**Length Weight Relationship of Five Dominant Fishes of Karingali Wetland of Central Kerala.**

**ABSTRACT**

The relationship between length and weight, as well as regression analysis and ANOVA, of five prevalent and edible fish species were meticulously analyzed from June 2020 to May 2022 within the Karingali wetland located in the Alappuzha and Pathanamthitta districts. The species studied include *Etroplus suratensis*, *Channa striata*, *Wallago attu*, *Anabas testudineus*, and *Heteropneustes fossilis,* all of which exhibit b values that are less than 3, indicating a characteristic of negative allometric growth in these fish species. The growth patterns of these fish are influenced by a multitude of factors, including angling pressure, environmental conditions, physicochemical parameters, the age of the fish, and pollution, among others. This investigation serves as the inaugural reference regarding the length-weight relationship pertinent to this specific wetland.

*Keywords: Allometric Growth, Wetland, Length, Weight, Fishes, Regression ,Anova*

**INTRODUCTION**

Freshwater ecosystems are distinguished from other ecosystems because of the possible effects of human activity, giving them priority for research, protection, and effective management. According to (Chong et al. 2010), among the aquatic systems, freshwater fishes currently have the highest proportion of fish species that are vulnerable. Due to pressure from development and changes to fish habitat, the diversity and distribution of freshwater fishes  have been rapidly disrupted.

The biodiversity of freshwater ecosystems is imperiled by a variety of factors, predominantly those associated with climatic variations and anthropogenic influences, which encompass nutrient enrichment, alterations in hydrology, morphological modifications, thermal fluctuations, as well as a range of other toxic and chemical stressors (Reid et al., 2019; Albert et al., 2020; Birk et al., 2020). Due to their substantial contributions to material and energy flow, fish are essential to aquatic ecosystems (Yang et al.,2020).

Usually during development, an organism's size (length, weight) increases. Along with the fish's size, age, sexual development, the main elements that affect fish growth are the quantity of food obtainable, the total amount of fish using the exact same source of food, temperature, oxygen levels, and other factors related to the water's quality. Each species undergoes development throughout the  life in both its size and its length,  the connection among both of these has both practical and fundamental significance. The length-weight connection is a fundamental technique that produces reliable biological data and is crucial in  fisheries. The statistical connection between the two factors, length and weight, is defined as it aids in determining changes from the predicted weight for the groups with known lengths.

Basic knowledge, such as the parameters that link fish weight to length, is scarce despite its critical importance in fisheries biology research and fish population assessment. Aside from morphological comparisons between populations of the same species or between species, its most common applications include the significance of length-weight relationships (LWR) in the computation of the fish average weight at a given length class and the conversion of an equation of growth in weight. In fishery assessments, LWR is very important. Measurements of length and weight can provide details about the composition, growth, mortality, and lifespan of the stock. Fisheries scientists will find value in the study's findings.

This relationship has three functions: (a) identifying the kind of mathematical relationship between two variables, allowing the other to be computed if one is known; (b) estimating the relative condition to evaluate the overall health of the fish and growth type, i.e., isometric or allometric; and (c) assisting in the estimation of the potential yield per recruit in the study of fish population dynamics. A relationship like this for fish could exist if they grow in an isometric manner. Accordingly, research on the correlation between fish weight and length is a crucial component of fish biology.

When just one of these quantities is available, a formulation of this connection could be of academic significance only in as much as the formula could be utilised to determine a corresponding length or weight. It might also be useful for calculating the amount of fish that bodies of water yield. It might also be helpful in controlling the fisheries by keeping the fishing gear's mesh size at a suitable level, which would allow smaller fish to leave and keep commercial-sized fish in the system. Furthermore, the fluctuation in this connection provides a measure of condition because the LWR of fish fluctuates based on the habitat and state of life. The variance in this relationship offers a gauge of the fish's condition coefficient and the appropriateness of the environment. In addition to the aforementioned, fish LWR research has a wide range of applications, including defining growth patterns during developmental pathways and estimating fish production from water masses.

Knowing the length-weight relationships (LWRs) of the species under study is important in order to assess the overall biomass of various fish populations. LWR is crucial for evaluating fish stocks. Understanding the status of fish stocks is essential for effective management (Ovando et al., 2022). Age information when combined with length and weight parameters can provide facts about the stock's design,  maturation, life expectancy, death rates, development, and productivity. ( [Froese, 2006](https://www.frontiersin.org/articles/10.3389/fmars.2021.625422/full#B10), [Mehanna and Farouk, 2021](https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2022.921594/full#B63)). Fish size is an indicator of age, food, and other biological and ecological variables According to theory, size is a good indicator of maturity in fish because size increases continuously  and does not decrease with age. As a result, size variation has significant effects on several fields of fisheries research and population structure. Since individual weight estimation in the natural environment can be difficult, length-weight regression analyses are often used to predict weight from length ([Sinovcic et al., 2004](https://www.frontiersin.org/articles/10.3389/fmars.2021.625422/full" \l "B30)).

LWR of fish is typically used to calculate fish health, mass from length analysis, and the transformation from increase in length calculations to increases in weight. through the utilization of the Weight-Length Relationship (WLR), categorizations of fish length data can be converted into approximations of biomass within aquatic ecosystems as well as growth rates (Sanaye et al.,2017). It is also helpful for comparing the life records of species across areas.

Length-weight examination is a helpful technique for determining the average weight of fish captured from the samples of their lengths( Adaka et al.,2015). The formulation of length-weight relationships is deemed a fundamental and ongoing endeavor within the realm of fisheries research (Hossain et al., 2014, 2015). The length-weight relationships of ichthyological species represent critical metrics for the implementation of conservation strategies and the management of fisheries programs. Fish physiology and fisheries research rely on the length-weight relationship (LWR) of fishes for providing data on growth trends and the overall health of many different species of fish (Bagenal and Tesch, 1978). Due to the rate, persistence, and extent of anthropogenic impacts, the  research  and understanding of LWRs is crucial  for the  administration  and  safeguarding of fish  population in aquatic habitats, especially freshwaterecosystems (Lawson, 2011). These types of environments are the most likely to contain effectual pollutant materials (Francis, 2012).

This research endeavor seeks to establish comprehensive information regarding the length-weight relationship of the predominant fish species inhabiting the Karingali wetland.

**MATERIALS AND METHODS**

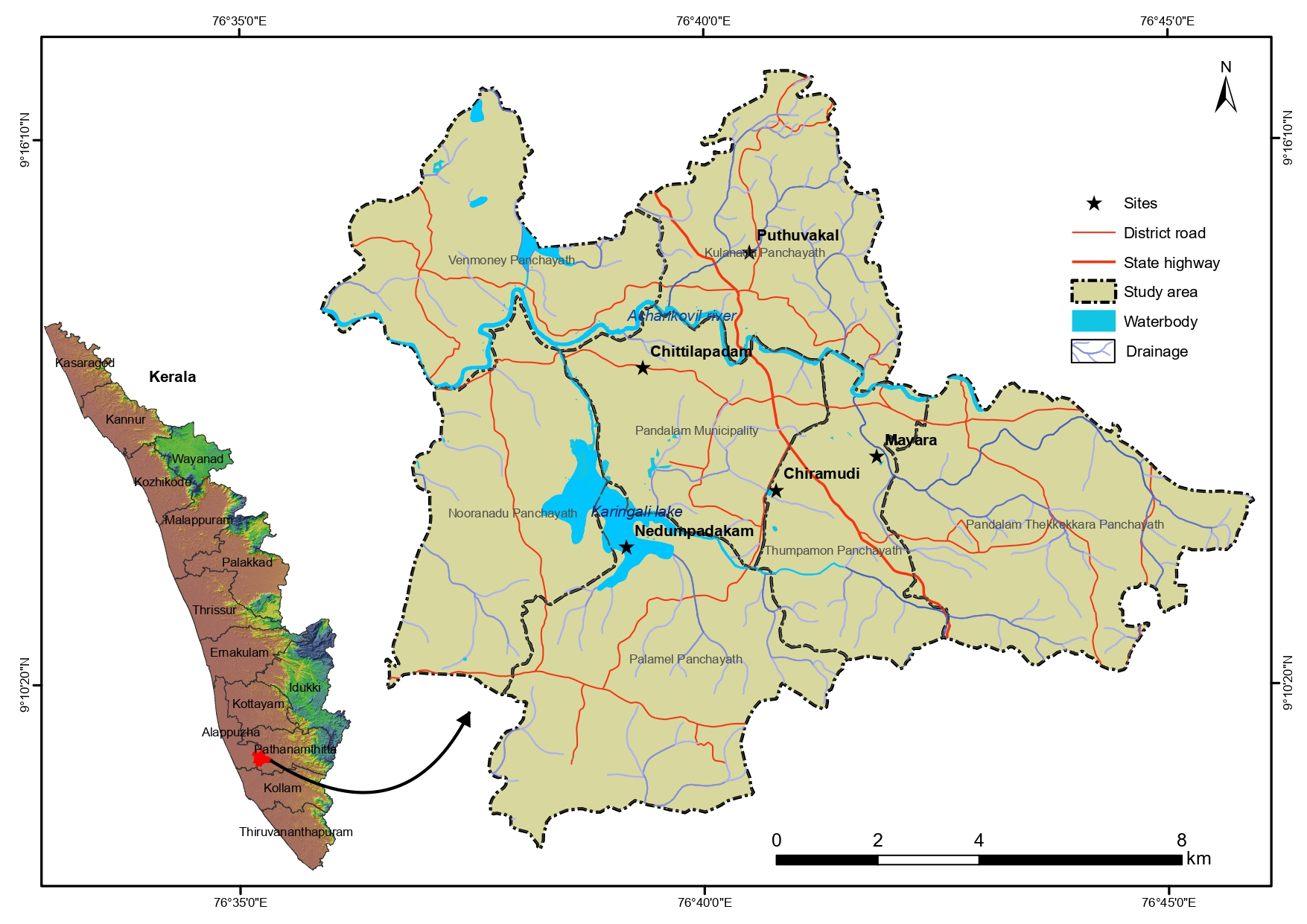
**STUDY AREA**

‘Karingali puncha’ is a collection of wetlands of Alappuzha and Pathanamthitta districts. It is one of the major wetland paddy fields of central Travancore and had been as the rice bank of Mavelikkara kingdom. The area falls under 4 panchayaths (Pandalam Thekkekkara‚ Nooranad‚ Palamel and Thumpamon) and Pandalam municipality. About 28 cultivating wetlands including Mavara‚ Karivellooor‚ Chiramudi‚ Puthuvakkal‚ Shasthampadi‚ Chittilappadam‚ Ampadakam‚ Noorukodi and Nedumpadakam‚ coming under two sections of the total land area: Mavera (near Pandalam) and Karingali (around the Karingali thodu‚ which is flowing through the centre of the wetland collection).

Irrigation and water cycling mechanism of Karingali puncha is centred by Karingali valiya thodu‚ flowing through the centre of wetland and its associated streams. The northern region of Padanilam bund of Karingali Padashekharam has a permanent stagnant water source‚ which act as the source of water during summer and other dry seasons. It is a major breeding ground and fishing point of Karingali wetland system. The rivulets and streams of padashekharam are emptying to River Achencovil. Within the Karingali area‚ about 130 acres of land is not being cultivated for the last 20 years. It is a part of Shanthi Theeram Eco- Tourism ( Santheeram Village Tourism Centre) .

Five sites comprised the study areas. S1 through S5 are Nedumpadakam (9°11.8001’N 76°39.1616’E), Mavara (9°12.7659’N 76°418584’E) , Puthuvakkal (9°14.9579’N 76°40.4856’E), Chittilapadam (9°14.9579’N 76°39.3365’E) and Chiramudi ( 9°12.4065’N 76°7708’E).The region of Nedumpadakam is bounded by deep waters. Mavara is a rocky agricultural region, Chittilappadam and Chiramudi are rice cultivation areas, and Puthuvakkal is a territory covered with many kinds of vegetation.

**Fig 1- The map of Karingali wetland with five sites**



**METHODOLOGY**

Five different varieties of edible fish have been measured and weighed for the analysis. Using a measuring scale, the total length (in cm) of each fish was calculated from the tip of the snout to the extended tip of the caudal fin. Using a weighing balance, bodyweight was calculated to the closest gramme.

The allometric formula W = a Lb (Le Cren, 1951), where W is the total weight of the body (g), L is the length in total (cm), and a and b are the coefficients of the functional regression between W and L (Beckman, 1948; Ricker, 1973), was used for calculating the LWRs.

The logarithmic-transformed values of the weight and length were used to estimate the values of the constants a and b:

log W = log a + b log L (Zar, 1984; Stergiou and Politou, 1995; Sivashanthini et al., 2009).

Since it can be challenging to dissect and identify the sex of specimens in many situations, the regression was carried out using Excel software, and all calculations were made for both sexes combined.

Fish with thicker bodies will typically have values of b that are larger than 3, whereas fish with thinner long bodies would typically have values of b that are less than 3. As a result, this can also aid to distinguish between isometric (b=3) and allometric somatic growth. ([Bagenal and Tesch, 1978](https://www.frontiersin.org/articles/10.3389/fmars.2021.625422/full" \l "B3).)

**RESULTS**

***Etroplus suratensis***

Throughout the course of the study, *Etroplus suratensis* species, which are also among the most edible fish found in wetland environments, were gathered from Karingali Wetland. Approximately 110 fish, ranging in length from 6.5-20.5 and weight from 52-290.10, were captured for the study (Table1). The regression statistics of this species gives the r square value 0.832672179, Multiple R 0.912508728 with standard error 0.528384794 the values were depicted in Table 2. The F value calculated for the fish is 248.8146 with significance 4.75979E-21. The values of slope was 2.493734496 and intercept -1.639393122 (Table-4).

**Table 1- Length and weight range of *Etroplus suratensis***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family** | **Species** | **No:of observations** | **Length range(cm)** | **Weight range (gm)** |
| Cichlidae | *Etroplus suratensis* | 110 | 6.5-20.5 | 52 -300.5 |

**Table 2- Regression Statistics of *Etroplus suratensis* from Karingali wetland**

|  |  |
| --- | --- |
| Multiple R | 0.912508728 |
| R Square | 0.832672179 |
| Adjusted R Square | 0.829325623 |
| Standard Error | 0.528384794 |
| Observations | 110 |

**Table 3- Anova table showing significance of** ***Etroplus suratensis* from Karingali wetland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *df* | *SS* | *MS* | *F* | *Significance F* |
| Regression | 1 | 69.46667702 | 69.46668 | 248.8146 | 4.75979E-21 |
| Residual | 109 | 13.95952451 | 0.27919 |  |  |
| Total | 110 | 83.42620153 |  |  |  |

**Table 4- Length- weight regression coefficients of** ***Etroplus suratensis* from Karingali wetland**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** |
| Intercept\* | -1.639393122 | 0.40652693 | -4.03268 | 0.000188 | -2.455926493 | -0.8228598 |
| Slope \*\* | 2.493734496 | 0.158092862 | 15.77386 | 4.76E-21 | 2.176195638 | 2.81127335 |

\*Values of log ‘a’, \*\* value of constant b

***Channa striata***

Throughout the investigation, the most common and edible fish in the Karingali wetland were discovered to be the *Channa striata* species. For the investigation, about 110 fish with lengths ranging from 15.2-26.5 cm and weights ranging from 150.8-386.95 kg were caught (Table 5).  
This species' regression statistics yield r square of 0.705214, multiple R of 0.83977, and standard error of 0.528384794.Table 6 presented the values. The fish's computed F value is 119.6145, with a significance level of 7.25E-15.The intercept was 0.214022, and the slope was 2.666034 (Table 8).

**Table 5- Length and weight range of *Channa striata***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family** | **Species** | **No:of observations** | **Length range(cm)** | **Weight range (gm)** |
| Channidae | *Channa striata* | 110 | 15.2-26.5 | 150.8-386.95 |

**Table 6- Regression statistics *Channa striata* from Karingali wetland**

|  |  |
| --- | --- |
| Multiple R | 0.83977 |
| R Square | 0.705214 |
| Adjusted R Square | 0.699318 |
| Standard Error | 0.054972 |
| Observations | 110 |

**Table 7- Anova table showing significance of *Channa striata* from Karingali wetland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***df*** | ***SS*** | ***MS*** | ***F*** | ***Significance F*** |
| Regression | 1 | 0.361464 | 0.361464 | 119.6145 | 7.25E-15 |
| Residual | 109 | 0.151095 | 0.003022 |  |  |
| Total | 110 | 0.512559 |  |  |  |

**Table 8- Length- weight regression coefficients of channa striata from karingali wetland**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** |
| Intercept\* | 0.214022 | 0.192677 | 1.11078 | 0.271976 | -0.17298 | 0.601026 |
| Slope\*\* | 2.666034 | 0.152332 | 10.93684 | 7.25E-15 | 1.360066 | 1.972002 |

\*Values of log ‘a’, \*\* value of constant b

***Anabas testudineus***

The *Anabas testudineus* species was found to be the most prevalent and edible fish in the Karingali wetland during the course of the research. About 110 fish with lengths ranging from 14.5-18.5 cm and weights ranging from 190.58-282.62 g were caught for the study (Table 9). Regression statistics for this species produce a standard error of 0.528384794, multiple R of 0.73379411, and r square of 0.538453796. The values were shown in Table 10.With a significance level of 1.74768E-18, the fish's computed F value is 116.6630319. The slope was 2.792590436 and the intercept was 0.148251274 (Table 12).

**Table 9- Length and weight range of *Anabas testudineus***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family** | **Species** | **No:of observations** | **Length range(cm)** | **Weight range (gm)** |
| Anabantidae | *Anabas testudineus* | 110 | 14.5-  18.5 | 190.58-  282.62 |

**Table 10- Regression statistics of *Anabas testudineus* from Karingali wetland**

|  |  |
| --- | --- |
| Multiple R | 0.73379411 |
| R Square | 0.538453796 |
| Adjusted R Square | 0.533838334 |
| Standard Error | 0.041077962 |
| Observations | 110 |

**Table 11- Anova table showing significance of *Anabas testudineus* from Karingali wetland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***df*** | ***SS*** | ***MS*** | ***F*** | ***Significance F*** |
| Regression | 1 | 0.196857075 | 0.196857075 | 116.6630319 | 1.74768E-18 |
| Residual | 109 | 0.168739893 | 0.001687399 |  |  |
| Total | 110 | 0.365596967 |  |  |  |

**Table 12- Length- weight regression coefficients of *Anabas testudineus* from Karingali wetland**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** |
| Intercept\* | 0.148251274 | 0.201579618 | 0.735447736 | 0.463788295 | -0.25167695 | 0.548179495 |
| Slope\*\* | 2.792590436 | 0.165964211 | 10.80106624 | 1.74768E-18 | 1.463322168 | 2.121858703 |

\*Values of log ‘a’, \*\* value of constant b

***Heteropneustes fossilis***

During the research, it was discovered that the most common and edible fish in the Karingali wetland was the *Heteropneustes fossilis* species. For the investigation, about 110 fish weighing between 190 and 300 g and measuring between 14.5 and 19 cm in length were caught.(Table 13) For this species, regression statistics yield a r square of 0.528384794, a multiple R of 0.830715, and a standard error of 0.036873. The numbers were displayed in Table 15.The fish's computed F value, is 120.2423.12 at a significance level of 2.37E-15, 2.352794 was the slope, while -0.52652 was the intercept.(Table 16).

**Table 13- Length and weight range of *Heteropneustes fossilis***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family** | **Species** | **No:of observations** | **Length range(cm)** | **Weight range (gm)** |
| Heteropneustidae | *Heteropneustes fossilis* | 110 | 14.5-19 | 190-300 |

**Table 14- Regression statistics of *Heteropneustes fossilis***

|  |  |
| --- | --- |
| Multiple R | 0.830715 |
| R Square | 0.690087 |
| Adjusted R Square | 0.684348 |
| Standard Error | 0.036873 |
| Observations | 110 |

**Table 15- Anova table of *Heteropneustes fossilis* from Karingali wetland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***df*** | ***SS*** | ***MS*** | ***F*** | ***Significance F*** |
| Regression | 1 | 0.163486 | 0.163486 | 120.2423 | 2.37E-15 |
| Residual | 109 | 0.07342 | 0.00136 |  |  |
| Total | 110 | 0.236906 |  |  |  |

**Table 16- Length- weight regression coefficients *Heteropneustes fossilis***

**from Karingali wetland**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** |
| Intercept\*\* | -0.52652 | 0.261953 | -2.00998 | 0.049441 | -1.0517 | -0.00134 |
| Slope\* | 2.352794 | 0.214563 | 10.9655 | 2.37E-15 | 1.92262 | 2.782967 |

\*Values of log ‘a’, \*\* value of constant b

***Wallago attu***

The one of the edible fish in the Karingali wetland was *Wallago attu* species. For the investigation, about 110 fish weighing between 100 and 2500 g and measuring between 31-51.2 in length were caught.(Table 17) .For this species, regression statistics yield a r square of 0.065786, a multiple R of 0.256488, and a standard error of 0.306441. The numbers were displayed in Table 18.The fish's computed F value, is 4.295529 at a significance level of 0.042446. 2.435393 was the slope, while 0.848113 was the intercept.(Table 20).

**Table 17- Length and weight range of *Wallago attu***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family** | **Species** | **No:of observations** | **Length range(cm)** | **Weight range (gm)** |
| Siluridae | *Wallago attu* | 110 | 31-51.2 | 100-2500 |

**Table 18 -Regression statistics of *Wallago attu***

|  |  |
| --- | --- |
| Multiple R | 0.256488 |
| R Square | 0.065786 |
| Adjusted R Square | 0.050471 |
| Standard Error | 0.306441 |
| Observations | 110 |

**Table 19- Anova table of *Wallago attu* from Karingali wetland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *df* | *SS* | *MS* | *F* | *Significance F* |
| Regression | 1 | 0.403377 | 0.403377 | 4.295529 | 0.042446 |
| Residual | 109 | 5.728275 | 0.093906 |  |  |
| Total | 110 | 6.131651 |  |  |  |

**Table 20- Length- weight regression coefficients of *wallago attu* from karingali wetland**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coefficients** | **Standard Error** | **t Stat** | **P-value** | **Lower 95%** | **Upper 95%** |
| Intercept\* | 0.848113 | 0.409209 | 2.072566 | 0.042446 | 0.029849 | 1.666378 |
| Slope \*\* | 2.435393 | 0.634865 | 2.260943 | 0.027341 | 0.165902 | 2.704883 |

\*Values of log ‘a’, \*\* value of constant b

**DISCUSSION**

The coefficient of determination (r square value) in the regression for fish length and weight indicates the proportion of the variance in fish weight that can be explained by fish length. It displays how well the regression model fits the data and how much the length explains the variation in the weight. A larger r square value indicates a stronger correlation between weight and length, suggesting that length is a good predictor of weight. Conversely, a lower r square value suggests that length may not be a reliable predictor of weight on its own. A regression model with a r square value of 1, which may fluctuate, indicates that the data are perfectly fitted by the equation., which might vary from 0 to 1.

The five dominant and edible fishes are used in this study to examine the association between length and weight. As previously indicated, all five species' a and b values were examined, and each one revealed a and b value that was either close to or less than 3.It indicates an extended body type for the fish species. In length-weight relationships, b values less than three denote negative allometric growth. This indicates that the organism's weight increases more slowly than its length. Put another way, the organism's weight does not rise in direct proportion to its length. The findings exhibit a resemblance to the antecedent research, the *Anabas testudineus* exhibits a value of b < 3 within the Kuttanadu wetland ecosystem located in Kerala ( Kumary, & Raj, S. 2016). *Channa striata*, *Heteropneustes fossilis*, and *Etroplus* *suratensis* exhibited comparable results from the Chalakudy River, which is situated within the biodiversity hotspot of the Western Ghats in India, as documented by Renjithkumar et al. (2021); correspondingly, the *Channa* species obtained from the riverine segments of Lake Vembanad in Kerala reveals similar outcomes that are consistent with the present investigation (Ali et al., 2013*).*Nevertheless, Sani et al. (2010) noted that the b-value was significantly < 3.0 for *W. attu* populations inhabiting the Gomti tributary of the Ganga River. Furthermore, Goswami and Devraj (1992),Rufus *et al.,(*2015) also documented a b-value < 3.0. The b coefficients associated with the length-weight relationships of the chosen ichthyological species demonstrated significant deviations from the isometric value (Froese, 2006). The regression coefficients were markedly dissimilar (p < 0.05), with r² values exhibiting considerable variability across different species. The growth coefficient (b) within an individual species may fluctuate, contingent upon factors such as seasonal changes, food availability, population dynamics, sex, environmental conditions, or physiological aspects (Freitas et al., 2017). A high concentration of dissolved oxygen and effective water circulation are also critical factors (Asriyana et al., 2020). These elements are relevant to fish species, including those examined in the current study; thus, the exponent value b plays a pivotal role in determining the productivity of any given aquatic ecosystem (Asriyana et al., 2020). It is imperative to comprehend that the growth patterns exhibited by various fish species are intricately linked to the exponential values (b) associated with the length-weight relationships (LWR), which are subject to variation; Such variations are influenced by environmental factors, including seasonal temperature fluctuations and habitat accessibility (Olopade et al., 2019). In conjunction, a diminished 'b' value alongside an elevated r-squared signifies a relationship between length and weight that is consistent yet not proportional. This phenomenon may arise from alterations in body morphology as the fish matures, or it is possible that larger specimens exhibit a lower density compared to their smaller counterparts. The findings of the current investigation align with the perspectives of Khan et al. (2011), Myla et al. (2012), Kuldeep Kumar et al. (2013), and Preetha G Nair et al. (2015) that fish typically do not preserve a consistent morphology or body configuration throughout their lifespan, and the specific gravity of tissues may exhibit variability, indicating that the actual correlation may diverge considerably from the cube law.

Season, habitat, gonad maturity, sex, food, stomach fullness, preservation methods, health, and variations in the length ranges of the specimens taken are some of the variables that might impact the length-weight relationship in fish. The precise link between length and weight varies between fish species based on the hereditary body form of each fish, and within a species based on the robustness or state of each individual fish. Sometimes, condition indicates growth and food availability in the weeks before sampling. However, the state is fluid and changeable. The average condition of each population fluctuates seasonally and annually, and individual fish within the same sample can differ significantly.

In the current investigation, the majority of the fish species inhabiting the Karingali wetland exhibited a negative allometric growth pattern. This phenomenon may be attributed to angling pressure suboptimal environmental conditions, particularly pollution and the limited availability of food resources within the ecosystem. Furthermore, this study underscores the significance of understanding the length-weight relationship for the indigenous fish species of the Karingali wetland. Such information contributes to enhancing the biological comprehension of species distribution and the principles of sustainable fisheries management.

**CONCLUSION**

Karingali Wetland is found to support a remarkably rich fish diversity and serves as a possible source of income for the  local people. A total of 35 species from 28 genus of 18 families and 11 orders were reported from the Karingali wetland during the study period. The major orders were Cypriniformes, [Siluriformes](http://en.wikipedia.org/wiki/Catfish), Perciformes, Anabantiformes, [Cichliformes](http://en.wikipedia.org/wiki/Cichliformes), [Beloniformes](http://en.wikipedia.org/wiki/Beloniformes), Elopiformes Synbranchiformes, [Gobiiformes](https://www.google.co.in/search?sa=X&hl=en&biw=1536&bih=746&sxsrf=ALiCzsac0yzwer1aION-1UpiEDmBNhlUMw:1667144261501&q=Gobiiformes&stick=H4sIAAAAAAAAAONgVuLSz9U3ME7ONaoyWcTK7Z6flJmZll-Um1oMAHJ9NzIcAAAA&ved=2ahUKEwjqx_urpIj7AhUrS2wGHSdcADoQmxMoAXoECFMQAw), [Clupeiformes](https://www.google.com/search?hl=en&sxsrf=ALiCzsYszpyxd-GEdrkqV_RhWTf9oEPiHw:1667131405509&q=Clupeiformes&stick=H4sIAAAAAAAAAONgVuLQz9U3SDG0tFjEyuOcU1qQmpmWX5SbWgwA9YuXZxsAAAA&sa=X&ved=2ahUKEwjNk-C59If7AhVN4XMBHXt-ASkQmxMoAXoECG0QAw) and Mugiliformes. The percentage composition among various orders reveals that the order Cypriniformes were represented by 42%, [Siluriformes](http://en.wikipedia.org/wiki/Catfish) 15%, Perciformes 5%, Anabantiformes 12%, [Cichliformes](http://en.wikipedia.org/wiki/Cichliformes) 12%, [Beloniformes](http://en.wikipedia.org/wiki/Beloniformes) 5%, Elopiformes 1% Synbranchiformes 2%, [Gobiiformes](https://www.google.co.in/search?sa=X&hl=en&biw=1536&bih=746&sxsrf=ALiCzsac0yzwer1aION-1UpiEDmBNhlUMw:1667144261501&q=Gobiiformes&stick=H4sIAAAAAAAAAONgVuLSz9U3ME7ONaoyWcTK7Z6flJmZll-Um1oMAHJ9NzIcAAAA&ved=2ahUKEwjqx_urpIj7AhUrS2wGHSdcADoQmxMoAXoECFMQAw) 2%, Mugiliformes 3% and [Clupeiformes](https://www.google.com/search?hl=en&sxsrf=ALiCzsYszpyxd-GEdrkqV_RhWTf9oEPiHw:1667131405509&q=Clupeiformes&stick=H4sIAAAAAAAAAONgVuLQz9U3SDG0tFjEyuOcU1qQmpmWX5SbWgwA9YuXZxsAAAA&sa=X&ved=2ahUKEwjNk-C59If7AhVN4XMBHXt-ASkQmxMoAXoECG0QAw) 1%. The Cyprinidae family represent more number of individual species. The length weight of fishes shows negative alometric growth pattern and R square closes to 1 .This phenomenon may be attributable to alterations in the morphology of the fish as it matures, or it is conceivable that the more substantial specimens exhibit a lower degree of body mass relative to their length (thereby indicating negative allometry); furthermore, the r-squared value approaching unity substantiates that length serves as a valid predictor of weight within this context, as evidenced by empirical investigations into length-weight correlations. Even though Karingali wetland are not as much polluted but at the verge of contamination. Because of human activity, agricultural pesticides and fertilisers and in addition, excessive reclamation and contamination from other sources are causing wetlands to lose some of their original qualities. As a result of the loss of biodiversity, there will soon be a shortage of basic foods and water. To effectively safeguard our wetlands and maintain wildlife for future generations, it is crucial to be aware of the situation. The preservation of fish diversity is crucial for preserving the ecological, dietary, and economical balance.

**REFERENCES**

1. Albert, J. S., Destouni, G., Duke-Sylvester, S. M., Magurran, A. E., Oberdorff, T., Reis, R. E., & Ripple, W. J. (2021). Scientists’ warning to humanity on the freshwater biodiversity crisis. *Ambio*, *50*(1), 85-94.
2. Ali A., N. Dahanukar & R. Raghavan. (2013). Length-weight and length-length relationship of three species of snakehead fish, Channa diplogramma, C. marulius and C. striata from the riverine reaches of Lake Vembanad, Kerala, India. *Journal of Threatened Taxa* 5(13): 4769–4773; [http://dx.doi.org/10.11609/JoTT. o3353.4769-73](http://dx.doi.org/10.11609/JoTT.%20o3353.4769-73)
3. Asriyana, A., Irawati, N., & Halili, H. (2020). Length-weight relationships and ponderal index of three reef fish (Teleostei: Labridae) off the Tanjung Tiram coast, Southeast Sulawesi, Indonesia. *Biodiversitas,*21(4), 1279–1286
4. Bagenal T. B., and Tesch F. W. (1978) − Aspects of fish fecundity in ecology of freshwater fish production, in Methods for assessment of fish production in freshwater, 3rd edition, Oxford, Blackwell Scientific Publications, 75-101.
5. Bagenal, T. B., and Tesch, F. W. (1978). “Age and growth,” in Methods of assessment of fish production in fresh waters, ed. (Oxford: Oxford Blackwell Scientific Publication), 101–136.
6. Beckman, W. C. (1948). The length-weight relationship, factors for conversions between standard and total lengths, and coefficients of condition for seven Michigan fishes. *Transactions of the American Fisheries Society*, *75*(1),237-256.
7. Birk, S., Chapman, D., Carvalho, L., Spears, B. M., Andersen, H. E., Argillier, C., & Hering, D. (2020). Impacts of multiple stressors on freshwater biota across spatial scales and ecosystems. *Nature Ecology & Evolution*, *4*(8), 1060-1068.
8. Chong V. C., Lee P. K. Y., and Lau C. M. (2010) − Diversity, extinction risk and conservation of Malaysian fishes, *Journal of Fish Biology*, 76, 2009-2066.
9. Francis R. A. (2012) − A handbook of global freshwater invasive species, Oxon, Routledge, 456.
10. Freitas, Magalhaes, T., Batista, J., Souza, D., and Prudente, B. S. (2017). Length-weight relationship in ten fish species from the Nhamundá River, the Amazon Basin, Brazil. *Acta Amazonica*,47(1), 75–78
11. Froese, R. (2006). Cube law, condition factor and weight–length relationships: history, meta-analysis and recommendations*. Journal of Applied Ichthyology*,. 22, 241–253. doi: 10.1111/j.1439-0426.2006.00805.
12. Goswami, P.K., and Devaraj, M. (1992). Breeding, age and growth of the freshwater shark Wallago attu (Bloch and Schneider) from the Dhir Beel of the Brahmaputra basin, Assam, India. *Journal of the Indian Fisheries Association*, 22: 13–20.
13. Hossain, M. Y., Jahan, S., Jewel, M. A. S., Rahman, M. M., Khatun, M. M., & Jasmine, S. (2015). Biological aspects of the critically endangered fish, Labeo boga in the Ganges River, Northwestern Bangladesh. *Sains Malaysiana*, *44*(1), 31-40.
14. Hossain, M. Y., Mosaddequr Rahman, M., Ahamed, F., Ahmed, Z. F., & Ohtomi, J. (2014). Length‐weight and length‐length relationships and form factor of three threatened fishes from the Ganges River (NW Bangladesh). *Journal of Applied Ichthyology*, *30*(1), 221-224.
15. Khan, S., Khan, M. A., Miyan, K., & Mubark, M. (2011). Length weight relationships for nine freshwater teleosts collected from River Ganga, India*. International Journal of Zoological Research*, 7(6), 401-405.
16. Khan, S., Khan, M. A., Miyan, K., & Mubark, M. (2011). Length weight relationships for nine freshwater teleosts collected from River Ganga, India. *International Journal of Zoological Research,* 7(6), 401-405.
17. Kumary, K. S. A., & Raj, S. (2016). Length-weight relationship and condition of climbing perch Anabas testudineus Bloch population in Kuttanad, Kerala. *International journal of advanced research in biological sciences*, 3(9), 21-26.
18. Lawson, E. O. (2011). Length-weight relationships and fecundity estimates in mudskipper, Periophthalmus papilio (Bloch and Schneider 1801) caught from the mangrove swamps of Lagos Lagoon, Nigeria. *Journal of Fisheries and Aquatic Science*, *6*(3), 264.
19. Le Cren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). *The Journal of Animal Ecology*, 201-219.
20. Mehanna, S. F., & Farouk, A. E. (2021). Length-weight relationship of 60 fish species from the Eastern Mediterranean Sea, Egypt (GFCM-GSA 26). *Frontiers in Marine Science*, *8*, 625422.
21. Myla.,Chakravarty, M. S., Pavani, B., and Ganesh, P. R. C. (2012). Length-weight relationship of ribbon fishes: Trichiurus lepturus (Linnaeus, 1758) and Lepturacanthus savala (Cuvier, 1829) from Visakhapatnam coast. *Journal of the Marine Biological Association of India* , 54(2), 99-101.
22. Olopade, O. A., Dienye, H. E., & Oderhohwo, O. (2019). Fish species composition and size structure exploited by gill net fishery in The New Calabar River, Nigeria. *Acta Aquatica: Aquatic Sciences Journal*, 6(1), 1-6.
23. Ovando, D., Free, C.M., Jensen O.P., Hilborn, R. (2022). A history and evaluation of catch-only stock assessment models. Fish Fish 23: 616–630.
24. Periopthalmus papilio (Bloch and Schneider, (1801). caught form the mangrove swamps of Lagos Lagoon, Nigeria. *Journal of Fisheries and Aquatic Science*, 6, 264-271.
25. Preetha G. Nair., Joseph, S., and Pillai, V. N. (2015). Length-weight relationship and relative condition factor of Stolephorus commersonii (Lacepede, 1803) exploited along Kerala coast. *Journal of the Marine Biological Association of India*, 57(2), 27-31.
26. Reid, Andrea J., Andrew K. Carlson, Irena F. Creed, Erika J. Eliason, Peter A. Gell, Pieter TJ Johnson, Karen A. Kidd et al. (2019).Emerging threats and persistent conservation challenges for freshwater biodiversity. *Biological reviews, 94(3), 849-873.*
27. Renjithkumar CR, Roshni K, Ranjeet K (2021) .Length–weight relations of 14 fish species (Actinopterygii) from the Chalakudy River, Western Ghats, India. *Acta Ichthyologica et Piscatoria* 51(3): 263–265.
28. Ricker, W. E. (1973). Linear regressions in fishery research. *Journal of the fisheries board of Canada*, *30*(3), 409-434.
29. Rufus, T., Eldho, P. S., Anvar Ali, N. D., & Raghavan, R. (2015). Length-weight relationship and condition factor of a large predatory catfish, Wallago attu (Schneider, 1801) from the rivers of central Kerala, India*. Journal of Aquatic Biology & Fisheries*, 3(1), 105-110.
30. Sanaye, S. V., Rivonker, C. U., Sreepada, R. A., Ansari, Z. A., Murugan, A., & Ramkumar, B. (2017). Weight–length relationship and Fulton's condition factor of the alligator pipefish, Syngnathoides biaculeatus (Bloch, 1785) from the Southeast coast of India. *Current Science*, 1605-1609.
31. Sani, R., Gupta, B.K., Sarkar, U.K., Pandey, A., Dubey, V.K., and Lakra, W.S. (2010). Length–weight relationships of 14 Indian freshwater fish species from the Betwa (Yamuna River tributary) and Gomti (Ganga River tributary) rivers. *Journal of Applied Ichthyology*, 26 (3): 456–459.
32. Sinovčić, G., Franičević, M., Zorica, B., & Čikeš‐Keč, V. (2004). Length–weight and length–length relationships for 10 pelagic fish species from the Adriatic Sea (Croatia). *Journal of Applied Ichthyology*, *20*(2), 156-158.
33. Sivashanthini, K., Gayathri, G., and Gajapathy, K. (2009). Length-weight relationship of Sphyraena obtusata cuvier, 1829 (Pisces: perciformes) from the Jaffna Lagoon, Sri Lanka. Journal of Fisheries. Aquatic Science. 4, 111–116. doi: 10.3923/jfas.2009.111.116
34. Stergiou, K. I., and Politou, C. Y. (1995). Biological parameters, body length-weight and length-height relationship for various species in Greek waters. NAGA 18, 42–45.
35. Yang, B., Dou, M., Xia, R., Kuo, Y. M., Li, G., & Shen, L. (2020). Effects of hydrological alteration on fish population structure and habitat in river system: A case study in the mid-downstream of the Hanjiang River in China. *Global Ecology and Conservation*, *23*, e01090.
36. Zar, J. H. (1984). Biostatistical Analysis. 2nd Edition. Englewood Cliffs: Prentice-Hall, Inc.