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**Research Article**

# Studies on Length –Weight Relationship of Selected Ornamental Freshwater Fish Collected from Kolathur, Tamil Nadu, India.

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**Abstract**

The aim of the present study was to ascertain the length and weight relationships of freshwater ornamental fish (135 nos.) which belongs to 7 different families; 18 genera and 25species. The correlation coefficient exhibited allometric (+,-) and isometric patterns in different types of fish species assessed in the present study. The fish were measured and calculated in correlation coefficient ($r^2$). This present study envisages the new arena of formulation of mathematical modelling using fish model.

**Keywords:** Length-weight, Freshwater Fish, correlation coefficient.

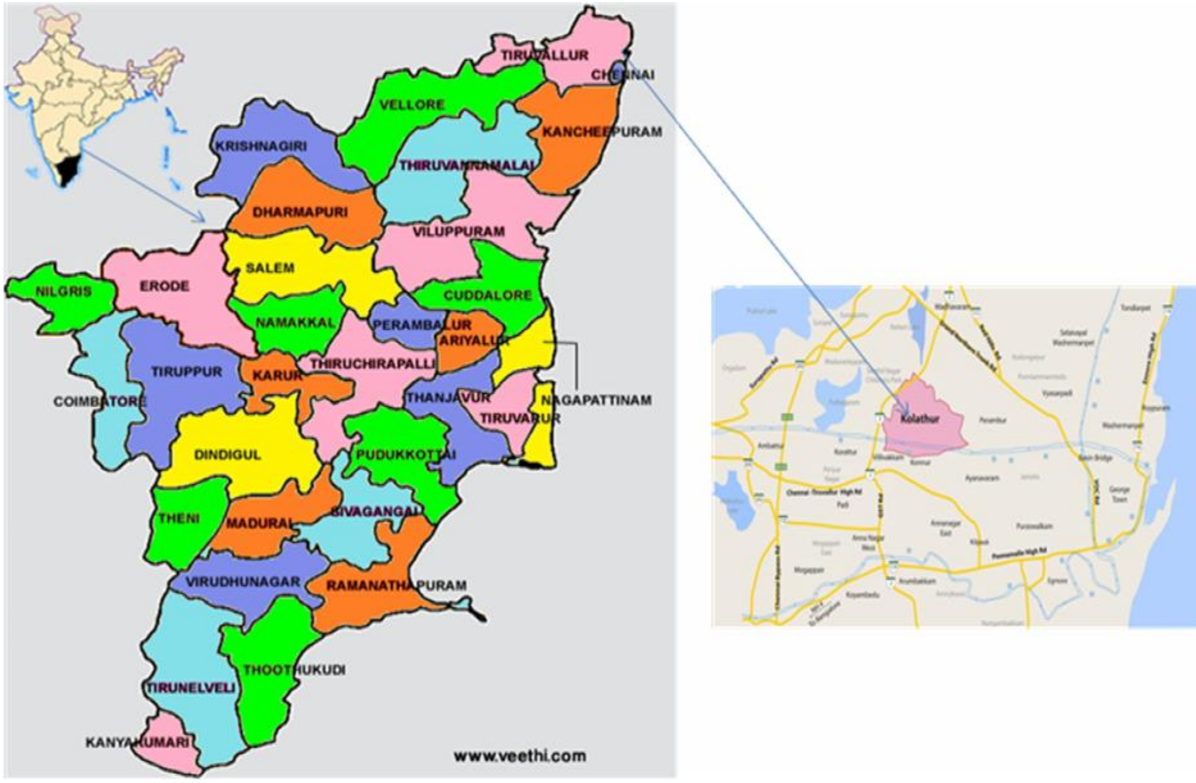
## 1. Introduction

Length-weight relationships are very useful for fisheries research because they: (a) allow the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models; (b) allow the estimation of biomass from length observations; (c) allow an estimate of the condition of the fish; and (d) are useful for between region comparisons of life histories of certain species (Goncalves et al., 1996, Froese and Pauly 1998, Moutopoulos and Stergiou 2000). They are an important component of Fish Base (Froese and Pauly 1998). Length and weight relationships are beneficial for a wide range of studies, including growth rate estimation, structure of age, and other aspects of fish population dynamics. It is used for length- weight regressions has been extensively applied to studies on the estimation of biomass from length observations required in yield assessment (Froese, 1998). Length-weight relationship (LWR) is of great importance in biological studies especially fisheries and other assessment studies (Goncalves et al., 1996; Sparre et al., 1989). The information of fisheries is scarce for the species represented in different regions (Govinda Rao et al., 2014). LWR measurements can give information include stock composition, life span, mortality, growth and production of resources (Bolger et al., 2007). Length and weight data analysis of a fish stock constitutes an important study since the growth of the fish is continuous and is dependent on both the genetic and environmental factors. Negative allometric growth relies upon the fihs becomes more slender as it increase in weight, while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increases in length (Riedel *et al*., 2007). Thus, condition factor is important in understanding the life cycle of fish species and it contributes to adequate management of these species, hence, maintaining the equilibrium in the ecosystem. In this present study deals with length –weight relationship of freshwater fishes as enlisted in Table 1.

## 2. Materials and Methods

### 2.1. Study Area

Live fish species were procured from Kolathur, Chennai, Tamil Nadu, India (Map 1).




**Map: 1. Study Area, Kolathur, Chennai**

The fish were transported to the laboratory in plastic buckets provided with a portable aerator, with an utmost care and an ambient environment was provided by acclimatizing the fish in the laboratory conditions.

## 2.2. Length – weight relationship

The analysis of length-weight data was aimed at describing mathematically the relationship between length and weight to enable conversion of one to another. It also measures the variation from the expected weight for length of individual fish. Calculations for males and females fish species was done separately and also combined using the conventional formula described by Le-Cren (1951) as follows:

$$W = alb \text{ ----------------------- } (1)$$

The above equation (1) and data were transformed in to logarithms before the calculations were made. Therefore equation (1) becomes:

$$\text{Log } W = \log a + b \log L \text{ ------------------ } (2)$$

Where,
W = weight of fish in grams
L = Total length of fish in centimeter, a = constant,
b = an exponent.

## 2.3. Condition factor (K)

The condition factors (K) were also calculated for individual fish species for each month using the conventional formulae described by Worthington and Richardo (1930) as:

$$K = \frac{W \times 100}{L^3} \text{ ----------------------------- } (3)$$

Where,
K = the condition factor,
W = weight of fish in grams,
L = Total length of fish in cm.

Le -Cren (1951) noted that condition is related to both sex sizes. Therefore, calculation was made for males and females separately and their statistical differences were obtained.

# 3. Results and Discussion

A systemic list of the species reported in this study was given Table: 1, it's also lists the species belong to the family, common name. The length-weight relationships of 27 species of fish representing 7 families were presented in this study. The family name, species name, length-weight parameters a and b, coefficient of determination ($r^2$), and standard deviation of slope (*b*) are given in Table: 2.

This species studied belong to seven families, the families with the highest species number were Calostoridae (n=5), Characidae (n=55), Cichlidae (n=10), Cyprinidae (n=20), Helostomatidae (n=5), Osphoronemidae (n=15), poecillidae (n=25). A total of 135 individuals were collected and samples length and weight average. Length –weight relationships were observed in allometric (+) n=3, allometric (-) n=21, isometric (n=3). Many workers have been reported both isometric and allometric growth for different type of fish species from various water bodies [King , 1996]. Park and Oh recorded the length-weight relationships of bivalves coastal water of Korea, the reported was isometric in most of the species (Park and Oh, 2002). However, the species of length-weight revealed that k is a condition factor (0.439943 – 3.7010690, a is a constant value (19683-862801.4). The condition factor or well-being of fish is crucial in fisheries biology (Weatherly & Gill 1987). This condition factor is also an index to understand the lifecycle of fish by referring to the coefficient values derived from the length-weight relationship data (Schneider *et al*. 2000). Additionally, this study offers a good description of length –weight data of some species and the length measurement used in comparison of weight, indicated by higher $r^2$ value. The correlation coefficient of length and weight relationships were obtained ($R^2$= 0.9636, 0.8385, 0.9939, 0.9823& 0.9636; Fig:2 to 5).

**Table 1: List of Fresh water fish collected from East Coast Road, Chennai.**

| S.No | Common Name | Family | Scientific Name |
|---|---|---|---|
| 1 | White Sucker | Catostomidae | *Catostomus commersonii* |
| 2 | Black Tetra | Characidae | *Gymnocorymbus temetzi* |
| 3 | Neon Tetra | Characidae | *Paracheirodon innesi* |
| 4 | Silver Tip Tetra | Characidae | *Hasemania nana* |
| 5 | Rummy nose Tetra | Characidae | *Hemigrammus bleheri* |
| 6 | Diamond Tetra | Characidae | *Moenkhausia pittieri* |
| 7 | Glow light letra | Characidae | *Hemigrammus erythrozonus* |
| 8 | Buenos Aires Tetra | Characidae | *Hemigrammus caudovittatus* |
| 9 | Blue columbian Tetra | Characidae | *Hyphessobrycon colimbianus* |
| 10 | Red Eye Tetra | Characidae | *Moenkhausia sanctae filomenae* |
| 11 | Gold fish | Cyprinidae | *Carassius auratus* |
| 12 | Black Widow fish | Characidae | *Gymnocorymbus ternetzi* |
| 13 | yellow prince | Cichlidae | *Labidochromis caeruleus* |
| 14 | Red zebra fish | Cichlidae | *Maylandia estherae* |
| 15 | Zebra danio | Cyprinidae | *Danro rerio* |
| 16 | Red tailed fin foil barb | Cyprinidae | *Barbonymus altus* |
| 17 | Tiger barb | Cyprinidae | *Puntius tetrazona* |
| 18 | Albino Tiger barb | Cyprinidae | *Puntus tetrazone* |
| 19 | Opaline gourami | Osphoronemidae | *Trichopodus trichopterus* |
| 20 | Gold gourami | Osphoronemidae | *Trichopodus trichopterus* |
| 21 | Fighter | Osphoronemidae | *Betta splenders* |
| 22 | Blue gourami | Osphoronemidae | *Trichogaster trichopterus* |
| 23 | Orange Sword tail | Poeciliidae | *Xiphophorus hellerii* |
| 24 | Golden soil fin Molly | Poeciliidae | *Poecilia latipinna* |
| 25 | Black Molly | Poecillidae | *Poecilia sphenops* |
| 26 | White Molly | Poecillidae | *Poecilia velifera* |
| 27 | Guppy | Poecilliidae | *Poecilia reticulate* |

**Table: 2. Length weight relationship and condition factor of Freshwater Fish**

| S.No | Length (cm) | Weight(g) | L(mm) | a | L | K | SD |
|---|---|---|---|---|---|---|---|
| 1 | 3.64 | 0.85 | 36.4 | 48228.54 | 85083.33 | 1.76417 | 1.972828 |
| 2 | 7.64 | 4.83 | 76.4 | 445943.7 | 483183.3 | 1.083507 | 1.350574 |
| 3 | 8.44 | 4.05 | 84.4 | 601211.6 | 405133.3 | 0.673861 | 2.213244 |
| 4 | 9.52 | 3.8 | 95.2 | 862801.4 | 379583.3 | 0.439943 | 2.093036 |
| 5 | 3.5 | 1.59 | 35 | 42875 | 158683.3 | 3.701069 | 0.509117 |
| 6 | 8.44 | 5.31 | 84.4 | 601211.6 | 531350 | 0.883799 | 1.053589 |
| 7 | 8.18 | 7.46 | 81.8 | 547343.4 | 746166.7 | 1.363251 | 2.227386 |
| 8 | 7.36 | 5.87 | 73.6 | 398688.3 | 586716.7 | 1.471618 | 3.104199 |
| 9 | 7.94 | 4.79 | 79.4 | 500566.2 | 478683.3 | 0.956284 | 1.371787 |
| 10 | 6.7 | 4.76 | 67 | 300763 | 476100 | 1.582974 | 4.193143 |
| 11 | 11.2 | 17.13 | 112 | 1404928 | 1712820 | 1.219151 | 2.65165 |
| 12 | 5.22 | 1.47 | 52.2 | 142236.6 | 146940 | 1.033067 | 2.97692 |
| 13 | 6.76 | 2.55 | 67.6 | 308915.8 | 254880 | 0.825079 | 1.598061 |
| 14 | 2.48 | 0.22 | 24.8 | 15252.99 | 22380 | 1.467253 | 1.513209 |
| 15 | 4.28 | 0.87 | 42.8 | 78402.75 | 86500 | 1.103278 | 1.774838 |
| 16 | 2.66 | 0.26 | 26.6 | 18821.1 | 26200 | 1.392055 | 1.704127 |
| 17 | 3.24 | 0.33 | 32.4 | 34012.22 | 33200 | 0.97612 | 1.697056 |
| 18 | 2.28 | 0.1 | 22.8 | 11852.35 | 9880 | 0.83359 | 1.98697 |
| 19 | 2.9 | 0.26 | 29 | 24389 | 26178 | 1.073353 | 2.199102 |
| 20 | 2.32 | 0.18 | 23.2 | 12487.17 | 17640 | 1.41265 | 1.866762 |
| 21 | 2.58 | 0.17 | 25.8 | 17173.51 | 16900 | 0.984074 | 2.057681 |
| 22 | 2.8 | 0.24 | 28 | 21952 | 24060 | 1.096028 | 2.411234 |
| 23 | 2.7 | 0.19 | 27 | 19683 | 19000 | 0.9653 | 4.044651 |
| 24 | 3.44 | 0.33 | 34.4 | 40707.58 | 33480 | 0.822451 | 1.541493 |
| 25 | 4.94 | 1.25 | 49.4 | 120553.8 | 124500 | 1.032734 | 1.810193 |
| 26 | 3.5 | 0.43 | 35 | 42875 | 42820 | 0.998717 | 2.609224 |
| 27 | 4.3 | 1.34 | 43 | 79507 | 133720 | 1.681864 | 2.170818 |

**a-Constant Value, L-Length, K- Condition Factor, SD-Standard Deviation**

**Table: 3. Length –Weight relationship and correlation coefficient of Freshwater fish**

| Family | SD | Growth Type |
|---|---|---|
| Calostoridae | 1.972828 | Allometric (-) |
| Cyprinidae | 1.350574 | Allometric (-) |
| Characidae | 2.213244 | Allometric (-) |
| Poeciliidae | 2.093036 | Allometric (-) |
| Osphronemidae and Helostomalidae | 0.509117 | Allometric(-) |
| Osphronemidae | 1.053589 | Allometric (-) |
| Helostomatidae | 2.227386 | Allometric (-) |
| Characidae | 3.104199 | Allometric (+) |
| Characidae | 1.371787 | Allometric (-) |
| Characidae | 4.193143 | Allometric (+) |
| Characidae | 2.65165 | Isometric |
| Characidae | 2.97692 | Isometric |
| Characidae | 1.598061 | Allometric (-) |
| Characidae | 1.513209 | Allometric (-) |
| Poecilliidae | 1.774838 | Allometric (-) |
| Cyprinidae | 1.704127 | Allometric (-) |
| Poecillidae | 1.697056 | Allometric (-) |
| Poecillidae | 1.98697 | Allometric (-) |
| Cyprinidae | 2.199102 | Allometric (-) |
| Characidae | 1.866762 | Allometric (-) |
| Characidae | 2.057681 | Allometric (-) |
| Poeciliidae | 2.411234 | Allometric (-) |
| Characidae | 4.044651 | Allometric (+) |
| Cyprinidae | 1.541493 | Allometric (-) |
| Cichlidae | 1.810193 | Allometric (-) |
| Cichlidae | 2.609224 | Isometric (+) |

**Fig: 1. Relationship between the length and weight Calostoridae to Helostomatidae**

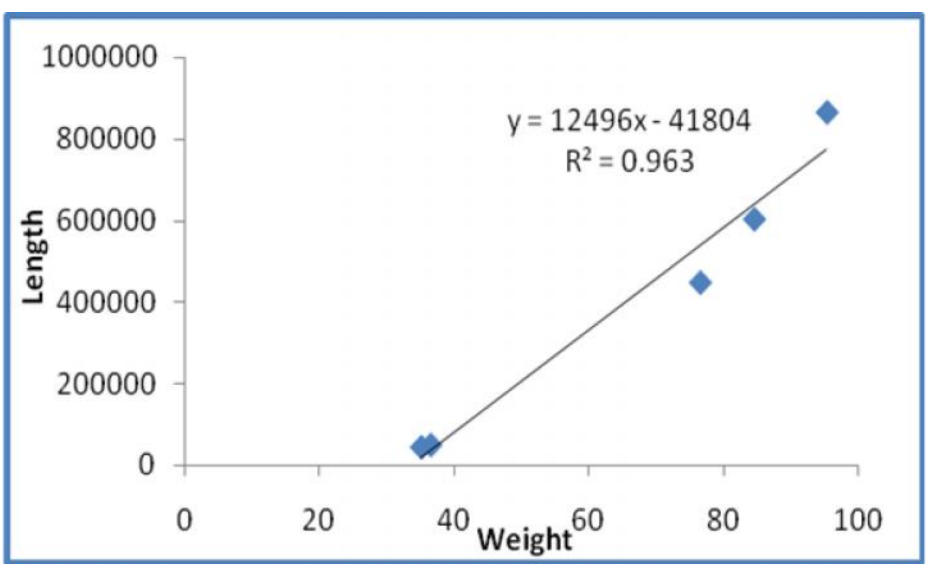


Fig: 2. Relationship between the length and weight of Characidae

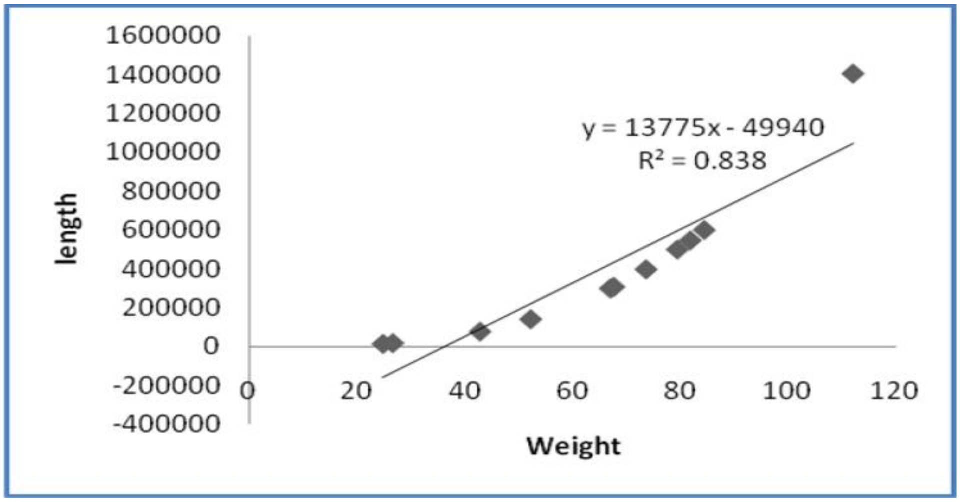



Fig: 3. Relationship between the length and weight of cyprinidae

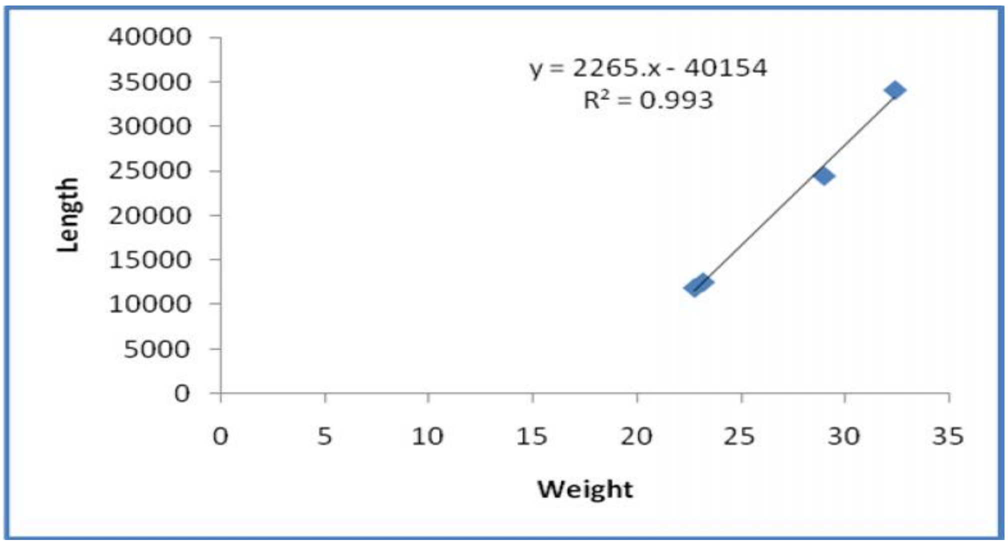



Fig: 4. Logarithmic relationship between the length and weight of Poecillidae

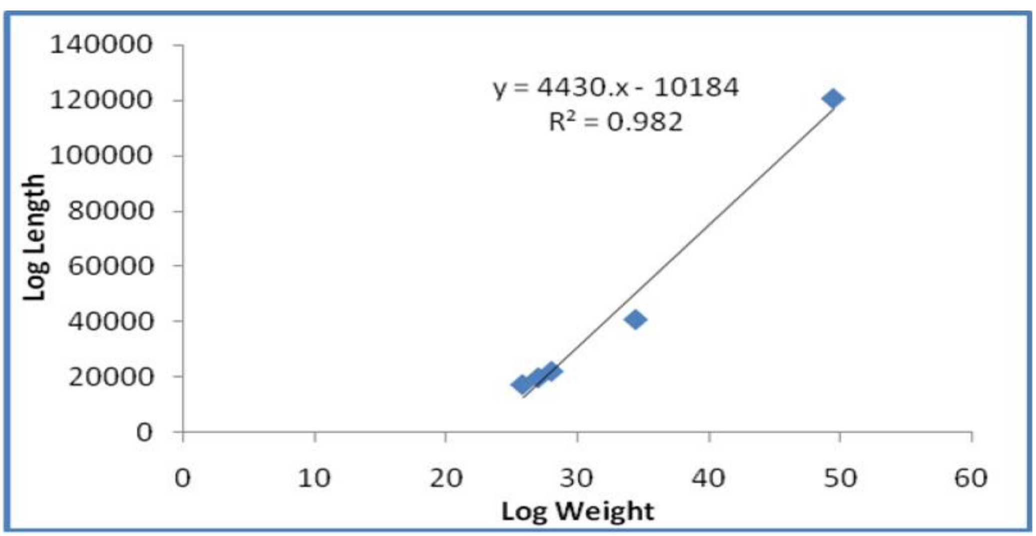


**Fig: 5. Relationship between the length and weight of Cichlidae**

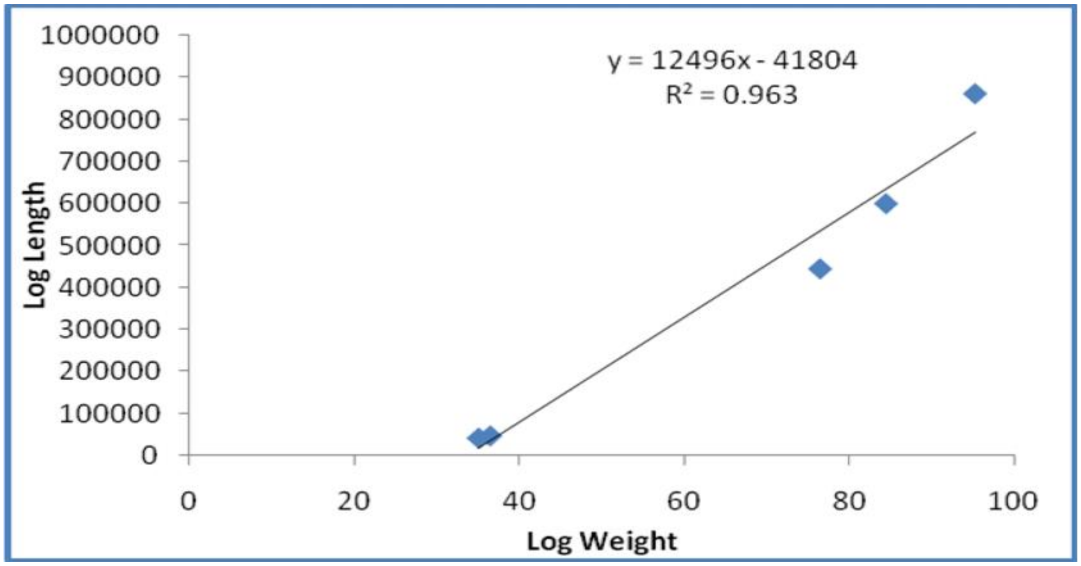
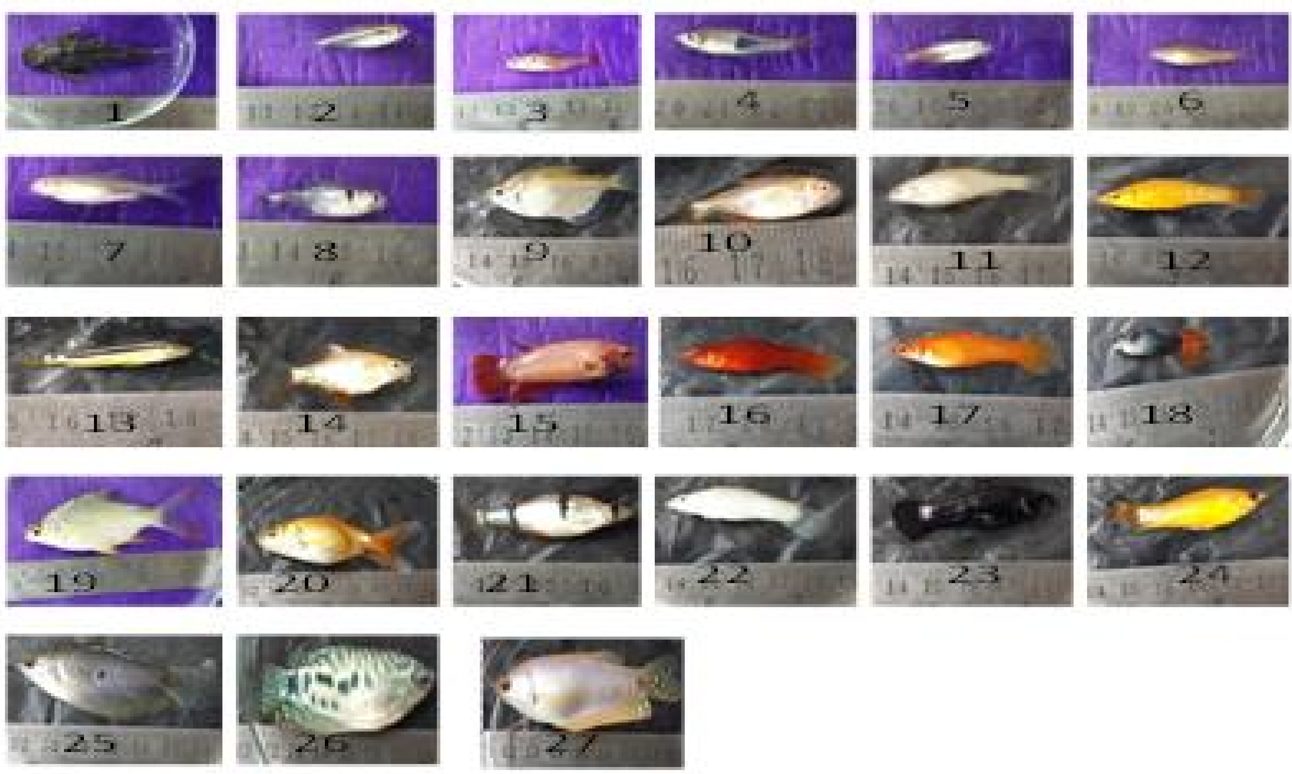



**Plate:1. Species selected for the present investigation**



1. *Catostomus commersonii*, 2. *Gymnocorymbus temetzi*, 3. *Paracheirodon innesi*, 4. *Hemigrammus caudovittatus*, 5. *Moenkhausia sanctae filomenae*, 6. *Hyphessobrycon colimbianus*, 7. *Hasemania nana*, 8. *Hemigrammus bleheri*,9. *Gymnocorymbus ternetzi*, 10. *Hemigrammus erythrozonus*, 11. *Moenkhausia pittieri*, 12. *Lasidochromis caeruleus*, 13. *Danro rerio*, 14. *Puntius tetrazona*, 15. *Betta splenders*, 16. *Xiphophorus hellerii*, 17. *Poecilia reticulate*, 18. *Hyphessobrycon colimbianus*, 19. *Barbonymus altus*, 20.*Caraacius auratus*, 21. *Puntius tetrazona*, 22. *Poecilia velifera*, 23. *Poecilia sphenops*, 24. *Poecilia latipinna*, 25, 26 &27. *Trichogaster trichopterus*

## 4. Conclusion

This study gained in the survey can enable fish biologist to derive length and weight parameters were measured. The length-weight parameters were obtained in survival of fresh water fish may be considered use in the fisheries people (Commercial application).

## Acknowledgments

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