Study of Length Weight Relationship and Ecological Factors Affecting Clarias Batrachus and Labeo Rohita

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Abstract:

The present study provides firsthand information about length – weight relation of two freshwater species, CLARIAS BATRACHUS and LABEO ROHITA from Ghazipur market, Delhi. We collected 20 specimens, 10 specimens each and took length weight for better conservation techniques and proper management for them. A total of 10 specimens of **Clarias Batrachus** were examined for study, which has ranging from **13 – 17 Inches** (TL) and **80 – 400 gm** (TW) and took 10 specimens of **Labeo Rohita** of **10-15 inches** (TL) and **200 – 470 gm** (TW) were used for study of LWR's and conditions factors. Our study exhibited that Clarias Batrachus and Labeo Rohita exhibited negative allometric growth (b < 3) that fish grow faster compared to their weight.

The values of correlational coefficient (r^2) and condition factor of Clarias batrachus is and 0.1068 and 10.13 of Labeo rohita is 0.387 and 18.20 respectively. This research will be useful for fishery research, stock management, conservation of estimation of fish conditions Ganga River.

Keyword: Clarias batrachus, Labeo rohita, LWR, environmental factors.

INTRODUCTION:

Freshwater ecosystems support diverse aquatic life and provide essential services such as nutrient cycling and food supply. In India, Clarias batrachus (walking catfish) and Labeo rohita (rohu) are economically and ecologically important freshwater fish. Clarias batrachus, now called Clarias magur, is an air-breathing endangered catfish (Vishwanath, 2010). This fish has great demand and attracts the attention of farmers for its high market value in Bangladesh (Hossain et al., 2006). Labeo rohita, on the other hand, is one of the most intensively cultured carps in India, which is sought after for its flavour, nutritional value, and rapid growth rate.

LWR is a fundamental concept in fisheries biology, expressed as:

W = al ^b,

where W is weight, L is length, a is the intercept, and b indicates growth pattern (isometric if b = 3, allometric if b ≠ 3). It helps assess fish health, growth trends, and ecological adaptations across habitats.

Fish growth is influenced by temperature, oxygen, pH, salinity, food, and habitat. Pollution, eutrophication, habitat loss, and invasive species negatively affect fish growth. LWR responses to these factors can indicate ecosystem health. LWR allow life history and morphological comparisons between

different fish species or between fish populations from different habitats and/or regions (Goncalves et al., 1997). The LWR is an important tool in fish biology, physiology, ecology and fisheries assessment (Oscoz et al., 2005).

The Clarias batrachus (Linnaeus, 1758) populations are native to Southeast Asia and have been introduced worldwide for fish farming (Allen, 2011). It is mostly found in freshwater and brackish water rivers, lakes, ponds, streams, swamps, ditches, rice paddies, and reservoirs (Froese & Pauly, 2023; Allen, 2011)

Rohu is a major Indian carp species, feeding on plankton and detritus. It grows rapidly in well-managed systems but shows growth decline under stress. Its LWR varies with water quality, oxygen levels, and density. This study is important for estimating biomass and managing harvests, optimizing feed and stocking, using LWR as an indicator of ecosystem health, guiding species and habitat protection strategies. The objectives of the study are to determine the LWR of Clarias batrachus and Labeo rohita, identifying ecological factors influencing growth, comparing species growth under different conditions and recommending sustainable fishery and aquaculture practices.

MATERIALS AND METHODS:

Fish specimens were collected from Kesar Ganj Fish Market, Meerut, Uttar Pradesh, originally sourced from the Ganga River and transported to Ghazipur Fish Market, Delhi. Ghazipur, an urban-semi-urban area in eastern Delhi, experiences human activity that impacts nearby aquatic ecosystems. Sampling sites were selected based on the availability of Labeo rohita and Clarias batrachus, accessibility, and representation of regional freshwater conditions. The flat terrain and seasonal variations in Ghazipur influence water flow and quality, affecting fish growth and health through environmental stressors. This research was conducted from March to April 2025, at the transition from late winter to early summer. This period was selected because the water temperatures are increasing, which tends to enhance activity, feeding, and growth in freshwater fish (Kar & Barbhuiya, 2010). Fish were obtained from Kesar Ganj Fish Market, Meerut (Uttar Pradesh), which received fish from Ghazipur Fish Market, Delhi, a large market that receives fish from the Ganga River region. Two freshwater aquatic species ecologically and economically significant in Indian inland waters, Labeo rohita (Rohu) and Clarias batrachus (Walking Catfish/Magur), were chosen for investigation. Both are widely distributed in Indian inland waters and are environmentally sensitive, being excellent bioindicators of the condition of the aquatic ecosystem (Oscoz et al., 2005).

SPECIES	COMMON NAME	HABITAT	FEEDING TYPE	FISHERY ROLE
Labeo rohita	Rohu	Freshwater	Omnivorous	Aquaculture, Inland Fisheries
Clarias Batrachus	Walking Catfish	Freshwater	Carnivores	Small scale Local fishery

We took ten samples from every species. We measured all the fish within six hours of catching to minimize the impact of post-mortem shrinkage on the accuracy of the data.

Length-Weight Relationship (LWR) Evaluation:

To confirm the trend of growth and status of the selected species, the Length-Weight Relationship (LWR) was collected in a standard format (Anderson & Gutreuter, 1983; Santos, 1997).

Formula for Length-Weight Relation;

The **length-weight relationship** of fishes is commonly expressed using the formula:

W= a L^b

Environmental conditions were noted to determine their possible impact on fish physiology and LWR. The ecosystem of the Ganga River basin, specifically of the Ghazipur region of Delhi, was assumed to be the source of the specimens under study. Ecological parameters were characterized to establish the background information.

RESULT AND DISCUSSION:

The condition factor (K) and length–weight relationship (LWR) of Labeo rohita and Clarias batrachus, two freshwater fish species of the Ganga River, Delhi, economically and ecologically significant, were examined. 20 specimens (10 each) were taken and examined for the analysis of growth patterns and ecological parameters.

The total length of Clarias batrachus ranged from 13–17 inches and weight between 80–400 g. The LWR was determined by the formula:

$\log(W) = 5.676 – 2.034 \log(L)$, with b = 1.20 and $R^2 = 0.115$.

This would indicate negative allometric growth (b < 3), with weight growing at a slower rate compared to length (Le Cren, 1951). The mean condition factor (K) was 10.13, varying from 1.95 to 18.21, and this indicates health variation that could be attributed to habitat quality or food (Deekae et al., 2010; King, 1995).

Labeo rohita recorded length of 10–15 inches and weight of 200–470 g. The LWR was:

$\log(W) = 0.470 + 1.371 \log(L)$, where b = 1.37 and $R^2 = 0.387$.

This was also preceded by negative allometric growth but with higher correlation than in Clarias. The average K was 18.29, indicating improved physiological condition under existing environmental conditions.

SPECIES	b- Value	Growth Type	r ^{2} Value	Mean K
Clarias batrachus	1.20	Negative Allometric	0.1068	10.13
Labeo rohita	1.37	Negative Allometric	0.387	18.29

Comparative analysis of both species
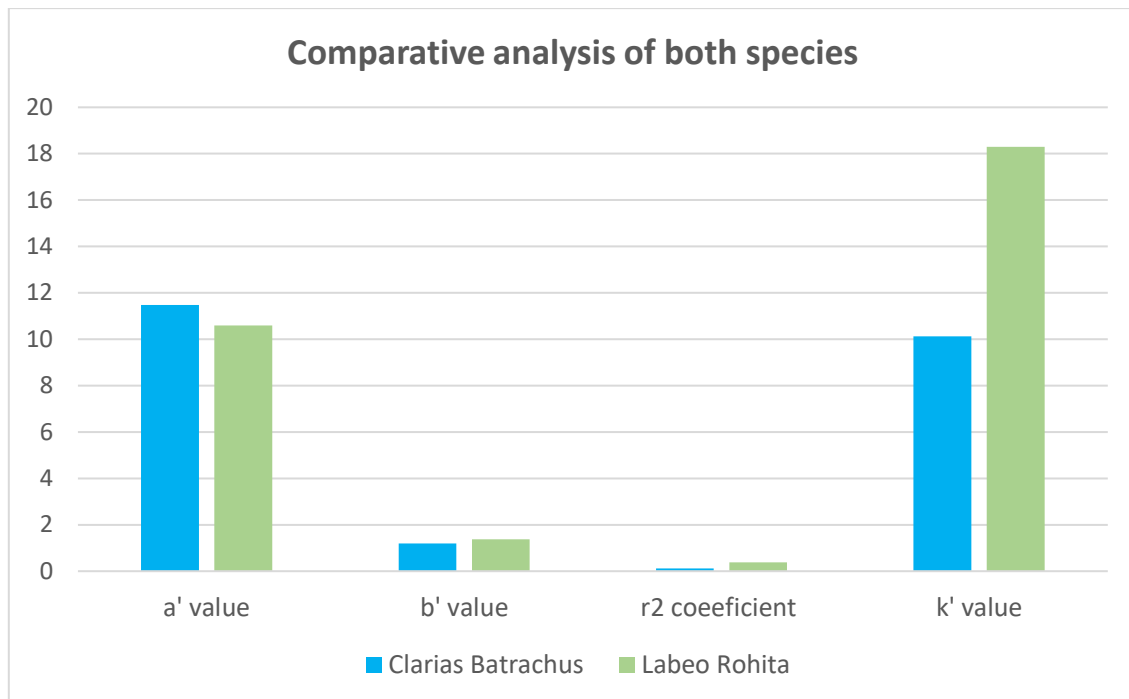
Environmental factors like dissolved oxygen, nutrient content, and water current should impact such patterns of growth. Clarias batrachus, being air-breathing and also relatively more tolerant, can survive in degraded habitats but is growth-limited under stress. Labeo rohita is, however, relatively more environmentally sensitive as it possesses greater condition values under optimal conditions (Froese, 2006; Das & Dewan, 1992).

CONCLUSION:

The findings concluded that both species exhibited **negative allometric growth** (b < 3), indicating that increases in length were not proportionally matched by increases in weight. This is a typical response to environmental stress or limited food availability in natural ecosystems.

Clarias batrachus demonstrated a lower growth exponent (b = 1.20) and weaker correlation (R^2 = 0.1068), suggesting greater susceptibility to environmental stressors or inconsistent food sources. In contrast, Labeo rohita showed comparatively better growth performance (b = 1.37; R^2 = 0.387) and a higher mean condition factor, reflecting more favorable habitat conditions or better adaptability under the prevailing circumstances.

In conclusion, understanding the LWR and condition factor of freshwater fish offers an effective tool for evaluating ecosystem health, guiding conservation efforts, and ensuring the sustainable use of aquatic resources.

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