Chwakravorty *et al.* (2019). Ice blocks are not sufficient according to the amount of fishes. Toilet facilities were present only in Baikali bazaar fish market (Leela *et al.*, 2018). Transportation vehicles were good but fish transportation techniques were not up to the mark. There were access points nearby of the fish markets, all of the three markets were daily markets but the market schedules were different (Leela *et al.*, 2018). Everyday about 40 to 60 score fishes are sold in each of the markets. Culture seeds were generally collected from Jashore and Mymensingh area of freshwater species (Asif *et al.*, 2014; Sharif and Asif, 2015; Ali *et al.*, 2018). Water supply in the fish markets were not up to the mark (Asif *et al.*, 2014; Hossain *et al.*, 2015; Rahaman *et al.*, 2015; Islam *et al.*, 2017; Leela *et al.*, 2018; Hossain *et al.*

al., 2018). Little amount of water were used for washing purposes and water sources were not hygienic. There was also service for the buyers in some fish markets as cutting the fishes, clearing the guts etc. there were some permanent customers of the markets surveyed who resided nearby. They informed that fish composition including taste had been decreased along with increasing price due to poor supply of fishes (Samad *et al.*, 2013; Leela *et al.*, 2018; Chwakovorty *et al.*, 2019; Mondal *et al.*, 2018b). High amount of variations in the price of some common and important fishes had also been found due to several reasons including high demand, seasonal variations, poor supply according to demand etc. Consumers preferred the fishes according to choice of taste, food and nutrition. A great variety of marine, freshwater and SIS species were available. According to the consumers prices of all type of fishes had increased during the last 5 years. Garbage bins were not found in any of the selected fish markets. Wastes and garbage of the fish were kept in a place outside the market area from where garbage-transporting vehicles of Khulna City Corporation (KCC) take away garbage once a day which causes air pollution. Each of the markets usually were washed and cleaned after trading daily. As there were no protective enclosures in the markets, different animal especially roadside dogs and cats often slept in the fish platform, which is also unhygienic.

5. Conclusions

Our fish markets are far below the world standard. Discussing with the officials of Department of Fisheries (DOF), Bangladesh, and Bangladesh Fisheries Development Corporation (BFDC), which is responsible to establish units for preservation, processing, distribution, and marketing of fish and fish products, it was found that government has a plan to develop the infrastructural condition of wholesale fish market in Khulna district and will include the rules and regulations for domestic fish trade and marketing system revising the present national fisheries policies to reach out nutritious and fresh fish to the consumers of all over the country, yet is awaiting for implementation. It is very much to be solicited that the fish handling sectors and the fish markets as well as the marketing systems work with each other to achieve the modern standards in the near future.

Conflict of interest

None to declare.

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