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Length-weight Relationship of Male and Female *Sperata seenghala* from River Gomti and River Saryu in Eastern Uttar Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study, conducted from July 2023 to April 2024 at the College of Fisheries, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India, investigates the length-weight relationships (LWR) of Sperata seenghala from two major aquatic bodies in eastern Uttar Pradesh, the Gomti River (Site 1) and the Saryu River (Site 2). At

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Site 1, the LWR analysis revealed significant differences between males and females. Females exhibited a steeper slope than males, a difference statistically significant at the 1% level ($p = 0.002312$). The adjusted means between sexes did not show a significant difference ($p = 0.082456$). High R-squared values indicated a strong correlation between length and weight for both sexes, with males showing a slightly higher correlation ($R^2 = 0.997015$) compared to females ($R^2 = 0.985104$). Pooled data from Site 1 also demonstrated a robust correlation ($R^2 = 0.995811$), underscoring the strength of the LWR across sexes. At Site 2, the LWR analysis also indicated significant differences between males and females, with females having a slightly lower slope than males. This difference was statistically significant at the 5% level ($p = 0.045766$). Similar to Site 1, the adjusted means did not differ significantly ($p = 0.104492$). R-squared values confirmed a strong correlation between length and weight, with females showing a slightly higher correlation ($R^2 = 0.99816$) than males ($R^2 = 0.990001$). The pooled data from Site 2 further supported a robust LWR correlation ($R^2 = 0.998624$), indicating consistent growth patterns across sexes.

Keywords: Sperata seenghala; river gomti; river Saryu; length-weitht.

1. INTRODUCTION

Catfish which can be found in both freshwater and marine environments, are highly important aquatic product. Catfish are widely distributed throughout the world. They reach their greatest diversity on the continents spanning the equator, namely South America, Africa, and Asia [1]. With about 4100 species, the order Siluriformes, which includes catfish, is one of the largest groups of teleosts, accounting for 6.3% of all vertebrates and 12% of all teleosts (Eschmeyer and Fong, [2], Wilson and Reeder, 2005).

The Saryu River, also known as Ghaghara in its lower course, is a significant waterway in northern India. Originating from the glaciers of the Himalayas in the Tibet Autonomous Region, it traverses through Nepal and enters the Indian state of Uttar Pradesh. The river is a major tributary of the Ganges and plays a crucial role in the hydrology and ecology of the region. The Saryu is renowned for its rich biodiversity, supporting various aquatic species, including the economically important *Sperata seenghala*. This river is not only vital for the local fisheries but also for the agricultural practices along its banks, providing essential water resources for irrigation. The Saryu's historical and cultural significance is also profound, with numerous references in ancient Indian scriptures, making it a river of both ecological and cultural importance.

The Gomti River, a prominent tributary of the Ganges, flows entirely within the Indian state of Uttar Pradesh. Originating from the Gomat Taal (formerly known as Fulhaar Jheel) near Madhoganj Tanda village in Pilibhit district, the river stretches over approximately 900 kilometers. It passes through several key cities, including Lucknow, the state capital, contributing significantly to the region's hydrology. The Gomti River basin is characterized by a diverse range of flora and fauna, making it an important ecological zone. This river supports a variety of aquatic life forms, including the commercially significant *Sperata seenghala*. Additionally, the Gomti provides crucial water resources for agriculture, industry, and domestic use, while also holding cultural and religious significance for the communities along its banks. The river's health and sustainability are vital for maintaining the ecological balance and supporting the livelihoods of millions in the region.

The length-weight relationship (LWR) of fish has significance in fisheries and biology since it provides a mathematical formula for estimating the average weight of fish within a specific length group. (Sarkar et al. [3], Mir et al. [4]. The LWR, like other morphometric features, can be used to differentiate taxonomic units and their relationship to developmental events like metamorphosis, growth, and maturity [5]. LWR can be used to calculate yield equations, estimate fish landings, and compare populations over time and geography [6].

2. MATERIALS AND METHODS

2.1 Length- weight Relationships

The present study was conducted at the college of Fisheries, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India from July 2023 to April 2024. The Gomti River (site 1) and Saryu River (Site 2) are two of the major aquatic bodies in eastern Uttar Pradesh. The samples were taken from the landing site. The fishes were caught by drag nets and gill nets.

For length weight relationship samples bring to laboratory and cleaned with fresh water and ensure that there is not any damage to samples. Total Length of fish was measured from tip of snout to end of caudal fin. Weight determined to the closest 1 g using an electronic weighing balance, with the gonads and viscera intact. The length weight relationship were estimated using the allometric formula [7], separately for both sexes and significant differences in the slopes of the regression lines for males and females were ascertained by ANCOVA [8].

$$W = aL^b \text{ or } \log W = \log a + b \times \log L$$

Where,

W is the total body weight (g). L is the total length (mm), a and b are the coefficients of the functional regression between W and L.

3. RESULTS AND DISCUSSION

3.1 Length-Weight Relationship of *S. seenghala* from Site 1

The analysis of Table 1 indicates that the Length-weight relationship slopes for males and females differ significantly, with females having a steeper slope than males. This change is statistically significant at the 1% level (p = 0.002312). However, there is no significant difference is found between the adjusted means of the groups (p = 0.082456). The R-squared values determine a strong correlation between length and weight for both sexes, with males showing a slightly higher correlation (R^2 = 0.997015) than females (R^2 = 0.985104). The pooled data also reflects a high correlation (R^2 = 0.995811), highlighting the robustness of the L-W relationship across sexes. Soomro et al. [9] have reported similar result in *Mystus cavasius* [10,11].

3.2 Length - Weight Relationship S. seenghala from Site 2

The analysis of Table 2 showed that the Length-weight relationship slopes for males and females are significantly different, with females having a slightly lower slope than males. This difference is statistically significant at the 5% level (p = 0.045766). However, the adjusted means of the groups do not differ significantly (p = 0.104492). The R-squared values indicate a very strong correlation between length and weight for both sexes, with females exhibiting a slightly higher correlation (R^2 = 0.99816) compared to males (R^2 = 0.990001). The pooled data also shows a high correlation (R^2 = 0.998624), highlighting the robustness of the L-W relationship across both sexes. Dinesh et al. (2019) also reported the same value for b ≤3, which showed normal growth of both sexes in river Ganga [12-14].

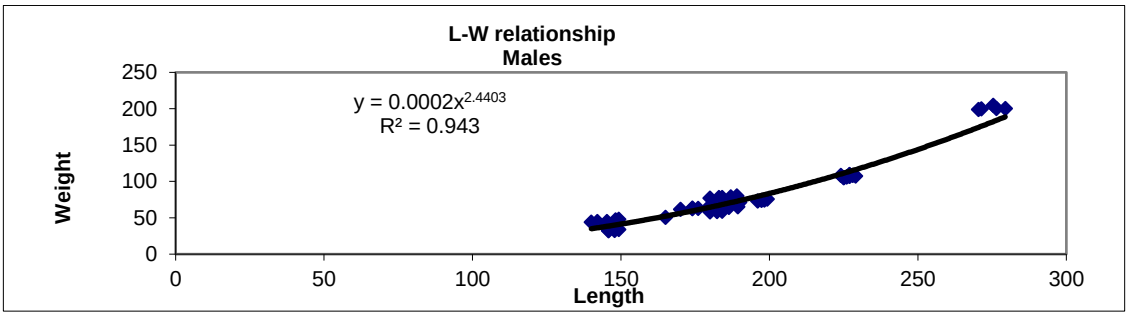

Fig. 1. a Length-weight of *S. seenghala* (Male) from site1

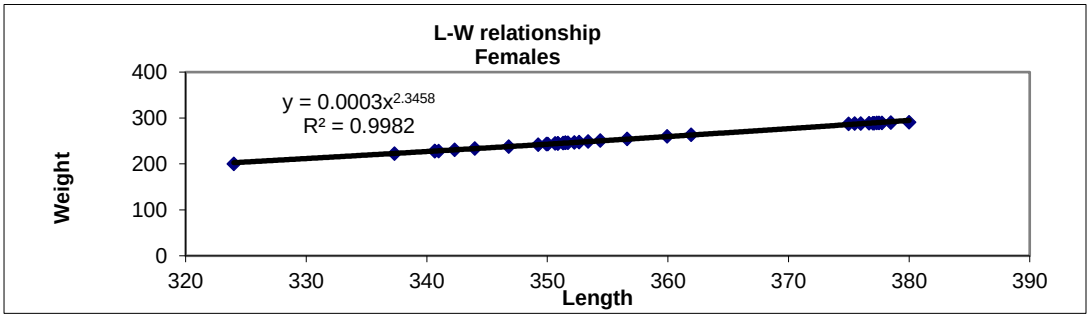

Fig. 1. b Length-weight of *S. seengahla* (Female) from site 1

Table 1. Comparison of regression lines of male and female *S. seenghala* by ANCOVA from Site 1

Comparison of L-W Relationship between Sexes										
						Deviations from Regression				
Source	**d.f.**	**Ssx**	**Ssy**	**Spxy**	**Reg.Coef**	**d.f.**	**S.S.**	**M.S**	**F**	**Prob**
Within										
Males	21	0.006276	0.038542	0.015474	2.465786	20	0.000385	1.93E-05		
Females	35	0.060204	0.331888	0.141223	2.345766	34	0.000611	1.8E-05		
						54	0.000996	1.84E-05		
Pooled W	56	0.066479	0.370429	0.156698	2.357096	55	0.001078	1.96E-05		
		Difference between slopes				1	8.19E-05	8.19E-05	4.177452	0.045766
Between B										
W+B	**57**	0.150408	**0.821838**	**0.351341**		56	0.001131			
		Between adjusted means				1	5.34E-05	5.34E-05	2.724923	0.104492
Note:	**If Prob <0.05 then significant at 5% level**									
	if Prob<0.01 then significant at 1% level									
L-W Relationship										
	a	**B**	**Rsqr**							
Males	0.000131	2.465786	0.990001							
Females	0.000262	2.345766	0.99816							
Pooled	0.000277	2.335925	0.998624							

Table 2. Comparison of regression lines of male and female *S. seenghala* by ANCOVA from Site 2

Comparison of L-W Relationship between Sexes										
						Deviations from regression				
Source	**d.f.**	**ssx**	**ssy**	**spxy**	**Reg.coef**	**d.f.**	**S.S.**	**M.S**	**F**	**Prob**
Within										
Males	**21**	0.006276	0.038542	0.015474	2.465786	20	0.000385	1.93E-05		
Females	**35**	0.060204	0.331888	0.141223	2.345766	34	0.000611	1.8E-05		
						54	0.000996	1.84E-05		
Pooled W	56	0.066479	0.370429	0.156698	2.357096	55	0.001078	1.96E-05		
		Difference between slopes				1	8.19E-05	8.19E-05	4.177452	0.045765778
Between B										

Comparison of L-W Relationship between Sexes									
W+B	57	0.150408	0.821838	0.351341	56	0.001131			
		Between adjusted means			**1**	**5.34E-05**	**5.34E-05**	**2.724923**	**0.104492479**
Note:	**If Prob <0.05 then significant at 5% level**								
	if Prob<0.01 then significant at 1% level								
L-W relationship									
	a	**b**	**Rsqr**						
Males	0.000131	2.465786	0.990001						
Females	0.000262	2.345766	0.99816						
Pooled	0.000277	2. 335925	0.998624						

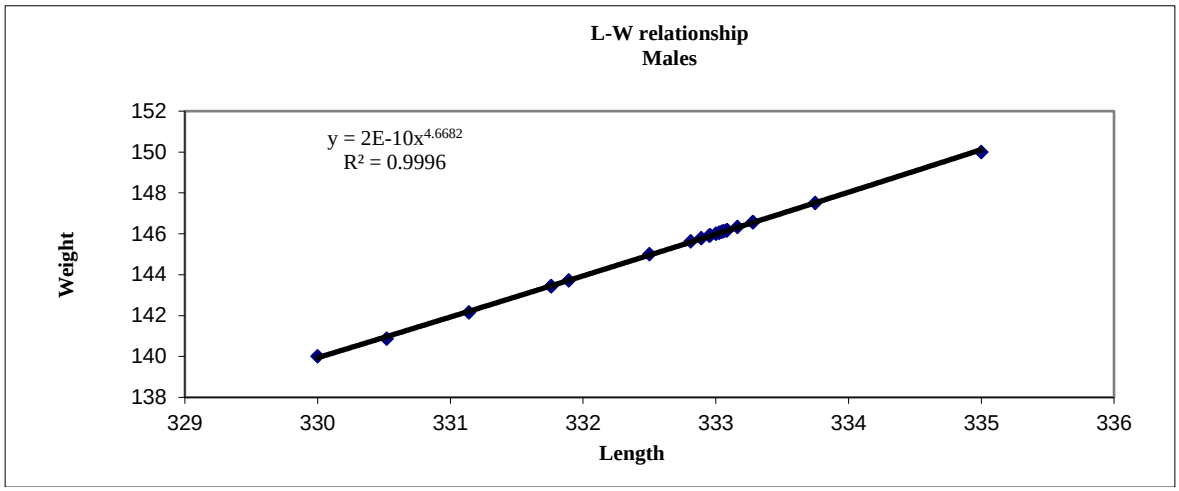

Fig. 2. a Length-weight of *S. seenghala* (male) from site 2

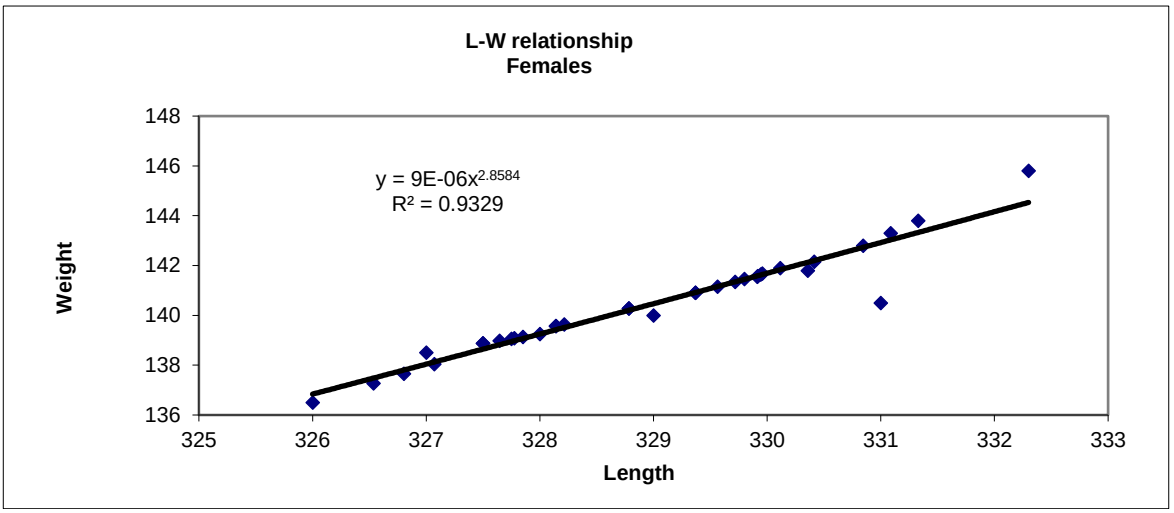

Fig. 2. b Length-weight of *S. seenghala* (female) from site. 2

4. CONCLUSION

The length-weight relationship analysis for *S. seenghala* from two sites reveals significant differences in growth patterns between males and females. At Site 1, females exhibit a steeper slope than males, whereas at Site 2, males have a slightly higher slope. These differences are statistically significant, highlighting sex-specific growth rates. However, the adjusted means do not differ significantly between sexes at either site. The high R-squared values for both sites and sexes indicate a strong correlation between length and weight, demonstrating the robustness of the length-weight relationship. These findings are consistent with previous studies, affirming normal growth patterns in both populations.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

I heraby declare that No genrative AI technologies such as Large Language models and text-to-image genrators have been not used during wirting.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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