Artificial Incubation for Intensive Fry Production of Nile Tilapia *Oreochromis niloticus* (L.)[1]

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Two experiments were conducted to evaluate and compare the production, quality, and survival of eggs and the subsequent growth and survival of fry in two small scale production systems: (i) natural incubation (NI), and (ii) egg collection followed by artificial incubation in upwelling glass funnels (AI). Cost benefits analysis was applied to the production figures to compare the economic viability of the two methods. The results were used to design a fry production system for the intensive production of Genetically Male Tilapia (GMT) from limited numbers of novel YY-male broodstock.

In the first experiment, 30 broodstock pairs per treatment (AI and NI) were placed in hapas, and eggs (every four days in AI) or fry (when released by females in NI) were collected over a 90-day period. There were 24% more spawnings among the females from which the eggs were collected compared to naturally incubating females, with significantly different mean spawning intervals (for those females that spawned) of 23 and 37 days respectively for AI and NI ($P<0.01$). Average spawning frequency for all females over the 90 day period was 1.53 for AI and 1.23 for NI but one third of females in both groups did not spawn during the experimental period. Egg collection indicated that the spawning females produced a mean of 11.3 eggs per g body weight. Mean fry number per g female was 9.66 for AI and 6.54 for NI indicating a significant increase ($P<0.01$) in fry survival up to the first feeding stage for AI (85%) compared to that estimated for NI (60%). Thus, bulk fry weight (per g female weight) was significantly greater ($P<0.05$) in the AI treatment even though artificially incubated fry were significantly smaller ($P<0.01$) than those naturally incubated. There was no correlation of egg or fry number, or egg or fry size with female weight in the AI (mean female weight 93.2 g) group but fry number was significantly positively correlated with female weight (mean: 97.2 g) in the NI group

[1]Adapted from a full paper: Mair GC, Estabillo CC, Sevillaja RC, Recometa RD. 1993. Small-scale fry production systems for Nile tilapia *Oreochromis niloticus* (L.). Aquaculture Fisheries Management 24:229-235.

In: Marte CL, Quinitio GF, Emata AC (Eds.). 1996. Proceedings of the Seminar-Workshop on Breeding and Seed Production of Cultured Finfishes of the Philippines. 4-5 May 1993,Tigbauan, Iloilo, Philippines. SEAFDEC/AQD, Tigbauan, Iloilo, Philippines. p.163-165.

($P<0.01$), indicating that larger (or older) females make better mothers. Total fry production was 31,120 for AI and 22,864 for NI.

In the second experiment, the quality of artificially incubated fry was directly compared with naturally incubated fry from the same family by partitioning the clutch into two parts. Approximately half of each clutch was removed from the female's mouth and incubated artificially while the remainder were naturally incubated. This procedure was repeated for five full-sib families. Growth and survival for these sibling groups stocked in hapas were monitored over a 30-day period. There were no significant differences in initial weight, final weight, growth increment, or survival between the artificially and naturally incubated sibling fry over this period. This indicated that the quality of artificially incubated fry is similar to naturally incubated fry.

Cost benefit analysis demonstrated that increased fry production more than compensated for the increased costs of artificial incubation. Allowing for labor and depreciation costs, egg collection followed by artificial incubation increased total net returns per 1,000 fingerlings, by almost 300%.

The conclusion from this study is that egg collection followed by artificial incubation produces highly significant increases in fry production. Additional advantages of this technique is that it enables greater control of production, permitting accurate estimation of fry numbers. Also, fry produced are of known age and therefore suitable for application of hormone treatment for the production of monosex male fingerlings.

The results of this study were utilized in the design of an intensive fry production system for genetically male tilapia (GMT) from novel YY-male broodstock at the pond site of the Freshwater Aquaculture Center of Central Luzon State University. There were few YY-males produced by genetic manipulation of the predominantly monofactorial sex determining mechanism in *O. niloticus,* so fry production was designed to utilize the maximum male:female broodstock ratio. Breeders are placed in 10 m^2 fine mesh hapas at a ratio of five YY males to 20 normal females. Eggs and fry are collected from incubating females every 7 days, at which time all females are replaced with a further batch of 20 females. The initial batch of females are conditioned for 14 days in 4 m^2 net cages. Thus, three batches of females are required to operate a 7-day spawning, 14-day conditioning, breeding cycle. These five YY males and 60 normal females (one batch of 20 spawning and two batches of 20 under conditioning at any one time) represent a spawning unit in which male to female ratio is maximized. During a brief period of operation from January to May 1993, egg production averaged 10,000 per spawning unit per month (this during the colder months when spawning is reduced). Preliminary trials with down welling incubators utilizing plastic mineral water bottles, however, were not successful. Mean fry survival rates, to the first feeding stage was only 45%. The practical and economic benefits of artificial incubation systems are dependent upon high rates of survival during incubation and this should be optimized and standardized prior to establishment of commercial systems.

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