Eco. Env. & Cons. 29 (August Suppl. Issue) : 2023; pp. (S417-S422)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i04s.064

Comparative analysis of some biochemical parameters and length weight relationship of *Schizothorax niger* and *Oncorhynchus mykiss* from Kashmir, India

Arshi Tariq*, Tasaduq H. Shah, Asifa Wali, Rizwan A. Dar, Syed Talia Mushtaq and Darve Sabina

Division of FRM, Faculty of Fisheries, Sher-e-Kashmir University of Science and Technology Kashmir, Rangil 190 006, Ganderbal, J&K, India

(Received 4 March, 2023; Accepted 17 May, 2023)

ABSTRACT

The study was aimed to investigate the biochemical composition of *S. niger* and *O. mykiss.* The biochemical parameters studied were total protein and total glucose estimated from the digestive tract of the two species. The length weight relationship was also estimated for both the fishes. Descriptive statistics of *S. niger* for protein showed the maximum value of 12.09 (g/dl) and minimum value of 0.11 (g/dl). For glucose, the maximum value was 96.91 (mg/dl) and the minimum value of 35.5 (mg/dl). Descriptive statistics of trout for the protein showed the maximum value of 43.18 (g/dl) and minimum value of 21.40 (g/dl) while for glucose, the maximum value of 151.36 (mg/dl) and minimum value of 58.85 (mg/dl) was estimated. The length-weight was established logarithmically as: *S. niger*: Log W = -3.344 + 2.293 Log L (R^2= 0.733) and for *O. mykiss*: Log W = -3.491 + 2.351 Log L (R^2 = 0.939).

Key words: *O. mykiss, Rainbow trout, Length–weight, Biochemical, Protein, Glucose.*

Introduction

Cold water fisheries play an important role in India's fisheries sector. India has vast cold water or hill fishery resources that are dispersed throughout the Himalayan and peninsular regions as upland rivers, streams, natural lakes, and reservoirs. Fish plays an important role in human nutrition. Fish is a nutritious food because of its biochemical constituents, particularly proteins, carbohydrates, lipids, vitamins, and minerals. In 2005, food fish contributed 14.7% of total global animal protein. Fish are commonly regarded as the most cost-effective, high-quality source of animal protein, and they hold a distinct position as a high-protein food commodity for human consumption. It is critical for enhancing nutritional status, food security, cardiovascular health, and other health-related issues (Bezbaruah and Deka, 2021).

Because of their specificity in relation to the nutritional value of the fish and the assessment of their physiological requirements at various stages of life, biochemical studies of fish tissue are of great interest. In order to use fish as food as effectively as possible and to advance the technology for processing fish and fish-derived products, it is also necessary to have information about the composition of fish. The values of body composition in fishes vary considerably within and between species, with fish size, sexual condition and feeding, time of the year and activity (Weatherley and Gill, 1987). Food composition, environment and genetic trait are also known to influence chemical composition of fish (Oni *et al*., 1983). The ability to decode the nutritional quality, physiological condition and health status of any edible portion of the organism requires comprehensive study to understand the proximate makeup of the species. The importance of such studies is to express food value in terms of energy units (Qasim, 1972).

The study of fish biology is critical in the field of fishery science because morphology and anatomy form the foundation for understanding biology. Biometry, food and feeding, maturity stages, length at first maturity, and other factors serve as the foundation for stock assessment and population dynamics. Growth studies are an important tool in fisheries resource management because they contribute to estimates of production, stock size, recruitment, and mortality of fish populations (Isaac, 1990). The length-weight relationship studies are critical for fishery biology and stock assessment of fishery resources. In general, the most suitable feature for establishing population analysis is fish growth, which is typically indicated by variations in length and weight (Mansor *et al*., 2010). The length-weight relation equation establishes a mathematical relationship between the two variables, length and weight, allowing the unknown variable to be calculated easily from the known variable. It is also used to calculate the expected weight based on length and weight and as an indicator of fatness. Length weight relationships are frequently used as indicators of fish gonad development and for determining life history traits of different species (Wooton, 1990; Ayoade and Ikulala, 2007). The length-weight relationship of fish is very important in studying fish population growth, gonadal development, and general well-being (Le Cren, 1951; Pauly, 1993 and Nagesh *et al.,* 2004) and for comparing life history of fish from different localities (Petrakis and Stergion, 1995).

Materials and Methods

Fish samples were caught by a local fisherman early in the morning from 15 June to 22 June for the measurement of various morphometric parameters. The fishes were brought to the Fisheries resource Management laboratory of Faculty of fisheries, Rangil, Ganderbal, SKUAST-Kashmir. The fishes were cleaned and length and weight of the specimens were taken by using Vernier calliper (Vernier, 1631) and digital weighing balance (Virgo SF 400 a). The length-weight relationship was estimated using the allometric formula proposed by Le-Cren (1951).

The relationship between length and weight of a fish is usually expressed by the equation:

$W= a L^b$.

Where 'w' is body weight (g), L is total length (cm), 'a' is a coefficient related to body form and 'b' is an exponent indicating isometric growth when equal to 3. A logarithmic transformation was used to make the relationship linear:

$\text{Log } W= \text{Log } a + b \text{ Log } L$.

Where, "W" is the total body weight in grams, "L" is the total length in mm, "a" and "b" are the coefficients of the functional regression. Values of the exponent b provide information on fish growth. When b=3, increase in weight is isometric. When the value of b is other than 3, weight increase is allometric (positive allometric if $b > 3$, negative allometric if $b < 3$).

Total protein and Glucose was estimated by using Biuret method and GOD/POD method respectively. The liver tissue to be analysed for protein and glucose level were first weighed and then grinded to obtain a homogeneous mixture by adding 1 ml of distilled water and poured into 2ml centrifuge tubes. The tubes were then centrifuged at 1200rpm for 10 min and the supernatants were used for protein estimation. Pipette into clean dry test tubes labelled as Blank (B), Standard (S), and Tested (T), 1000 µl reagent was added in each test tube by micropipette and 20µl distilled water in blank test tube, 2-4 drops of standard in the standard test tube and 20µl of sample in tested test tube. The test tubes were then placed in an incubator for 10 min at 37°C. Absorbance of standard and tested proteins was determined using a spectrophotometer.

Results and Discussion

The length-weight relationship was estimated using the allometric formula proposed by Le-Cren (1951). The length-weight was established logarithmically as:

Schizothorax niger: Log W = -3.344 + 2.293 Log L (R^2= 0.733)

Oncorhynchus mykiss: Log W = -3.491 + 2.351 Log L (R^2 = 0.939)

Descriptive statistics of *S.niger* for protein showed the maximum value of 12.09(g/dl) and minimum value of 0.11(g/dl). The various statistical measures obtained for protein was mean ± SE (4.46±1.07), variance (11.62), standard deviation (3.40), Median (3.25), CV (76.43). For the glucose, the maximum value was 96.91 (mg/dl) and the minimum value of 35.5 (mg/dl), and statistical measures recorded was Mean ± SE (58.78±6.76), variance (458.07), standard deviation (21.40), median (55.56), CV (36.43) are presented in Table 1 and Fig. 1. Descriptive statistics of trout for glucose showed the max value of 151.36 (mg/dl) and minimum value of 58.85(mg/dl) and the Mean ± SE was obtained 97.57±9.38, variance (880.34), standard deviation (29.67), Median (91.65), CV (30.40) and for the protein it shows the max value of 43.18(g/dl) and min value of 21.40(g/dl) and the mean ± SE was obtained 30.19±2.32, variance (53.97), standard deviation (7.34), Median (29.18) and CV (24.32) are presented in table 2. In the present study, the values of regression coefficient and b value for the length weight relationship were estimated at 0.733 and 2.293 for *S. niger* and regression coefficient and b value for *O.mykiss* was 0.939 and 2.351. A perusal of length weight relationship worked out for mirror carp from Manasbal Lake, showed the exponential value of 'b' equal to 2.89 (Yousuf *et al*., 1992). Soni and Kathal (1979) have reported the value for *Cyprinius carpio* as 3.75 in the tropical lake Sagar. In case of *Labeo rohita*, Chaudhari *et al*. (1982) have reported the value of regression coefficient to be 2.3477 which coinciding with our findings. Our study showed the allometric length weight relationship for both the species. Various authors reported the relationship of length weight like *Schizothorax niger* in Dal Lake of Kashmir by Sunder *et al.* (1979) have reported the value of regression coefficient to be 2.347, Yousuf *et al.* (1992) have reported the value for *S. niger*as 3.014 from Manasbal Lake. Pandit (1987) reported the regression coefficient to be 2.977 for the same fish in Dal Lake in Kashmir. Qadri and Mir (1979) recorded the value of 'b' to be equal to 2.448 in case of *S. richardsoni* of Sindh Nallah. Bhagat and Sunder (1984) calculated the value of 'b' in *S. esocinus* to be 3.0180 from Dal Lake Kashmir. Le Cren (1951) pointed out that the variation in 'b' value is due to environmental factors, season, food availability, sex, life stage and other physiological factors. High 'b' values in case of males were reported by Sunder *et al.* (1984) and Yousuf *et al*. (2001). Hatikakota and Biswas (2004) and reported higher values of 'b' in females, while higher values of 'b' in females were also observed by Sunder (1985), Kulshrestha *et al.* (1993). Shah *et al*. (2011) recorded a correlation coefficient of 0.9751 for farmed female rainbow trout in Kashmir while as Wali *et al*. (2019) found a much lower correlation coefficient of 0.608 in trout from Kashmir.

Protein content

Proteins are the fundamental building blocks for tissue biosynthesis and enzyme production in all animals. The nutritive value of a protein depends primarily on its capacity to satisfy the needs for nitrogen and essential amino acids. Fish offers high-quality protein. Fish and shell-fish contain about 19 percent protein that is similar in amino acid composition to that found in muscle meats. The content varies from one to 30 percent depending upon the species and the season of the year. Protein content of fish varies not only in relation to species, but in relation to individuals of the same species (Mackie *et al.*, 1971). The variation of the protein fraction may be due to the planktonic feed and to climatic changes in the year which influence the general biochemical composition of the fish. The protein content of fish

Table 1. Descriptive statistics of protein and glucose (*S. niger* and *O. mykiss*)

Statistics	*S. niger*		*O. mykiss*	
	Total Protein	Total Glucose	Total Protein	Total glucose
N	10	10	10	10
Min	0.11	35.5	21.4	58.85
Max	12.09	96.91	43.18	151.36
Sum	44.61	587.88	301.98	975.73
Mean	4.46	58.78	30.19	97.57
SE	1.07	6.76	2.32	9.38
Variance	11.62	458.07	53.97	880.34
SD	3.40	21.40	7.34	29.67
Median	3.25	55.56	29.18	91.65
CV	76.43	36.43	24.32	30.40

changes very little with season (Tzikas *et al.,* 2007). Protein is not an efficient energy source for fish. It will be used for energy if the available energy from other sources (lipid and carbohydrates) are insufficient (Phillips, 1969). Fish contains good quality, balanced and digestible protein (Mohanty *et al.*, 2012). Fresh fish meat provides a good source of human diet, about 90 to 95% of fish protein is assimilated by humans (Memon *et al.,* 2010). Abdullahi (2001) reported that the protein content in fish might vary with species due to certain factors such as the season of the year, effect of spawning and migration, food available etc. Effect of essential amino acids was more prominent in those fishes fed on low protein diets than those fed on higher protein diets (Naeem *et al*., 2011). Like previous studies, body composition of herbivorous fish species is a true reflection of their natural food. Situation was however, different in carnivores which ate a less protein diet (herbivore fish species ~ 65% protein on dry weight basis) but displayed a much higher percentage (~85%) in the body. Protein contents increase and fat decrease with age in carnivorous varieties, while vice versa is true in herbivores. In present study the highest protein content is shown by *O.mykiss* being a carnivorous fish than *Schizothorax niger* as herbivorous fish, feeding mainly on green algae, plant fragments, diatoms, detritus. In the present study the protein composition of *O. mykiss* and *S. niger* was determined and results determined are 97.57±9.38 and 4.46±1.07 respectively. The highest protein content was estimated for *O.mykiss* and lowest for *Schizothorax niger.* Our results are in tune with Bhuyan *et al.* (2003) who reported maximum protein content in the ripe and gravid fish and the minimum in spent and early maturation phases. Immediate source of energy is carbohydrate as Phillips *et al.,* (1966) reported that carbohydrates are utilised for energy in trout, thus sparing protein for building of the body.

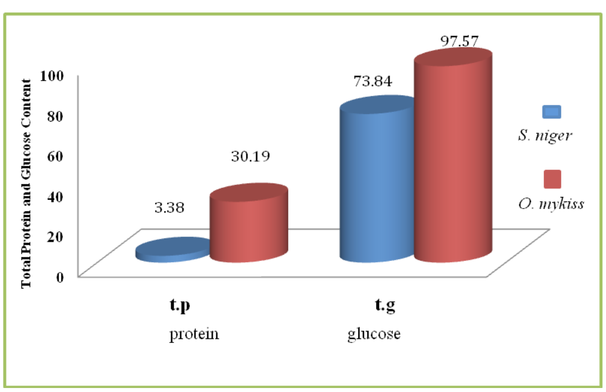

Fig. 1. Comparison between the protein (g/dl) and glucose content (mg/dl) of *S. niger* and *O. mykiss*.

Glucose content

Muscle glycogen that is the main source of energy for swimming is variable amount. Its amount depends on the nutrition situation of the environment, the ability of the fish to feed, its physiological status, sexual maturity, reproduction activity and environmental stress factors (Norton and MacFarlane, 1995). The stored glycogen in the Muscle of fish decreased during rapid movement. As the fish used in the study are caught, their muscle glycogen values may not reflect the real values. The carbohydrate content in fish muscle is very low, usually below 0.5%. This is typical for striated muscle, where carbohydrate occurs in glycogen and as part of the chemical constituents of nucleotides. Carbohydrates formed a minor percentage of the total composition of the muscle and do not show so much seasonal variation. Carbohydrates are not stored in large quantities by

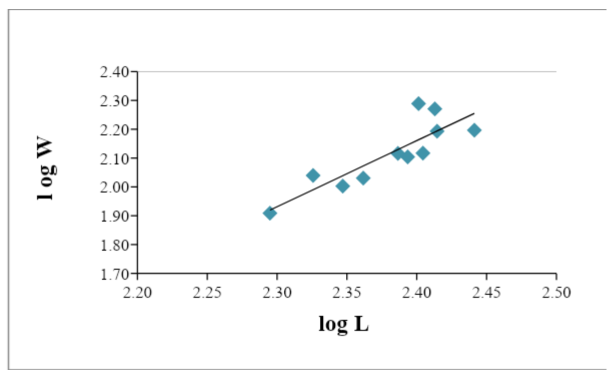

Fig. 2. Logarithmic relationship of body weight with the body length in *Schizothorax niger.*

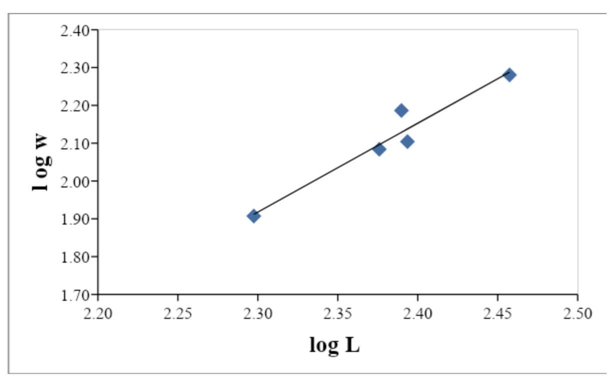

Fig. 3. Logarithmic relationship of body weight with the body length in *O. mykiss*.

fish as energy-rich compounds unlike mammals. This ingestion of relatively high concentration of carbohydrates will often lead to their catabolism shortly after absorption or conversion to other organic compounds for storage. Immediate source of energy is carbohydrate as Phillips *et al.* (1966) reported that carbohydrates are utilized for energy in trout, thus sparing protein for building of the body. The present study shows the glucose content for *O.mykiss* and *Schizothorax niger* are 30.19±2.32 and 58.78±6.76 respectively. The low values of carbohydrates could be because glycogen does not contribute much to the reserves in the body (Jayasree *et al*., 1994). The highest glucose content was seen in *S. niger.*

Conclusion

An organism's growth, development, biochemical and physiological state are critical factors in determining species, sustainability, survivability, and availability. These findings indicate that consuming fish is good for your health because it contains biochemical components like carbohydrate and protein. Protein deficiency can be mitigated to some extent by making fish and shellfish items available to local communities. It compares the values of two parameters, such as proteins and carbohydrates, from two different fish. Knowledge of the biochemical composition of *Schizothorax niger* and *Oncorhynchus mykiss* is extremely beneficial in evaluating not only its nutritional value but also in quality assessment and optimum production.

References

Abdullahi, S.A. 2001. Investigation of Nutritional status of *Chrysichthysnigrodigitatus*, *Barus filamentous* and *Auchenoglanisoccidentalis*: Family Bagridae. *Journal of Arid Zone Fisheries.* 1: 39-50.

Ayoade, A.A. and Ukulala, A.O.O. 2007. Length weight relationship, condition factor and stomach contents of *Hemichromisbimaculatus*, *Sarotherodon melanotheron* and *Chromidotilapiaguentheri* (Perciformes: Cichlidae) in Eleyele Lake, Southwestern Nigeria. *Rev. Biol. Trop.* 55: 969-977.

Bezbaruah, G. and Deka, D. D. 2021. Variation of moisture and protein content in the muscle of three catfishes: A comparative study. *International Journal of Fisheries and Aquatic Studies.* 9(1): 223–226.

Bhagat, M.J. and Sunder, S. 1984. Some biological aspects of Schizothoraicthysesocinus Heckel, from Kashmir waters with a note on its utility in culture. *Journal of Inland Fisheries Society of India.* 16(1-2): 42-47.

Bhuyan, H. R., Chowdhury, M.B., Nath, K K., Seal, P. and Hag, M. A. 2003. Studies on the biochemical parameters of Cynoglossidae in the Kutuboha Channel, Bangladesh. Bangladesh *J. Sci. Ind. Res*. 38: 91-96.

Chaudhari, M., Kolekar, V. and Chandra, R. 1982. Length weight relationship and relative condition factor of four Indian major carps of River Brahmaputra, Assam. *Journal of Inland Fish. Soc., India.* 14(2): 42-48.

Isaac, V.J. 1990. The accuracy of some length-based methods for fish population studies. *ICLARM (International Centre for Living Aquatic Resources Management) Tech. Rep.* 27: 81.

Jayasree, V., Parulekar, A.H., Wahidulla, S. and Kamat, S.Y. 1994. Seasonal changes in biochemical composition of *Holothurialeucospilota* (*Echinodermata*). *Indian J. Mar. Sci.* 23: 117-119.

Koedprang, W., Nakajima, M., Maita, M and Taniguchi, N. 2002. Correlation of haematology and plasma chemistry levels in silver crucian carp (*Carassiuslangsdorfii) i. Fish. Sci.* 68 (4): 721-728

Kulshrestha, S.K., Srivastava, M., George, M.P., Saxena, R. and Tieari, A. 1993. Length weight relationship of a major carp *Catlacatla* (Ham) from two water bodies of Bhopal. In: *Advances in Limnology* (Ed. H.R.Singh). Narendra Publishing House, Delhi, pp 329-392.

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

Mackie, I. M., Hardy, R. and Hobbs, G. 1971. Fermented fish products FAO Fisheries Report No. 100. Food and Agricultural Organisation of the United Nations. Rome.

Mansor, M.I., Che-Salmah, M-R., Rosalina, R., Shahrul-Anuar, M.S. and Amir-Shah-Ruddin, M.S. 2010. Length-weight relationships of freshwater fish species in Kerian River Basin and Pedu Lake. *Research Journal of Fisheries and Hydrobiology.* 5: 1-8.

Memon, N. N., Talpur, F.N. and Bhanger, M.I. 2010. A comparison of proximate composition and fatty acid profile of Indus river species. *Int.J. Food. Prop*. 13: 328–337.

Mohanty, B.P., Paria, P., Das, D., Mitra, P., Ganguly, S., Verma, A., Mahanty, A., Sahoo, S., Behera, B.K., Aftabuddin, Md and Sharma, A.P. 2012. Nutrient profile of giant river-catfish *Sperataseenghala (Sykes)*. *National Academy of Science Letter.* 35(3): 155-161.

Naeem, M., Salam, A., Tahir, S.S. and Rauf, N. 2011. The effect of fish size and condition on the contents of twelve essential and non essential elements in *Aristichthysnobilis* from Pakistan. *Pak Vet J.* 31(2): 109-112.

Nagesh, T.S., Jana, D., Khan, L. and Khongngain, O. 2004. Length-weight relationship and relative condition of

Indian major carps from Kuliabeel Nadia, West Bengal. *Aquaculture.* 5(1): 85-88.

Norton, E.C. and MacFarlane, R.B. 1995. Nutritional dynamics of reproduction in viviparous yellowtail rockfish, *Sebastesflavidus*. *Fish. Bull.* 93:299-307.

Oni, S.K., Olayemi, J.Y. and Adegboye, J.D., 1983.Comparative physiology of three ecologically distinst freshwater fishes, *Alestes nurse* Ruppell, *Synodontisschall*, Bloch and Schneider and *Tilapia Zilli*, Gervias. *J. Fish. Biol*. 22: 105-1099.

Pandit, A.K. 1987. *Some aspects of biology and embryonic development of Schizothorax niger,* M. Phil. Dissertation, University of Kashmir.

Pauly, D. 1993. Editorial Fish byte. *Naga ICLARM Quarterly.* 16: 16-26.

Petrakis, G. and Stergion, K.I. 1995. Weight-length relationship of 33 species in Greek waters. *Fisheries Research.* 21: 465-469.

Phillips, A. M., D. L. Livingston and H. A. Poston. 1966. Use of caloric sources by brook trout. *Proc. Fish Cult.* 67-72.

Phillips, A.M. Jr., 1969. Nutrition, digestion and energy utilization. In: *Fish Physiology,* edited by W.S. Hoar and D.G. Randall. New York, Academic Press. 1: 391-432.

Qadri, M. Y. and Mir, S. 1979. Reproductive biology of *Orienusplagiostomus*. *Second All India Seminar on Ichthyology, Nainital*. p. 9.

Qasim, S.Z. 1972. The dynamics of food and feeding habits of some marine fishes. *Indian Journal of Fisheries.* 19(1-2): 11–28.

Rao, A.K.V.C.S. and Sreeramullu, K. 2006. Length-weight relationship of the Gobilid fish *Pseudapocryptes lanceolatus* (Bloch) and Schneider, 1801 of the Vasishta Godavari Estuary, East coast in India. *Fish Management and Aquatic Environment.* 110-135.

Shah, T.H., Balkhi, M.H., Najar, A.M. and Asimi, O.A. 2011. Morphometry, length-weight relationship and condition factor of farmed female rainbow trout (*Oncorhynchusmykiss* Walbaum, 1792) in Kashmir. *Indian Journal Fisheries.* 58(3): 51-56.

Soni, D.D. and Kathal, K.M. 1979. Length-weight relationship in *Cirrhinus mrigala* (Val.) and *Cyprinus carpio* (Ham.). *Masya.* 5: 69-72.

Sunder, S. 1985. Food and feeding habits of *Puntius conchonius* (Ham.) from Dal Lake, Kashmir. *Geobios.* pp. 131-136.

Sunder, S., Bhagat, M. J., Joshi, K.V. and Ramakrishna. 1979. Fishing methods and fish catch composition of dal lake, Kashmir (J&K) during 1969-72. *J. Inland Fish. Soc. India.* 10: 9-18.

Sunder, S., Kumar, K. and Raina, H.S. 1984. Food and feeding habits and length weight relationship of *Cyprinus carpio* specularis of Dal Lake, Kashmir. *Indian J. Fish*. 31(1): 90-99.

Tzikas, Z., Amvrosiadis, I., Soultos, N. and Georgakis, S.P. 2007. Seasonal variation in the chemical composition and microbiological condition of Mediterranean horse mackerel (*Trachurus mediterraneus*) muscle from the North Aegean Sea (Greece). *Journal of Food Control.* 18 : 251–257.

Wali, A., Shah, T.H., Balkhi, M.H. Bhat, B.A., Bhat, F.A., Qadri, S. and Mohamad, I. 2019. Morphometry and length-weight relationship of rainbow trout *Oncorhynchus mykiss* Walbaum, 1792 (Salmoniformes: Salmonidae) from Kashmir. *Journal of Entomology and Zoology Studies.* **7**(1): 1653-1656.

Weatherley, A.H. and Gill, H.S. 1987. *The Biology of Fish Growth.* Academic, London. pp. 443.

Wooton, R. J. 1990. *Ecology of Teleost Fishes,* Chapman and Hall, London

Yousuf, A.R., Gazala, F., Balkhi, M.H. and Pandit, A.K. 1992. Studies on the length-weight relationship in some cyprinid fish in Manasbal Lake, Kashmir. In: *Current Trends in Fish and Fishery Biology and Aquatic Ecology* (Eds. A.R. Yousuf, M.K. Raina and M.Y. Qadri). Postgraduate Department of Zoology, the University of Kashmir, Srinagar, pp. 185-189.

Yousuf, A.R., Firdous G. and Pandit, A.K. 2001. Length-weight relationship of *Schizothoraxniger*. *J. Res. Dev*. 1: 54-59.