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Quantitative osteological study of a bottom feeder hillstream cyprinoid fish *Crossocheilus latius latius* (Hamilton- Buchanan)

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Abstract: The quantitative osteological study has been conducted on a Hillstream bottom feeder fish Crossocheilus latius latius. C. latius latius is a common hillstream fish of Snowfed Rivers of Alaknanda. The bones have been taken from different sized fishes ranged from 13 to 27 Cm in length and 39 to 132 gm in weight. The correlation is applied between Body Weight and the Weight of different disarticulated bones of C. latius latius. The correlation (r) is highly significant among the different parameter of body in relation to osteology which ranged from r = 0.952; P< 0.1 to r = 0.999; P< 0.1.

Keywords: Articulated and disarticulated bones, Correlation coefficient, *Crossocheilus latius latius*, Quantitative osteological study

INTRODUCTION

The vertebrates' skeleton system has a positive correlation with their body weight. Also there is a strong positive correlation between the weight of different skeleton and the total skeleton system (Bahuguna and Bisht, 2005).

The skeleton not only determines the form, shape and size of the body of organisms based on their habitat but it also provides protection, gives coverage and play a very important role in haematopoiesis. Accordingly, the organisms have developed diverse adaptations in skeleton system and bio-chemically formulate a particular mineral composition.

Considerable works on osteo-morphology in respect to function of different bones have been conducted by Gregory (1933) classical memoir on osteology and on skull and cranial muscles of vertebrates by Edgeworth (1935). Some valuable work have also been conducted on the cranial anatomy of Indian teleosts by Sarbahi (1932), Ramaswami (1945;1952) and Khandelwal and Mittal (1965). Dubale and Nair (1977) have given interesting account of the functional morphology of head bones of cyprinoid fishes.

In the present study an attempt has been made to find out the osteo-morphological relationship among the different bones of hill stream fish *Crossocheilus latius latius* in relation to its length and weight. The study will be helpful for the phylogenetic study of the living and fossils fishes by the Ichthyo-paleontologists. This study will also be helpful to know the history of the Icthyofauna of the Himalayan region where day-by-day erosion is increasing the possibilities of earthquake, high sedimentation and submergence of many water bodies.

MATERIALS AND METHODS

For the present study the fishes; *Crossocheilus latius latius* (Hamilton-Buchanan) were collected from the River Alaknanda around Srinagar Garhwal area and its spring-fed tributaries.

Most of the fishes were caught by fisherman through gillnet and drag net. The different-sized fishes; ranging from 13 to 27 cm in length and 39 to 132 gm in weight; were selected for the present study. The disarticulated skeleton of fishes was obtained by boiling method. The length and weight of bones were measured with the help of Vernier Caliper and Annamed Top Pan balance, respectively. The correlation coefficient (r) was calculated by the following formula to understand the length-weight relationship of bones with the help of computer Microsoft Excel programme.

$$r = \frac{\sum x.y}{\sqrt{\sum \mathbf{x^2}.\ \mathbf{y^2}}}$$

Where; r = Correlation coefficient; x = Deviation of x variables; y = Deviation of y variables; ∑x. y= Sum of multiplication of deviation of x and y.

RESULTS AND DISCUSSION

The present investigation involves the correlation study between body weight, body length and weight of different disarticulated skeleton of *Crossocheilus latius*

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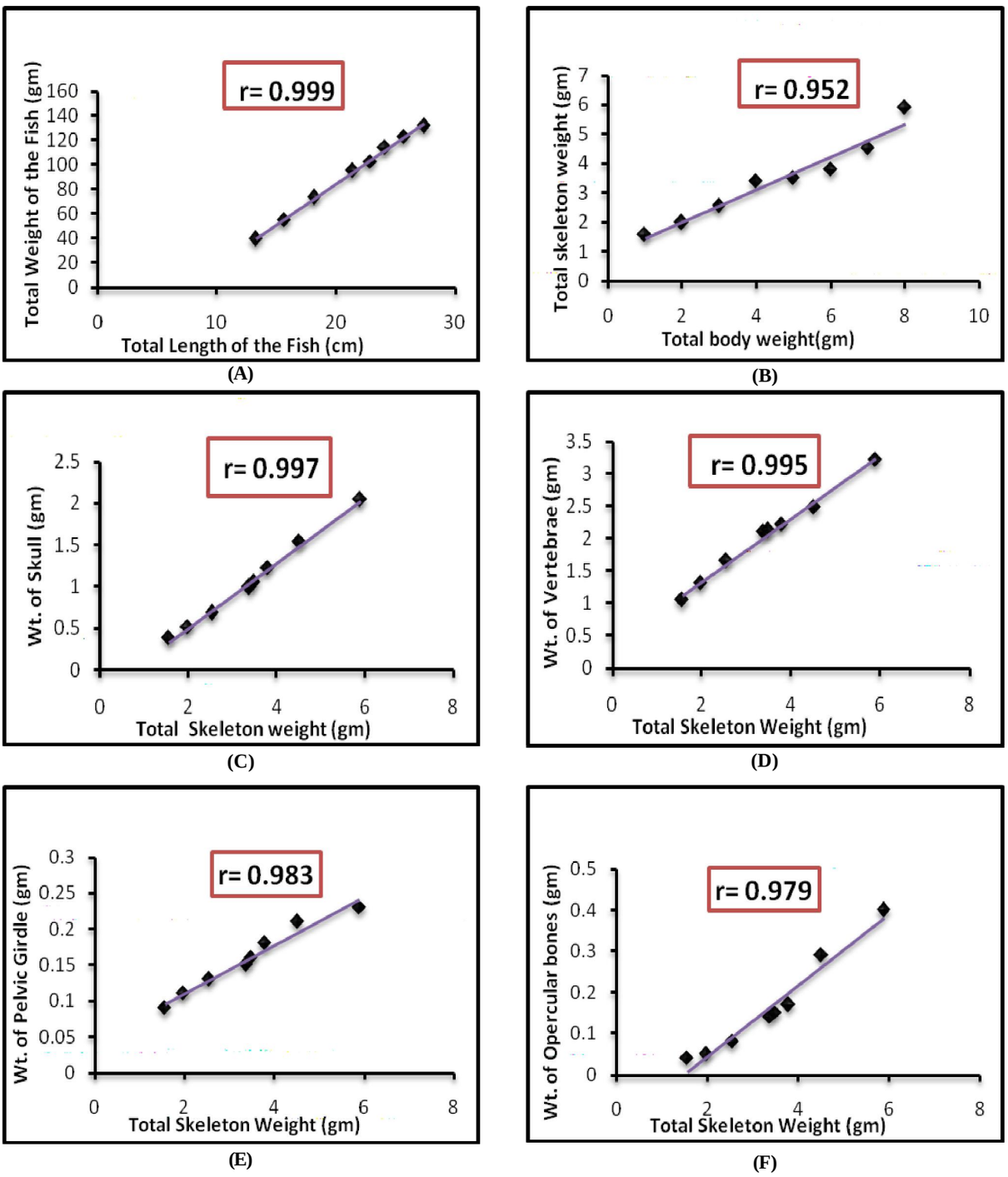

Fig. 1. (A-F) *A correlation shown through graphical interpretation showing linear line, *r= correlation coefficient.*

latius. Various correlation parameters which have been taken for the quantitative osteo-morphological study are :Total body length (TBL) and Total body weight (TBW); Total body weight (TBW) and Total skeleton weight (TSW) ; Total skeleton weight (TSW) and fish skull weight (SW); Total skeleton weight (TSW) and Vertebral weight (VW); Total skeleton weight (TSW) and Weight of the different bones of operculum (OW); Total skeleton weight (TSW) and Pelvic girdle weight (PGW). The correlation coefficient presented revealed that the correlation between all the parameters studied was positive and highly significant ranging from 0.952 to 0.999. Maximum correlation was observed between TBL-TBW ($r = 0.999$; $P< 0.1$), while minimum was found between

TBW-TSW i.e. (r = 0.952; P< 0.1).The co-relationship between total weight of fish in relation to total length of the fish and also total skeleton weight in relation to weight of skull, weight of vertebrae, weight of pelvic girdle and weight of opercular bones showed a linear line having correlation coefficient (r) less than 1.0 (Fig.1)

The significant and non-significant values of different body parts of the organism are directly related to the adaptive evolution among the bones. In *C. latius latius* the significant correlation between total body weight and total length of the fish and also total skeleton weight in relation to weight of skull, vertebrae, pelvic girdle and opercular bones suggests the evolution or adaptation towards the high altitude habitat. A positive correlation with significant 'r' values has been computed between skeleton weight (SW) and different head bones of Snowtrout (*S. richardsonii*, and *S. plagiostomus*) and Mahseer (*T. putitora*, and *T. tor*). But *T. tor* showing non-significant correlation between skeleton weight (SW) and pre-opercular (POP), inter-opercular (IOP), Sub-opercular (SOP), Urohyal (URO) and Parietal (PAR), which showed their non-adaptive osteo-morphological nature towards the snowfed high altitude. It is directly related to the importance of the osteo-morphology in relation to the environmental adaptation or habitat adaptation (Bisht, 2005). Within *Tor* spp. also, it has been noticed that the *T. putitora* have more significant values (r= 0.903, 0.952; P< 0.1) than *T. tor* (r= 0.34, 0.485; not significant) as a result of which *T. putitora* inhabited higher altitude than *T.tor* (Bisht, 2005). Thus, the study is useful to find out the importance of those bones in different fishes which have more eco-morphological adaptive nature due to high significance value than those fishes having less or insignificant value in high altitude riverine system. So they may fit to live for long time in snow-fed high speed gradient water.

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