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Ichthyology

A NOTE ON THE LENGTH-WEIGHT RELATIONSHIP
OF *PUNTIUS AMPHIBIUS* (VAL.) (*PISCES-CYPRINIDAE*)

O ZALEŻNOŚCI POMIĘDZY DŁUGOŚCIĄ A MASĄ CIAŁA
U *PUNTIUS AMPHIBIUS* (VAL.) (*PISCES: CYPRINIDAE*)

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The length-weight relationship of *P.amphibius* was calculated separately for males and females. Results reveal that there is a close relationship between the length and weight of the fish. The regression coefficient of males was significant at 1% level. By testing the regression coefficients against the isometric value of 3, it was found that for females the growth pattern agrees with the isometric growth formula while in the case of the males the cubic formula was not found to be a proper representation of the length weight relationship.

INTRODUCTION

The length-weight relationships of freshwater fishes have been worked out by previous workers like Prasadam (1971), Thakur and Das (1974), Rita Kumari and Nair (1978). Understandably, however, the same fit is not valid for different species as their morphology and ecology need not always necessarily be the same. A study of the growth of a species in a specific environment helps in the management of the fishery.

Even though *Puntius amphibius* is of economic importance as a forage fish in the freshwater fishery resources of India, its biological aspects have not been fully known. A detailed biology of a fish naturally includes a study of the length-weight relationship.

MATERIAL AND METHODS

A total number of 426 fishes comprising of 240 females and 186 males ranging from 37 to 104 mm and 39 to 82 mm in standard length respectively, were obtained from a boat-channel, quite close to the Department. The specimens were collected during the period from December 1978 to November 1979.

The regression coefficient 'n' in the allometric formula $W = aL^n$ may vary for fish from different localities, of different sexes and so this difference may or may not be statistically significant (Le Cren, 1951; Antony Raja, 1967 and Rita Kumari and Nair, 1978). On account of this the data of length-weight relationship of *P.amphibius* were analysed separately for males and females.

Usually the relation between length and weight is expressed by the hypothetical law $W = aL^n$ where 'W' represents the weight of the fish, 'L' its length, 'a' a constant and 'n' another constant to be calculated empirically i.e., from the data. This general equation can be written as $\log W = \log a + n \log L$, i.o., $Y = A + BX$ where $A = \log a$; $B = n$; $Y = \log W$ and $X = \log L$ which is a linear relation between Y and X. This linear equation was fitted separately for the two sexes to the data collected during the period of the study. The estimates of the parameters 'A' and 'B' for each case were obtained by the method of least squares.

Analysis of covariance was employed to test whether the estimate of B differed significantly between females and males.

RESULTS AND DISCUSSION

Results of the analysis of covariance are presented in Table 1. The value of F as given in the table i.e., 14.4613 is significant at 1% level which shows that the estimate of B differed significantly between females and males. Hence length-weight relationship was fitted for each sex separately. The corresponding logarithmic equation may be written as

$$\text{Female : } \log W = 2.9547 \log L - 1.5675$$

$$\text{Male : } \log W = 2.5369 \log L - 0.8119$$

It can be seen from the equation that the value of B is greater for females, showing that the rate of growth in weight per unit growth in length is greater in females than in males.

The scatter diagrams for females and males are shown in Figures 1 and 2 respectively. From the closeness of the scatter it was clear that there exists a good relation between length and weight, and also the suitability of fitting the exponential formula, $W = aL^n$ to the data.

The fact that weight will be proportional to the cube of any linear dimension has been much discussed. According to Allen (1938) an ideal fish which maintains a constant shape, the value of 'n' will be 3. Hile (1936) and Martin (1949) were of the opinion that it may vary between 2.5 and 4.0. Discussing the merits of allometric formula with cube

Table 1

Analysis of covariance for testing differences in regression coefficients between females and males of *P. amphibius* (compared the slopes)

Source of variation	Regression coefficient	Deviation from regression		
		Degree of freedom	Sum of squares	Mean square
1. Female	2.9547	238	1.0437	0.0044
2. Male	2.5369	184	1.3065	0.0071
3. -	-	422	2.3502	0.0056
4. Pooled within	-	423	2.4307	0.0057
5. Difference between slopes	-	1	0.0805	0.0805

For comparison of slopes:

$$F = \frac{0.0805}{0.0056} = 14.375 \quad (d_f = 1 \text{ and } 422) - \text{Significant at } 1\% \text{ level}$$

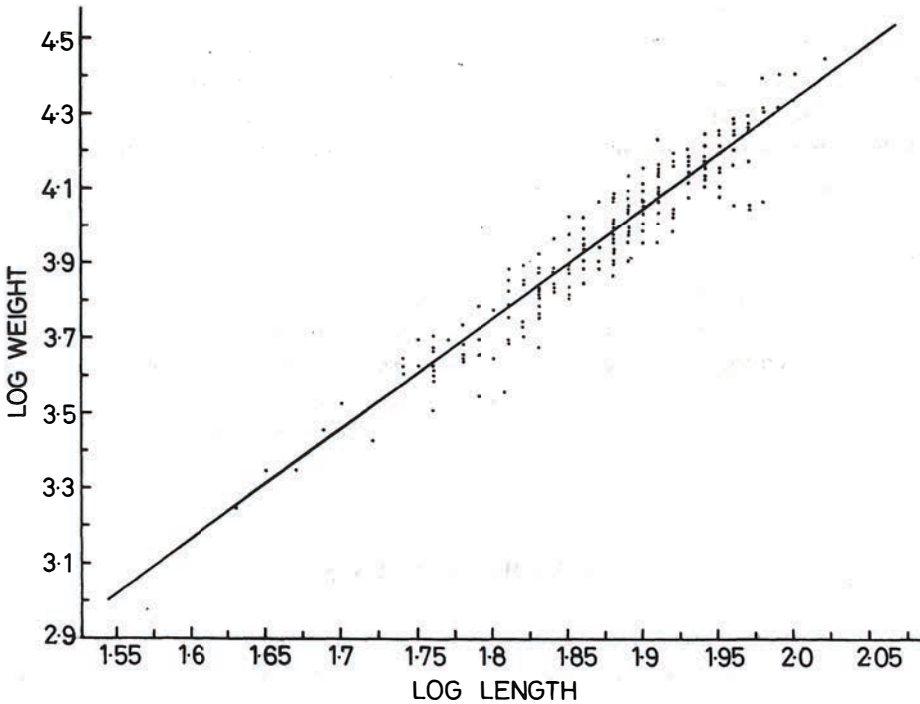


Fig. 1. Length-weight relationship in females of *P. amphibius*

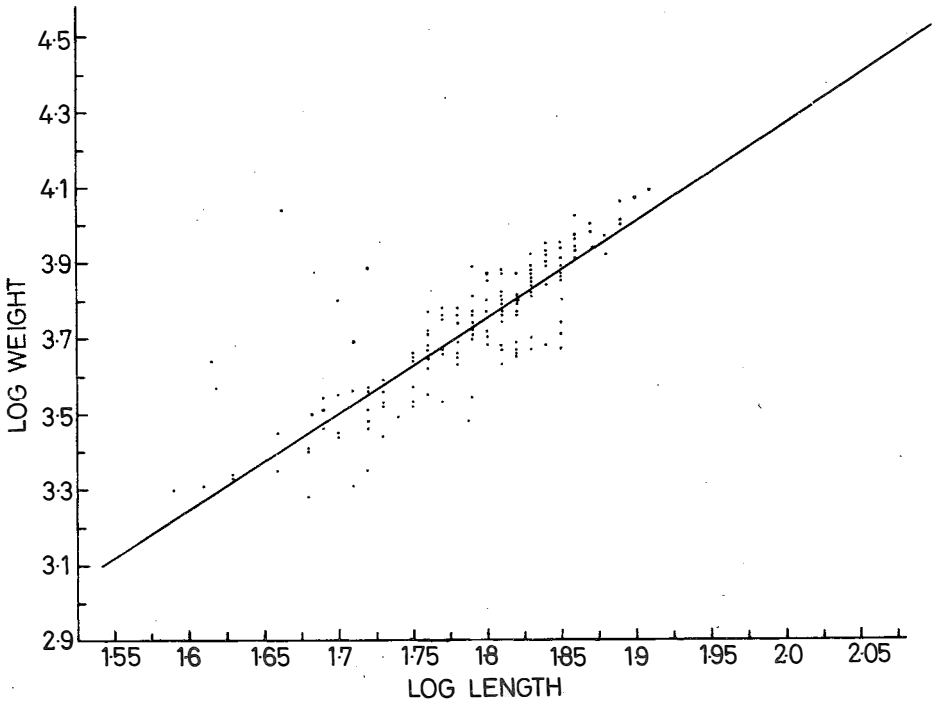


Fig. 2. Length-weight relationship in males of *P. amphibius*

formula in expressing the length-weight relationship, Beverton and Holt (1957) remarked that instances of marked deviation from isometric growth in adult fishes are rare. Hence it is felt to list the regression coefficients against the isometric growth value of 3 to find whether there is any significant departure. So 't' test was conducted by using the formula

$t = \frac{[3.0 B]}{S_B}$ The 't' test for females and males of *P.amphibius* gave the following results.

Females : $t = 0.6842$ ($d_f = 238$) – not significant

Males : $t = 5.4964$ ($d_f = 184$) – significant at 1% level

It is observed that the cubic formula $W = aL^3$ will not yield a proper representation of the length-weight relationship of the males of *P.amphibius* i.e., the growth in this case is different from isometric growth of the fish. On the other hand female fishes do not show this departure from isometric growth.

ACKNOWLEDGEMENTS

The authors are thankful to the Head of the Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum, for providing necessary facilities. One of us

(K.P.K.) wishes to express his gratitude to the University of Kerala for awarding a research scholarship during the tenure of which the work was carried out.

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UWAGI O ZALEŻNOŚCI POMIĘDZY DŁUGOŚCIĄ A MASĄ CIAŁA U *PUNTIUS AMPHIBIUS*

STRESZCZENIE

W pracy scharakteryzowano zależność pomiędzy długością a masą ciała u *Puntius amphibius*. Materiał obejmował 426 osobników złowionych w latach 1978–1979. Przyjęto do wyrażania tej zależności ogólnie stosowane równanie potęgowe $W = aL^n$, którego parametry określono metodą najmniejszych kwadratów. Równanie powyższe obliczono oddzielnie dla obydwu płci; wyniki wykazały istotne różnice w przebiegu omawianej zależności u samic i samców. Różnice te kształtowały się w ten sposób, że określonym przyrostom długości odpowiadały u samic wyraźnie większe przyrosty ciężaru, niż u samców. Stwierdzono, że u obydwu płci przyjęta formuła potęgowa dobrze oddaje charakter badanej zależności.

Zastosowaną formułę porównano z formułą potęgową o wykładniku $n = 3$. Stwierdzono, że w przebiegu zależności określonej obydwoma metodami u samic nie zachodzą statystycznie istotne różnice, natomiast u samców różnice te są istotne przy 1% poziomie ufności.

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ПРИМЕЧАНИЯ О ЗАВИСИМОСТИ МЕЖДУ ДЛИНОЮ И ВЕСОМ ТЕЛА
У PUNTIUS AMPHIBIUS

Р е з ю м е

В работе охарактеризована зависимость между длиной и весом тела у *Puntius amphibius*. Материал для исследований состоял из 426 особей, происходящих из улова проведенного в 1978-1979 гг. Для выражения этой зависимости применялось степенное уравнение $W=aL^n$, параметры которого определяли по методу наименьших квадратов. Для обоих уловов вычисление применявшегося уравнения производили разделено. На основании полученных результатов установлено существенные различия в поведении рассуждаемой зависимости у самок и самцов. Эти различия формировались таким образом, что у самок определенным приростам длины соответствовали значительно большие приросты веса, чем у самцов. Установлено также, что для обоих полов принятая степенная формула представляет собой хорошую характеристику исследуемой зависимости.

Применявшуюся формулу сравнивали со степенной формулой с показателем $n=3$. Установлено, что в поведении зависимости, определенной по обоим методам, статистически существенные различия не наблюдались у самок, тогда как у самцов существенные различия присутствовали при доверительном уровне 1%.

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Received: 12 April 1984