

**LENGTH WEIGHT RELATIONSHIP, CONDITION FACTOR AND SEX
RATIO OF *CHROMIDOTILAPIA GUENTHERI* AND *MALAPTERURUS
ELECTRICUS* IN IKPOBA RIVER, EDO STATE.**

BY

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CERTIFICATION

We certify that this project was done by **Oghenekevwe Kay OHWOEFE** with the matriculation number **LSC1906378** in the Department of Animal and Environmental Biology, University of Benin, Benin City, Edo State, Nigeria.

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DEDICATION

This project I dedicated the Almighty God for giving me wisdom, strength and guidance to successfully carry out this research work.

To my parents for financial and moral support throughout my life in university and during the research period.

ACKNOWLEDGEMENT

I want to specially acknowledge the Almighty God from the depth of my heart for His love, grace, mercy and sustenance. He has been wonderful.

I wholeheartedly want to appreciate my supervisor, Dr. (Mrs) G. N. Agali, for dedicating her time and effort in teaching, guiding, advising and correcting me, all of which were very helpful in the successful completion of this work. I'm so grateful.

To my parents Mr and Mrs Ohwoefe for all their support, for continuously checking up and supporting me.

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ABSTRACT

This study examined the length-weight relationship, Fulton's k-factor, and sex ratios of *Chromidotilapia guentheri* and *Malapterurus electricus* from October 2023 to March 2024. The study was carried out in Ikpoba River, Benin City. The Overall mean values for total length (TL), standard length (SL), head length (HL), body depth (BD), weight, and k-factor for *Chromidotilapia guentheri* during the sampling period were 26.0cm, 20.3cm, 7.1cm, 8.2cm, 106.4g, and 3.8725, respectively. The Overall mean values for TL, SL, HL, BD, weight, and k-factor *Malapterurus electricus* during the sampling period were 32.9cm, 28.0cm, 8.5cm, 5.3cm, 139.2g, and 4.5710, respectively. The sex ratios of *C. guentheri* were 0.4:0.6, indicating a higher number of females, *M. electricus* were 1:00.8, indicating a higher number of males. *C. guentheri* had a mean k-factor ranging from lower than 1.61 in November to higher than 2.26 in March, while *M. electricus* ranged from lower than 0.94 in January to higher than 10.4 in March. The regression coefficients were less than 3 ($b < 3$) for both species, indicating a negative allometric growth, meaning that the fish become slimmer/less weighty with increasing. The knowledge of these species is important for proper management of fishery resources and increase knowledge on understanding the species and other related fish

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF STUDY

Beneath the shimmering surface of Earth's vast oceans and freshwater bodies lies a realm of unparalleled diversity and wonder—the enchanting world of fish. With over 34,000 known species, ranging from the tiniest of neon tetras to the colossal whale shark, these aquatic creatures captivate the imagination of scientists, enthusiasts and casual observers alike. Fish have played a crucial role in shaping the ecosystems of our planet for millions of years, adapting to a multitude of environments and evolving into an array of forms and behaviours that continue to astonish us.

The term fish is applied to a variety of vertebrates of several evolutionary lines. Rather than describing a taxonomic group, it describes a life form. Fish and other vertebrates share some characteristics since they belong to the same phylum, Chordata. These characteristics include gill slits at some stage of the life cycle, a tail, a dorsal hollow nerve cord, notochord or skeletal supporting rod. About five classes include living fishes, and these are different from each other as four classes of well-known air-breathing creatures (birds, mammals, reptiles and frogs)

Fish are classified into three major groups: Agnatha (jawless fish, such as lampreys and hagfish), Chondrichthyes (cartilaginous fish, including sharks and rays), and Osteichthyes (bony fish which make up the majority of the fish species) this is by far the largest class, unlike the scale of the cartilaginous fishes, those of bony fishes, when present, grow throughout life and are made up of thin overlapping plates of bone.

Fishes have existed for more than 450 million years, during which they have evolved repeatedly to fit into almost every conceivable type of aquatic habit. The popular conception of a fish as a slippery, streamlined aquatic animal that possesses fins and breathes by gills applies to many fishes, but far more fishes deviate from that conception than conform to it. For example, the body is elongated in many forms and greatly shortened in others; the body is flattened in some (principally in bottom-dwelling fishes) and laterally compressed in many others; the fins may be elaborately extended, forming intricate shapes, or they may be reduced or even lost; and the positions of the mouth, eyes, nostrils, and gill openings vary widely.

Fish inhabit a wide range of environments, almost all-natural bodies of water bear fish life, the exception being hot thermal ponds and extremely salt-alkaline lakes, such as the Dead Sea in Asia and the Great Salt Lake in North America. They have adapted to various conditions, including extreme temperatures, high pressures, and low light levels. They exist in two major aquatic habitats, such as freshwater (rivers, streams, lakes, ponds, and wetlands) and marine water (saltwater example oceans, coral reefs, and estuaries). For the most part, the fishes in a marine habitat differ from those in a freshwater habitat, even in adjacent areas, but some such as salmon, migrate from one to the other.

Fish have diverse feeding habits ranging from herbivorous feeding to omnivorous feeding. Herbivorous fish feed on plants and algae, carnivores feed on other fish and invertebrates, and omnivores consume both plant and animal matter.

Malapterurus electricus is a fascinating fish found in African rivers and lakes. Its sleek, elongated body, devoid of scales, and mottled brown, grey, and olive coloration allow it to blend seamlessly with the riverbed. Whisker-like barbels help it navigate the murky depths and locate tasty invertebrates. But the electric catfish's most remarkable feature lies within its body. Specialized electric organs generate jolts strong enough to stun prey and send shivers down the spines of would-be attackers. These organs also play a role in communication and navigation, making this fish a true master of its watery domain.

Chromidotilapia guentheri, a dazzling cichlid from West Africa, paints the freshwater realm with its vibrant hues. Males boast a stunning combination of blue and yellow markings, while females and juveniles' shimmer in subtler shades of brown and grey. Their elongated, compressed bodies, typical of cichlids, dart through rivers and lakes adorned with submerged vegetation and rocky outcrops. These omnivores savour a diverse diet of invertebrates, insects, and even plant matter. Males, reaching up to 20 centimetres, outshine their smaller female counterparts with their elongated dorsal fins and vivid markings.

1.2 Length weight relationship

In fishes there are two types of growth namely; the isometric and the allometric growth pattern. Isometric growth is associated with no change of body shape as an organism grows, while

allometric growth has negative and positive. Negative allometric growth implies that the fish becomes slender as it increases in weight, while positive allometric growth, the fish becomes stout as it increases in length. In calculating length-weight relationship, the mean length and mean weight is taken into consideration. Length-weight relationship can also be used to predict weight from length measurements made in the yield assessment (Pauly 2003)

1.3 Condition Factor

Condition factor shows the degree of well being of fish in their habitat. This factor is a measure of various ecological and biological factors such as degree of fatness, gonad development, etc. condition factor also gives information when comparing two populations living in certain feeding, density, climate and other conditions. When the value of condition factor is higher than 1, it means the fish is in good condition. Any value less than 1 means, the fish is in a bad condition. The condition factor of fish can be affected by several factor such as stress, sex, season, availability of feeds, and other water quality parameters (Khallaf *et al.*, 2003).

1.4 Sex Ratio

This is the grouping of male and female species in a population and aids the determination of biological reproduction amount, used in age-structured model. Sex ratio data provides basic information for stock assessment.

1.5 Aims and Objectives

This was undertaken to:

- Establish the relationship between the length-weight relationship of *Malapterurus electricus* and *Chromidotilapia guentheri*.
- Determine the condition factor of the species of fish sampled.
- Determine the sex ratio of *Malaterurus electricus* and *Chromidotilapia guentheri*.

CHAPTER TWO

2.0 Literature Review

2.1 Length-weight Relationship

Length-weight data are often used as an indication of fatness, general well-being or gonad development of fish and are useful for between-region comparisons of like histories of a specific species (Wootton 1990)

Wala *et al.* (2022) in Rivers State University had a study period of 12 months (April 2021-March 2022) which was used to examine the length-weight relationship and condition factor of several fish species in the Imo River. 13 different fish species were caught during this period in Kono and Opuoko respectively. The length-weight relationship showed that all fish species in the two stations exhibited negative allometry in growth pattern ($b < 3$) and the condition factor value showed that four species *Sardinella maderensis*, *Chrysichthys nigrodigitatus*, *Ethmalosa fimbriata* and *Polydactylus quadrifilis* were in poor condition.

Obasohan *et al.* (2012) examined the length-weight relationships and condition factor of five freshwater fishes: *Papycrocranus afer*, *Parachanna obscura*, *Malapterurus electricus*, *Tilapia mariae* and *Oreochromis niloticus* from Ibiekuma Stream, Ekpoma, Nigeria. The results of the length-weight analyses showed that all the fishes exhibited negative allometric growth patterns with regression exponent b values less than 3, while the correlation coefficients (r) obtained which ranged from 0.850 to 0.963 revealed a high degree of positive correlation. The analyses also showed that the condition factor of *P. afer* and *P. obscura* was less than 1. They implied that these fishes were not in good physiological state of well-being in the stream. Still, the values for *M. electricus*, *T. mariae* and *O. niloticus* were greater than 1 and implied that they were in good physiological condition.

From *et al.* (2017) estimated the length-weight relationship, condition factor and gut content of *Chrysichthys furcatus* a commercially important fish in Obubra, central Cross River State. Monthly samples were collected for six months between May to October 2014. During the period a total of 187 specimens comprising 125 females and 62 males were collected. The length-weight frequency distribution shows a total length ranging from 16 cm-60 cm and a weight of 50 g-549 g. The female fish have the highest length and weight frequency distribution

except at weight ranges of 50 g-99 g where the males were more. Both sexes exhibited negative allometric growth patterns with an increase in length resulting in to increase in the weight of the fish. The condition factor (k) decreased with an increase in the size of fish, why July and August recorded the lowest monthly condition factor.

Fafioye and Oluajo (2005) studied the LWR of 320 fishes covering 3 families, 4 genera and 5 species inhabiting Epe Lagoon; *Clarias gariepinus*, *Chrysichthys nigodigitatus*, *Chrysichthys walker* and *Ethmalosa fimbriata*, from November 2001 to October 2002, and January to December 2003. The results showed a nearly isometric relationship with 60% of the variation in body weight being accounted for by the changes in length and lower b value which attributed to the pollution status that occurs in it.

Adaka *et al.* (2015) studied some fish from the Oramiri-Ukwa River, from January to December, 2014. The slope (b) obtained indicated a negative allometric growth pattern except for the *Papyrocranus afer* which showed a positive isometric growth pattern.

Obasohan, *et al.* (2012) examined the LWR and condition factor of five freshwater species in Ekpoma, Nigeria. The result of the length-weight relationship analysis showed that all the fish correlation coefficients (r) obtained which ranged from 0.850 to 0.964 revealed a high degree of positive correlation. The analysis showed that the specimen exhibited a negative allometric growth pattern. the correlation coefficient of the LWR indicated a high degree of positive correlation.

2.2 Condition Factor

In fish, the factor of condition (k) reflects through its variations, information on the physiological state of the fish concerning its welfare. K also gives information when comparing two populations living in certain feeding, density, climate and other conditions; when determining the period of gonadal maturation and when following the degree of feeding activity of a species (Baagenal and Tesch, 1978)

Obasohan, *et al.* (2012) The condition factors of *P. afer* and *P. obscura* were less than 1 and implied that these fishes were not in a good physiological state of well-being in the stream, but the values of *M. electricus*, *T. mariae* and *O. niloticus* were greater than 1 and implied that they were in good physiological condition.

Abowei (2009) studied the condition factor of five fishes from the Nkoro River in the Niger Delta region of Nigeria. Specimens were stored in coolers containing ice and transported to the laboratory for further analysis. Total length and weight were measured using standard methods. All species studied exhibited isometric growth ($b=3$) except *S. maderensis* and *C. senegalensis* with $b=3.6$ and 3.5 respectively exhibiting positive allometric growth. The condition factor ranged from 0.917 (*I. africana*) to 0.985 (*C. senegalensis*). There was a difference in the condition factors for the combined fish species and the monthly factor for each species studied *E. senegalensis* ($0.62+0.011$) *E. fimbriata* ($0.85+0.015$), *I. africana* ($0.96+0.061$), and *S. maderensis* ($0.87+0.072$), while *C. senegalensis* was $1.10+0.042$. All species studied were in good condition.

Dan-Kishiya (2013) investigated the length-weight relationship and condition factor of five fish species: *Tilapia zilli*, *Tilapia mariae*, *Oreochromis niloticus*, *Barbus occidentalis*, and *Barilius loati*, in the Lower Usuma Reservoir, Abuja, Nigeria. Samples were collected between July 2009 and June 2011 using multifilament gillnets. Static fleets of nine graded gillnets with varying mesh sizes were deployed at different depths. 2,452 fish specimens were collected, identified, and measured in the laboratory. Length-weight relationships were analyzed using linear regression. Condition factor (K) was calculated to assess fish health. All species except *Tilapia mariae* exhibited a strong correlation between length and weight. Growth patterns were negatively allometric, with 'b' values ranging from 1.4 to 2.3. Mean condition factor (K) values for all species ranged from 1.06 to 2.02, indicating healthy fish populations. The fish species in the Lower Usuma Reservoir generally showed good health and exhibited negative allometric growth patterns.

Bolarinwa (2015) examined the growth patterns and health of two fish species, *Cynoglossus cynoglossus* and *Caranx hippos*, in Epe Lagoon, Nigeria, over six months (May-October 2015). *Cynoglossus cynoglossus* was negatively allometric (b value = 2.02), they grow lighter relative to their length as they get bigger. *Caranx hippos* are positively allometric (b value = 3.47), they grow heavier relative to their length as they get bigger. *Cynoglossus cynoglossus* lower condition factor ($K = 0.48$) suggests less optimal health compared to *Caranx hippos*. *Caranx hippos*, a higher condition factor ($K = 2.24$) indicate better health and suitability for the Epe Lagoon

environment. The fact that the K value of *Caranx hippos* was higher than that of *Cynoglossus cynoglossus* shows a higher suitability of Epe lagoon for the former.

Ayoade (2007) stated the condition factor (k) calculated for *H. bimaculatus* varied from 1.14-3.13±1.79, for *S. melanotheron* K varied from 1.40-3.60±2.79, while it was 1.13-2.24±1.67 for *C. guentheri*. The seasonal variation occurred in the k factor of the three cichlid species and the highest mean k factor was recorded during the rainy season for *S. melanotheron* (3.21) and *C. guentheri* (1.76), while, *H. bimaculatus* showed an interesting pattern. While its peak k value (1.92) occurred during the dry season, it was the only species where the difference between rainy and dry season k was statistically significant, indicating the change wasn't just a random chance. Size also mattered for this species, with smaller individuals (7.7-9 cm) generally having better body condition than larger ones. Looking at *S. melanotheron* (24.1-30 cm) and *C. guentheri* (10-11.9 cm), the trend reversed, larger individuals seemed healthier.

2.3 Sex Ratio

Sex population is the estimation of the abundance of any sex at any particular time under natural condition (Grayson *et al*, 2014). Sex ratio is a biological parameter that affects the growth rates and ecology of wild population (Dyson and Hurst, 2004) and it is fundamental to a sexually reproducing population (Gusmao *et al*, 2013).

Adeosun (2019) a manmade lake located in Ikere river Oyo state, Nigeria, samples were taken on the first 3 days of the first week of every month covering 18 calendar months of wet (April-September) and dry months (October-March). *C. nigrodigitatus* a total of 1423 species, 606 males and 817 females. *L. niloticus* a total of 170 species, 93 males and 77 females. *T. melanopleura* 596 specimen, females were higher than the males. *S. galilaeus* 432 species, 154 males and 278 males. Females were more predominant throughout the months of the year among the fish species in the area with the exception of *Lates niloticus*. Skewed sex ratio, in favour of one sex has been reported to be a sign of declining wild population and threat of extinction of the species. *C. nigrodigitatus* revealed highest preponderance toward female sex in the month of January and lowest ratio of male to female was recorded in June. Females were more with the exception of *L. niloticus*.

Bussou *et al* (2010) four coastal rivers in Côte d' Ivoire (Ehenia, Noè, Somié, Eholié) The reproductive activities of a small Cichlid *Chromidotilapia guntheri* were investigated, fishes

were sampled during 8 sampling surveys from July 2003 to March 2005. A total of 212 fishes were collected of these 23 were unsexed (mostly immature) 114 were males and 75 were females. Thus, the sexual composition of pooled river samples was dominated by males with female to male ratios significantly different. The males were predominant. The deviation from 1:1 sex ratio and the predominance of males might result from either physiological differences or mechanisms which render males more prone to capture or less prone to natural mortality than females (i.e male aggressive reproductive behaviour, mouth breeding).

Kamelan *et al*, (2019) dam lake of Buyo Côte d'Ivoire, a total of 325 specimens were sampled monthly from August 2017 to July 2018, 188 males and 137 females were examined. The overall sex ratio as in favour of the males. The predominance of one sex is a relatively common phenomenon in Teleostan fish species.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Ikpoba River in Benin City, in the Upper Lawani Axis. It takes its source from Ikpoba Okha. The river is a source of income for fishermen, water and recreational means.

3.1.1 Geographical Location

It lies between Lat 6.376068 N 6°22'33.84408" and Long 5.646119 E 5°38'46.02984"

3.1.2 Vegetation

The study area is heavily shaded by forest and economic trees such as raffia palm (*Raphia hookeri*), oil palm (*Elaeis guineensis*) and shrubs. On the river are floating vegetations such as watermoss (*Salvinia nymphellula*) and water hyacinth (*Eichhornia crassipes*). The level of pollution is low, as there was no evidence of industries. Fishing is the major occupation, while farming is secondary.

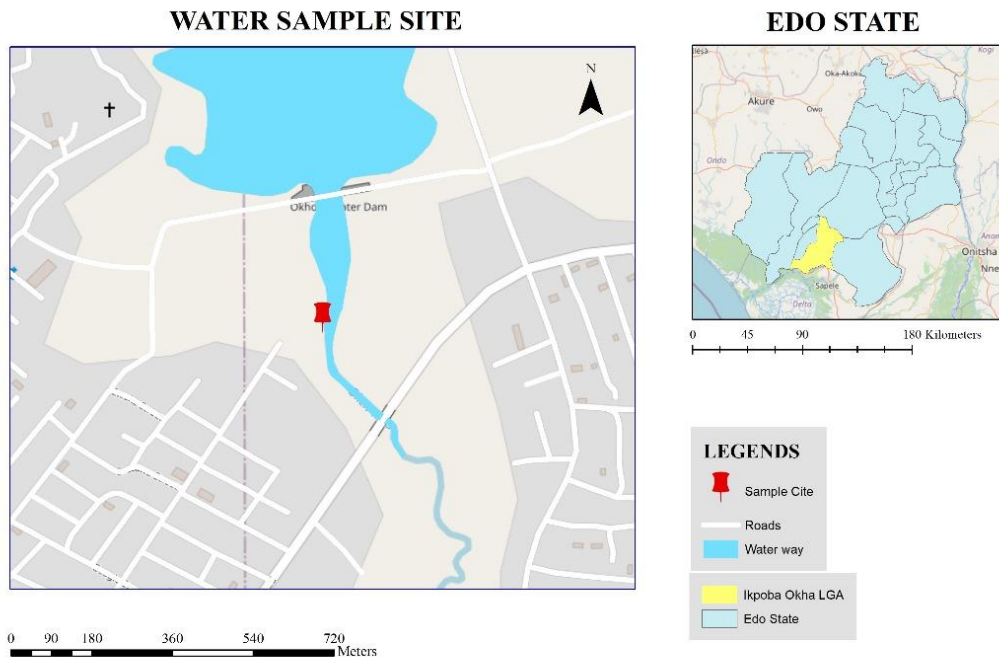


Figure 1: Map of the Study Area Ikpoba River Upper Lawani

3.1.3 Climatic Condition Around the Study Area

The study area has a tropical wet and dry season climate. During the sampling for six months from October 2023 to March 2024 it alternated between dry and wet.

3.1.4 Land Use/ Human Activities in the Study Area

The community around the river are urban and the river serves as a source of water for recreations, and livelihood. No industries are cited along the riverbank.

3.2 Collection of samples

Samples were collected once in every month from October 2023 to March 2024. The fish samples were collected from local fishermen using [insert fishing tool]. The samples were then taken back to the lab in a bucket for identification using guides from Idodo-Umeh, (2003).

3.3 Fish Measurement

The morphometric features such as total length (TL) were measured from the mid-tip of the snout to the lateral mid base of the caudal fin; standard length (SL) were taken as the caudal fin; standard length (SL) were taken as the distance from the anterior of the snout to the caudal base, head length (HL) measured from the tip of the snout to the posterior-dorsal function of the membranous margin of the gill opening, body depth was taken as the deepest point, exclusive of fleshy structure in the body of fish samples. The meristic features included dorsal, pectoral, pelvic, ventral and caudal fin-rays and the spines. All these measurements were done with a board and meter rule to the nearest 0.1 cm and weighed using a weighing balance.

The length- weight relationship and condition factor of the fishes was calculated from the length and weight values formulated by Pauly (1983).

3.4 Sex Determination

The sexes of the fishes were confirmed by dissecting on the ventral side and on visual examination. They were dissected so that the reproductive organs can be used to differentiate the sexes. Specimens were

grouped into male and female for each species. The total numbers of each sex was recorded for each species every month and the ratio of males to females were determined.

3.6 Data analysis

3.6.1 Length-weight relationship

The length-weight relationship was calculated by the formula

$$W = aL^b$$

Where:

- W = weight of the fish in grams
- L = standard length of the fish in centimetres
- a = constant (intercept)
- b = the length exponent (slope)

3.6.2 The condition factor (K)

Condition factor was calculated by the formula (Pauly, 1984)

$$K = 100 \frac{W}{L^3}$$

Where K = condition factor

L = total length of the fish in centimetres

W = body weight of fish in gram.

3.7 Sex Ratio

Specimen were grouped into male and female for each species. The total numbers of each sex were recorded for each species every month and the ratios of males to females were determined

$$\text{Sex ratio} = \frac{\text{Number of males}}{\text{Number of females}}$$

CHAPTER FOUR

4.0 RESULTS

4.1 MORPHOMETRIC CHARACTERISTICS OF *CHROMIDOTILAPIA GUENTHERI* AND *MALAPTERURUS ELECTRICUS* ACROSS THE SAMPLING DURATION FROM OCTOBER TO MARCH

Tables 1-6 show the values of specimens collected, sex, total length (TL), standard length (SL), head length (HL), body depth/width (BD), weight(W) and Fulton's condition factor (K_f) of *C. guentheri* and *M. electricus* across the sampling duration from October to March, while table 7 shows the summary of the means of the species' morphometric characteristics across the sampling period .

Table 1: Morphometric Characteristics and K-factor of *C. guentheri* across the sampling duration

MONTH	SPECIMEN	Sex	SL(cm)	HL(cm)	BD(cm)	TL(cm)	Weight (g)	K-FACTOR
OCT	1	M	10	4	4.5	14.5	145	4.7562
	2	M	10.5	4	4.9	14	132	4.8105
	3	M	7.5	2.5	3.5	10.5	126	10.8844
	4	M	7.2	2.5	3.4	10.5	131	11.3163
NOV	1	F	14.6	5.3	7.5	20.8	190	2.1114
	2	F	15.2	6	8	32.3	220	0.6529
	3	M	14.2	5	6.3	19.2	160	2.2606
DEC	1	F	13.6	4.8	6.8	19.8	160.8	2.0715
	2	F	13.5	4.7	6.7	19.8	140	1.8036
			13.55	4.75	6.75	19.8	150.4	1.9375
JAN	1	M	13	4.5	4.6	15.5	60	1.6112
	2	F	12	4	4.5	14.5	55.3	1.8139
FEB	1	M	13.5	4.5	5.8	18	105	1.8004
	2	F	13.5	5	6.2	17.5	120	2.2391
	3	F	10.1	3.2	4	12.2	46	2.5333

	4	M	8.4	3.2	3.4	10.9	23	1.7760
	5	F	10.7	3.1	4.2	13.8	66	2.5113
	6	F	11.8	4.2	4.5	14.8	48	1.4807
	7	F	12	3.9	4.4	14.8	59	1.8200
	8	F	9.2	3.2	3.8	12.4	38	1.9931
	9	F	7.5	2.3	2.8	9.9	20	2.0612
MAR	1	F	10.1	3.5	4.2	13	63	2.8675
	2	F	11.3	4.5	4.7	14	52	1.8950
	3	M	11.8	3.9	4.6	13.8	61	2.3211
	4	F	9.4	3.9	4.3	14	42	1.5306
	5	F	8.2	3.1	3.9	12	46	2.6620
TOTAL	25	0	172.5	60	69.9	221.1	904.3	32.9165
MEAN	1	0	20.3	7.1	8.2	26.0	106.4	3.8725

In October Table 1 above, four (4) catches of the specimen *Chromidotilapia guentheri* were recorded, mean of TL, SL, HL, BD, Wt and Kf were 45cm, 8.8cm, 3.3cm, 4.1cm, 133.5g and 7.94 respectively.

In November ,three (3) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 24.1cm, 14.6cm, 5.4cm, 7.3cm, 190g and 1.67 respectively.

In December, three (3) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 19.8cm,13.6cm, 4.8cm, 6.8cm, 150.4g and 1.94 respectively

In January, two (2) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 15cm, 12.5cm, 4.3cm, 4.6cm, 57.7g and 1.71 respectively

In February, nine (9) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 13.8cm, 10.7cm, 3.6cm, 4.3cm, 58.3g and 2.02 respectively.

In March five (5) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 13.3cm, 10.2cm, 3.7cm, 4.3cm, 52.8g and 2.26 respectively.

Across the sampling duration, a total of twenty four (24) specimens of *C. guentheri* was collected. The lowest monthly mean K-factor of 1.61 was recorded in November and highest 2.26 in March. Mean of means value for TL, SL, HL, BD, weight and k-factor across the entire specimens during the sampling period were of 26.0cm, 20.3cm, 7.1cm, 8.2cm ,106.4g and 3.8725.

Table 2: Morphometric Characteristics and K-factor of *M.electricus* across the sampling duration

MONTH	SPECIMEN	Sex	SL(cm)	HL(cm)	BD(cm)	TL(cm)	Weight (g)	K- FACTOR
OCT	1	M	13	2.5	3.5	14.9	58	1.7534
	2	M	16.5	3.5	4.4	20.5	76.5	0.8880
NOV	1	M	13.5	2.4	2	15.7	50	1.2920
	2	M	13	2.5	2.5	16.2	65	1.5289
DEC	1	F	15.5	3.5	2.5	18.6	70	1.0878
	2	M	12.6	2.2	1.4	15	45	1.3333
JAN	1	F	18.6	15.5	3.5	25	70	0.4480
	2	M	15	12.6	2.2	19.4	45	0.6163
	3	F	12.9	2.4	1.4	15.5	48	1.2890
	4	M	17	4.1	4	21	132	1.4253
FEB	1	M	14	3	3	7.3	75	19.2794

	2	M	17.6	4	3.8	20.5	130	1.5090
MAR	1	M	12	2.5	1.6	15	48	1.4222
	2	F	14.4	3.4	2.8	16.8	69	1.4552
	3	F	18.1	4.2	3.8	22	132.1	1.2406
TOTAL	15	0	223.7	68.3	42.4	263.4	1113.6	36.5684
<i>MEAN</i>	<i>1</i>	<i>0</i>	<i>28.0</i>	<i>8.5</i>	<i>5.3</i>	<i>32.9</i>	<i>139.2</i>	<i>4.5710</i>

In October Table 2, two (2) catches of the specimen *Malapterurus electricus* were recorded, mean of TL, SL, HL, BD, Wt and Kf were 17.7cm, 14.8cm, 3cm, 4cm, 67.2g and 1.32 respectively.

In November, two (2) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 16cm, 13.3cm, 2.5cm, 2.3cm, 57.5g and 1.41 respectively.

In December, two (2) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 16.8cm, 14.1cm, 2.9cm, 2cm, 57.5g and 1.21 respectively

In January, four (4) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 20.2cm, 15.9cm, 17.9cm, 2.7cm, 73.8g and 0.94 respectively

In February, two (2) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 13.9cm, 16.1cm, 3.5cm, 3.4cm, 102.5g and 10.4 respectively.

In March three (3) catches were recorded, mean of TL, SL, HL, BD, Wt and Kf were 17.9cm, 14.8cm, 3.4cm, 2.7cm, 83g and 1.37 respectively.

Across the sampling duration, a total of fifteen (15) specimens of *M.electricus* was collected.

The lowest monthly mean K-factor of 0.94 was recorded in January and highest 10.4 in February.

Mean of means value for TL, SL, HL, BD, weight and k-factor across the entire specimens during the sampling period were of 32.9cm, 28.0cm, 8.5cm, 5.3cm, 139.2g and 4.5710

Table 3: Summary of Means of Morphometric Characteristics of *C.guentheri* from October to March

MONTH	SPECIMENS	SL(cm)	HD(cm)	BD(cm)	TL(cm)	Weight (g)
OCT	4	8.8	3.3	4.1	12.4	133.5
NOV	3	14.7	5.4	7.3	24.1	190.0
DEC	2	13.6	4.8	6.8	19.8	150.4
JAN	2	12.5	4.3	4.6	15.0	57.7
FEB	9	10.7	3.6	4.3	14.0	58.3
MARCH	5	10.2	3.8	4.3	13.4	52.8
<i>MEAN OF MEANS</i>	4	11.7	4.2	5.2	16.4	107.1

Table 4: Summary of Means of Morphometric Characteristics of *M.electricus* From October to March

MONTH	SPECIMENS	SL(cm)	HD(cm)	BD(cm)	TL(cm)	Weight (g)
OCT	2	14.8	3.0	4.0	17.7	67.3
NOV	2	13.3	2.5	2.3	16.0	57.5
DEC	2	14.1	2.9	2.0	16.8	57.5
JAN	4	15.9	8.7	2.8	10.1	73.8
FEB	2	15.8	3.5	3.4	22.1	102.5
MARCH	3	14.8	3.4	2.7	15.0	83.0
<i>MEAN OF MEANS</i>	3	14.8	4.0	2.8	16.3	73.6

4.2 SEX RATIO OF *CHROMIDOTILAPIA GUENTHERI* AND *MALAPTERURUS ELECTRICUS*

4.2.1 *Chromidotilapia guentheri* sex ratio

Sex ratios of *C. guentheri* collected across the sampling duration. During sampling period, nine (9) males and sixteen (16) females were sampled randomly. Highest count was recorded seven (7) for females in February 2024 and four (4) for males in October 2023, while the lowest was recorded zero (0) in December 2023 for male and zero (0) in October 2023 for females. Mean sex ratio was 0.4:0.6.

In the month of October 2023, four (4) male and zero (0) female were recorded. Similarly, in November 2023, one (1) male and two (2) females were recorded. In December 2023, zero (0) males and two (2) females were recorded. In January 2024, one (1) male and one (1) female were recorded. In February 2024, two (2) male and seven (7) female were recorded. In March one (1) male and four (4) female were recorded.

Table 5: Sex Ratio of *C. guentheri*

MONTH	TOTAL CATCH	MALE	FEMALE	SEX RATIO
OCT	4	4	0	1:00
NOV	3	1	2	0.5:1.0
DEC	2	0	2	0:1.0
JAN	2	1	1	01:1.0
FEB	9	2	7	0.2:0.8
MARCH	5	1	4	0.25:0.75
TOTAL	25	9	16	
MEAN S.R.				0.4:0.6

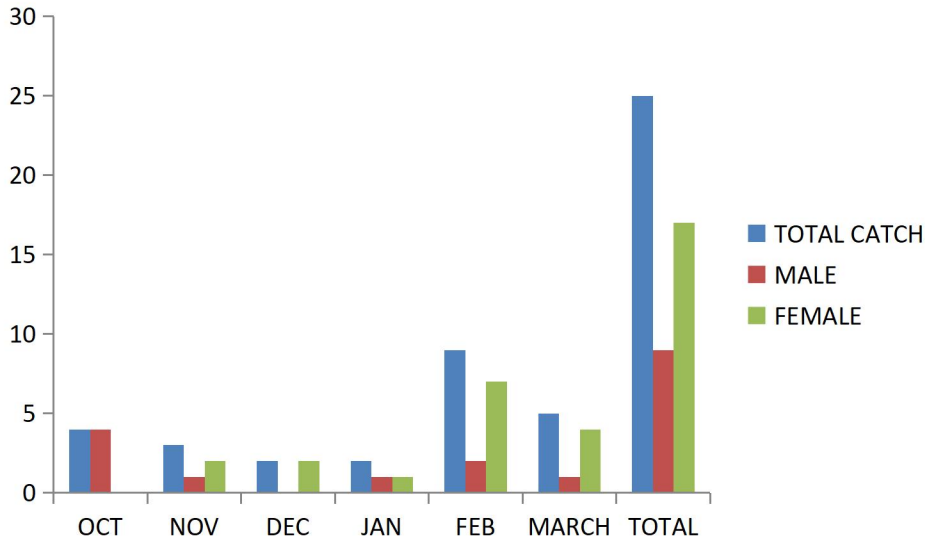


Fig. 2: chart showing sex ratio of *C. guentheri*

4.2.2 *Malapterurus electricus* sex ratio.

Sex ratios of *M. electricus* collected across the sampling duration. Ten (10) male and five (5) female specimens were randomly sampled. Highest count were recorded two (2) for males and females in January 2024; while lowest zero for females in October 2023, November 2023 and February 2024, and one (1) for males in December 2023 and March 2024. Mean sex ratio was 1:00.8

Table 6: Sex Ratio of *M. electricus*

MONTH	TOTAL CATCH	MALE	FEMALE	SEX RATIO
OCT	2	2	0	1:01
NOV	2	2	0	1:01
DEC	2	1	1	1.0:1.0
JAN	4	2	2	01:01.0
FEB	2	2	0	01:01.0
MARCH	3	1	2	0.5:1.0
TOTAL	15	10	5	

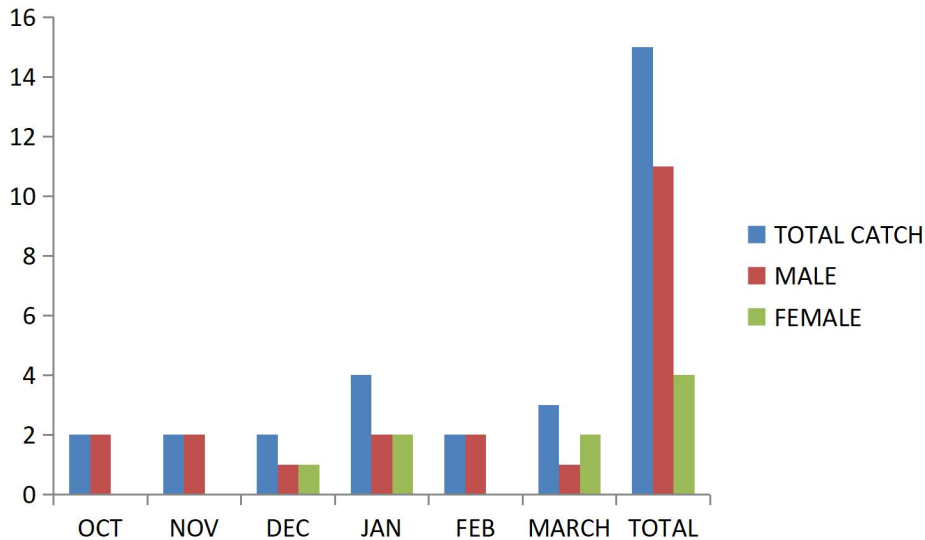


Fig. 3: chart showing sex ratio of *M. electricus*

4.3 K- FACTOR OF *CHROMIDOTILAPIA GUENTHERI* AND *MALAPTERURUS ELECTRICUS*

The Fulton's k-factor recorded for twenty five (25) *Chromidotilapia* and fifteen (15) *Malapterurus electricus* respectively were sampled between October 2023 and March 2024

The lowest mean monthly k-factor (1.8084) was recorded in January 2024 and the highest (7.1535) in October for *C. guentheri*, but lowest (1.4737) in December and highest (1.8121) in March for *M. electricus*.

The mean K-factors for both species across the sampling period are all greater than 1.0, indicating a healthy fish population and good growth conditions across the duration. The mean differences both species were further compared using unpaired t-test to check for significant differences. There was significant difference in k-factor of the two species ($P < 0.05$) sampled across the duration of the random catches ($P > 0.05$)

Table 7: Summary of K-Factors of *C. guentheri* and *M. electricus* from October to March

SPECIES	MONTH											
	OCT		NOV		DEC		JAN		FEB		MAR	
	C	M	C	M	C	M	C	M	C	M	C	M
	4.7562	1.7534	2.1114	1.2920	2.0715	1.0878	1.6112	1.2413	1.8004	1.9274	2.8675	1.4222
	4.8105	0.8880	0.6529	1.5289	1.8036	1.3333	1.8139	1.2566	2.2391	1.5090	1.8950	1.4552
	10.8844		2.2606					1.2489	2.5333		2.3211	1.2406
	11.3163							1.2528	1.7760		1.5306	
									2.5113		2.6620	
									1.4807			
									1.8200			
									1.9931			
									2.0612			
<i>SPECIMENS</i>	<i>4</i>	<i>2</i>	<i>3</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>4</i>	<i>9</i>	<i>2</i>	<i>5</i>	<i>3</i>
<i>MEAN</i>	<i>7.1535</i>	<i>1.5471</i>	<i>2.0062</i>	<i>1.6070</i>	<i>1.9584</i>	<i>1.4737</i>	<i>1.8084</i>	<i>1.7999</i>	<i>2.7215</i>	<i>1.8121</i>	<i>2.7127</i>	<i>1.7795</i>

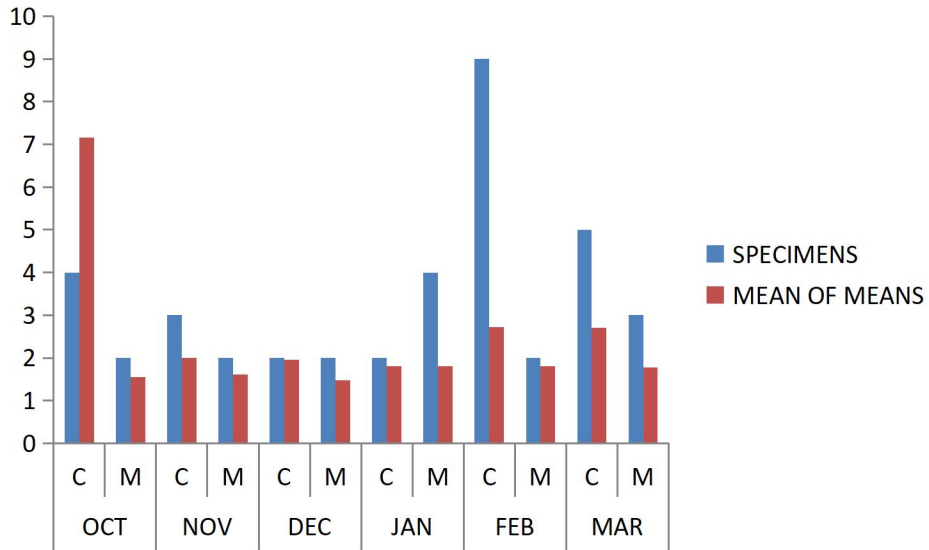


Fig. 4: Chart showing Summary of K-Factors of *C. guentheri* and *M. electricus* from October to March

4.4 LENGTH-WEIGHT RELATIONSHIP OF *C. GUENTHERI* AND *M. ELECTRICUS*

The relationships between the length as the independent variable and weight as the dependent variable of the growth characteristics of *C. guentheri* and *M. electricus* recorded from October to March are indicated in Table 8 and Fig. 4 and 5 below:

TABLE 8: Length-Weight Relationship of *C. guentheri* and *M. electricus*

SPECIES	L-W RELATIONSHIP	a	b	R2	GROWTH PATTERN	P-value	SIG.
<i>C. guentheri</i>	$\text{LogW} = -0.1043 + 1.7022 \log L$	-0.1043	1.7022	0.4743	- ALLOMETRY	0.81104	Not Sig. different
<i>M. electricus</i>	$\text{LogW} = 1.6511 + 0.173 \text{Log L}$	1.6511	0.173	0.1365	- ALLOMETRY	0.39	Not Sig. different

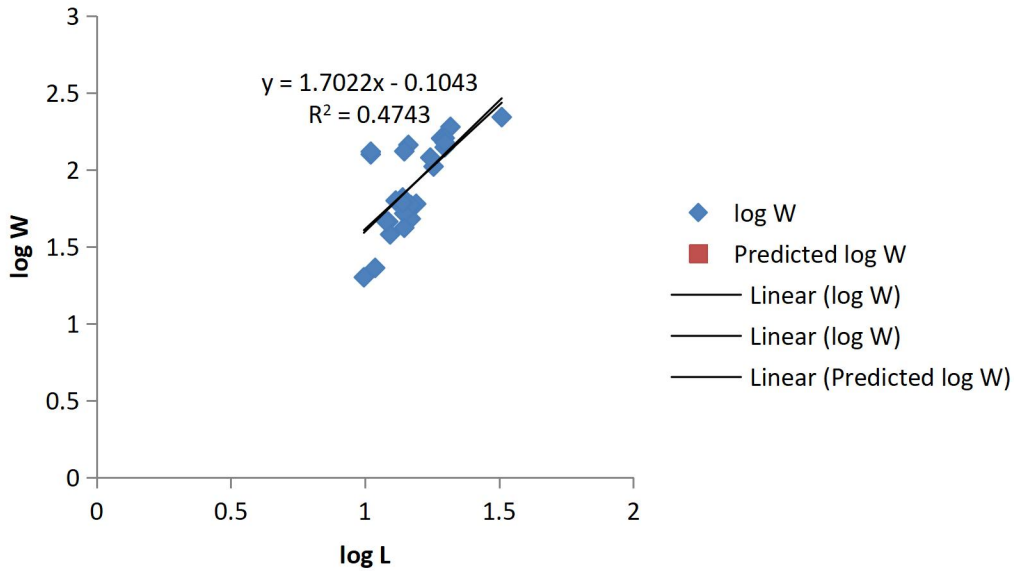


Fig. 5: Regression graph of L-W Relationship of *C. guentheri*

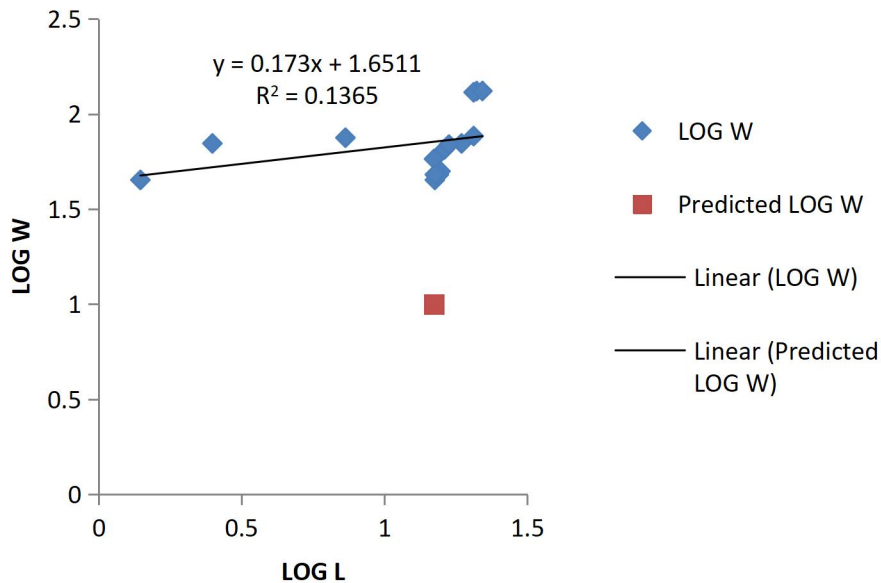


Fig. 6: Regression graph of L-W Relationship of *M. electricus*

From table 8 and Fig. 4 and 5, the exponential relationship between the log weight and log length for both species *C. guentheri* and *M. electricus* across the sampling duration is expressed by the linear equation on logarithm transformed data:

$$\text{LogW} = -0.1043 + 1.7022 \log L \quad (a = -0.1043, b = 1.7022 \text{ and } r^2 = 0.4743)$$

$$\text{LogW} = 1.6511 + 0.173 \text{Log L} \quad (a = 1.6511, b = 0.173 \text{ and } r^2 = 0.1365)$$

with 'a' representing the intercept and 'b' the slope of the relationship; 'r²' the coefficient of determination (the closer r² is to 1, the nearer weight is regressed on length, i.e. better prediction of linearity) while 'r' is Spearman's correlation coefficient.

From the study, regression coefficients were less than 3 ($b < 3$) for both species, indicating a negative allometric growth (i.e. fish become slimmer/less weightier with increasing length). Both

r^2 was close to 1, indicating a fairly good linearity and regression of weight on length, and the ANOVA regression analysis ($p < 0.05$) obtained suggested that there is high significant difference in the regression of weight on length in both species; indicating that these species have a relatively slow growth rate/ weight gain with length, and tend to be thinner.



Fig 7: Length measurement of *C. guentheri* using meter rule



Fig 8: Length measurements of *M. electricus* using meter rule

DISCUSSION

Length-weight relationship of fishes is used by biologists to determine the growth patterns of fish (Bagenal and Tesch, 1978). The length-weight relationship of the fish from Ikpoba Okha River revealed considerable variation in fish sizes indicating that sampling by fishermen with fish traps and gill nets was efficiently carried out.

During the sampling period, nine (9) males and sixteen (16) females *Chromidotilapia guentheri* were sampled randomly. The mean sex ratio was 0.4:0.6. Ten (10) male and five (5) female specimens of *Malapterurus electricus* were randomly sampled. The mean sex ratio was 1:00.8. this is in contrast to the report of Olowo *et al* (2022), where the sex ratio was equal. However, there was no significant difference in the number of males and females in this study.

The mean Fulton's k-factor recorded for twenty-five (25) *Chromidotilapia guentheri* was 3.8725 and fifteen (15) *Malapterurus electricus* was 4.5710 respectively. Similar to work by Keziah (2017) carried out on *Parachana obscura*, *Malapterurus electricus*, *Labeo senegalensis* and *Erpetoichythes calabaricus*, fish species had condition factor values that approximately ranged from 0.1 to 1.0. Thus, scores greater than 0.1, imply that the fishes are in good living condition.

From the result, regression coefficients were less than 3 ($b < 3$) for both species *Chromidotilapia guentheri* and *Malapterurus electricus*, indicating a negative allometric growth (i.e. fish become slimmer/less weightier with increasing length). This is similar to the report by Abu (2016), where the fish exhibited negative allometric growth. However, this finding is in contrast with the report by Okwodu (2022) where positive allometric growth was reported, indicating that they grew faster in weight than in length.

CONCLUSION

The study focused on the length-weight relationship of *C. guentheri* and *M. electricus* in the Ikpoba River. Findings from this study show that both species exhibited negative allometric growth patterns and were found to be in good condition during sampling. The sex ratio of *Chromidotilapia guentheri* indicated a higher number of females and *Malapterurus electricus* indicated a higher number of males. The knowledge of these species is important for proper management of fishery resources and increase knowledge on understanding the species and other related fish

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