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Study on length weight relationship and feeding habits of a threaten fish *Ompok pabda* from Tripura, India

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Abstract

Ompok pabda is a highly consumer preferred fish. The biological parameters such as length and weight, condition factor (K_n), growth pattern and types of growth of *Ompok pabda* is necessary to know for the aquaculture practices. So, to study the bionomics (i.e., food and feeding habit, the relative length of gut, stomach content and feeding intensity) of *Ompok pabda* (Hamilton, 1822) the fish were sampled from the Gomati River and Rudrasagar lake of Tripura. The relationship between the length and weight of the species was studied by applying non linear model. The parameter estimates, mean square error (MSE) and mean absolute error (MAE) were also computed for finding the better model. The average relative condition factor (K_n) was also estimated. The length and weight relation of different age group were calculated for *Ompok pabda*. The food and feeding habit and the relative length of gut, stomach, and feeding intensity were examined by using standard methods. The morphology and morphometrics of the alimentary canal have also been studied along with the gut content analysis using standard methods. The Relative length of Gut of the dissected fish was studied meticulously and recorded the food contents as per point's methods. Out of total 362 sample specimens of *Ompok pabda*, the total length was varied from 7.7-20.7 cm. The morphology and morphometrics of the alimentary canal have also been studied along with the gut content analysis. The gastro-somatic index observed maximum (11.7%) in February and recorded in higher values from January to March. This phase revealed the early maturing stages of gonad and lowest GaSI (%) recorded during the advance spawning stage of gonads during the months of May to August (2.1 to 0.81). The result of the present study reveals the isometric pattern of growth and food and feeding habit of the fish indicate that *O. pabda* is a carnivorous fish. It was found that the effect of length on weight is statistically significant at 5% level of significance (<0.05). Similarly, it was observed that the effect of gender on weight is statistically significant at 5% level of significance (<0.05).

Keywords: Condition factor, food and feeding, length-weight, RLG value

Introduction

The catfish *Ompok pabda* locally known as pabda or butter cat fish is an indigenous freshwater small fish belonging to the order Siluriformes. Owing to its delicious taste, pabda is a very favourite food fish. It is commonly found in natural water bodies i.e. rivers, beels, and floodplains of northeast India. The species can be a good candidate species of aquaculture. The species has undergone significant decline due to over exploitation and hence placed in near threatened category by IUCN assessment information version 3.1. It is a well-known fact that the knowledge on fish biology is of utmost importance not only for academic knowledge but also for management of aquaculture practices. Food and feeding habits of many of the Siluroid fish have been studied by many authors. However, information on food and feeding habit of *Ompok pabda* are very few. In hatchery system for propagation of fish species knowledge of feeding habits, rates of growth and condition of fishes is very essential as it plays a vital role in fishery^[1, 2]. The proper growth of fish depends mainly upon the quantity and quality of food having all the essential nutrients; there is a limit of maximum growth for fish even of fish feed which is an important prerequisite for commercial culture of fish species. Quality of food and its availability is one of the important factors influences growth rate of fishes^[3, 4]. Food is the main source of energy and plays an important role in determining the population level, conversely the importance of food in the daily life of a fish reflected in the form of mouth and jaws dentition the size and shape of the gill racker etc. and therefore, the difference in their feeding habits^[5] and several workers from India have investigated on the morphology of the alimentary canal of fishes and its associated structures and food correlated with it^[6, 7].

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It is an established fact that the ratio of intestinal length to body length was greater in Herbivore than that in Carnivores. The relationship between the structure of the alimentary canal and feeding habits is evident in the works. The present study is focused on the relationship between length and weight, the structure and organization of the alimentary canal of *Pabda* and variation of the morphometric parameters of alimentary canal with food and feeding habits. *Ompok pabda* [8] is a threaten species in the North-Eastern region of India. There is a paucity of information on the biology of the fish *O. pabda* [8]. Thus, the aim of the present study is to investigate various food webs and feeding biology of *Ompok pabda* to establish the relationship between length and weight study the structure and organization of the alimentary canal.

Materials and Methods

Site of Studies

Ompok pabda was sampled live from the freshwater environment of Tripura, India. The environmental resources were Gomati river and Rudrasagar wetland as well. Climate of the study area is defined with dry season during November-March and wet season during April-October. During the period of observations, a total of 362 fish were randomly sampled among them juveniles recorded 7.0 cm to 13.3 cm and females observed more in number than male.

Length weight relationship and condition factor

The specimens of *Ompok pabda* collected from the Gomati river and Rudrasagar lake of Gomati and sipahijala District during the period of 2013-15. After collection, the specimens were brought to the laboratory and preserved in 10% formalin. The length (cm) and weight (g) of the sampled specimens of different length groups were then recorded. The length weight relationship was estimated separately male, female and juveniles and pooled data using the linear form of formula $W = aL^b$ (9). Where, W = weight of the fish in gram, L = length of the fish in cm and a and b are constant. The equation has been transformed into the following logarithmic form: $\log W = \log a + b \log L$ the values of 'a' and 'b' were determined empirically.

The observed average weight was plotted against the observed average length to examine the nature of parabola. On converting the values to logarithm, the exponential relationship obtained from the linear equation described above has been examined. The regression of log-weight on log-length has been calculated by the method of "Least-squares" by grouping the sample data into several length groups. In the present study, condition factor or Ponderal index has been determined using the formula: $K = W \times 10^5 / L^3$ Where, K = Condition factor; W = weight of the fish; and L = length of the fish; the number 10^5 is a factor to bring the Ponderal index (K) near to unity [10].

Food and feeding habit and Gastro somatic Index:

A total of 362 specimens of *Ompok pabda* (8.5-20.5 cm) were collected from different locations of Rudrasagar, Kentali Kachigancherra and Gomati river of Tripura. Immediately after collection the specimens were preserved in 10% formalin. In the laboratory total length of the fish was determined. The alimentary canal was removed and measured in mm. The measurement includes length of the whole alimentary canal uncoiled from lip to anus, length from lip to oesophagus, length of stomach and length of intestine. The stomach contents were examined to find out the nature of

food. For estimation of food organism, the 'Points (Volumetric)' method [11], was followed. The principle of the method is each food item in the stomach is allotted a certain number of points based on its volume. The structure of the different components of alimentary canal was studied under a dissecting binocular microscope. The specimens of taken up for the present study were grouped into different length viz, group-8.5cm-13.5cm juvenile stage above 13.5 cm adult stage.

Results and Discussion:

Length-Weight Relationship-

The relationship between the length (mm) and weight (gm) of fish was studied using the following equation:

$$W = aL^b$$

Where 'a' and 'b' are the parameters of the above nonlinear model, W and L are the length (mm) and weight (gm) of the sampled fishes. Levenberg-Marquardt method was followed in the present study for computing the nonlinear least square estimates of the above model. The summary statistics like parameter estimates, mean square error (MSE) and mean absolute error (MAE) were also computed for finding the better model in terms of having least values of MSE and MAE. The relative condition factor (Kn) of sampled fishes was also calculated to observe the biological condition of the fishes under the experiment as suggested by Le Cren [9] and the formula is given below:

$$K_n = W / aL^b$$

The estimates of parameter for the fitted model, goodness of fit statistics and values of condition factors are presented in Table-1.

Table 1: Summary statistics of the fitted model to length-weight dataset of the *O. pabda*

Parameters Estimates of fitted model	
a	0.000057
b	2.5657
Goodness of fit Statistics	
MAE	2.200904
MSE	13.4055
Condition Factors	
Average Relative Condition Factor (K _n)	0.9140964

The parameters a and b are estimated with reasonably small values of asymptotic standard errors and the values of MSE and MAE are also very small which indicate that the appropriateness of the estimated parameters as well as the fitted model [12, 13] the value of 'b' usually ranges between 2.5 and 4.0 [14]. Suggested that the value of 'b' remains constant for ideal fish. The average values of condition factor (K) and relative condition factor (Kn) are also given in Table-1. The effect of length on weight of *Ompok pabda* was studied using one-way ANOVA wherein the length of fishes was categorized into two groups by observing the maturity stages of gonads one having length less than 15.44 mm which shows immature gonads and other group having length more than 15.44 with more mature gonads It was found that the effect of length on weight is statistically significant at 5% level of significance (<0.05). Similarly, the effect of gender on weight of *O. Pabda* was also compared by one-way ANOVA

techniques. It was observed that the effect of gender on weight is statistically significant at 5% level of significance (<0.05).

The correlation coefficient of pooled data shows a very high degree of correlation between length and weight of the fish species of *Ompok pabda*. The value of (b) of the present experiment of length-weight relationship is observed more or less great than '3' and the result of the present study reveals the isometric pattern of growth and development of the fish. There are observed high degree of co-relation in between length and weight as recorded the 'r' value and t test. The length-weight relationship of *Ompok pabda* followed the cube law formula, hence indicates the isometric growth. The variations in the exponential value 'b' are supposed to be under the influence of numerous factors viz., environmental, physiological conditions of the fish at the time of collection, sex, gonadal development and nutritive conditions of the environment of the fishes reported by Le Cren [9]. Significant variations in 'b' values were found in case of juveniles and adults of *Ompok pabda*. (Fig: 1-2)

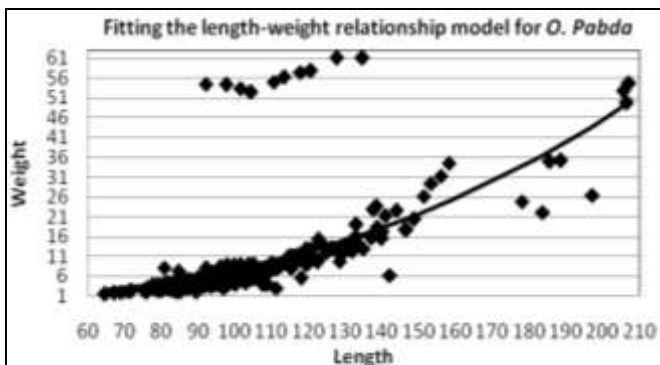


Fig 1(a): Length-Weight relationship model of Pabd

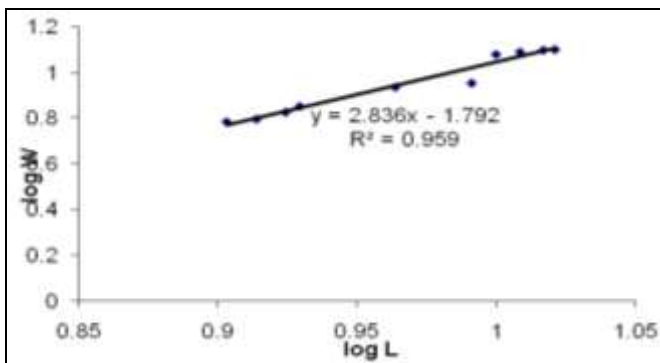


Fig 1(b): Length weight relationship of Juvenile of *O.Pabda*

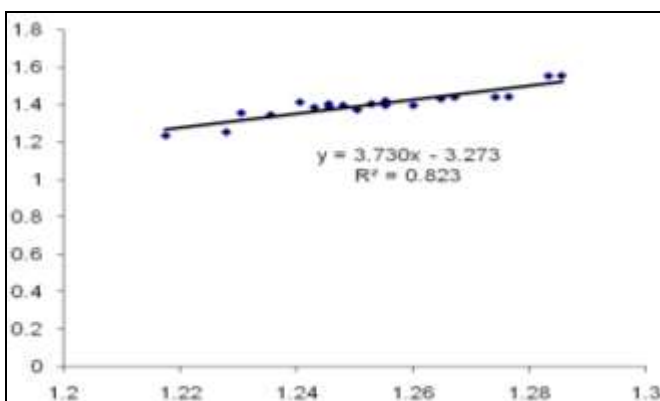


Fig 2(a): Length weight relationship of Female *Ompok pabda*

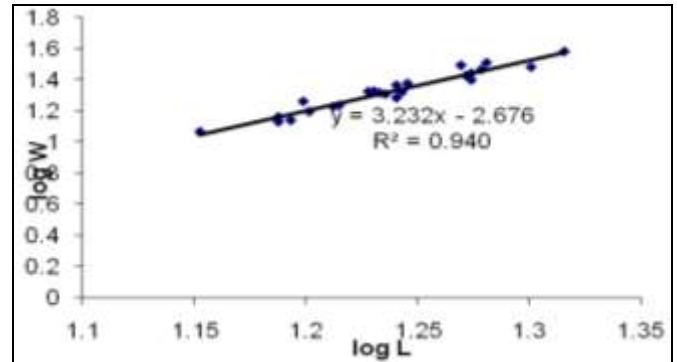


Fig 2(b): Length weight relationship of Male of *Ompok Pabda*

An intra specific difference in the power function 'b' of length in relation to body weight also mentioned by different authors, [15, 24], in their work in *Rita rita*, *Sardinella albella*, and *Acrossocheilus hexagonolepis* respectively at different stages of their growth. In *Monopterus cuchia* isometric pattern of growth was also observed by some author [16]. The value of regression coefficient in *Labeo calbasu* was 3.0 from Loni river [17]. In *Garra gotyla* from river Bhagirathi; recorded the same observations [18]. In some other fishes also observed the similar values in *Strongylura leiura* and in *Ablenne slians* [19], in *A. hexagonolepis* [24] and in *Nemipterus japonicus* [20]. Relatively low 'b' value was observed in juveniles (2.836) of *Ompok pabda* and the value was found to be greater than '3' (3.73) in case of female and male (3.231). The environmental factor and the period during spawning and immediately after spawning affect the length-weight relationship. In case of fish the gut weight also changes the fish weights as per the weight of the food taken just before weighing [21]. Some other opined that the deviation of 'b' value from 3.0 is rather rare [22]. In fishes like *Channa gachua* deviation of 'b' values from 3.0 may be due to the availability of food and feeding habits of the species. It may be the presence of good amounts of detritus along with vegetable matter in the stomach. In *Ompok pabda* 'b' values for males and females were found to be greater than '3' revealed isometric growth. In *Tor tor* the 'b' value found 3.16 (male) and 3.39 (female), [23]. The observation results similar were also observed in males and females of *A. hexagonolepis*, [16]. The values of 'b' as 3.16 for males and 3.20 for females in *Labeo bata* reported from Bangladesh [25]. In *Tenualosa ilisha* from Pakistan, recorded the value of 'b' as 3.02 for males and 3.03 for females [16]. The results of the present works are also coinciding with the findings of the various authors as described and reported that the value of 'b' increases in the carnivorous fish. This is also observed in case of *Ompok pabda*. [12, 13, 26, 27]. The higher value of 'b' (4.36) also observed in *Cirrhinus mrigala* [28] that is due to the presence of large quantities of sand and mud in the stomach and increase in total weight as a whole. The value of regression coefficient (b) usually lies between 2.5 and 4.0, as reported by different author [12, 13, 26] that value of 'b' might be between 2.0 and 4.0. However, a variation of 'b' value may be observed due to different seasonal variations. The value of 'b' remains constant 3.0 for an ideal fish [15].

Condition factor

In *Ompok pabda* variations in the condition factor may be recorded to different factors, such as ecology, occurrence of food and the maturation of gonads has also been suggested by many workers [9, 29]. According to them study on the changes in the condition value with increase in length may yield

evidences concerning the size at first maturity. In its variation with the increasing length, the 'K' values in *Ompok pabda* showed higher in juvenile. From this it can be indicated that juveniles have better condition factor^[30, 24]. The present result support that even among the members of one population, sampled on a single date, there may be considerable variation in condition with length^[31]. The fish populations display considerable changes in average condition, reflecting normal seasonal fluctuations in their metabolic balance and in the pattern of maturation and subsequent release of reproductive products. Feeding intensity may also influence 'K' factor,^[31].

Alimentary canal

The adaptations of the alimentary canal and certain external morphology of the species greatly influence its ecology and ethology (scientific study of animal behavior, especially as it occurs in a natural environment) of the food and feeding regimes. The shape of the body and mouth, dentition system, barbel and gill rakers in *Pabda*, values of relative gut length were generally low, so indicates carnivorous as observed in *Bagarius bagarius* (0.8) and *Chitala chitala* (0.4), (6). The average R.G. I value of *Ompok pabda* (Table: 2) determined in the present study fall in the category of carnivorous fishes. Range 0.52-1.01. In case of *Ompok pabda* the R.G.I value was found to be on the higher side in adult 1.01 of the range, for carnivorous fishes probably due to the presence of some vegetable matter in its diet.

Table 2: Average value of R.G.I. and Gut length of *O. Pabda*

Parameters In Adult	Range	Average	% of Gut length	
			Range	Average
R.G.I.	0.54-1.01	0.68	-	-
Gut length	7.8-20.2	12.37	-	-

The feeding habit of *Pabda* may be termed as carni omnivorous. The juveniles are found highly carnivorous than adult. It is observed that *Pabda* larvae is a highly carnivorous and an opportunistic cannibal. Similar behavior also observed in *Channa striatus* larvae^[32, 33].

Gut content analysis

The stomach content analysis (Table- 3) revealed that *Pabda* is a euryphagous fish.

Table 3: Presence of food in the gut of *Ompokpabda*

Item	Percentage
*Vegetable matter	5%
*Green algae	5%
#Zoo plankton	10%
#Crustacean	15%
#Crustacean larvae	2%
#Annelids-tubifex worm,earthworm	35%
#Fish	10%
#Unidentified animal matter	25%
Sand and mud	3+

*Vegetable matter (25%), #Animal matter (72%), +Unidentified

In present study the variety of foods and greenish gut content seems that they take vegetative matters as food but the general plan of the alimentary canal has been found to be carnivorous type. *Ompok pabda* feeds on vegetative matter and small fishes, same observation recorded by different authors^[34, 35]. The availability of natural food items in the environment vary with the season, temperature and time of the day^[16].

In the present study among the food content percentage of animal matter recoded highest, out of the recorded animal matter tubifex worm found 30% trash fish 5%. The similar

observation of trash fish and live tubificid worms found the best food of larvae *Ompok pabda*.

The length of the gut is compensated by the average mucosal area and short gut may be compensated by longer mucosal fold^[36]. The pattern of mucosal folds in different regions of the alimentary canal is meant for conduction, retention and assimilation of the ingested material^[37]. In *Ompok pabda* the mucosal folds are mostly longitudinal; the longitudinal folds probably help in facilitating conduction of foods, Percentage of food items are show in (Table.3). Gastro somatic index (fig: 3.a) observed maximum during the pre-spawning phase. In (Fig; 3.b) indicates that fishes gradually become carnivorous during the increase of age.

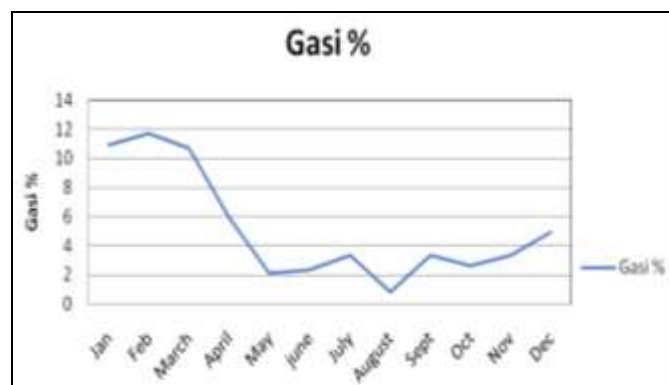


Fig 3(a): Graphical representation of monthly variation of Gastro somatic Index

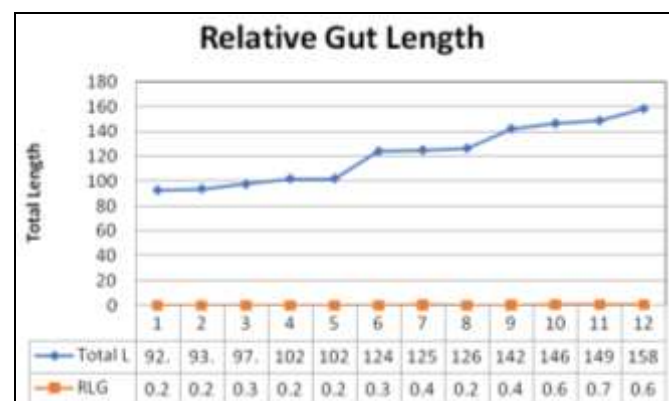


Fig 3(b): Relative gut length of different length group

Conclusion

Decline in fish catch due to over fishing and rampant killing of fish juveniles through destructive fishing gears have made natural fisheries no more a profitable venture. As the demand and price of the SIF, including *Ompok pabda* are high in market, *Ompok pabda* from river Gomati and Rudrasagar Lake is found mainly carnivorous in feeding habit and change their feed preference according to size. The present study reveals the b value near about 3 indicates isometric growth of the species and the average relative condition factor is near 1 which is the reflection of biological well-being of the species in the natural water body. It is essential to produce adequate quantity through aquaculture that can support an alternative livelihood in Tripura. However, the major challenges for its aquaculture are paucity of wild seeds and unavailability of hatchery produced seeds^[34]. Present research work finds ample information on food and feeding habit, and biology of *Ompok pabda* which will definitely provide directions to carry out further research on different aspects of this fish. However, there is limited knowledge on captive breeding, nursery

rearing, and nutritional requirement, farming technology, disease occurrence and marketing which may have direct implications in aquaculture.

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