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Short Communication

Length weight relationship and ponderal index of rainbow trout (*Oncorhynchus mykiss* W., 1792) from Dachigam stream in Kashmir

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The rainbow trout (*Oncorhynchus mykiss*), introduced in Kashmir in 1912, has thrived well since then and is now established in almost all the cold water streams, lakes and rivers of the valley. This study was aimed to describe the length-weight relationship and ponderal index (condition factor) of the fish from Dachigam stream in Kashmir. The investigation was carried out between April and December, 2005 and the data were recorded from anaesthetized fish, which ranged from 110 to 488 mm in length and 20 to 1425 g in weight. The length-weight relationship was estimated as LogW = - 4.9216 + 2.9618LogL and the *b* value (2.9618) did not differ significantly from 3. The coefficient of correlation (r) for the length-weight relationship was estimated at 0.9968 which showed a high degree of positive correlation between the length and weight of the fish. The condition factor (K) value was estimated as 1.15 ± 0.013.

Key words: *Oncorhynchus mykiss*, rainbow trout, length weight relationship, ponderal index, Dachigam stream, Kashmir.

INTRODUCTION

Rainbow trout are members of the genus *Oncorhynchus*, which also includes Pacific salmon and members of the family Salmonidae, such as, Atlantic salmon, trout, char, graylings, white fish and several other groups. Rainbow trout are native to coldwater environments in the north temperate zones and are distributed from Southern California through Alaska, the Aleutians, and the Western Pacific areas of the Kamchatka Peninsula and Okhotska sea drainages. Rainbow trout are, thought of as freshwater fish, but in the eastern Pacific, seawater forms called steelhead trout exhibit an anadromous life history, meaning that they spend a part of their life in the ocean, but return to the lakes and rivers to spawn. Rainbow trout have been widely transplanted around the world and are established in South America, Japan, China, Europe, parts of Africa, India, Pakistan, Australia and New Zealand. Trout and salmon are the only exotic game fishes introduced in India. According to Mitchell (1918), the first attempt at shipment of trout ova to the country was in the year 1900 when the Duke of Bedford sent trout ova as a present to the Maharaja of Kashmir. This whole consignment, however, perished on the way on account of heat. Subsequently, eyed eggs of brown trout were imported in 1900 as well as in 1901. This attempt was successful in yielding fish which were fortuitously distributed far and wide in the valley due to a heavy flood

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in 1903. Rainbow trout was introduced in Kashmir in 1913 when nearly 1000 alevins hatched out from a consignment of eyed ova presented by the Bristol Waterworks from their head works at Blagdon, England (Mitchell, 1918). Length-weight relationship and condition factor are extremely useful tools for understanding the biological changes in fish stocks (Le Cren, 1951; Bagenal and Tesch, 1978). For more efficient fishery management, the knowledge of growth in fish is of paramount importance.

The length-weight relationship is a very useful tool in fisheries assessment. It is usually easier to measure the length of a specimen than the weight, and weight can be predicted later on using the length-weight relationship. Furthermore, standing crop biomass can be estimated (Morey et al., 2003) and seasonal variations in fish growth can be tracked in this way (Richter et al., 2000). The length-weight relationship also helps in predicting the condition, reproductive history and life history of fish species (Nikolsky, 1963; Wooton, 1992) and in morphological comparison of species and populations (King, 1996). The ponderal index or condition factor is often associated with fitness, that is, a poor condition can manifest as a number of negative fitness consequences for the individual fish and fish populations. Somatic growth potential of fish can be reduced (Danzmann et al., 1988). Reproductive success can be reduced through a number of factors like lower fecundity, poor quality eggs and sperms (Kjesbu et al., 1991, 1992; Rakitin et al., 1999). Additionally, poor condition may also lower the chances of survival (Wilkins, 1967). Of the hill stream fishes reported from Kashmir, the rainbow trout (*Oncorhynchus mykiss*), being a transplanted exotic fish, has established very well; almost in every nook and corner of the valley. Rainbow trout supports an important coldwater fishery resource of this northernmost state of the country. Biological aspects of the indigenous schizothoracids have been studied in detail by a number of authors. However, not much information is available as far as rainbow trout is considered. This work determined the length-weight relationship and condition factor of rainbow trout (*O. mykiss*) from Dachigam stream of Kashmir.

MATERIALS AND METHODS

A total of 359 specimens of rainbow trout (*O. mykiss* W.*)* in the length range of 110 to 488 mm and weight range of 20 to 1425 g were caught from the Dachigam stream, Harwan area of Srinagar, Kashmir, India from April, 2005 to December, 2005. The total length of the fish was taken from the tip of the snout to the end of the caudal fin, measured to the nearest millimetre and the weight to the nearest gram. All the fish were anaesthetized using clove oil (50 mgl^{-1}) and then were measured in length and weight. After the recovery from the anaesthetic effect, the fish were released in the vicinity of the site from where they were caught. Care was taken to remove the moisture from the fish by blotting prior to the measurement of weight. The general formula adopted for the evaluation of the length-weight relationship was given by Le Cren (1951) as:

$$W = aL^b$$

where, W is the weight of the fish specimen (g); L is the length of the fish specimen (mm) and a and b are constants. The formula is expressed logarithmically as:

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

The coefficient of correlation (r) for length-weight relationship was calculated as per the method described by Snedecor and Cochran (1967) to show the degree and nature of the correlation between length and weight of the fishes.

Condition factor or ponderal index (K) meant for studying the degree of the well being of the fish was determined by using the formula of Hile (1936), which is:

$$K = [W/L^3] \times 10^5$$

The number 10^5 is a factor to bring ponderal index (condition factor) to near unity (Carlander, 1950). The study of condition, a standard practice in fisheries ecology, is based on the analysis of length-weight data and assumes that heavier fish of a given length are in better condition (Bolger and Connolly, 1989). A fish is said to be in better condition when the value of K is more than 1 and in worse condition than an average individual with the same length, when K value is less than 1. At the population level, the average K indicates whether a population is in better ($K > 1$) or worse ($K < 1$) condition than an average population.

RESULTS AND DISCUSSION

The equation obtained for the length-weight relationship in this study is given by LogW = - 4.9216 + 2.9618 LogL. The coefficient of correlation (r) for the length-weight relationship was estimated at 0.9968, indicating a high degree of positive correlation between the two parameters. The value of exponent *b* (2.9618) did not differ significantly from 3.0. The length-weight exponents (*b*) for most animals fall roughly around 3.0 (Siegfried, 1980; Uye, 1982; Hopcroft et al., 1998). An exponent above 3.0 indicated that the fish become wider or deeper as they grow, while an exponent below 3.0 indicates that the fish become more slender. The value of the condition factor (K) was estimated as 1.15 ± 0.013.

The nearness of the K value to 1.0 clearly indicated the suitability of the environment in the Dachigam stream for good growth of the fish. The results are in consonance with those of Kumar et al. (1979) where the length-weight relationship and ponderal index of brown trout catches from five Kashmir streams were studied and analyzed. According to the authors, the values of the exponents in the length-weight equations estimated for males and females indicated that females departed more from the cube law. The general relationship between LogW and LogL was LogW = -5.2844 + 3.14862 LogL. The value of the ponderal index (K) ranged between 1.19 and 1.31.

Reimers et al. (1955) studied the fisheries of some lakes in Mono County, California and reported the value of K factor for 61 rainbow trout ranging from 125 to 325

mm to be between 0.881 and 1.023. Rabe (1967) reported the value of condition factor (K) between 0.859 and 1.104 for rainbow trout in Alpine lakes. Zimmerman (1999) reported the length-weight relationship of rainbow trout from Portal lake as $W = 0.00004 \times L^{2.72}$ ($r = 0.99$). The author estimated the value of the condition factor as 1.09 ± 0.14. Maia and Valente (1999) worked on the brown trout populations in the river Lima and obtained *b* value between 2.92 and 3.00. The authors reported a high degree of correlation (r = 0.99) for the length-weight relationship.

The value of condition factor was estimated to range between 1.13 and 1.25. Arslan et al. (2004) studied the length-weight relationship of brown trout from Coruh Basin, Turkey and reported the *b* value for the fish to be 2.97. Kimmerer et al. (2005) opined that the length-weight relationships for a single species of fish may differ substantially from one study to the next. Reasons for these differences can generally be categorised as biological, procedural and statistical. The biological causes of different length-weight relationships consist of real differences in weight and length among data sets. The weight of fish varied as a result of feeding history and the allocation of energy to growth and reproduction, so weight at a given length may vary spatially (especially between regions) and temporally (particularly between seasons). Ahmet et al. (2005) studied the brown trout populations in Firniz stream of the river Ceyhan, Turkey and reported that the value of exponent *b* in the length-weight relationship of *Salmo trutta macrostigma* was 2.971 for females and 3.009 for males. The authors reported the mean condition factor of 1.521 ± 0.010 for the population.

REFERENCES

Ahmet A, Kara C, Murat H (2005). Age, growth and diet composition of the resident brown trout, *Salmo trutta macrostigma* Dumeril 1858, in Firniz stream of the river Ceyhan, Turkey. Turk. J. Vet. Anim. Sci. 29:285-295.

Arslan M, Yildirim A, Bektas S (2004). Length-weight relationship of brown trout, *Salmo trutta* L., inhabiting Kan stream, Coruh Basin, North-Eastern Turkey. Turk. J. Fish. Aquat. Sci. 4:45-48.

Bagenal TB, Tesch FW (1978). Age and growth. *In*. T. B. Bagenal (ed.) Methods for the assessment of fish production in freshwaters. Oxford, Blackwell Scientific Publication. pp. 101-136.

Bolger T, Connolly PL (1989). The selection of suitable indices for the measurement and analysis of fish condition. J. Fish. Biol. 34:171-182.

Carlander KD (1950). Handbook of freshwater fishery biology. William C. Brown. Dubuque, Iowa.

Danzmann, RG, Ferguson, MM, Allendorf FW (1988). Heterozygosity and components of fitness in rainbow trout. Biol. J. Linn. Soc. 33:285-304.

Hile R (1936). Age and growth of the cisco, *Leucichthys artedi* Le Sueur, in the lakes of the Northeastern Highlands, Wisconsin. Bull. Bur. Fish. U.S. 48(19):211-317.

Hopcroft RR, Roff JC Bouman HA (1998). Zooplankton growth rates: the larvaceans *Appendicularia, Fritillaria,* and *Oikopleura* in tropical waters. J. Plankton Res. 20:539-55.

Kimmerer W, Avent SR. Bollens SM (2005). Variability in Length-weight relationships used to estimate biomass of estuarine fish from survey data. Trans. Am. Fish. Soc. 134:481-495.

King RP (1996). Length-weight relationships of Nigerian freshwater fishes. *Fish Byte*. 19(4):53-58.

Kjesbu OS, Klungsoyr J, Kryvi H, Whitthames P, Greer R Walker M (1991). Fecundity, atresia and egg size of captive Atlantic cod (*Gadus morhua*) in relation to proximate body composition. Can. J. Fish Aquat. Sci. 48:2333-2343.

Kjesbu OS, Kryvi H, Sundby S, Solemdal P (1992). Buoyancy variations in eggs of Atlantic cod (*Gadus morhua*) in relation to chorion thickness and egg size: theory and observations. J. Fish Biol. 41:581-599.

Kumar K, Sehgal KL, Sunder S (1979). Length weight relationship and ponderal index of brown trout *Salmo trutta fario* (Linnaeus) catches in the streams of Kashmir. J. Inland Fish. Soc. India 11(1):156-61.

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

Maia CFQ, Valente ACN (1999). The brown trout *Salmo trutta* L. populations in the river Lima catchment. *Limnetica* 17:119-126.

Mitchell FJ (1918). How trout were introduced into Kashmir. J. Bombay Nat. Hist. Soc. 26(1):295-99.

Morey G, Moranta J, Massuti E, Grau A, Linde M, Riere F, Morales-Nin B (2003). Weight-length relationship of littoral to lower slope fishes from the Western Mediterranean. Fish. Res. 62:89-96.

Nikolsky GW (1963). The ecology of Fishes. Academic Press, London and New York. p. 352.

Rabe FW (1967). Rainbow trout in Alpine lakes. *Northwest. Sci*. 41(1):12-22.

Rakitin A, Ferguson, MM, Trippel EA (1999). Sperm competition and fertilization success in Atlantic cod (*Gadus morhua*): effect of sire size and condition factor on gamete quality. Can. J. Fish. Aquat. Sci. 56:2315-2323.

Reimers N, Maciolek JA. Pister EP (1955). Limnological study of the lakes in Convict Creek Basin, Mono County, California. U.S. Fish and Wildlife Service. Fisheries Bull. 103:437-503.

Richter HC, Luckstadt C, Focken U, Becker K (2000). An improved procedure to assess fish condition on the basis of length-weight relationships. Arch. Fish. Mar. Res. 48:255-264.

Siegfried CA (1980). Seasonal abundance and distribution of *Crangon franciscorum* and *Palaemon macrodactylus* (Decapoda, Carida) in the *San Francisco Bay-Delta.* Biol. Bull. 159:177-192.

Snedecor GW, Cochran W G (1967). Statistical Methods. Oxford and IBH Publishing Company. p. 435.

Uye S (1982). Length-weight relationship of important zooplankton from the Inland sea of Japan. J. Oceanogr. Soc. Japan 38:149-158.

Wilkins NP (1967). Starvation of the herring, *Clupea harengus* L.: survival and some gross biochemical changes. Comp. Biochem. Physiol. 23:503-518.

Wooton RS (1992). Fish Ecology. Printed in Great Britain by Thomson Litho Ltd. Scotland.

Zimmerman T (1999).Recreational Fishery Stock Assesment 1999 Final report of Portal Lake. Ministry of Environment, British Columbia.