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Research Article

A Review on Conservation Strategies of A Wonder Fish Asian Catfish *Clarias Batrachus* (Linnaeus, 1748) By Artificial Propagation Method

Abhishek Giri[1]* and Shriparna Saxena[2]

[1]*Department of Aquaculture, Sanjeev Agrawal Global Educational University, Bhopal-462022, Madhya Pradesh, India*

[2]*Professor and Head, Department of Aquaculture, Sanjeev Agrawal Global Educational University, Bhopal-462022, Madhya Pradesh, India*

Abstract

Due to its excellent nutritional content, *Clarias batrachus* is a common food fish on the Indian subcontinent. Numerous researchers have already studied the biology of this fish species' feeding and reproduction, but comprehensive knowledge on the subject is lacking. In order to compile the information that is currently accessible, a review of published literature on the induced breeding of *C. batrachus* has been done. Fish reproduction is significantly regulated by environmental conditions. Varied researchers are successfully testing pituitary gland extract, HCG, and synthetic hormones such as WOVA-FH, ovaprim and ovatide for the induction of fish reproduction under varied climatic situations, with differing degrees of success. A gap in knowledge has been identified for additional research, particularly in the age group differences in dietary preferences and the correlation between breeding periodicity and hydrological factors and photoperiod.

Keywords: Artificial propagation; Asian catfish; Brood stock; Clarias batrachus (Linn.); Synthetic hormone

Introduction

An accusatory statement against human civilization and overpopulation is made by global warming [1]. Food security and its sustained production have drawn praise from people all throughout the world for thwarting the subsequent pursuit. High output that is also sustainable may be an indicator of recent consequences. For instance, fish has historically been a significant source of protein in Bangladesh, making up around 60% of the daily diet's animal protein intake [2]. Fish that normally do not breed in still bodies of water do so when certain hormones or stimulants are injected into their bodies. This process is known as induced breeding. For certain fish that do not breed in captivity, induced breeding, also known as hypophysation or artificial propagation, has now solved the issue of fish seed production. The ripe brood fish are given certain stimulating chemicals or hormones throughout this phase, and the stimulation encourages the timely release of eggs and milk from these ripe breeders in captivity. Mohoshin Master founded the first fin fish hatchery in Jessore in 1967. One of the most significant types of freshwater fish in this delta is the catfish, and it is becoming more and more well-liked, indicating a bright future for commercial farming [3].

The richness of fish and other aquatic organisms in open water has been diminishing so much and so quickly as a result of natural and man-made risks that aquatic animals, especially fish, are unable to keep up [4]. The capture fisheries in Bangladesh's open waters are in grave danger today because of the destruction of the ecological balance, altering catchments, building of drainage facilities and flood control, siltation, soil erosion, washing of industrial pollutants, and agrochemicals. The capture fisheries in Bangladesh's open waters are in grave danger today because of the destruction of the ecological balance, changing catchments, construction of drainage infrastructure and flood control, siltation, soil erosion, washing of industrial pollutants, and agrochemicals. To prevent the extinction of the species, the reliance on hatchery-produced fry has grown quickly.

Aquaculture could benefit from the walking catfish, *Clarias batrachus* [5]. The availability of high-quality seed is one of the crucial prerequisites for every species' effective culture. In order to obtain the best possible quantity and quality of stocking material, induced spawning is always advised. With a total production of 4.621 million MT in 2020–2021, Bangladesh is one of the top fish-producing nations in the world [6]. In 2020–21, the fishing industry alone accounts for 1.35% of all export revenues. It also provides 3.52% to the GDP and 26.37% to the agricultural GDP [7]. With the rise in demand, fish culture is expanding swiftly. The need for fish seed is gradually rising in Bangladesh as more people start aquaculture businesses. Bangladesh is blessed with abundant water resources that exhibit a wide spectrum of natural diversity. Natural fishing resources are consequently dispersed across the nation. In India, Bangladesh, Pakistan, Indonesia, and other Asian nations, *Clarias batrachus* [8] is commercially valuable, readily available, and cultured [5,6] According to Ng and Kottelat [8] and Mir et al. [9], *Clarias magur*, a member of the Clariidae family, is a neotype of *Clarias batrachus* [3]. Because of its hardiness and endurance for harsh environmental conditions, its high density culture has a high productivity per unit area. Fish seed is still the essential component of controlled fish culture, but today's limits on growing this species include spontaneous captive breeding, a lack of high-quality seed, and reliance on wild seeds, which are

***Corresponding author:** Abhishek Giri, Department of Aquaculture, Sanjeev Agrawal Global Educational University, Bhopal-462022, Madhya Pradesh, India, E-mail: abhishekraju.giri@gmail.com

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unreliable, time-consuming, and uneconomical. In order to address these issues, it is believed that the only other approach for supplying and producing high-quality seed is induced spawning [10]. The size, flavour, and commercial value of the small catfish species are notable. They are found in lentic and lotic water basins, and during the monsoon, they naturally reproduce in perennial rivers. Even while certain catfish have been successfully bred and raised as larvae, commercial production of these fish has not yet been accomplished. Therefore, keeping catfish healthy is essential for accomplishing successful induced breeding. Therefore, the most important aspects of extending this species' culture are proper techniques for induced breeding and larval rearing for large-scale production of fry. Although some previous research on its induced breeding has been done, the methodologies available have not been standardized to be advised to farmers. The major goal of this review effort is to consolidate the disparate material and to identify the knowledge gaps that need to be filled in order to do additional research on this particular fish species. This review makes assumptions about the global composition of magur's triggered breeding hormones. With particular emphasis on the administration of its hormones, we have covered a thorough study and information on the induced breeding of magur.

Materials and Methods

Search engines including Google Scholar, Web of Science, Academia, and Scopus were utilized to look up various articles on *C. batrachus* artificial propagation. This lesson reviewed hormone administration, fertilization, and hatching rate based on various hormones in brood stock management, conditioning, inducing agents, and conservation. This review article will assist farmers in learning about the hormone preparation and induced breeding methods of *C. batrachus* so that they can produce a specific quantity of high-quality seed.

Results and Discussion

Management of the broodstock

According to Sahoo et al. [10]. C. batrachus broods were reared in ponds made of soil (0.01 hectare) and fed pelleted feed containing 30% crude protein at 2% of their body weight daily. In July and August, the female broods weighing between 120 and 130 g were chosen for induced breeding. In the Assamese district of Nalbari, farmers gathered brooders of magur bred in captivity in clay ponds. Fish meal-based diet comprising 30–35% protein at 3-5% of body weight was given to brooders twice daily. Magur 150 g body weight broodstock was employed for breeding. Although it occasionally depends on the release of the egg, farmers maintained the optimal sex ratio of 1:2 (male to female) for better rate of fertilization [11]. In the earthen ponds of the hatchery, magur fish were raised at a stocking density of 100 fish decimal-1 for the development of broodstock, according to Khan et al. [12] To make the fish sexually mature, a high protein (32%) commercial diet rich in vitamins (A, B, C, and E) was applied twice daily at a rate of 3–5% body weight. When Magur was a year old and weighed about 100 g, he became sexually mature. Due to the presence of mature, hefty eggs, females may be clearly identified during breeding season by their soft, bulging abdomen. Males, on the other hand, can be distinguished by their long, protruding genital papillae and flat abdomen [13]. Fish eggs were taken from a local fish farm in West Bengal, India, during the breeding season (July-August), and the eggs were healthy and gravid. Males were chosen based on their round, reddish genital papillas, soft abdomens, and uniformly sized intra-ovarian oocytes, whereas females were chosen based on their pointed (Figure 1), reddish genital papillas [14].

Figure 1: Sex identification of *Clarias batrachus*.

Dhara and Saha [15] smeared healthy, disease-free pregnant males (average length: 26 cm, weight: 160 gm), and females (average length: 25 cm, weight: 220 gm). Induced breeding was carried out on Clarias batrachus (Order: Siluriformes; Family: Clariidae). The choice of the gravid fish was based on its outward morphological characteristics. A soft, enlarged belly, a crimson vent, and a small, button-shaped, slit-like genital papilla were all indicators of a gravid female fish. The size uniformity of the eggs released by the slight pressure on the enlarged belly was used to assess the female's prime maturity. Males who were fully pregnant may be recognised by their slender, stream-lined bodies and conical, elongated genital papillas with pointy, scarlet tips.

Administration of hormones

(Table 1) outlined the comparison research of the Carp Pituitary Extract (CPE) and several synthetic hormones used to induce breeding in Clarias batrachus by various authors. The Asian catfish, Clarias batrachus, also referred to as the "magur fish" locally, is a significant air-breathing fish with a high market value. This catfish has been affected by the lack of marketable fish and seeds from the natural ground. Because rice fields serve as the primary spawning sites for this fish, the likelihood of obtaining magur seed from natural sources has decreased as a result of the increasing use of pesticides there. The effectiveness of breeding in captivity is determined by the type of hormone used, its potency, the hormone dose, and the fish's maturity level, which all depend on the fish's reproductive performance. One of them, Human Chorionic Gonadotropin (HCG) at 14–23 h latency in combination with a dosage of 3000–4000 IU HCG, was efficacious in inducing ovulation in catfish. Maximum egg output during induced breeding is always produced by the proper dosage of the inducing substance and the appropriate length of the stripping period. The best results were achieved with a single injection of 0.6 ml/kg body weight of ovaprim (Figure 2).

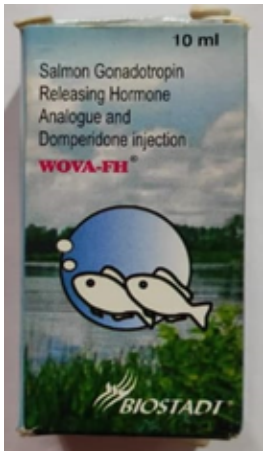

Figure 2: Synthetic hormone (Wova-FH) for artificial propagation of fish.

S.N.	Hormone	Dose	Fertilization rate (%)	Hatching rate (%)	References
1	Ovaprim	1.0-2.0 ml/kg	70.6-72.8	55.3-66.7	Srivastava *et al*. [1]
2	Ovatide	1.0 ml/kg	83	71	Sahoo *et al*. [16]
3	Ovaprim	1.0-1.5 ml/kg	-	-	Sahoo *et al*. [17]
4	Ovatide	1.0 ml/kg	82.33	55.35	Sharma *et al*. [18]
5	Ovaprim	1.50 ml/kg	79.48	63.17	Rajbongshi *et al*. [11]
6	GnRHa	1.5 ml/kg- 1st dose 2 ml/kg- 2nd dose	-	-	Chakraborty [19]
7	Pituatary gland extract	50 mg/kg- Male 120 mg/ kg-Female	80	71	Dhara and Saha [15]
8	Ovaprim	0.4-1.0 ml/kg- Male 0.8-2.0 ml/ kg-Female	77	65	Dhara and Saha [15]
9	Ovaprim	0.5-1.0 ml/kg- Male 1.0-2.0 ml/ kg-Female	70.6-72.8	55.3-60.7	Srivastava *et al*. [1]
10	Ovaprim	1.50 ml/kg	78	84	Hussain *et al*. [20]
11	Pituatary gland extract	5 mg/kg- 1st dose 15 mg/ kg- 2nd dose	40.65	20.33	Taslima and Ahmed [13]
12	HCG	5000 IU/kg	60.47	50.65	Taslima and Ahmed [13]
13	Ovaprim	0.02 ml/100 g- Male 0.08 ml/100 g-Female	78.10	89.65	Hossain *et al*. [21]
14	Ovupin	1 ml/kg	78.20	54.93	Khan *et al*. [22]
15	Flash	1 ml/kg	93.09	75.77	Khan *et al*. [3]
16	HCG	2272 IU	81.60	64.41	Khan *et al*. [22]
17	Ovatide	1 ml/kg	80±2.1	75±2.5	Jagtap and Kulkarani [23]
18	Ovaprim	0.6 ml/kg	93.16	55.10	Das [24]
19	HCG	3000-4000 IU	-	-	Sahoo *et al*. [25]
20	Ovaprim	2.0 ml/kg	97.08±2.6	87±2.1	Sahoo *et al*. [26]
21	Ovaprim	2.0 ml/kg	91.06	79.18	Bordoloi [27]

Table 1: Comparative analysis of the Carp Pituitary Extract (CPE) and synthetic hormones used to encourage breeding in catfish Clarias batrachus by various authors.

A single dose of 0.1–0.2 ml/kg body weight was administered to the men. Again, spawning was successfully induced by the administration of fish PG at dosages ranging from 12 to 30 mg/kg fish weight given in two doses: a provocative dose of 5–10 mg/kg and a final dose of 8–20 mg/kg given at a 5- to 6-hour interval. When feeding termites twice daily with a 1:1 mixture of rice bran and mustard oil cakes, hapa nursing of magur animals had an average survival rate of 51% [28]. Male fish with gravid testes were slaughtered before the females were removed, and the testes were removed and macerated in ordinary saline (0.9% sodium chloride). In this medium, the spermatozoa became inactive, and the extract could be kept for a short time in the refrigerator. Female fish were stripped and their eggs were retrieved on a dry enamel dish after a 16-hour latency period. The addition of fresh water activated the milt (spermatozoa) extract medium prior to fertilisation. Sperms started to move and their motility was observed under a microscope. So prepared sperm was adequate to fertilise the ova taken from two females. Gametes were carefully combined with bird feathers and sperm extract before being sprinkled over the eggs and given two to three minutes to fertilise. Fertilised eggs were moved to hatching trays for incubation after being repeatedly washed in freshwater [29]. In the Asian catfish *C. batrachus*, Chakraborty [19] reported the plasma steroid profiles during oocyte maturation and LHRHa pimozide-induced ovulation. He concluded that the levels of estradiol-17ß and estrone rapidly increased, peaking during the vitellogenic phase, while a decline was seen during the spawning phase. Hussain et al. [20] also discovered that 1.50 ml/kg of ovaprim was efficient in causing ovulation in *Clarias batrachus*. Hossain et al. [21] discovered that *Clarias batrachus* effectively ovulated after receiving first doses of 10.0 mg PG/kg body weight and second doses of 45.0 mg. On the other hand, Rao and Karamchandani [30] showed that 30-60 mg PG/kg body weight improved the breeding response of 140-260 g catfish.

Using HCG at a rate of 4000 IU/kg of body weight during breeding operations also led to an experiment [31] Khan et al. [22] conducted experiment to monitor the three growth hormones viz., Ovupin (100 mg dom- pridone and 0.2 mg S-GnRHa) at the rate of 1 ml.kg-1 body weight, Flash (20 mg S-GnRHa, 10 mg dompridone and propyl- ene glycol) at the rate of 1 ml.kg-1 body weight and Human Chorionic Gonadotropin (HCG) hormone at the rate of 2272 IU.kg-1 body weight on breeding performances. Sahoo et al. [17] showed that domperidone combined with an injection of SGnRHa could successfully stimulate spawning in *C. batrachus*. The Asian Catfish, *Clarias batrachus*, was reared as a larva for 21 days in an indoor hatchery under the observation of Srivastava et al. [1].

They claimed that with ovaprim at 1.0-2.0 ml/kg body weight for females and 0.5-1.0 ml/kg body weight for males, fish were successfully induced to breed. At the spawn stage, the percentages of fertilisation, hatching, and survival were, respectively, 70.6-72.8, 60.7-55.3, and 54.3-56.2. Pituitary gland extracts (40 and 120 mg/kg body weight for females and 25 and 50 mg/kg body weight for males) and Ovaprim (0.8 and 2.0 ml/kg body weight for females and 0.4 and 1.0 ml/kg body weight for males) were used in breeding experiments on *Clarias batrachus* by Dhara and Saha [15] at 26o, 28o, and 30oC. When carp pituitary gland extracts were administered into *Clarias batrachus* at a rate of 50 mg/kg of male body weight and 120 mg/kg of female body weight at 28 °C with a 15-hour latency period, the highest rates of fertilisation (80%) and hatching (71%) of eggs were observed. At 28°C and the higher doses of ovaprim, the fertilisation and hatching rates were 77% and 65%, respectively. In a laboratory setting, Jagtap and Kulkarni [23] evaluated the *Clarias batrachus* breeding success at various ovaprim doses. On male and female fish, different doses of ovaprim were attempted; the best response was seen at doses of 1 ml/kg of female body weight and 0.5 ml/kg of male body weight. [32-34] Weights of the brooders ranged from 250 to 450 g. Breeding response was investigated using several criteria, and results showed that latency period (h), fecundity, fertilisation, and hatching (%) were, respectively, 121.2, 4500150, 802.1, and 752.5.

Conclusion

Using CPE, HCG, ovaprim, and ovatide, *Clarias batrachus* was able to produce healthy larvae. The genetic resources of *C. batrachus*

must be preserved for food and aquaculture in a sustainable manner. The main barrier to the cultivation of this species is the lack of fish seeds and the lack of adult brood fishes. Through induced breeding, this issue can be resolved in terms of both seed production and aquatic habitat cultivation. The prevalent practise of using synthetic inducing hormones for successful ovulation followed by stripping has been investigated by a number of researchers in Bangladesh. According to FAO estimates, there is a rising global demand for catfish, and Asians in particular continue to favour *Clarias batrachus* due to its many health benefits. Additionally, government agencies and fish geneticists should collaborate in order to safeguard this species' genetic resources against unintended hybridization, to which it is highly susceptible.

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