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Morphometric Analysis of Freshwater mussel, *Lamellidens marginalis* from different sites of Gomti River, Lucknow (U.P)

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Abstract- Freshwater mussels are ecologically significant organisms, contributing to water quality and ecosystem stability. This research paper aims to conduct a comprehensive Morphometric analysis of the freshwater mussel species *Lamellidens marginalis* from the Gomti River in Lucknow, Uttar Pradesh, India. The study encompasses various aspects, including size variations in shell length, width, height and weight of the animal. Data was collected from five sites along the Gomti River, Lucknow and detailed Morphometric measurements were performed on the collected specimens. The results provide valuable insights into the biology and conservation needs of *Lamellidens marginalis* in this region.

Keywords: Freshwater mussel, *Lamellidens marginalis*, Gomti River, Morphometric analysis, Uttar Pradesh, Distribution, Conservation

Introduction-

Lamellidens marginalis is a freshwater mussel in the order Unionida, Class-Bivalvia of the Phylum Mollusca. This species is found in fresh water rivers, lakes, and ponds, among other places. These are hidden in the seafloor and feed on algae, planktons, and bacteria. These bivalves are key components of the fresh water food chain, as well as water purifiers and bio indicators of aquatic ecosystems (Crabarkiewicz and Davis, 2008; Pashupuleti and Subba Rao, 2015; Sultana *et al*., 2016; and Dhaneswari and Sanjeevi, 2016). *Lamellidens marginalis* has a peculiar life cycle, and its sexes are separate but not distinguish easily by external morphology. They have traditionally been utilized in the pearl and button industries, as well as in medicine and as food (Misar, 2005; Safaktullah and Krishnamoorti, 2014; Dhaneswari and Sanjeevi, 2016). Freshwater pearl culture is a growing industry in Asia, and it is strongly related to Because of their extensive distribution and biological filtration function (Lewandowski and Stanczykowska, 1975; Kasprzak, 1986), they play significant role as both environmentally and commercially (Subba Rao and Dey, 1989). The basic information on the indigenous fresh water pearl culture technology has been detailed by Janaki Ram *et al*., (1997) *Lamellidens marginalis* (Lamarck), an important pink pearl producing freshwater mussel is increasing demand in pearl

producing countries (Ram 1989). Freshwater pearl culture is an emerging enterprise across the Asia now days, which is directly linked with the type of shell and secretion of nacre (Mishra *et al*., 2009). Freshwater pearl culture is a developing technology in India. Mussels have been used for food, decoration, pearls, lime, and medicine all throughout the world (Nayar and Rao, 1985; Saurabh *et al*., 2014). As such as a study is plan to screen Morphometric variation of the species from various sites of Gomti River Lucknow (U.P). *Lamellidens marginalis* have been reported from Lucknow and identified by Zoological Survey of India (Shukla *et al*., 2018). *Lamellidens marginalis* found all over year in the River Gomti in Lucknow, and freshwater pearl culture is growing continuously by them (Rawat and Singh 2023).

Material and Methods-

Collection of specimens completed during March, April and May (2023) at morning time from various sites of Gomti River, Lucknow. *Lamellidens marginalis* (Lamarck) identified by identification key provided by Zoological Survey of India. The taxonomic study of Indian fresh water molluscs has been done by Zoological Survey of India, Subba Rao (1989). For the collection and Morphometric analysis of *Lamellidens marginalis* from all 5 Sites like 1st- Saraura Ghat, 2nd-By Pass Bridge, 3rd- Musa Bagh, 4th- Ghaila, 5th- Gau Ghat the following procedures were followed:

1. **Sample Collection:** Specimens of *Lamellidens marginalis* were collected from all Sites along the Gomti River in Lucknow, Uttar Pradesh. Different specimens were sampled for the analysis from all the sites. The collection was carried out using hand-held nets and handled with care to ensure the mussels' preservation and integrity.
2. **Morphometric Measurements:** Each collected specimen was measured for length, height, and width using a digital calliper. The length was measured from the anterior to the posterior end of the shell, while height and width were measured perpendicular to the total length. The measurements were recorded in millimetres (mm).
3. **Measurement Parameters-** Morphometric measurements involve quantifying specific characteristics of the mussels' external features. The following measurement parameters are commonly used in the morphometric study of *Lamellidens marginalis*:-

Photograph shows Measurement of Length

Photograph shows Measurement of width

Photograph shows measurement of Height

Photograph shows measurement of Weight

Data Collection Techniques- The sample size consisted of 20 randomly selected *Lamellidens marginalis* specimens from every site. The specimens were chosen to represent a diverse range of sizes and age groups within the population. Accurate and consistent data collection techniques are essential for obtaining reliable morphometric measurements. The following techniques are commonly employed-

Shell Length- Shell length is measured as the distance from the anterior to the posterior end of the mussel shell with the help of digital vernier calliper. It provides insights into the overall size and growth of individuals within a population.

Shell Width- Shell width refers to the maximum width of the mussel shell. It provides information on the width variation and shape characteristics of *Lamellidens marginalis.*

Shell Height- Shell height represents the distance from the dorsal to the ventral side of the mussel shell. It indicates the vertical dimension and shape of the shell.

Weight of Animal- Weight of the animal is measured by digital weighing machine; which provides accurate reading of weight of the whole animal. Table of morphometric data of *Lamellidens marginalis* from various sites of Gomti River given below-

S.No	Length (mm)	Height (mm)	Width (mm)	Weight (gram)
1	60.1	17.5	30.1	21.0
2	70.1	20.3	30.3	38.0
3	60.5	17.9	30.0	26.0
4	60.1	20.0	30.0	21.0
5	70.0	20.2	30.4	34.0
6	60.0	20.0	30.4	18.0
7	60.5	20.0	30.0	23.0
8	70.5	20.0	30.2	27.0
9	70.0	20.3	30.2	39.0
10	60.5	20.2	30.5	33.0
11	50.5	20.0	30.0	18.0
12	60.0	20.0	30.0	19.0
13	70.0	20.0	30.3	30.0
14	60.0	20.0	30.0	24.0
15	60.2	20.3	30.2	24.0
16	62.2	20.0	30.1	25.0
17	65.4	20.2	30.7	26.0
18	70.2	20.8	30.9	37.0
19	64.5	20.2	30.1	30.0
20	60.2	18.0	30.0	28.0
Mean value	**63.27 mm**	**19.79 mm**	**30.22 mm**	**27.05 gram**

Table 1- Morphometric Data of *Lamellidens marginalis* from Site 1st Saraura Ghat

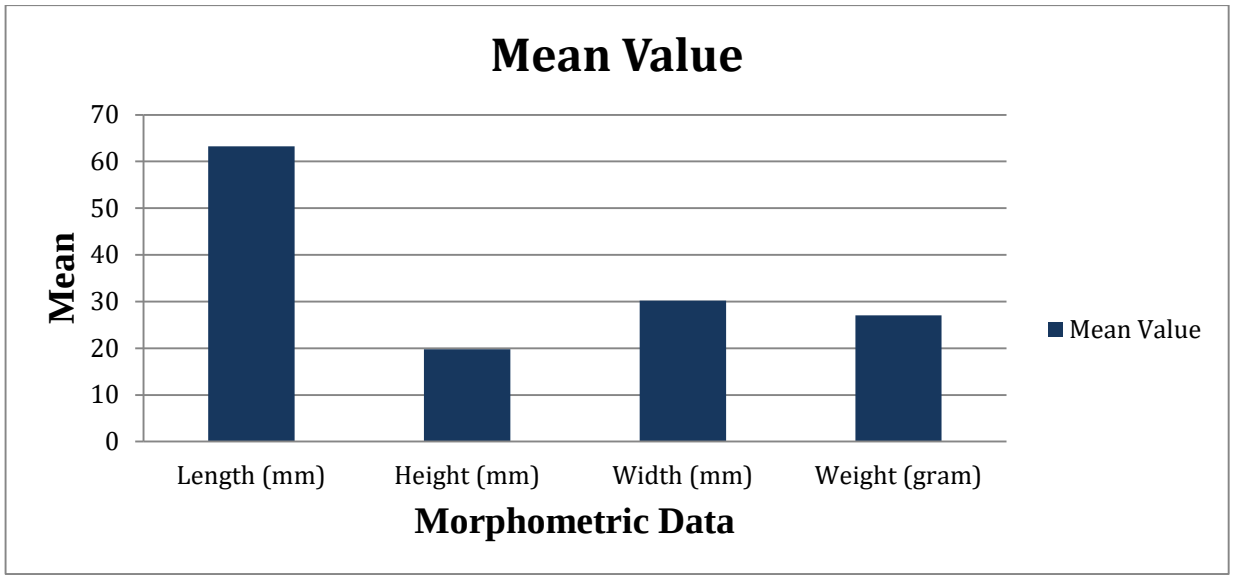


Fig 1- Variation in mean value of Length, Height, Width and Weight of 1st site

S.No	Length (mm)	Height (mm)	Width (mm)	Weight (gram)
1	60.1	17.5	30.1	21.0
2	70.1	20.3	30.3	38.0
3	60.5	17.9	30.0	26.0
4	60.1	20.0	30.0	21.0
5	70.0	20.2	30.4	34.0
6	60.0	20.0	30.4	18.0
7	60.5	20.0	30.0	23.0
8	70.5	20.0	30.2	27.0
9	70.0	20.3	30.2	39.0
10	60.5	20.2	30.5	33.0
11	50.5	20.0	30.0	18.0
12	60.0	20.0	30.0	19.0
13	70.0	20.0	30.3	30.0
14	60.0	20.0	30.0	24.0
15	60.2	20.3	30.2	24.0
16	62.2	20.0	30.1	25.0
17	65.4	20.2	30.7	26.0
18	70.2	20.8	30.9	37.0
19	64.5	20.2	30.1	30.0
20	60.2	18.0	30.0	28.0
Mean Value	**63.27 mm**	**19.79 mm**	**30.22 mm**	**27.05 gram**

Table 2- Morphometric Data of *Lamellidens marginalis* from Site 2nd - Bypass Bridge

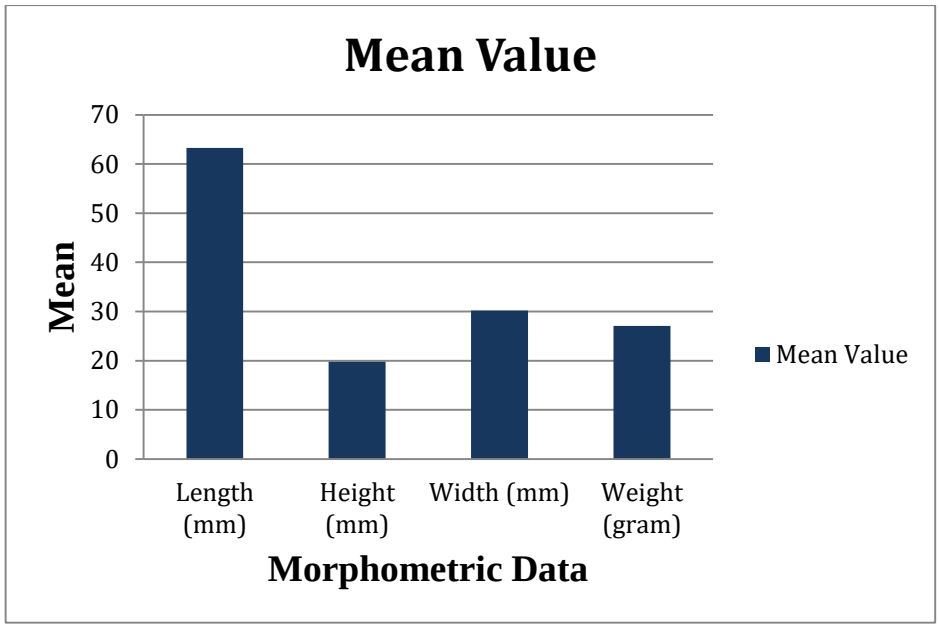


Fig 2- Variation in mean value of Length, Height, Width and Weight of 2nd site

S. No	Length (mm)	Height (mm)	Width (mm)	Weight (gram)
1	70.5	20.3	30.5	35.0
2	60.3	20.0	30.1	23.0
3	60.5	20.0	30.1	24.0
4	70.0	20.2	30.5	35.0
5	70.0	20.1	30.1	30.0
6	60.5	20.1	30.3	32.0
7	60.0	20.0	30.0	17.0
8	60.3	20.4	30.2	38.0
9	70.0	20.1	30.4	22.0
10	60.1	20.0	30.0	29.0
11	70.0	20.1	30.3	19.0
12	60.0	20.0	30.0	19.0
13	60.5	20.1	30.0	22.0
14	60.0	20.0	30.0	23.0
15	60.0	20.1	30.1	23.0
16	71.0	20.4	30.3	29.0
17	70.1	20.4	30.2	27.0
18	60.1	20.0	30.0	23.0
19	70.0	20.3	30.2	29.0
20	60.0	20.0	30.1	24.0
Mean Value	**64.19 mm**	**20.13 mm**	**30.17 mm**	**26.15 gram**

Table 3- Morphometric data of *Lamellidens marginalis* from Site 3rd Musa Bagh-

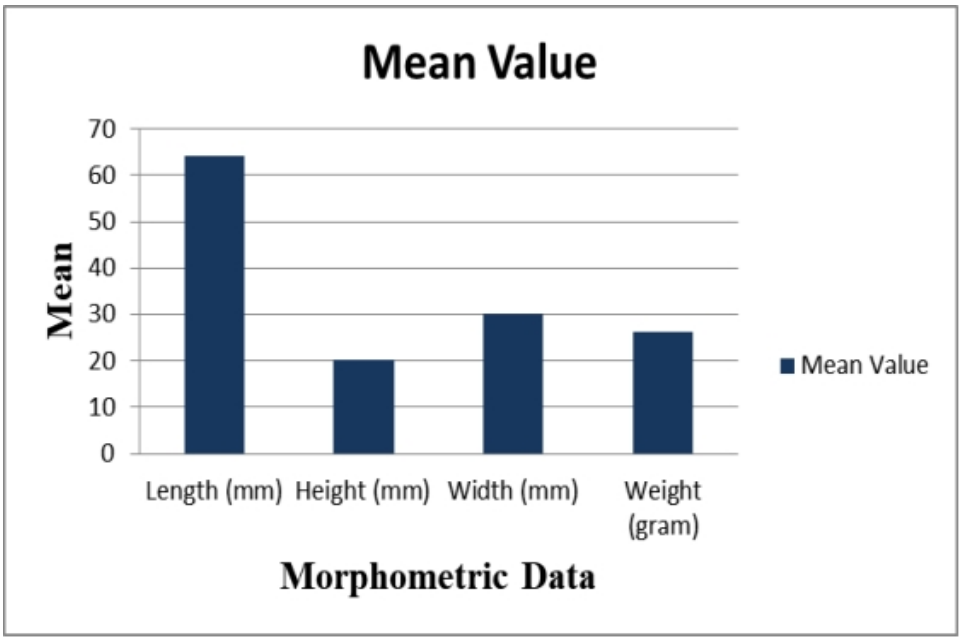


Fig 3- Variation in mean value of Length, Height, Width and Weight of 3rd site

S.No	Length (mm)	Height (mm)	Width (mm)	Weight (gram)
1	60.4	20.0	30.2	24.0
2	70.3	20.1	30.3	29.0
3	60.3	20.1	30.1	26.0
4	60.1	20.0	30.0	21.0
5	60.2	20.0	30.0	21.0
6	60.4	20.0	30.2	25.0
7	70.0	20.1	30.3	30.0
8	70.3	20.0	30.2	26.0
9	60.1	20.0	30.3	24.0
10	70.0	20.2	30.2	33.0
11	80.0	20.4	30.5	48.0
12	60.6	20.0	30.3	28.0
13	70.0	20.0	30.5	27.0
14	70.0	20.1	30.3	30.0
15	60.4	20.1	30.1	26.0
16	60.1	20.0	30.6	20.0
17	70.1	20.4	30.5	42.0
18	70.0	20.0	30.2	28.0
19	70.0	20.0	30.2	27.0
20	70.0	20.0	30.2	25.0
Mean value	**66.16 mm**	**20.07 mm**	**30.26 mm**	**28.0 mm**

Table 4- Morphometric Data of *Lamellidens marginalis* from Site 4th Ghaila

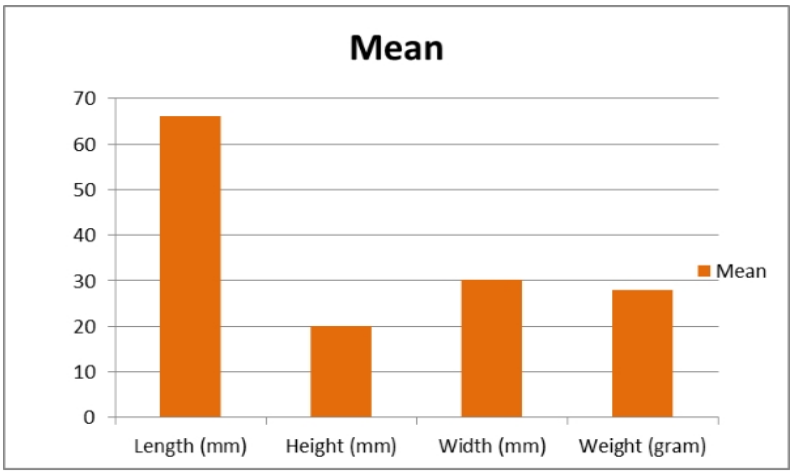


Fig 4- Variation in mean value of Length, Height, Width and Weight of 4th site

S. No	Length (mm)	Height (mm)	Width (mm)	Weight (gram)
1	70.0	20.1	30.4	30.0
2	60.4	20.2	30.4	30.0
3	60.2	20.0	30.0	18.0
4	60.6	20.0	30.5	25.0
5	60.1	20.0	30.0	21.0
6	60.6	20.0	30.5	27.0
7	60.3	20.0	30.2	23.0
8	60.0	20.0	30.0	19.0
9	60.0	20.0	30.0	19.0
10	60.4	20.0	30.1	24.0
11	70.0	20.1	30.4	30.0
12	60.2	20.0	30.1	20.0
13	60.2	20.0	30.1	22.0
14	70.0	20.3	30.4	33.0
15	60.5	20.1	30.1	26.0
16	60.1	20.0	30.1	19.0
17	80.0	20.3	40.0	38.0
18	60.5	20.5	40.1	46.0
19	60.5	20.1	30.2	27.0
20	60.4	20.1	30.2	26.0
Mean Value	**62.75 mm**	**20.09 mm**	**31.19 mm**	**26.15 mm**

Table 5- Morphometric Data of *Lamellidens marginalis* from Site 5th Gau Ghat-

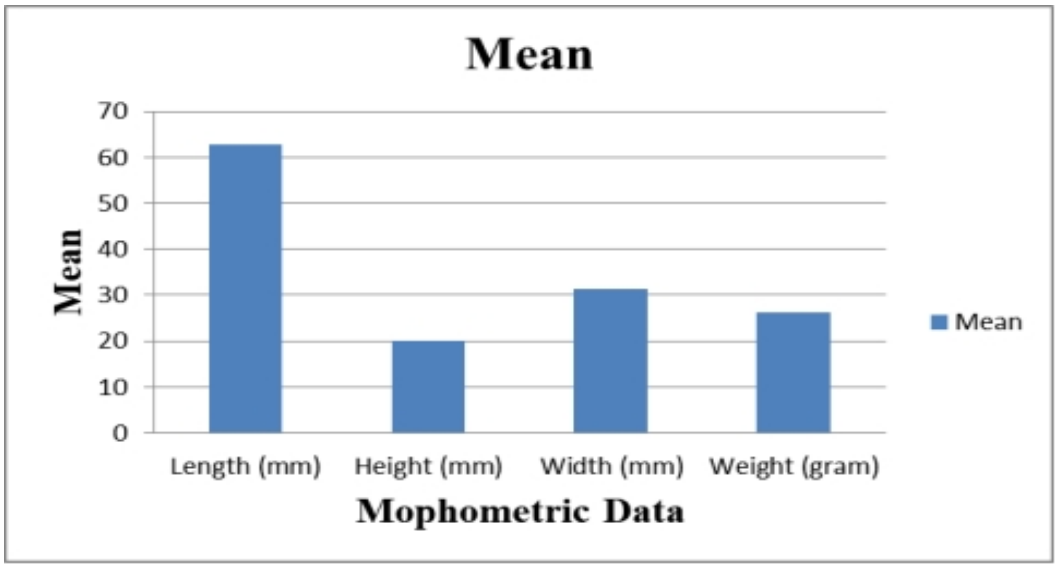


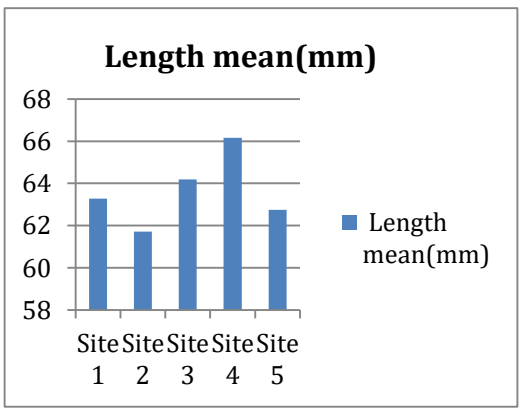
Fig 5 - Variation in mean value of Length, Height, Width and Weight of 5th site.

Result and Discussion-

The specimen collection was conducted during March, April and May (2023) at day time from five different sites of Gomti River, Lucknow (U.P). From every Site, 20 specimens were collected for the measurement of Length, Height, Width and Weight. Morphometric data of all specimens from different sites are given in tables 1 to 5 respectively. After taking Morphometric data of all collected specimens, their mean value was calculated and variation in their mean value of length, height, width and weight is shown by bar diagram. The table of mean value of all morphometric data with respect to their sites are given below-

Site. No	Total Length mean(mm)	Total Height mean(mm)	Total Width mean (mm)	Total Weight mean (gram)
Site 1	63.27	19.79	30.22	27.05
Site 2	61.71	20.04	30.16	24.75
Site 3	64.19	20.13	30.17	26.15
Site 4	66.16	20.07	30.26	28.00
Site 5	62.75	20.09	31.19	26.15

Table 6- Showing mean value of all morphometric data with respect to their sites



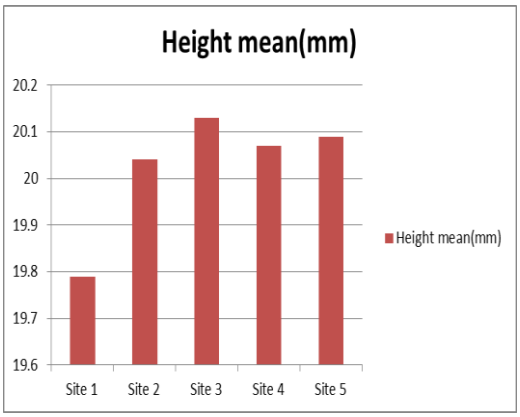
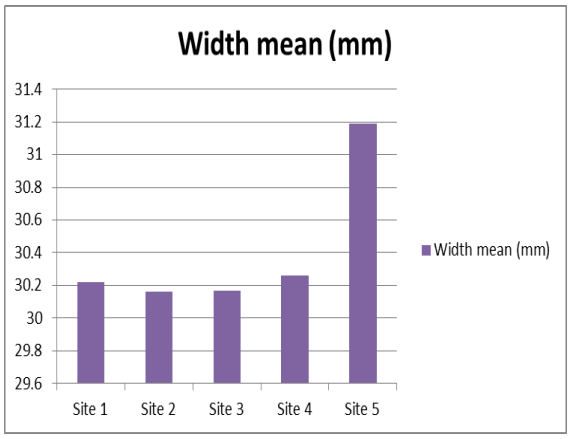


Fig 6- Comparison of total length mean with respect to all sites

Fig 7- Comparison of total height mean with respect to all sites



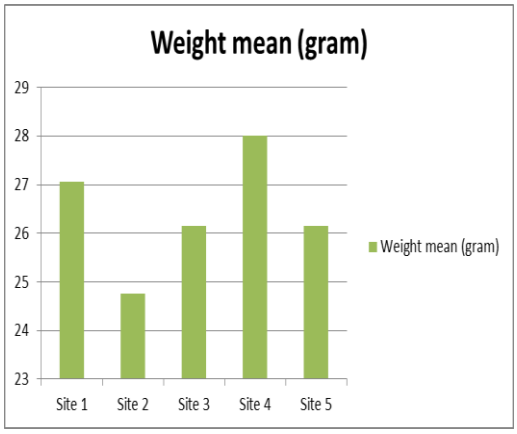


Fig 8- Comparison of total width mean with respect to all sites **Fig 9-** Comparison of total weight mean with respect to all sites

Discussion-

The observed size variations among *Lamellidens marginalis* individuals in the Gomti River may be influenced by various factors, including food availability, water quality, and habitat characteristics. It is important to consider the interplay of both genetic and environmental factors that contribute to the growth and development of these mussels. Studies on the relationship between shell size and age can provide valuable information about their growth rates and life history traits, which can further enhance our understanding of their population dynamics. The distribution pattern of *Lamellidens marginalis* across the different sites along the Gomti River reflects their habitat preferences and adaptability to varying environmental conditions. Sites with higher water flow and suitable substrates may support larger and healthier populations of mussels. Understanding the factors that contribute to the preferential distribution of these mussels can help in identifying critical habitats that require special conservation attention. The variations in shell morphology observed during the morphometric analysis could be indicative of different selective pressures acting on these mussels. For instance, mussels in areas with higher predation pressure may exhibit thicker and stronger shells as a defense mechanism. The coloration and patterns on the shells may also play a role in predator avoidance and camouflage. Investigating the ecological significance of these shell variations can shed light on the interactions between *Lamellidens marginalis* and other species in the ecosystem. The morphometric analysis and the information obtained from this study can have practical implications for mussel conservation in the Gomti River. Understanding the size distribution and population structure of *Lamellidens marginalis* can aid in the development of effective management strategies for their protection. It is crucial to consider the potential threats faced by these mussels, including habitat degradation, pollution, and climate change, to devise appropriate conservation measures. Body morphometrics is an extensively used tool for the conservation, biological assessment, and resource management of aquatic organisms (Mozsar *et al*., 2015; Okuthe & Bhomela, 2020). The morphometric analysis in molluscans seems to be common, and similar growth models were reported in *Donax cuneatus*, (Takar *et al*., 2021) and *Pila globosa* in India (Panda *et al*., 2021), and *Perna viridis* in Bangladesh (Khan *et al*., 2010).

Conclusion:

In conclusion, this research paper presents a comprehensive morphometric analysis of the freshwater mussel Lamellidens marginalis from the Gomti River in Lucknow, Uttar Pradesh, India. The study highlights the species' size variations, growth patterns, and ecological characteristics, shedding light on its biology and distribution in the study area. The findings of this research contribute to the growing body of knowledge about freshwater mussels and their importance in maintaining aquatic ecosystem health. The data generated through this study can serve as a valuable resource for future research and conservation initiatives aimed at protecting Lamellidens marginalis and its habitat. We hope that the insights gained from this research will encourage further investigations into the ecology and conservation of freshwater mussels, not only in the Gomti River but also in other water bodies across India and beyond. By working collaboratively and implementing effective conservation measures, we can ensure the continued survival and ecological significance of Lamellidens marginalis and other freshwater mussel species for generations to come.

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