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Udaya Hajong
Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh, India

Shadab Siddiqui
Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh, India

Anubhuti Minare
Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh, India

Vipin Vyas
Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh, India

Corresponding Author:
Shadab Siddiqui
Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh, India

Breeding biology and culture pattern of *macrobrachium lamarrei lamarrei* (H. Milne-edwards, 1873) in glass aquaria

Udaya Hajong, Shadab Siddiqui, Anubhuti Minare and Vipin Vyas

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Abstract
This research aims to calculate the fecundity, egg diameter, embryonic development stages and culture pattern of *Macrobrachium lamarrei lamarrei* conducted in August - December, 2023 in the laboratory of Department of Zoology and Applied Aquaculture. The prawns were collected by using fishing net from Badhbada Dam, Bhopal, (M.P) and then transported to laboratory and kept in glass aquarium for further examinations. The maximum number of ovigerous females was observed in the month of August and September. The highest fecundity was 240 at the total length of 5.6cm and body weight was 1.59g, whereas the lowest fecundity 38 was recorded at the total length of 4.2cm with the body weight of 0.58g. The highest and lowest mean fecundity was found in the month of September and November, respectively. Egg development stages were determined using external features of the eggs.

Keywords: Breeding Biology, Fecundity, Embryonic developmental stages, *Macrobrachium lamarrei lamarrei*

1. Introduction
Macrobrachium lamarrei lamarrei is a medium-sized freshwater prawn, belong to the family palaemonidae. It is commonly known as “Kuncho river prawn” or “Jingha”. After fish, prawns are an important source of protein and, via their recycling of decomposing organic matter, they contribute significantly to aquatic ecosystems. It is small in size, widely distributed and abundantly available species of prawn. It is nocturnal in habit and found in freshwater streams, ponds and lakes not. It likes slow-running water and is bottom feeder. It has dual mode of locomotion: slow walking at the bottom with the help of its walking legs and active swimming in water with the help of its pleopods. It is omnivorous, feeding on small organisms like algae, mosses, minute insects, debris, etc.

Freshwater prawns are members of the Palaemonidae family. The genus Palaemon had a marine origin, according to Tiwari (1955), and it migrated from the sea into the heart of the land by rivers to gain freshwater habitat. Prawns eat anything that can be contained in their chelae, such as fish, algae, planktonic creatures, even tiny parts of their own muscle. Both adult and juvenile prawns feed frequently and copiously on a diverse range of food items, demonstrating their omnivorous nature. The larger prawns in the aquarium did not assault the smaller ones when they were housed together.

Fecundity is the number of ripening eggs in the ovaries of female before spawning, the quantity of eggs laid in the brood pouch in a single spawning operation is also referred to by this term. The quantity of eggs released by several shrimp species might differ significantly. Depending on their age, length, weight, and environmental circumstances, individuals of the same species lay different numbers of eggs. Fecundity information is crucial for determining a brood prawn's ability for reproduction, which in turn informs management decisions for prawn hatcheries. To fully comprehend the breeding biology of any species, fecundity research is essential.

2. Materials and Methods

2.1 Study area: The present work was carried out at the Department of Zoology & Applied Aquaculture, Barkatullah University, Bhopal (M.P), India.

2.2 Collection of prawns: The prawns were procured from Badhbada dam, Bhopal, M.P, India. The prawns were caught during day time around 10am to 11am using a net and transported to the laboratory of Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal for further studies and were kept in glass aquarium (Size of Aquarium). Aquarium was supplied with well-aerated tap water, an aerator and PVC pipes for hiding as the prawns are nocturnal. For the experimental runs, the prawns were randomly picked and placed into two glass aquaria at a rate of 50 prawns per aquarium.

2.3 Morphometric measurements: The length (to the nearest 0.01 cm) and body weight (to the nearest 0.1 g) with an electronic balance were used to measure the animal's total length (TL, from the tip of the rostrum to the posterior end of the telson) and carapace length (CL, from the posterior orbital margin to the posterior margin of the carapace).

2.4 Fecundity estimation: The quantity of eggs in the ovary prior to spawning is known as fecundity. Prior to extracting the eggs from their bodies, measurements of length and weight were taken. Using forceps to extract the egg mass from the female brood pouch and count all of the eggs, the fecundity was determined and noted. The sub-sample method was not applied to estimate fecundity because the quantity of eggs was not very high.

2.5 Egg diameter: An occular micrometer was used to measure the diameters of the eggs in each randomly chosen berried female. The micrometer was placed into the microscope's ocular to ascertain the size of the eggs. After being put on a slide, the eggs were examined at a 10X magnification using an electronic compound microscope.

2.6 Developmental stages: A tiny aquarium was used to raise a select few fertilized females that were chosen from the tank. An aerator was installed to provide an adequate amount of oxygen. These ladies were fed animal-based meals as well. Until the eggs changed color from dark green to light green and finally transparent, the females were monitored on a regular basis. By holding the specimens with their ventral side up and looking at the egg that they were holding in their pleopods, one could see the change in color of the eggs. The females were moved to another tank once they had laid their eggs in the water.

3. Results and Discussion

3.1. Morphometric Measurements: A total of 18 (Both ovigerous and non-ovigerous) female specimens of *M. lamarrei lamarrei* were analyzed. Total length (TL) and body weight (Wt) were measured to the nearest 0.1 cm and 0.01 g.

Table 1: Mean length and weight of *M. lamarrei lamarrei*.

Months	Mean Length (cm)	Mean weight (g)
August	4.1	0.45
September	4.8	0.81
October	4.1	0.53
November	4.4	0.60
December	4.0	0.51

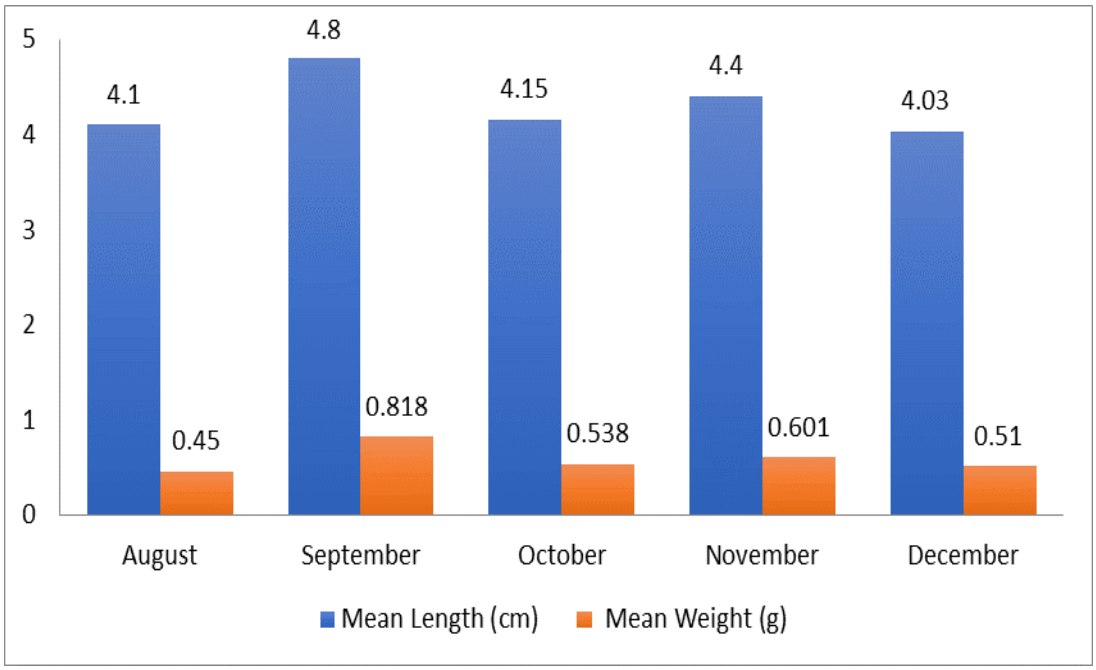


Fig 1: Graph showing variation in Mean length and weight.

3.2. Fecundity: It was observed that the highest fecundity was found at the total length of 5.6 cm with the body weight of 1.59g, whereas the lowest fecundity was recorded at the total length of 4.7cm that weighed of 0.75g. The estimated fecundity range with mean fecundity of female *M. lamarrei lamarrei* samples are shown in Table 2. Here, the highest and the lowest mean fecundity were found in the months of September and November, respectively.

The number of eggs produced by crustaceans varies widely. According to Parson and Tucker, fecundity can vary seasonally, annually and between areas. In several crustaceans, there is a linear relationship between the number of eggs per brood and the size of the females. This has also been observed in *M. lamarrei lamarrei*.

Table 2: Monthly recorded mean fecundity of *M. lamarrei lamarrei.*

Months	Mean fecundity
August	180
September	139
October	88
November	43
December	60

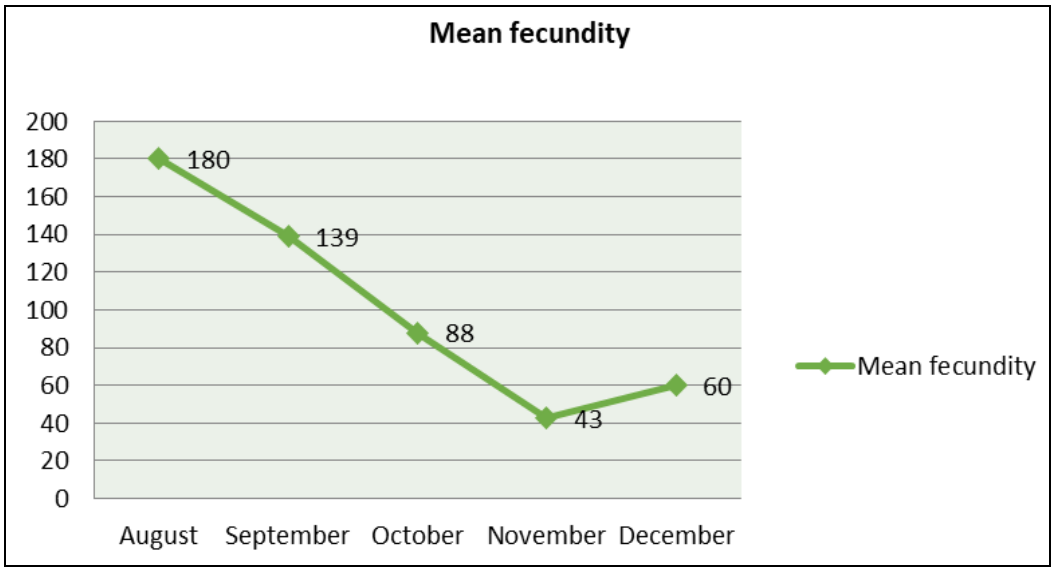
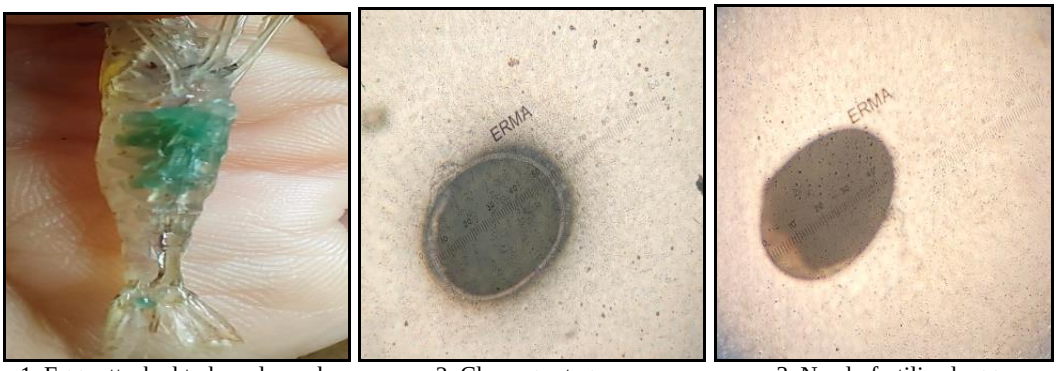


Fig 2: Graph showing variation in mean fecundity of *M. lamarrei lamarrei*.

3.3. Developmental Stages of *M. lamarrei lamarrei:* Mature Macrobrachuim lamarrei lamarrei eggs measured approximately 1-1.27mm in long axis, and were somewhat oval. When the eggs were young, they were a dark green color that changed to a pale green color before becoming transparent when they hatched. The females were moved to a medium-sized glass aquarium with a constant oxygen supply when they began to produce clear eggs with two black spots in them. The eggs hatched after two to three days. Before hatching, the eye markings were easily seen from the outside. The eggs took five to six hours to fully hatch. The female lays her eggs by vigorously moving her pleopods to ensure that the eggs are uniformly distributed throughout the water. Following egg laying in water, the females were removed from the glass aquarium.



1. Eggs attached to brood pouch. 2. Cleavage stage. 3. Newly fertilized egg.

4. Non-eyed egg. 5. Blastula stage. 6. Pre-hatching stage.

Fig 3: Developmental stages of *M. lamarrei lamarrei*.

In the present study, the total length (TL) ranged from 2.9 cm to 5.6 cm for *M. lamarrei lamarrei*, while the weights were varied between 0.13g and 1.59g. The maximum number of ovigerous females was observed in the month of August and September. The ovigerous female were found less in the month of October and November. These observations revealed that spawning season of *M. lamarrei lamarrei* occurred in the month of August. In close agreement with our current work, Sharma and Subba (2005) [10] found that female M. lamarrei from Biratnagar, Nepal were not producing mature eggs in the months of December, January, and February. Our results are almost identical to those of Hussain and Manohar (2016) [3], Hussain and Manohar (2017) [4], and Sarkar *et al*. (2012), who claimed that M. lamarrei was a continuous breeder from West Bengal and Bhopal in India, respectively. For M. lamarrei from Bhopal, India, there are two peak seasons per year (May–June and November–December), according to Hussain and Manohar (2016) [3] and Hussain and Manohar (2017) [4]. The overall fecundity of M. lamarrei lamarrei ranged from 38 to 240 in the current investigation. The results of our investigation show that the body weight of 1.59g and the total length of 5.6cm had the highest fecundity of 240, while the body weight of 0.58g and the total length of 4.2cm had the lowest fecundity of 38. Table 2 displays the estimated mean fecundity of M. lamarrei lamarrei. In this case, August and November had the highest and lowest mean fecundity, respectively.

4. Conclusion

Reproduction is a key concept in fish biology that is necessary for the sustainable production of fish populations and their wise use. Fish reproductive characteristics can be utilized to offer reliable scientific guidance for managing fisheries since the information improves comprehension of population variations. Additionally, research on the breeding season and related variables helps to predict recruitment variations and protect the recruits. The two other major problems in fish biology are the description of fish reproductive techniques and the measurement of fecundity. Understanding a species' reproductive biology is essential for managing and assessing fisheries because it helps us comprehend population dynamics, resilience, and susceptibility to natural and human-caused impacts like habitat fragmentation, fishing, and climate change. These findings marked a significant advancement in our understanding of the reproductive biological characteristics of the species, enabling managers to make informed decisions and set appropriate management goals for it that would ensure its continued sustainable use.

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