

An Overview on Feeding Habit, Reproductive Biology and Induced Breeding of *Ompok bimaculatus* (Bloch, 1794)

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Abstract: *Ompok bimaculatus* is a freshwater catfish, used to occur naturally in streams, rivers, lakes, ponds, canals and inundated fields. It is a popular food fish in South and South-East Asian countries especially due to its good taste and high nutritional value with good amount of protein, lipid and mineral content. Recently it has also been reported to have moderate demand among the ornamental fish hobbyists. Earlier few works have been documented on food and feeding habit, reproductive biology and induced breeding of this fish species; but so far no such consolidated review report is available on these aspects. So with this view, the current report has been prepared to sum up all those previously documented information along with pointing out the lacunae of information further study of which will be beneficial for fishery and conservation perspective for this fish species in near future.

Key words: Feeding Habit • Induced Breeding • Reproductive Biology • *Ompok bimaculatus*

INTRODUCTION

Ompok bimaculatus (Bloch, 1794) is a catfish belongs to the family Siluridae under order Siluriformes. It's a freshwater fish used to occur naturally in streams and rivers with sluggish to moderate movements, lakes, ponds, canals and inundated fields [1, 2] and is widely distributed throughout India, Bangladesh, Nepal, Sri Lanka, Afghanistan, Pakistan, China, Thailand, Java, Laos, Malaya, Myanmar, Sumatra, Vietnam, Yunnan, Cambodia and Indonesia [3-5]. This fish species is commonly known as Indian butter catfish [1, 6]. It is a highly priced and popular food fish due to its good taste and nutritional value with good amount of protein, lipid and mineral content in its flesh [7, 8]. Recently it has also made its entry in ornamental fish markets of India and has been reported to have moderate market demand among the hobbyists [9, 10] and has been reported to become exported from India in international ornamental fish markets [11]. At present in nature this fish species is facing high risk of extinction as over the last 10 years its wild population has undergone a steady decline (>50%) due to over exploitation mainly due to indiscriminate fishing during the breeding season, disease, pollution,

siltation, poisoning, loss of habitat etc. It has been listed among the 97 endangered fish species of India according to CAMP report [12] and is under near threatened category as per IUCN Red list [13].

Captive breeding is one among the major steps so far has been suggested by the experts to conserve any fish species. But to get success in captive breeding of any fish species, proper information on its feeding habit and reproductive biology is needed. Apart from this, proper knowledge on the dose of inducing agent (for induced breeding) is also required. Earlier few works have been carried out on feeding habit, reproductive biology and induced breeding of *Ompok bimaculatus*, but no such consolidated report is available on these aspects. So with this view the current report has been prepared to note down all these available information with pointing out the information lacking further study of which will be helpful for its fishery and conservation management.

Morphological Characters: Talwar and Jhingran [3], Jayaram [5] and Day [14] have well documented the morphological characters of *Ompok bimaculatus* which has been summarized below:



Fig. 1: A fresh specimen of *Ompok bimaculatus*.

Body is elongated and strongly compressed; body depth 3.7-5.6, head length 4.7-7.1 in standard length. Eyes are small; diameter 4-7.5 in head length, 2.5-5 in inter-orbital width and 1-2 in snout length. Median longitudinal groove on head is not reaching the base of occipital process. Occipital process is longer than broad at base and not reaching basal bone of dorsal fin. Mouth is large and oblique; the lower jaw is very prominent, the width of the gape of the mouth equals the postorbital length of the head or behind the middle of the eyes. Teeth are villiform on jaws, depressible, sharp and pointed backwards, sometimes large and prominent, sometimes small, velvet like; vomerine teeth are in two oval patches with a considerable inter-space between. Barbels- Two pairs of barbels; maxillary pair is longer than head length, extend to or slightly beyond anal fin origin; mandibular pair is short, sometimes rudimentary. Fin- Rayed dorsal fin is short, inserted above half length of pectoral fin without any spine. Pectoral fin is as long as the head behind the middle of the eyes or as the postorbital length of the head; and strongly or feebly serrated internally, or even entire. Pelvic fin reaches up to anal fin. Anal fin is long, inserted well behind dorsal fin, separated from the caudal by a narrow notch. Caudal fin is deeply forked, lobes are pointed; upper lobe is conspicuously longer than the lower. Color- Skin is smooth. Silvery shot with purple, dorsally dark gray-green to brownish with a tinge of golden yellow; a large dusky spot is present on shoulder behind the gill-opening and above the middle of the pectoral fin; a small black spot is also present on caudal peduncle just above the lateral line; often a dark transverse bar is present across the base of caudal fin. Fins are pale golden in color; occasionally the caudal fin is edged with gray and its tips are black.

Food and Feeding Habit : Studying the food and feeding habit of *Ompok bimaculatus*, some workers [15-18] have reported it as a carnivorous fish while Mishra *et al.* [6], Sivakami [19] and Arthi *et al.* [20] have reported it as an omnivorous fish.

From Mekong River in Cambodia, Rainboth [16] has reported that *Ompok bimaculatus* used to feed on crustaceans, fish and molluscs while Hanjavanit and Sangpradub [17] and Sangpradub *et al.* [18] have reported insectivorous nature of this fish species. Sivakami [19] and Parameswaran *et al.* [21] earlier also have reported insectivorous nature of *Ompok bimaculatus*. Hanjavanit and Sangpradub [17] have documented aquatic insects, zooplankton, ostracods, fish, shrimps, plant materials and algae as primary food for this fish species in order of preference while Sangpradub *et al.* [18] have documented aquatic insects, shrimps, fish, oligochaetes, plant parts and algae as preferred food for this fish species. Sivakami [19] also has reported its preference mainly for insects in his study at Bhavanisagar reservoir, Tamil Nadu. Arthi *et al.* [20] have documented fish as the mostly preferred food item followed by vegetable matter, crustacean adults, crustacean nymphs, crustacean larvae, insects, molluscs and miscellaneous organisms for *Ompok bimaculatus* in their study at Amaravathy River, Tamil Nadu. They also have reported no change in food habit between juveniles and adults of this fish species. Piscivorous feeding habit has also been reported by Qayyum and Qasim [15]; they have reported fish (more than 60% of the diet) and insects along with crustacean (Prawn) to form the main food for this fish species. Fish species mainly *Puntius ticto*, *Puntius conchoni*, *Puntius stigma*, *Esomus danricus*, *Chela* sp., *Trichogaster* sp., *Mystus* sp., *Rohtee cotio*, *Amblypharyngodon* sp. and insects belong to the orders Orthoptera, Hymenoptera, Coleoptera, Odonata,

Hemiptera, Ephemeroptera, Plecoptera etc have been documented from its gut content. They also have reported it as a surface and selective feeder. Cannibalistic nature of this fish species has been reported by Parameswaran *et al.* [21].

Change in feeding intensity with breeding periodicity has been reported by Qayyum and Qasim [15], Sangpradub *et al.* [18], Arthi *et al.* [20] and Rao and Karamchandani [22] for *Ompok bimaculatus*; low feeding activity has been reported during breeding season while high feeding activity has been reported during pre and post spawning period.

Sexual Dimorphism: Parameswaran *et al.* [23] first have documented the sexual dimorphic characters of *Ompok bimaculatus*; they have reported that in male pectoral fin is with a strong internally serrated spine while in female it is feebly serrated. Rao and Karamchandani [24] have added few more features on this aspect. They have documented that in male, pectoral fin is strong and hard, laterally flattened, broad and somewhat thick along the entire length, abruptly tapering into blunt spine, inner edge of the spine with strong and prominent serration; in female, pectoral fin is weak and flexible, thin and narrow along the entire length, gradually tapering into sharp spine, inner edge of the spine feebly serrated or nearly smooth. They also have reported that in male, genital papilla is a small outgrowth but in female, it is somewhat fleshy and comparatively larger in size, almost double in size that of the male. In male, it is visible only during the breeding season. Later Kurian and Inasu [25] have documented some other sexual dimorphic characters of *Ompok bimaculatus*. They have reported that female of *Ompok bimaculatus* is nearly two times longer and five times heavier than the male of the same age group. Dorsal profile of the head of the male has a clear downward slope while dorsal profile of the head is more or less straight in the female. A conspicuous wide crescent shaped groove is present on the ventral side of the head in female while it is absent in male. The lateral line in the female has a downward bend somewhat at the middle of the body, while the lateral line is straight in male in the middle portion and it sloped downwards only near the operculum. Eyes of the female are bulged conspicuously, while the male has very small eye balls. The maxillary barbels in female do not extend beyond the pectorals while the maxillary barbels in male extend beyond pectorals. Central rays of the caudal fin in female have dark longitudinal stripes while these stripes are absent in

male. The entire skin of the female is darker than that of the male. Later Banik *et al.* [7] have documented that males are with elongated and pointed genital papilla while the same is rounded in females; pectoral fin spine is longer and thicker in males than the females.

Sex Ratio: Female dominance over male has been reported in *Ompok bimaculatus* by Qayyum and Qasim [15] and Arthi *et al.* [26]. On the other hand, Mishra *et al.* [6] and Rao and Karamchandani [22] have documented female and male with equal proportion in their studied population.

Fecundity: Rao and Karamchandani [22] and Arthi *et al.* [26] have reported fecundity range of 3,393-54,747 and 1,831 to 19,446 respectively for *Ompok bimaculatus* while Parameswaran *et al.* [21] have reported relative fecundity of 221/g of body weight for this fish species.

Length and Age at First Maturity: Qayyum and Qasim [15] have reported 10 cm and 11 cm as length at first maturity for male and female of *Ompok bimaculatus* respectively while Mishra *et al.* [6] have reported 22.3 cm and 23.2 cm for the same. Rao and Karamchandani [22] have reported 21 cm as length at first maturity for female of *Ompok bimaculatus* at Kulgarhi reservoir, Madhya Pradesh. Sivakami [27] has reported minimum size of maturity for male and female is 23 cm and 24 cm respectively in this fish species.

Regarding age at first maturity, Debnath *et al.* [2] and Qayyum and Qasim [15] have reported *Ompok bimaculatus* to become mature at the end of first year of its life. All these workers have reported early maturation of male in respect to female in this fish species.

Gonadal Maturity Stages: On the basis of observation of the external gonad morphology, Qayyum and Qasim [15] have documented five maturity stages for both male and female of *Ompok bimaculatus*; these are immature, maturing virgin/recovered spent, ripening, ripe and spent. On the basis of microscopic appearance of ova and macroscopic gross examination of the ovaries, Rao and Karamchandani [22] have documented eight maturity stages in *Ompok bimaculatus* namely immature, maturing A, maturing B, maturing C, mature, ripe, partly spent and spent & resting. Based on the general appearance, extension in the body cavity and the colour of the gonads Arthi *et al.* [28] have reported four maturity stages for both male and female of *Ompok bimaculatus*;

in male these are immature, maturing, mature and spent while in female these stages are immature, maturing, mature and ripe.

Breeding Periodicity: Sivakami [19] has reported *Ompok bimaculatus* to breed throughout the year with peak spawning activity in October at Bhavani Sagar reservoir, Tamil Nadu. Rao and Karamchandani [22] have reported July to August as its spawning season at Kulgarhi reservoir, Madhya Pradesh. Qayyum and Qasim [15] have reported July-August as spawning season for this fish species at Aligarh, Uttar Pradesh. Arthi *et al.* [28] have reported that *Ompok bimaculatus* used to breed throughout the year with peak spawning activity during the month of August and September at Amaravathy River, Tamilnadu. Mishra *et al.* [6] have reported June to July as its spawning season at Ghaghara River, India. Debnath *et al.* [2] have reported June to August while Banik *et al.* [7] have documented June to late July as its breeding season in Tripura. Renunuan and Silapachai [29] have documented July to September as spawning season for *Ompok bimaculatus* at Nong Koh reservoir, Chonburi Province, Thailand.

Debnath *et al.* [2] and Qayyum and Qasim [15] have reported single spawning nature of *Ompok bimaculatus* while Rao and Karamchandani [22] have reported it as a multiple spawner.

Induced Breeding: Over last few years, number of workers has tried to induce breed *Ompok bimaculatus*; most of them have used ovaprim as the inducing agent. Sridhar *et al.* [1] have tried to induce breed *Ompok bimaculatus* using ovaprim at a dose of 0.5 ml/kg of body weight in both males and females; spawning has been reported to occur after 5-6 hours of injection; 3,874-4,150 eggs have been reported to spawn; fertilization rate of 75% and hatchling survivability rate of 55-60% have been documented in this trial. Banik *et al.* [7] have tried to induce breed this fish species using different doses of ovaprim and have found that dose of 1 ml/kg of body weight in female and 0.5 ml/kg of body weight in male is the best in respect to the fertilization rate (80%) and hatching success (72%) achieved. Chaturvedi *et al.* [30] have used ovaprim to induce breed at a dose of 0.06ml/100 gm of body weight in males and 0.12 ml/100 gm of body weight in females; latency period for breeding has been reported to be 10-12 hours of the intraperitoneal drug administration; 10,300 fertilized eggs have been documented to recover with fertilization rate ranging

between 70-80%. Comparative high rate of hatching success has been reported in flow-through hatchery (80%) in respect to conventional hapa (40%) in this experiment. Debnath *et al.* [2] have also documented successful induced breeding of this fish species using ovaprim at a dosage of 1-1.5 ml/ kg of body weight for females and 0.5-1.0 ml/kg of body weight for males. Pradhan and Barman [31] have induced bred it with ovaprim at a dose of 1.0 ml/kg of body weight in female and 0.5 ml/kg of body weight in male. They have documented better larval survivability (62%) while larvae were fed with artemia nauplii than fed with zooplankton (47%). Apart from ovaprim, some other inducing agent has also been used for this purpose, Raizada *et al.* [32] have reported successful spawning of *Ompok bimaculatus* in captive condition using sGnRH analogue and dopamine antagonist at a dose of 0.7 ml /kg of body weight in female and 0.5 ml/kg of body weight in male; fertilization and hatching rate of 75-90% and 80-90% respectively have been documented by them while nurturing in flow through system.

Concluding Remarks: Considering the information summed up here in this report it is quite clear that in respect to the food and feeding habit of *Ompok bimaculatus* till date no such firm conclusion is there; some workers have reported it as carnivorous fish while some others have documented its omnivorous feeding habit. Regarding its food preference, some have reported its insectivorous feeding nature, while some others have documented it as piscivorous fish. This kind of contradiction regarding food and feeding habit has also been reported earlier for some other fishes [33-36]. So, more detailed study is required to put proper information on food and feeding habit of *Ompok bimaculatus*. In this regard, morpho-histology and enzyme profile analysis of the digestive tract can be studied in respect to different size and stage which could be effective to put some knowledge not only on food and feeding habit but also change of the same in respect to size and stage if any for this fish species. This information will also be helpful for successful rearing of fry, juveniles and brood stock in captivity.

In respect to reproductive biology, though information available on sexual dimorphic characters are sufficient; not much works so far have been done on sex-ratio and fecundity of this fish species. Further analysis is needed in these aspects to get proper information. Regarding length at first maturity, though some

information is available but nothing can be finally concluded from this available information. In this regard, information provided by Mishra *et al.* [6] is completely different from the information documented by Qayyum and Qasim [15]; though their result is too some extent similar with the result documented by Rao and Karamchandani [22] and Sivakami [27]. Length at first maturity depends on number of factors like habitat, season, food availability, hydrological parameters etc.; these factors could be behind this variation. So, considering all these factors further study is needed to get proper information on length at first maturity for *Ompok bimaculatus*. Information available on gonadal maturity stages is also not conclusive enough; Qayyum and Qasim [15] and Arthi *et al.* [28] have documented five and four maturity stages respectively for both sexes of this fish species while Rao and Karamchandani [22] have reported eight maturity stages for female only. Most of these workers have documented information on this aspect mainly by observing the external gonad morphology which itself is a very crude technique; monthly study on variation in percentage of different stages of intra-ovarian ova and histological analysis should be done to make a definite conclusion in this issue. Spatial variation in respect to breeding periodicity has been documented for *Ompok bimaculatus*; in Tamil Nadu this fish has been reported to breed throughout the year while in Tripura and central India it used to breed during the monsoon season. This variation in breeding periodicity may be due to number of factors like variation in habitat, food availability, initiation timing of monsoonal rainfall, hydrological parameters etc.

So far good number of works have been carried out on induced breeding of this fish species; considering all these works, it can be suggested that application of ovaprim at a dose of 1.0 ml/kg of body weight in female and 0.5 ml/kg of body weight in male is effective to get success in its induced breeding. Raizada *et al.* [32] have recently reported successful spawning of *Ompok bimaculatus* in captive condition using sGnRH analogue and dopamine antagonist which has added a new dimension regarding its captive breeding.

Even after its high demand as a food fish and hardy and tolerant nature; *Ompok bimaculatus* has not received that much attention in aquaculture due to unavailability of gravid brood stock for experimentation, lack of information on its feeding and breeding biology, larval rearing and culture technology. High mortality rate during the period of larval rearing is the most serious problem as

has been reported for commercial production of this catfish species [7]. Success achieved so far in its induced breeding experiments can be considered as a silver line but further study is needed to get success in larval rearing. In this respect, recent experiment by Banik *et al.* [37] can be considered as a path finder who has reported better survivability and growth of larvae when fed with live mass cultured zooplankton along with tubifex. Chawpaknam *et al.* [38] have also reported a better growth and higher survival rate when fry of age 3-15 days were fed with *Moina* than those fed with egg custard. Pradhan and Barman [31] have also documented better larval survivability when larvae have been fed with artemia nauplii than fed with zooplankton. So, these food components can be supplied during the early larval stages to promote growth as well as to increase survivability. Regarding culture potential of this fish species with other fishes, earlier no such work has been carried out; but recently a preliminary experiment has been conducted on this aspect at ICAR, Tripura centre which has shown that Indian Major Carps i.e. *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* are well compatible with this catfish and a total production of over 1,000 kg of fish/ha in 180 days could be achieved at a species composition of 40% catla, 30% rohu, 15% mrigal and 15% butter catfish at a stocking density of 4,000 fish/ha [2].

So, finally it can be concluded that further studies are needed to get the information which are so far lacking mostly on different aspects of reproductive biology and fry rearing, not only to promote its fishery but also for its proper conservation management.

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