LENGTH-WEIGHT AND LENGTH-LENGTH RELATIONSHIPS IN FRESHWATER GARFISH *XENENTODON CANCILA* (HAM.) FROM MURIYADHAR, SUNSARI, NEPAL

B.R. Subba, S.N. Mehta and S. Adhikaree

ABSTRACT

Present paper attempts to describe length-weight (LW) and total length-standard length (TL and SL) relationships of fresh-water garfish *Xenentodon cancila.* Fish of different length and weight were caught using cast nets from Muriyadhar, Sunsari. The fish were kept in ice box in fresh condition and brought to fish laboratory, Department of Zoolog post Graduate Campus, Biratnagar. The data obtained from measurement were analysed using the formula $W = aL^b$. The b values estimated for the total length and standard length in relation to body weight were 3.2202 and 3.2559 respectively. The values of b clearly indicate the allometric growth pattern and for total length and standard length relationship, the linear value of b was 0.3223.

Key words: fresh-water garfish, length-weight, length-length relationship

INTRODUCTION

The freshwater garfish *Xenentodon cancila* (Ham.) commonly known as 'Kauwa', 'Chuchebam' is a common fish in the rivers of Tarai. The study of length-weight and length-length relationships is paramount important and widely practiced tool in the fishery for different purposes, especially in the study of population dynamics, ecology, taxonomic differences, event in life history like metamorphosis, maturity, stock management (Le Cren 1951, Lagler *et al*. 1962, Froese 2006, Abdoli *et al*. 2008, Ferreira *et al*. 2008, Vaslet *et al*. 2008, Epler *et al.* 2009). In fishes, generally the growth pattern follows the cube laws (Brody 1945, Lagler 1952) but the actual relationship may depart from this (Le Cren 1951), either due to environmental factors or some other reasons. The relationship is generally expressed by the equation, $W = aL^b$.

Several workers have studied length-weight and length-length relationships of fishes living in different environmental conditions. Le Cren (1951) gave an account of the length-weight relationship and seasonal cycle in gonad weight and condition factor in the Perch (*Perca fluviatilis*). The works of Thakur and Das (1974), Subba and Ghosh (2000), Subba and Pandey (2000), Abdallah (2002), Somro *et al.* (2007), Kara and Bayhan (2008), Nowak *et al*. (2008), Ansumala and Subba (2009), Subba *et al.* (2009) have given an account of length-weight and length-length relationsips of the following fishes *viz*. *Heteropneustes fossilis, Mugil cephalus, Moemacheilus triangularis, Lepidocephalus thermalls, Cirrhinus mrigala, Puntius sarana, Barilus bendelisis* and *B. vagna, Glyptothorax telchitta, Botia lohachata, Leuciscus leuciscus, Phoxinus phoxinus, Salmo trutta, Boops boops, Eutropiichthyes vacha, Schistura rupicola* and *Gudusia godanahiae* respectively.

The present study is an attempt to estimate and impart lacking information about length-weight and length-length relationships of freshwater garfish *Xenentodon cancila*.

MATERIALS AND METHODS

Fresh water garfish of varied length and weight were harvested using cast net in Muriyadhar which runs parallel to the east dam of the Koshi river in Sunsari. The fish were kept in ice box in fresh condition and brouhgt to the fish laboratory of Zoology Department, Post Graduate Campus (TU), Biratnagar. The samples were collected from July 2007 to June 2008. The fishes were measured, in full stretched condition, to the nearest 0.2 cm and weighed to the nearest 0.2 gm, after removing moisture from their body using papers and towel. The weight of each fish was taken in gram and measurement of the fish from the tip of the snout to the tip of the tail in (cm) for its total length. The standard length measurement was taken from the tip of the stout to the base of the tail in cm.

The weight of fish specimens ranged from 1.19 to 27 g and maximum total length 27.4 cm and minimum 8.50 cm similarly maximum standard length 25.5 cm and minimum 8.0 cm. The data obtained from the measurements were computed for regression and correlation coefficient values in case of length-weight and length-length relationships. An application of logarithmic transformation of the data was made to establish the relationship equation by least square method.

RESULTS AND DISCUSSION

The weight of *Xenentodon cancila* (Ham.) showed clear cut increasing trend with the increase in body length. When logarithmic values of weight were plotted on the co-ordinate (Y-axis) against those of respective length on the abscissa (X-axis) they always gave straight line (Figs 1, 2 and 3).

The computed regression coefficient (b) values for the relationships between weight and lengths i.e. total length and the standard length came to be more than 3 i.e. 3.2202 and 3.2559 respectively. The relationship equations are as follows:

1. For total length:

$Wt = 0.0092\ TL^{3.2202}$

Or Log Wt=-20362+3.2202Log TL

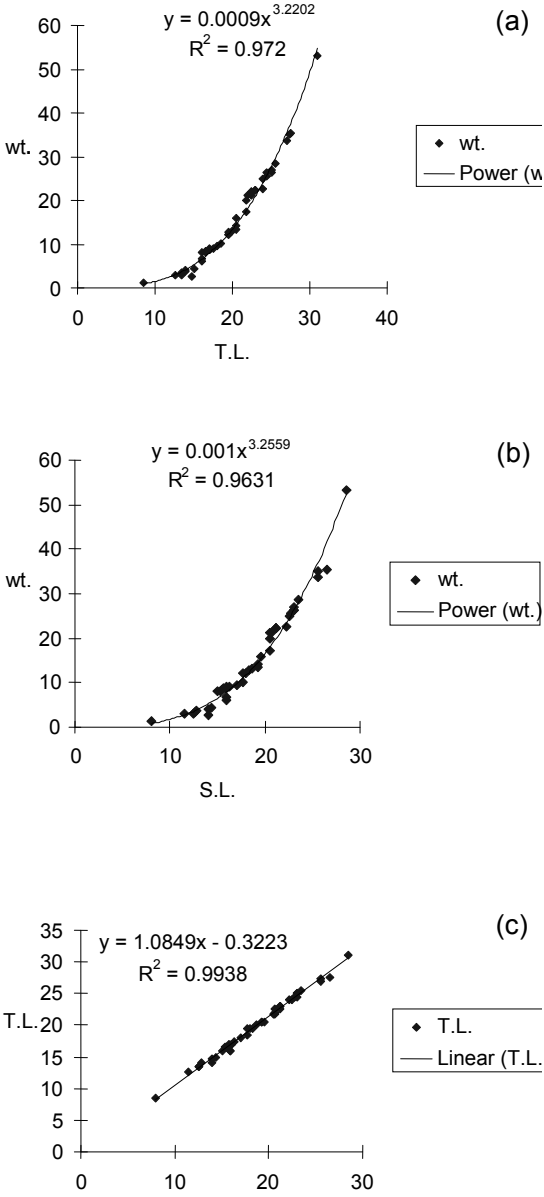
2. For standard length:

$Wt = 0.001\ SL^{3.2559}$

or Log Wt = - 3 + 3.2559 Log SL.

In the case of length-length relationship the linear value of b came to be -0.3223

The computed values for coefficient of determination 'r^2' for all the relationships ie. total length-weight (TL-Wt), standard length-weight (SL-Wt) and standard length-total length (SL-TL) were 0.972, 0.9631 and 0.9938 respectively (Figs.1, 2 and 3).



Figures (a, b and c). Relationships between (a) total length (T.L.) and weight (Wt.) (b) standard length (S.L.) and weight (Wt.) (c) total length (T.L.) and standard length (S.L.).

Several workers have made estimations on length–weight and length-length relationships in different fish species. Le Cren (1951) has stated that the length-weight relationship in fishes are probably related to the seasonal variation since fat and water content of fish may vary according

to temperature The change in 'b' value shows allometric growth of the body due to the influence of numerous factors *viz.*, seasonal fluctuations, change in physiological condition during spawning periods, gonad development, sex, physico-chemical conditions of the environment and nutrition conditions of the environment (Sinha 1973). The reported exponent values for 'b' for different fishes ranged between 2.5 to 4.0 (Hile 1936, Martin 1949) and 2 to 4 (Bagenal and Tesch 1978, Koutrakis and Tsikliras 2003). Lal and Dwivedi (1965) and Sekheran (1968) have also observed an inter-specific for 'b' that remains constant at '3.0' for an ideal fish. In the present fish sample, the calculated values for 'b' for length and weight were higher than 3 i.e. 3.2202 and 3.2559 which were of expected range and indicated that the growth is allometric in *Xenentodon cancila*. Similar differences in slope value have been reported by Pandey *et al*. (1974), Thakur and Das (1974), Subba and Ghosh (2000), Subba and Pandey (2000), Ansumala and Subba (2009), Subba *et al.* (2009) on *Heteropneustes fossilis, Glyptothorax telchitta, Schistura rupicola* and *Gudusia godanahiae.* Le Cren (1951) states that the length weight relationship in fishes is probably related to the seasonal variations as fishes do not retain the same shape or body contour through out the year. So there should be slight change in slope values in different seasonal studies. The values of coefficient of determination 'r^2' calculated for all relationships *viz*., TL-Wt, SL-Wt and SL-TL in the freshwater garfish (Figs.1a, b, c) were 0.972. 0.9631 and 0.9938 respectively which are highly significant ($p<0.001$).

REFERENCES

Abdallah, M. and A.E. El-Haweet, 2000. Stock assessment of sardine in the Egyptian Mediterranean waters by virtual population analysis: case for the coast from Alexandria to Abu-Qir. *Egypt. J. Aqu. Biol. And Fish,* **4**(3):173-191.

Abdoli, A.P. Rasooli and H. Mostafavi, 2008. Length-weight relationships of *Capoeta capoeta capoeta* (Guldenstaedt 1772) in the Gorganrud River, South Caspian Basian *J. Appl. Ichthyol.,* **24**:96-98.

Ansumala, A. and B.R. Subba, 2009. Studies on length-weight relationship of a hillstream loach, *Schistura rupicola* (McClelland). *J. Nat. Hist. Mus.,* **24**:126-129.

Bagenal, T. and F.W. Tesch,1978. *Age and growth. Method for assessment of fish production in freshwater.* (ed T. Bagenal), IBP Hand book, Blackwell Scientific Press, Oxford.

Brody, S.,1945. *Bioenergetivs and growth.* Reinhold Publishing Corporation, New York, 1023 p.

Epler, P.M. Nowak and W. Popek, 2009. Growth rate of the chub (*Squalius cephalus*) and the nase (*Chondrostoma nasus*) from Raba, Dunajec and Poprad river-AACL *Bioflux,* **2**:1-8.

Ferreira, S.R.Sousa, J. Delgado, D. Carvalho and T. Chada, 2008. Weight-length relationships for demersal fish species caught off the Madeira archilelago (eastern-central Atlantic). *J. Appl. Ichthyol.,* **24**:93-95.

Froese, R., 2006. Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *J. Appl. Ichthyol.,* **22**:241-253.

Hile, R.,1936. Age and growth of the Cisco, *Leucichys artedi* (Le sueur) In the lakes of the north-eastern highlands. *Wisconsin Bull. U.S. Bur. Fish,* **8**: 311-317.

Hossain, M.Y., Z.F. Ahmed, P.M. Leunda, A.K.M. RoksanulIslam, S. Jasmine, J. Oscoze, R.R.

Miranda and J. Ohtomi, 2006. Length-weight and length-length relationships of some indigenous fish from the Mathabhanga river,south western Bangladesh. *J. Appl. Ichthyol.,* **22**:274-278.

Kara, A. and B. Bahar, 2008. Length-weight and length-length relationships of the bogue *Boops boops* (Linneaus 1758) in Izmir Bay (Aegean Sea of turkey). *Belg. J. Zool.,* **138**(2):154-157.

Koutrakis, E.T. and A.C. Tsikliras, 2003. Length-weight relationships of fishes from three northern Aegean estuarine systems (Geece). *J. Appl. Ichthyol.,* **19**:258-260.

Lagler, K.F.,1952. *Freshwater fishery biology.* W.M.C. Brown Company, Dubyqu, Iowa.

Le Cren, E.D.,1951. The length-weight relationships and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis). J. Anim. Ecol.,* **20**:201-219.

Martin, W.R.,1949. The mechanics of environmental control of body form in fishes. *Univ. Toronto stud. Boil.* 58, Ont. Fish. Res. Lab., **70**:1-91.

Moutopoulos, D.K. and K.I. Stergiou, 2002. Length-weight and length-length relationships of fish species from Aegean Sea (Greece). *J. Appl. Ichthyol.,* **18**:200-2003.

Nowak, M.P. Wlodzimierz, J. Wojciech, D. Stanislaw, P. Jakub, K. Krzysztof and E. Piotr, 2009. Weight-length relationships for three fishes (*Leuciscus leucisc, Phoxinus phoxinus*, *Salmo trutta*) from the Strwiaz river (Dniester River Drainage). *Arch. Pol. Fish,* **17**:313-316.

Pandey, B.N., B.J. Choubey and J.S. Dutta Munsh,1974. Studies on some aspects of an air-breathing fish *Heteropneustes fossilis* (bloach). *Ind. J. Zool.,* **15**(2):79-86.

Sinha, A.L.,1973. Length-weight relationship of a freshwater catfish, *Clarias batrachus* (Linn.), *Ind. J. Zool.,* **14**(2):97-102.

Soomro, A.N., W.A. Baloch, S.I.H. Jafri and H. Sujuki, 2007. Studies on length-weight and length-length relationships of catfish, *Eutropichthyes vacha* Hamilton (Schibeidae: Siluriformes) from Indus river, Sindh, Pakistan. *Caspian J. Env. Sci.,* **5**(2):134-135.

Subba, B.R. and M.R. Pandey, 2000. Length-weight relationship of *Botia lohachata* (Chand) from the Saptakoshi river, Nepal. *J. Nat. His. Mus.,* **19**: 83-87.

Subba, B.R. and T.K. Ghosh, 2000. Length-weight relationship of a hill-stream fish *Glyptothorax telchitta* (Ham.) from saptakoshi river of Nepal. *J. Ind. Fisheries Associations,* **27**:79-82

Thakur, N.K. and N.K. Das,1974. Length-weight relationship of *Heteropneustes fossilis* (Bloch). *J. Inland Fish. Soc.,* **6**:95-96.

Vaslet, A.,Y. Bouchon-Navaro, M. Louis and C. Bouchon, 2008. Weight-length relationships for 20 species collected in the mangrovesof Guadeloupe (Lesser Antiles). *J. Appl. Ichthyol.,* **24**:99-100.

AUTHOR'S ADDRESS

Bharat Raj Subba, Satya Narayan Mehta and Shaligram Adhikaree

Department of Zoology, Post Graduate Campus,Tribhuvan University , Biratnagar, Nepal (email: subbabharat@yahoo.com)