Asian Australas. J. Biosci. Biotechnol. 2018, 3 (3), 190-200

**Asian-Australasian Journal of Bioscience and Biotechnology**
ISSN 2414-1283 (Print) 2414-6293 (Online)
www.ebupress.com/journal/aajbb

*Article*

# Culture strategies, diseases and their mitigations in mono-sex Nile tilapia farming in Jessore sadar region, Bangladesh

Chinmoy Biswas[1], Md. Mer Mosharraf Hossain[1], Abdulla-Al-Asif[1,2*], Baadruzzoha Sarker[3], Md. Masum Billah[4] and Md. Afroj Ali[1]

[1]Department of Fisheries and Marine Bioscience, Faculty of Biological Science and Technology, Jessore University of Science and Technology, Jessore, Bangladesh
[2]Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
[3]Production Officer, BRAC Fish Hatchery, Satgao, Sreemongal, Moulvibazar, Sylhet 3214, Bangladesh
[4]Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor Darul Ehsan, Malaysia

*Corresponding author: Abdulla-Al-Asif, Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. Phone: +8801716838294; E-mail: m15160218@bau.edu.bd

Received: 20 November 2018/Accepted: 18 December 2018/ Published: 31 December 2018

**Abstract:** A survey was carried out to investigate culture strategies, disease patterns and mitigations in mono-sex Nile tilapia in Jessore sadar region. Data obtained by questionnaire interview, individual interview, telephonic interview, PRA method, mono-sex Nile tilapia farm survey from four villages. It was observed that 30.769% farmers and farm owner had no training about culture of mono-sex Nile tilapia while 69.230% farmers and farm owner received short term training from different Department of Fisheries, different NGOs. Mono-sex Nile tilapia culture in ponds was basically a three-tier culture system. Pre-stocking management of ponds in the study area comprised dike repairing, aquatic weed control, waste soil removal and undesirable species (predator and trash fish) control. Majority (85%) of the farm owners and farmers depends on ground water and only (15%) depends on surface water. About 95% of farm of farm owners controlled aquatic weeds manually. Removal of predatory and undesired fish from pond used different types of chemicals but most used rotenone (80%). Fertilizer of pond preparation (Organic and inorganic) in the study area but mostly used cases inorganic fertilizers had applied at the rate of urea 114 kg/ha and triple superphosphate 60 kg/ha in 4–5 installments. Stocking density of mono-sex Nile tilapia was 200-380 fry per decimal. It was recorded that 85% of mono-sex Nile tilapia farmers and farm owner applied supplementary such as commercially manufactured feed and 12% are applied of farm made feed. It was observed,they provided heavy fertilizer, high stocking density, over feed provided, provided over dose drugs so ultimated result of disease occured. Parasitic related disease, bacterial diseases, fungal diseases, viral diseases were attacked in mono-sex Nile tilapia. Argulosis and Streptococcus were mostly common disease in this mono-sex Nile tilapia farm.

**Keywords:** farmed tilapia; management practice; harvest; freshwater aquaculture

## 1. Introduction

The introduction of tilapia in Bangladesh from Thailand was first initiated in 1954 with *Oreochromis mossambicus* (Ahmed *et al*., 2013) and later in 1974, high yielding species of tilapia (*Oreochromis niloticus*) was introduced by UNICEF with a hope that it would make a significant contribution to fish production but the attempt was not successful because of very little efforts were made to understand the culture management by the farmers. Bangladesh Fisheries Research Institute (BFRI) again brought a fresh batch of *O. niloticus* from Thailand in 1987 and developed low input and low cost technologies. Tilapia is the common name applied to

three genera of fish in the family Cichlidae, Oreochromis, Sarotherodon and Tilapia which are widely distributed in many countries of the world. Now it can be found in more than 100 countries (Ballarin and Hallar, 1982). The species those are most important for aquaculture is in the genus *Oreochromis*, including the Nile tilapia (*O. niloticus*), the Mozambique tilapia (*O. mossambicus*) and the blue tilapia (*O. aureus*). The important characteristics of tilapia are very high tolerant to environmental condition i.e. pollution, salinity as well as diseases (Zubaida *et al.*, 2005; Lutz *et al.*, 2010). Tilapia, the most important aqua cultured species has been already named as the "food fish of the 21st century" (Zhang *et al.*, 2011) and has poultry broiler like growth with a short culture period. Mono-sex population of male tilapia was produced by treating fry with a synthetic male hormone 17α methyl testosterone at a treatment regime of 10 mg/kg food for 30 days. The healthy cultivation of tilapia depends on nutritional status and rearing environmental conditions (Qiang *et al*., 2013). Stocking density is a major factor that affects aquatic animals' growth under cultured conditions (Di Marco *et al*., 2008; de Oliveira, 2012). Due to improper management of disease has become a major problem of fish culture system in Bangladesh (Rahman and Chowdhury, 1996). Freshwater fishes of Bangladesh may have different health status, showing disease symptoms like, tail and fin rot, gill rot, red spot, dropsy, EUS, argulosis, nutritional disease and white spot disease (Faruk *et al*., 2004). In fish the most obvious external clinical signs are inflammation, hemorrhaged of fins, skin or head, frayed fins, hemorrhaged opaque eye, necrotic and ulcerative lesion at any location on body, scale and excessive mucus production (Plumb, 1994). In recent time mono-sex Nile tilapia farmers and mono-sex Nile tilapia farm owner are Jessore regions facing many health problems in the culture of mono-sex Nile tilapia. It was necessary of investigate to health condition of fish. The experiment was conducted with the objectives, to know the mono-sex Nile tilapia culture methods that practices in Jessore sadar upazila regions and to know the disease pattern and control measures of mono-sex Nile tilapia.

## 2. Materials and Methods

### 2.1. Study area and periods

The study was carried out in Jessore sadar upazilla of Jessore district for a period of four months from April 2016 to July 2016 in the mono-sex tilapia fish farm in the Jesore Sadar upazilla regions namely Beltala (23°08'44.4"N 89°12'34.1"E); Chanchra (23°08'51.0"N 89°12'05.0"E); Jamtula (23°07'47.5"N 89°18'31.7"E) and Rupdia (23°07'36.6"N 89°17'27.0"E), Jessore, Bangladesh.

### 2.2. Target groups

Mono-sex fish farm owners, mono-sex fish farmers; mono-sex culture related workers and different person from different chemical and feed seller were observed.

### 2.3. Data collection

Data were collected through a structured questionnaire, by the method of direct interviews and focused group discussion (FGD). The secondary data were collected from Bangladesh Fisheries Research Institute (BFRI), Jessore; Department of Fisheries (DoF); BRAC, WorldFish Center (WFC) and other Government and Non-government organization, different aquaculture books, project reports, maps, thesis paper, journals and websites as well as five shops (chemical, drag, feed seller) were also investigated.

### 2.4. Data analysis

After data collection, all the data were arranged in tabular form to fulfill the objectives of the study. By combining the both information from the study area, final result was prepared. For processing and analysis purpose, MS excel and MS word has been used.

## 3. Results

### 3.1. Knowledge and training

It was observed that 30.769% farmers and farm owner had no training about culture of mono-sex Nile tilapia while 69.230% farmers and farm owner received short term training Department of Fisheries (DoF), different NGOs such as BRAC, CARE, DANIDA, Youth Development, WorldFish Center were found in the study (Figure 1).

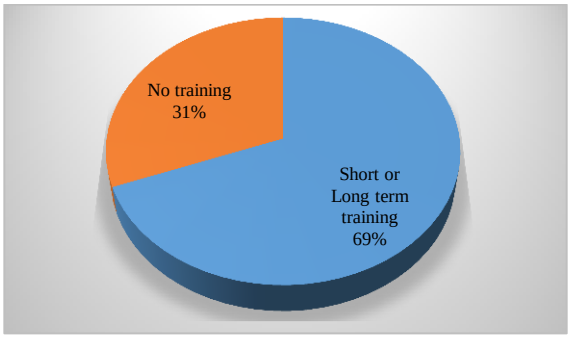


**Figure 1. Training status of mono-sex Nile tilapia farmers and farm owners.**

### 3.2. Management of mono-sex Nile tilapia fish pond

#### 3.2.1. Pre-stocking management

##### 3.2.1.1. Removal of predatory and undesired fish from pond

For controlling undesirable species most of them (80%) used netting methods. A few of them used different types of chemicals like as rotenone, bleaching powder (8%), phostoxine (7%), and others toxicants (Table 1 and Figure 2).

**Table 1. List of chemicals and plant derivatives used by mono-sex Nile tilapia farmer.**

| Poison name | Dose (kg/ha/m) | Practice |
|---|---|---|
| Rotenone | 4.95-8.65 (20-35 g /dec) | Mostly used |
| Bleaching powder | 350 – 500 | Used |
| Phostoxine | 3-5 tablets /dec | Used |
| Endrin. | 50-60 ml /dec. | Less used |
| Mohua oil cake | 2 500 | Used |
| Anhydrous ammonia | 20 – 30 | Used |
| Powdered seed of *Croton tiqlium* | 30 – 50 | Less used |
| Root powder of *Milletia pachycarpa* | 40 – 50 | Less used |
| Seed powder of *Milletia piecidia* | 40 – 50 | Less used |
| Seed powder of *Barrinqtonia acutanqula* | 150 | Less used |
| Seed meal of tamarind *(Tamarindus indica*) | 1 750 –2 000 | Less used |
| Tea seed cake (*Camellia sinensis*) | 750 | Used |

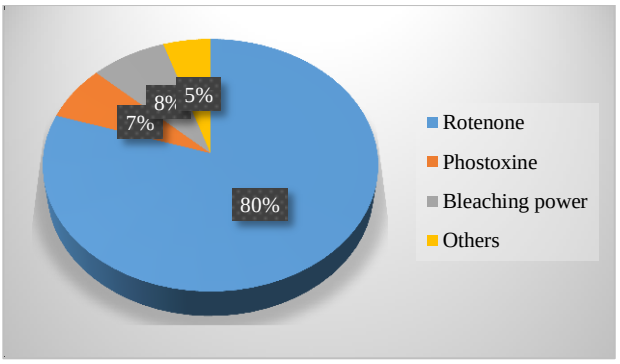


**Figure 2. Fish toxicants used in culture in study area.**

##### 3.2.1.2. Eradication of predatory insects

The basic method was to apply a thin oily film over the pond surface which chokes the respiratory tubes of aquatic insects. In study area some of the common chemicals were used for eradication of predatory insects (Table 2).

**Table 2. Chemical used in insect control.**

| Name of Treatment method | Dose |
|---|---|
| Fenithrothion | 2-3 ml /dec |
| Malathion. | 2-3 ml /dec |
| Dipterex 80sp | 6-12 ml /dec |
| Soap oil emulsion | 60 kg vegetable oil + 18 kg soap |
| Diesel oil | 50-57 l per ha. |
| Kerosene oil | 80 – 90 l per ha. |
| Turpentine oil | 70-75 l per ha. |
| Diesel emulsifier | Diesel 50-55 l per ha. |

### 3.2.1.3. Application of lime

An adequate level of calcium carbonate (CaCO3) in the pond provides a buffering system. Lime also used as disinfectants in the study area (Table 3).

**Table 3. Lime application rate of different farmer in the study area.**

| Farmer no. | Soil pH Highly acidic(4.0 – 4.9) | Soil pH Near neutral(6.5 – 7.4) | Soil pH Mildly alkaline(7.5 – 8.4) | Soil pH Highly alkaline (8.5 – 9.5) |
|---|---|---|---|---|
| Farmer 01 | 350 kg/ha | 247 kg/ha | 200kg/ha | Nil |
| Farmer 02 | 340 kg/ha | 250 kg/ha | 160 kg/ha | Nil |
| Farmer 03 | 400kg/ha | 220 kg/ha | 190 kg/ha | Nil |
| Farmer 04 | 300 kg/ha | 250 kg/ha | 180 kg/ha | Nil |
| Farmer 05 | 320 kg/ha | 200 kg/ha | 200 kg/ha | Nil |
| Farmer 06 | 295 kg/ha | 250 kg/ha | Nil | Nil |
| Farmer 07 | 400 kg/ha | 300 kg/ha | 170 kg/ha | Nil |
| Farmer 08 | 300 kg/ha | 220 kg/ha | 150 kg/ha | Nil |

### 3.2.1.4. Use of fertilizer

In mono-sex Nile tilapia farmers and farm owner were proper analysis of soil and water before deciding on the fertilization schedule. Poultry litter cow dung is easily available and relatively cheap in the study area. After 7 days of liming the ponds were than fertilized with Urea, TSP, MoP (Table 4).

**Table 4. Use of fertilizer of pond preparation (Organic and inorganic).**

| Name of fertilizer | | Farmer 1 | Farmer 2 | Farmer 3 | Farmer 4 | Farmer 5 |
|---|---|---|---|---|---|---|
| Inorganic fertilizer | Urea | 62 kg/ha | 50 kg/ha | 74 kg/ha | 87 kg/ha | 49 kg/ha |
| | TSP | 74 kg/ha | 87 kg/ha | 74 kg/ha | 63 kg/ha | 62 kg/ha |
| | MoP | 62 kg/ha | 64 kg/ha | 63 kg/ha | 62 kg/ha | 87 kg/ha |
| Organic fertilizer | Cow dung | 10000 kg/ha | 8000 kg/ha | 7000 kg/ha | 9000 kg/ha | 10000 kg/ha |
| | Poultry litter | 4600 kg/ha | 2200 kg/ha | 1900 kg/ha | 1800 kg/ha | 1900 kg/ha |

### 3.2.1.5. Supply of water

After preparation of pond, water was supplied into the ponds from deep tube-well. It was found that majority (85%) of the farm owners depends on ground water and only (15%) depends on surface water (Figure 3).

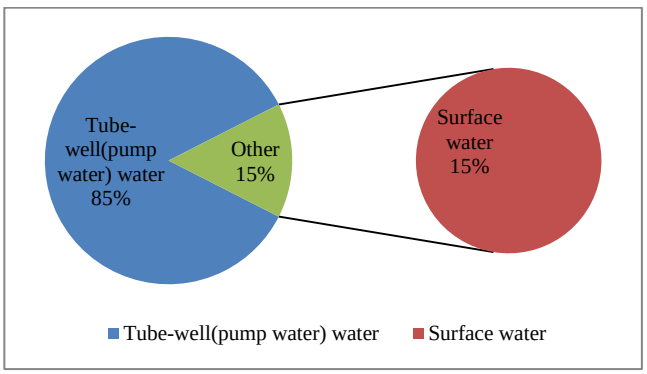


**Figure 3. Sources of water in study area.**

**3.2.1.6. Pond size and depth**

In study area, it was found maximum pond depth was 6-8 feet and some of pond was 4-6 feet. In the study area different types pond size was found but maximum pond size was 99-132 decimal.

**3.2.1.7. Collection of mono-sex Nile tilapia fry**

In study area, most of the farmers and farm owner collected fry from different hatcheries, mono-sex Nile tilapia fry farm, NGOs and others regions. C.P. Bangladesh Ltd.; Quality Aquabreeds Ltd.; Ava mono-sex tilapia hatchery, Jessore.; New modern mono-sex hatchery, Jessore.; Masho kanon hatchery, prembag, Jessore; Vai vai fish hatchery, Jessore; Shohag hatchery, kalaroa; Khan fish farm and hatchery, Jessore; Charulata agro Fisheries Ltd., Mymensingh; Spectra namsai bd (S.H.N) Company Ltd., Lakshmipur, Bangladesh are the major sources of seeds in the study area.

**3.2.1.8. Stocking of mono-sex Nile tilapia**

Confirmation of absence of distress and zero mortality after 24 hours of detoxification the pond should be regarded as ready for stocking, which is shown in table 5.

**Table 5. Stocking density of mono-sex Nile tilapia in study area.**

| Sl. No. | Farmers | Stocking density/fry |
|---|---|---|
| 01 | Farmer 1 | 200-250 per decimal |
| 02 | Farmer 2 | 200-300 per decimal |
| 03 | Farmer 3 | 150 200 per decimal |
| 04 | Farmer 4 | 220-250 per decimal |
| 05 | Farmer 5 | 300-350 per decimal |
| 06 | Farmer 6 | 320-350 per decimal |
| 07 | Farmer 7 | 280-320 per decimal |
| 08 | Farmer 8 | 220-280 per decimal |
| 09 | Farmer 9 | 350-380 per decimal |
| 10 | Farmer10 | 250-270 per decimal |

**3.2.1.9. Method of stocking mono-sex Nile tilapia fry followed by farmers**

In study area farmers and farm owners were stocking of fry and fingerlings done very carefully to avoid any post-stocking mortality due to shock or infections. To minimize post-stocking mortality of fry/fingerlings, they should be done slowly and gradually acclimatized to the temperature and quality of the water in the stocking pond. To do so, open the mouth of the seed transport bag/container and gradually add the pond water in phases and after 15–20 minutes slowly dip and tilt the bag/container in the pond so that the spawn/fry/fingerlings were free to swim out. Stocking should preferably be done in the cool evening hours.

**3.2.2. Post-stocking management in the study area**

**3.2.2.1. Feed and feeding practices**

From the survey, it was found that 85% of mono-sex Nile tilapia farmers and farm owner applied supplementary such as commercially manufactured feed and 12% are applied of farm made feed such as rice bran, mustard oil cake. Rest 3% farmers others or depends on natural food in the pond.

**3.2.2.2. Periodic fertilization**

In study area, periodic fertilization continuous followed by maximum mono-sex Nile tilapia farmers. It was the essential part of mono-sex Nile tilapia culture.

**3.2.2.3. Pond environmental monitoring**

The supply of nutrients could be from within the pond itself or from outside.so they regulate the physico-chemical parameters of the pond ecosystem within the safe tolerance limits of the cultured fish species. In the study area, mono-sex Nile tilapia farmers and farm owner following, some parameter to be monitored (Table 6).

**Table 6. Schedule for monitoring different physic-chemical parameters.**

| Parameters | Periodicity | | | | |
|---|---|---|---|---|---|
| | **Daily** | **Weekly** | **Fortnightly** | **Monthly** | **Quarterly** |
| A. | | **Water** | | | |
| Water colour | x | - | - | - | - |
| Transparency | - | x | - | - | - |
| Temperature | x | - | - | - | - |
| Depth | - | - | - | x | - |
| pH | - | x | - | - | - |
| Free $CO_2$ | - | - | - | - | - |
| Alkalinity: Total | - | - | - | - | - |
| Bicarbonate | - | - | - | - | - |
| Dawn Dissolved $O_2$ | - | x | - | | - |
| $NH_4$-N | - | - | - | - | - |
| $NO_3$-N | - | - | - | - | - |
| $PO_4$-P | - | - | - | - | - |
| B. | | **Soil** | | | |
| Sediment depth | - | - | - | - | x |
| pH | - | - | - | x | - |
| Organic carbon | - | - | - | - | - |
| Total nitrogen | - | - | - | - | - |
| Total $PO_4$-P | - | - | - | - | - |

Here, `x" indicated monitoring parameters, "-` indicated not monitoring parameters.

### 3.3. Harvesting

Although fish were harvested throughout the year. In the study area, mono-sex tilapia fish culture time/period of pond in 2-3 months. Sometimes they sold fish in early, depends on market value.

### 3.4. Disease pattern of mono-sex Nile tilapia

#### 3.4.1. Parasite-related diseases

Factors that normally influence the incidence of parasite populations were water quality and temperature. These main species of parasites infecting mono-sex tilapia in Jessore sadar region a were *Argulus japonica*, *Lernaea cyprinus, Dactylogyrus* sp., *Gyrodactylus* sp.,

#### 3.4.2. Bacterial diseases

A wide range of bacterial pathogens is known to infect mono-sex Nile tilapia in the study area. *Pseudomonas* was found to responsible for the mortalities of mono-sex Nile tilapia fry. When temperature increased in summer season, water quality was undesirable then *Streptococcus iniae* affected in the study area. Other prevalent pathogenic bacteria were *Aeromonas*, *Edwardsiella*, *Flavobacterium* (formerly *Flexibacter*), *Pseudomonas* etc.

#### 3.4.3. Fungal diseases

In the study area fungal disease rarely attacks healthy fish, but commonly infects fish that have suffered stress from temperature shock, mechanical injury, or lesions from other diseases. The main fungal diseases known to affect mono-sex Nile tilapia cultured in Jessore sadar region were saprolegniasis, gill rot and tail rot. Tail rot disease was most common fungal disease of mono-sex Nile tilapia farm in the study area.

#### 3.4.4. Viral diseases

In the study area some viral diseases were infectious pancreatic necrosis virus (IPNV), Mortalities of mono-sex Nile tilapia fingerlings cause of several types of virus. The viral infections of various organs, but particularly the spleen and kidney. Very few viral disease found in the study area.

### 3.5. Cause of disease in study area

Poor quality and scarcity of fish seed, any deficiency in quantity and quality of feed may cause various diseases by increasing susceptibility to many infections, poor water quality, with poor water quality resulting in suppression of the immune system, high stocking density, high temperature, high amount of fish feed provided,

high amount of organic and inorganic fertilization used in pond, lack of knowledge about disease, abrupt and wider fluctuations in some of the environmental parameters, algal blooms of pond.

### 3.6. Treatment and chemicals (drugs) used in study area

Various chemicals and medicine are available in the study area. Farmer used to practice such kind of medicine and chemicals to get rid of fish diseases (Table 7).

**Table 7. Name of chemicals, trade name, purpose and dose used.**

| Name | Trade name | Purpose | Dose |
|---|---|---|---|
| Zeolite | JV Zeolite /Mega Zeo | Remove gas. Maintains water color | 200 g /dec. |
| Fenithrothion | Sumithion 50ec | Insect kill | 2-3 ml /dec |
| Trichlorfon | Dipterex 80sp | Insecticide | 6-12 ml /dec |
| Vitamin and mineral | Aqua Cal C /Aqua | Anti-oxidant, developed body | 0.1-0.3 g /kg feed |
| Formalin | Formalin | Employed as an antifungal agent and in the control of ectoparasites most often in hatchery systems | 1-3 ppm as disinfectants and 3-5 ppm for disease treatment |
| EDTA | Ethylene diamine tetra acetic acid. | Widely used to disinfectants of the hatchery equipment and also water treatment | 0.1-1 ppm |
| Potassium permanganate | Potash | Active against saprolegniasis dactylogyrosis, Argulosis gyrodectylosis | 5-15 mg/dec |
| Malachite green | Malachite green | Active against the oomycete Saprolegnia, which infects fish eggs in commercial aquaculture | 1-5 mg/dec, 1-2 ppm |
| Salt | *Lobon/ Nun*/ Salt | active against for coastiasis chilodonelliasis, trichodiniasis | 500-1000 g/dec |
| Oxytetracycline | Oxy-dof-f/ Aquamycine Renamycin | Effective against a wide range of Gram-negative and Gram-positive bacteria | 2-6 mg /kg feed |
| Amoxicillin | Acimox(vet Powder/ Renamox 15%-vet/ Ranamox | Effective against columnaris edwardsiellosis and mycobacteriosis | 3-7 mg/kg feed |
| Chlorotetracycline | Captor/ Orgacycline-15% | Effective against *Aeromonas vibrio* spp. in fish | 3-7 mg/kg feed |
| Rice | Rice EC | Active against argulus | 5-15 g/dec |

## 4. Discussion

It was observed 30.769% mono-sex Nile tilapia farmers and farm owners had no training while 69.230% mono-sex Nile tilapia farmers and farm owners received short term training from Department of Fisheries, Different NGOs such as BRAC, CARE, DANIDA, Youth Development, worldFish Center. According to Rahman *et al.* (2013) about 31.63% FSF owners had no training while 52.51% FSF owner's received short term training from Department of Fisheries and/or from Bangladesh fisheries Research Institute (BFRI). Similar research were conducted by several research group (Asif *et al*., 2014; Islam *et al*., 2014; Asif *et al*., 2015; Islam *et al*., 2015a; Sharif *et al*., 2015; Islam *et al*., 2015b; Sultana *et al*., 2015; Ali *et al*., 2016; Shabuj *et al*., 2016; Vaumik *et al*., 2017; Razeim *et al*., 2017; Zaman *et al*., 2017; Hossain *et al*., 2017; Islam *et al*., 2017; Asif and Habib, 2017; Faruk *et al*., 2018; Adhikary *et al*., 2018b and Mondal *et al*., 2018) and their result were similar with this present results. Broadly, the various steps involved in the management of ponds at all the three stages of culture may be classified as, pre-stocking, stocking and post-stocking management operations. Ragendran *et al.* (1994) reported a research on feasibility of mono-sex culture of male tilapia (*Oreochromis mossambicus*) along with paddy in Kokkali field in Karalla of India. The size attained (200g) was acceptable to the consumer and the yield at a medium stocking density of 3000/ha was 0.2 tons in 3 months which was support the result of Haq *et al*. (2017) and present study. Another research of Faruk *et al*. (2018) had the similar statement with three steps of culture of Koi fish in Bangladesh. The farmers and farm owners prepared ponds 15 days before stocking of mono-sex Nile tilapia. Pre-stocking management of ponds in the study area comprised dike repairing, aquatic weed control, waste soil removal and undesirable species (predator and trash fish) control. Lime and Zeolite were used for pond preparation and water quality management. Rotenone, phostoxin tablet, bleaching powder and endrin were used as fish toxicant of which rotenone was widely used (70% of nursery farmers, 80% of grow out

farmers). In addition, sumithion, Malathion, diesel and dipterex were used as insecticides. 53% of the nursery farmers and 43% of grow-out owners used sumithion. Several studies (Shabuj *et al*., 2016; Chowdhury *et al*., 2015; Neowajh *et al*., 2017; Adhikary *et al*., 2018a; Rahman *et al*., 2017 and Yeasmin *et al*., 2016) discussed about fish diseases and preventive measures from diseases as well as effective chemical used for that particular disease for relief and save economic loss. Formalin, bleaching and EDTA were used as disinfectants of which formalin was the most widely (43% farmers) used disinfectant. Four types of feed additive were frequently used in culture activities. Fish health management and disease treatment were the key areas where majority of different chemicals were used. Farmers used six types of chemicals in disease treatment namely lime, salt, potash, malachite green, copper sulphate and formalin where 30% farmers used potash. Oxytetracycline was the most widely used (47% farmers) antibiotic besides farmers used chlorotetracycline and amoxicillin for disease treatment which is relevant with the study of Chowdhury *et al*. (2015) and Adhikary *et al*. (2018a). Maximum visited areas of mono-sex tilapia farmers and farm owners had maintained water quality properly. Environmental parameters exert an immense influence on the maintenance of a healthy aquatic environment and production. According to Aminul (1996) stated that the water temperature ranged from 25°C to 35ºC is suitable for fish culture. In the present study water temperature was within the suitable range. In present study, use of fertilizer of pond were Urea 62 kg/ha, 50 kg/ha, 50 kg/ha, TSP 74 kg/ha, 87 kg/ha, 74 kg/ha and others rate of fertilizer also used. Stoking density had very high in study area. Stocking density was found 200-380 fry/per decimal of mono-sex Nile tilapia ponds. Rahman *et al*. (2016) conducted an experiment on the growth and production performance of mono-sex Nile Tilapia (*O. niloticus*) in ponds condition. An experiment was undertaken over a period of 120 days from 25$^{th}$ May to 25$^{th}$ September. She found that the production of Nile Tilapia under different stocking density such as 200, 250 and 300 fish/decimal. According to Rahim (2010) conducted an experiment on the growth and production performance of mono-sex Nile Tilapia (*O. niloticus*) in ponds condition. The experiment was undertaken over a period of 120 days from 30$^{th}$ June to 30$^{th}$ October 2010. He found that the production of Nile Tilapia under different stocking density such as 200, 250 and 300fish/decimal. Maximum mono-sex farmers and farm owners had provided supplementary feed. It was found that 85% of mono-sex Nile tilapia farmers and farm owner applied supplementary such as commercially manufactured feed and 12% are applied of farm made feed such as rice bran, mustard oil cake. Rest 3% farmers others or depends on natural food in the pond. Roy (2009) reported that the production of GIFT tilapia under different stocking density such as 80, 120 and 160 fish/decimal with feeding 30% protein containing diet at a rate 3-5% body weight were 9.04, 11.97 and 13.91 kg/decimal, respectively. He showed that, the fish in the lowest stocking density resulted in best individual weight gain (104g). Khan (1996) reported that the feeding, growth performance and production potential of GIFT tilapia in cage under pond condition. The pond was situated on the northern side of Fisheries Faculty, BAU, Mymensingh and experiment was undertaken over a period of 60 days from August to October. The stocking densities were 200 and 400 fish/m3. The highest yield 4.18 kg/m3 was obtained from cages stocked with 400/m3 and fed with 90% wheat bran+10% fish meal. The initial length and weight were 8.18 cm and 10.29 g. After the period of study, the net gain length and weight were 3.11 cm and 18.82 g and percentage net gain in length and weight were 38.02% and 182.89%. The highest ADG (weight) and SGR were 0.313 and 1.70 which is relevant with the study of Haq *et al*. (2017). According to Khan (1996) reared cat fish fry (*p. sutchi*) in ponds and cages using fresh and decomposed fish feed containing of 60% wheat bran, 30% mustered oil cake and 10% wheat flour. Significantly higher growth rate was obtained in case of decomposed fish feed. In study area, farmers provided feed at the rate of different life stage of mono-sex Nile tilapia and more than three times provied feed daily depending on size and weight of fish. According to Nahar (2011) conducted an experiment on the effect of feeding frequency on the growth and production performance of monosex male tilapia (*Oreochromis niloticus*). She found that the weight gain of tilapia 0.362, 0.257 and 0.207 g in 28 days culture period having the feeding frequency five, four and three times daily respectively. She also found that the FCR, %weight gain and also production increase with the increase of feeding frequency. Mono-sex Nile tilapia farmers and farm owner had been monitoring some parameter to the pond. Hasan (2007) studies on GIFT tilapia (*Oreochromis niloticus*) during the experiment period in ponds situated at ″Nagla Fisheries Ltd", Haluaghat, Mymensingh and recorded that temperature ranged from 21-32.9°C, dissolved oxygen ranged from 4.62 to 5.75 mg/l and pH ranged from 6.4 to 9.0. There was observed parasite-related diseases, bacterial diseases, fungal diseases, viral diseases. Hossain *et al.* (2014) mentioned Transmission and pathology of *Streptococcus inane* in monosex Nile tilapia (*Oreochromis niloticus*) in aquaculture of Bangladesh. According to (Lom 1995; Lom & Dykova 1992) reported that Low numbers of *Trichodina* sp. was not harmful, but when fish are crowded or stressed, and water quality deteriorates, the parasite multiplies rapidly and causes serious damage. Infested fishes do not eat well, become weak and thus also susceptible to opportunistic bacterial pathogens present in the water. Many studies have reported infestation of Nile tilapia by different species of *Trichodina.* Different types of treatment and chemicals (drugs) had used in

study area like Zeolite, Trichlorfon, EDTA, Malachite green, Amoxicillin, Rice etc. which is similar with the study of Chowdhury *et al*., (2015) and Adhikary *et al*. (2018a). According to Hussain, (2004) farming of tilapia, Breeding plans, mass seed production and aquaculture was hampered by *Argulus sp.* For pond treatment Mesoten or Dylox may be applied at the rate of 0.25 ppm once in a week for at least 4 weeks for Argulosis. MacMillan (2001) mentioned that antibiotic should be used only for the treatment of bacterial diseases.

## 5. Conclusions

The mono-sex Nile tilapias as a species is now probably the most frequently cultured aquatic species in the world. In a word, it can be said that it can help to improve socio-economic development of rural people of greater Jessore region through fish culture extension sincerely as well as whole heartedly. Now a days we found that proper culture method played better result on the growth and production of mono-sex Nile tilapia. However, further investigation should be carried out for sustainable mono-sex Nile tilapia culture in our country and we hope it would also help to evolve a definite pond culture technology of mono-sex Nile tilapia culture in our country.

## Conflict of interest

None to declare.

## References

Adhikary RK, M Rahman and AA Asif, 2018a. Present status of aqua-medicines used in aquaculture at Jessore sadar upazila, Bangladesh. Asian J. Med. Biol. Res., 4: 288-297.

Adhikary RK, S Kar, A Faruk, A Hossain, MNM Bhuiyan and AA Asif, 2018b. Contribution of aquaculture on livelihood development of fish farmer at Noakhali, Bangladesh. Asian-Austra. J. Biosci. Biotechnol., 3:106-121.

Ahmed GU, N Sultana, M Shamsuddin and MB Hossain, 2013. Growth and production performance of monosex Tilapia (*Oreochromis niloticus*) fed with homemade feed in earthen mini ponds. Pak. J. Biol.Sci., 16: 1781 -1785.

Ali MM, AA Asif, MAI Shabuj, S Vaumik, MA Zafar and BMN Sharif, 2016. Status of polyculture *Pangasius hypophthalmus* with carps in Jhikargacha upazila of Jessore district, Bangladesh. Int. J. Fish. Aqua. Stud., 4: 423-430.

Aminul IM, 1996. Qualities of water and soil in aquaculture. Fish week compendium. DoF publication, Ramna, Dhaka- l000.

Asif AA and MAB Habib, 2017. Socio-economic condition of fish farmers of Jhikargachha upazila in Jessore district, Bangladesh. Asian J. Med. Biol. Res., 3: 462-475.

Asif AA, MA Samad, BMS Rahman, MA Rahman, MH Rahman, SM Yeasmin, and A Nima, 2014. Study on management of fish fry and fingerling marketing of Jessore in Bangladesh. Int. J. Bus. Soc. Sci. Res., 2: 127-135.

Asif AA, MA Samad, MH Rahman, MA Farid, SM Yeasmin and BMS Rahman, 2015. Socio-economic condition of fish fry and fingerling traders in greater Jessore region, Bangladesh. Int. J. Fish. Aqua. Stud., 2: 290-293.

Ballarin JD and RD Haller, 1982. The intensive culture of tilapia in tanks, raceway and cages. Recent advancement in aquaculture. West view press, Boulder, Colorado, USA. pp. 265-355.

Chowdhury AA, MS Uddin, S Vaumik and AA Asif, 2015. Aqua drugs and chemicals used in aquaculture of Zakigonj upazilla, Sylhet, Asian J. Med. Biol. Res., 1: 336-349.

de Oliveira EG, AB Pinheiro, VQ de Oliveira, AR Melo da Silva, MG de Moraes, IRCB Rocha, RR de Sousa and FHF Costa, 2012. Effects of stocking density on the performance of juvenile pirarucu (*Arapaima gigas*) in cages. Aquaculture, 371: 96–101.

Di Marco P, A Priori, MG Finoia, A Massari, A Mandich and G Marino, 2008. Physiological responses of European sea bass *Dicentrarchus labrax* to different stocking densities and acute stress challenge. Aquaculture, 275: 319-328.

Faruk A, A Hossain, AA Asif, MNM Bhuiyan and MJ Sarker, 2018. Culture and management techniques of Vietnamese Koi. Asian-Austra. J. Biosci. Biotechnol., 3: 93-105.

Faruk MAR, MMR Sarkar, MJ Alam and K Kabir, 2004. Economic loss from fish disease on rural freshwater aquaculture of Bangladesh. Pak. J. Biol. Sci., 7: 2086-2091.

Haq ME, M Rahman, A Hossain, AA Asif, H Rahman, P Chwakravorty, A Satter and MS Islam, 2017. Comparative growth performance between monosex and natural XY male tilapia in Noakhali region, Bangladesh. Asian J. Med. Biol. Res., 3: 391-397.

Hasan SJ, 2007. Effects of stocking density on growth and production of GIFT Tilapia (*Oreochromis niloticus*). MS Thesis, Department of Aquaculture, BAU, Mymensingh.

Hossain A, MAR Hossain, AA Asif, S Ahmed and A Satter, 2017. Fish fermentation in Lalpur, Brahmanbaria district: ecological implication and value chain analysis. Asian-Austra. J. Biosci. Biotechnol., 2: 159-172.

Hossain MMM, A Ehsan, MA Rahman, M Haq and MBR Chowdhury, 2014. Transmission and pathology of *Streptococcus inane* in monosex Nile tilapia (*Oreochromis niloticus*) in aquaculture of Bangladesh. Journal of Fisheries, 2: 90-99.

Hussain MG, 2004. Farming of Tilapia: Breeding plans, mass seed production and aquaculture techniques. Bangladesh Fisheries Research Institute, Mymensingh 2202, Bangladesh. pp. 130.

Islam FMK, AA Asif, M Ahmed, MS Islam, B Sarker, MA Zafar and M Rahman, 2017. Performances of resource poor households in aquaculture practices in sadar upazila, Meherpur, Bangladesh. Int. J. Fish. Aqua. Stud., 5: 281-288.

Islam MA, AA Asif, MA Samad, BMS Rahman, MH Rahman, A Nima and SM Yeasmin, 2014. Socio-economic conditions of the fish farmers in Jessore, Bangladesh. Int. J. Bus. Soc. Sci. Res., 2: 153-160.

Islam MM, AA Asif, S Vaumik, MA Zafar, BMN Sharif, MH Rahman and S Shahriyar, 2015a. Socio economic status of fry collectors at Sundarban region. Int. J. Fish. Aqua. Stud., 3: 89-94.

Islam MR, MJH Biswas, MGR Akanda, MR Amin, IM Hasan, AA Asif, S Sheheli and BMN Sharif, 2015b. Attitude of the farmers towards climate change effect on agriculture. Asian J. Med. Biol. Res., 1: 367-379.

Khan MSH, 1996. Culture of Genetic Improved of Farmed Tilapia (GIFT) in cages. MS Thesis, Department of Aquaculture, BAU, Mymensingh.

Lom J and I Dykova, 1992. Protozoan parasites of fishes. Elsevier science publishers. pp. 315.

Lom J, 1995. Trichodinidae and other Ciliates (Phylum Ciliophora). Pages 229-262 in P.T. K. Woo, editor. Fish diseases and disorders: Protozoan and metazoan infections. CAB International, Cambridge.

Lutz CG, AM Armas-Rosales and AM Saxton, 2010. Genetic effects influencing salinity tolerance in six varieties of tilapia (*Oreochromis*) and their reciprocal crosses. Aquacul. Res., 41: 770-780.

MacMillan JR, 2001. Aquaculture and antibiotic resistance: A negligible public health risk? World Aquacult., 32: 49-50.

Mondal MAI, MA Kader, AH Choudhury, MG Mustafa, MRU Nabi, MM Billah, AA Asif and AAM Siddiqui, 2018. Socio-economic uplifting analysis of ESBN fishery of the coastal villages, Kumira and Kattoli, Chittagong, Bangladesh. Int. J. Res. Gran., 6: 248-263.

Nahar N, 2011. Effect of feeding frequency on the growth and production performance of monosex male tilapia (*Oreochromis niloticus* L). MS Thesis, Department of Aquaculture, Faculty of Fisheries, BAU, Mymensingh.

Neowajh MS, MM Rashid, AA Asif, MA Zafar and A Hossain, 2017. Effects of chemotherapeutics against experimentally injured stinging catfish *Heteropneustes fossilis*. Asian J. Med. Biol. Res., 3: 476-487.

Plumb JA, 1994. Health maintenance of cultured fishes: Principal microbial diseases. CRC Press, Boca Raton, Florida, USA.

Qiang J, H Yang, H Wang, MD Kpundeh and P Xu, 2013. Interacting effects of water temperature and dietary protein level on hematological parameters in Nile tilapia juveniles, *Oreochromis niloticus* (L.) and mortality under Streptococcus iniae infection. Fish Shellfish Immunol., 34: 8-16.

Rahim A, 2010. Effects of stocking density on growth and production performance of mono-sex Tilapia (*Oreochromis niloticus*) in ponds, MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.

Rahman A, M Mrida, B Sarkar and P Haq, 2013. About 31.63% FSF owners had no training while 52.51% FSF owners received short term training from Department of Fisheries and/or from Bangladesh Fisheries Research Institute (BFRI).

Rahman MA, MH Rahman, Yeasmin SM, AA Asif and D Mridha, 2017. Identification of causative agent for fungal infection and effect of disinfectants on hatching and survival rate of bata (*Labeo bata*) larvae. Adv. Plants Agric. Res., 7: 00264.

Rahman MM and MBR Chowdhury, 1996. Isolation of bacterial pathogen causing an ulcer disease in farmed carp fishes of Mymensingh. Bangladesh J. Fish., 19: 103-110.

Rahman MM, D Mondal, Amin MR and MG Muktadir, 2016. Impact of stocking density on growth and production performance of monosex tilapia (*Oreochromis niloticus*) in ponds. Asian J. Med. Biol. Res., 2: 471-476.

Rajendran CG, MV Mohan, NK Sasidharan, TU George and KM George, 1994. Feasibility of monosex culture of male tilapia (*Oreochromis mossambicus*) along with paddy in pokkali field. J. Aquacult. Trop., 9:173-178

Razeim MA, MG Farouque, MA Sarker, AA Asif and M Ahmed, 2017. Attitude of farmers towards Pangas farming for their livelihood improvement. Asian-Austra. J. Biosci. Biotechnol., 2: 106-119.

Roy R, 2009. Effect of stocking density on the growth and survival of GIFT tilapia fed on formulated diet. MS Thesis, Department of Aquaculture, BAU, Mymensingh.

Shabuj MAI, T Bairagi, AA Asif, O Faruq, MR Bari and MS Neowajh, 2016. Shrimp disease investigation and culture strategies in Bagerhat district, Bangladesh. Asian J. Med. Biol. Res., 1: 545-552.

Sharif BMN, AA Asif, S Vaumik, MA Zafar, MM Islam and MA Samad, 2015. Socio-economic condition of fish farmer and trader at the village of Pitamborpur in Chaugachha upazilla in Jessore, Bangladesh. Int. J. Fish. Aqua. Stud., 3: 212-217.

Sultana N, AA Asif, MMI Dihider, SM Ahsan and FS Maraj, 2015. Usefulness of farm women training programmes in livelihood security. Int. J. Bus. Soc. Sci. Res., 4: 13-24.

Vaumik S, SK Sarker, MS Uddin, MT Alam, A Satter and AA Asif, 2017. Constraints and prospects of fish farming in Lalmonirhat district. Int. J. Bus. Soc. Sci. Res., 5: 201-210.

Yeasmin SM, MA Rahman, MMM Hossain, MH Rahman and AA Asif, 2016. Identification of causative agent for fungal infection and effect of disinfectants on hatching and survival rate of common carp (*C. carpio*) larvae. Asian J. Med. Biol. Res., 1:578-588.

Zaman MFU, MA Samad, MA Islam, MHU Jaman, S Khondoker and AA Asif, 2017. Assessment of sustainability of Pangasius (*Pangasius hypophthalmus*) farming at Jhikargachha upazila in Jessore district, Bangladesh. Int. J. Fauna Biol. Stud., 4: 109-119.

Zhang X, J Feng, M Xu and J Hu, 2011. Modeling traceability information and functionality requirement in export-oriented tilapia chain. J. Sci. Food Agric., 91: 1316–1325.

Zubaida UB, AL Arago and RW Doyle, 2005. A farmer-oriented Nile tilapia, *Oreochromis niloticus L*., breed improvement in the Philippines. Aquaculture Research, 36: 113–119.