Growth performance of freshwater Mud Eel, *Monopterus cuchia* in different ditches conditions

Md. Hafiz All Hosen¹, Mst. Naima Afrin Eliyana¹, Mousumi Sarker Chhanda²*

¹Department of Fisheries Management, Hajee Mohammad Danesh Science & Technology University, Dinajpur, Bangladesh
²Department of Aquaculture, Hajee Mohammad Danesh Science & Technology University, Dinajpur, Bangladesh

**Key words:** *Monopterus cuchia*, culture, water quality parameters and growth performance.

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**Abstract**

An experiment was carried out to observe the water quality parameters and growth performance of the freshwater mud eel, *Monopterus cuchia* at Uthrail union of Sadar upzila under Dinajpur district for six months in different ditches namely as T₁(concrete ditch), T₂ (tripal ditch) and T₃(normal ditch). Randomized Complete Block Design (RCBD) with three replication in each treatment was differentiated at significant level 0.05. Stocking density, feed and fertilization were same for each treatment. The average weights (gm) of the freshwater mud eel, M. cuchia in three treatments were was 316.7±1.8, 403.4±1.4 and 416±1.3, while an average length (cm) was 71.15±1.02, 73.07±0.59 and 75.13±0.88. It also found that the body weight (gm) gain was 221.05±1.2, 305±0.9 and 318±1.5 while the body length (cm) gain was 16.87±0.8 cm, 17.61±1.2 cm and 18.02±1.09 cm at T₁, T₂ and T₃ respectively. The survival rate was observed maximum (99%) at T₂ and minimum was found (60%) at T₁. From the study, it can be observed that the highest growth performance of *Monopterus cuchia* was found in the normal ditch (T₃) but survival rate was the lowest. On the basis of survival rate and growth performance, it is suggested that T₂ (tripal ditch) is suitable for the culture of freshwater mud eel, *M. cuchia*.

*Corresponding Author: Mousumi Sarker Chhanda chh.sarker@hstu.ac.bd*
Introduction
Bangladesh is an agro-based development country because of striving hard for the rapid development of its economy (Ahmed, 1997). The amount of fish production was 41.37 lakh MT in the fiscal year 2016-17 in Bangladesh. Fish provides about 60% animal protein and 11% of people involves in the fisheries sector for their livelihood. Bangladesh earned 4287.68 million Tk. as export revenue from fisheries sector in 2016-17 (DoF, 2018). Freshwater mud eel or swamp eel, Monopterus cuchia, also known as Kuchia or Kucha. It belongs to the family Synbranchidae of the order Synbranchiformes and commonly occurs in freshwater of Bangladesh, Pakistan, Nepal, Myanmar and throughout the India (Talwar and Jhingran, 1991). The mud eel (M. cuchia) is a carnivorous and nocturnal species, prefers animal-based food like small fishes, mollusks and worms etc. The mud eel is very tasty, nutritionally rich with medicinal value and highly priced in the other foreign markets. The average protein content of eel flesh is 14g/100g and the caloric value of eel flesh is as high as 303 Kcal/100g compared to 110 Kcal/100g in other average fishes (Nasar, 1997).

Many poor people harvest and sell mud eel as a full-time or part-time profession. However, recently, due to the extreme amount of exporting mud eel has been reduced from nature faster than any other time in past abundance of this species. Nature has been decayed due to habitat destruction, aquatic pollution and indiscriminate uses of pesticides.

Though several researches have already been conducted such as Growth and yield performance of a sustainable aquaculture of Monopterus cuchia (Chakraborty et al., 2017), technical and co-management aspects of mud eel culture (Chakraborty et al., 2010), rearing and production performance (Miah et al., 2015), effect of different shelters and feeds on growth, survival and production (Narejo et al., 2003), effect of different temperature on food, growth and survival rate (Rahman et al., 2005). It is commercially important due to its high demand for export and the value of earnings has been steadily increasing. The demand of supplying this species is increasing day by day but no technology for commercial culture and production of mud eel is developed so far in Bangladesh. However, there is a lack of enough information regarding growth performance of mud eel in different ditches. Thus, this study was aimed to investigate the growth performance in the different types of ditches of mud eel.

Material and methods
Experimental site and design
The study was carried out for a period of six months from 1 July to 30 December, 2017 in nine different constructed ditches such as T1 treatment (concrete ditch), T2 treatment (Tripal ditch) and T3 treatment (Normal ditch) located at Uthurail union in Dinajpur sader upazila, Dinajpur district, Bangladesh. The ditches were maintained about 24 feet long, 12 feet wide in size and around 3 feet depth throughout the study period.

Experiment procedure
Concrete ditches were made of cement, brick and sand mixed like casting. When casting was hard, than applied the first layer 10cm clay soil layer (80% of clay soil and 20% of the loamy soil mixed), second layer was made of 10 cm lime, dung, water hyacinth and straw mixed compost, third layer was made of 2-3 cm 7 days dry banana leaves and finally fourth layer 10cm volume clay layer (80% of clay soil and 20% of the loamy soil mixed). After drying the layer, liming (500 gm) was applied and filled with water. Finally, Water hyacinth was used on water to reduce the temperature.

Tripal ditches were dried and applied polythene and tripal as per ditch volume. The same four layers were applied on the tripal. A border was built in 40-50 cm wide around the ditch which was made of 80% clay soil. Next step was followed as concrete ditch. The normal ditches were dried and then followed as like concrete and tripal ditches.After preparation of all ditches, small fish fry was released for investigation only 2-4 days. If small fry was live, then ditches were
appropriate for mud eel culture. The small sizes of the freshwater mud eel, *Monopterus cuchia* were collected from local tribal. About 215 experimental mud eel was stocked each of the constructed ditches in the morning. Small dead fish, earthworms, small live fish (tilapia/carp fry), snails, small frog, chicken viscera, dry fish and aquatic insects were supplied. The feed was given in the night because *M. cuchia* was a nocturnal animal. The feed was given about 3-5% body weight.

**Water quality parameters**

Four physico-chemical parameters of ditches water were recorded *viz.*, temperature, dissolved oxygen, pH and transparency were measured with an interval of 15 days during the whole period of study.

Temperature and dissolved oxygen were measured by using a mercury-in-glass thermometer and a dissolved oxygen meter (YSI model 58, USA), respectively. The pH was measured by using portable pH meter (model 56, NR 87 BB 203) (Rad *et al.* 2006) and the transparency of ditches water was determined using Secchi disc.

**Growth parameters**

During the period of the experiment, the mud eel were caught by using hand every 15 days later. The growth of mud eel was recorded by measuring the length (cm) and weight (gm) of the harvested eel by using a measuring tape and an electric balance, respectively.

**Weight gain**

Weight gain (W) was calculated through the following equation: Weight gain, \( W = W_2 - W_1 \)

Where \( W_1 \) is initial weight and \( W_2 \) is final weight

**Specific growth rate**

The specific growth rate of mud eel under different treatments was calculated by using the following formula -

\[
SGR (%) = \frac{\ln W_2 - \ln W_1}{T} \times 100
\]

Where, \( \ln W_2 - \ln W_1 \) is the difference of logarithm of initial and final weight and \( T \) is the duration of the experiment (days).

**Survival rate**

The survival rate (SR) of mud eel was calculated as follow:

\[
SR (%) = \frac{\text{Final total number of fish}}{\text{Initial total number of fish}} \times 100
\]

**Statistical analysis**

The data were analyzed by one-way ANOVA procedure of Statistical Analysis System (SPSS Windows Version 23). Treatment means were compared at \( p<0.05 \) according to the Tukey test and Least Significant Difference (LSD).

**Result and discussion**

Mean levels of physic-chemical parameters over the six months culture of *Monopterus cuchia* are presented in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Variations in water quality parameters of ditches water under different treatments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
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<tr>
<td>Temperature</td>
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</tbody>
</table>
The individual average weight (416±1.3 gm) was the maximum at T₃ and the minimum individual average weight was 316±1.8 gm at T₁ treatment. It was also found that the maximum individual average length was 75.1±0.88 cm at T₃ treatment and the minimum individual average length (71.15±1.02 cm) was found at T₁ treatment (Table 2).

**Table 2.** Growth performance of *Monopterus cuchia* (Mean±SD) in different treatments over the experimental periods.

<table>
<thead>
<tr>
<th>Species</th>
<th>Item</th>
<th>T₁</th>
<th>T₂</th>
<th>T₃</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Monopterus</em></td>
<td>Initially No. of mud eel</td>
<td>215</td>
<td>215</td>
<td>215</td>
</tr>
<tr>
<td><em>Cuchia</em></td>
<td>Av. Individual weight of mud eel (gm/eel)</td>
<td>98±9</td>
<td>98±10</td>
<td>98±8</td>
</tr>
<tr>
<td></td>
<td>Av. Individual total length of mud eel (cm/eel)</td>
<td>55±2.7</td>
<td>56±1.8</td>
<td>57±2±2.6</td>
</tr>
<tr>
<td>Finally No. of mud eel</td>
<td></td>
<td>130</td>
<td>212</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>Av. Individual weight of fish (gm/eel)</td>
<td>316.7±1.8a</td>
<td>403.4±1.4b</td>
<td>416±1.3a</td>
</tr>
<tr>
<td></td>
<td>Body weight gain (gm/eel)</td>
<td>221.05±1.2a</td>
<td>305±0.9b</td>
<td>318±1.5a</td>
</tr>
<tr>
<td></td>
<td>Av. Individual total length of fish (cm/eel)</td>
<td>71.15±1.02a</td>
<td>73.07±0.59b</td>
<td>75.15±0.88b</td>
</tr>
<tr>
<td></td>
<td>Body length gain (cm/eel)</td>
<td>16.87±0.8a</td>
<td>17.61±1.2b</td>
<td>18.02±1.09a</td>
</tr>
<tr>
<td></td>
<td>Specific growth rate (%growth)</td>
<td>0.6±0.4a</td>
<td>0.7±0.4a</td>
<td>0.79±0.5a</td>
</tr>
<tr>
<td></td>
<td>Survival rate (%)</td>
<td>60%</td>
<td>99%</td>
<td>72%</td>
</tr>
</tbody>
</table>

* a< mean values with different superscripts letters in the same row indicate a significant difference (p<0.05) based on one-way ANOVA followed by Tukey test.

After six months of cultivation, the maximum body weight gain (318±1.5 gm) was found at T₃ treatment while the minimum body weight gain (221.05±1.2 gm) was found at T₁ treatment (Figure 1). Therefore, the maximum body length gain (18.02±1.09 gm) was found at T₃ treatment while the minimum body weight gain (16.87±0.8 gm) was found at T₁ treatment (Figure 2).

The temperature, water transparency, pH and dissolved oxygen of the experimental ditches were within the acceptable range for mud eel culture that agrees well with the findings of Chakraborty *et al.* (2017), Chakraborty *et al.* (2010), Narejo *et al.* (2003) and Miah *et al.* (2015). Narejo *et al.* (2003) reported that the optimum temperature was 22-31°C for increasing mud eel growth performance. Nasar (1997) reported that the optimum temperature for the suitable rearing of *M. cuchia* was between 20 to 35°C. *Anguilla* sp. does not take meal properly at 12°C (Usui, 1974). Chakraborty *et al.* (2017) found that the secchi disk transparency was suitable in the treatment.
T3 (22.33cm) for cuchia culture. Chakraborty et al. (2010) also found that the transparency was appropriate for cuchia culture between 14.80-20.50 cm in a rice field and 13.60-18.40 cm in ponds. Narejo et al. (2003) found that the dissolved oxygen values were found between 3.7 to 4.15 mg/l. Chakraborty et al. (2010) recorded that the pH value was 5.50-7.20 in a rice field and 5.88-7.40 in ponds. Narejo et al. (2003) found that the range of pH value was 7.35-7.55.

![Graph showing body weight gain for different treatments](image1)

**Fig. 1.** Weight of *Monopterus cuchia* at different treatments.

![Graph showing body length gain for different treatments](image2)

**Fig. 2.** Length of *Monopterus cuchia* at different treatments.

The body weight gain of mud eel was 221.05±1.2 gm, 305±0.9 gm and 318±1.5 gm in three different prepared ditches T1, T2 and T3 treatment. Chakraborty et al. (2010) recorded that the body weight gain was 214.67±0.98 gm and 144.04± 0.84 gm. The body length gain was 16.87± 0.8 cm, 17.61± 1.2 cm and 18.02± 1.09 cm in three different prepared ditches T1, T2 and T3 treatment. Narejo et al. (2003) recorded that body weight gain was 53.80± 0.65 gm in mud, 82.63± 5.80 gm in Water hyacinth, 34±1.0 gm in PVC pipes and finally 24.93± 0.89 in control. The present results might not be similar to the findings due to
The environment, culture period, feed, stocking density etc.

The specific growth rate was high at T3 compare to the T1 and T2 (Figure 3). The specific growth was 0.64±0.4%, 0.73±0.4% and 0.79±0.5% which was more or less similar to Chakraborty et al. (2010). Chakraborty et al. (2010) were found that the specific growth rate of the freshwater mud eel was 0.79±0.23% in a rice field and 0.61±0.32 in ponds, respectively.

Fig. 3. Monthly variations of the specific growth rate of M. cuchia in different treatment.

At the end of the experiment the highest survival rate (99%) was observed in T2 and the lowest survival rate (60%) was recorded in T1 while the rate of survival (72%) was found in T3 (Figure 4). The survival rate was recorded at 60%, 99% and 72% which was near to Chakraborty et al. (2017). Chakraborty et al. (2017) observed that the highest survival rate was 96% and the lowest was 87%. The survival rate of the
freshwater mud eel was 90% in a rice field and 87.25% in ponds (Chakraborty et al. 2010).

Conclusion
The results of the study concluded that the maximum growth of the mud eel occurred at a temperature range of 20-35°C. The optimum dissolved oxygen and pH for the cultivation of the mud eel ranged between 4.2-5.4mg/l and 7.4-8.4 respectively. It also found that the range of transparency was ranged between 26-35 cm. The growth performance of the selected mud eel was the highest at T3 treatment and the highest survival rate was 99% at T2 treatment in contrast to T1 and T3 treatment. However, the growth rate was high but the survival rate was low at T1, the survival rate and growth performance was also good at T2. Finally the survival rate and growth performance was very low at T1 treatment. So, this study suggests that the cultivation of the freshwater mud eel at tripal ditch (T2) culture system will be more suitable in compared to the other normal ditch (T3) and concrete ditch (T1) culture system.

References


