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Fish management with respect to length and weight ratio and ecology of river Jhelum

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Abstract
Fish growth plays an important role in the economical development of a nation because it is the most important source of protein for the human being. Kashmir is a place which is mostly famous for the freshwater lakes. These fresh water lakes which form the cold sector are famous for fish growth. There are different species found in Kashmir valley. Fauna of the Jhelum River is one of the oldest fauna known to science the first fauna found in the Jhelum River. However through this study length-weight relationship of fishes was established. Length-weight relationship studies of fishes are considered as an important tool for understanding of fish. Length is a linear measure (in centimeter) and the weight of a fish (in gram) is approximately equal to its volume (cubic centimeter). Hence, weight of a fish is a function of length. The relationship can be expressed by the hypothetical law W= aL3. The value of exponent may considerably deviate from the value 3, as most fishes change their form or shape when they grow. This variation from expected weight to the actual weight of individual fish is assessed by analyzing the length weight relationship.

Keywords: Kashmir, fauna, linear, length weight

Introduction
Jammu and Kashmir of India is called the paradise of earth is geographically dived into three regions, the Jammu region, the Kashmir and the Ladakh. Among most of the states of India Jammu and Kashmir has sufficient number of water resources. The major rivers include Jhelum, Chenab, Indus etc. the common name for Jhelum is Veth. The main source of Jhelum is Verinag spring in Anantnag district. Jhelum has an enormous prospective resources in the fishing sector. The fish fauna of Jhelum river is the earliest local fish faunas which were discovered by science [1]. Many researches were conduxted on Jhelum river ecology especially on the species belonging to genus *Cypriniformes*, *Siluriformes*, *Cyprinodoniformes* and *Salmoniformes* in Jhelum and its connecting rives. Therefore the monetary value of any species of fishes it depends on the relationship between its length and weight. The relationship between length-weight ascertains the numerical relationship between length and weight of fish. Length weight relationship gives information on the changes in the well-being of the fishes that happens during their life cycle.
The Length-weight relationships among fishes can be used as parameter for identification of different groups. An already established length-weight relationship will be useful for assessing the data that contains only length frequency measurements. This relationship can be used in setting up of yield equations, estimate the number of fishes landed and for comparing the population over space and time [2].
Scizothorax belongs to schizothoracinae subfamily mainly located in torrential mountain streams of the Himalaya and central Asia.They are commonly called snowtrouts as they are locally constricted to cold regions covered with snow.
Cyprinidae is a family of fishes characterized by good size, traits and reasonably most capricious and valuable food fish of the paradise dale. It can always be recognized by the combination of large high scale count, high gill raker number and thin lips [3, 4]. The reported maximum size of this fish is 40 cm^5 and 1,250 g in weight [6].

Methodology for estimating length weight relationship
Weight–length relationships are only known for a restricted number of species, which hampers efforts to model aquatic ecosystems where observations are typically obtained as the number of specimens by length class that have to be transformed into estimates of the biomass.
Weight length ratio are majorly used to estimate the weight with respect to length and the condition factor associated helps in understanding the conditions like fatness, well-being of fish based on the prediction of humans that fish with heavy weight reflects the better condition [7].
In this study fishes are collected during a specific period and weighed and measured in fresh condition with the help of measuring board and weighing balance. The length weight relation was established using the parabolic equation [8].

$$W= aL^b \quad (1)$$

Where, W= Weight of Fish (g), L= Length of Fish (cm), a = Constant (Initial Growth Index), b = Equilibrium Constant/growth coefficient.
The value of constants as and b was estimated by linear regression after logarithmic transformation of weight and length data by using formula:

$$LogW= Loga +bLogL \quad (2)$$

Where b represents the slope of the line, Log ais a constant.

Statistical Analysis
The values of an average total length were plotted against their respective weights. The departure from cubic law has been tested and correlation coefficient r has also been computed to test whether regression coefficient departs significantly from the cubic value [9].

Understanding Parameter B
Parameter b is the exponent of the arithmetic form of the weight–length relationship (Eqn 1), and the slope of the regression line in the logarithmic form (Eqn 2). If b ¼ 3, then small specimens in the sample under consideration have the same form and condition as large specimens. If b > 3, then large specimens have increased in height or width more than in length, either as the result of a notable ontogenetic change in body shape with size, which is rare, or because most large specimens in the sample were thicker than small specimens, which is common. Conversely, if b < 3, then large specimens have changed their body shape to become more elongated or small specimens were in better nutritional condition at the time of sampling.

Understanding Parameter A
Parameter is the coefficient of the arithmetic weight–length relationship (Eqn 2) and the intercept of the logarithmic form (Eqn 2). From the logarithmic form of the weight–length relationship every decrease in the slope of the regression line will lead to an increase in the intercept, and vice-versa. Froese points out that if several weight– length relationships are available for a species, then a plot of log a over b will form a straight line and can be used to detect outliers.

Condition Factor (K)
Heincke established the usefulness of Fulton's condition factor (Eqn 1) for comparing seasonal changes in nutritional condition. This is best done by a double-logarithmic plot of condition over length, where the connected points will form a more or less straight line [10].
Condition factor K:
$K=W*100/L^3$
Where k=coefficient of condition
L=Standard length in cm
W=Weight in gram
The significance of the LWR and K were evaluated by ANOVA and tested by t-test to verify its significance level in different months of a year.
Relative condition and relative weight is suitable for comparing condition within a given sample [11]. Wege and Anderson's (1978) relative weight is useful for comparing condition across populations and species; however, their decision to take as a reference point a value larger than mean weight at length makes it arbitrary to calculate and use. Rather, I suggest deriving relative weight by comparison with a mean weight (W_m) derived from a mean length–weight relationship representative of the species as a whole. I suggest using geometric mean a (a_m) and mean b (b_m) across all available, non-questionable weight–length estimates for a species as parameters of the mean weight–length relationship. The relative weight (W_{rm}) of a specimen with weight W and length L is then given by:

$W_{rm} = 100*w/a_mL^b_m$

Ecology of River Jhelum
The oldest economic activity lined with the river Jhelum and Dal Lake is fishing and as the home of all indigenous fish fauna, the Jhelum and Dal Lake are of great economic importance. Few of the types of fishes available in Jhelum include *Cyprinus carpio, Schizothorax niger, Schizothorax curvifrons, Schizothorax esocinus.*

Pollution of Jhelum River
As a cultural symbol of Kashmir, river Jhelum is as healthy as ever, but as a river it is fast losing its significance. Its water is today repugnant. The source of pollution in the river is sewage and effluents. The problem assumes greater dimension due to dense human settlement along the banks dispensing and dumping the whole municipal garbage into the river. The Jhelum flows besides the capital city of Srinagar through three major cities, Anantnag, Sopore and Baramulla. It is through these stretches that the river receives maximum of its pollutants.
Schizothorax species are experiencing a major threat to their community in Dal lake and river Jhelum has been experiencing a constant and significant fall both over few decades. The species being sensitive cannot withstand unclear waters. Since the water quality in the river and lake has deteriorated over the years, the Schizothorax finds it difficult to thrive in water with depleted oxygen levels. A fish's condition reflects its ability in finding and storing energy under prevailing environmental condition. Condition not only reflect the health, growth and reproductive state of a fish, but also reflects environmental characteristics such as habitat quality and prey availability.
Condition indices have been widely used as indicators of relative health [13], since these provide relatively simple and rapid indicators of how well the fish cope with their environment [14]. Aquatic organisms are often exposed to high levels of pollutants through bio-concentration and/or bioaccumulation. Currently, it is difficult to find any source of water that does not carry fingerprints of human activity. Acid precipitation causing leaching of metals from surrounding soils and increasing numbers of synthetic organic compounds and metabolized pharmaceuticals finding their way into surface waters in unlikely places, and makes their identification by untargeted chemical analysis prohibitively expensive. As a result, fish have become an indispensable model system for the evaluation and/or measurement of the extent of aquatic pollution.

Conclusion
Within-species variance in weight–length relationships can be substantial, depending on the season, the population, or annual differences in environmental conditions. As a result, differences in weight estimated from length can be two-fold or more, depending on which relationship is chosen. Thus, if at all possible, one may want to re-estimate weight–length relationships for the specimens under study.

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