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Mass scale seed production of Magur, *Clarias batrachus* at farm level through improvised modifications

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Abstract
The *Clarias batrachus* (Linn.), an air-breathing indigenous catfish, popularly known as magur in India commands a good market value. In mass scale seed production under captive condition, occasionally huge mortality in larval rearing phase is observed that might be due to lack of brood care, appropriate feeds and feeding techniques, lack of standardized rearing environment, maintenance of optimum water quality parameters and disease management. The comprehensive study of breeding and larval rearing of *C. batrachus* has been done with some improvised modifications for production of magur seed in large scale at farm level in respect of brood fish management, larval feeding, water quality management and disease prevention. In the present communication, the successful findings have been highlighted which will pave the way of mass scale seed production of magur under captive condition.

Keywords: Magur, Breeding, Larval rearing, Survivability, Farm level.

1. Introduction
Natural sources of magur, *Clarias batrachus* (Linn.) seed have been sharply declining due to ecological imbalances in their natural breeding ground [8]. Theses imbalances are caused by habitat destruction through development of low lying paddy field, indiscriminate use of chemical fertilizer and chemical pesticides [10]. On the other hand, fish farmers being attracted by the good market value of magur owing to its high consumer preference, have been showing a trend of diversifying the culture practice with magur since the concluding decade of last century [12]. But non-availability of adequate quantity of magur seed during the desired hours of stocking, stands as main constraint in the way. Besides, non-availability of magur seed is sometimes also driving farmers to either get engaged in culture of an exotic magur or a hybrid *Clarias* species [6, 7, 9].
In the above context, mass scale production of magur seed in captivity, is the only way out. The magur seed production technology as developed by the apex fish research institutes of the country [4, 8, 11, 16, 18] faces some major constrains while implemented at the farm level. This needs modifications. The paper deals with some modifications for production of magur seed in large scale at farm level in respect of brood fish management, larval feeding, water quality management and disease prevention.

2. Material and Methods
Study of breeding and larval rearing of indigenous magur, *Clarias batrachus* have been done during 2010-2014 in Bluetech Dynamics fish farm at Dakshin Bijaynagar, West Bengal. During the tenure the farm level study was carried out from mid-May to third week of August every year. Locally collected and captive raised 200 numbers of brood stock having average weight of
150 gm each at a ratio of 1Male:1Female were used (Fig 1). A number of improvised modifications during that tenure were made in respect of existing practices regarding brood fish maintenance, use of material for constructing hatching and rearing containers, larval feed management, water quality maintenance and disease management which are described categorically here under in table 1. For Water quality management Checking was done 8 a.m. and 8 p.m. daily. Water quality analysis has been done following standard methods [2, 13]. Examination of other parameters was conducted using standard kits produced by the Hatch Chemical Company, USA.

Fig 1: Well managed brooders (Left♂ and Right ♀)

Table 1: Details of improvised modifications with regards to Existing practice of magur breeding and rearing

Management criteria	Existing practice	Modified practice
Brood fish management	No special feed. Only rice-bran and fish meal mixture in 9:1 @ 10 % of body weight.	Farm made pelleted feed containing soybean whole 35%, Fish meal 40%, Soybean oil cake 10%, GN Cake 10%, Rice polishing 2%, Fish oil 2%, Vitamin and minerals 1% fortified with trace elements like cobalt and phosphorus @ 3% of body weight three months prior from the breeding season.
	No artificial water sprinkling in breeding season.	Artificial water shower for one hour in every evening prior to one month of the breeding season to stimulate neuro- endocrine responses.
Hatching, Larvae and fry rearing container	Plastic material, Cement and bricks, occasionally Fibre-glass reinforced Plastic (FRP) with different dimensions	Self-designed flow-through Glass aquariums (Fig-2) of 6mm thickness with two different dimensions were used for Hatching (120 cmX60 cmX15 cm) and Larvae-cum-fry rearing (120 cmX60 cmX30 cm).
Larval and fry feed	Larval feed: Freshly hatched *artemia* naupli up to twelve days followed by mixed zoo-plankton, egg custard, finely minced molluscan meat or fish flesh	Larval feed: Rotifer and Moina, chopped tubifex (Fig-3) filtered through nylon net, adequately washed in fresh water and disinfected with Di-decyl di- methyl Ammonium Chloride. (Fig-4)
	Fry feed: Molluscan meat or fish flesh and whole tubifex worms.	**Fry feed:** Wholetubifex, finely chopped tubifex.
Stocking density and water level	**Upto 15 days:** Stocking density 3000-4000/ M2. Water level 8-10 cm	**Upto 15 days:** Stocking density: maximum 2000/M2. Water level15 cm.
	After 15 days: Stocking density 1000/ M2. Water level 50 cm	After 15 days: Stocking density 2500/M2. Water level 30 cm.
Water quality maintenance	50% water exchange twice daily with siphoning of faecal matter and excess feed particle at 12 hrs interval.	100% water was exchanged throughout the day by Flow-through technique with siphoning of faecal matter and excess feed particle at 6 hrs interval along with installation of in-situ sponge type aerobic bio-filter
	Water quality parameters like DO, pH, ammonia, nitrite concentration checked at frequent interval. (Rao et al., 1994)	Chemical parameters such as D.O., pH, dissolved carbon-di-oxide concentration, TAN (total ammoniacal nitrogen), Nitrite concentration, alkalinity and one physical parameter, temperature monitored every day.
Disease management	Curative approach: Oxytetracycline and/or chloramphenicol @ 50 mg/Kg in feed or quaternary ammonium compound dipping @1-4 ppm for 1 hour or dipping in formalin @25ppm -for bacterial diseases. Malachite green oxalate @1ppm in rearing medium- for fungal disease.	Preventive approach: Vit-C was administered @1ml/lit of rearing medium absorbing in dry tubifex for consecutive seven days with repetition for twice in the 60 days span of rearing. First 7 days: 7th -13th day, Second 7 days: 35th -42nd day. Saline (3% NaCl) bath for five minutes to larva and fry after 7th day onwards @ once in a week

Fig 2: Self-designed flow-through Glass aquarium

Fig 4: Feeding of filtered chopped tubefix macro-granules to magur larvae

3. Results and Discussion

Details of modified practice in comparison with existing practice are presented in table 2. In modified practice using glass aquarium, outbreak of microbial diseases was found less owing to the fact that the absence of roughness of the rearing container and no leaching of chemical

compounds from glass material contributed towards less colonization of microbial organisms and thereby favoured good microbial character of water quality [15]. Besides, as visibility of movements of the larva and fry had been easier in glass medium and hence cleaning the bottom and the side wall of the container was more accurate facilitating disruption of bio-film formation for colonization of the microorganisms [3]. Moreover, it was comparatively cheaper than cement or FRP cisterns. The brood fish showed advanced maturity and it was more or less four to five weeks prior in comparison to brood stock matures in the existing system. Brood fish became more fecund and both the hatchability of eggs (Fig 5) and survivability rate of larva became higher. Additionally, the supplementation of trace elements in feed in the modified practice, also results to better growth and survivability of larvae and fry. This may be due to availability of higher level of vitelogenic protein and lipids (n.3PUFAs) provided through feeding of fish meal which in conjunction with trace elements and vitamin synergistically favored higher level of production and productivity [21, 19] by proper gonadal maturity. Larva accepted tubifex granules and showed higher survivability with better growth in respect to the larva fed *artemia* nauplii and zoo-plankton. Fry preferred whole tubifex worm very much and also showed best growth and survivability among other feeds used. The better growth from tubefix may be due to the higher crude protein content (65%) in comparison to other feeds (41-55%) used at this stage. Larval feeding of Magur at the initial stage immediately after starting of exogenous feeding is done usually with zoo plankton from the 4th day of hatching. Here in the modified practice, a new method of feeding by introducing finely chopped tubifex worms sieved through filtered net by replacing the conventional feed was adopted. This newly introduced live feed meets the standard requirements of protein without dependence on other limited and conditional sources of live feed collected from the natural resources. Moreover, these worms are cheaper than Artemia which is also used as alternative of live larval feed. The larvae uptake tubifex which being annelids resembles zoo plankton for their movement owing to muscular contraction due to regenerative property.

Fig 5: Healthy fertilized eggs

In the conventional practice, magur larvae and fry were encountered mainly with microbial septicaemia infections caused by gas producing *Aeromonashydrophila* [19] and *Edwardsiella tarda* [14] (Fig 6) which was basically an opportunistic infection resulted from crowding and degradation of water quality parameters. The disease appeared with the symptoms of hanging of the fishes vertically upward in the water surface, waddling swimming behaviour, cessation of feed, swelling at the base of the pectoral fin, presence of fluid in body cavity, haemorrhagic lesions on body and necrosis in skin. For management of disease the policy adopted 'prevention is better than cure' proved successful as the disease once setup, it is very difficult to cure and control/restrict further incidence.

Fig 6: Mass mortality of magur fry due to infection with *Aeromonas hydrophila* and *Edwardsiella tarda*

Table 2: Details of modified practice in comparison with existing practice

Type of practice	Existing practice	Modified practice
Brood fish maturity advancement (days)	0	30±4.2
Fecundity (Nos)	17500±25.5	23525±24.0
Hatchability (%)	82±2.1	96±1.5
Larval Survivability (%)	80.5±2.7	96.8±2.0
Microbial load (CFU)	3.4 X103 CFU/ml	1.1 X103 CFU/ml
Involvement in farming (hrs)	5.2±0.5	2.2±0.4
Feed cost (Rs./Kg)	210 ±15	80±5
Larval length at 15 days age (mm)	17.5±2.0	27.4±1.3
Larval weight at 15 days age (mg)	27.1±0.25	47.2±0.50
Fry length at 45 days age(cm)	4.5±0.02	6.5±0.03
Fry weight at 45 days age(g)	1.8±0.1	2.3±0.12
pH	8.0±0.21	7.2±0.20
DO (ppm)	4.5±0.13	6.2±0.11
TAN (ppm)	0.04±0.001	0.025±0.000
Nitrite concentration (ppm)	0.20±0.01	0.09±0.00
Carbon di-oxide concentration (ppm)	10.5±0.50	13.6±0.21
Alkalinity (ppm)	32.5±0.67	23.5±0.29
Disease incidence (%)	32.5±1.24	2.5±0.01
BC ratio	2.21	3.50

The modified practice of magur seed production emphasizes on water quality parameters, maintenance as some of these parameters demands more attention for optimum output from the stock. In water, ammonia (NH3) reacts to form ammonium hydroxide (NH4OH) which readily dissociates to the NH4+ and OH- ions. The change from ammonia to ammonium is temperature and pH dependent, the amount of ammonia being less at lower pH values. The ammonium ion is relatively harmless to fish, but ammonia is quite toxic [17] thus the pH of water containing ammonia or ammonium salt is a major determining factor with regard to toxicity. Fish can tolerate high concentrations of ammonium ion at a low pH, but become more sensitive as the pH increases and the toxic ammonia is formed. Another factor which also affects ammonia toxicity is dissolved carbon dioxide [1]. Carbon dioxide decreases the pH and also decreases the NH3 concentration [5]. Since fish expires carbon dioxide, the pH of the microenvironment around the gill surface may be more acidic than that of the rest of the water. However, if the dissolved oxygen level of the water falls, the amount of CO_2 given off is decreased and the pH around the gill surface is increased making the fish more susceptible to ammonia and thereby opportunistic infection. In this point of view, the modified practices have the advantage of reducing this toxicity induced ailment and resulted in better survivability. Feeding of Vitamin C prevents the disease outbreak as it is involved in the carnitine synthesis and detoxification of different toxicants in process involving cP-450 besides enhancing the disease preventive capacity by phagocytosis [20].

3. Conclusion

In the conventional method of magur seed production, the usual package of practices faced with many untoward results which needed to be modified at the farmers' level. The present work was carried out with an intention to mitigate the problems of existing practices and have better productivity in an eco-friendly sustainable manner. The present endeavour of Flow- through system coupled with bio-filter helped to lower the ammonia and nitrite below the optimum level and maintain the D.O. near to saturation which in turn results to reduce the chance of opportunistic bacterial infection and thereby better survivability along with optimum larval growth and advanced and proper brood fish maturity.

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