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LENGTH-WEIGHT RELATIONSHIP OF FRESH WATER FISH NILE TILAPIA, *OREOCHROMIS NILOTICUS* IN THEROOR WETLAND, TAMIL NADU, INDIA

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ABSTRACT
The study aimed to investigate the length-weight relationship of *Oreochromis niloticus* (Nile thilapia) from Theroor wetland. Monthly sampling was carried out during the study period, length varied between 9.5 cm to 35.5 cm, with the maximum length observed during the month of March and minimum in the month of September, weight varied from 50.3 g and 410.6 g during March and September (2015-2016). Regression value maximum observed (R^2 = 0.849) during December and minimum (R^2 = 0.264) was observed during April 2015. Present study reported that this *O. niloticus* species available all the seasons, hence the length-weigh relationship was differ during monsoon season based on the flection of food as well reproduction.

KEYWORDS: Condition Factor, Length-Weight relationship, *Oreochromis niloticus.*

1. INTRODUCTION

Fisheries have huge part in earning foreign exchange, sustenance, and service for a country. It plays a fundamental part on the world food economy for South-Asian countries like India. India being the third largest producer of fish and second largest producer of fresh water fish in the world depend on fish as a source of food and protein supply. In tropical country like India, fish is one of the most preferred groups of animal foods for human beings, as fish is considered too valuable source of protein that exceeds in protein concentration than that of all other animals and also provide the much needed nutrient that cannot be provided by cereals (Zuraini *et al.*, 2006; Abolagba *et al.*, 2008). One of the key factors for successful fish culture and fishery management basically understands some of their biological fundamentals especially external morphological measurement.

In the recent years despite the advent of largest techniques which directly examines on the external morphological measurement, biology, population structure of any species, a conventional morphometric and the meristic methods that which remains the simplest and most direct way still play an important role in fishery management even today. From previous studies of length and weight relationship done by Koutrakis and Tsikliras, (2003); Vishalakshi and Singh, (2008); Alemayehu and Prabu, (2008); Abowei, (2009); Kamal *et al.* (2010); Sabu et al. (2014); Khabade (2015). morphometric difference analysis among species are recognized as a prerequisite for developing management and conservation strategies (Turan et al., 2005) which may be applicable for studying short-term and environmentally induced variations, for evaluating the population structure and as a basis for identifying stocks.

Morphometric and meristic characters being the powerful, rigorous tool always indicates the degrees of stabilization of taxonomic characters in fish species, helps in easy and correct identification of fish species (Begenal and Tesch, 1978; Jayaram, 1999). So this tool is prerequisite for assessing the relative wellbeing of the fish population. Being an useful and important fishery management tool it is used in assessing the relative wellbeing of a fish population Beyer, (1987); Goncalves *et al.* (1997) by giving information on the stock composition, life span, mortality, growth and production (Diaz *et al.,* 2000; Mendes *et al.,* 2004; Sinovcic *et al.,* 2004). It also determines the interrelation between the body parameters like length, weight, fecundity, helps in the understanding of the relation between body parts, used in the identification of the differences in fish population, so these parameters are considered as standard results of fish biology analysis. Present study is aimed at investigating eco biological impact on length-weight relationship, condition factor of *Oreochromis niloticus* in Theroor wetland to provide useful information on the trophic relationship in aquatic ecosystems and biodiversity, understanding the autecology, production and ecological role of fish population for initiating necessary steps for remedial actions in case of frequent discharge of industrial and domestic wastes into the

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selected wetland that affects food productivity of fishes and alters the water quality, and to create a baseline of the conservation work for future generation.

2. MATERIALS AND METHODS

2.1 Fish sampling

Fish samples were collected using a number of fishing gears such as gill nets, traps, purse seine, cast nets and hooks were procured fisherman in Theroor wetland period of one year. Captured fish were immediately, identified with reference to the description (Reed *et al.*, 1967; Holden and Reed,1972) and the fish species were put in sterile polythene bags and taken in icebox to the laboratory.

2.2 Morphometric data collection

Fishes were moped on a filter paper before they were weighed to remove excess water from their body in order to ensure accuracy (Anderson and Gutreuter, 1985). The total length (cm) and the body wet weight (g) of each of the fish samples were measured. Weight and length of each individual fish were measured by using a one-meter measuring board graduated in mm. The total lengths (cm) were measured as distance from the snout with mouth closed to the tip of the caudal fin.

2.3 Length-weight Relationship

This relationship was determined following Length-weight was expressed as W = aLb, the logarithm transformation of which gives the linear equation. Log W = a + b log L. Where W = Weight in (g), L = length in (cm), where as a = intercepts constant being the initial growth index, and b = growth coefficient. Constant 'a' represents the point at which the regression line intercepts the y-axis and 'b' the slope of the regression line. All measurements were taken on the left side of fish. Condition Factor The condition factor (K) which is defined as the wellbeing of the fish was calculated. K is a useful index for monitoring of feeding intensity, age, and growth rates. The K was determined by K=W.100/L3.Where W= weight of fish in grams. L= length of fish in centimeters.

2.4 Data analysis: Statistical calculations such as regression equation have been calculated after (Snedecor and Cochran, 1967)

3. RESULTS

3.1 Length-weight relationship of tilapia fish (*O.niloticus*)

Length-weight relationship of tilapia fish (*O.niloticus*) were estimated from Theroor wetland ecosystem during the study period. The average length-weight relationships were estimated from Mar 2015 to Feb 2016. The month wise average length was measured were the minimum size (9.5cm) during Mar, Apr and May respectively and weight (50.3g) during Mar was recorded respectively and maximum average length and weigh 35.5cm and 410.6g recorded the month of September 2015 respectively, the detailed report was showed in Table.1.

The range of length and weight was noted to varied based on the month and season, the study were divided into four seasons *viz*., summer, monsoon, post-monsoon and pre-monsoon. Average value of minimum length 9.50cm and weigh 55.15g was recorded during summer while maximum length 20.17cm and weight 112.73 g. During monsoon minimum average length 11.23 and maximum length 26.93 cm and minimum and maximum weight 64.93g and 249.45g respectively. In post-monsoon the minimum and maximum value of average length 10.60 to 33.77 cm and weight 60.41 to 383.47 gram were recorded respectively. During the pre-monsoon season the minimum length and weight 14.30 cm and 78.60g and maximum length and weight 78.60cm and 257.50 gram were recorded respectively and the results were expressed in Figure 1&2.

3.2 Linear equation with length-weight relationship of tilapia fish (*O.niloticus*):

The average value of linear regression (R^2) was recorded during the study period and presented in Table. 2. The maximum regression (R^2 = 0.849) was indicated in the month of December 2015 and minimum regression (R^2 = 0.264) were indicated during the month of April 2015. Among the four seasons the R^2 values were noted vary according to the change of length weight relationship. In these R^2 values in summer (0.36733), monsoon (0.747), Post-monsoon (0.8163) and Pre-monsoon (0.66) were recorded respectively result was showed in Figure. 3.

Table. 1 Length-weight relationship of *O. niloticus*

Months	Total Numbers	Minimum Length (cm)	Maximum Length (cm)	Minimum Weight (g)	Maximum Weight (g)
Mar'15	15	9.5	17.5	50.3	110.6
April	15	9.5	21.5	57.23	112.3
May	15	9.5	21.5	57.92	115.3
June	15	11.4	24.7	71.3	235.03
July	15	11.4	25.7	58.25	138.41
August	15	10.9	30.4	65.23	374.9
September	15	9.8	35.5	58.5	410.6
October	15	10.9	32.4	65.23	364.9
November	15	11.1	33.4	57.5	374.9
December	15	17.2	23	87.5	225
January'16	15	11.4	24	69.7	290
February	15	14	24.3	57.25	213

Table. 2 Linear equation with length-weight relationship of *O. niloticus*

Months	Regression equations	Regression (R^2)
Mar,15	Log W=0.198+0.798LogTL	0.560
Apr	Log W=1.337+0.449LogTL	0.264
May	Log W=1.352+0.442LogTL	0.278
June	Log W=0.148+1.542LogTL	0.776
July	Log W=0.292+1.336LogTL	0.712
Aug	Log W=-0.353+1.871LogTL	0.753
Sep	Log W=0.111+1.541LogTL	0.807
Oct	Log W=-0.277+1.870LogTL	0.787
Nov	Log W=-0.367+1.932LogTL	0.855
Dec	Log W=1.490+2.811LogTL	0.849
Jan'16	Log W=-0.412+1.974LogTL	0.741
Feb	Log W=-0.847+2.294LogTL	0.390

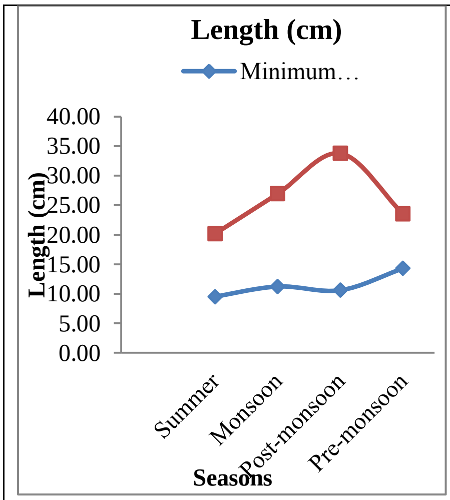

Fig. 1. Average length (cm) of *O. niloticus*

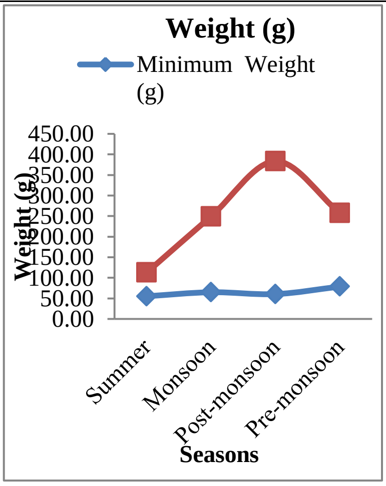

Fig. 2 Average weight (g) of *O. niloticus*

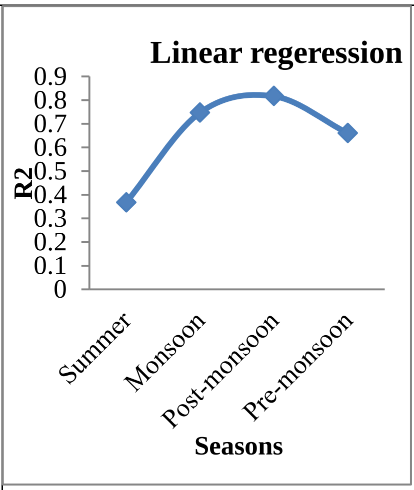

Fig. 3 Season difference with the regression value of *O. niloticus*

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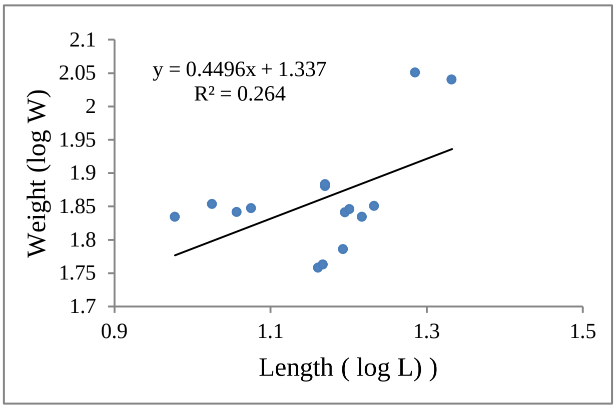

Fig. 4 Linear value of *O. niloticus* in Mar 2015

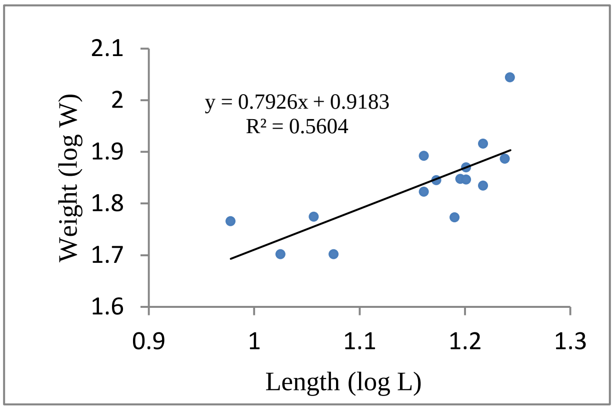

Fig. 5 Linear value of *O. niloticus* in Apr 2015

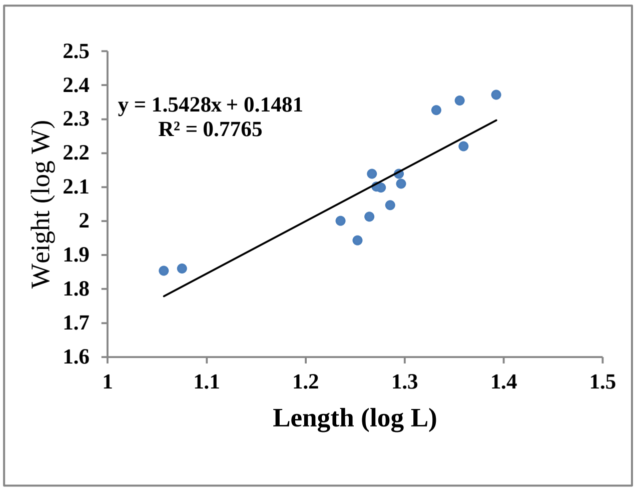

Fig 6. Linear value of *O. niloticus* in May 2015

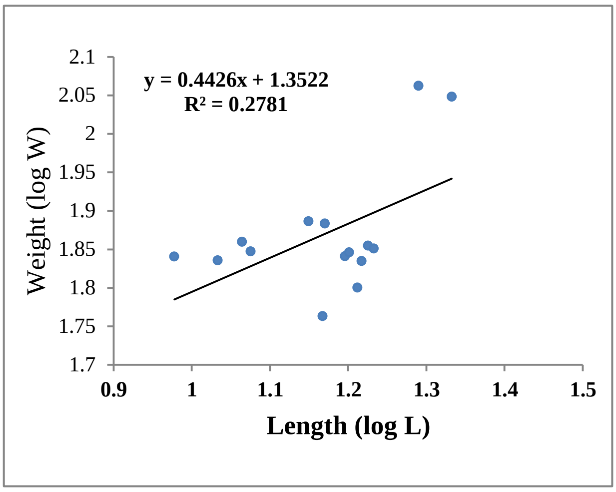

Fig 7. Linear value of *O. niloticus* in June 2015

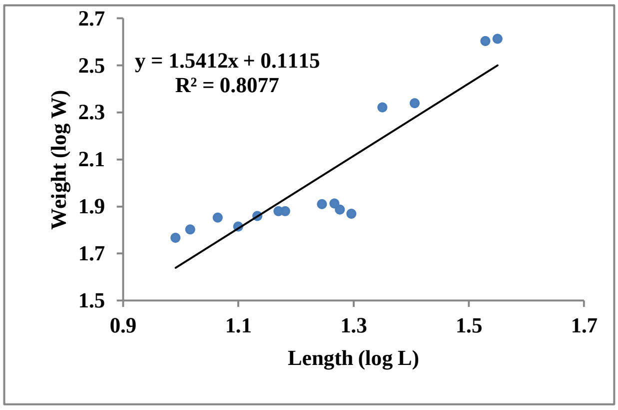

Fig. 8 Linear value of O. niloticus in July 2015

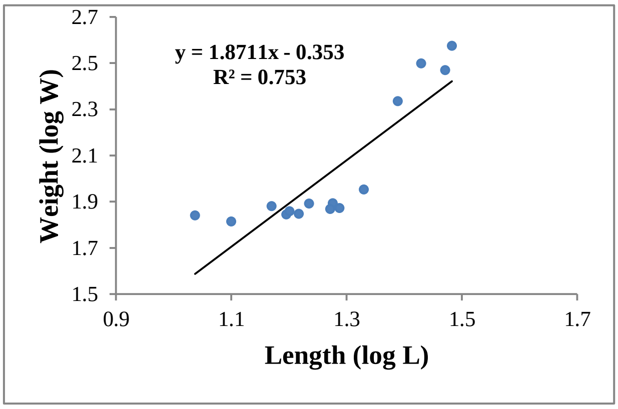

Fig .9 Linear value of *O. niloticus* in Aug 2015

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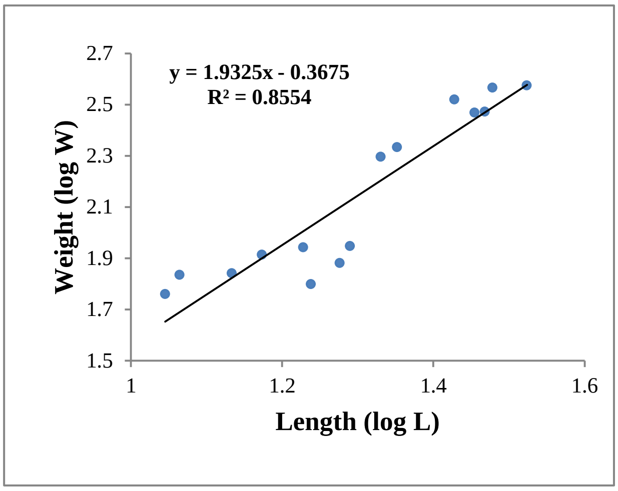

Fig. 10 Linear value of *O.niloticus* in Sep 2015

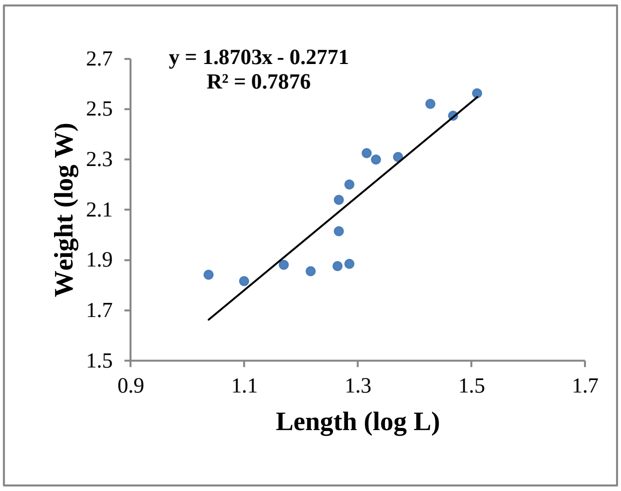

Fig. 11 Linear value of *O. niloticus* in Oct 2015

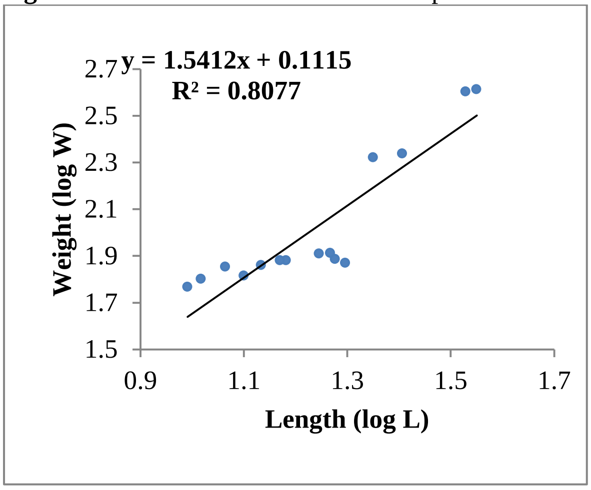

Fig. 12 Linear value of *O. niloticus* in Nov 2015

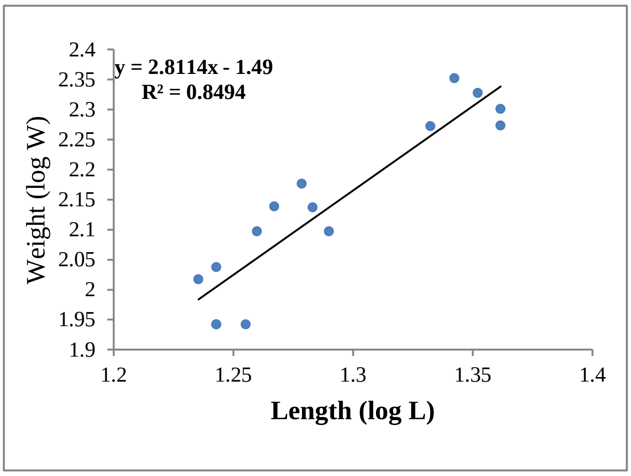

Fig. 13 Linear value of *O. niloticus* in Dec 2015

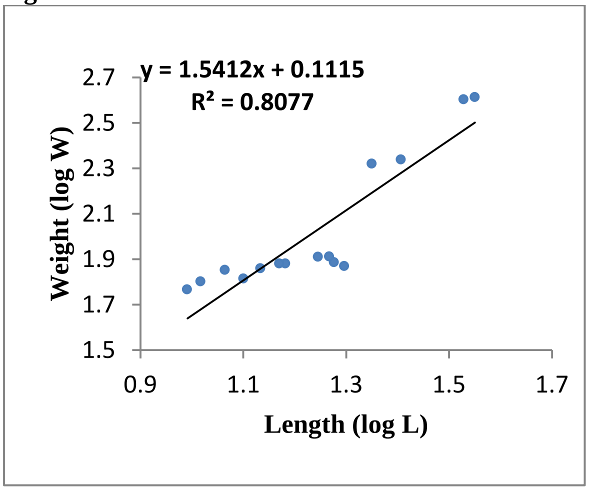

Fig. 14 Linear value of *O. niloticus* in Jan 2016

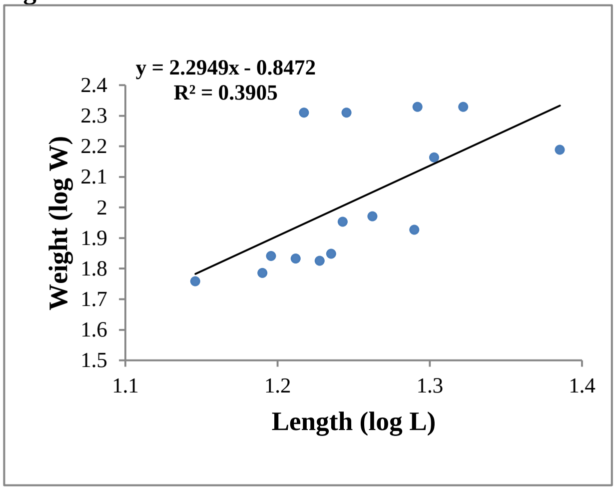

Fig. 15 Linear value of *O. niloticus* in Feb 2016

In the present study, the correlation coefficient showed that the regression values were significant ($P<0.05$) which indicated a significant relation between length and weight. The length-weight relationship of *O. niloticus* was found to be higher in the month of November, followed by December, September, October, June, January, March, February, May, April with regression (R^2) value of 0.855, 0.849, 0.807, 0.787, 0.776, 0.741, 0.560, 0.390, 0.278 and 0.264 respectively.

4. DISCUSSION

India having wide spread of inland water bodies has vast potential for the development of commercial inland fisheries. Nowadays fish production plays a significant role in the human economy due to its economic importance and abundance. Recently the importance of fish in the economy and ecology of wetland waters has generated sustained interest more precisely in recent years with a considerable interest in tilapia species popularly known as ‘aquatic chicken’ (Fitzsimmons, 2005) due to the importance of these fish as a cheap source of animal protein. In the field of aquaculture for best production and management of any fish species basic knowledge of quantitative aspects such as length-weight relationship, condition factor, growth, recruitment, food and feeding and mortality of fishes are important tools for studying fishing biology are necessary. And also factors such as diet composition (Moraes *et al.*, 2009), stocking density (Araujo et al., 2010), and chemical and physical parameters of the water which may affect the fish growth (Lizama *et al.*, 2002) is also necessary to be understood because all these provide good outcome and production. Among the basic management tools, the most primary tool that provides information on growth patterns and growth of animals is the LWR tool (Ighwela *et al.*, 2011), which helps in predicting weight from length required in yield assessment and in the calculating biomass.

During the present study in Theroor wetland the most abundantly caught fish in each catch of commercial importance is *Oreochromis nillotcus* which was selected as the study species for length-weight relationship. On examination, the experimental fish on monthly and seasonal basis maximum length (35.5cm) of *Oreochromis nilotcus* was noticed in month of September in post- monsoon and minimum length (9.5cm) was observed during summer season (March-May).The maximum weight (410.6 g) recorded was during September in post monsoon and minimum weight (50.3g) during March in summer season. According to statement of Ahmed *et al.* (2011) the relationship of length-weight can be used in the estimation of condition factor (K) of fish species in order to compare the condition, fatness or wellbeing of fish. During the post monsoon season both the length – weight of *Oreochromis nilotcus* was noted to exhibit positive allometric growth pattern. The weight of fish increased when they utilize the food items that are available for growth and energy (Offem *et al.*, 2007; Kamaruddin *et al.*, 2012). The following correlation coefficient (R^2) value that ranges between 0.264-0.855 at $P > 0.05$ indicated high degree of positive correlation between the standard lengths and body weights.

Poorly conditioned fishes are associated with negative allometric growth, which implies that the fish becomes more slender as it increases in weight while fishes with appropriate condition factor have isometric growth, which implies that the fish becomes relatively deeper-bodied as it increases in length. The condition factor of fish can be affected by a number of factors such as stress, sex, season, availability of feeds, and other water quality parameters (Khallaf *et al.*, 2003). However, the higher weight gains of fish in this study were because the fish were fed until apparent. Feed intake is a major factor for tilapia growth (Tran-Duy *et al.*, 2012), and in present study, fish preferred to be fed to apparent satiation because of the constant and high dissolved oxygen concentration during the studies. Breck, (2014) reviewed the close relationship of body size to body composition for many freshwater and marine fish species. Moreover as a useful tool in determining weight and biomass, for understanding the relationship between body weight and length, as well as developing prediction equations for body composition, provide important support for genetic improvement, fish management, feeding strategies, and marketing the next basic steps that has to be analyzed in fishery assessment was food and feeding.

Basically for any successful fish culture along with morphometric characteristics understanding of some biological fundamentals like food and feeding behavior is considered as key factor. However, from fisheries’ perspectives, ecological disturbance associated with biological invasions often results in negative alterations of food web dynamics. As a most known member of tropical and subtropical fresh water fish and FAO recommended species of aquaculture importance, as a rich protein contributing fish through advanced cultural techniques *Oreochromis nilotcus* is now globally popular.

Since feeding constitutes 50-70% of the any fish species being considered as an important tool for analysis present study. So in the present investigation being fish of commercial importance and regular fish on the table diet of Theroor village *O. nilotcus* is taken for gut content analysis with the view to determine the kind of natural food to be encouraged.

5. CONCLUSION

Based on the results of Length- weight relationship from this study the body composition of Nile tilapia varies according to its body weight and can be estimated using the length weight relationship. Prediction equations of body composition derived from linear regression analysis can be employed to address the requirements of specific consumer markets.

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