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## Feeding and reproductive biology of blue perch, *badis badis* (hamilton, 1822) under captivity

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### Abstract

Feeding and reproductive biology of Blue perch, *Badis badis*, were studied for domestication and captive maturation under captivity. For captive maturation semi-natural habitat for fish were made with the help of sandy bottom, gravels, stones along with plantation of some of the ornamental plants and were stocked in 02 different systems i.e., flow through system (75 cm length × 45 cm width × 25 cm water height; 85 lit approx) and Cement cistern (180 cm length × 95 cm width × 45 cm water height; 770 lit approx). A total number of about 464 specimens of *B. badis* belonging to the size ranges of 16.5-59.3 mm and 0.05-2.52 g were taken for this present study. The RLG value was found increased with the increase of total body length. The average GaSI was found to be  $4.76 \pm 1.27$ . Sexual dimorphism is well marked by their colour pattern, adult males display bright colour with 5 pairs (10 nos.) of black stripes visible on the body.

**Keywords:** Blue perch, *Badis badis*, feeding and reproductive biology, captivity

### 1. Introduction

The dwarf chameleon fish or blue perch, *Badis badis*, commonly known as Chameleon fishes (Badidae) under order Perciformes, plays a significant role among the small ornamental fish. Due to their beautiful colour and as well as easy maintenance the fish is very much popular to the aquarists. Among the indigenous ornamental fish, *Badis badis* is one of the most high demand aquarium fish for both local and export market. Price in local market varies between Rs. 8/- to 12/- per piece<sup>[12]</sup> whereas the export value is 1-2 US\$ per piece<sup>[3]</sup>. Due to their small size, they can be raised in aquarium throughout their life span and thereby this species can be regarded as a 'classified ornamental fish'. *Badis badis* is under the perch like group which belonging to two genera: *Badis* (twenty four species) and *Dario* (six species)<sup>[6]</sup>. *Badis* is Lay in ancient which means "the colour of swift" refers to its special body colouration. In 1822 Hamilton described this species without preserving any specimens, to avoid confusion with similar congeners Kullander and Britz<sup>[9]</sup> designated a neotype, collected from the Tumapao River, a tributary of the Ganges located 65 km north of Calcutta. The fish is mainly tropical fish. The fish was once widely distributed in the northern part of the Indian subcontinent. As per IUCN (assessed: 26<sup>th</sup> March, 2010)<sup>[8]</sup>, the species currently is in Least concern condition but declining sharply due to habitat loss and over exploitation. The Assessor(s) give the justification of this species assessment i.e. *Badis badis* has a very wide distribution and although it is extensively fished for ornamental trade, until further information is available on the impacts of harvest on the species, it is assessed as Least Concern. *B. badis* commonly inhabits paddy fields, ponds and small streams and are found to be distributed in all the North Eastern States of India<sup>[11]</sup>. Now it is also known to be native to the Ganges river system and its tributaries in Nepal and Bangladesh. About 50-60 years ago plenty of this fish was available in the market as common food fish collected from the natural riparian wetland habitats<sup>[12]</sup>.

### 2. Materials and methods

#### 2.1 Collection of the fish

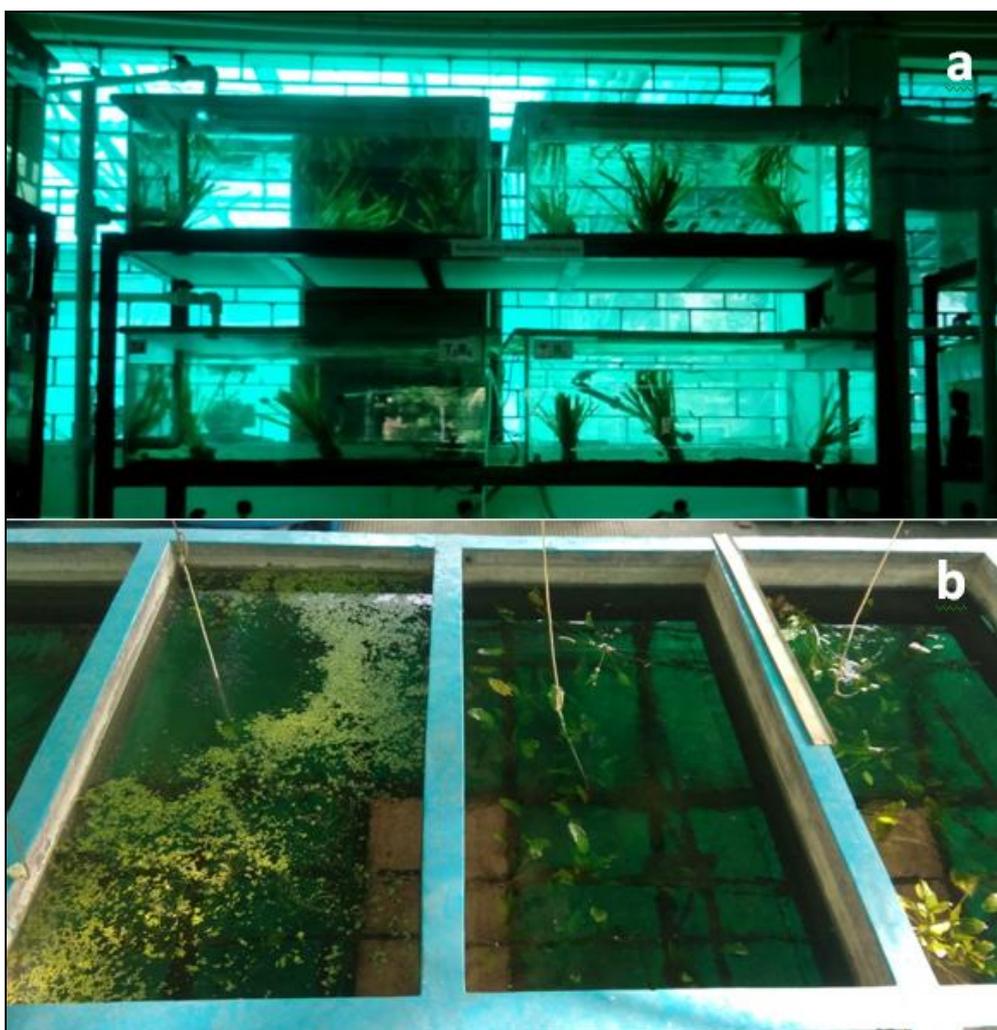
A total numbers of 464 specimens of *B. badis* belonging to all available size classes were taken to "Ornamental Fish Research Centre" of ICAR-Central Institute of Fisheries Education, Kolkata Centre for this present study during March, 2016 to February, 2019. They

were collected mostly from Dattafuliya of North 24 Parganas, situated at West Bengal and Bangladesh border.

## 2.2 Experimental setup through bio-mimicry for captive rearing

The fish were stocked in 02 different systems after acclimatization. i.e., RAS (flow through system) with the dimension of 75 cm length × 45 cm width × 25 cm water height (water volume – 85 lit approx) and Cement cistern (confined system) with the dimension of 180 cm length × 95 cm width × 45 cm water height (water volume – 770 lit approx) (Fig. 1). The average size of stocking was about 1.5

cm with the body weight of around 250 mg. The habitats for fish were made with the help of sandy bottom, gravels, stones along with plantation of some of the ornamental plants like Amazon, *Vallisneria*, *Hydrilla* in RAS system while apart from above the *Lemna*, *Cabomba*, *Hydrilla*, *Cryptocorine*, *Ceratophyllum* and *Salvinia* were planted in the cement tanks. The depth of water was maintained about 1 ft. in the cement tank. The fish were fed with Plankton, *Artemia* naupli, Tubifex and chlorella twice a day. The following two broad aspects were undertaken to conduct the study of *Dario dario* species i.e. habitat ecology and biological aspects of the fish.



**Fig 1:** Captive rearing and maturation of *Badis badis* under seminatural in (a) RAS (flow through system) and (b) Cement cistern (confined system)

## 2.3 Sample collection and preservation for biological studies:

For biological studies fish samples were collected from the experimental setup on monthly basis. After collection serial photography was made by Sony DSC W800 camera and fishes were preserved in 5% formaldehyde solution. Total length (mm) of individual fish specimen was taken from the tip of the snout to tip of the caudal fin using Mitutoyo Digital Slide Calipers to the nearest 0.01 mm. Body weight (g) of each fish specimen was taken to the nearest gram using a top Mark Electronic Balance after blot-drying excess water from the body. Before dissecting out the guts, the length and weight as well as colouration of individual specimen was documented. After dissections the weight of guts were

recorded to nearest 0.01 g. Different aspects of food, feeding and reproductive biology of selected fish species were studied.

## 2.4 Relative length of gut (RLG)

The characterization of fish as carnivore, herbivore or omnivore is done by using the Relative gut length (RLG) as the main morphological variable. A sample size of 10 fish were taken every month and dissected. Before dissection the total length of the fish was taken, and then later the gut length was. Relative gut length (RGL) was calculated by the following formula given by Al-Hussaini [2].

$$RLG = \frac{\text{Total length of gut (mm)}}{\text{Total body length (mm)}}$$

### 2.5 Gastro-somatic index (GaSI)

Feeding intensity of fish was determined as the Gastro-somatic Index, a numerical value. A sample size of 10 fish was taken every month and dissected. The body weights and gut weight were measured by using an electronic balance. Gastro-somatic index (GaSI) was calculated by the following formula.

$$GaSI = \frac{\text{Weight of gut (gm)}}{\text{Total weight of fish (gm)}} \times 100$$

### 2.6 Sexual dimorphism

Randomly 200 adult fishes were collected from the stock and kept in a transparent aquarium and their size, colouration, fins shape and body shape was observed and recorded. The observations were carried out for the entire captive rearing period, so as to find the differences in the characters in breeding and non-breeding period. A couple of fishes were dissected for sex confirmation.

### 2.7 Gonadosomatic index (GSI)

Monthly samplings of 50 fish were carried out from the captive culture stock from July, 2018 to June, 2019. The gonadosomatic index, abbreviated as GSI is a tool for measuring the sexual maturity of animals in correlation to ovary development and testes development. It is the calculation of the gonad mass as a proportion of the total body mass. It is represented by the formula

$$GSI = \frac{\text{Weight of gonads}}{\text{Total weight of fish}} \times 100$$

### 2.8 Fecundity

Absolute fecundity is the total number of eggs that are likely to be spawned in one spawning period. Matured female fishes were dissected, and then ovaries were carefully removed from the body, and sub samples were collected from the anterior, posterior and middle portions of right and left ovaries put into 10% neutral buffered formalin (NBF) for fixation. Then the eggs were loosened from the ovary by shaking the tube and counted under microscope to find out fecundity<sup>[7]</sup>.

## 3. Results

The length of studied fish is ranges between 16.5-59.3 mm the weight ranges between 0.05-2.52 g. The dwarf chameleon fish is micro predators feeding on small aquatic crustaceans, worms, insect larvae and other zooplankton feeds on phytoplankton, zooplankton and insects; however, having a preference. The mouth of the fish is terminal. In the aquarium they often refuse dried foods, and should instead be offered small live or frozen fare such as glassworm, Artemia, Daphnia etc. While they tend to be shy, under low light, they feed well and may have issues with obesity if a lot of food is provided to them.

### 3.1 Relative gut length

The Relative Gut Length of *B. badis* species under captivity was recorded in different length groups (Table 1). The mean RLG was found to be highest (0.80±0.02) in the length group of 22-27mm and lowest (0.52±0.03) in the length group of 12-17mm. The alimentary canal is short in length and the range

of RLG varies from 0.46mm to 0.84mm, which implies that the fish is carnivorous in nature.

**Table 1:** Relative length of gut in different length groups

Length Group (mm)	Combined Sex (RLG)
12-17	0.52±0.03
17-22	0.70±0.06
22-27	0.80±0.02

### 3.2 Gastro-somatic index

Gastro-somatic index (GaSI) of *B. badis* was found out for 12 months from July, 2017 to June 2018. The average gastro-somatic index of *B. badis* species was found to be 4.76±1.27. The range of GaSI varies from 2.74mm to 7.14mm. The variations of GaSI in combined sexes have been summarized in Table 2.

**Table 2:** Variation of Gastro-somatic index in combined sex

GaSI	Combined Sex
Mean	4.76±1.27
Range	2.74-7.14

### 3.3 Sexual dimorphism

Sexual dimorphism is observed between both the sexes of blue perch, *Badis badis*. The male blue perch is more colourful and attractive than the female blue perch (which are without the red or blue colour on their flanks). The colours become more vibrant during the breeding season. During breeding season, a matured male can be identified by seeing the blue patch of colour at the ventral region between the opercula and the pectoral fin. During breeding season the female can be identified by the enlarged fat abdomen swollen belly. Males are larger than females growing to a maximum length of 5.2 cm and females are smaller in size. Males possess a straight looking body compare to females (shorter and rounder looking body). Adult males display bright colour with 5 pairs (10 nos.) of black stripes visible on the body and females are less colorful (Fig. 2). Mature males develop extended dorsal and caudal fins. No such characters are found in females. Mature males display blue pigmentation in the fins. Sexually motivated males are black associated with extreme aggressiveness.



**Fig 2:** Adult *Badis badis*: Male and Female

### 3.4 Gonadosomatic index (GSI)

Gonadosomatic index (GSI) of blue perch, *Badis badis* was found out for 12 months from July 2018 to June 2019. The gonad of the fish is small in length and slight yellowish in colour (Fig. 3). 50% of all female specimen attaining a length of 75-85 mm and weight of 6.50-7.75g was matured. The breeding season of the fish extend from late July to December. The Gonado-Somatic Index (G.S.I.) for the gravid females ranged from 0.037 to 0.15 with an average of 0.077.



Fig 3: Different size of gonad

### 3.5 Fecundity

Pre-spawning absolute fecundity of blue perch, *Badis badis* was found out to 305.3 as mean and the range was 372 – 502. The minimum number of ova produced was 116 in a female having a length of 27 mm and weight of 0.28 g. A maximum of 518 numbers of ova was produced by a female having a length of 29 mm and weight of 0.47 g.

### 4. Discussion and conclusion

In order of sharp decline of this ornamental fish, large scale seed production of *B. badis* is becoming very important. For captive maturation feeding and reproductive biology of any fish species is essential for assessing commercial potentialities of its stock, life history, culture practice and actual management of its fishery [15]. The information on food and feeding habit of the species is very scanty, only few information was available from north eastern hilly region [10]. The present investigation therefore, is carried out to study the feeding and reproductive biology including breeding, and fecundity of *Badis badis*. Fish is known to consume a great variety of food items. Mookerjee *et al.* expressed that there is not a single fish in nature which is exclusively carnivorous or herbivorous [13].

In view of the importance of food and feeding habits of *B. badis*, considerable attention has been paid by some workers to these aspects of feeding biology [10]. According to the earlier study, the fish feeds on phytoplankton, zooplankton and insects; among them 95% of which was represented by phytoplankton and the rest was zooplankton and others [10]. In *B. badis*, a gradual increase in average RLG (relative length of gut) value is noticed among the fish of different size groups from 12-27mm which varies from  $0.52 \pm 0.03$  to  $0.80 \pm 0.02$ . RLG values have not shown any significant appreciable difference along with the different size groups; so indicates no significant change of feeding habit along with growth in this fish species. Al-Hussaini earlier enlisted the RLG values for carnivorous (0.5-2.4), omnivorous (1.3-4.3) and herbivorous (3.7-6.0) fishes [1]. Das and Moitra later also mentioned that RLG value is generally low in carnivorous fish, higher in omnivorous fish and highest in herbivorous fish [4]. Hence, the RLG values of *Badis badis* in the present study shows that the

feeding habit of fish is carnivore in nature. The feeding intensity index i.e. GaSI varies from 2.74mm to 7.14mm which is also correlated with the earlier work done from north-eastern hilly region.

Study on reproductive biology of any fish species is essential for assessing commercial potentialities of its stock, life history, culture practice and actual management of its fishery [5]. The significance of studying maturity of a particular fish is to ascertain the sex- ratio, size and age at first maturity, the number of matured fish in the stock at a particular time of the year and the gonadosomatic index of the fish. The ratio between gonad weight and fish weight is designated as gonadosomatic index or gonosomatic (GSI). This index is used as an indicator of spawning period of fishes. GSI is also used to ascertain the period of development of gonads as well as the spawning season [14].

Male and female of *B. badis* clearly distinguished in the breeding season. Males are more colourful than females. Mature males display blue pigmentation in the fins. Adult males display bright colour with 5 pairs (10 nos.) of black stripes visible on the body. Female chameleon fish (*B. badis*) rate somewhere between drab and plain most of the time. The same result was recorded by Mahapatra [10] from north-eastern hilly region. The minimum length and weight at first maturity was 27.00 mm and 0.25 g in females. The attainment of first maturity occurs when male is 5+ months old and female is 6+ months old like seen the same from North-eastern hilly region, Assam [10]. The minimum number of ova produced was 116 nos. in a female having a length of 27 mm and weight of 0.28 g. A maximum of 518 nos. of ova was produced by a female having a length of 29 mm and weight of 0.47 g. The average fecundity recorded was 305.3 almost similar of the population belongs from north-eastern hilly region [10]. The number of mature eggs per gram of body weight (fecundity factor) ranged from 414.3 to 1102.1 with an average of 830.8. The gonad of the fish is small in length and slight yellowish in colour. 50% of all female specimen attaining a length of 75-85 mm and weight of 6.50-7.75g was matured. The breeding season of the fish extend from late July to December. The GSI for the gravid females ranged from 0.037 to 0.15 with an average of 0.077.

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### 6. References

1. Al- Hussaini AH. The feeding habit and morphology of the alimentary tract of some teleosts living in the neighbourhood of the Marine Biological station, Ghardaga, Red Sea. Publ. Marine Biol. Station, Ghardaga, 1947; 5:4-61.
2. Al- Hussaini AH. On the functional morphology of the alimentary tract of some fish in relation to differences in their feeding habits: anatomy and histology. Quart. J. Micr. Sci., 1949; 90(2):109-139.
3. Bhattacharya S, Mahapatra BK, Maity J. Morphological Identification of a Near Threatened Ornamental Fish, *Ctenopoma nobilis*. Int. J. Scient. Resear. 2015; 4(8):6-8.
4. Das SM, Moitra SK. Studies on the food and feeding habits of some fresh water fishes of India, part IV. A review on the food and feeding habits, with general conclusions. Ichthyologica, 1963; 2:107-115.

5. Doha S, Hye MA. Fecundity of Padma River hilsa, *Hilsa ilisha* (Hamilton). Pakistan Journal of Science, 1970; 22(3, 4):176-178.
6. Fishbase. [www.fishbase.org](http://www.fishbase.org). Downloaded on 25<sup>th</sup> January, 2019.
7. Grimes CB, Huntsman GR. Reproductive biology of the vermilion snapper, *Rhomboplites aurorubens*, from North Carolina and South Carolina. Fish. Bull. 1980; 78:137-146
8. IUCN Red List of Threatened species. [www.iucnredlist.org](http://www.iucnredlist.org). Downloaded on 27<sup>th</sup> January, 2015.
9. Kullander SO, Britz R. Revision of the family Badidae (Teleostei: Perciformes) with description of a new genus and ten new species, 2002.
10. Mahapatra BK. Biology of *Badis Badis* (Ham., 1822) From North Eastern Hill Region. J. Inland Fish. Soc. India. 2016; 48(1):97-101.
11. Mahapatra BK, Vinod K, Mandal BK. Fish Biodiversity of North Eastern India with a Note on Their Sustainable Utilisation. Environmental & Ecology. 2004; 22(1):56-63.
12. Mahapatra BK, Vinod K, Mandal BK. Export potentiality of native ornamental fish from North Eastern Hill States of India with a note for development of such fisheries. Environment & Ecology. 2005; 23(4):780-786.
13. Mookerjee HK, Sengupta SN, Roy Choudhury DN. Food and its percentage composition of the common adult food fishes of Bengal, Science & Culture. 1946; 12(7):247.
14. Natarajan AV, Jhingran VG. On the biology of *Catla catla* (Ham.) from the river Jamuna. Proc. Nat. Inst. Sci. India (B), 1963; 29(3):326-355.
15. Oronsaye CG, Nakpodia FA. A comparative study of the food and feeding habits of *Chrysichthys nigrodigitatus* and *Brycinus nurse* in a tropical river. Pak. J. Sci. Ind. Res. 2005; 48:118-121.