# Optimizing Goldfish (*Carassius auratus*) Breeding and Larval Nurturing for Materialistic Aquaculture Utilizing Synthetic Hormones


## Abstract:

Gold fish (*Carassius auratus*) are familiar in India as an ornamental freshwater fish with economic importance. This experiment aimed to explore the possibility for mass-scale breeding and larval rearing of goldfish under biofloc setup. Natural brooders were collected, acclimatized and induced to breed utilizing synthetic hormones at various dosages. Breeding execution parameters namely spawning success, fertilization rate and hatching performance were analysed. The highest fertilization and hatching rate were gradually noticed at 80.8% and 80.9% by using a dose of 0.4ml/kg body weight for females and 0.2ml/kg for males. Larval rearing was accomplish by applying several live and formulated feeds across various life stages in normal rearing tanks and biofloc tanks also. The growth performance of larvae in biofloc tanks express a satisfactory rate , with a maximum weight gain of 7.1 g and length gain of 5 cm over 120 days compared to 5.1 g and 3.5 cm in normal tanks. Water quality parameters were kept within the optimum range all over the experiment. The functionable study exhibits the viability of captive breeding and mass scale larval nurturing of goldfish employing induced breeding techniques and biofloc technology.



Key Words: Gold fish, Induced Breeding, Biofloc, Production.


## 1. Introduction:

Today as an ornamental fish species, gold fish are supposed to be the most popular fish which kept in aquariums and outdoor ponds globally. Their vigorous colours, hardy nature and distinctive behaviour have built them a preferred among hobbyists and aqua culturists alike. Beyond their decorative value, goldfish also carry cultural significance in several traditions and have been the subject of particular breeding for centuries, ensuing in diverse captivating verities (Demir and Sarigoz 2016).

India is a leading country for production of ornamental fish due to its divergent aquatic ecosystem, suitable climate condition and intensive labour cost. With the emerging demand for ornamental fish in the aquarium business, there is a crucial need to develop effective and regenerative production methods for goldfish. Generally healthy and mature gold fish are preferred to meet the demand of commercial market (Lorenzoni et al.,) Conventional breeding practices frequently rely on natural spawning, which can be uncertain and production inconsistent results. Additionally the survivality and growth rate of goldfish larvae can be initiated by different factors such as water quality, feed composition and rearing conditions.

This research intended for evaluate the prospective for large-scale breeding and larval rearing of goldfish under captive conditions. By applying induced breeding techniques and advanced larval rearing systems, the researchers sought to flourish a reliable and systematic method for producing high quality goldfish on a commercial scale.

## 2. Material and Methods:

### 2.1. Collection and Acclimatization of Brooders and Observe Breeding Behaviour:

Adult goldfish brooders were collected from local water bodies utilizing normal fish capture techniques. The fish were transported to the research potential and moderately acclimated to captive conditions in specific designed holding tanks. Different physico chemical parameters like temperature, dissolved oxygen, pH, and ammonia levels were sharply monitored and maintained within optimal levels for goldfish. Fishes were kept in separate tank according their sexual variation and monitoring the sexual courtship under the captivity.

## 2.2. Artificial Breeding Setup and Procedures:

Brooders were precisely chooses based on their morphological characteristics and reproductive maturity. Both males and females were segregated and nurture in separate spawning tanks equipped with suitable substrates and ecological conditions helpful to breeding.

## 2.3. Hormone Administration Protocols:

For getting an expected result from induce spawning, synthetic hormones (HATCHME composition of SGnRH 0.002%, Domperidone 0.998%,Proylene Glycol 99.0%) were applied to the brooders. Distinctive doses synthetic gonadotropin releasing hormone analogue (SGnRHa) was checked to determine the standard dosage for successful breeding. The hormones were applied through intramuscular injections and the brooders were closely monitored for symptoms of spawning.

## 2.4. Larval Rearing Systems:

Two well defined larval rearing systems were constructed in this research: normal rearing tanks and biofloc tanks. The normal rearing tanks were furnished with specific aquaculture practices, while the biofloc tanks assimilate the principles of biofloc technology, which entail the promotion of useful microbial communities in the rearing water.

## 2.5. Feed Formulation and Feeding Regimes:

Larvae were fed a blend of live and artificial feeds at various stages of their growing period. Live feeds mainly artemia nauplii and rotifers were provided during the primary stages, while transition to artificial diets arise as the larvae grew. The formulated feeds were attentively framed to meet the nutritional demand of goldfish larvae, and feeding regimes were enhanced based on larval growth and development.

## 2.6. Sampling and Data Collection:

Uniform sampling was drive to monitor the survivality rate of the larvae, growth rate and water quality parameters. During the experimental period, length and weight measurements were checked out by predetermined intervals and survival rates were calculated by following survivality law which was counting the number of live larvae in each rearing system.

## 2.7. Water Quality Parameters:

Several water quality related parameters like dissolved oxygen, pH, ammonia, nitrite and nitrate levels, were checked regularly utilizing standard analytical methods. Adjustments were assembled as needed to maintain ideal conditions for larval growth and development.

## 3. Results and Discussion:

## 3.1. Observation of Sexual Dimorphism and Breeding Behaviour during Experiment:

In this experiment, sexual dimorphism and breeding behaviour of goldfish were recorded through continuous observation. Males express visible breeding coloration with prominent tubercles on the operculum and pectoral fins and female show bit fatter than normal. Especially courtship period, chasing and nudging behaviour was noticed.

**Figure 1: Difference between male (Left one) and female fish (Right one)**

### 3.2. Spawning Success, fertilization and hatching rates across treatment groups:

The evaluation reported the spawning success, hatching rates, fertilization rates achieved across distinct treatment groups, including different dosages of the synthetic hormones. The highest rate of fertilization and hatching rate were noted at 80.8% and 80.9% by applying the dosage of 0.4ml/kg body weight for females and 0.2ml/kg for males.

### 3.3. Growth Performance (Length and Weight gain):

Larval growth performance was checked by measuring the length and weight gain over time. The larval growth rate in biofloc tanks show a tremendous growth rate than the normal rearing tanks which was 7.1 g in weight and 5 cm in length at biofloc tanks compared to 5.1g in weight and 3.5 cm in length at normal tank over a 120-day period.

### 3.4. Larval Survival Rates in Different Rearing Systems:

The survivality rate of larvae in both normal and biofloc tank were monitored carefully during the research. According to the recorded data the survivality rate was higher in normal tank compared to biofloc tank.

**Table 1: Survivality of Goldfish under captivity**

| Tank size | Tank types | Number of fish | Survivality rate |
|---|---|---|---|
| 4''×1.5''×1'' | Hatchling Tank | 960 | 81.9% |
| 4''×1.5''×1'' | Nursery Tank | 787 | 83.8% |
| 4''×1.5''×1'' | Rearing Tank | 660 | 75.7% |
| 4''×2''×1'' | Biofloc Tank | 120 | 63.3% |

### 3.5. Water quality analysis:

During the experimental period different physico chemical parameter like temperature, dissolved oxygen, pH, ammonia, nitrite and nitrite levels were maintained both normal andbiofloc rearing tanks for getting optimal result from the experiment. Temperature ranges between 20 to 24°C, pH extent from 6-8 and ammonia noted as 0.01 to 0.05 ppm.

### Conclusion:

The focus of the research was to explore the potential applications of the findings from the experiment in the context of mass scale goldfish production. The recorded data indicate the feasibility of adopting induced breeding techniques and enhanced larval rearing systems for commercial-scale operations of goldfish considering economic viability and sustainability.

## Disclaimer (Artificial intelligence)

We, hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

### Reference:


Al-Noor, S. (2010). Population Status of Gold Fish Carassius auratus in Restored East Hammar Marsh, Southern Iraq. *Journal of King Abdulaziz University-Marine Sciences*, *21*(1), 65–83. https://doi.org/10.4197/Mar.21-1.3

Arindam, M., Paramveer, S,, Manas, M., Singh, M., Girish, T., & Gaurav, Tripathi. (2018). *Comparative study of gold fish (Carassius auratus) breeding via induced and natural breeding*. Unpublished. https://doi.org/10.13140/RG.2.2.15956.04484

Chanda, M., Paul, M., Maity, J., Dash, G., Gupta, S., & Patra, B. (2011). Ornamental fish goldfish,Carassius auratusand related parasites in three districts of West Bengal, India. *Chronicles of Young Scientists*, *2*(1), 51. https://doi.org/10.4103/2229-5186.79351

Demir, O., & Sarigoz, S. (2016).Development of feeding program for early larval stage of gold fish (*Carassius auratus). Turkish Journal of Fisheries and Aquatic Sciences*, *16*(2). https://doi.org/10.4194/1303-2712-v16_2_12

Faizullah, M. (2015). Impact of Biofloc Technology on the Growth of Goldfish Young Ones. *Indian Journal of Science and Technology*, *8*(1), 1–8. https://doi.org/10.17485/ijst/2015/v8i13/54060

Lorenzoni, M., Corboli, M., Ghetti, L., Pedicillo, G., & Carosi, A. (2007). Growth and reproduction of the goldfish Carassius auratus: A case study from Italy. In F. Gherardi (Ed.), *Biological invaders in inland waters: Profiles, distribution, and threats* (Vol. 2, pp. 259–273). Springer Netherlands. https://doi.org/10.1007/978-1-4020-6029-8_13

Mahapatra, B., Kavungal, V., & Mandal, S. (2013). *Production of Gold Fish, Carassius auratus (Linnaeus) and its Economics in Meghalaya*. J.Inland Fish.Soc.India. https://www.researchgate.net/publication/261525261

Patil, P. A., Dube, K., Verma, A. K., Chadha, N. K., Sundaray, J. K., & Jayasankar, P. (2019). Growth performance of goldfish, Carassius auratus and basil, Ocimum basilicum in media bed aquaponics. *Indian Journal of Fisheries*, *66*(1). https://doi.org/10.21077/ijf.2019.66.1.78353-15

Shete, A. P., Verma, A. K., Tandel, R. S., Prakash, C., Tiwari, V. K., & Hussain, T. (2013). Optimization of Water Circulation Period for the Culture of Goldfish with Spinach in Aquaponic System. *Journal of Agricultural Science*, *5*(4), p26. https://doi.org/10.5539/jas.v5n4p26

Walker, H. J., Ingole, B., Nayak, G. N., Wafar, M., Wafar, S., Yennavar, P., Bokuniewicz, H., & Lambeck, K. (2005). I. In M. L. Schwartz (Ed.), *Encyclopedia of Coastal Science* (pp. 542–571). Springer Netherlands. https://doi.org/10.1007/1-4020-3880-1_9

Pratiwy, Fittrie Meyllianawaty, and Dini Agustiani. 2023. "The Use of Fermented Feed on the Growth of Tilapia (Oreochromis niloticus): A Review". Asian Journal of Fisheries and Aquatic Research 21 (1):43-47. https://doi.org/10.9734/ajfar/2023/v21i1528.

Jitendrasinh , Rana Rushirajsinh, A. S. Kotiya, and Jungivala Mansi Dipakbhai. 2024. "Bioactive Feed Ingredients Used in Aquaculture: A Review". Journal of Scientific Research and Reports 30 (5):399-414. https://doi.org/10.9734/jsrr/2024/v30i51956.

Mangiamele LA, Thompson RR. Testosterone rapidly increases ejaculate volume and sperm density in competitively breeding goldfish through an estrogenic membrane receptor mechanism. Hormones and behavior. 2012 Jul 1;62(2):107-12.

Tacon AG, De Silva SS. Feed preparation and feed management strategies within semi-intensive fish farming systems in the tropics. Aquaculture. 1997 May 15;151(1-4):379-404.