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Length-Weight Relationship and Well Being of the Natural Stock of Rainbow Trout Inhabited in Balkhila Stream in Uttarakhand, India

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Abstract: In this study an attempt has been made for evaluating the length weight relationship and well being of the natural stock of rainbow trout inhabited in Balkhila stream of Alakhnanda river at Chamoli district of Uttarakhand, India. In collected stock, about 80% specimen showed full gonadal maturity, which reflects the conducive conditions for the gonadal maturity. In present study coefficient correlation (r) for male was found to be 0.84257 which is positively significant ($P<0.05$) and exponential value 'b' significantly less than '3' (i.e. b=2.71) (ideal isometric growth) which conclude that weight of male rainbow trout do not grow according to isometric growth pattern. Similarly, the coefficient correlation (r) for female was found to be 0.565974 which is negatively significant ($P<0.05$) and exponential value 'b' significantly less than '3' (i.e. b=1.76) (ideal isometric growth) which conclude that weight of female rainbow trout do not grow according to isometric growth pattern. Hence, the exponential form of the equation derived for the length-weight relationship does not reflect the well-being of stock and isometric growth.

Keywords: Rainbow trout, Exponential value, Balkhila stream, Coefficient correlation

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Introduction

The rainbow trout is a native of North America and now it has become extensively distributed in rivers and streams throughout the world. In Turkey, rainbow trout has become the most frequently farmed freshwater fish species (Yoğurtçuoğlu *et al*., 2021). In India, rainbow trout (*Oncorhynchus mykiss*) constitute the trout fishery in the streams, lakes and reservoirs of Indian Himalayan region (Vass, 2000). Trout is rich in omega-3 poly unsaturated fatty acid that is needed for the development of brain and retina in infants (Ackman, 1989). The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group (Beyer, 1987) and in assessing the relative well being of a fish population (Bolger and Connoly, 1989). Consequently, length-weight studies on fish are

extensive. It has enormous advantages as it allows the estimation of the average weight of the fish of a given length group by developing a mathematical relationship between length and weight (Beyer, 1987). It is also useful for assessing the relative well being of the fish population (Bolger and Connolly, 1989). Like any other morphometric character, the length-weight relationship can also be used for the differentiation of taxonomic units and this relationship is seen to change with various developmental events in life such as metamorphosis, growth and the onset of maturity. Besides this, the length-weight relationship can also be used in setting yield equations for estimating the number of fish landed and comparing the population in space and time (Beverton and Holt, 1957).

The present study on breeding biology of Rainbow trout (*Oncorhynchus mykiss)* from Balkhela river of Shivalik Himalaya of Uttarakhand is of prime importance, because the fish has high nutritional value and high market value in comparison to other cold water fishes. Breeding biology of this fish in natural habitat provides information to the scientists and researchers. This also ensures protection of aquatic eco-friendly environment, preservation, biotic diversity leading to the concept of sustainable development in the cold climate and geographical realm of hilly area of Uttarakhand. In addition to above, the ecological awareness programme would be launched in favour of conservation, culture and management of fishes in the hill state.

Materials and Methods

This study on breeding and spawning of Rainbow-trout was conducted at Trout hatchery of Bairangna, Gopeshwer, District Chamoli, Uttarakhand state ($30^0$24'45.20988" North, $79^0$19' 10.46064" East). Adult male and female fishes of 2-3 years age group were caught by netting and trapping from Balkhila stream. Brooders were collected by cast netting during morning hours. The fishes were transported in live condition to Govt. trout farm, Bairangna, District Chamoli. The fishes were disinfected with 1 ppm $KMnO_4$ solution and stocked in acclimatization pond and were later shifted to a cemented pond (10 m x 3 m x 1.25 m). Stripping, fertilization, incubation and fry rearing operations were conducted inside the indoor hatchery complex of the farm. Body length and corresponding weight of the individual fish were recorded. The length and weight relationship of the fish was worked out as per cube law given by Le Cren (1951). Length weight relationship was analyzed by the formula: $W = aL^b$, where W = total weight of the fish, L = total length of the fish, a = intercept, b = regression coefficient and expressed logarithmically as:

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

Results and Discussion

Length weight relationship is an important tool to assess the biological condition of fish in natural habitat. It has a number of important applications in fish stock assessment such as estimating the standing stock biomass, and comparing the ontogeny of fish population from different regions. Length-weight data are often used as an indication of fatness, general well being (Le Cren, 1951) or of gonad development of fish and are useful for comparisons of like histories of a specific species (Wooton, 1990).

The length-weight relationship based on the fish specimen caught during the field study in Balkhila stream has been worked out and results presented as Figures 1-4.

A total of 96 specimens of rainbow trout in the length range of 23 cm to 42.5cm and weight range of 140 g to 800 g, comprising of 48 males (23 cm to 41 cm in total length and 140 g to 750 g in total weight) and 48 females (23 cm to 42.5 cm in length and 160 g to 800 g in total weight) were analyzed for estimating length-weight relationship.

The length – weight relationship was established as:

Male: $W = 0.02716L^{2.714934}$

Female: $W = 0.751278L^{1.766343}$

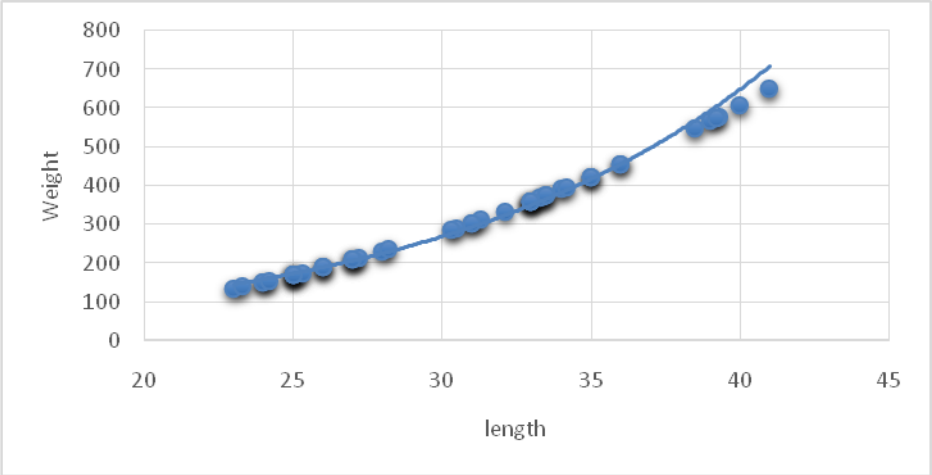

Fig. 1: Length-weight relationship in rainbow trout (male).

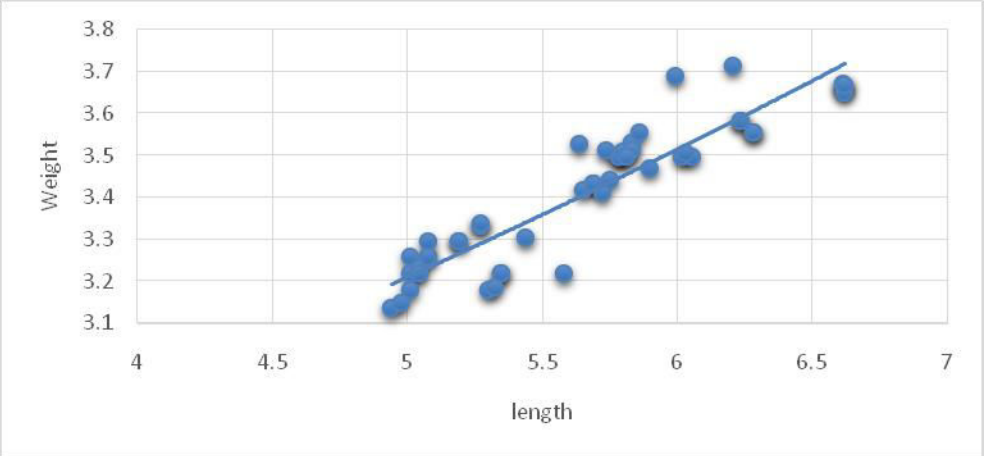

Fig. 2: The logarithimic relationship between length-weight in rainbow trout (male).

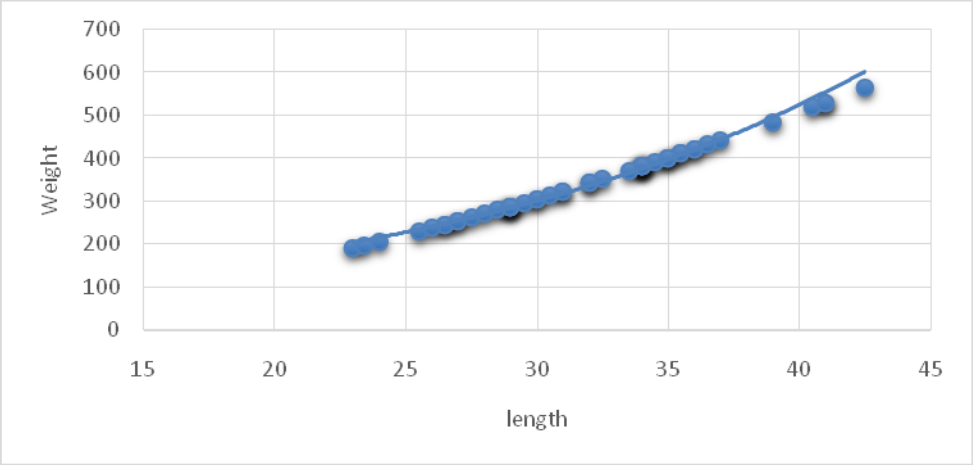

Fig. 3: Length-weight relationship of rainbow trout (female).

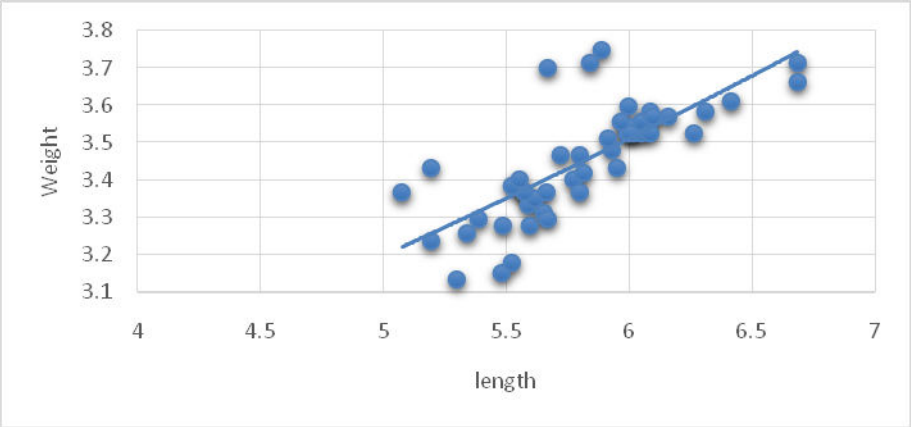

Fig. 4: Logarithmic relationship between length-weight of rainbow trout (female).

The same is expressed logarithmically as:

Male: Log W = -3.60602 + 2.714934Log L (r^2 =0.84257)

Female: Log W = -0.28598 + 1.766343Log L (r^2 = 0.565974)

The scatter grams of power relation and logarithmic relation of length and weight have been plotted separately for males and females. Analysis of variance indicated that the regression co-efficient of length-weight relationship of female shows significant variation at 5% level of significance whereas male shows no significant variation at 5% level of significance.

According to Le Cren (1951), the equation $W=aL^b$ is a better fit to express the relation between length and weight than the hypothetical cube law $W=aL^3$. Hence, the former equation was applied to the present study. The 'b' values are known to range between 2.0 and 4.0 in fishes (Le Cren, 1951) and in the majority of cases, the value deviated from 3. The variation in 'b' values could be attributed to environmental factors, food availability and the physiological factors including sex and life stages (Le Cren, 1951).

Greater emphasis has been laid by fishery biologists to study the possible mathematical relationship between the length and weight of fishes because of its significance in understanding the growth, biology, general well-being of the fish population (Le Cren, 1951) and differentiating the unit stock, which in turn helps in fisheries management. The exponential form of the equation derived for the length-weight relationship of the male Rainbow trout was found to be $W = 0.02716L^{2.714934}$ and the respective linear relationship could be expressed as Log W = -3.60602 + 2.714934Log L (r^2 =0.84257).

In the present study, coefficient correlation (r) for male was found to be 0.84257 which is positively significant ($P<0.05$) and exponential value 'b' significantly less than '3' (i.e. b=2.71) (ideal isometric growth) which conclude that weight of rainbow trout male do not grow according to isometric growth pattern.

The exponential form of the equation derived for the length-weight relationship of the female Rainbow trout was found to be $W = 0.751278L^{1.766343}$ and the respective linear relationship could be expressed as Log W = -0.28598 + 1.766343Log L (r^2 = 0.565974).

In the present study coefficient correlation (r) for female was found to be 0.565974 which is negatively significant ($P<0.05$) and exponential value 'b' significantly less than '3' (i.e. b=1.76) (ideal isometric growth) which conclude that weight of female rainbow trout do not grow according to isometric growth pattern.

The Length weight relationship of *Tor putitora* has been described by Lal and Nautiyal (1980), Johal and Tandon (1981), Nautiyal (1985) and Johal *et al*. (2005) for a few riverine and reservoir populations. They found that the value of 'b' of Length weight relationship is either 3 or very close

to 3. Madan Mohan (1999) reported the values of exponent as 2.9695-3.0556 for the wild stock of snow trout in Gaula river of the Uttarakhand.

Conclusion

This study has provided some basic information on the length-weight relationship which would be helpful for future studies. Not much information is available on rainbow trout fishery, culture and also biological aspects. The present study is a maiden attempt in the Uttarakhand region and the results obtained from it may contribute significantly to the knowledge of rainbow trout fishery and promotion of trout based aqua-tourism in Uttarakhand state.

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References

Ackman RG. (1989) Nutritional composition of fats in sea food. Prog Food Nutr Sci. 13: 161-241.

Beverton RJ Holt SJ. (1957) On the dynamics of exploited fish populations, Fishery Investigations Series II, Vol. XIX, Ministry of Agriculture. Fisheries and Food, 1: 957.

Beyer JE. (1987) On length-weight relationships. Part 1: Computing the mean weight of the fish of a given length class. Fish Byte. 5: 11-13.

Bolger T and Connolly PL. (1989) The selection of suitable indices for the measurement and analysis of fish condition. J Fish Biol. 34(2): 171-182.

Johal MS and Tandon KK. (1981) Age, growth and Length-weight relationship of *Tor putitora* (Ham.) from Govind Sagar Reservoir Himachal Pradesh. Pb Fish Bull Special Cold Water Fisheries: 43-48.

Johal MS, Negi RK and Onka SR. (2005) Length-weight relationship of Golden Mahseer, *Tor putitora* (Ham.) from Pong Reservoir, Himachal Pradesh. Uttar Pradesh J Zool. 25(1): 85-88.

Lal MS and Nautiyal P. (1980) Eco-biologica1 studies of some hill stream fishes of Garhwal Himalayas-II. Length-weight relationship of *Tor putitora* (Ham.) Indian J Zool. 21(1-3): 107-110.

Le Cren ED. (1951) The Length and weight relationship and seasonal cycle in gonad weight and condition in the Perch (*Perca fluvitalis*). J Anim Ecol. 20(2): 201-219.

Madan Mohan (1999) Preimpoundment bio-ecological characteristics of River Gaula in Kumaon Himalaya. Ph. D. Thesis, Ch. Charan Singh University, Meerut.

Nautiyal P. (1985) Observations on the length-weight relationship and relative condition factor of Himalayan Mahseer with reference to its fisheries. Indian J Anim Sci. 55: 65-70.

Vass KK. (2000) Breeding biology of trout. Cold water aquaculture and fisheries, Narendra Publishing House, Delhi, pp.155-168.

Wooton JR. (1990) Ecology of teleost fishes. Chapman and Hall, London, England.

Yoğurtçuoğlu B, Bucak T, Ekmekçi FG, Kaya C and Tarkan AS. (2021) Mapping the establishment and invasiveness potential of rainbow trout (*Oncorhynchus mykiss*) in Turkey: With special emphasis on the conservation of native salmonids. Front Ecol Evol. 8: 599881.