

Uses and Impact of Aqua Drugs and Chemicals on Shrimp Production in Khulna Region of Bangladesh



A Thesis

By

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Uses and Impact of Aqua Drugs and Chemicals on Shrimp Production in Khulna Region of Bangladesh

Approved as to style and content

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DECLARATION

Uses and Impact of Aqua Drugs and Chemicals on Shrimp Production in Khulna Region of Bangladesh

The results presented in this thesis are entirely 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.

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Abstract

The present study was carried out to know the available aqua drugs and chemicals and their impact on shrimp production. Data were collected through questionnaire interview with fish farmers, drug sellers, personal contact and market survey from selected area of Khulna region. Ten categories of drugs and chemicals were identified that have been using by shrimp farmers for different purposes. The categories included pond preparation and water quality management, antibiotics, disinfectants, gas removal, oxygen supplier, vitamins and minerals, growth promoter, insect killer and predator. The companies included Fish Tech, Renata, Firstcare, ACI, ACME, Square, Samco, Novartis, Eon, Opsonin, Al Madina, Rals, Organic, Padma, Nature care, Advance and SK+F etc. Farmers of the selected area used mainly Renamycin, Amoxifish, Timsen, Aquamysine, Ossi-C, Aquamycine, Virex, Aqua kleen, Geolite gold, Oxy Dox F, Polgard plus, Charger gel, Aqua magic, Bactisal, Acurtc Gold, Super Biotic, Oxy life, Dolomite, pH Fixer and Calmag for shrimp culture. The present study revealed that commercial aqua drugs have some positive impact on shrimp production. It was observed that farmers of the selected areas got good results in shrimp production by applying single or combinations of various aqua-drugs and chemicals. Average shrimp production was 300 kg/acre in chemical treated extensive farms and 5000 kg/acre in chemical treated semi-intensive farms on the otherhand, the production was 150 kg/acre in control farms (where no drugs and chemicals were used).

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List of Abbreviations and non-English Words

Abbreviation	Elaboration
BFRI	Bangladesh Fisheries Research Institute
MS	Master of Science
DoF	Department of Fisheries
et al.	And Others
Fig.	Figure
FMRT	Fisheries and Marine Resource Technology
GDP	Gross Domestic Product
kg	Kilogram
gm	Gram
KU	Khulna University
L	Liter
pp	Pages

CHAPTER ONE

INTRODUCTION

Chapter 1

Introduction

1.1. Background of the study

Bangladesh is a riverine country. The country is crisscrossed with hundreds of rivers and endowed with vast water resources. The climate of Bangladesh is unique for aquaculture and fisheries resources management. The Bay of Bengal is situated at the south of the country. As a result, Bangladesh has significant role in aquaculture and capture fishery potential. So, aquaculture production is increasing day by day in Bangladesh (Rahman, 2011).

Aquaculture intensification is crucial needs and practiced in Bangladesh to increase in the total aquaculture production. Aquaculture production has impact on national economy and act as a source of animal protein, employment opportunities, food security, foreign incomes and socio-economic improvement (Ahmed *et al.*, 2015).

Fisheries production contributes 3.57% to total GDP and 25.30% to agricultural GDP in Bangladesh. Directly and indirectly involved about 10% of the population and intake 60% of our daily animal protein from fisheries products (DoF, 2018).

Fisheries sectors plays a crucial role in income and employment-generating in Bangladesh and supplies safe foods to the population of the peoples of country. Total fish production in our country during the 2015-2016 was about 3.46 million metric tons of which 2.68 million metric tons were produced from freshwater including culture fisheries and 0.05 million metric tons from marine water including shrimp (Hasan *et al.*, 2015).

Brackishwater aquaculture in coastal areas primarily involves shrimp culture and is widespread on the south-east coast in Bangladesh. Huge concentrations of shrimp farms are situated in Khulna, Satkhira, Bagerhat, Chattogram and Cox's-bazar (Rajib *et al.*, 2014).

Shrimp culture is the most important aquaculture in Bangladesh. Shrimp export and cultivation in Bangladesh has undergone rapid expansion over the last two decades. Shrimp and prawn together represent the second largest exportable items contributing to foreign exchange earnings of

Bangladesh. Shrimp is a particularly valuable export crop generating substantial revenues and foreign exchange (Hasan *et al.*, 2015).

Not only this sector earns valuable foreign exchange, but also employs significant numbers of rural workers and provides a livelihood for households throughout Bangladesh. Bangladesh Shrimp and Fish Foundation estimate that there are over 6,00,000 people employed directly in shrimp aquaculture who support approximately 3.5 million dependents (Islam *et al.*, 2014). With the expansion of aquaculture, aqua-medicines are being more used for the aquatic animal health management (Ali *et al.*, 2014).

Aqua-drugs greatly impacts on production and applied in different administration ways. Different types of chemicals and drugs (include sodium chloride, formalin, malachite green, methylene blue, potassium permanganate, hydrogen per oxide and glutaraldehyde) used in health management of aquatic animals, pond construction, soil and water management, improve aquatic productivity, feed formulation, manipulation of reproduction, growth promotion and processing and in value added products (Kawsar *et al.*, 2019).

A variety of aqua-medicines are used in aquaculture for fish health management. Some common aqua-medicines or chemicals are Sea Fresh, NaCl, formalin, KMnO₄, H₂O₂, copper compounds, malachite green and methylene blue. Most of the farmers in Bangladesh use lime, rotenone, various forms of organic and inorganic fertilizer, salt, dipterex, antimicrobials, formalin, KMnO₄ and CuSO₄. Probiotics, vitamin and antibiotics are also used in semi-intensive culture (Ali *et al.*, 2008).

Mutazen and Zymatin are used for vitamin supply. KMnO₄ is used for protozoan infestation on fish and shrimp. NaCl is used for parasitic and fungal disease of fish. Antibiotics have been applied in aquaculture for over 50 years for treating bacterial infection in fish (Hossain *et al.*, 2014). Malachite green is an organic chemical that has been popular as a parasiticide and fungicide on fish. Mainly Sea Fresh and Oxy-flow are used for oxygen problem (Plumb, 1996).

Antibiotics and chemicals play a vital role in health management in aquatic animal, pond preperation, feed formulation, manipulation of reproduction, growth promotion and processing and value addition of the final product, soil and water quality management, improved natural aquatic productivity and transportation of live fish. Chemicals are used to control aquatic pest, prevent and treat diseases (Chowdhury *et al.*, 2012).

Health problems have become very common in fish and shrimp culture, especially in intensive and semi-intensive system. Protozoan and crustacean ectoparasites, as well as bacterial diseases were caused. It increase mortality in brackish water shrimp culture. To reduce this problems, various chemicals and antibiotics are widely used treatment and prevention of infectious diseases in shrimp farms. The application of chemicals by immersion and the addition of antibiotics to shrimp feed are methods that are normally practiced by the farmers (Rasul *et al.*, 2017).

With the expansion of aquaculture in Bangladesh, there has been increasing trend in using more chemicals in fish health management. Commonly used chemicals in Bangladesh aquaculture are lime, rotenone, various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion, melathion etc. (Faruk *et al.*, 2005).

1.2. Objectives of the study

- To investigate the uses of aqua drugs and chemicals used in Khulna region.
- To study the impact of aqua drugs and chemicals on shrimp production in Khulna region.

CHAPTER TWO

LITERATURE REVIEW



Chapter 2

Literature review

Plumb (1996) found that potassium permanganate is good for treating external protozoa and external bacterial infections. He also stated that Sodium chloride is an old treatment used for a variety of diseases of fish especially some fungal and parasitic diseases.

Pathak *et al.* (1996) studied on the use of chemicals in aquaculture in India and concluded that for the improved use of chemicals in Indian aquaculture are provided for farmers, government and aquaculture institutions, the chemical industry, regional and international agencies, and research institutions.

Faruk *et al.* (2005) observed that commonly used chemicals in aquaculture are lime, salt, urea, triple super phosphate (TSP) potassium permanganate, vitamins, antibiotics (mainly oxytetracycline and chlorotetracycline), rotenone, phostoxin, sumithion, melathion and some hormones. It is also found that most of the farmers used chemicals and antibiotics indiscriminately without knowing their mode of action, doses and appropriate procedures of application.

Faruk *et al.* (2008) carried out study on evaluation of the status of use of chemicals and antibiotics in freshwater aquaculture activities with special emphasis to fish health management and said that thirty three pharmaceutical companies were producing and marketing these products.

Rahman (2011) observed that mostly traditional chemicals were available in the drugs shops for treatment of fish diseases. Potash, lime, formalin, salt, methylene blue, malachite green and timsen were used regularly for fish disease treatment in Jamalpur and Sherpur region.

Chowdhury *et al.* (2012) studied on chemicals used in freshwater aquaculture with special emphasis to fish health management of Noakhali and stated that twenty two different chemicals

were used for different purposes as artificial breeding, pond preparation, water quality management and fish poisoning, insect killing, disinfectant and fish disease treatment in this region such as Lime, Zeolite, Rotenone, Phostoxin tablet, Bleaching powder, Endrin, Salt, Potash etc.

Monsur (2012) found that for water quality management geotox, JV zeolite, mega zeo, lime, bio aqua and acme's zeolite were used in Nalitabari upazila of Sherpur district.

Shamsuzzaman and Biswas (2012) carried out a study on aqua chemicals in shrimp farm: A study from south-west coast of Bangladesh and found that traditional chemicals in health management included lime, salt, potassium permanganate, sumithion, melathion, formalin, bleaching powder and malachite green. Thirteen branded probiotics were also found in the market to use mainly by the coastal shrimp farmers against vibriosis and other luminescent bacteria to improve water and soil quality.

Mondal *et al.* (2013) studied on present status of good aquaculture practices (gap) in shrimp farms of south-western coastal area of Shyamnagar and Kaliganj upazila under Satkhira district. To control the pest, 35% and 25% shrimp farmers of Shyamnagar and Kaliganj upazila were found to use banned chemicals (Sumithine and Thiodine), respectively.

Ahmed *et al.* (2014) research on study on impact of aqua drugs and chemicals on shrimp health in Bangladesh and found that health condition of shrimp of Khulna region was better than those of Cox's Bazar region. Histopathologically, muscle of control shrimp (without drugs treated) of all the investigated areas of Cox's Bazar and Khulna regions were almost normal except some vacuums in control shrimp muscle of Fakirhat.

Alam *et al.* (2014) studied on use of aqua-medicines and chemicals in aquaculture in Shatkhira district and the present study pointed out the lack of technical knowledge of fish farmers about use of aqua-medicines and chemicals in Shatkhira district as well as future environmental hazards caused by the massive use of huge numbers of aqua-medicines.

Sharker *et al.* (2014) research on drugs and chemicals used in aquaculture activities for fish health management in coastal region in Bangladesh and stated that six categories of aqua drugs and chemicals were found to be used by fish farmers and hatchery owners for water quality management, disinfectants, disease treatment, antibiotics and growth promoter.

Islam *et al.* (2014) worked on obtainable drugs for fish hatchery operation and grow-out ponds in Bangladesh. They concluded that a number of commercial products with various trade names available in the market namely JV zeolite, geotox, green zeolite, orgavit aqua, fish vitaplus, AQ grow-G, oxyflow, oxymax, 02-marine which were most widely used.

Ahmed *et al.* (2015) research on the impacts of aqua-drugs and chemicals on fish health and production in Mymensingh, Bangladesh from July 2013 to June 2014. Data were collected through personal contact, market survey, focus group discussion and participatory rural appraisal with fish farmers, associations and aqua-drug sellers. Fifty five different types of aqua-drugs and chemicals were recorded in the study area, among those, 20 types were widely used by the farmers for different fish disease treatment.

Ahmed *et al.* (2015) research on the impact of aqua-drugs and chemicals on fish health and total fish production in Sherpur region, Bangladesh from July 2014 to June 2015. Forty nine different types of aqua-drugs and chemicals were recorded in the study area; among those sixteen types mainly ADDIC drugs and chemicals were widely used by the farmers for treatment of different fish diseases.

Chowdhury *et al.* (2015) carried out a study on aqua drugs and chemicals used in aquaculture of Zakigonj upazilla and found that various categories of drugs and chemicals were identified and problems associated with the use of such chemicals due to lack of knowledge of farmers about the use of chemicals, appropriate dose, method of application and their indiscriminate use of chemicals. The study also highlighted the names and approximate price of aquaculture chemicals available with the chemicals sellers.

Hasan *et al.* (2015) carried out to evaluate the effect of aquaculture•drugs and chemicals on health and production of prawn in Narail district. Data were collected through questionnaire interview, market survey and focus group discussion from June to December 2014. Six categories and 28 types of chemicals were found in the chemical shops as well as used by the farmers. Chemicals used in pond preparation, equipments disinfection, oxygen supplementation, growth promotion, antibiotics and disease treatment

Rahman *et al.* (2017) was carried out to investigate the drugs and medicine used in aquaculture activities in greater Comilla region in Bangladesh for fish health management and increasing aquaculture production.

Rasul *et al.* (2017) worked on drugs, chemicals and antibiotics usages in freshwater aquaculture activities at Jaintapur upazila of Sylhet and found that most common dose of lime, urea and TSP used by the farmers were 0.5-1 kg/40m², 80-150g/40m² and 50-100g/40m² respectively for pond and water quality management, disinfection, controlling DO level, disease treatment, antibiotics and growth promoter.

Mishra *et al.* (2017) carried out a study on the availability and use of different commercial grade aqua-medicines, drugs and chemicals in aquaculture activities in the selected key districts of four aquaculture dominant states of India viz., Andhra Pradesh, Odisha, Jharkhand and Chhattisgarh and they found six categories of aqua drugs and chemicals to be used by the fish farmers and hatchery owners which included those used for i) water quality management, ii) anti-parasitic drugs, iii) disinfectants or sanitizers, iv) water and feed probiotics, v) feed supplements and growth promoters and vi) antibiotics.

Manage (2018) found that antibiotics have been extensively and effectively used in aquaculture due to accelerated growth of aquaculture and this has resulted in the development of serious health problems in aquaculture, other animals, and human. The use of a wide variety of antibiotics in large amounts, including non-biodegradable antibiotics, ensures that they remain in the aquatic environment for a long time.

Kawsar *et al.* (2019) carried out to assess the aqua drugs and antibiotics used in aquaculture activities in north Chittagong of Bangladesh. They also found the impact of aqua drugs and antibiotics on fish production.

Chapter 3

Materials and Methods

3.1. Study area and period

The present study was carried out to collect data from field level of Khulna region of Bangladesh during January 2019 to May 2019. Data were collected from 6 different semi-intensive and 18 different extensive shrimp farms and hatcheries of Khulna and Bagerhat districts through questionnaire interview.

3.1.1. Target group

Since aquaculture activities in Khulna region are quite diversified, data were collected from different target groups to have an overall picture of chemicals used in aquaculture activities in the observed areas (Table 1).

Table 1: Target group of the study area



Culture system	Serial No.	Specific location of the survey	District	Sample size
Semi-intensive	1	Paikgacha	Khulna	1
	2	Batiaghata	Khulna	1
	3	Rupsa	Khulna	1
Extensive	1	Paikgacha	Khulna	3
	2	Batiaghata	Khulna	3
	3	Rupsa	Khulna	3
Semi-intensive	1	Bagerhat Sadar	Bagerhat	1
	2	Mongla	Bagerhat	1
	3	Rampal	Bagerhat	1
Extensive	1	Bagerhat Sadar	Bagerhat	3
	2	Mongla	Bagerhat	3
	3	Rampal	Bagerhat	3

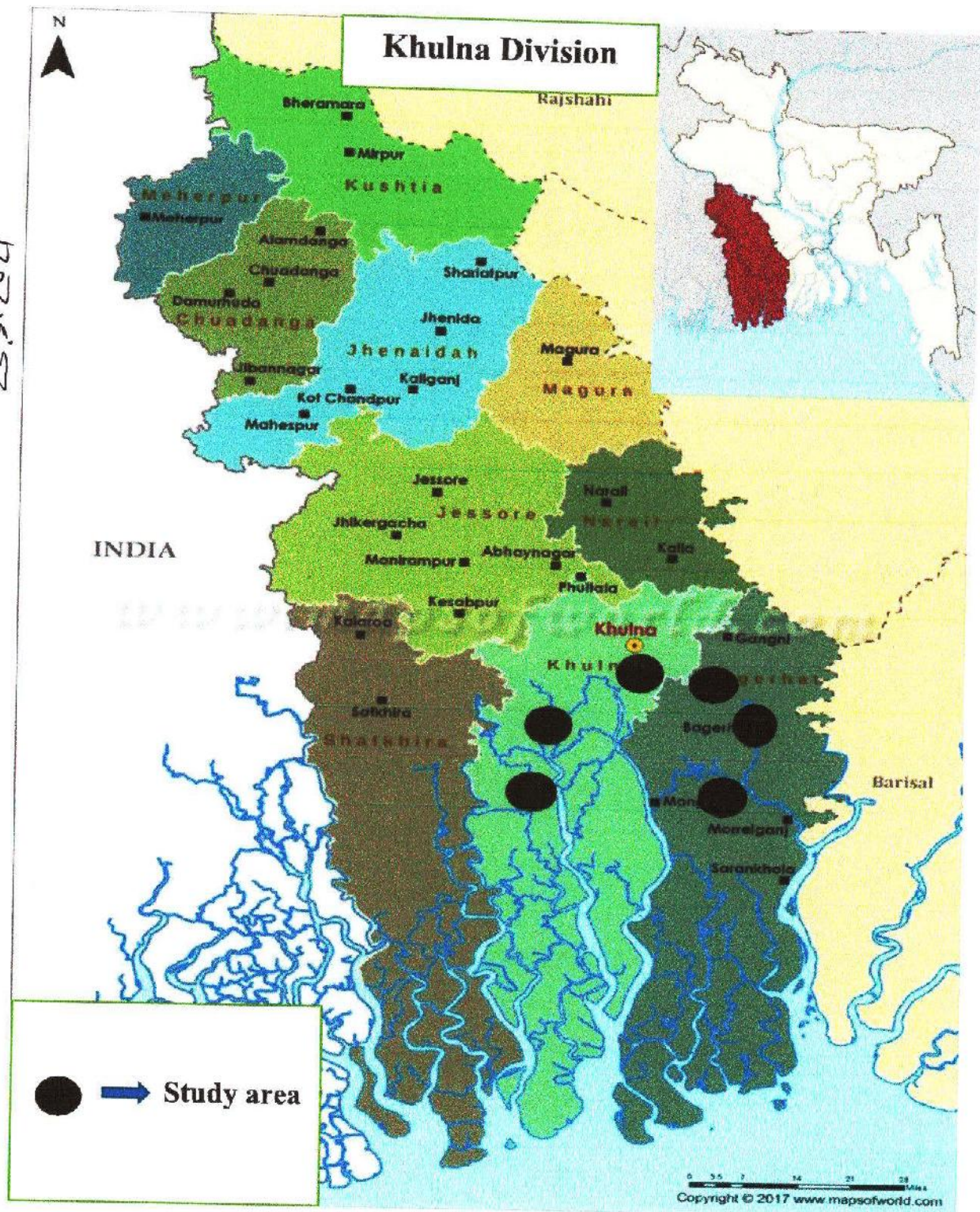


Fig. 1. Map showing study areas

3.2. Research design

The design of the survey for the present study involved some necessary steps, which are outlined in Fig. 2.

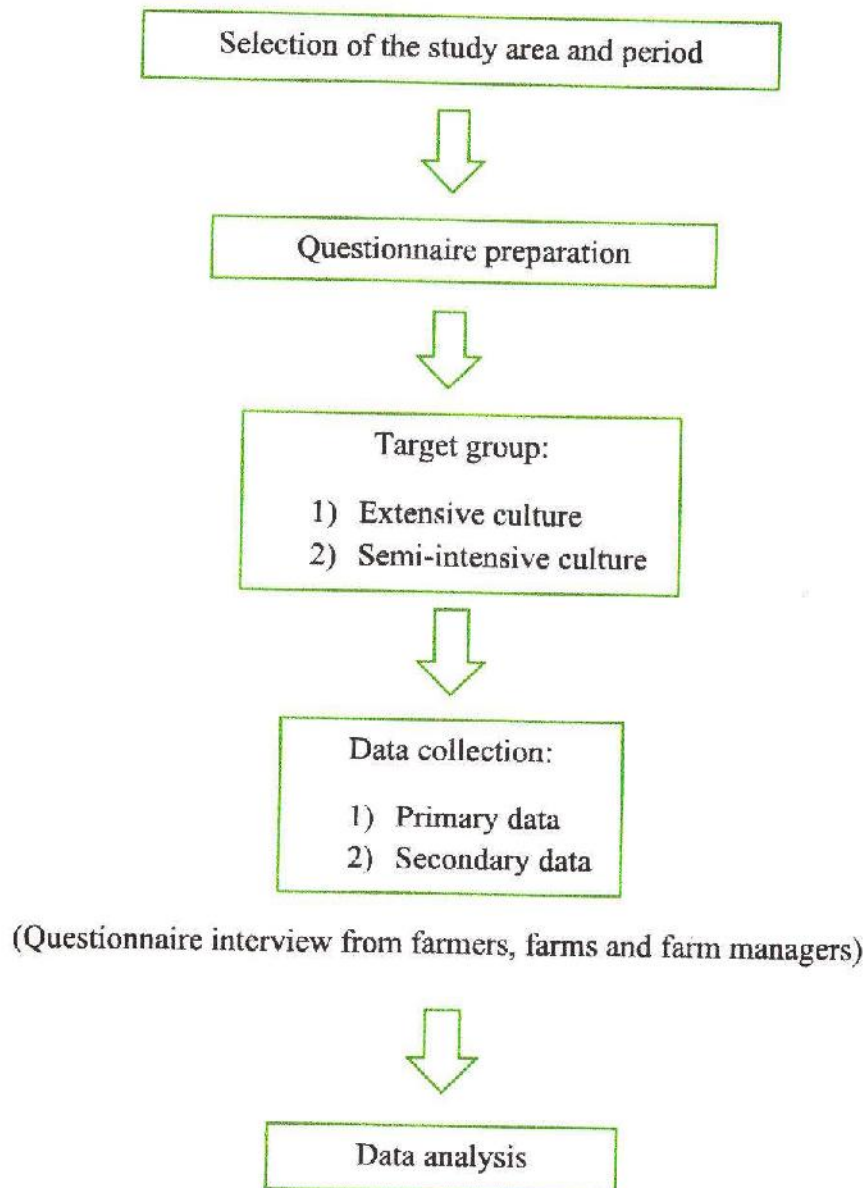


Fig. 2. Research design

3.3. Questionnaire preparation

Questionnaire was prepared in such a way that people could easily answer with their interest for my research at first which has been included in Appendix 1.

3.4. Questionnaire interviews

During the survey I visited the selected area and collected data by direct questionnaire interview from commercial and small scale shrimp farmers, owners, managers and then the questionnaire forms were filled up.

3.5. Data collection

During the survey both primary and secondary data were collected for my study.

3.5.1. Primary data

Primary data were collected from different commercial and small scale shrimp farmers, owners and managers by questionnaire interview. Some survey questions were asked on the application method of chemicals, their active ingredients, purpose of application, applied doses, effectiveness, duration, source and price of those chemicals. Data were also collected by market survey.

3.5.2. Secondary data

Secondary data were collected from different books, thesis papers, published research papers, journals etc.

3.6. Data analysis

The data were analyzed using tabular and descriptive statistical techniques. The summary tables were prepared in accordance to the objective of the study. Collected data from various sources were entered into a data base system using Microsoft office Software.

CHAPTER FOUR

RESULT

Chapter 4

Results

4.1. Categories of chemicals in aquaculture

From market survey, 12 different categories of around 55 commercial aqua-drugs and chemicals were recorded for aquaculture. Among them mostly 10 different categories of commercial aqua-drugs and chemicals were found to use by aqua farmers in their aquaculture activities. The categories include pond preparation and water quality management, antibiotics, disinfectants, gas removal, oxygen supplier, vitamins and minerals, growth promoter, insect killer and predator killer.

4.1.1. Pond preparation and water quality management

About 5 drugs and chemicals from different sources were found to use by the farms for pond preparation and water quality management. Their trade name, dose and source are mentioned in Table 2.

Table 2. Drugs and chemicals used for pond preparation and water quality management

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Lime	CaO, Ca(OH) ₂	100 kg/acre	100	Chemical seller
02	Calmag	CaMg(SO ₄)	20 kg/acre	50	CP products
03	Dolomite	CaMg(CO ₃)	25 kg/acre	65	CP products
04	JV Zeolite	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, Mn, P	18 g/acre	45	Novartis animal health Ltd
05	Sodamix	Carbonated water, high fructose corn syrup	22 kg/acre	37	CP products



Fig. 3. Different pond preparation drugs used by the aquafarmers. 1) Soda mix, 2) Calmag.

4.1.2. Antibiotics

About 7 antibiotics with different trade names were found to use by the aqua farmers for the treatment of fish diseases. Their name, dose and sources are given in Table 3. Mainly broad spectrum antibiotics were found to use with mixing in fish feed.

Table 3. Antibiotics used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Renamycin	Oxytetracycline	50 mg/kg b.w.	30	Renata
02	Aquamysine	Oxytetracycline HCL 25%	1-1.5 kg/ton	36	Fish Tech
03	Aquamycine	Oxytetracycline HCL 25%	1-2 gm /kg feed	45	ACI
04	Doxioxy	Magnesium stearate and microcrystalline cellulose.	1-2 gm/kg feed	25	Opsonin
05	Oxy Dox F	Oxytetracycline 20%, doxycycline 10%	1-2 gm/kg feed	42	ACI
06	Amoxifish	Amoxicillin trihydrate	3-5 gm/kg feed	35	Fish tech



Fig. 4. Different antibiotics used by the aquafarmers. 1) Doxy-oxy, 2) Renamycin.

4.1.3. Disinfectants

About 6 disinfectants from nine different sources were found to use by the farms. Their trade name, dose and source are mentioned in Table 4. Farmers use chemicals as the disinfectant to keep their pond free from pollution or microbial pathogen.

Table 4. Disinfectants used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Polgard plus	3-Methyl and 4-Methyl two chain brominated compound	500 ml/acre	52	Fish tech
02	Virex	Potassium Peroxymono sulphate 50%	100-200 gm/33 dec	33	ACI

03	Timsen	n-Alkyldimethylbenzyl ammonium chloride and Stabilized urea	1 st dose: 80 gm/33 dec 2 nd dose: 50 gm/33 dec	43	Eon
04	Aqua cleaner plus	Tetradesail Tri-methyl Amonium bromid, BKC	1 L/50 decimal for 3-5 ft depth	50	Fish world
05	Formalin	40% Formaldehyde	1-3 ppm	78	Chemical seller
06	Bleaching powder	Clorine	60 ppm	85	Chemical seller

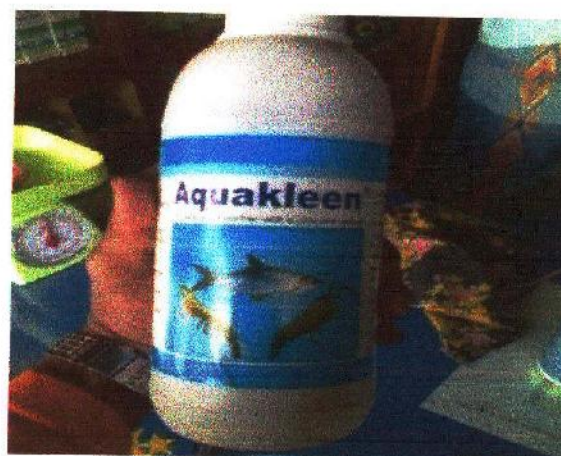
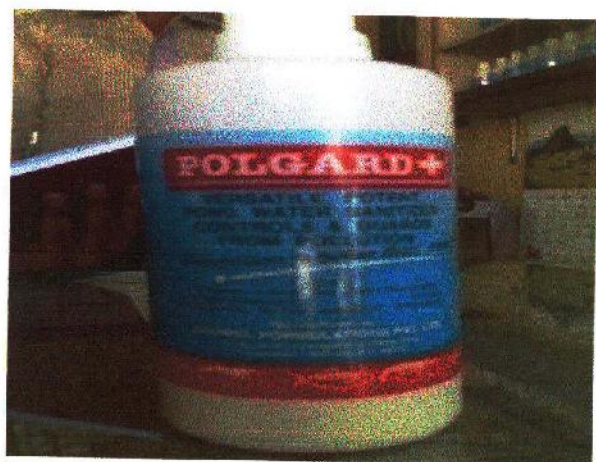


Fig. 5. Disinfectants used by the aquafarmers. 1) Polgard plus, 2) Aquakleen.

4.1.4. Gas removal

To remove organic and inorganic wastes producing gas in ponds, farmers were seen to use gas removal agent to their culture pond. 3 gas removal with different trade name were found to different farm. Their name, dose and sources are given in Table 5.

Table 5. Gas removal used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Zeolite gold	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, LoI, K ₂ O	200-250 gm/decimal (repeat 30-40 days interval)	37	Fish tech
02	Gasonex plus	Na-lorile ether sulphate	200-400 gm/acre	40	Fish tech
03	Aqua magic	Azotabactor chorococcum, Bacillus subtilis, candida utilis	05-08 kg/acre	30	Fish tech



Fig. 6. Gas removal used by the aquafarmers. 1) Zeolite Gold, 2) Aqua-Magic.

4.1.5. Oxygen supplier

When dissolved oxygen deficiency occur farmers use different kinds of oxygen supplier. 3 oxygen suppliers with different trade name were found to use by the farmers in the study area (Table 6).

Table 6. Oxygen suppliers used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Oxy gold	Sodium percarbonate	10 kg/acre	28	Fish tech
02	Oxy life	Sodium percarbonate	10 kg/acre	30	Square
03	Oxy flow	Sodium carbonate, H ₂ O ₂	10 kg/acre	32	Novartis
04	Sea-Fresh	Oxygen	10 kg/acre	35	CP products

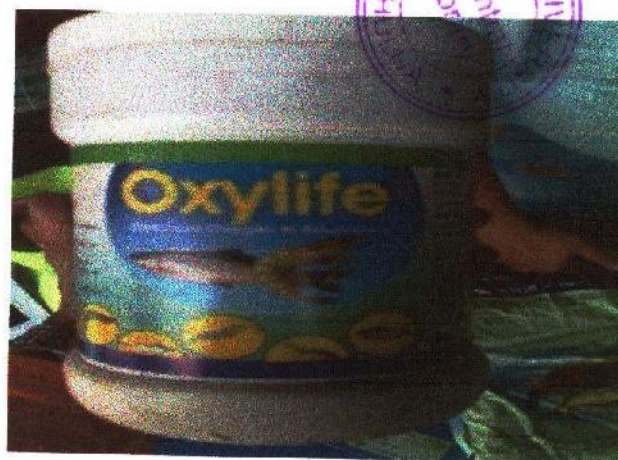
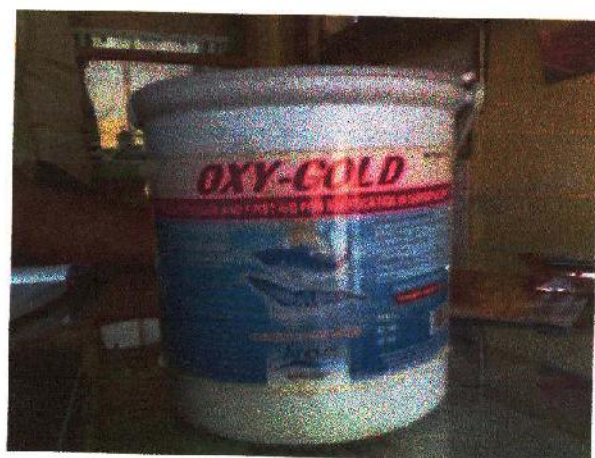


Fig. 7. Oxygen supplier used by the aquafarmers. 1) Oxy-Gold, 2) Oxylife.

4.1.6. Growth promoters

Farmers in the study area named three different types of chemicals used as growth promoters of their fish. Their name, dose and source are given in Table 7.

Table 7. Growth promoters used by aquafarmers

Sl. No.	Trade name	Active Ingredients	Dose	Frequency of uses (%)	Source
01	Aqua boost	Organic acid, β -glucan	5 gm/kg	45	Novartis
02	Charger gel	1-3 D-Glucan, Polysaccharides, Btain, Beta Glucan	2-4 gm /kg feed	42	Fish tech
03	Bio-grow	Herbal growth factor	100 ml/33 decimal	40	Sia agro-vet
04	Mutagen	Major vitamin and mineral	10 gm/kg	35	CP products
05	Zymetin	Benificial bacteria	8 gm/kg	33	CP products

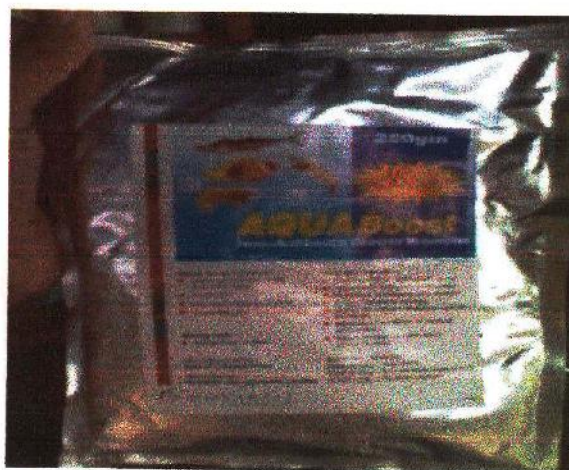
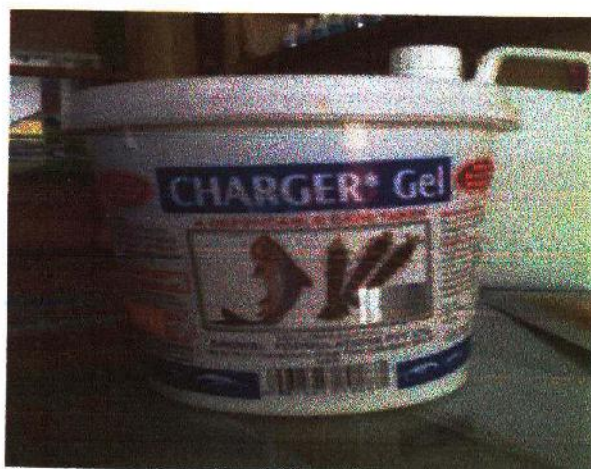


Fig. 8. Growth promoters used by the aquafarmers. 1) Charger Gel, 2) Aqua Boost

4.1.7. Vitamins

Three vitamins with different trade names were found to use by the farmers to increase disease resistance power and sometime to treat diseases of their cultured fish. Their name, dose and source are given in Table 8.

Table 8. Vitamins used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Grow fast	Vitamin, mineral and amino acid supplement	1 ml/3-4 liter	27	Rals
02	Silver mil	Vitamin, mineral and amino acid	1-2 ml/kg feed	25	Sia agro-vet
03	Ossi-C	Ascorbic acid (Vit-C), natural betain	4-5 ml/kg feed for 5-7 days	35	Fish tech

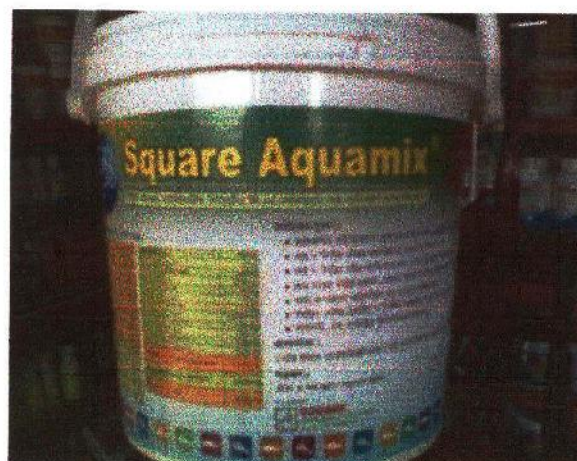
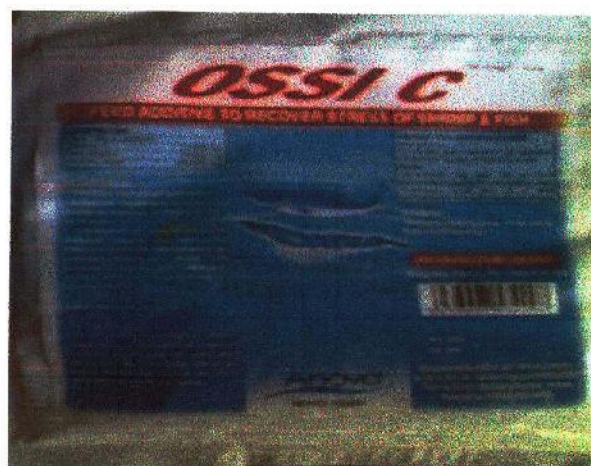


Fig. 9. Different vitamins used by the aquafarmers. 1) Ossi C, 2) Square Aquamix.

4.1.8. Probiotics

Four probiotics with different trade names were found to use by the farmers in shrimp farm. Their name, dose and source are given in Table 9.

Table 9. Probiotics used by aquafarmers

Sl. No.	Trade name	Active ingredients	Dose	Frequency of uses (%)	Source
01	Super Biotic	Bacillus sp.	1 kg/acre	22	CP products
02	Pond Plus	Bacillus subtilis	.5 kg/acre	25	Fish tech
03	pH Fixer	Bacillus sp.	1 kg/acre	30	CP products
04	Super PS	Rodobacter sp. Rodococcus sp.	12 L/acre	33	CP products



Fig. 10. Different probiotics used by the aquafarmers. 1) Super biotic, 2) pH Fixer.

4.1.9. Insect killer

Sumithion and Deletix are the two insect killer used by the farmers in their pond to kill different types of harmful insects. The recommended dose of Sumithion was 5-10 ml/day/3ft depth and Deletix was 25-30 ml/acre for 4 feet water depth. Samco and Fish Tech were the two companies which provide the chemicals to the farmers.



Fig. 11. Two insect killers used by the aquafarmers. 1) Deletix and 2) Sumithion.

4.1.10. Predator killer

Farmers use rotenone powder to remove predator fish. Rotenone with a brand name Acurte Gold is provided by a pharmaceutical company Samco was found in the study. The recommended dose of Acurte Gold was 15 gm/dec/1 ft depth.

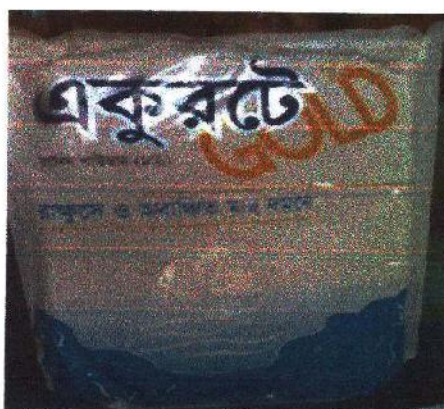


Fig. 12. Acurte Gold was investigated predator killer.

4.2. Pharmaceutical company and widely used aqua- drugs and chemicals

Fifteen pharmaceutical companies were seen to provide commercial aqua drugs and chemicals to fish farms. Major companies were Fish Tech, Renata, Firstcare, ACI, ACME, Square, Novartis, Eon, Padma, Nature care, Advance and SK+F. During the survey, around 42 trades named aqua-drugs and chemicals were recorded. Among those, 20 types are widely used by the farmers as given in Table 10.

Table 10. Mostly used commercial aqua-drugs and chemicals in shrimp farms

Sl. No.	Trade name	Purpose of use	Frequency of uses (%)	Source
01	Renamycin	As antibiotic	30	Renata
02	Amoxifish	As antibiotic	35	Fish tech
03	Timsen	As disinfectants	43	Eon
04	Aquamysine	As antibiotic	36	Fish tech
05	Ossi-C	As vitamins	35	Fish tech
06	Aquamycine	As antibiotic	45	ACI
07	Virex	As disinfectant	33	ACI
08	Aqua kleen	As disinfectant	50	Square
09	Zeolite gold	For removing gas	37	Fish tech
10	Oxy Dox F	As antibiotic	42	ACI
11	Polgard plus	As disinfectant	52	Fish tech
12	Charger gel	As growth promoter	42	Fish tech
13	Aqua magic	For removing gas	30	Fish tech
14	Bactisal	As disinfectant	25	First care
15	Acurte Gold	As predator killer	30	Samco
16	Super Biotic	Probiotic	22	CP products
17	Oxy life	O ₂ supply	30	Square
18	Dolomite	As pond preparation	65	CP products
19	pH Fixer	Probiotic	30	CP products
20	Calmag	As pond preparation	50	CP products

4.3. Impact of aqua drugs and chemicals in extensive and semi-intensive culture system

In the present investigation it was found that aquaculture-drugs and chemicals had tremendous impact on shrimp production. Production varied from treated and not treated systems.

4.3.1. Shrimp production in Khulna district

In Khulna district, in Paikgacha upazilla shrimp production was 150 kg/acre in control farms (where no drugs and chemicals were used), whereas, 350 kg/acre in treated extensive farms and 5000 kg/acre in treated semi-intensive farm. However, in Batiaghata upazilla shrimp production was 150 kg/acre in without drugs farms, whereas, 300 kg/acre in treated extensive farms and 5500 kg/acre in treated semi-intensive farm. And in Rupsa upazilla shrimp production was 150 kg/acre in control farms (where no drugs and chemicals were used), whereas, 300 kg/acre in treated extensive farms and 4800 kg/acre in treated semi-intensive farms (Table 11).

Table 11. Shrimp production in Khulna district

District	Upazilla	Extensive Production(kg/acre)		Semi-Intensive Production(kg/acre)
Khulna	Paikgacha	1	300	5000
		2	400	
		3	350	
	Batiaghata	1	250	5500
		2	350	
		3	300	
	Rupsa	1	300	4800
		2	250	
		3	350	

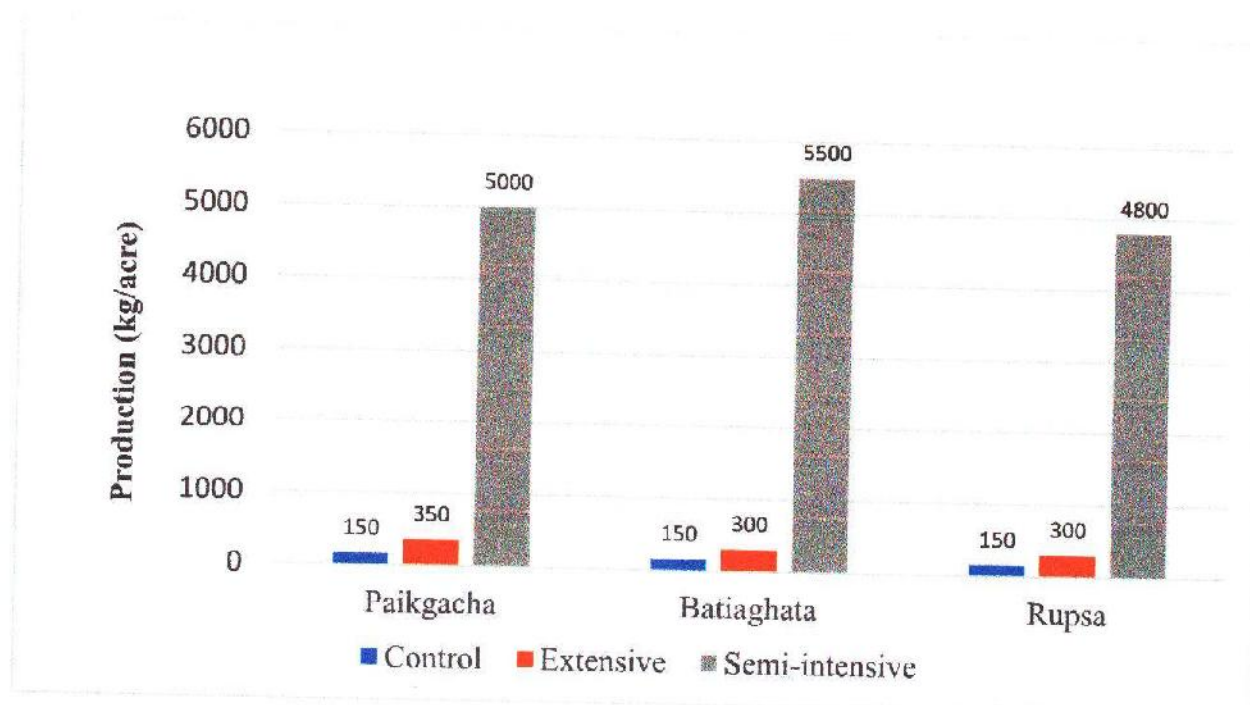


Fig. 13. Shrimp production in Khulna district

4.3.2. Shrimp production in Bagerhat district

In Bagerhat district, in Bagerhat Sadar upazilla shrimp production was 150 kg/acre in control farms (where no drugs and chemicals were used), whereas, 300 kg/acre in treated extensive farms and 5500 kg/acre in treated semi-intensive farm. However, in Mongla upazilla shrimp production was 150 kg/acre without drugs farms, whereas, 250 kg/acre in treated extensive farms and 4500 kg/acre in treated semi-intensive farm. And in Rampal upazilla shrimp production was 150 kg/acre in control farms (where no drugs and chemicals were used), whereas, 200 kg/acre in treated extensive farms and 5000 kg/acre in treated semi-intensive farms (Table 12).

Table 12. Shrimp production in Bagerhat district

District	Upazilla	Extensive Production(kg/acre)		Semi-intensive Production(kg/acre)
Bagerhat	Bagerhat Sadar	1	300	5500
		2	350	
		3	250	
	Mongla	1	300	4500
		2	250	
		3	200	
	Rampal	1	200	5000
		2	230	
		3	180	

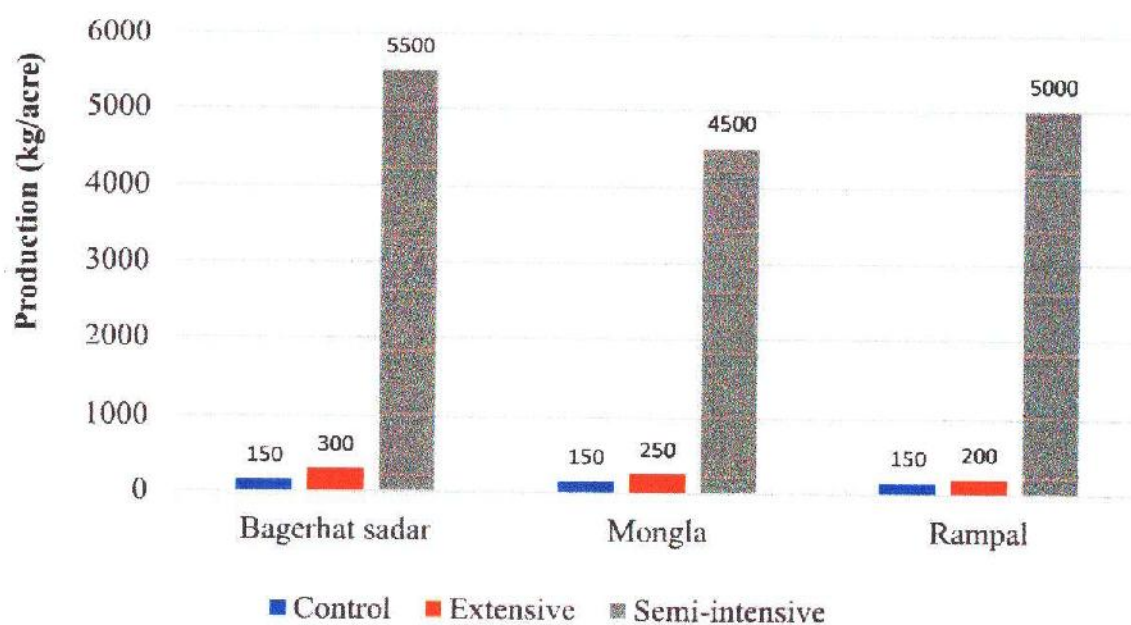


Fig. 14. Shrimp production in Bagerhat district

CHAPTER FIVE

DISCUSSION

Chapter 5

Discussion

Aquaculture in Bangladesh is heading towards commercialization and intensification. Different types drugs and chemicals have become an essential part for successful aquaculture production. The present investigation was conducted to know the current status of commercial aqua-drugs and their impact on shrimp production. Data was collected through questionnaire interview, market survey and personal contact with retailers and representatives of pharmaceutical companies in Khulna and Bagerhat district.

In the present study, it was found that mostly seven different categories of commercial aqua-drugs and chemicals were used by farmer for different aquaculture activities like disease treatment, pond preparation, disinfectants, growth promotion and improve disease resistance. All these activities were related for better health management of aquatic animal. At present 42 products of 15 animal health companies were seen to market at field level.

Moreover, these pharmaceuticals companies found to have very attractive information leaflet to sell their products to the farmer. Farmers of the selected area used mainly Amoxifish, Renamycin, Timsen, Aquamysine, Deletix, Seaweed, Ossi-C, Oxy gold, Charger gel, Renaquine, Polgard plus, Vectisol, Aqua kleen, Rotenone, Aqua, boost, Timsen, Sumithione, Doxioxy, and Virex as trade name for disease treatment. Faruk et al (2008) also found the similar drugs like JVzeolite, Geotox, Green zeolite, Orgavit aqua, Fish vitapulus, AQ grow-G, Oxy flow, Oxy max and O₂-marine. However, in the present study we got some new products with various trade names which include Ossi-C, Oxy gold, charger gel, Polgard plus and Vectisol.

Health problems had become very common in fish and shrimp culture, especially in intensive and semi-intensive system. Protozoan and crustacean ectoparasites, as well as bacterial diseases were caused. It increase mortality in brackish water shrimp culture. To reduce this problems, various chemicals and antibiotics such as Renamycin, Aquamysine, Doxioxy, Polgard plus, Virex, Timsen etc were widely used treatment and prevention of infectious diseases in shrimp farms.

The present study revealed that commercial aqua drugs have some positive impact on shrimp production. It was observed that farmers of the selected areas got good results in shrimp production by applying single or combinations of various aqua-drugs and chemicals. Average shrimp

production was 150 kg/acre in control farms, whereas, 300 kg/acre in chemical treated extensive farms and 5000 kg/acre in chemical treated semi-intensive farms.

In the study area different types of diseases like EUS, exophthalmia, white spot and dropsy in shrimp were observed. A number of authors also reported the similar conditions in aquaculture of Bangladesh (DoF, 2002 and Faruk et al., 2004). Most of the farmers of the selected areas used drugs and chemicals to control these types of disease. It meant that disease problem was one of the major concerns in aquaculture of the studied areas.

In the present study, it was observed that some antibiotics such as Renamysin, Aquamysine, Doxioxy, Amoxifish, Orgamysin were used by the farmer. Antibiotics should be used only for the treatment of bacterial diseases. It was found in the present study that antibiotics were used indiscriminately without knowing the exact reasons of disease. Some farmers did not follow the described dosages for treatment. It is widely recognized that the excessive use of antibiotics contributes the development of resistant strains of bacteria (Plumb, 1996).

Disease treatment in aquaculture can be a great value when used properly but when improperly applied, can causes great loses of aquatic ecosystem. So, it is important to apply drug against appropriate disease and best application methods for aqua-health management. Pharmaceuticals companies should conduct more research and development towards reducing the harmful impact of aqua-medicine in aquaculture.

CHAPTER SIX

CONCLUSION

Chapter-6 Conclusion

The research has been done to know the updated status of commercial aqua drugs and chemicals and their impact on shrimp production. Data was collected through questionnaire interview with fish farmers and drug sellers, personal contact and market survey from selected area in Khulna and Bagerhat district.

Through the observation we obtained different categories of commercial drugs and chemicals were using for different purposes. From the starting of pond preparation to disease treatment different drugs and chemicals were used by the farmers. There are various pharmaceuticals companies were found to provide different types of drugs and chemicals with different trade name to meet the farmers demand. Different types of diseases like EUS, exophthalmia, white spot and dropsy in shrimp were observed in the study area. To overcome such kind of situation farmers used different kinds of drugs and chemicals. After use of drug they got good to better result. But some certain cases they did not get any recovery.

Farmers used different types of aquaculture-drugs and chemicals for shrimp production. Average shrimp production was 300 kg/acre in chemical treated extensive farms and 5000 kg/acre in chemical treated semi-intensive farms, whereas, 150 kg/acre in control farms. So, it can be said that aquaculture-drugs and chemicals had a great impact on shrimp production in Khulna region. However, farmers should be aware of over doses of each drugs and chemicals.

CHAPTER SEVEN

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Chapter 7

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CHAPTER EIGHT

APPENDIX

Questionnaire

Basic information:

Name of district:

Name of upazilla:

Type of culture:

Farm /Hatchery Information:

1. Name of the farm/gher/hatchery

2. Name & age of farmer

3. Education level

4. Contact

5. Size of farm/gher/hatchery

6. Depth of water

Sl. No.	Product name	Doses	Purpose of uses	Stage	Source	Price