COMPARATIVE STUDY OF TILAPIA NILOTICA (*Oreochromis niloticus*) IN THE ASPECT OF QUALITY OF THE HARVEST AND HATCHING BETWEEN RIVER BASE CAGE CULTURE AND EARTHEN POND

A Thesis

By

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The Thesis submitted to the Fisheries and Marine Resource Technology Discipline in partial fulfillment of the requirements for the degree of Master of Science in Fish Processing & Quality Control

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Approved as to style and content
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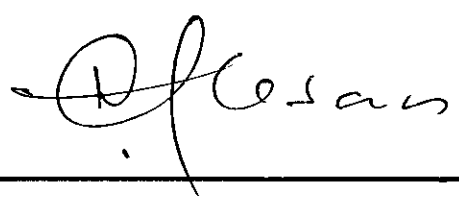

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Declaration

Comparative study of t. Nilotica (*Oreochromis niloticus*) in the aspect of quality of the harvest and hatching between river base cage culture and earthen pond

The results submitted in this thesis are entirely of the candidate's own investigations and no part of the results has been accepted for any degree, nor is it being concurrently submitted for any degree

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December, 2011

DEDICATED TO

MY BELOVED PARENTS

Acknowledgement

This Endeavour is done under the supervision of dear sir Rashedul Hasan , who never said "no" to me though I made plenty of mistakes. I have had less opportunity to meet this wonderful person but I think I am fortunate enough to work under his guide. The author wishes to express his gratefulness to Honorable freedom fighter Mr. Abdul Mutaleb, Chairman-4MK aquaculture, Muhury project Feni for making the chance of thesis work along with job. Thanks are also extended to Mr.Ruhul Amin,Consultant, Niribili Tilapia Hatchry, Cox's bazaar for his technical support.

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Uttam Kumar
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December, 2011

Abstract

The reason for choosing the titled work that in Bangladesh work on hatching & rearing the offspring keeping on Cages in river has not yet been developed. And comparing it to the traditional hatching and nursing system for tilapia fish fry is still not discovered. The entire experiment has done under the breeding season of tilapia (March to August). And Brood stocking, feeding, Egg collection has done at the same time at same rate so that we find the exact outcome of the study. The location of the study chose carefully cause we need an earthen pond based tilapia hatchery and a river beside it so that we can run the study at a time simultaneously. Considering this fact Muhuri project area is the best. The difference that we observe between two different sampling place (Cage and Pond) on the result is its egg collection rate, egg size, hatch survivability and hatch deformity. All those aspect samples from the cage shows better result most of the time than that of samples from the earthen pond. Egg collection starting first from the broods from 12 May 2011 both in pond and cages and at a regular interval collection process kept to 4 June 2011 in 3 different phases. Highest size of the egg sample found .2mm from the river cages and lowest size found .1mm both from pond and cages. Similarly egg collect rate per brood is highest observe 20gm/4 pieces of mother from the river reared broods and lowest collection rate found 15gm/10 pieces of broods. And hatch survivability rate of eggs observed highest is 100% at 17 May 2011 in spawning trey of river's sampled eggs and lowest is 93% (1557 eggs survived from initial 1667 eggs)shown in the pond's egg sample trey at 13 May 2011. At after hatching deformity of the juveniles has been counted for extended study. In that cage highest deformity of the offspring has been observed about 36count from the river reared sample. But total deformity counted less from pond sampled fry.

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CHAPTER-ONE

INTRODUCTION

1.0 Introduction

Today in Bangladesh Tilapia (O. niloticus) is being top popular, profitable fish species. Because of it's easy hatchery operation and high production rate putting low investment. Also for species itself, its rapid growth rate within a short period of time, could be culture in any kind of aquatic environment – extensive to intensive culture method, available feed, pelleted or domestic will do for it. Farmers give choice on this species easily for its filter feeding habitat; they nurse it under their own visual sight. They also get entertainment when those fishes are getting growth day after day with their personal care. Although in Bangladesh, there are plenty of commercial tilapia hatcheries where breeding based on brood stocking system in pond usually is operated but breeding based on brood stocking in river and artificially hatching that breeding is not established yet. As an experiment this thesis work is done upon this matter of possibility of the entire hatching process based on river.

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1.1 General Physiology and Anatomy of O. niloticus

There are over 20,000 species of fishes all over the world both in marine and fresh aquatic environment. All are divided into 3 major groups-

1. Bony fishes. Ex-major carps, salmon
2. Cartilaginous fish, ex-Sharks, Rays. And
3. Jawless fish, ex- Lampreys.

Bony fish which have skeletons of bone and swim bladders (gas-filled organs) to keep them afloat. Tilapia is one kind of bony fish. All kind of tilapia further divided into 3 genera's –

1. Genus Tilapia: - Breed on pond bottom and make hatch the eggs by fanning the eggs using its fins. Tilapia of this genus never takes eggs to its mouth. Ex; T.gilli.
2. Genus Sarotherodon: - Tilapia of this genus takes eggs by male species only. Ex, S. galilaeus.
3. Genus Oreochromis: - Those tilapia species which takes eggs to its mouth by their female species only and make the eggs hatched keeping into mouth using gills to supply oxygen for the eggs. Ex, O. niloticus.

Entire the world includes Bangladesh used to culture tilapia of oreochromis genus and its super male or single sex.

Chapter - 1

Taxonomic position of O. niloticus :-

Phylum – Chordata

Class – Osteichthyes

Order – Perciformes

Family – Cichlidae

Genus – Oreochromis

Species – O. niloticus.

Common name – Nile tilapia.

Biological features: Body compressed; caudal peduncle depth equal to length .Scales cycloid .A knob-like protuberance absent on dorsal surface of snout. Upper jaw length showing no sexual dimorphism. First gill arch with 27 to 33 gillrakers. Lateral line interrupted .Spinous and soft ray parts of dorsal fin continuous. Dorsal fin with 16 - 17 spines and 11 to 15 soft rays. Anal fin with 3 spines and 10-11 rays. Caudal fin truncated. Colour in spawning season, pectoral, dorsal and caudal fins becoming reddish; caudal fin with numerous black bars.

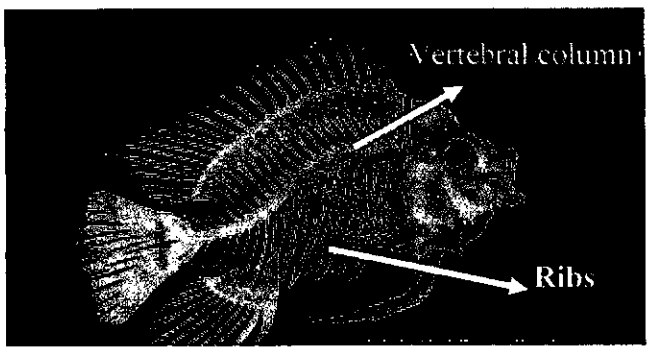


Fig 1: Anatomy of O. niloticus

Tilapia shows a descent physiological and anatomical phenomenon. It's shape, growth, feeding habitation. The mouth shape is a good clue to what fish eat. The larger it is the bigger the prey it can consume. Fish have a sense of taste. The stomach and intestine used to break down food and absorb nutrients. Fish such as bass that are carnivores, have fairly short intestine because such food is easy to chemically breakdown and digest but fish such as tilapia that are herbivores, require longer intestine cause plant matter is usually tough and fibrous and more difficult to breakdown into usable components. The liver of tilapia has a number of functions, its assist in digestion by secreting enzymes that breakdown fats, protein and carbohydrates from the food stuff. Liver also work for destruction of old blood cells and in maintaining proper blood chemistry as well as

playing a role in nitrogen (waste) excretion. Differences in the distribution and number of vertebrae of T.nilotica –

(A) Abdominal (Trunk) region. (B) Caudal region.

a) First vertebrae connected with skull.
b) Second vertebrae enclosed by lateral apophyges.
c) Third vertebrae with a strong process on the ventral side and bearing large diapophysed to which tall ribs are connected.
d) Flexible vertebrae in caudal region.

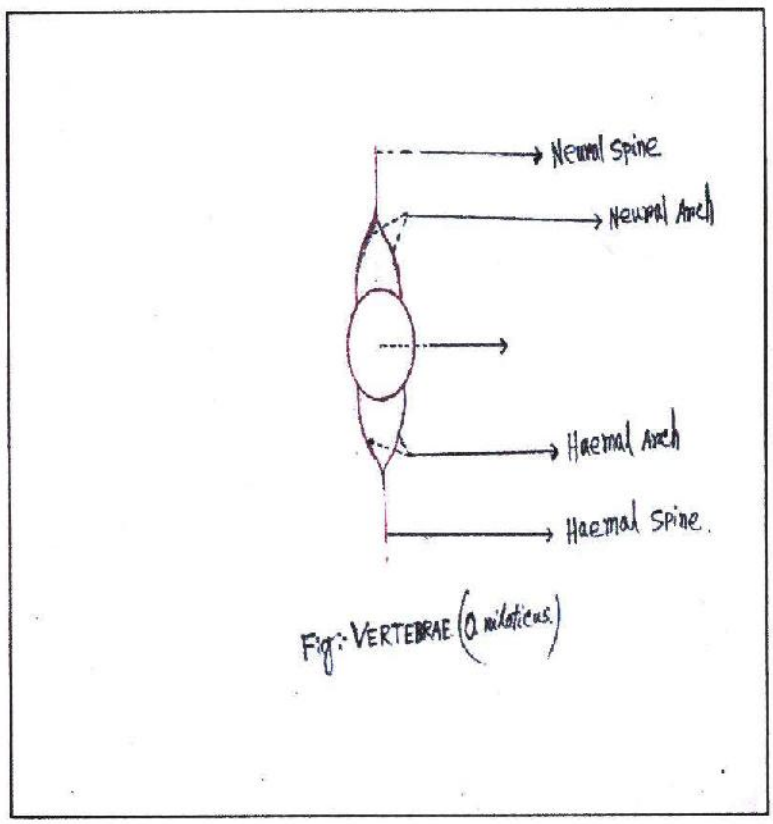


Fig 2: Vertebrate of O. niloticus

Sex Determination: Sex determination in tilapia is quiet easy rather than other bony fishes. It is important for making good spawning, If brood stocking procedure take wrong ratio in the basis of genital difference, total Endeavour will comes in vain. The work is done by external eye sight before stocking. Usually males are big in size in tilapia. Brood stocking is done by the following physical symptom –

1) Males are big in size and greater in weight than female.

2) Male looks bright where females look pale grey in color.

3) Male has bright reddish caudal fin and greenish operculum.

4) Lower jaw is slightly cervical in female.

5) Caudal fin looks different.

6) Genital pore is wider and flat in female where male has narrowed and long.

7) Oviduct is clear sometimes if female are genetically ripe .

Hence tilapia sex determination is quite hard in the early age (immature) because it takes time to form sexual organ fully.

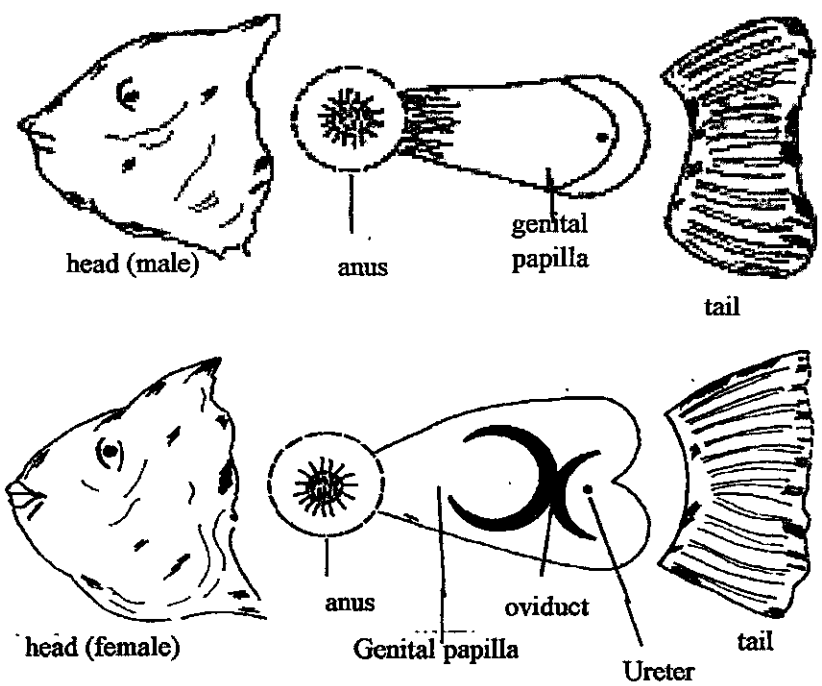


Fig 3: Sex differences of male and female tilapia.

1.2 Objectives

The aim of this thesis is to verifying the entire procedure of tilapia fish farming and propagation system along with its quality difference in two different arenas (Cage and Pond) and comparative study in a commercial view. It is also to be classified about following aspects:-

1. Egg collection rate from mouth of the brood in cages differ to the brood of pond.
2. Hatch survivability rate of eggs of caged brood differ to the brood of the pond.
3. Water current measurement and its effect to the brood while mouthing egg.
4. Water productivity and nutritive measurement of the consumed water area in cages.
5. Counting/rate of hatched deformities fry.
6. Dynamical analysis of net cage structure.

CHAPTER-TWO

MATERIALS AND METHODS

2.0 MATERIALS AND METHOD

The experiments were launched just beside at the well known Mohury sluice Gate project area. The artificially dragged Mohury river channel which is about 2km long and 0.5km wide in size fully separated from the original river, gives the channel a blissful environment. Because of building embankment and diverting river way the old river get waterless. The entire work is done in two places of Muhury project area. One is "4MK aquaculture" (cage culture on river),Muhury project,Sonagazi upazila under Feni district. And the other place is "K.K. Hatchery and Farming Complex" Muhury project, Mirsharai upazila under Chittagong district.

Expected outcome of the study

The quality of the cultivated fish species into two different environments will differ to following categories-

1. Outlook
2. Survival rate.
3. pathogenic activities after harvest.
4. Immune aspect
5. Customer/Market demand

And for

a) Breeding rate per individual brood.
b) Egg quality difference (size, colour)
c) Hatching rate from the newly breed eggs.
d) Deformation (weakness, unexpected shape, abnormal swimming in the incubation tray etc.) rate of hatched fry.

In every categories Cage product is giving a better result than that of earthen pond based species.

Cage construction procedure and feasibilities

Usually cages are various types in shape -

1) Rectangular
2) Circular
3) Square

4) Cylindrical.
5) Box or cubic

Cylindrical and box shaped cages are run for small scale fish culture activities, giving least finance and personal entrepreneurship with minimal input. This type of activities broadcasted for monoculture and short time process to get early cultivation. This type of cages can easily handled cause of easy portability.

In case of commercial and intensive culture system, rectangular and circular shaped cages are used .The thesis work where it is done also committed rectangular shaped frames.

2.1 Structure of frame:-

The frame of the experimented work is made of iron pole overlapping with extra synthetic dies which gives the frame extra strength and sustainability against getting fragile and rust. This rectangular frame has 3 chambers of which 2 chambers are used for float. The Circumference of iron pole is 10cm (Parrot color Patch indicated) which is locally made.

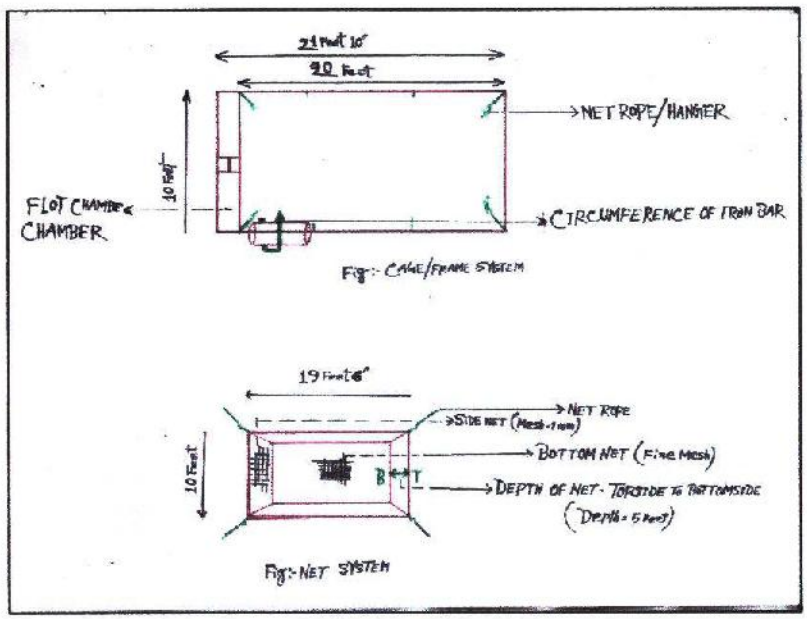


Fig 4: Net System

Cage Net-Vital things of cage are netting. All the nets used are polyethylene made having different mesh size. The economic life of that net range from 3 to 6 year. Different mesh is used for different sizes of fishes.

Table 1:-Relationship between fish size and mesh size of cage net.

Size of fish (cm)	Size of mesh (mm)
1-5	Fine mesh
5-9	1sq.mm
10-50	5sq.mm

Float- As a floats, plastic drums or barrels (3 feet length) is used having suitable thickness and capacity of seven gallons. The economic life of the floats range from 1 to 5 years.

Anchor-Anchor is used to keep the cages in static condition properly. The entire anchor is completely driven into mud. This anchors are made of iron bar (Diameter 0.5 to 1cm) usually used in small trawlers. Cause of different depth every anchor is placed 28 to 40 fathoms (50 to 73 meters) from the cages. Cages are strong and straightly banded with anchor by polyethylene rope.

The cage frame is constructed using iron pole. Every pole end is joined vertically to other and shapes a rectangular form. Every single frame is made another 2 small rectangular form perpendicularly to the breadth side of the frame. Area of the frame is-

$$L \times B = (20ft \times 10ft)$$

Cage dynamics- The total cage dynamics is followed by lumped-mass method. In this model the mooring lines are divided into linear elements and the net cage divided into several plane surface elements.

The interconnected points or corners are called nodes or lumped mass centers. The external force is calculated on each element and equally distributed to its nodes. By adding the contributed forces from the neighboring elements, a system of motion equations for nodes is formed. The volume reduction co-efficient of a net-cage is estimated by the ratio of minimum volume of net-cage during fluid and structure interaction to the original volume.

Current status of net-cage systems is still not so appropriate in order to be able facing the strong currents. *Kawakami*(1964) has proposed relatively reliable semi-empirical formulas for a flexible net subject to the effect of currents. The formulation includes the drag force caused by material properties, mesh size of net and current velocity.

Cage net volume reduction co-efficient:- Aarsens *et al.* (1996) and Loland (1991) separated the external forces into drag and lift forces, taking into account the angle between current velocity and the normal direction of net panel. They have also included the shadow effect in calculating the total force on a cage system.

These works have laid a good foundation for the estimation of the external forces on an offshore net-cage system.Lader *et al.* (2003) and Lader and Enerhaug (2005) have conducted a series of experiments investigating forces and deformation on a net cage in a uniform current.

2.2 Current measurement under and surface of the Muhuri river water:-

The water current is measured in Mohuri river channel in different depths and time.To made the reading the following locally available tools were used-

a) Nylon rope(1m)
b) Weight(10gm)
c) Small float

Those tools were entitled in a single column. The weight is twisted by a thin polyethylene pouch so that water can't enter to the weight and then weight is being twist vertically with the rope. Underwater and surface current is measured manually with this handmade apparatus.

Procedure:- First of all, the weighted is drowned 1m under the surface water in aside of a cage, showing a spongfloat floating above the surface of the water. The device were placed in such a way that it can swim horizontally with the current direction. The formula is-

Current rate = (End point Length-Start point length)/consumed time.

As example, if the device is kept just under the frame line of north side and keep the time in stopwatch until it touch the southline.Then the total distance is divided by the time consumed, is the desired current rate.

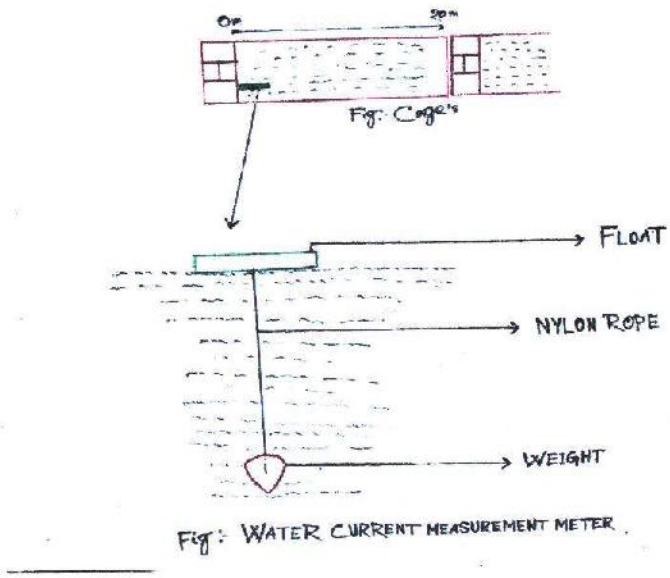


Fig 5: Water current measurement meter

The work is done in four different water current movement phenomenons, like-

a) In the time of high tide,

b) In the time of low tide,

c) In the time of surface runoff.

The current velocity reading in different times has been conducted along inside the cage and outside the cage. The readings are-

Table2: current velocity reading.

Date	Time	Current readings inside the cage	Current readings outside the cage	Tidal situation
5April,2011		0.02feet/min	0.12feet/min	Low tide
-		0.009feet/min	0.07feet/min	High tide
10May,2011		0.18feet/min	1.68feet/min	Low tide
-		0.10feet/min	1.06feet/min	High tide
7 June 2011		0.8feet/min	1.5feet/min	Low Tide
-		0.7feet/min	1.04/min	High Tide

2.3 Current rate affecting on breeding and egg collection rate:-

Current rate were measured indifferent times in different seasons in this particular place where the thesis work is done.

It was also seen that current rate is different in outside the cage and inside the cage. The reading of outside the cage is more than that of inside the cage. Current due to tidal activity shown in the Muhury river project in the time of April to July when The Mohury river Dam (Sluice gate) is opened so that overflowing water could be discharged to the low land area. Otherwise those gates have closed to reserve the water for irrigation. This is why the other time there is no tidal activity or current in this river channel. Hence due to gate construction river water could make weak current at high tide rather than that current of low tide.

2.4 Pond preparation, Hapa and cage setting

Pond preparation is necessary prior to stocking, to create a favorable condition for brood for mating. To get highest breeding, the water and soil quality to be keep in a optimum condition like, water and soil ph,black and poisonous hydrogen sulphide (which create bad odors)free pond bottom.remarkeble oxygen dissolved into water of the pond, toxic ammonia(free ammonium) and nitrate free water is obvious for good result. Pond water temperature should be keep always 22 to 28°c for mating and growth.

A "hapa" (net enclosure or "bitinan") is like an inverted mosquito net which the four top corners are tied to bamboo stakes. It is made of fine meshed polyethylene netting. The seams are sewn with nylon thread and double stitched to prevent splitting.

A "hapa", measuring 3 m long , 3 m wide and 1.5 m deep is the most common size used. Usually, it is installed in ponds, lakes or along river banks with slow moving current. The open part of the "hapa" should be two feet above the water surface .Hapa is a special type of nursing apparatus for fish and fry. It is used for intensive care of the targeted species only. Hapas were set in shallow water and in a series of row horizontally. Every single hapa have the size of 2m×1m to12m×3m with the depth of 1.5m. This shape of hapas can be the perfect set in the pond fixing them with bamboo or PVC poles by nylon thread. At least .25m of the hapa should left above water surface and the hapas can be covered by the very same net or could be uncovered.

Cage were almost set like pond set hapa.The difference is,hapa is set in static condition but cages do not set engaged by any such condition, it is something about mobile. The

cages on the river were set 6.096m or 20ft by 3.048 or 10 ft . The cages were hanged by both sides with long line rope and anchor.

2.5 Advantage and Disadvantages in farming (cages and pond) during culture period

The culture of Nile tilapia at high densities in floating cages is practiced in large lakes and reservoirs of several countries including China, Indonesia, Mexico, Honduras, Colombia, and Brazil. Mesh size has a significant impact on production and should be 1.9 cm or greater to maintain free circulation of water.

Cage culture offers several important advantages. The breeding cycle of tilapia is disrupted in cages, and therefore mixed-sex populations can be reared in cages without the problems of recruitment and stunting. Eggs fall through the cage bottom or do not develop if they are fertilized. Other advantages include:

- Use of water bodies that cannot be drained or seined and would otherwise not be suitable for aquaculture.
- Flexibility of management with multiple production units.
- Ease and low cost of harvesting.
- Close observation of fish feeding response and health.
- Relatively low capital investment compared to other culture techniques.

However, there are a number of disadvantages, which include:

- Risk of loss from poaching or damage to cages from predators or storms.
- Less tolerance of fish to poor water quality.
- Dependence on nutritionally complete diets.
- Greater risk of disease outbreaks.

Cages vary widely in size and construction materials. In Brazil, cage volumes and stocking densities range from 4 m3 cages stocked at 200-300 fish/m3 to cages 100 m3 or larger stocked at 25-50 fish/m3. Yields range from 50 kg/m3 in 100 m3 cages to 150 kg/m3 in 4 m3cages. In Colombia, cages range from 2.7 to 45 m3 in volume and are stocked with 30 g sex-reversed male fingerlings and raised to 150-300 g in 6-8 months. The fish are fed extruded feeds with 24-34 percent crude protein. Streptococcal infections

are a problem, and survival averages 65 percent. Annual yields at final densities of 160-350 fish/m3 are 76-116 kg kg/m3

2.6 Brood stocking in Pond and Cages

Tilapias are asynchronous breeders. So, hormones are need not to used for induce breeding. Breading is occurred all the year round (except winter when temperature stand below20°c) in an gentle interval of 15 to 30 days by the same breeders. Breeding could be possible making any aquatic condition like pond, tanks or hapas. For better result everywhere it is used to breed tilapia keeping brood into hapa.

Table 3: Stocking ratio between male to female follow most common everywhere in Bangladesh.

Type	Male	Female	Density/Square meter
a	1	2-4	.2-.3 kg/sqm
b	1	1-3	.3-.7kg/sqm

Hapa size- In south east asia, a common hapa size is 120 sqm. (*Linnaeus*,1758 Cultured Aquatic species information programme, *Oreochromis niloticus*). Broods were kept in Hapas both in Cages and pond in following density-

Table 4: Brood density amount in Hapas both in Cages and pond.

Type	Stocking date	Male/hapa	Female/hapa
Pond hapa	14 april,2011	20	60
River hapa (Cage)	15 april,2011	25	75

Stocking density were followed by the ratio of male: female=1:3,hence more brood is stocked in river cage cause of good water quality, transmission .Hapas were kept vacuum in 3 days for conditioning the tight new net.

Four hapas were taken for the experiment [2 in pond, 2 in cage] and 360 piece of brood having good quality with pure GIFT strain [from BFRI] used for the same purpose.

2.7 Space measurement of Hapas:- Though, water is the only home for broods, so it is important to know that how much water ground they possessed or need. Because food competition, movement, oxygen consumption all things are depend on water volume. If we imagine the cages in cubic structure we get-

Length=20ft,

Breadth=10ft

And

Depth=5ft.Setting down the values of the cage dynamics, it is seen that

Total area of the cages = (L×B×D) cubic feet.

= (20×10×5)

=1000 cubic feet.

We know, water volume of 1 cubic feet = 28 liter

So, total water volumes of 1000 cubic feet= (28×1000)

= 28000 liter.

So, it is seen that this plenty of water is sufficient for every 100 brood fish hence those are captive condition.

2.8 Feeding and Inspecting:- Feeding the broods were started after the very stocking day. The broods were usually showing reluctance to their feed. For this aspect some additives like vitamin c (Ascorbic acid) is added with a mixture of 6-8 gm/kg of pellet. Sometimes vitamin E (2-3gm/kg pellet) was added to it for better breeding and hatch successibility. Market available commercial pellet feeds were given the broods both in river and pond. Because of river open water there had been using floating pellet. It brings some purpose, like-

1) Inspection of feeding could be done,
2) Feed ratio could be reset,
3) Feed waste could be retard.

The pellet were given twice in a day 2% of the total body weight of broods. Average weight of the male spwaner were 350gm and female spawner were 250 gm and average weight of spawners is 300gm.

So total biomass of broods in pond hapa is

= (Female +Male Number)× Average weight of the broods

= (20+60)×300

=24000gm

=24 Kg

And total given feed (Kg) were-

= 2% of total biomass

=(0.02 × 24)

=480gm or .48 kg

Similarly, total biomass of broods in cages in river is-

= (Female +Male Number)× Average weight of the broods

= (75 + 25) × 300 gm

= 30Kg

And the total given feed (Kg) were

=2% of total biomass

=(0.02×30)

=.6 Kg or 600gm.

Feeding was done everyday under the same time in both two experimental places until 1st, 2nd and 3rd type egg collected.

2.9 Egg collection Procedure:-

Spawning is directly depending on temperature and other water parameters. Since reproduction rate was reduced when water temperature decreased below 22°C and spawning of females ceased when water temperature was less than 19°C regardless of the presence of natural photoperiod, it is concluded that spawning performance of Nile tilapia depended on the combined effect of temperature and photoperiod (Davies *et al.* 1995).

So, this work was done regularly. Availability of the average physio-chemical factors in those time were-

Temperature = 24-28°c

Ph = 6.9 to 7.8 ppm

D.O. = 5 to 6.8 mg/l

Salinity = 3-5ppt [though is tidal area]

Ammonia = 0.2 ppm

Nitrite = Nil

Hydrogen sulphide (Toxic) = nil

Alkalinity = 60-150 ppm

Total Hardness =20-28 ppm.

Eggs were available 15 days after brood stocking. Female brood stock were checked for fertilized eggs in the buccal cavity every after 4^{th} day in both experimental places.

Studies with some species (*Forester and Alderdice* 1966) have shown that low incubation temperatures produced larger fry at hatching, whereas studies with other species (*Hasler* 1982) have shown that low incubation temperatures produced smaller fry at hatching. The results of the present study indicate that incubation temperature does not have an effect on total body length of yolk-sac fry, after hatching. The protein level in test diets and photoperiod applied to brood stock during the spawning season also did not affect that parameter either.

CHAPTER-THREE

RESULTS & DISCUSSION

3.0 Result and Discussion

Egg collection was done from pond and cages every time at afternoon 4pm with great care. Eggs were collected in 3 different types for getting the verified result for exact thesis work.

3 different types of eggs which is available in the buccal cavity before hatching in wild natural process were collected in 3 different days. Those three types of eggs are –

a) Grade A or 1st day egg (white-yellowish),
b) Grade B or 2nd day egg (light reddish),
c) Grade C or 3rd day egg (dark reddish).

Table 5: Egg collection on first phase.

Date	Source	Egg type	Egg size	Egg color	Weight/egg	Collection rate
12 May 2011	River cage	Grade-A	.2mm	White-yellowish	0.007gm	10gm/4ps mother
-	Pond hapa	-	.1mm	-	0.006gm	10gm/5ps mother

Table 6: Egg collection on second phase.

Date	Source	Egg type	Egg size	Egg color	Weight/egg	Collection rate
23 may,2011	River cage	Grade -B	.1mm	Light-reddish	0.010gm	15gm/6ps mother
-	Pond hapa	-	.1mm	-	0.010gm	15gm/10ps mother

Table 7: Egg collection on third phase.

Date	Source	Egg type	Egg size	Egg color	Weight/egg	Collection rate
4 June,2011	River cage	Grade -C	.01mm	Dark reddish	0.010gm	20gm/4ps mother
-	Pond hapa	-	.01mm	-	0.010gm	20gm/6ps mother

Eggs which are collected were not same in weight all the time but for easy verification, 10gm, 15gm and 20gm taken in three phases both from pond and river cage.

Egg collection rate was determinates through weighing a descent (15gm) amount of egg against counting the giver mother brood. As an example- In river cage 15gm eggs were weighted first and then it was found that to get 15gm egg, six mother broods cavity need to exhausted.

So, the rate of egg collection rate was- 15gm/6piece of brood.

Collected eggs were transferred to the neighbor side hatchery for incubation and getting exact outcomes. Because of Grade –A, eggs need more water flow to turn it to hatch out .The reason why Grade-A eggs were kept on small transparent incubation jar which is much popular today in tilapia hatching purpose. Before keeping eggs in the jar, this jar were cleaned and set under a pipeline. And the eggs were washed in a antifungal solution for a while using a scoop net.

Table 8: Hatch survivability rate of Grade-An eggs both from pond and cage.

Date	Source	Number of eggs[10gm]	Jar/Trey	Temperature °C			Number of spoiled egg or Larvae/day
				5.00am	1pm	11pm	
12May,2011	River cage	1429*	jar	25	28	26	43
-	Pond hapa	1667	jar	-	-	-	84
13May,2011	River	-	-	24	29	27	48
-	pond	-	-	-	-	-	110
14May,2011	River	-	Trey	25	29	26	10
-	Pond	-	-	-	-	-	29
15May2011	River	-	-	27	30	29	11
	Pond	-	-	-	-	-	8
16May2011	River	-	1/3 hatched	26	29	27	24
	Pond	-	½ hatched	-	-	-	27
17May2011	River	-	full hatched	26	28	24	nil
	Pond	-	fully hatched	-	-	-	05

*Number of eggs =10÷7/1000

So, Total spoilage =136in cage egg & 263 in pond egg.

Table 9: Hatch survivability rate of Grade-B eggs both from pond and cage.

Date	Source	Number of eggs[15gm]	Jar/Trey	Temperature °C			Number of spoiled egg or Larvae/day
				5 am	1 pm	11 pm	
23May, 2011	River cage	1500*	jar	25	29	25	14
-	Pond hapa	1500	-	-	-	-	67
24May, 2011	River	-	Trey	25	28	27	22
-	pond	-	-	-	-	-	59
25May, 2011	River	-	-Fully hatched	26	29	26	13
-	Pond	-	-1/3hatched	-	-	-	27
26May 2011	River	-	-	27	29	28	06
	Pond	-	-full hatched				17

*Number of eggs =15÷10/1000

Total spoilage =in cage 55 eggs & in pond 170eggs.

Table 10: Hatch survivability rate of Grade-C eggs both from pond and cage.

Date	Source	Number of eggs[20gm]	Jar/Trey	Temperature °c			Number of spoiled egg or Larvae/day
				5 am	1 pm	11 pm	
4June,2011	River cage	2000*	Trey	26	28	28	17
-	Pond hapa	2000	-	-	-	-	22
5June,2011	River	-	1/3hatched	24	26	26	7
-	pond	-	-	-	-	-	13
6June,2011	River	-	Full hatched	23	26	27	3
-	Pond	-	-	-	-	-	14

*Number of eggs =20÷10/1000
So, Total spoilage =in cage egg 27 & in pond egg 49.

3.1 Hatched deformation of Samples: - After hatch out, newly hatched larvae keep itself float with the water flow in the plastic trey. The yellowish yolk-sac still with their body makes obstacles in free swimming. Some damage might occur during this time which leads to further deformation of their body. Embryos may hatch out weak or deformed in fish, Deformities generally are curved and bent spines, Many of this deformed fish die soon after hatching (*J skorpua*,1998).In this study it was observed that some deformities in early stage of larvae, like-

a) Yolk sac is light whitish.
b) Yolk sac is larger than its body.
c) Granular yolk sac.

In the next stage of larvae when yolk-sac is fully disappeared and could swim freely with or against the water flow of plastic trey, show another phase of it. Deformation of the offspring could be seen easily in this fry stage. Like-

a) Some fry were swimming where water flow is less in the plastic trey.
b) Some fry shows abnormal swimming.
c) A Grey spot were found in the ventral side of the fry.
d) Some had abnormally big head larger than its own body.
e) Some fry still can't swim though its yolk sac eclipsed.

On the basis of those symptoms and dissimilarities deformed hatched offspring were count both in two level of experiment on

Table 11: Grade- A outcomes.

Source/Origin of hatch out	Date	Available larvae(ps)	Number of deformation	Available Fry (ps)	Number of deformation
River Cage	17May	1293	24	-	-
Pond hapa	-	1404	27		
River cage	18May	-	-	(1293-24)=1269	10
Pond hapa	-	-	-	(1407-27)=1380	8

Table 12: Deformities in grade-B.

Source/Origin of hatch out	Date	Available larvae(ps)	Number of deformation	Available Fry (ps)	Number of deformation
River Cage	26May	1445	12	-	-
Pond hapa	-	1330	42		
River cage	27May	-	-	(1445-12)=1433	36
Pond hapa	-	-	-	(1330-42)=1288	30

Table 13: Deformities in grade- C.

Source/Origin of hatch out	Date	Available larvae(ps)	Number of deformation	Available Fry (ps)	Number of deformation
River Cage	6June	1973	4	-	-
Pond hapa	-	1951	22	-	-
River cage	7June	-	-	1969	2
Pond hapa	-	-	-	1929	14

CHAPTER-FOUR

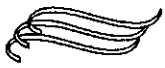
CONCLUSION

4.0 Conclusion

From the above discussion it is clear enough that river cage cultured fish (Tilapia) quality in their spawning, Hatch survivability, Uniform juvenile grading, immune system, color, texture bring a deference from pond basis cultured fish. Though, in Bangladesh still not raised any tilapia hatchery based on river kept broods but it could brings better result .The reason behind not to established cage fish caring is –

1. It needs extra security every other time.
2. Maintenance is hard
3. Egg collection procedure need more time.

But in sense of our little land resource in Bangladesh against vast unused river water body, the time is now to think seriously about our great opportunity.



CHAPTER-FIVE

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Appendix

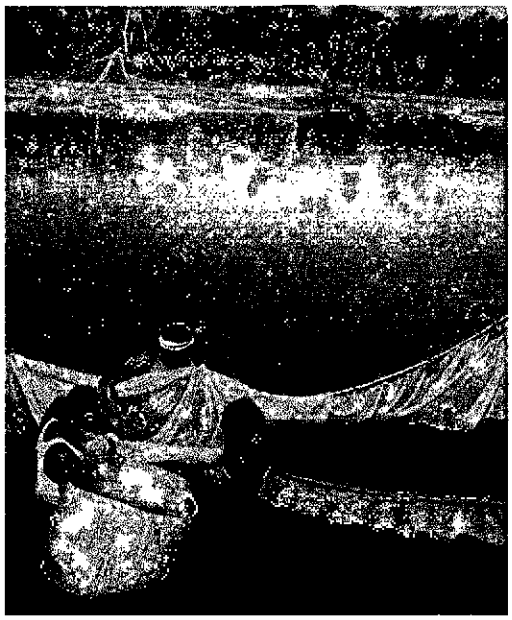

Fig: (a) Hapa setting & Brood Keeping River

Fig: (b) Cage setting on Muhury River

Fig: (c) Feeding the Broods

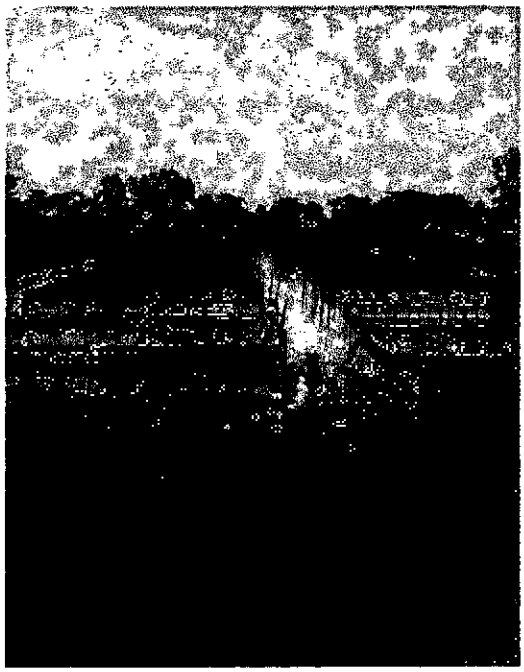

Fig: (d) Egg collection from brood

Fig: (e) Eggs in incubation jar

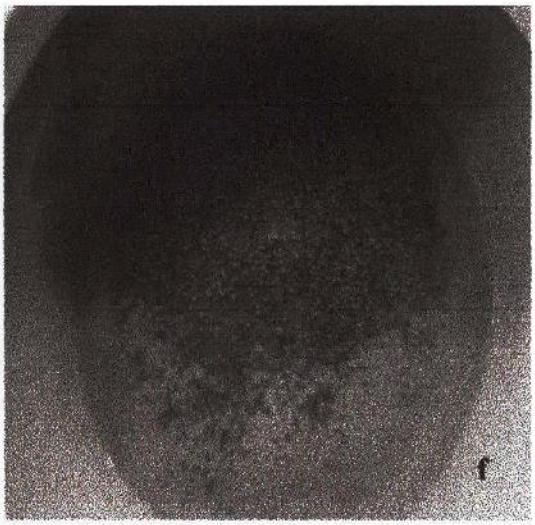

Fig: (f) Grade – B eggs of tilapia

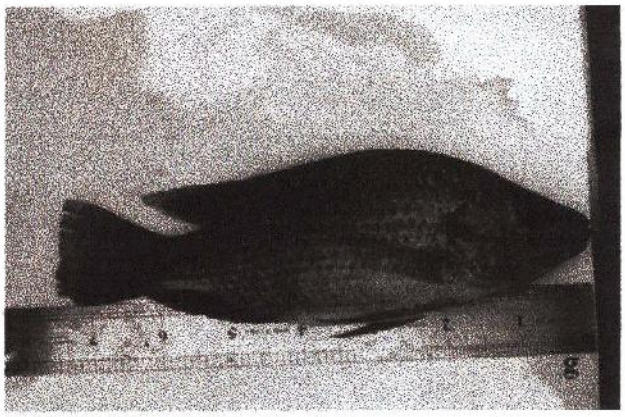

Fig: (g) Brood weight-Eggs weight

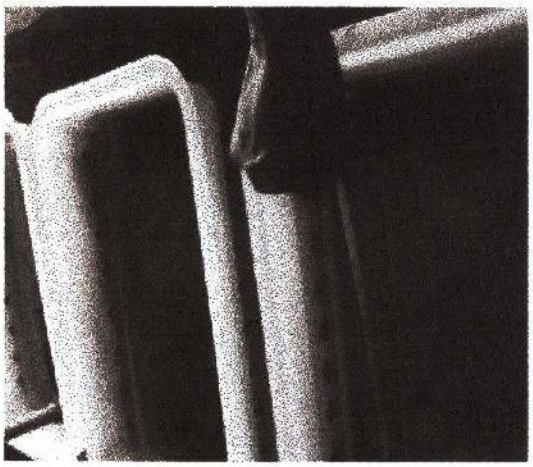

Fig: (h) Water Temperature measurement on incubation Trey

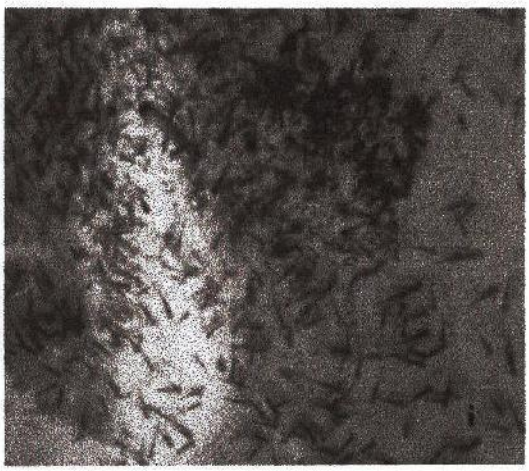

Fig: (i) Hatch deformity counting of Tilapia fry.