PRESENT STATUS OF HATCHERIES AND BROODSTOCK FEEDS IN DINAJPUR DISTRICT

A Thesis
By

SHAYAN KUMAR BARMAN
Examination Roll No. 1705515
Session: 2017
Semester: July-December 2018

MASTER OF SCIENCE (MS)

IN

AQUACULTURE

DEPARTMENT OF AQUACULTURE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY
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June 2019

DEDICATED
TO MY
BELOVED PARENTS

ABSTRACT

A yearlong study was conducted to investigate the present status of fish hatcheries and broodstock feeds used in the hatcheries in Dinajpur district. Twelve hatcheries were found in the study areas. Data were collected by using a well structured questionnaire. The study revealed that age of the most respondents (44.44%) was in the age group of 41-55 years, all of them were male and Muslim and used underground water in the hatchery activities. Educational qualification of most of the hatchery owners was higher secondary level (34%) and 56% of the respondents were trained by different organizations. It was found that 75% hatcheries were operated privately, 50% were large (area above 6 acres), and annual productivity of fish seed of 66.66% of hatcheries was low (less than 1000 kg). Most of the respondents (66.67%) used both commercial and on-farm feeds and commercial feed was collected from various reputed feed companies e.g. Mega Feed, Provita Feeds Limited, Quality Feeds Limited, Aftab Feed Production Limited, AG Agro Feeds Limited, Lili Feeds Limited etc. and 41.67% of the respondents applied feeds at 1-2% of body weight, 66.67% of the respondents fed twice daily in morning and evening, all of them fed the brood fish manually

Keywords: Survey, Broodstock Feeds, Fish Hatchery and Dinajpur district.

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CHAPTER I

INTRODUCTION

Bangladesh is blessed with enormous inland water bodies which are very rich in diversity of aquatic species (Samad *et al.* 2013). The favorable geographic position of Bangladesh along with a large number of aquatic species and provides plenty of resources to support fisheries potential (Ghose, 2014). The fisheries sector can largely be classified into three categories: inland capture fisheries, aquaculture and marine fisheries, of which the inland aquaculture sector is contributing more than 55% to the total production (DoF, 2016). The inland fish diversity is attributed to the habitats created by the Bengal Delta wetlands and the confluence of the Brahmaputra, Ganges and Jamuna rivers that flow from the Himalayan Mountains into the Bay of Bengal. Aquaculture has increasingly been playing a key role in total fish production of the country and presently more than half (50%) of the total production comes from aquaculture.

Aquaculture is growing more rapidly than all other animal food-production sectors (Siriwardena *et al.* 2007).Bangladesh has recorded an annual output of 41.34 lakh MT against a demand of 40.50 lakh MT in 2016-17. Fish and fisheries sectors have contributed 3.61% to our national GDP and around one-fourth (24.41%) to the agricultural GDP in Bangladesh (DoF, 2016-17). More than 11 percent of total population of Bangladesh is engaged with this sector on full time and part time basis for their livelihoods. More than 2% of Bangladeshi export value comes from the inland fisheries sector. The fisheries sector has plentiful potential in creating various types of supplementary industries in rural areas that often have a high rate of economic return. These employment opportunities for poor rural citizens would also stem their migration to urban areas. Fish supplements about 60% of Bangladeshi people's daily animal protein intake (DoF, 2016-17). Above 17

million people including about 1.4 million women depend on fisheries sector for their livelihoods through fishing, farming, fish handling, and processing (BFTI, 2016).

Aquaculture practices in Bangladesh started with fish seed collected from river but now it is almost entirely replaced by hatchery produced fish seed. A vast amount of eggs and spawn were collected from major rivers such as the Hadla, the Jamuna, the Padma and their tributaries during the monsoon season. However, collection of seed from natural water has declined in recent years. As against an estimated collection of 12,533 kg fish seed during 1988, the fish seed collected during 2017 was only 6,63,462 kg (Fisheries Statistical Yearbook of Bangladesh, 2016-17). Nowadays, due to continuous destruction of natural habitats the natural availability of fish seed has largely gone down and the aquaculture ventures are fully dependent on the hatchery-produced fry/fingerling. During 1980`s about 95% fish spawn used to be collected from natural sources. Currently more than 98.41% fish spawn is produced in the hatcheries. At present the total number fish hatcheries in Bangladesh is 825 and their total production is 6,66,088 kg hatchlings (Fisheries Statistical Yearbook of Bangladesh, 2016-17). During 1990s there were 5 large hatcheries and 106 fish seed multiplication farms established in public sector. A part of from Government hatcheries, a large number of carp hatcheries had been built in the private sector in different parts of Bangladesh. Day by day many private hatcheries were established in our country. Most of the hatchery owners did not follow aquaculture code of conduct, breeding protocols, brood stock and hatchery management technology and proper knowledge about feed and feeding of fish.

In Rangpur division there are 15 govt. and 72 private hatcheries are operated. The total fry production from these hatcheries is 2535.6 kg and 53654 kg per year respectively from govt. and private hatcheries (Fisheries Statistical Yearbook of Bangladesh, 2016-17). A

total number of 12 hatcheries found in Dinajpur district and the total production of these hatcheries is 3775 kg fry every year.

Culture of aquatic animals especially fish culture has undergone a dramatic worldwide growth in the last few years. Nutrition plays a vital role in improving animal productivity (Jacob and Raj 1987). Understanding about the nutritional requirements and production of fish feed is essential to the development and sustainability of aquaculture as the industry has matured. Feeding of fish during culture aims at producing the maximum weight of marketable fish within the shortest time at least cost. The feed should supply the energy for movement and all other activities the fish engages in. It should also provide nutrients for body maintenance, growth and reproduction.

Hatchery fish are fed diets specially designed for their nutritional needs. This feed contains all the essential nutrients needed to keep them healthy and growing. This feed usually is in the forms of dried pellets, similar in many ways to dry dog food. Nutritional guidance such as allowance magnitude (Tyler and Dunn 1976, Springate *et al.* 1985, Shabuj *et al.* 2016), energy gratified (Smith *et al.* 1979, Takeuchi *et al.* 1981), lipid and fatty acid configuration (Watanable *et al.* 1984, Santiago and Reyes 1993, Bhuiyan *et al.* 2018), protein (Santiago *et al.* 1983, Shim *et al.* 1989, Bhuiyan *et al.* 2018, Islam *et al.* 2016, Rahman *et al.* 2015) and protein: carbohydrate fraction (Cerda *et al.* 1994) in fishes have been testified by numerous researchers. Brood stock nourishment remnants single of the further most tacit in the arena of fish sustenance, besides readings are imperfect to a few types (Izquierdo *et al.* 2001). Conspicuously, the feasibility of fry was associated to their HUFA contented the afore mentioned accompanying to the HUFA gratified fed to brood stock (Lavens *et al.* 1999). Gonadal improvement and productiveness are affected by definite nutrients, predominantly for paternities with an uninterrupted level plus a petite epoch vitellogenesis. Some species of fish voluntarily integrate the dietary unsaturated

fatty acids in eggs, straight throughout the breeding period. In particular fish species, LC-PUFA (Long chain polyunsaturated fatty acids) in brood stock nourishment upsurge productiveness, fertilization and egg excellence. This has been pronounced in specie of common carp *C. carpio* (Manissery *et al.* 2001). Attributable to deprived administration developmental deformities or exterior malformations transpire in the hatchery (Rahman *et al.* 2015). These have been accredited to tetra genic possessions of environmental adulteration, scarceness of nutrient, oxygen scarcity, unexpected vicissitudes in temperature, water current, inbreeding etc. (Hore *et al.* 2010). The nutrients needed by fish include carbohydrates, fats, protein, vitamins and minerals. Other components of feed are fiber and moisture. Fish diet must contain all the nutrients in the right proportions to bring about growth. The present study is conducted to review and research the present status of brood stock feeds used in the hatcheries in Dinajpur region of Bangladesh.

Objectives of the study

- To understand the operating procedure of hatcheries
- To assess the feed ingredients and feeds used for brood fish rearing in hatcheries

CHAPTERII

REVIEW OF LITERATURE

Broodstock feed is a very important part in fish hatchery. For getting healthy, disease free fry, proper amount of quality feed should be supplied. This chapter deals with the reviewing the previous studies related with fish hatcheries and feeds used in hatcheries.

Jahan *et al.* (2018) conducted an investigation for a period of one year in Dinajpur district, Bangladesh to know the current aquaculture practices with special emphasis on fish feeds. The pond areas of 85.8% farmers were less than 0.50 ha with an average depth of 1.5 m. In the study areas 30% fish farmers used farm made feeds, 40% used commercial feeds and 30% used both farm made and commercial feeds. The feed was applied manually twice in a day by most of the farmers (95%). Generally fishmeal, mustard oil cake, rice bran, maize bran, wheat flour etc. were used to prepare on-farm feeds and among the commercial feeds, Mega feed was used by the highest percentage of respondents (35%).

In a study on 10 hatcheries Ali *et al.* (2018) found that maximum and minimum annual spawn production were 2,500 and 800 kg, respectively. The sources of brood fish were own pond (50%), others hatchery (30%) and natural sources (20%). Seeds of Indian major carps, carpio, sarpunti, silver carp, grass carp, magur, shing etc. were produced with the varying capacities from 25 to 75 kg per hatchling cycle depending on size and facilities of the hatcheries. Most of the hatcheries were operated by skilled technicians; on the other hand, some hatcheries were run by the well experienced hatchery owners. The hatchery owners had improved their social status though hatchery income.

Islam *et al.* (2017) conducted a study in order to understand the status of hatcheries. Questionnaire interview and participatory rural appraisal tools were used in North-west Fisheries Extension Project (NFEP), Parbatipur. There were two hatcheries in NFEP,

Parbatipur- a carp hatchery and a prawn hatchery. Brood fish were collected from rivers and other sources which they maintained in their brood stock ponds with proper management. It was found that the hatcheries produced fish seed of a variety of species such as Indian major carps, carpio, sarpunti, silver carp, grass carp, magur, shing as well as freshwater prawn. The quantity of fish seed produce varied from 25 to 75 kg per hatching cycle depending on size and facilities of hatcheries. Brood fish were reared in 3 ponds having the area of 1.5 ha and water depth in between 5 -7ft. 25% protein level was maintained in the feed for the brood fish. Commercial and on-farm feed was supplied year round by the hatchery operation team

Ali *et al.* (2016) carried out to a study to know the artificial breeding of *Ompk pabda, Heteropneustes fossilis* and *Pangasius hypophthalmus* using pituitary gland (PG) in the hatcheries in Jessore region. A total of 10 hatcheries were included in that study. Most of the broods (80%) were reared from own hatchery and rest of them (20%) were collected from market. For good health and full maturation artificial diet were supplied. The proximate compositions such as crude protein 29.35%, lipid 8.68%, ash 12.76%, moisture 13.16%, carbohydrate 29.25%, crude fiber 5.80%, and vitamin 1% were maintained properly.

Shabuj *et al.* (2016) conducted a study on brood stock management of Thai Pangus (*Pangasius hypophthalmus*) in the hatcheries of Jessore region. In the study, it was mentioned that the hatchery owners followed several criteria to buy the brood fishes feed. During the management process, they used two types of feed such as formulated and commercial feeds. Maximum time they applied commercial feed such as Mega feeds for their brood fish. The hatchery owners supplied pellet feed in their brood stock pond for the standard quality of feed. They used formulated feeds two days and commercial feeds five days per week in a brood stock pond. But they could not maintain protein level of

formulated feed in their brood rearing ponds. They generally used fish meal, rice polish, mustard oil cake, maize meal, soyabean meal and vitamin premix as formulated feed. The brood fishes were reared for four months with feeding at two times a day according to the body weight of fishes. It was observed that the farmers feed Pangus as 2-2.5% body weight of fish in their brood rearing ponds.

In a study Hossain *et al.* (2016) observed the status of Indian major carp broodstock management in hatcheries in Jessore, Bangladesh. The survey was conducted in 20 hatcheries. The sources of brood fish were mainly own and other sources were Halda River, Padma River, Govt. brood bank, World Fish Centre and BFRI. Feed ingredients applied for feeding were rice bran (39%), mustard oil cake (29%), vitamin and mineral premix (3%), wheat flour (7%), fish meal (13%) and soyabean flour (5%). Nutritional compositions of feed were protein (20-30%), lipid (10-12%), carbohydrate (25-35%) and fat (7-11). Hatching rate was 85-91% and deformed hatchlings were 5-7% in the hatcheries.

In a study Lutfar *et al.* (2014) evaluated some commercial fish feeds available in Bangladesh comparing the nutrient content through chemical analysis. The commercial fish feeds collected from the markets were Mega Feeds Limited (MF), Jayson Agrovet Limited (JF), Quality Feeds Limited (QF), ACI Agrovet Private Limited (ACI), Paragon Agro Limited (PF). Proximate composition such as moisture, crude protein, crude lipid, ash, fibre and NFE (nitrogen free extract) were analysed. However, two pangas feeds such as starter and grower of MF had much lower protein content (31.20 % and 26.46 %) compared to 35% protein value for both declared by the company. Similarly, large (more than 5%) differences between the analysed and company declared protein content was observed in case of carp starter and grower feeds of QF. On the other hand, analysed protein content of all feeds of ACI was more than that declared by the company except for

grower-II feed which had slightly lower (1%) protein compared to the company declared value. Pangas feeds (grower I and II) of PF had about 2% lower protein than the company declared value. The analysed lipid contents of all feeds were higher than the company declared values except Sonali (G) feeds of QF which had about 1-2% less lipid content compared to the company declared value. Moisture content of most of the feed was around the company given maximum values except Surovi (S) of QF that was 3% higher. Fibre contents of different feeds analysed were much higher (3-5%) than the company declared values. The results of the study showed that on the basis of nutrient content feeds from ACI Agrovet Private Limited is better than other feeds.

Samad *et al.* (2014) conducted a survey on 40 hatcheries in Jessore. The areas of ponds were ranged from 33.33 to 400 decimal and shape with maximum rectangular. Most of the broodstocks were collected from their own hatcheries (range from 61% to 67%) and the rest of broods were collected from the natural sources including Halda River and Padma River. Moreover, 4 carp species (rui, catla, mrigala and kalbashu) among 13 endemic and 4 exotic carp species (silver carp, grass carp, bighead and common carp) out of 6 exotic carps species were used for seed production. The formulated feed which contained 20-30% protein for carp broodstock were prepared using the indigenous ingredients including mainly rice bran, mustard oil cake, vitamin and mineral premix, wheat flour, fish meal and soya bean flour and maize flour. Proximate compositions of food that were used in brood ponds in which protein was 20-30%, carbohydrate was 25-35%, lipid was 10-12%, moisture was 10-15%, Phosphorus, Calcium, Vitamins and minerals was 7-11% and Others was 5-10%.

Alom *et al.* (2012) conducted a study in Fulpur upazila under Mymensingh district to know the nutritive value of commercial fish feed used in fish hatcheries. Fish hatchery owners were prominent in the study area and majority was illiterate but had the ability of

signature. Majority of fish farm owners leased water body for aquaculture. The minimum size of the farm was 0.162 ha and maximum size of the hatchery was 3.722 ha. The average depth of the water body in winter season was 1.61 meter and in summer season was 2.32 meter. Majority of fish farm owners followed proper pre-stocking and post stocking management with maintaining high stocking density of fish and using either commercial or farm made fish feed. Among the commercial fish feed tested the highest value of moisture was found in Aftab feed, protein in Nourish feed, lipid in CP feed, ash in Aftab feed, fibre in ACI feed and carbohydrate in ACI feed. Most of the commercial fish feed maintain standard level of chemical composition.

Bascınar *et al.* (2007) evaluated the growth, feed consumption and conversion ratios of Black Sea trout (*Salmo trutta labrax*) by daily feeding frequencies. A total of 320 fish were taken for the study. Nine fibreglass experimental tanks, each with a full volume of 400 L, were used in the experiment. The three treatments (namely, daily feeding frequencies of one - F_1, two - F_2 and three - F_3) were each applied to three tanks, which were randomly allocated. So the each trial was run in three replicates of 40 fish each. After the groups were formed, each fish was weighed individually to obtain the initial weight of the groups. Fish were fed with commercial 4.0 mm extruded trout feed. Approximately one-month intervals all the fish were weighed individually at the end of the experiment. Specific growth rates (SGR) exhibited clear fluctuations ranging from 0.14 to 0.40 with overall mean values of 0.27, 0.28 and 0.36% in groups F_1, F_2 and F_3, respectively. The growth data clearly indicated that the final live weight and SGR values of group F3 were significantly higher than those of other groups.

Ali *et al.* (2005) conducted a 6-month feeding trial in field condition using10 hatchery ponds to investigate the effect of mixed feeding schedules on the growth of Pangus

(*Pangasius hypophthalmus*) with silver carp(*Hypophthalmichthys molitrix*). Two diets of high protein (30%, HP) and low protein (16%, LP) were prepared using locally available feed ingredients. The fish were fed twice daily at the rate of 15%, 10%, 8% and 5% of their body weight for first, second, third month and rest of experimental period respectively. Feeding rate was calculated only on the basis of weight of pangus and was adjusted every 2 weeks according to weight gain. Fish fed LP and HP on alternate day (1LP/1HP) resulted in significantly ($P<0.05$) higher growth rate, feed utilization and production among the treatments.

Kader *et al.* (2005) conducted a study to analysis and compare the nutrient content of some commercial fish feeds available in Bangladesh. The commercial fish feeds collected from the markets were Quality Feeds Ltd. (QF), Aftab Feed Products Ltd. (AF), Saudi-Bangla Fish Feed Ltd. (SBF), Paragon Feeds Ltd. (PF) and AIT Feeds Ltd. (AIT). Proximate composition such as moisture, crude protein, crude lipid, ash, fibre and NFE (nitrogen free extract), and some of the macro minerals such as Ca, P, Na, K and S were analysed. In general, there was no large variation between analysed and company declared nutrient contents of different feeds except the protein and lipid content of some feeds. However, two pangas feeds such as Surovi (nursery and grower) of QF had much lower protein content (27.57% and 20.24%) compared to 32% and 25% protein value respectively declared by the company. Similarly, large (more than 5%) differences between the analysed and company declared protein content was observed in case of carp starter and grower feeds of QF. On the other hand, analysed protein content of all feeds of SBF was more than that declared by the company except for special shrimp feed which had slightly lower (1%) protein compared to the company declared value. Pangas feeds (grower I and II) of PF had about 3% lower protein than the company declared value. The analysed lipid contents of all feeds were higher than the company declared values except

nursery feeds of QF which had about 1-2% less lipid content compared to the company declared value. Fibre contents of different feeds analysed were much higher (3-5%) than the company declared values. The analysed mineral contents in all the feeds were higher than the recommended mineral requirement for fishes.

Nandeesha *et al.* (1995) conducted a 90 days trail with common carp. *Cyprinus carpio* to test the suitability of mixed feeding using a plant-based low-protein diet (16% -diet A), and two fish-meal-based diets of 26% protein (diet B) and 31% protein (diet C). Three mixed feeding schedules were tested as 1A/2B. 2 A/2B and 2 A/2C. Fish grown on diet A grew the least, while there was no significant difference between those fed on diets B or C. Of the three mixed schedules 2A/2C produced the highest growth, which was better than that on control diets B or C. The plant protein diet resulted in poor-quality flesh as indicated by carcass composition. The study supports the view that fish can be fed alternately with animal- and plant-protein based diets of varied protein levels. This practice would help to reduce protein input, and would contribute to the efficient utilization of low-quality, plant-protein-based diets.

CHAPTER III

MATERIALS AND METHODS

This chapter deals with the methodology, which was adopted to attain the objectives of the study. Selection of research tools, methods of data collection, selection of research sites, target groups and analytical methods are the key factors in conducting the research work properly. The study is mainly based on field survey, gathering information through survey from the hatchery owners. The Figure 3.1 represents the methodological approaches followed during the study.

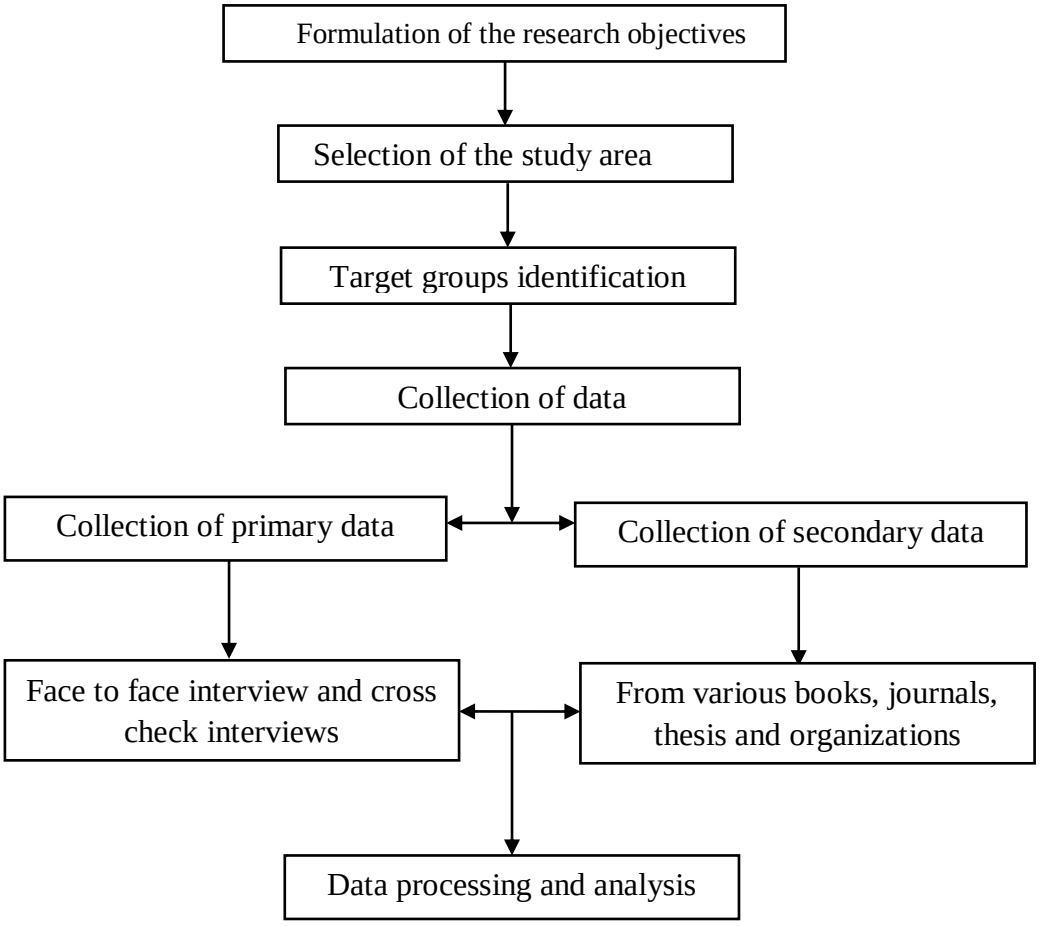

Figure 3.1: Methodology followed for the study

3.1 Selection of Study Area

The study was conducted in some selected areas of Dinajpur district where fish hatcheries were running. Dinajpur district consists of 13 upazilas of which hatcheries were available in Dinajpur Sadar, Parbatipur, Birol, Birganj, Kaharole and Bochaganj upazila.

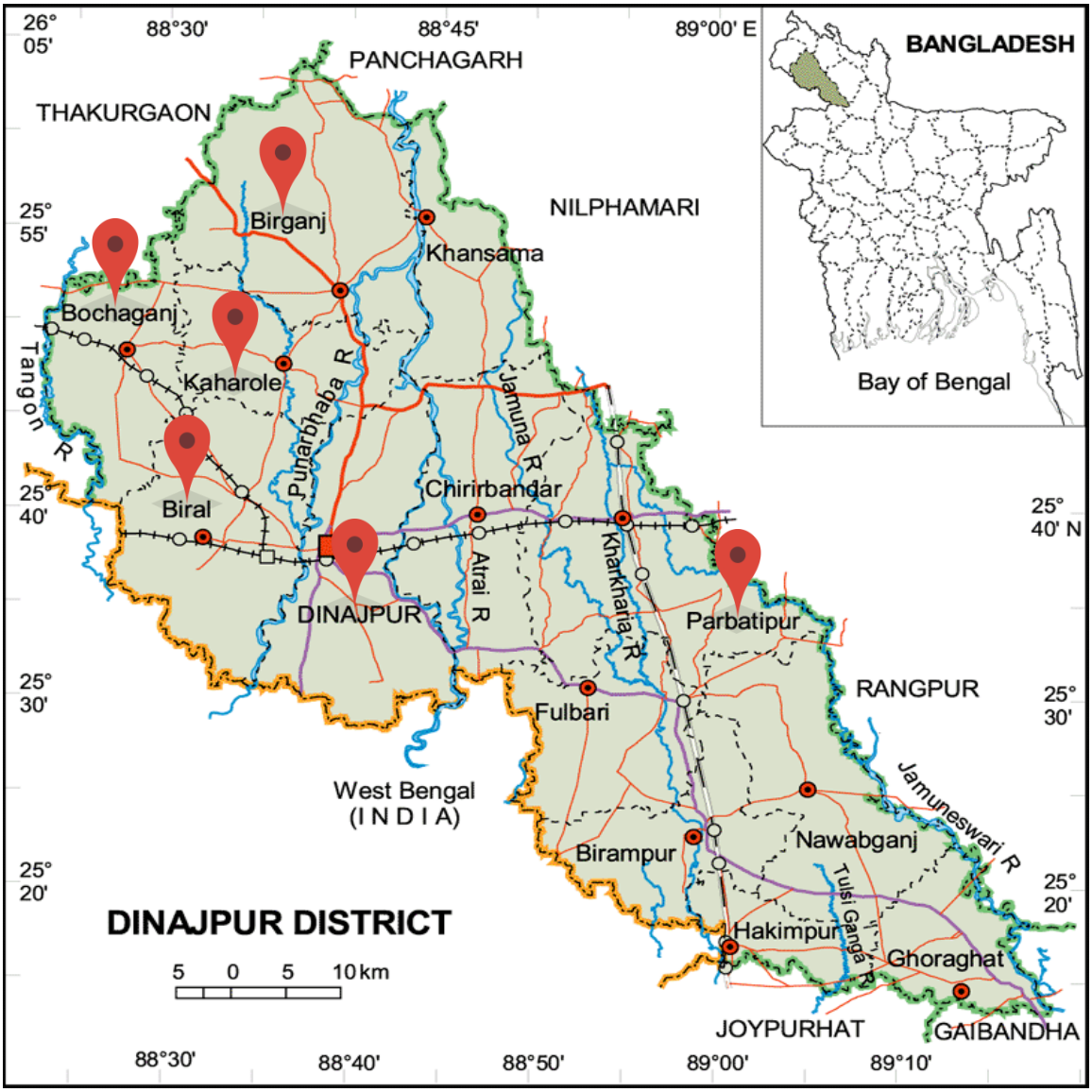

Figure 3.2: Map showing the study areas in Dinajpur district

Table 3.1: Sample Distribution in the Study Area

Name of the hatchery owner	Location of the hatchery
Md. Sajol Chawdhory	Sukhdevpur, Bochaganj, Dinajpur
Md. Aftab Uddin	Sukhdevpur, Bochaganj, Dinajpur
Md. Ashadujamman Nur	Sundora, Khanpur, Dinajpur
Md. Amzad Hossain (Ripon)	Maherpur, Bochaganj, Dinajpur
Md. Mahfuj Alam	Mohonpur, Biral, Dinajpur
Sheikh Abdul Hai	Hatisha, Kaharol, Dinajpur
Mostafa Chawdhory	Nalahar, Cheradangi, Dinajpur
Sultan Mahmud Murtoza	Jamalpur, Dinajpur
Md. Anwar Hossain	Gabur, Dinajpur
North-West Fisheries Extension Project	Haldibari, Parbotipur, Dinajpur
Fish Seed Production Centre	Birganj, Dinajpur
CARITAS Fish Fare and Hatchery	Bajunia, Dinajpur

3.2 Duration of the Study

The study was carried out for a period of twelve months, from July 2017 to June 2018.

3.3 Preparation of Questionnaire

In order to collect relevant information a questionnaire was carefully designed for achieving the objectives of the study. Before preparing the final questionnaire, it was carefully edited and was pre-tested by interviewing a few hatchery owners of the study area. Thus some parts of the questionnaire were improved, rearranged, modified and added in the light of practical experiences.

3.4 Selection of Variables and their Measurement

Due to the limitation of time and resource availability, a few variables were chosen for the study. Those variables were: age, annual income, training condition, area of the hatchery, types of the hatchery, source of broods, source of water, feed type, feeding frequency, application of feeds, feeding method etc.

3.4.1 Age

Age of a hatchery owner is an important factor in the case of hard work including fish hatchery operation. It was measured by counting the period of time from the owner's (male/female) birth to the time of interview which was expressed in year.

3.4.2 Education

The educational status was measured according to the respondent's academic qualification such as primary, SSC, HSC or graduation level.

3.4.3 Annual Income

Annual income of each respondent was measured on the basis of his/her family's yearly earnings from crops, fish farm, livestock, business, jobs and others and was expressed in taka.

3.4.4 Training

It was determine by any types of training taken by the respondent from any government or non-government organizations in his/her entire life.

3.4.5 Hatchery Type

According to the ownership, the hatcheries of respondents were divided into three groups: private hatchery, govt. hatchery and non-govt. hatchery.

3.4.6 Hatchery Category

Hatcheries in the study areas were categorized into two groups on the basis of species preference. One group of respondents preferred only fin fish and another group of respondents preferred mixed species (finfish, catfish, prawn) of fishes.

3.4.7 Source of Brood

Broods were collected from different sources. The source of brood fish of the hatcheries were measured on the basis of various sources such as: own farm, river, commercial (other hatcheries, retailers etc.) or other sources.

3.4.8 Water Source

Water is one of the vital parts of fish hatchery. Water source of hatchery owner was determined on the basis of from where they supplied water in hatchery ponds.

3.4.9 Production Capacity

Production capacity of the hatcheries was assessed by finding the total production of seeds in a year.

3.4.10 Types of Broodstock Feed

Types of broodstock feeds were measured on the basis of various types of feeds applied for feeding in the hatcheries.

3.4.11 Sources of Commercial Feed

In the study areas, various types of commercial feeds were applied. It was determined according to the respondent's preference.

3.4.12 Application of Feed (% body weight)

It was evaluated on the basis of the percentage of feeds supplied for brood's body weight.

3.4.13 Feeding Time

Feeding frequency was measured according to when the respondents applied feeds in their hatcheries.

3.4.14 Feeding Method

It was determined in which way the respondents applied feeds in the brood ponds.

3.5 Data Collection

There were two types of data were collected for the study.

3.5.1 Primary Data Collection

The interview schedule was used to collect primary data from the hatchery owners. Before going to make an actual interview, a brief introduction about the objective of the study was given. Each question was explained clearly and asked systematically for their clear understanding.

Figure 3.3: Some pictorial view of interview

3.5.2 Secondary Data Collection

Secondary data were collected from a number of sources. Such as-

- Upazila Fisheries Officer,
- From some published reports, papers and some official documents (DFO, DoF, NGO etc.).

3.6 Data Processing and Analysis

After collection of data from the field, data were verified to eliminate errors and inconsistencies. Then the data were tabulated, coded, compiled, and analyzed carefully. The qualitative data were converted into quantitative numbers then categorized and

analyzed mainly based on descriptive statistical analysis using SPSS (Software Package used for Statistical Analysis).

3.7 Problems and Constraints during Hatchery Operation

During the study there were some problems and constrains faced by the hatchery owners. The problems and constrains were mentioned below:

- High price of commercial feed and inadequate supply of feed
- Inadequate supply of broods
- Irregular supply of electricity
- Lack of skilled manpower
- High labor cost
- Poor transportation facilities
- Inadequate knowledge about the modern technology
- Lack of capital

CHAPTER IV

RESULTS

This chapter describes the results concerning with current information on fish hatcheries and feeds used in these hatcheries. The results of the study are presented in this chapter. A total of 12 hatchery owners were interviewed from the study areas. A detailed analysis were done on the following way and presented in the chapter.

4.1 General Information on Hatchery owners

The general information of hatchery owners were related with their age, education levels and training.

4.1.1 Age

The age of respondents varies from 30 to 69 years. The respondents were categorized into three age groups: young (25-40 years) was 22.22%, middle age (41-55 years) was 44.44% and old (56-75 years) was 33.34% (Fig. 4.1).

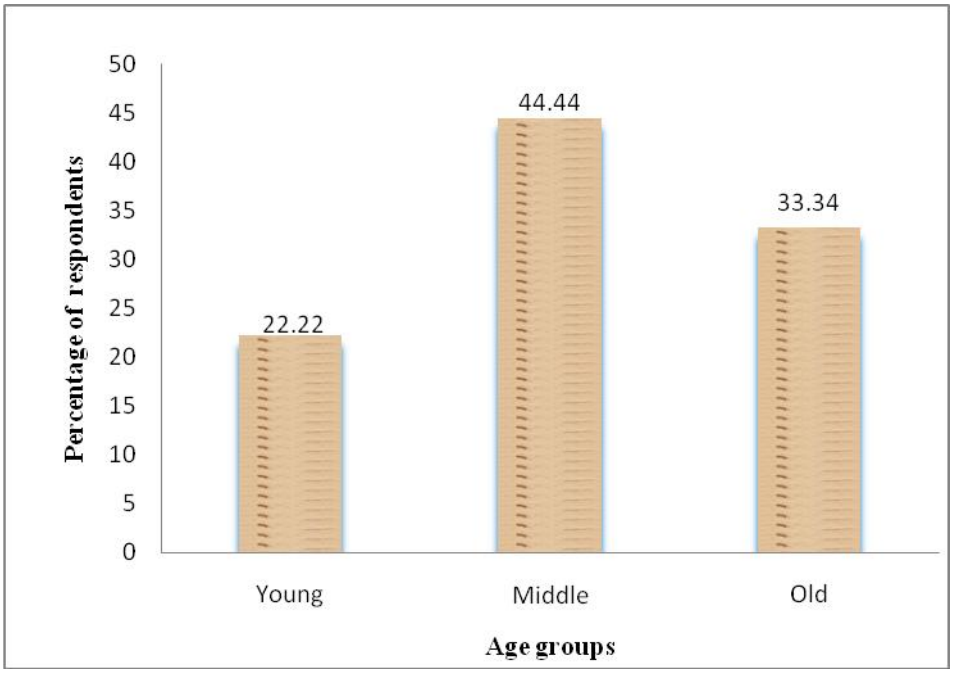

Figure 4.1: Age distribution of the respondents

4.1.2 Education Levels

Educational status can play vital roles in efficient management and operation as well as in successful production. No illiterate respondents were found in the study areas. On the basis of academic educational qualifications, the respondents were divided into four groups such as primary, SSC, HSC and graduation levels. The distribution of the respondents is presented in Figure no 4.2.

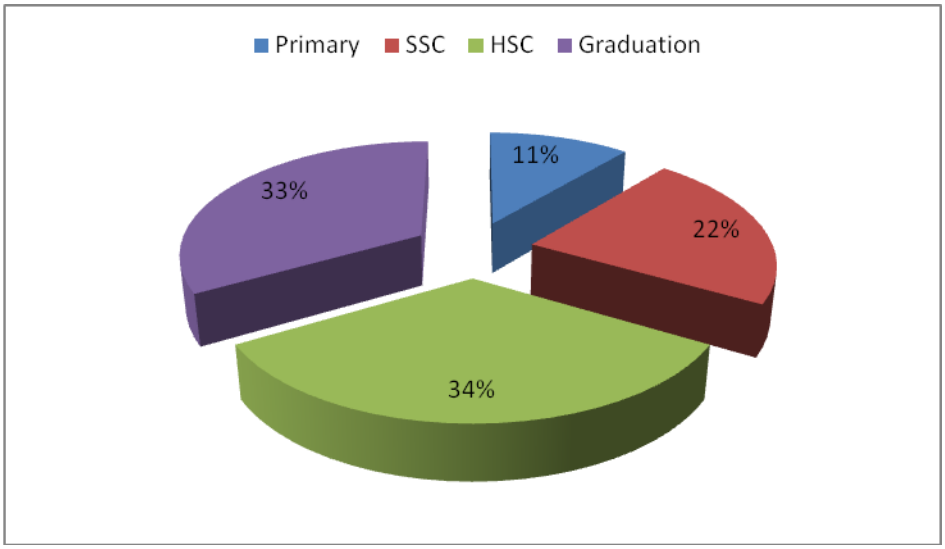

Figure 4.2: Educational qualifications of the respondents

4.1.3 Annual Income

The annual income of the hatchery owners was categorized into three groups such as: low (<3 lacs), medium (3-5 lacs) and high (>5 lacs). According to the annual income scores, the results obtained from the study area are shown bellow (Fig. 4.3).

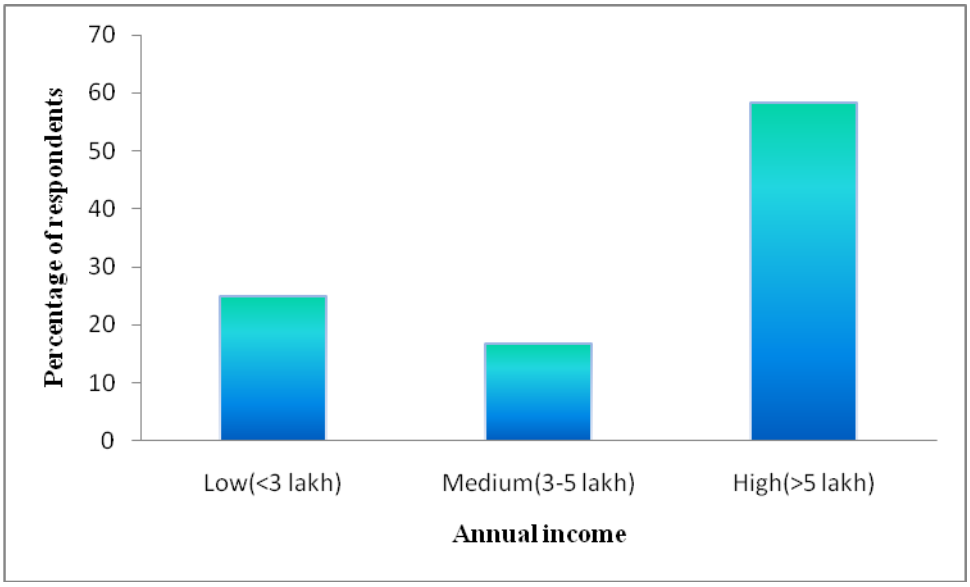

Figure 4.3: Annual income of respondents

4.1.4 Training

Training experience play an important role for influencing fish production. It accelerates the ability of a person to perform farming activity more efficiently. In the study, the respondents who had training on aquaculture practice from different government or non-government organizations were identified (Fig.4.4).

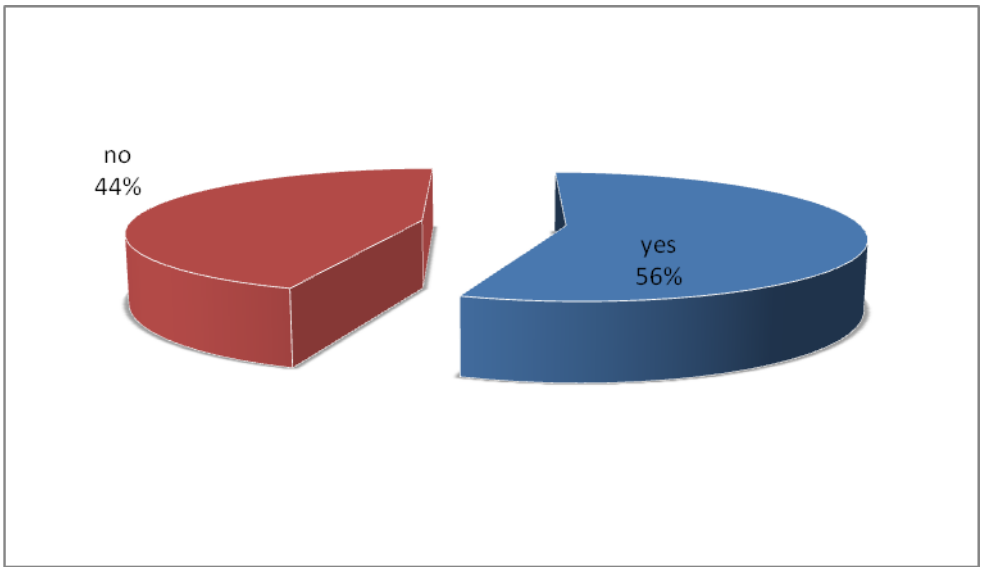

Figure 4.4: Training status of respondents

4.2 Information on hatchery

4.2.1 Hatchery Type

In the study, it was found that the highest number of hatcheries were private (75%), followed by government (16.67%) and non-government (8.33%). Distribution of the hatchery types is shown in Figure 4.5.

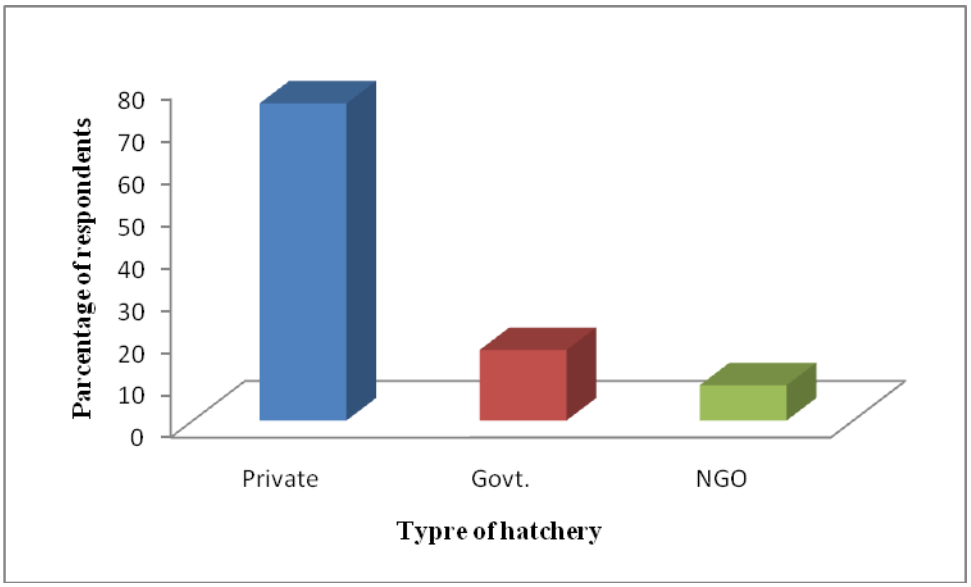

Figure 4.5: Hatchery type of respondents

4.2.2 Hatchery Category

The hatcheries in the study area were categorized basis on different kinds of fishes were cultured. Mainly finfish, catfish, shrimp were cultured in those hatcheries. Hatcheries were divided into two groups which are shown in Figure 4.6.

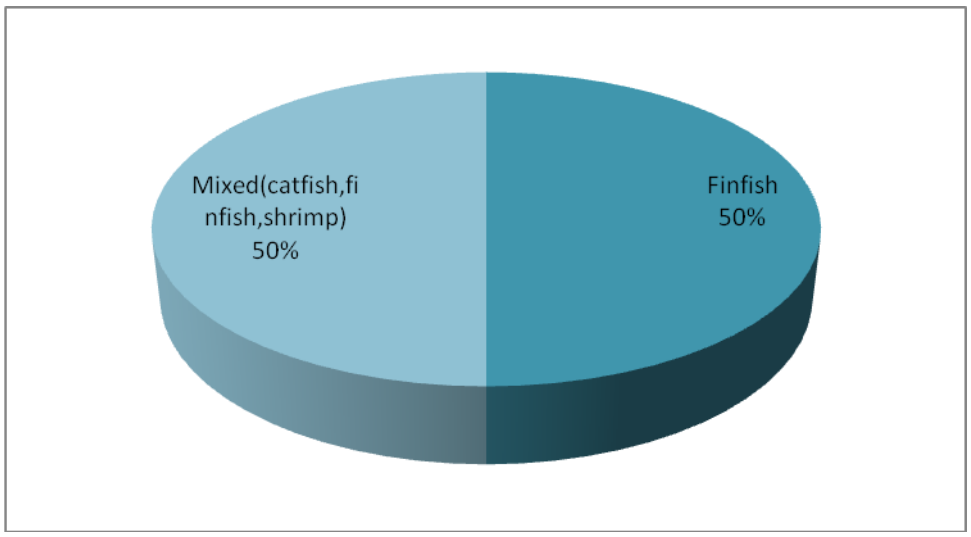

Figure 4.6: Hatchery category of respondents

4.2.3 Area of the Hatchery

The study showed that 16.67% of the respondents had less than 3 acres of land for hatchery, 33.33% had 3-6 acres and 50% had above 6 acres of land (Table 4.1).

Table 4.1: Total area of the hatcheries

Category	Number of respondents (N=12)	% respondents
Small (<3 acres)	2	16.67
Medium (3-6acres)	4	33.33
Large (>6acres)	6	50.00

4.2.4 Area of the Brood Ponds

The present study showed that 42% of the broodstock ponds were small (15-30 decimal), 33% were in medium (31-45 decimal) and lest were large (46-60 decimal) in size which was shown in below.

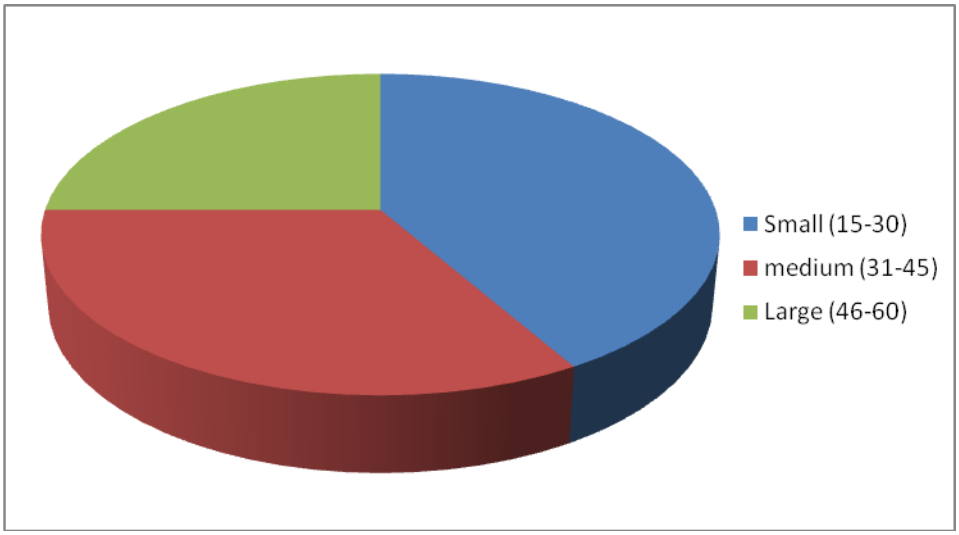

Figure 4.7: Area of the Brood Ponds

4.2.5 Depth of Ponds

In the study area, various depth of brood ponds were found. The ponds were divided into three categories according to their depth. From the study it was found that 58% of pond's depth was 5.1-6 feet, 34% of ponds 4.1-5 feet and rest of the pond's depth was 6.1-7 feet.

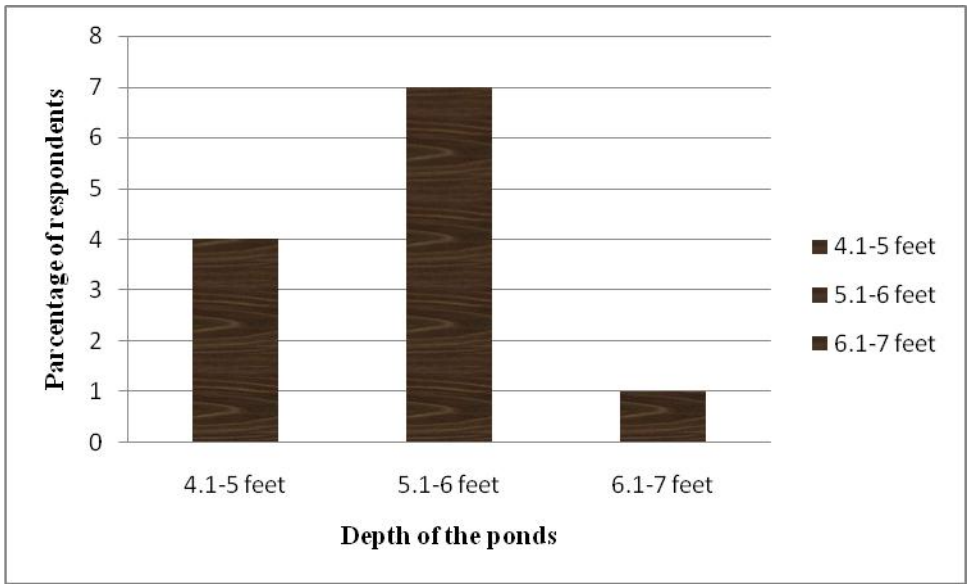

Figure 4.8: Depth of Ponds

4.2.6 Source of Brood

The study revealed that the broods were collected from different sources as: local source, river, commercial etc.

Table 4.2: Sources of brood fish in the hatcheries

Sources	Number of hatchery (N=12)	% respondents
Local	3	25.00
River	1	8.33
Commercial	2	16.67
Local and commercial	4	33.33
River and commercial	2	16.67

4.2.7 Water Source

All the respondents (100%) used underground water for their hatchery purpose.

4.2.8 Production Capacity

The production capacity of hatcheries in the study areas varied from 480 to 3600 kg fry per year. According to the production capacity, they were divided into three groups as below (Fig. 4.7).

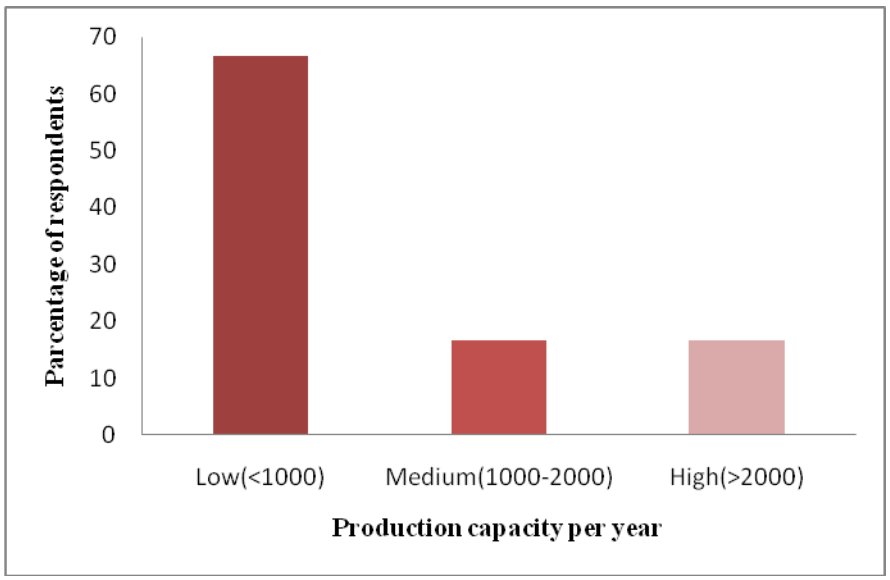

Figure 4.9: Seed production capacity (kg/year) of the hatchery

4.3 Information on feeds

4.3.1 Types of Broodstock Feed

In the study, it was found that both commercial and on-farm feeds were applied for brood feeding. Most of respondents preferred both commercial and on-farm feed and their percentage was 66.67%, the percentage of only commercial feed was 25% and rest of the respondents (8.33%) applied only on-farm feed (Fig. 4.10).

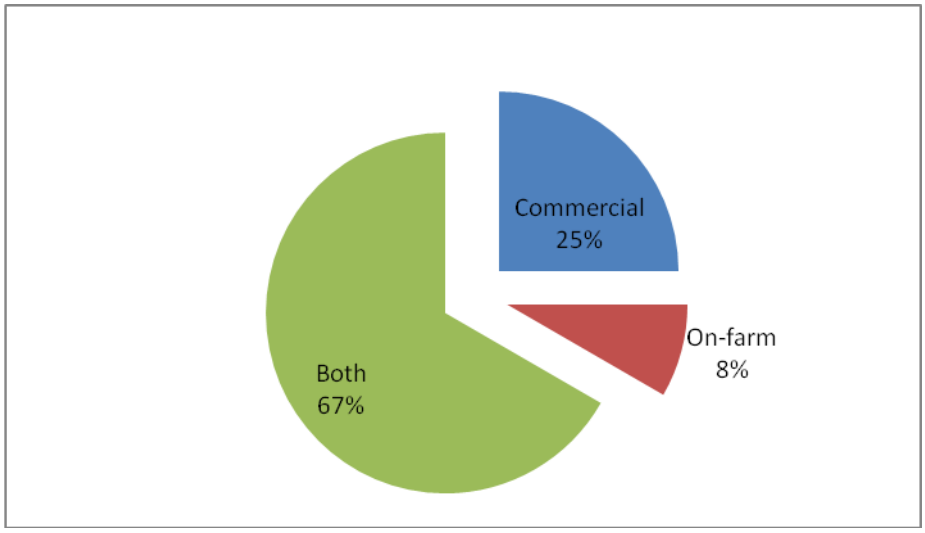

Figure 4.10: Types of feeds used in the hatcheries

4.3.2 Sources of Commercial Feed

From the study, it was found that most of the commercial feed was collected from various reputed feed companies of our country such as- Mega Feed, Provita Feeds Limited, Quality Feeds Limited, Aftab Feed Production Limited, AG Agro Feeds Limited, Lili Feeds Limited etc. 17% of the respondents in the areas applied only one type of commercial feed, 41% apploed two types and 42% of the respondents applied more than two types of commercial feeds which was shown in Figure 4.11.

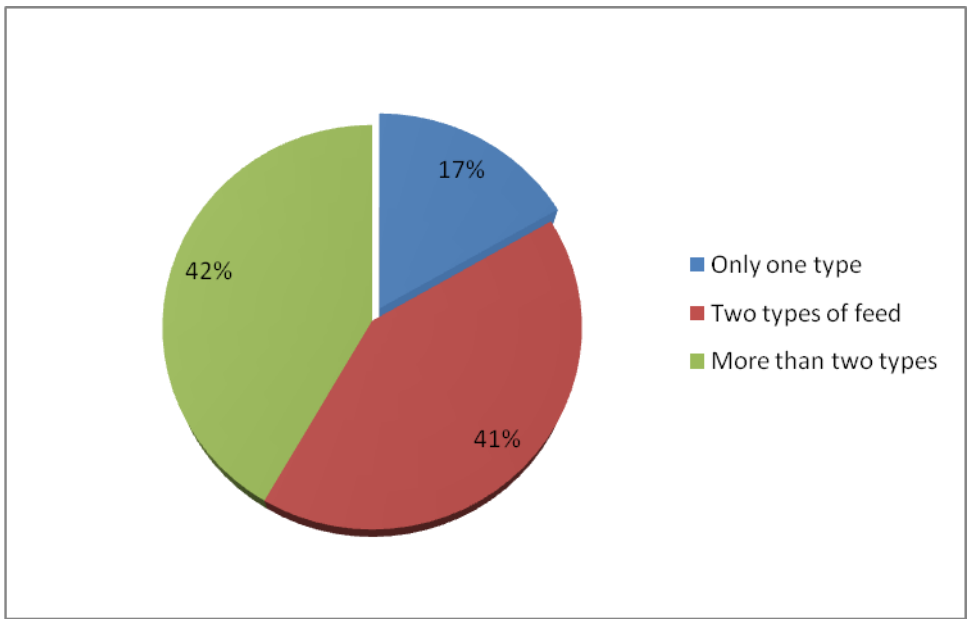

Figure 4.11: Sources of commercial feeds

4.3.3 Application of Feed (% body weight)

Most of the respondents (41.67%) applied feed at 1-2% of body weight, 25% applied 2.1-3% and 33.33% of respondents applied 3.1-4% body weight which was shown as below (Fig.4.12).

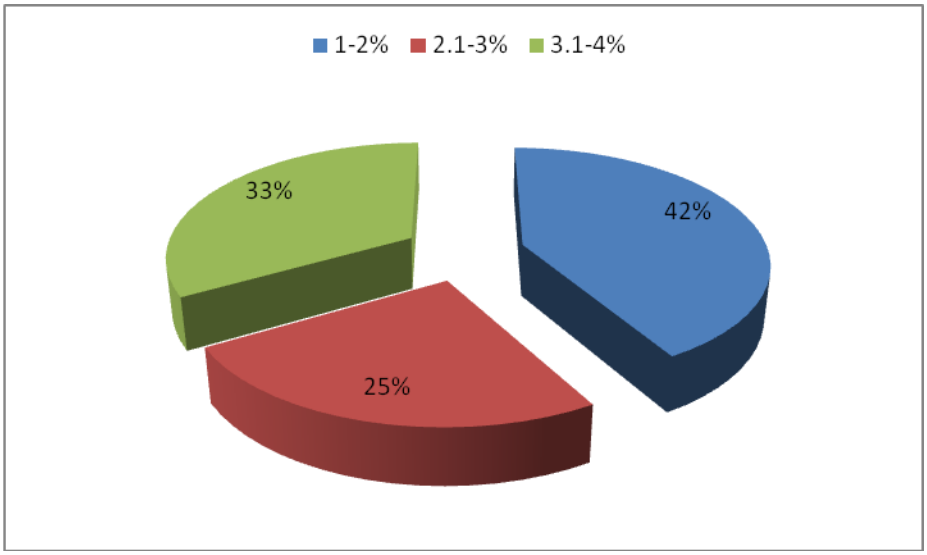

Figure 4.12: Application of feed for brood fish in the hatcheries

4.3.4 Feeding Frequency

Study showed that, 66.67% of respondents supplied feed two times in a day and rest of the respondents applied only one time (Fig. 4.13).

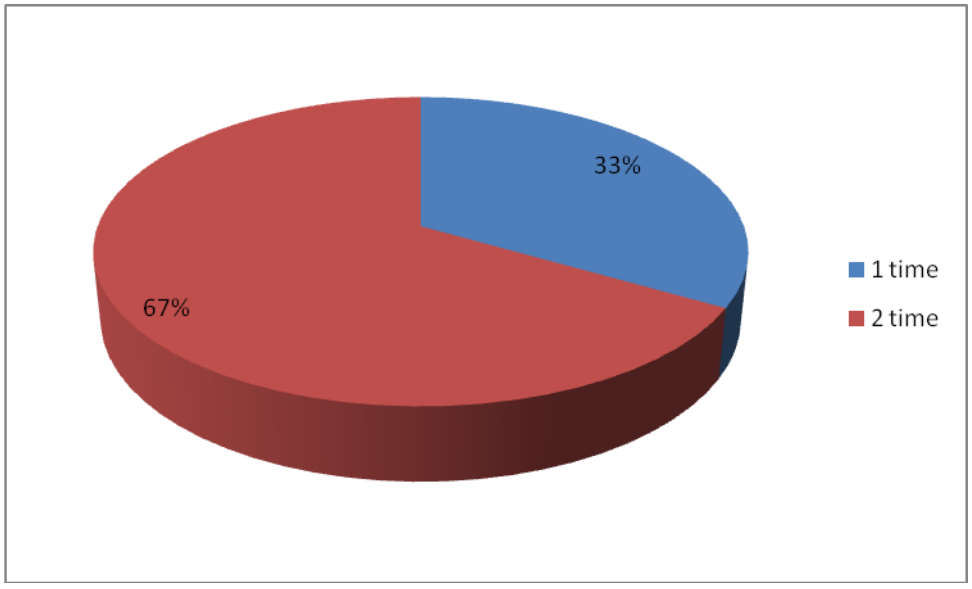

Figure 4.113: Feeding frequency of the brood fish

4.3.5 Feeding Time

In the study, it was found that all of the respondents applied feeds in morning and afternoon. Most (66.67%) of them applied both in morning and afternoon, 8.33% applied in morning and 25% applied feed in afternoon (Table 4.3).

Table 4.3: Feeding time in the hatcheries

Time	Number of respondents (N=12)	% respondents
Morning	1	8.33
Afternoon	3	25.00
Morning and afternoon	8	66.67

4.3.6 Feeding Method

All of the respondents (100%) in the study areas applied feed to the brood manually.

CHAPTER V

DISCUSSION

In the study, it was found that 44.44% of the respondents engage with hatchery operation belonged to the middle age group (41-55 years) and 33.34% of them were old age group (56-70 years). Das *et al.* (2018) reported that 52.72% of the hatchery owners are old and 34.54% of them were middle age. Mekkawy *et al.* (2017) mentioned that the ages of the majority of the respondents (67%) were between 35 and 50 years. These results were more or less relevant to the present study.

There were no illiterate respondents in the study area. From the study, it was found that about 34% of them completed the higher secondary level of education 33% were graduate. 50.90% of the respondents passed secondary level and only 9.09% of them completed higher secondary level, which was not similar to Das *et al.* (2018).

Training is an important part of running a fish hatchery. In the study it was found that about 56% of the respondents were trained by different organizations. Bhuiyan *et al.* (2011) pointed that 38.16% hatchery owners had no institutional training, on the other hand 19.56% had short term training, 15% consulting with UFO and 27.28% gathered knowledge through personal communications, which was more or less similar with the present study.

The hatcheries in the study area were categorized on the basis of species of brood fish. Hatcheries were divided into two groups finfish (50%) and mixed (finfish, catfish, prawn) hatchery (50%). It was reported that 60% of hatcheries produced carp and another 40% for others. This data was more or less relevant to (Mondal *et al.* 2018).

The present findings showed that 42% of the broodstock ponds were small (15-30), 33% were in medium (31-45) and lest were large (46-60) in size. Akter *et al.* (2016) mentioned that 30% of the ponds were small, 20% were medium and rest of the pond were large which was not similar to the present study.

The current study revealed that most of the broods were collected from local source, river, commercial (other hatcheries, retailer) etc. 8.33% of the broods were collected from river and 25% were collected from local sources. Mony *et al.* (2012) mentioned that 23.33% of broods were collected from own hatchery and 10% from river. These findings were more or less similar to the present study.

All the respondents (100%) used ground water as the source of hatchery water. Identical finding on hatchery water was reported by Samad *et al.* (2013).

The production capacity of hatcheries in the study area was varied from 480 to 3600 kg fry per year. Production capacity of the most hatcheries (66.66%) was low (less than1000 kg fry/year) and only 16.67% had high production (above 2000). Mondal *et al.* (2018) found that the highest production 2500 kg per year and lowest production was 800 kg per year. From the comparison of the study, it was found that the production capacity of Dinajpur district was lower than Chanchra under Jashore district.

Feed is the most important part of a fish hatchery. For getting a healthy output, good quality feed should be supplied. In the study, it was found that most of the respondents (66.67%) used both commercial and on-farm feeds, the percentage of only commercial feed user was 25% and only 8.33% applied on-farm feeds. Shabuj *et al.* (2016) pointed that, the hatchery owners applied quality feeds for their broods, where 71.42% hatchery owners supplied commercial feeds and rest of the hatchery owners applied on-farm feeds in their brood rearing ponds. In another study, Samad *et al.* (2014) reported that generally

mustard oil cake, rice bran, wheat polish etc. were given to fish fry for feeding. From the comparison of these studies, the findings of present study were slightly different.

Most of the respondents (41.67%) supplied feed to the brood fish at the rate of 1-2% of body weight and 66.57% hatchery owners applied feed two times a day i.e. feeding frequency 2. Yeasmin *et al.* (2018) reported that feeds were applied one time in a day (morning or evening) at the rate of 2-3% of the body weight in first a few days and increased gradually according to the feeding frequency of the fish. In another study Shabuj *et al.* (2016) observed that the farmers supplied feed at 2-2.5% body weight in their brood rearing ponds, which was more or less relevant to the current survey study.

CHAPTER VI

SUMMARY AND CONCLUSION

The study was conducted to observe the present status of fish hatcheries and broodstock feeds used in the hatcheries in Dinajpur district. Hatcheries were found in Dinajpur Sadar, Biral, Kaharole, Birganj, Bochaganj and Parbatipur upazilas. For the data collection a well structured interview schedule was prepared. The questionnaire contained close formed questions. According to the questionnaire data such as personal information of hatchery owners, types of feed, feeding rate, feeding frequency, culture methods, cultured fish species, annual production, income etc. were collected from the respondents in the study area through personal interview. The data obtained from the interview methods was then coded, categorized and analyzed to describe the present status of broodstock feed used in hatcheries in the study area.

In the study, it was found that the age of the respondents varies from 30 to 69 years and most of them were middle aged (41-55 years) and all of them were male. Higher secondary level of education (34%) was the prominent level of education among the respondents. The percentage of graduate was also notable (33%). The annual income of the hatchery owners was categorized into three groups, as: low (Tk <3 lacs), medium (Tk 3-5 lacs) and high (Tk >5 lacs) and majority of them (58.33) were in high category. Training is one of the vital parts for operating a fish hatchery. In the survey study it is found that 56% of the respondents had taken training from various government and non-government organization.

It was found that, most of the hatcheries (75%) were operate privately, 16.67% were government and 8.33% were non-government. The hatcheries in the study area were categorized into two groups as only finfish culture and mixed culture (finfish, catfish,

shrimp etc.). The percentages of these two groups were 50-50%. The study showed that 16.67% of the respondents had less than 3 acres of land for hatchery, 33.33% had 3-6 acres and 50% had above 6 acres of land. The study showed that 25% of the brood were collected locally, 33.33% were collected from both local and commercial source 16.67% from commercial, 16.67% from both commercial and river and 8.33% from only river. All of the respondents (100%) used ground water for their hatchery purpose. From the study, we had found that most of the respondents (66.66%) had low production capacity (less than 1000 kg fry per year).

Most of respondents used both commercial and on-farm feed and their percentage was 66.67%, the percentage of only commercial feed was 25% and 0nly on-farm feed was 8.33%. The commercial feed was collected from various reputed feed company of our country as: Mega Group, Provita Feeds Limited, Quality Feeds Limited, Aftab Feed Production Limited, AG Agro Feeds Limited, Lili Feeds Limited etc. in the study it was found that 17% of the respondents used only one type of commercial feed, 41% used two types and 42% of the respondents used more than two types of commercial feeds. 41.67% of respondents used 1-2% feed per body weight of fish, 25% used 2.1-3% and 33.33% of respondents used 3.1-4% feed per body weight. The study showed that, 33.33% of respondents used only one time in a day for feeding and 66.67% used two times of a day for feeding. All of the respondents (100%) of the study area applied feed manually in their hatcheries.

Recommendations:

The following recommendations were made to improve the production and profit from the fish hatcheries based on the major findings of the study:

- On-farm feeds may be supplied for the brood stock to reduce production cost.
- There are a few hatcheries in Dinajpur district. To fulfill the demand of animal protein, more hatcheries should be established.
- Transportation facilities should also be improved.
- Training facilities awareness should be increased to produce good quality seed.

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APPENDIX

QUESTIONNAIRE

Research Title: Present Status of Hatcheries and Broodstock Feeds in Dinajpur District.

Respondent No.: Date:

A. Personal Information

Name and address of the owner:…….....…….

…….....

Contact No.: …….

1. Age: ……years

2. Sex: Male ☐ Female

3. Educational level: ☐ Don't read & write ☐ Primary ☐ SSC ☐ HSC ☐ Graduation

4. Occupation: ☐ Job ☐ Business ☐ Others

5. Annual income from hatchery:……Tk.

6. Other sources of income (if any): ……Tk.

7. Drinking water sources: ☐ Tube well ☐ Others

8. Training receive:

Did you receive any training from any organization?

☐ Yes ☐ No

If yes, Time: ……

Duration:……...

Institution: …….

B. Information on Hatchery

1. Name and address of the hatchery: .....

……...

2. Year of establishment: …….

3. Type of hatchery: ☐ Government ☐ Private

4. Ownership type: ☐ Single-ownership ☐ Multi-ownership

5. Hatchery category: ☐ Catfish ☐ Finfish ☐ Shrimp/Prawn ☐ Others

6. Area of the hatchery: ……

7.Number of the brood ponds: …….....

8.Area of the brood ponds: ……

9.Depth of the brood ponds: …….

10. Sources of bloodstock: ☐ Locally produced ☐ River ☐ Commercial hatcheries

☐ Import: (Country - ……) ☐ Others: ……..

11.Species preferences: …….

12. Amount of broodstock: (i) Brood pond area: ……ha; (ii) Amount of brood fish: …….kg; (iii) Density of brood fish: …….kg/ha

13. Sources of water: ☐ Tube-well ☐ Pond ☐ River ☐ Underground ☐ Others:

14. Production capacity: …….kg/yr

15. Starting of production (month): ……

16. Peak period of production (month): …….

17. Average weight of male (kg): ……

18. Average weight of female (kg): …….

19. Frequency of the broodstock replacement:……

20. Experience in hatchery operation: ……years

C. Information on Feeds

1. Types of brood feed: ☐ Natural ☐ On-farm ☐ Commercial ☐ Others

2. Sources of on-farm ingredients: ☐ Plant origin ☐ Animal origin

3. Name of plant origin ingredients you use: ……

4. Name of animal origin ingredients you use: …….

5. Manufacturing process of on-farm feeds: ……

6. Ratio of the ingredients (Plant: Animal): …….

7. Sources of commercial feeds: …….

8. Name of the commercial feeds applied: …….

9.Nutrient content (%) in commercial feeds: ☐ Moisture: ……., ☐ Protein: ……,

☐ Lipid: ……, ☐ Carbohydrate: ……, ☐ Fibre:…….. ,☐ Ash/Mineral: ……

10. Feed applied (% bw): …….

11. Feeding frequency: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

12. Feeding time:☐ Morning ☐ Noon ☐ Afternoon ☐ Evening

13. Feeding method: ☐ Manually ☐ Mechanically ☐ Others

14. Lab facilities for testing nutritional status of feeds: ☐ Yes ☐ No

D. Technical Assistance (if any)

1. Have you received any technical assistance during hatchery preparation?

☐ Yes ☐ No

2. If yes, then write the types and sources of assistance: ……

……..

3.Frequency of the assistance: ☐ Weekly ☐ Monthly ☐ Half-yearly ☐ Annually

E. Constraints to feeds and feed ingredients:

Constraints	Yes	No
Inadequate supply of feeds		
High cost of feeds		
Low nutrient content		

F. Constraints to management

Constraints	Yes	No
Suitable land acquisition		
Inadequate infrastructure		
Inadequate supply of broods		
Irregular electricity supply		
Irregular water supply		
Poor water quality		
Poor capital		
High price of materials		
Inadequate skills workers		

High labor cost		
Poor hatchery facilities		
Poor marketing		
Disease and poaching		
Environmental aspects (if any)		

Comments/observations (if any): ……

……

Thank you for your kind information and cooperation.

…….. ……

Signature of the Interviewee Signature of the Interviewer

Date: …… Date:…….