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Length weight relationship and condition factor of *Mystus bleekeri* (Day, 1877) in Rudrasagar Lake, a Ramsar site in Tripura

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Abstract

The aim of the present study was to assess the length-weight relationship as well as condition factor of a small sized freshwater cat fish *Mystus bleekeri* from Rudrasagar Lake, a Ramsar site of Tripura. A total of 337 fish specimens were collected from June 2015 to May 2016 following random sampling approach using different types of fishing gears as gill net, cast net and drag net of various mesh sizes for the aforesaid purpose. The results revealed intercept 'a' and slope 'b' value as -4.310 and 2.816, respectively with $R^2 = 0.99$ at 95% confidence limit. A negative allometric growth has been observed in the present study as the growth coefficient value is less than 3 indicating the population of fish to be less rotund. The calculated Fulton's condition factor value ranged from 1.76 to 2.60 with an average K value of 2.07 indicating a very healthy condition of the fish. This study is useful in providing relevant information in understanding the biology of the fish, estimation of fish condition in its environment and in the assessment of population dynamic parameters.

Keywords: Length weight relationship, Condition factor, *Mystus bleekeri*, Rudrasagar Lake, Ramsar site

Introduction

Fisheries management and research often require the use of biometric relationship to transform data collected in the field into appropriate indices as the length-weight relationship, condition factor, growth rate estimation, estimation of population characteristics and stock assessment [1]. This relationship is used by fishery researchers and managers for two main purposes: one is to predict the weight from the length of a fish and second to compare the average associated parameters between fish groups spatially or temporally [2]. The morphometric relationships between length and weight can be used to assess the well-being of individuals and to determine possible differences between separate unit stocks of the same species [3]. LWR of fishes is important in fisheries and fish biology because they allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relation between them [4]. LWR can also be used in setting yield equation for estimating the number of fish landed and compared the population in space and time [5]. It is an essential tool for getting knowledge on the increment in weight as a function of length in that way monitoring the healthiness of the fish species under study [6-8]. The morphometric relationships between length and weight can be used to assess the well-being of individuals and to determine possible differences between separate unit stocks of the same species [9]. In addition, length-length relationships are also important in fisheries management for comparative growth studies [10]. The condition factor is a measure of various ecological and biological factors such as degree of fitness, gonadal development and the suitability of the environment with regard to the feeding condition [11]. When condition factor value is higher it means that the fish is in a better condition. Fulton's condition factor (K) is also widely used in fisheries and fish biology to study the condition of a fish by calculating the relationship between the length and its weight [12]. The different values in K of a fish also indicate the state of the degree of food availability in its habitat [13].

Mystus bleekeri is a small freshwater catfish with a reported maximum length of 15.5 cm [14] and belongs to order Siluriformes and family Bagridae. The natural habitats of this species included streams, rivers, side channels, tanks and reservoirs [15] distributed in South and South

East Asia. Among the small sized fishes, it has high economic importance as a popular food fish [16, 17], having good taste and nutritional value. As per the IUCN red list status [18], this fish is categorized under Least Concern (LC) category.

To best of knowledge, scarce information is available on the length-weight relationship of *M. bleekeri* from Rudrasagar Lake. The present work aims to carryout length-weight relationship of *M. bleekeri* from Rudrasagar Lake.

2. Materials and methods

2.1 Study area

Rudrasagar Lake is located in Melaghar district of Tripura State between latitude 23°29' N and longitude 90°01' E. Rudrasagar lake was one identified of the wetlands of National Importance of conservation and sustainable use based on its bio-diversity and socio economic importance by the Ministry of Environment and Forest (Govt. of India). The lake was identified as Ramsar site (Wetlands of International Importance) in the year 2005. The role of wetlands in conserving fish diversity has been widely acknowledged as these ecosystems are used by fishes as a refuge for breeding, feeding and nesting purposes at one or the other stage of their life cycle [19]. The lake harbors about 53 fish species and contributes significantly in the fish production of Tripura. It also helps in maintaining and conserving the ichthyo-fauna diversity of Tripura [20].

2.2 Collection of specimen

The samples of *M. bleekeri* were collected during day time from a period of June 2015 to May 2016 from Rudrasagar Lake. Different types of fishing gears such as cast net, gill net and drag net having mesh size of about 1.5- 2.0 cm were used for collecting fish specimens. After collection, specimens were preserved in 10% formalin solution and were correctly labeled. The fish specimens were identified according to Talwar and Jhingran [21]. The total length (TL) of each fish was taken from the tip of the snout to the extended tip of the caudal fin by vernier calipers and weighed to the nearest 0.01 g body weight by a digital electronic balance. Simple random sampling method has been used for the collection of the specimen.

2.3 Length weight relationship

The length-weight relationship of fish under study was calculated using the expression: $W = aL^b$ [6] where W = body weight (g), L= total length (cm); and 'a' and 'b' are the intercept and regression coefficients respectively. The statistical analysis, linear regression was done using MS Excel software to estimate the value of the coefficients 'a' and 'b', and coefficient of determination i.e. R^2 . In computing linear regression between length and weight of the collected fish samples the confidence limit was set to be 95 %.

2.4 Condition factor (K)

The condition factor shows relative fatness and well being of fish was determined by Fulton's formulae [22] $K = 100 * W/L^3$, where W = weight (g), L = length (cm) and 100 is a factor to bring the value of K near unity.

2.5 Statistical analysis

All the statistical were performed using the SPSS package (version 16.0) and Microsoft Office excel software (version 2007).

3. Result and Discussion

A total of 337 specimens ranging from 54-158 mm in TL (total length) and 3.8-78 g in BW (body weight) were used for

the study of length weight relationship and condition factor. The length weight relationship was calculated as $\text{Log } W = -4.310 + 2.816 \text{ Log } L$ with $R^2 = 0.99$. The weight of the fish increases logarithmically with an increase in length and with the value of 'b' lying between 2.5 and 3.5 but usually close to 3.0 [23]. The value of 'b' usually remains constant at '3' in an ideal fish [24], but under natural conditions the value of 'b' usually ranges between 2.5 and 4 [25, 26]. The b value was calculated to find out whether the fish is growing allometrically or isometrically. If the 'b' value is 3.0 the growth is considered to be isometric and the increase in weight is proportional to the cube of length. Moreover, when b is far less or greater than 3, growth in the fish is allometric which means the fish becomes much thinner or thicker with increase in length [27-29]. The b value decides growth pattern of the fish species. In the present study the 'b' value obtained for *M. bleekeri* is 2.816, so we can conclude that a negative allometric growth has been observed in the present study. Regarding growth type, a value close to 3.0 follows the cube law indicating that the fish grows isometrically and values other than 3.0 indicate allometric growth [30]. Muhammad *et al.* [31] found the 'b' value for *M. bleekeri* as 2.49 from Indus River, Pakistan showing a negative allometric growth, similar to our results. Similar results were also obtained by Naeem *et al.* [32] as the 'b' value obtained for *M. bleekeri* was 2.62 indicating negative allometric growth. Using the same methodology, Maurya *et al.* [33] found positive allometric growth for *Pethia ticto* from Gomti River, Uttar Pradesh. Difference in b values can be attributed to the combination of one or more factors such as: number of specimens examined; area; seasonal effect; habitat; degree of stomach fullness; gonadal maturity; sex; health and general fish condition; preservation technique; and differences in the observed length ranges of the specimens caught [34, 35]. The coefficient of determination was found to be the 0.99 indicating highly significant value of the result. The length weight relationship plot is presented in Fig. 2.

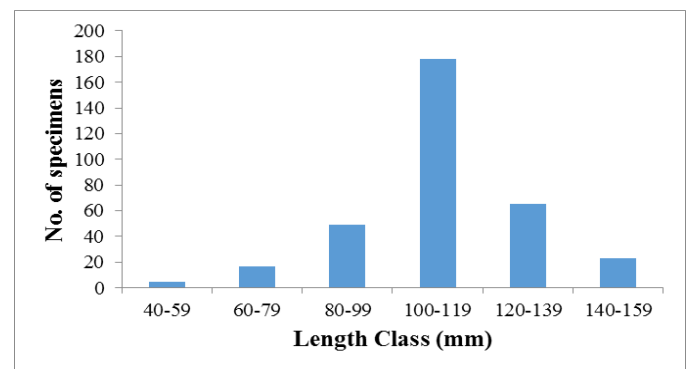


Fig 1: Number of fish specimen in each length group

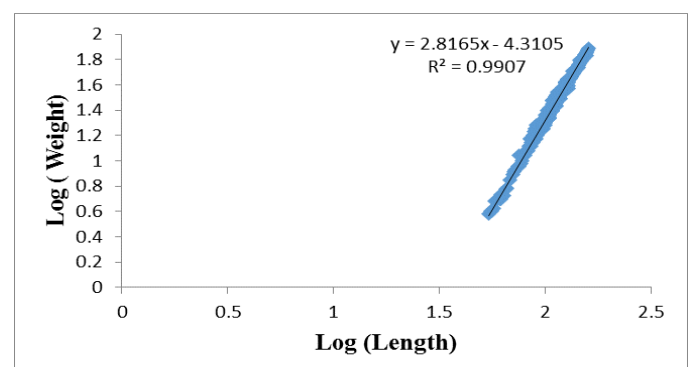


Fig 2: Length weight relationship of *M. bleekeri*

Condition factor basically represents health status of fish which is actually the result of the interactions between biotic and abiotic factors and their effect on the physiological condition of the fish. However, variations in condition factor of fish primarily reflect its nourishment status and state of sexual maturity [36]. In the present study the calculated Fulton's condition factor value ranged from 1.76 to 2.60 with an average K value of 2.07. The K value for length groups 40-59 mm, 60-79 mm, 80-99 mm and 100-119 mm was computed as 2.36, 2.2, 2.15 and 2.07 respectively. The same for length groups 120-139 mm and 140-159 mm was calculated as 2.02 and 1.9 respectively. The K value for each length group is shown in Fig. 3. Since the calculated K value is more than 1 for each length group, it can be concluded that the fitness of the candidate species is good in the ecosystem. This also indicates a sign of good health status of fish as well as its habitat. Muhammad *et al.* [31] calculated the K value for *M. bleekeri* as 1.35 from Indus River, Pakistan. The factors affecting the K value includes sex, size, season and degree of gonadal development in fish [37]. Ecological factors, food supply, disease outbreak and parasitism have great influence on the well being of the fish [6]. Fluctuations in K of many fishes were observed in relation to their reproductive cycle, feeding rhythms, physico-chemical factors of the environment, age, physiological state or some other environmental factors [38-40]. This study indicates that *M. bleekeri* is naturally recruited in the study area. The samples observed are also healthy as indicated by its length weight relationship. Further studies are needed to carry out the stock assessment of the species for its sustainable exploitation and responsible fishing.

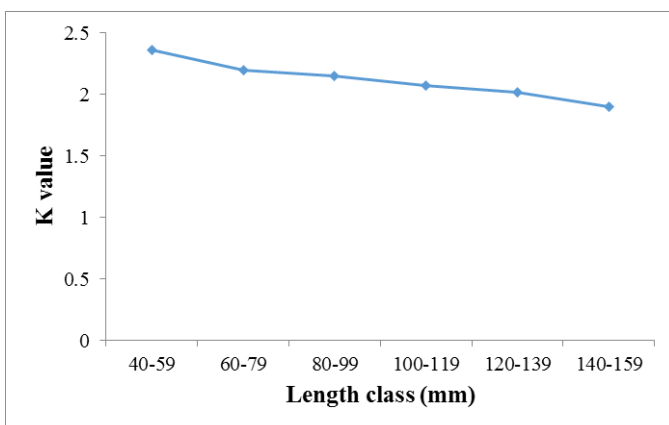


Fig 3: Fulton's condition factor for each length group

4. Conclusion

Based on the length weight relationship and condition factor results, it can be concluded that *M. bleekeri* is in good condition in Rudrasagar Lake. The present study for *M. bleekeri* will therefore provide useful information for fishery biologists and conservation agencies for sustainable fishery management.

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