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# Studies on length weight relationship, condition factor and hepatosomatic index of one stripe spiny eel *Macrognathus aral* (Bloch and Schneider, 1801) in West Bengal.

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***Abstract***- The regression coefficient for *Macrognathus aral* juveniles and males were found to be lower than '3' indicating negative allometric pattern of growth where as in females it was greater than '3' suggesting positive allometric growth. Total body weight shows positive increase with total length in both male and female fishes. Different morphometric features like head length, snout length, dorsal fin length, pre dorsal length shows positive correlation with total length. Condition factor values in both male and female specimens gradually decreased before spawning season and start to increase again after the spawning season is over. Hepatosomatic index in female specimens attains peak value before spawning season and then shows a gradual decrease with the onset of spawning period.

***Index Terms***- *Macrognathus aral,* length-weight relationship, condition factor, hepato-somatic index.

## I. Introduction

Morphometric measurements and meristic counts are considered as easiest and authentic methods for the identification of specimen which is termed as morphological systematics (Nayman, 1965). Morphometric measurement is measurements of different external body parts of an organism and meristic counts mean anything that can be counted (Talwar and Jhingran, 1991).The mathematical relationship between length and weight of fishes is a practical index suitable for understanding their survival, growth, maturity, reproduction and general well being (Le Cren 1951).

Length weight relationship (LWR) of fishes are important in fisheries biology because they allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relation between the two (Beyer 1987). Length-weigth relationships are important in fisheries management for comparative growth studies (Moutopoulos & Stergiou 2002). Condition factor studies take into consideration the health and general well-being of a fish as related to its environment; hence it represents how fairly deep bodied or robust fishes are (Reynold, 1968). Condition factor is also a useful index for the monitoring of feeding intensity, age, and growth rates in fish (Oni *etal*., 1983). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live. Hepato somatic index is associated with liver energetic reserves and metabolic activity (Pyle,2005). While some authors (Sloof W,1983) claimed that HSI might be useful as an indicator of chemical water pollution, others showed that it was inconsistent as a biomarker (Khan R.A. 1999).

## II. MATERIALS AND METHODS

Specimens of *Macrognathus aral* (Bloch and Schneider) were collected from Ballir beel located in north 24 parganas (22°47′40.69″N/88°53′35.86″E), West Bengal. Fishes were preserved in 8% formalin solution immediately after collection. The specimens were mopped on filter paper to remove excess water from their body surfaces. Their total lengths were then measured using a ruler to the nearest one-tenth of a centimeter. The total length was measured as the distance from snout to the tip of the caudal fin. The body weight was taken on a electrical weighing balance (Sartorius BT 223 S) to the nearest 0.1g. The morphometric parameters were measured from left side of each specimen.

The length-weight relationship was estimated separately for males and females using the linear form of formula $W= aL^b$ (Le Cren, 1951) as $\log W= \log a + b \log L$, where, W = weight of the fish, L = length of the fish and '*a'* and '*b'* are constants.

Condition factor of the specimens were determined by using the formula:

$K = 100 \times W/ L^3$ (Bagenal, 1978) Where, K= condition factor, W = total body weight (gm), L = standard length (cm)

Hepatosomatic index (HSI) was determined (Htun-hun, 1978) as:

HSI = liver weight x 100/Body weight

## III. RESULTS

**Size groups**

All the specimens of *Macrognathus aral* (Bloch and Schneider) collected during the study period were classified into four size groups based on total length; group I: 100 – 150 mm; group II: 151 – 200 mm; group III: 201 – 250mm; group IV: 251

– 300 mm. The proportion of individuals belonging to different size groups, present in samples collected from wild stock are given in fig: 1. A-B. Size group II was the most frequently obtained group all through the year.

Different morphometric characters (total length snout length, head length, body depth, pectoral fin length, predorsal length, dorsal fin length, anal fin length, caudal fin length) of *Macrognathus aral* (Bloch and Schneider) were measured separately for each size group. [Table 1. A]

**Study of morphometric characters**

Relationship between total length and some other morphometric characters were determined and expressed by the following equations

Log snout length = 0.7416 Log total length – 0.4712 **[$r^2$ =0.75; p<0.01]**

Log head length = 0.9534 Log total length – 0.6178 **[$r^2$ =0.82; p<0.01]**

Log dorsal fin length = 1.0654 Log total length – 0.4233 **[$r^2$ = 0.95; p<0.01]**

Log pre dorsal length = 0.9359 Log total length – 0.2568 **[$r^2$ = 0.96; p<0.01]**

Log pectoral fin length = 0.6797 Log total length – 0.48 **[$r^2$ = 0.89; p<0.01]**

Log anal fin length = 1.3102 Log total length – 1.2218 **[$r^2$ = 0.70; p<0.01]**

Log caudal fin length = 0.9821 Log total length – 1.1415 **[$r^2$ = 0.85; p<0.01]**

Log body depth = 1.2225 Log total length – 1.4145 **[$r^2$ = 0.93; p<0.01]**

**Study of length-weight relationship**

Relationship between total length and total weight were determined separately for both male and female *Macrognathus aral* (Bloch and Schneider).

In males, the parabolic equation showing the relationship between total weight and total length is -
**$TW = 0.00003\ TL^{2.5615}$**

[TW= Total weight; TL= Total length]
The following equation is derived after transforming the parabolic equation into its logarithmic form –
**Log TW = 2.5615 Log TL – 4.5229 [$r^2$ = 0.902; p<0.01 ]**

In females, the parabolic equation showing the relationship between total weight and total length is -
**$TW = 0.000001\ TL^{3.2371}$**

[TW= Total weight; TL= Total length]

The following equation is derived after transforming the parabolic equation into its logarithmic form –
**Log TW = 3.2371 Log TL – 6 [$r^2$ = 0.933; p<0.01]**

In juveniles, the parabolic equation showing the relationship between total weight and total length is -
**$TW = 0.000008\ TL^{2.8262}$**

The following equation is derived after transforming the parabolic equation into its logarithmic form –
**Log TW = 2.8262 Log TL – 5.0969 [$r^2$ = 0.91; p<0.01]**

**Study of condition factor**

Condition factor (K) was determined independently for male, female and juvenile of *Macrognathus aral* (Bloch and Schneider) [fig 1.N-P]. In males, the condition factor ranged between 0.32 – 0.38 and exhibits peak value in February. In female's condition factor ranged between 0.34 – 0.42 and exhibits highest value in January. In juveniles condition factor ranged between 0.35 – 0.40 and peak value is observed in January.

**Study of hepatosomatic index**

Hepatosomatic index of females and males of *Macrognathus aral* (Bloch and Schneider) was determined separately [Fig 1.Q-R]. In females, HSI value attains its peak value in June and then following a gradual decrease reaches the lowest value in December. In males, HSI attains its highest value in November (first year) and October (second year). Lowest value is observed in April (first year) and March (second year).

**Table 1. A Measurement of morphometric characters of different size groups of*Macrognathus aral* (Bloch and Schneider)**

| Morphometric parameters(mm) | Size group I | Size group II | Size group III | Size group IV |
|---|---|---|---|---|
| Snout length | 12±1.5 | 15±2.3 | 19±2.2 | 21±2.3 |
| Head length | 26±2.2 | 32±4.6 | 41±3.9 | 49±3.6 |
| Pectoral fin length | 10±1.1 | 11±0.8 | 13±1.6 | 15±1.1 |
| Pre-dorsal length | 56±4.9 | 68±7.5 | 88±9 | 101±6.3 |
| Dorsal fin length | 71±5.4 | 91±6.6 | 119±9.5 | 146±10.8 |
| Anal fin length | 35±4.6 | 47±7.9 | 60±8 | 74±5.3 |
| Caudal fin length | 9±0.9 | 12±1.9 | 14±2.3 | 17±2 |
| Body depth | 18±1.9 | 24±3.9 | 28±2.5 | 33±3.6 |

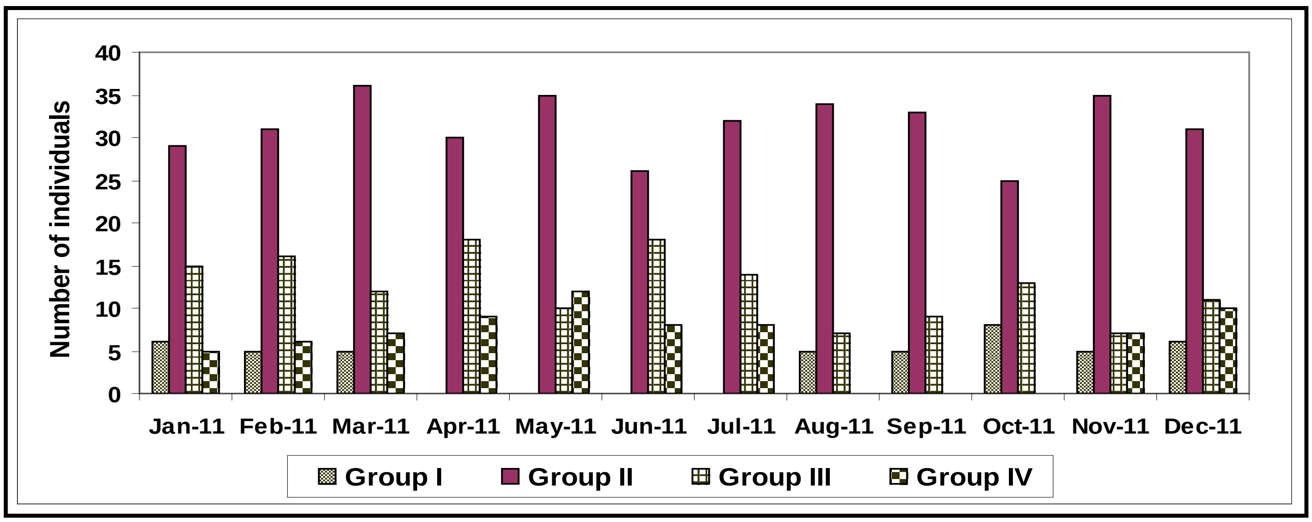


**Fig 1.A: Annual variation of different size groups in the wild population of *Macrognathus aral* selected for current study**

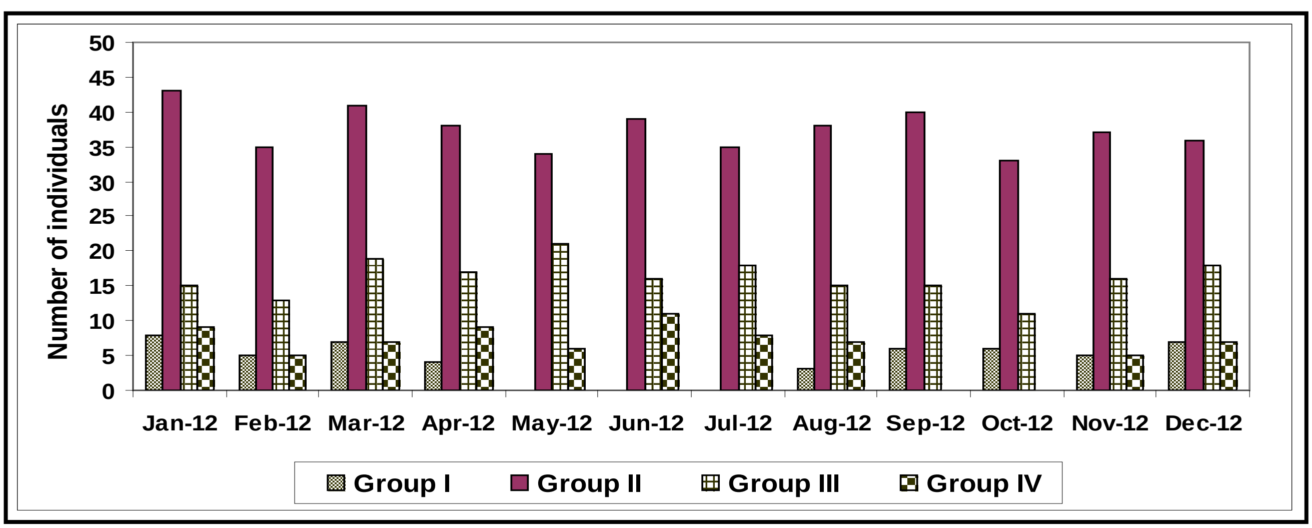


**Fig 1.B: Annual variation of different size groups in the wild population of *Macrognathus aral* selected for current study**

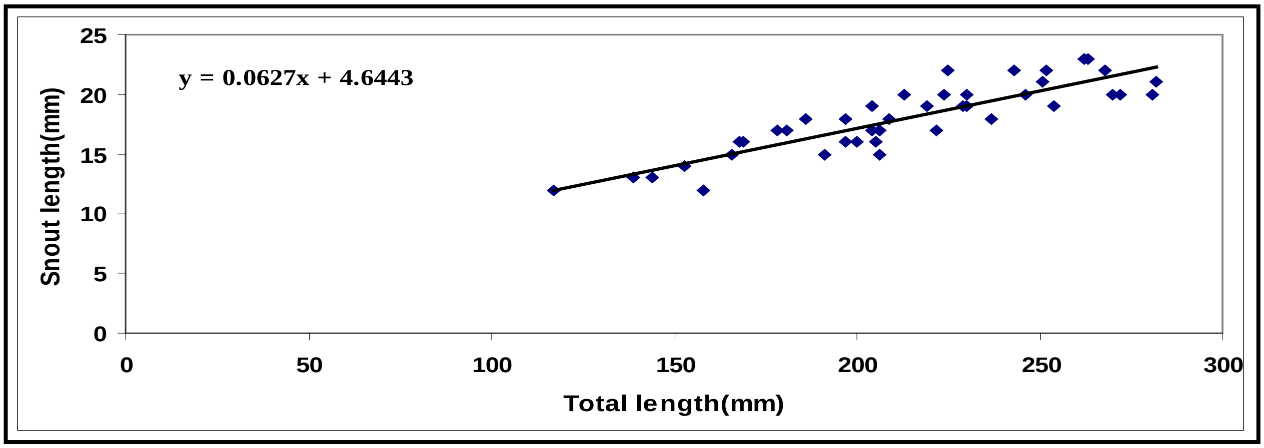


**Fig.1.C: Relationship between total length and snout length of *Macrognathus aral***

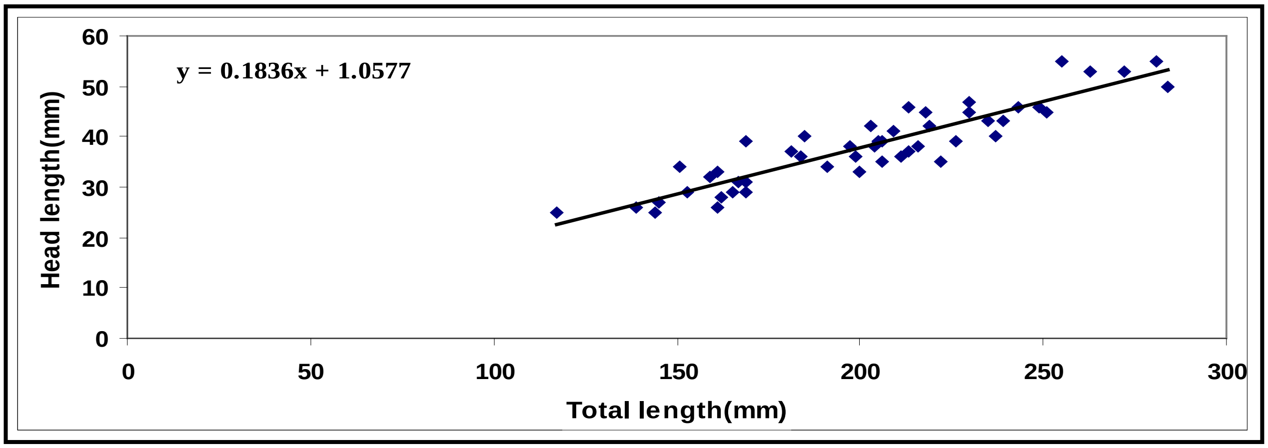


**Fig.1.D: Relationship between total length and head length of *Macrognathus aral***

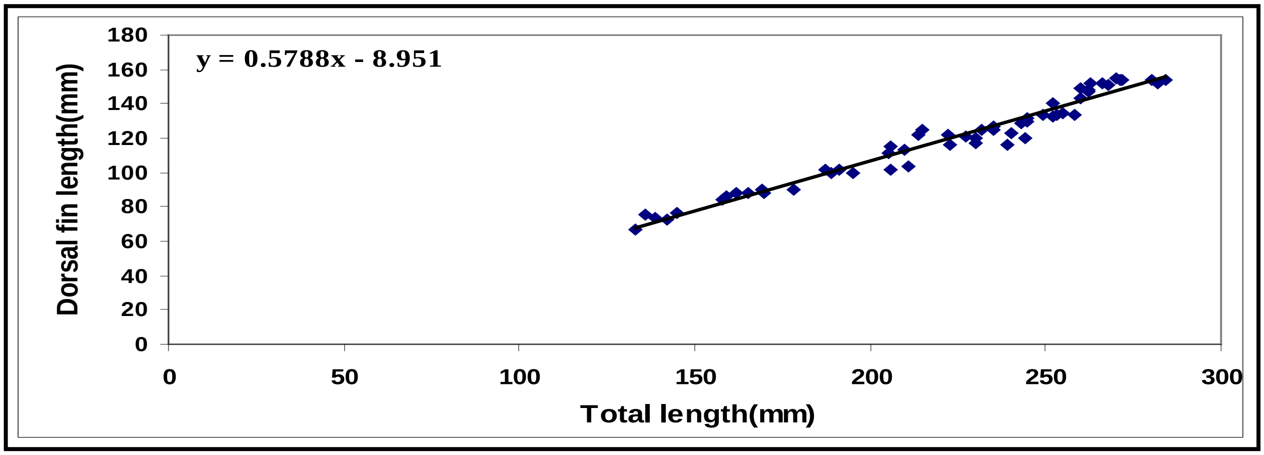


**Fig.1.E: Relationship between total length and dorsal fin length of *M. aral***

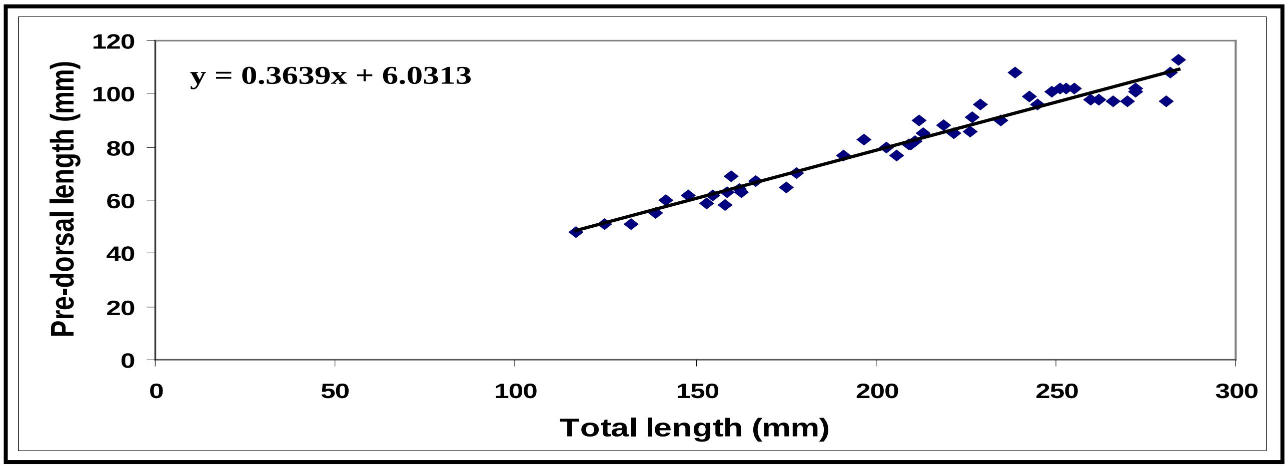


**Fig.1.F: Relationship between total length and pre dorsal fin length of *M. aral***

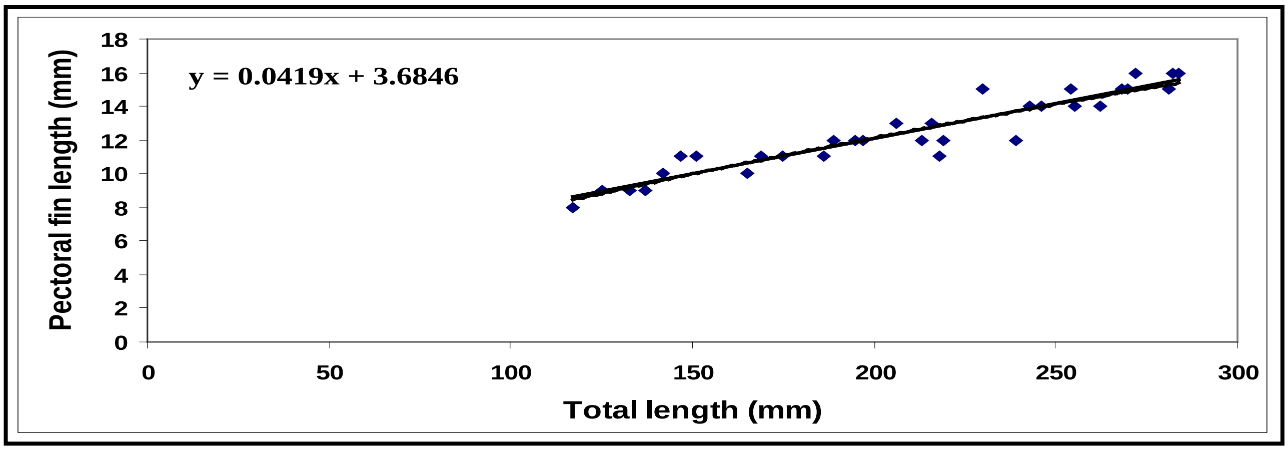


**Fig.1.G: Relationship between total length and pectoral fin length of *M.aral***

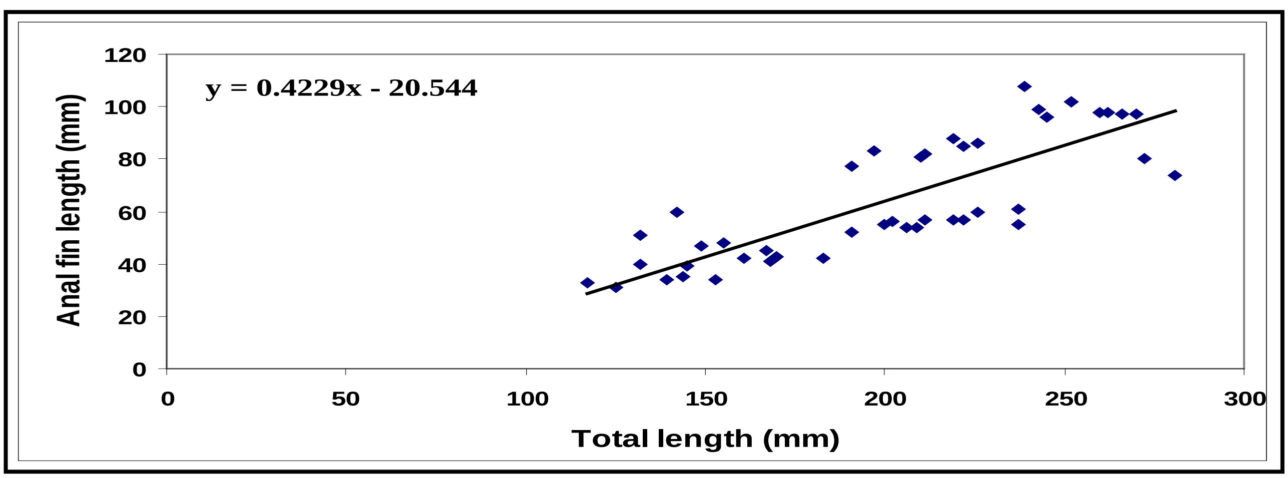


**Fig.1.H: Relationship between total length and anal fin length of *M. aral***

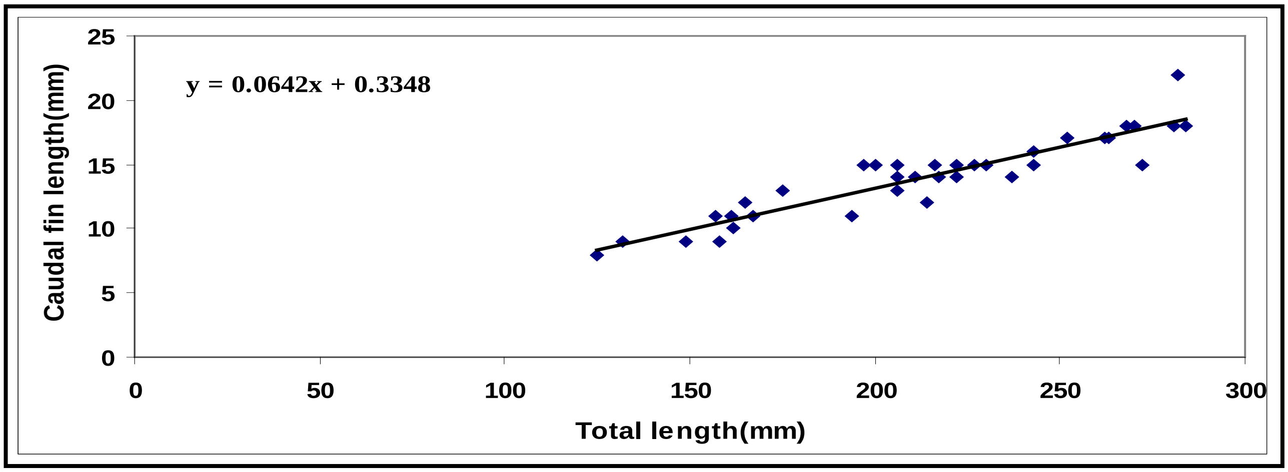


**Fig.1.I: Relationship between total length and caudal fin length of *M. aral***

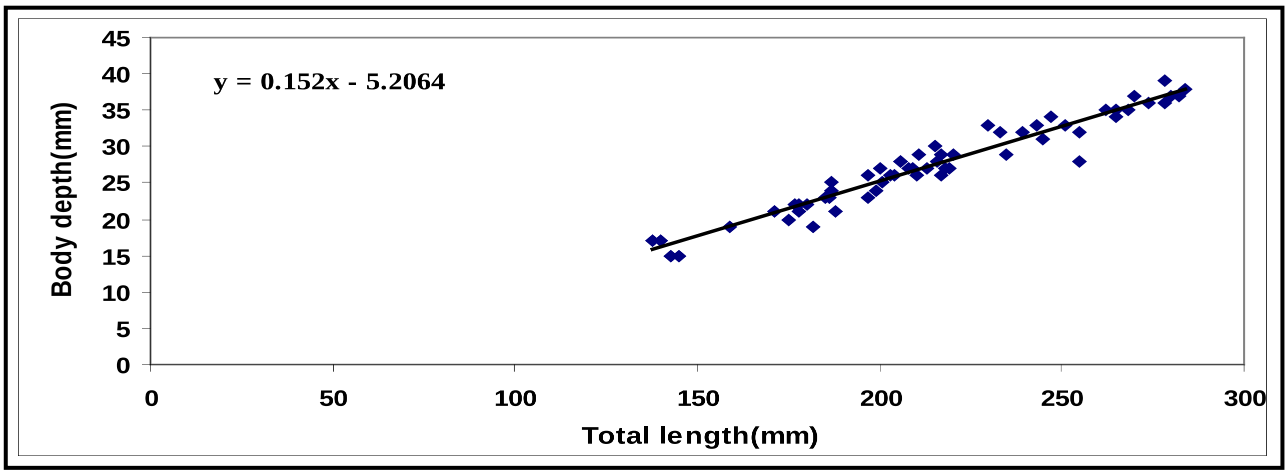


**Fig.1.J: Relationship between total length and body depth of *M. aral***

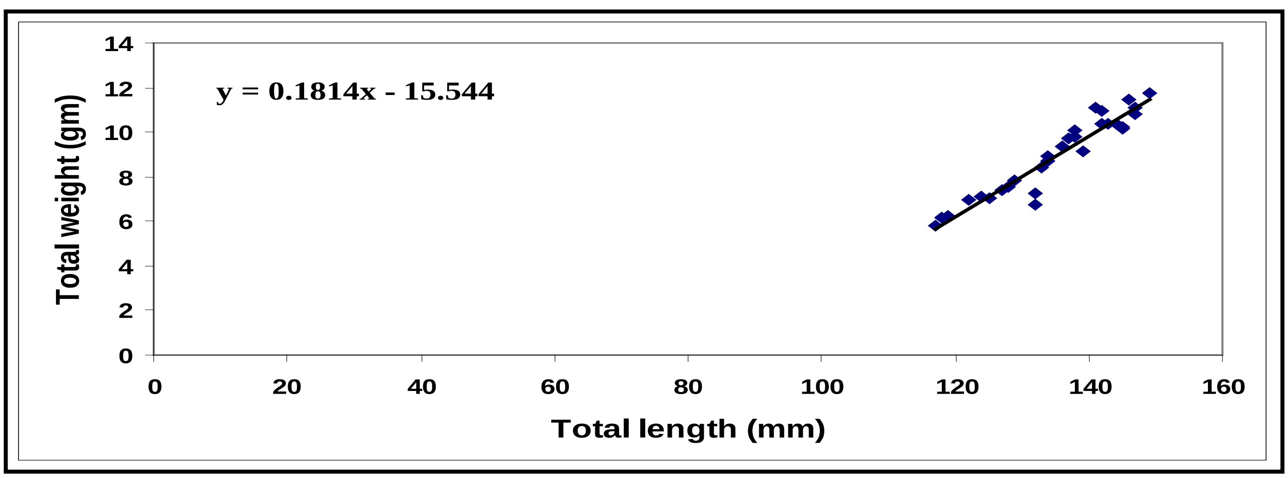


**Fig.1.K: Relationship between total length and body weight of *M. aral* juvenile.**

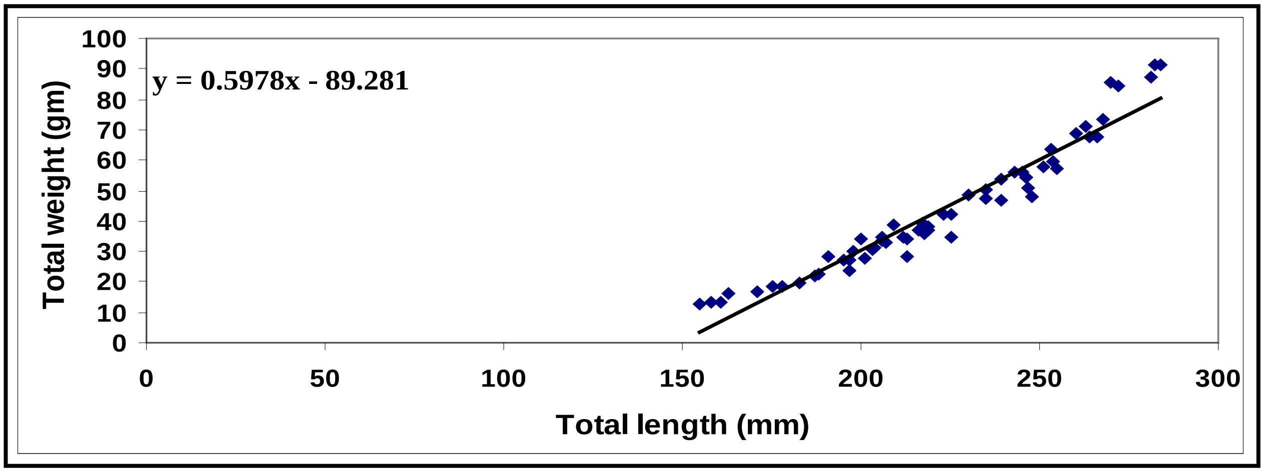


**Fig.1.L: Relationship between total length and body weight of *M. aral* female**

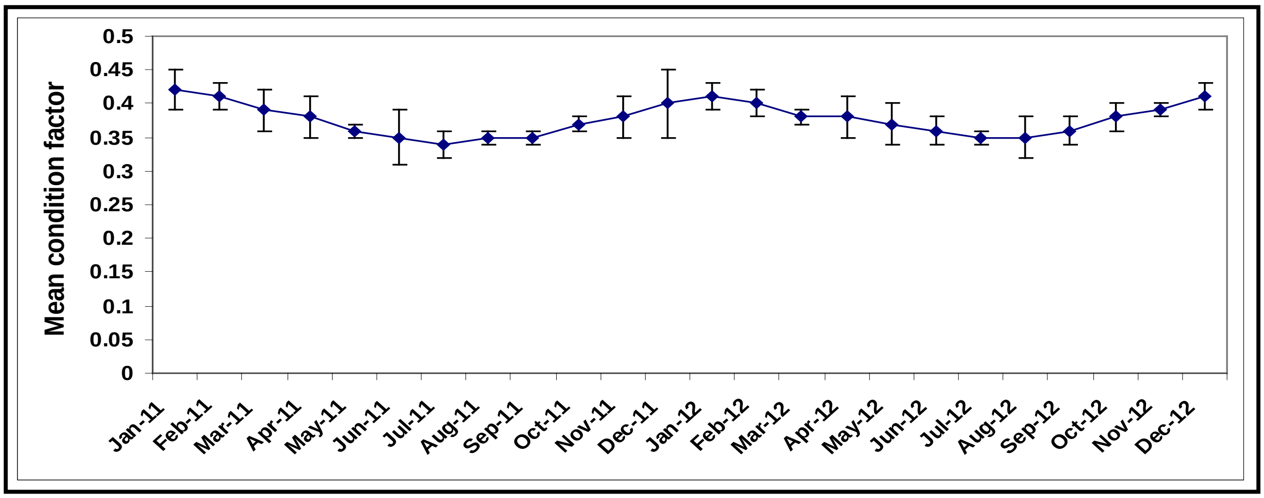


**Fig.1.M: Relationship between total length and body weight of *M. aral* male**

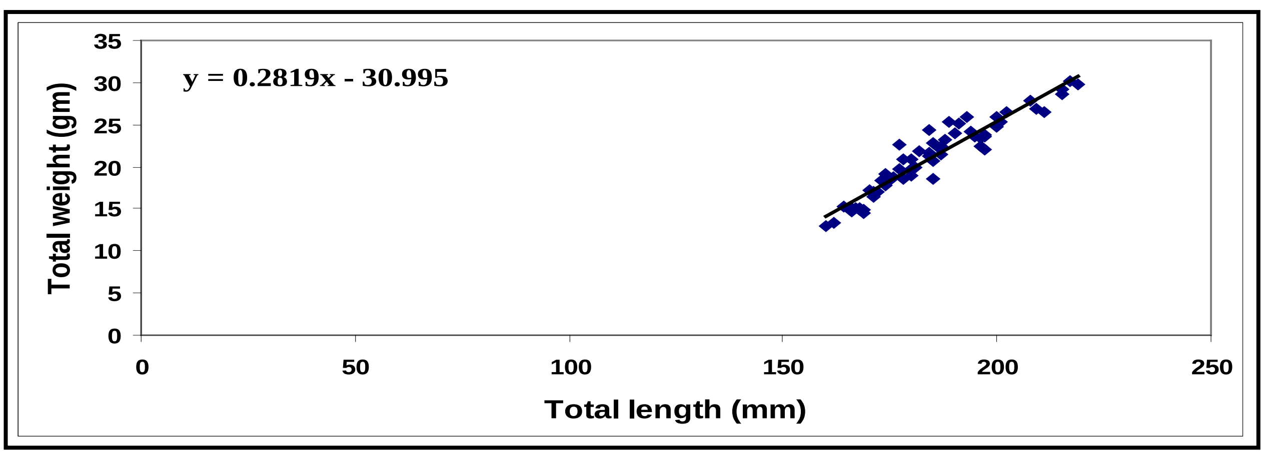


**Fig.1.N: Annual fluctuation of condition factor in *Macrognathus aral* female**

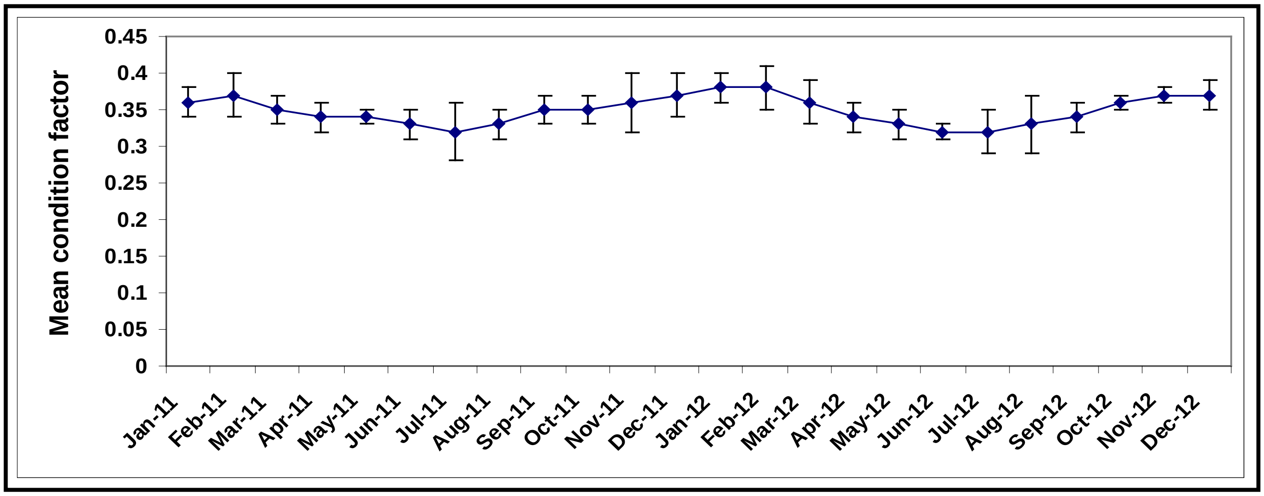


**Fig.1.O: Annual fluctuation of condition factor in *M. aral* male**

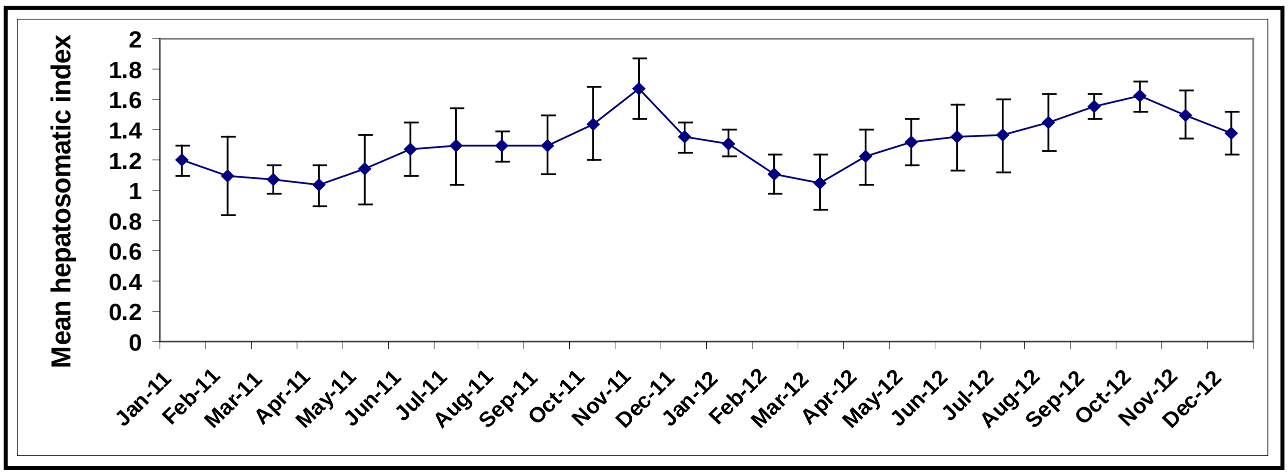


**Fig.1.P: Annual fluctuation of condition factor in *M. aral* juvenile**

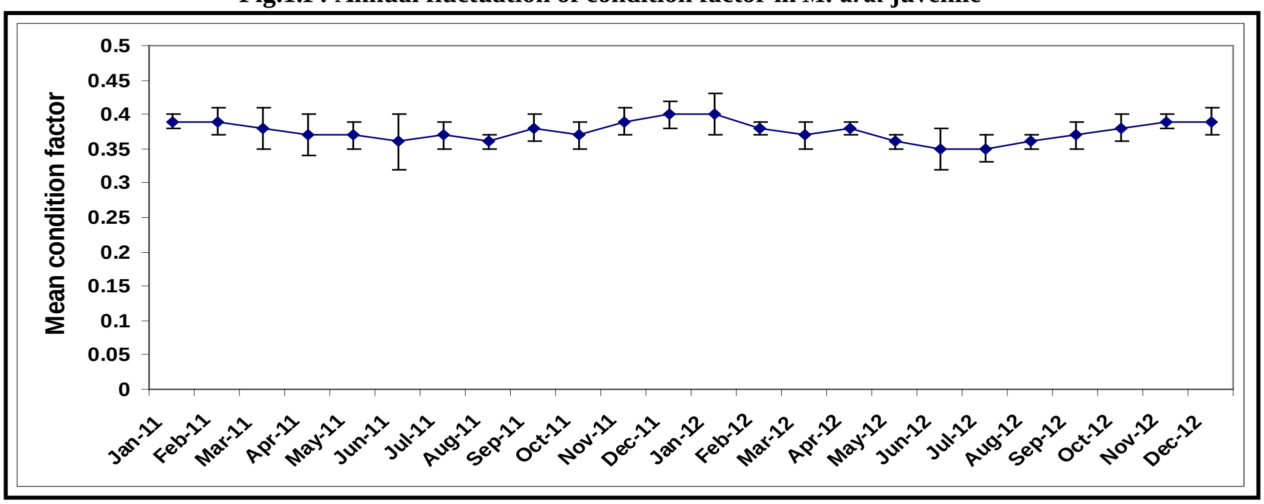


**Fig.1.Q: Annual trend of hepatosomatic index in *M. aral* female.**

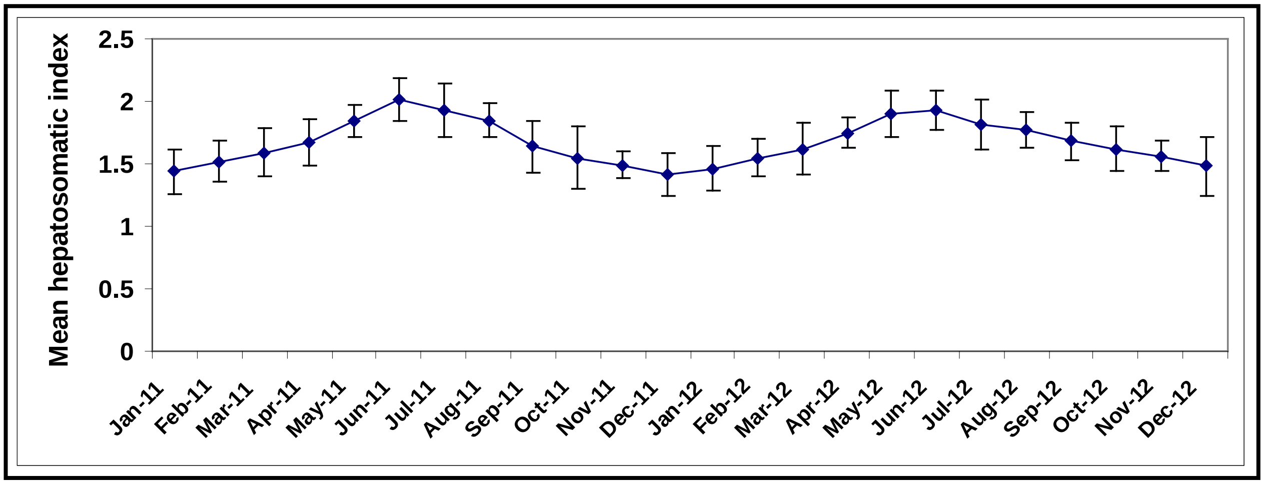


**Fig.1.R: Annual trend of hepatosomatic index in *M. aral* male.**

## IV. DISCUSSION

In females the 'b' value of length – weight relationship equation was greater than 3 (b=3.27) indicates that the length-weight relationship deviates from maintaining the cube law and exhibit positive allometric pattern of growth. The greater 'b' value (3>) in females suggests that larger specimens of female have increased in width more than in length. Conversely, in case of male and juvenile specimens, the 'b' value was less than 3 (b= 2.56 for male, 2.83 for juvenile) which suggests negative allometric growth. The lesser 'b' value (<3) in males predicts that in case of large male specimens body shape became elongated as length increased more than width.

Lal & Dwivedr (1965), Sekheran (1968) and Dasgupta (1988) have also observed an intraspecific difference in the power function 'b' regarding length related to body weight in *Rita rita*, *Sardinella albella*, *S. gibbosa* and *Acrossocheilus hexagonolepis* respectively at different growth stages.

Observations from the present study shows that condition factor in both male and female specimens exhibits a gradual decrease before spawning period and attain lowest value during the spawning season (monsoon) indicating that development of gonads occurs at the expense of somatic weight. After the spawning season, condition factor starts to increase and reaches peak value in post monsoon. The overall low value of condition factor suggests scarcity of food in the environment. Development of gonads and variations in feeding intensity are the probable factors contributing to the seasonal fluctuations in condition factor. Hossain et al (2006) obtained similar observations in Asian striped catfish, *Mystus vittatus*.

Studies on hepatosomatic index has revealed that in female specimens HSI value reaches peak value prior to spawning season and then starts to decrease after spawning period. Decrease in HSI value after spawning months can be due to the loss of hepatic glycogen which is a common morphologic response of fish liver to stress (spawning and reproduction) that enhances consumption of glycogen as an instant source to meet the energy demand during the spawning seasons ( Schreck, 1981).

## V. CONCLUSION

Different morphometric characters like snout length, head length, predorsal length, dorsal fin length, pectoral fin length, anal fin length, caudal fin length show significant positive increase with total length.

Positive allometric growth pattern was observed in case of female fishes in the *Macrognathus aral* population selected for the present study. Males on the other hand exhibited negative allometric growth pattern.

Availability of food, gonadal maturity and spawning were the most possible reasons for variation of condition factor and hepatosomatic index in the studied fish population.

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