Length – Weight Relationship in *Schizothorax niger* Heckel, an Endemic Lacustrine Fish of Kashmir

A.R. Yousuf*, Gazala Firdous and Anil K. Pandit

P. G. Department of Zoology, The University of Kashmir, Srinagar–190 006, Jammu & Kashmir

* Centre of Research for Development, The University of Kashmir, Srinagar - 190006

ABSTRACT

Length – weight relationship was determined for *Schizothorax niger* Heckel from three different lacustrine habitats of the valley of Kashmir. While in the two highly eutrophic lakes, viz. Dal and Anchar, the relationship was found to deviate significantly from the cube law, in the Manasbal Lake (which shows early signs of eutrophication) the length and weight relationship showed very small variation from the ideal conditions. The influence of environmental conditions on the relationship was significant.

Keywords: Kashmir, *Schizothorax*, lacustrine habitat.

INTRODUCTION

The endemic fish fauna of Kashmir valley is peculiar in having schizothoracines as the dominant component. While most of the schizothoracines found in the valley are characteristic of lotic as well as lentic habitats, *Schizothorax niger* Heckel is confined to the lacustrine habitats of the valley proper where it contributes a significant part of the total fish catch. The present article on the relationship between its length and weight is based on a part of the data collected by the authors on various biological features of the fish in the Dal , Anchar and Manasbal lakes.

MATERIAL AND METHODS

Fish for the present study were procured from Dal, Anchar and Manasbal lakes. The fish landing centres of these lakes were visited regularly in the first week of each month and the live fish purchased from the fishermen. After wiping the fish with the help of a sponge on the spot, length and weight measurements were made. Log transformation of the cube law ($W = a L^b$), i.e., Log W = Log a

+ b Log L (where W and L are weight in grams and length in millimeters of the fish respectively, a is initial growth index and b is equilibrium constant) was used. The length - weight relationship was determined separately for the fish from the three lakes.

RESULTS

The statistical data on the length and weight relationship in *Schizothorax niger* Heckel (= *Shizothoraichthys niger* Misra) in the three lakes, viz., Dal, Anchar and Manasbal, are presented in Table 1.

Table 1. Value of a, b and r in the length - weight relationship of *S. niger* in the three lakes of Kashmir valley.

Habitat	No. of fishes	a	b	r
Dal	181	-1.958	2.977	0.96
Anchar	290	-5.004	2.974	0.97
Manasbal	173	-2.137	3.014	0.95

The relationship between length and weight was also determined separately for the two sexes in the Dal and Anchar lakes. The coefficient of correlation between the two parameters in both the sexes was highly significant (r = 0.96 for both sexes in the Dal and 0.94 for males and 0.97 for females in the Anchar). The value of b was significantly higher in males in case of Dal Lake but in Anchar Lake the value was slightly higher in females (Table 2). In order to assess the influence of gonadal condition on the length-weight relationship, values of a, b and r were calculated during different phases of gonadal development- developing, mature and spent - in both the sexes in the fishes from the Dal Lake (Table 3). The value of 'b' was found to be the highest in the mature stage in both the sexes (3.275 in males and 2.966 in females). The lowest value of b in males (2.715) was recorded in spent fish, while in females the developing stage recorded the lowest b value (2.612).

Table 2. Length – weight relationship in *S. niger* on the basis of sex in the Dal and Anchar lakes.

Male		
	Dal	Log W = 3.068 Log L – 2.069 (r = 0.96)
	Anchar	Log W = 2.726 Log L – 4.484 (r = 0.94)
Female		
	Dal	Log W = 2.926 Log L – 1.897 (r= 0.96)
	Anchar	Log W = 2.930 Log L – 4.881 (r = 0.97)

Table 3. The values of a, b and r in the length – weight relationship of *S. niger* during the three phases of gonadal cycle in the Dal lake.

Stage	Sex	a	b	r
Developing	Male	-1.768	2.834	0.96
(Aug. - Sep.)	Female	-1.448	2.612	0.95
Mature	Male	-2.569	3.275	0.99
(Jan. - Feb.)	Female	-1.954	2.966	0.99
Spent	Male	-1.587	2.715	0.96
(Apr. - May)	Female	-1.798	2.855	0.93

DISCUSSION

The length and weight relationship has been greatly used by the fishery biologists in studying the fish population dynamics in water bodies and also for investigating the patterns of growth in fish stocks. Bagenal (1957) showed that in equation $W = a L^b$ value of 'a' changes with time, season and habitat of a fish. The value of 'b', on the other hand, remains constant within a particular stanza of life (Bagenal, 1957) and is as such of more importance than the value of 'a' in establishing the relationship between length and weight. According to Allen (1938) the value of b in the above equation remains constant at 3 in an ideal fish living in an ideal environment. However, in nature the ideal conditions are only rarely observed and as such deviations from 3 are a common feature. The extent

of deviation from the ideal condition can be taken as an indication of the general well being of the fish or the state of its gonadal development (Le Cren, 1951). The value of 'b' has been found to fluctuate from 2.5 to 4.0 in different fishes (Hile 1936; Bhatnager, 1962; Soni & Kathal, 1979) but in ideal conditions its value is placed at 3. In the present fish the value of b was slightly less than 3 (i. e., 2.977) Values less than '3' have also been reported in some other schizothoracines of the region (2.8928 in *S. curvifrons* by Sunder, 1985 and 2,4487 in *S. richardsoni* by Qadri and Mir, 1980). From the data it is evident that *S. niger* shows higher 'b' value than either of these and the value is relatively nearer to the ideal conditions. This is probably due to the fact that *S. niger*, being a typical lacustrine fish, is better adapted to the eutrophic conditions experienced by the lakes of the valley than the other two, which, although still contributing a little to the lacustrine fisheries, are under much higher stress.

The fish health, on which the length – weight relationship depends, is influenced by the environmental factors to a great extent. Both the Dal and the Anchar are eutrophic in nature (Yousuf, 1996; Pandit, 1999; Yousuf *et al*., 2001) and as such the stress on the fish, particularly the schizothoracines, is similar in the two habitats. This is also revealed by the value of b in the length and weight relationship, which is slightly lower than that found in ideal conditions. Because of similarity in the environmental conditions the value shows only slight variations between the fish of the two habitats. The Manasbal Lake, on the other hand, is at a relatively lower trophic level than the Dal and the Anchar and this habitat is better suited for the survival and growth of S. niger. This is clearly indicated by the length – weight relationship as well. The value of b in this case is significantly different from the value obtained in the other two habitats.

Significant differences have been reported for the value of exponent 'b' in the two sexes of a species. While Jhingran (1961) observed higher b values in males, Bhatnager (1963) and Sunder (1985) recorded higher values in females. The present data revealed that the value of 'b' in two sexes varies with habitat. While in the Dal males had higher b value, in the Anchar the females revealed higher values. The value of b also showed a close relation with the gonadal development. In the mature condition gonadal mass is very high and it results in the highest b value in both the sexes. During the developing condition and spent stage the value of b was much lower.

When b value was calculated separately for size ranges of below 200 mm and above 200 mm in the two sexes no significant changes were observed in

males. But in females the fish below 200 mm showed very low b value as compared to > 200 mm fish, which recorded value comparable to that of males. It may be that in the smaller fish the relatively higher strain due to gonadal development does not allow the weight of body to increase proportionately increase in its length.

ACKNOWLEDGMENTS

Thanks are due to the Head, P. G. Department of Zoology for providing laboratory facilities.

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