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Studies on length–weight relationship of seven commercially important freshwater fish species of Gomti River Lucknow (U.P.) India

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ABSTRACT

This study includes the length–weight relationship of the seven fish species of the Gomti River Lucknow, India. Total of 271 specimens ranging from 15 to 57 cm total length and 25 to 155 g total weight were collected. In these study values of b varied 2.54 for *Wallago attu* to 3.2 for *Channa punctatus* in the Gomti River. The mean value of b for all species was 2.99 in the Gomti. The coefficient of determination (r^2) for Gomti River ranged from 0.90 (*Notopterus notopterus*) to 0.95 for *Channa punctatus* with a median value of 0.94, five out of a total of seven regressions presented r^2 values higher than 0.90. All linear regressions were highly and statistically significant ($P < 0.001$). The objective of study was to evaluate length–weight relations of freshwater fishes of Gomti River in order to help in conservation and management of the riverine population.

Keywords: Morphology, Fresh water fishes, Different sites, Gomti River.

1. Introduction

Weight–length relationships (WLR) are used for estimating the weight corresponding to a given length, and condition factors are used for comparing the condition, fatness, or well-being^[16] of fish, based on the assumption that heavier fish of a given length are in better condition. Fisheries management and research often require the use of biometric relationships in order to transform data collected in the field into appropriate indexes^[1, 2]. Biomass is often estimated from length–weight regressions because direct weight measurements can be time-consuming in the field. Length–weight relationships (LWRs), condition factors (K), growth, recruitment, and mortality of fishes is important tools for the study of fishery biology, mainly when the species are at the base of the higher food web. Establishment of a relationship between weight and length is essential for the calculation of production and biomass of a fish population^[1, 4, 3, 8, 7]. The Gomti River originates in a natural reservoir of the forested area near the town of Pilibhit, Uttar Pradesh, about 50 km south of the Himalayan foothills^[6]. The river flows through the central and eastern part of Uttar Pradesh, traversing about 730 km. The Gomti, although supporting a rich biodiversity and offering livelihood and nutritional security, has been less-studied from biology, ecology and conservation point of view. No information was available on the length–weight relationships of fishes, except for studies on biodiversity^[5, 9]. Studies on length–weight relationships of threatened and commercially important fishes are highly significant for management and conservation of populations in natural water bodies. No more studies are available in the literature on the biological aspects, especially length–weight relationships, of freshwater fishes of Gomti River. Aim of the study was therefore to investigate certain biometric characters with special reference to length–weight relationship from various drainages of the River Gomti, India.

2. Materials and methods

Fishes were captured monthly during the period in 2012–2013. Samples were collected from three sites in upstream, midstream, and downstream areas to cover all representative habitats all species were identified according to^[17].

Length of each fish was taken from the tip of the snout to the extended tip of the caudal fin by scale and weighed by digital weighing machine (Scimadzu). Parameters *a* and *b* were calculated using a simple linear regression model of log transformed weight over length data. Specimens were collected from various drainages of the River Gomti; India during the period in 2012–2013 using different types of fishing gear (cast net, drag net, gill net). Collections were made at random intervals because of their low population density and sporadic appearances. Altogether 271 specimens were collected, ranging from 15 cm to 57 cm length and 25 g to 155 g weight. As the gonad size is small in both sexes, external determination of sex is difficult even when the fish is fully mature. We observed that maturity percentage varied in male and female throughout the rivers studied, males attain maturity earlier than females, which may be attributed to the faster growth of males than females. Specimens were preserved in

10% formalin, kept in plastic fish carriers and transported to the laboratory. The LWR was estimated by using the equation $W = aL^b$ [15]. The L–W relationship of the fish was studied by linear regression of $\text{Log TW} = \text{Log } a + b \text{ Log TL}$, where, TW was the total body weight in grams, TL total length in cm, and *a* and *b* are the parameters of the equation. To test for possible significant differences in both slope and intercept, analysis of co-variance was followed.

3. Results and Discussion

A total of 271 fishes were examined for the study. Length–weight relationships with statistics are shown in Table 1. Linear regressions were highly significant ($P < 0.001$), with the coefficient of determination (r^2) values being > 0.90 for all fish species. The value of *b* indicated positive allometric growth for *H. fossilis* (3.05) and for *C. punctatus* (3.2)

Table 1: Descriptive statistics and estimated parameters of length-weight relationships ($W = aL^b$) for 7 fish species of Gomti Rivers, Uttar Pradesh, India.

Family	species	N	Max. (Length in Cm)	Min (Length in Cm)	a	b	90% CL of a	90% CL of b	r^2
Channidae	<i>Channa punctatus</i> (Bloch)	45	28	16	.008	3.2	-2.31 to -1.75	2.37 to 3.16	.95
Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch)	40	55	17	.005	3.05	-2.03 to -1.23	2.45 to 3.25	.91
Bagridae	<i>Sperata aor</i>	35	42	15	.0052	2.55	-2.54 to -2.01	2.53 to 3.12	.94
Siluridae	<i>Wallago attu</i>	25	57	20	.0240	2.54	-2.01 to -1.11	2.11 to 2.45	.92
Notopteridae	<i>Notopterus notopterus</i>	42	32	15	.0166	2.67	-2.14 to -1.70	3.10 to 2.60	.90
Bagridae	<i>Mystus tengara</i>	48	33	16	.0064	2.62	-2.64 to -2.13	2.78 to 3.14	.94
Schilbeidae	<i>Clupisoma garua</i>	36	40	15	.0045	2.69	-2.52 to -2.12	2.66 to 3.17	.93

Total number (N), Maximum, Minimum, *a*, intercept; $10a$, anti log of *a*; *b*, slope; r^2 , coefficient of determination.

Sample size, minimum and maximum length [10] for each species as well as LWR, coefficient of determination (r^2), slope regression (*b*), 90% confidence range for *b*, antilog of *a* (intercept of regression) with antilog of 90% confidence range are presented in Table 1. The calculated linear regression indicates significant differences between the slopes of the L-W relationship among species. These differences may be attributed to availability of food as well as changes in the maturity stage [11].

In our study values of *b* varied from 2.54 for *Wallago attu*, to 3.2 for *Channa punctatus* in the Gomti River. The mean value of *b* for all species was 2.99 in the Gomti. The coefficient of determination (r^2) for Gomti River ranged from 0.90 (*N. notopterus*) to 0.95 for *Channa punctatus*, with a median value of 0.94; seven regressions presented r^2 values higher than 0.90. All linear regressions were highly and statistically significant ($P < 0.001$). According to Hile [12] and Martin [13] the value of *b* usually remains constant at 3.0 for an ideal fish. However, Beverton and Holt [14] suggested that the decreasing of the *b* value from three is rare in adult fishes. Within species variance in weight–length relationships can be substantial, depending on the season, the population, or annual differences in environmental conditions.

In the current study maximum fishes showed deviations from the ideal value.

The result of, our study has provided the basic information on the length–weight relationships of 7 fish species from the Gomti Rivers that would be beneficial for fishery researcher and conservationists to improve regulations for sustainable fishery management in River Gomti (U.P.) India.

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