LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF CLARIAS GARIEPINUS (BURCHELL, 1822) FROM AJIWA RESERVOIR, KATSINA STATE, NIGERIA

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ABSTRACT

*The length-weight relationship and condition factor of Clarias gariepinus from three study sites (Kadaji, Gajerargiwa and Kundu waje sites respectively) in Ajiwa Reservoir, Katsina State Nigeria was evaluated over a period of six months. The length-weight relationship is an important fishery management tool designed to estimate mean weight at specific lengths in a given set in order to analyse the relative health of a fish population. The fish were caught using drag nets and Malian traps, with the help of local fishermen. In order to avoid indiscriminate fishing, the type of gear and mesh sizes utilised, as well as fish life phases in the water bodies, should all be considered. A total number of ninety (90) adult fish samples were collected during the study period utilising drag nets and traps and promptly immersed in 10% formalin before being transported to the laboratory. The fish samples consisted of 40 males and 50 females. The length-weight regression analysis revealed 'b' values of 2.81, 2.93, and 2.85, indicating a negative allometric growth tendency in males, females, and combined sexes, respectively.The significant linear relationships **"r"** revealed 0.94, 0.96 and 0.95 in males, females and combined sexes respectively. The condition (**K**) factor recorded was 1.01for the males, 1.03 for the females and 1.02 in the two combined sexes. The "**K**" values observed in this study that were greater than 1 indicated that the male and female C. gariepinus from Ajiwa Reservoir were in a stable condition. The condition factors of all fish species studied fall within the range suggested for developed fresh water fish species in the tropics. Clarias gariepinus is one of the most widely cultured catfish species in aquaculture. Its fast growth rate, adaptability to diverse environments, and high reproductive capacity make it a preferred choice for fish farmers. The species contributes significantly to the global aquaculture industry, providing a source of income and livelihood for many. In its natural habitat, Clarias gariepinus often occupies the role of a top predator. This can have cascading effects on the structure and dynamics of aquatic ecosystems by influencing the population sizes of other species in the food chain.*

KEYWORDS

Ajiwa, Reservoir, Length, Weight, Clarias gariepinus, Condition factor, Allometric Growth,

1. INTRODUCTION

Fishes and fish product is amongst the low-cost, frequently available animal protein's sources. In term of nutrient composition, it is excellence made it enhanceda well-chosenfor human being eating. Apart from landings from captured fisheries, aquaculture production has given fish species for human consumption, among other uses. The African catfish, *Clarias gariepinus*, is one of the commercially important fish species that has benefited from aquaculture development in Africa [1]. *Clarias gariepinus* is found in a broad variety of African water bodies, including swamps, streams, rivers, and lakes. *Clarias gariepinus's* widespread presence in inland waters

has been attributed to their ability to use a variety of items as food, their ability to withstand a wide range of environmental conditions, their fast growth rate, high fecundity rate, ease of artificial spawning, and good marketable value, among other characteristics [1]. *Clarias gariepinus* African catfish is a representative of air breathing catfish with a scale less, bony elongated body with long dorsal fin and anal fins; without dorsal fin spine as well as adipose fin. Anterior edge of pectoral spine serrated. Caudal fin rounded and a helmet like head, Head is large, depressed and bony with small eyes. Dorsally, the colour ranges from dark to light brown and is frequently mottled with colours of olive and grey, while the underside is a creamy cream to white [2].It is highly priced and requested for by fish farmers and consumers in Nigeria either as smoked or fresh and well appreciated [3]. The African catfish possesses physiological adaptations which enables it to tolerate extreme environmental conditions [4].The *Clarias gariepinus* African catfish is source of wild nourishment to trawling/hunting(fishing) villages [5], promising fish farming species [6]as well as invasive in its non-endemic surroundings [7]. The African catfish *Clarias gariepinus* (with local name in Hausa *Tarwada*) has been considered to hold great promise for aquaculture in Africa; it has a wide geographical spread, high growth rate, resistance to handling and stress, and it is well appreciated in a wide number of African countries both for food and aquaculture [8]. The length-weight relationship is very important for proper exploitation and management of the population of fish species [9]. African catfish *Clarias gariepinus* has been established as a very important freshwater candidate for aquaculture in Nigeria. They are the most cultured fish species due to their ability to withstand a variety of harsh weather conditions, rapid growth rate, high rate of fecundity, easy artificial spawning, and can fetch a fair market price. Fish palatability and nutritional qualities have increased demand for eating in Nigeria's rural and urban areas. As a result, the intensity of artisanal fishing is concerning [1]. The study of fisheries biology requires knowledge of the length-weight connection and condition factor (K) of fishes. It is critical to obtain the link between total length and other body weight in order to stabilise the taxonomic characteristics of the species [10]. Length and weight information are a valuablein addition tobenchmark end result of fish selection/sampling programs. These data are needed to estimate growth rates, length and age structures, and other components of fish population dynamics [11]. In conjunction with age data, length and weight measurements can provide information on the fish population, age maturity, life duration, death, development, as well as reproduction [12]. Length-weight relationship of fish is generallyacknowledged as asignificantinstrument in fisheries science particularly in environmental science,inhabitants' dynamicsas well as stock management [13]. The condition factor (K) is used in fisheries science to compare the "condition" of fish, such as fatness or wellbeing [14]. The condition factor in fish is an indicator of the fish's physiological state in relation to its well-being [15] in addition similarly makes available information when associating two inhabitant'salive in particularfeeding density, climatecondition as well as other conditions [16]. Thus, the condition factor is significant in understanding the life cycle of fish species and contributes to appropriate management of these species, thereby maintaining ecosystem equilibrium [17]. This study aimed at providing information on length-weight relationship and condition factor of *Clarias gariepinus* obtained from Ajiwa Reservoir in Katsina, Nigeria.

2. MATERIALS AND METHODS

2.1. Study Area

The study area; Ajiwa reservoir, is located on Latitude 12°'98'N, Longitude 7°'75'E, in Batagarawa Local Government, Katsina State, Nigeria. The reservoir's primary function is to provide irrigation and water supplies to the residents of Katsina, Batagarawa, Mashi, and Mani Local Government Areas. The reservoir was filled in 1973 and opened in 1975 [18]. For the

purpose of this study three villages (landing site) around the dam site were selected and they were; Kadaji, Gajerargiwa and Kunduwaje.

2.2. Identification of *Clarias Gariepinus*

The experimental fish (*Clarias gariepinus*) were identified using the description of [19].

2.3. Sample Collections

Fish samples were collected from the selected study area for period of (6) months.5 (five) experimental fish were gathered from three (3) dissimilar sample sites. Local fisherman fishing in the reservoir used drag nets and traps to catch their catch. The fish samples were promptly soaked in 10% formalin in a plastic container and transported to the Department of Biological Science laboratory at Federal University Dutsin-Ma in Katsina State.

2.4. Measurement of Experimental Fish Samples

Standard lengths were measured with a metric ruler, and weights were measured with a top loading sensitive balance (GT4100 model). Some of morphometric measurements such as body weight, total length and standard lengthwere taken following a guide reported in [20], for morphometric identification of *Clarias* species.

2.5. Length-Weight Measurement Determination

The length-weight relationship was estimated using [15]'s method. W= aLb
Where **W** is the weight of the fish (g), **L** is the length of the fish (cm), **a**is a constant value, and **b** is an exponent.

The values of constants a and b were estimated using least square linear regression after logarithmic transformation of W=aLb, = logW=loga + blogL

2.6. Condition Factor Determination

The condition factor K was calculated for each fish using the standard formula stated by [21].

Factor of Condition: $(K) = \frac{W \times 100}{L^3}$
Where K as the condition factor;
W = Weight of fish in gram; L = Length in centimetres

3. RESULTS

The males from Ajiwa reservoir were found to be (40) and female were found to be (50). The estimated parameters of length-weight relationships and condition factor of the ninety (90) catfish species (*Clarias gariepinus*) obtained from Ajiwa Reservoir are presented in Table 1.The estimated length-weight "b" values were 2.81 for male *Clarias gariepinus*, 2.93 for female *Clarias gariepinus*, and 2.85 for the combined sexes, males and females*Clarias gariepinus* from the Ajiwa reservoir. The result showed that both males and females and the combined sexes of *Clarias gariepinus* exhibited negative allometric growth pattern. Consequently, *Clarias gariepinus* follow the cube law, demonstrated a positive correlation between total length and body weight, and the associations were highly significant ($P<0.05$) with "r" values of 0.90 for all

catfish species found from Ajiwa reservoir. If the condition factor (K) for *C. gariepinus* was less than one, it would have indicated that the fish were not in good condition in the reservoir, whereas if the condition factor (K) for *C. gariepinus* was greater than one, it would have indicated that the fish were in good condition in the reservoir.The values of the condition factor (Average, Minimum and Maximum) values recorded in the present study were (1.01, 0.76 and 1.27) Males (1.03, 0.19 and 2.71) Females and (1.02, 0.19 and 2.77) combined (Table 2).

The length-weight relationship for males, females and combined was graphically represented by the following figures 1, 2 and 3 respectively. Similarly condition factor (Average, Minimum and Maximum) values for males, females and combined sexes were represented in figures 4, 5 and 6.

Table 1: Length-weight connections and condition factor of *Clarias gariepinus* in Ajiwa reservoir, Batagarawa local government, Katsina State

Sex	Condition factor (K) value	$W = aL^b$	N	A	B	r
Male	1.01	$-1.81L^{2.81}$	40	-1.81	2.81	0.94
Female	1.03	$-1.88L^{2.93}$	50	-1.88	2.93	0.96
Combined	1.02	$-1.83L^{2.85}$	90	-1.83	2.85	0.95

N= number of samples, a = intercept/regression constant, b = the slope/regression coefficient, r = the correlation co-efficient, K = condition factor

Table 2: The Average, Maximum and Minimum Condition factors of *Clarias gariepinus* obtained from Ajiwa reservoir, Batagarawa local government Area, Katsina State

	Male		Female		Combined	
Ajiwa	Average	1.015	Average	1.033	Average	1.025
	Maximum	1.272	Maximum	2.776	Maximum	2.776
	Minimum	0.763	Minimum	0.191	Minimum	0.191

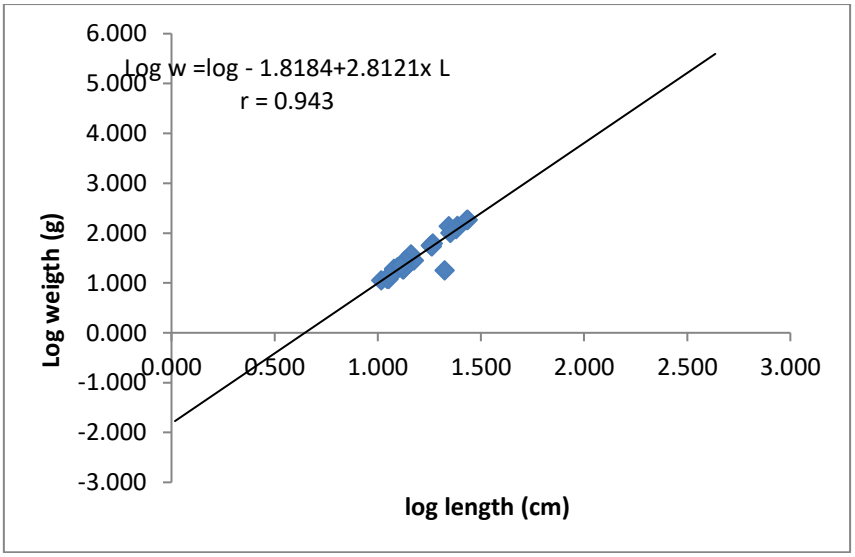

Fig.1 Length-weightrelationship Male of *Clarias gariepinus* obtained from Ajiwa reservoir

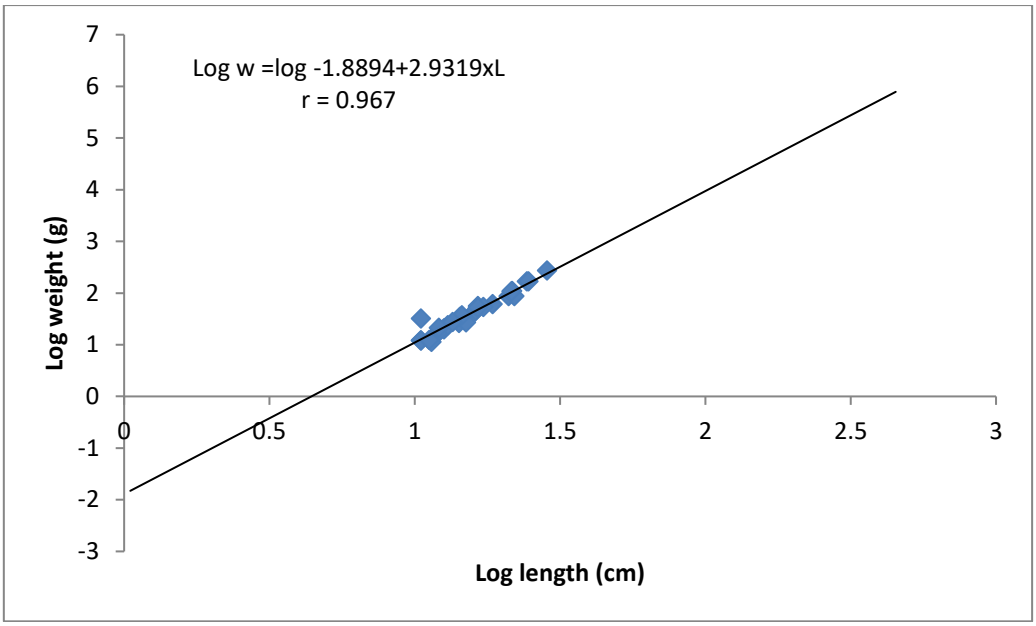

Fig.2 Length-weight relationship of Female *Clarias gariepinus* obtained from Ajiwa reservoir

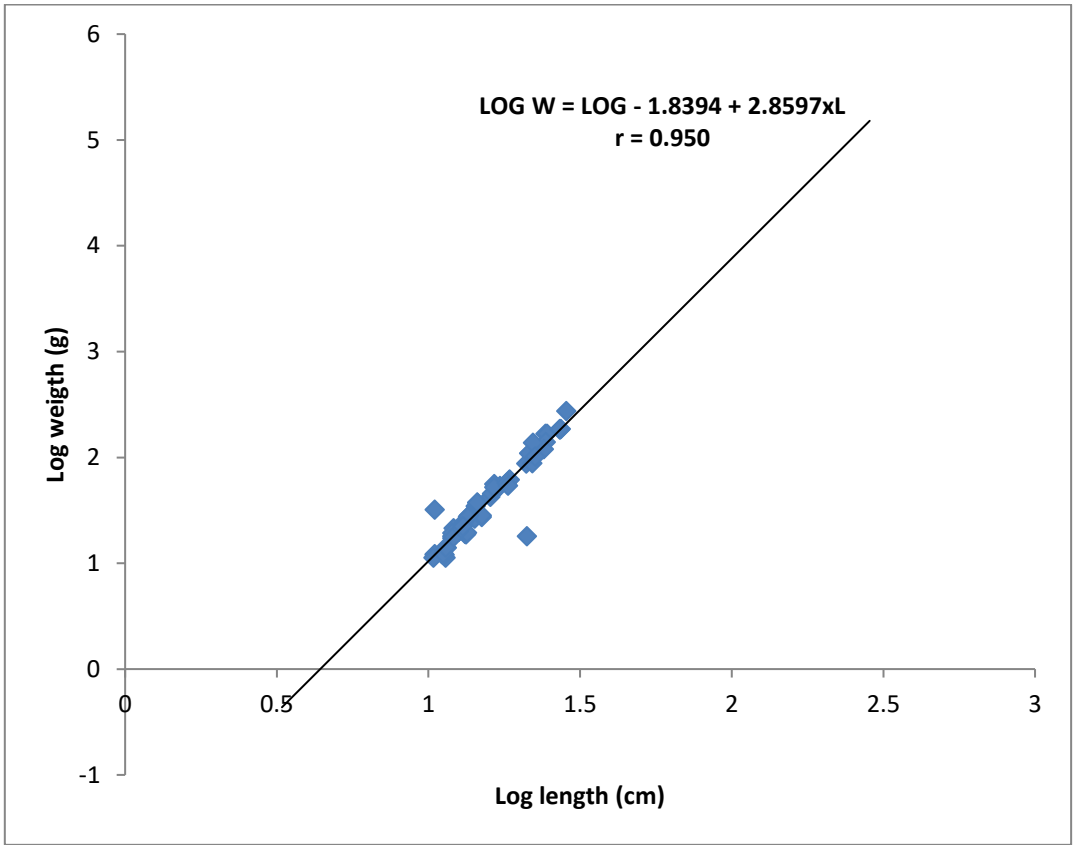

Fig.3 Length-weight relationship of Male and Female *Clarias gariepinus* obtained from Ajiwa reservoir

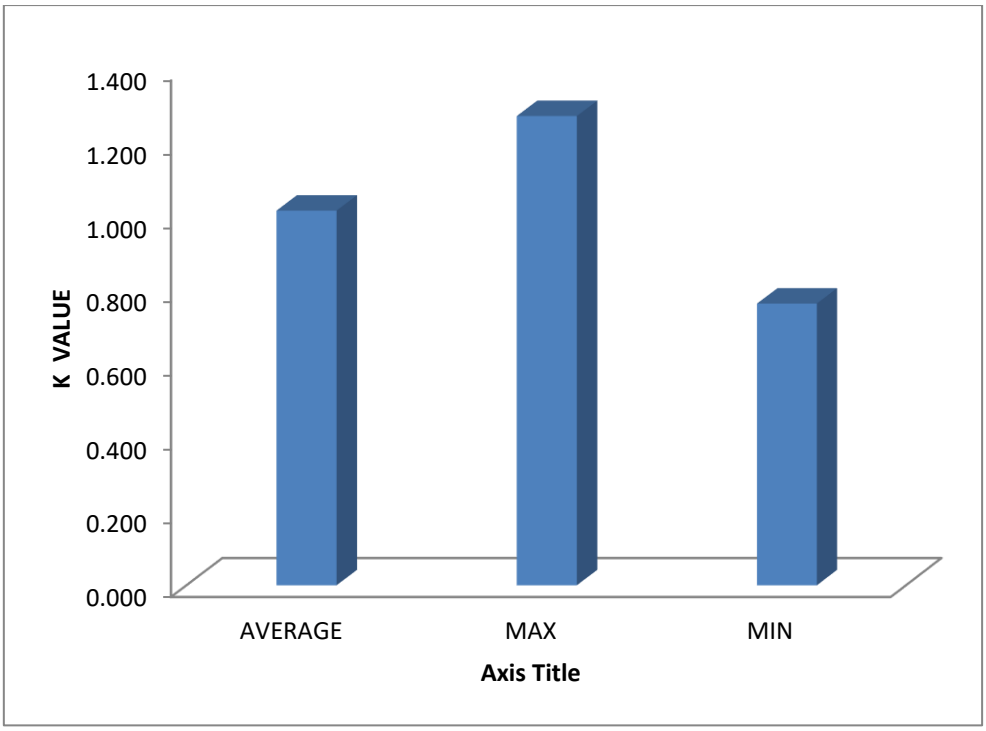

Fig 4. Condition factor of Male Clarias gariepinus obtained from Ajiwa reservoir, Batagarawa local government area, Katsina State

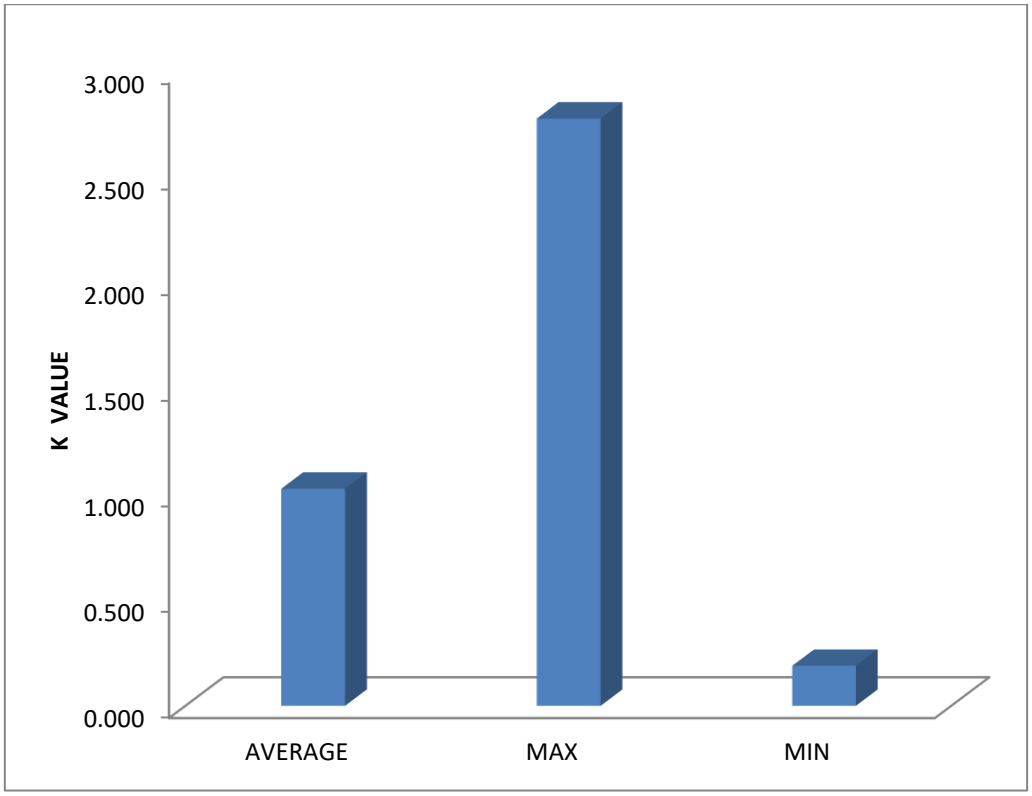

Fig 5. Condition factor of Female *Clarias gariepinus* obtained from Ajiwa reservoir, Batagarawa local government area, Katsina State

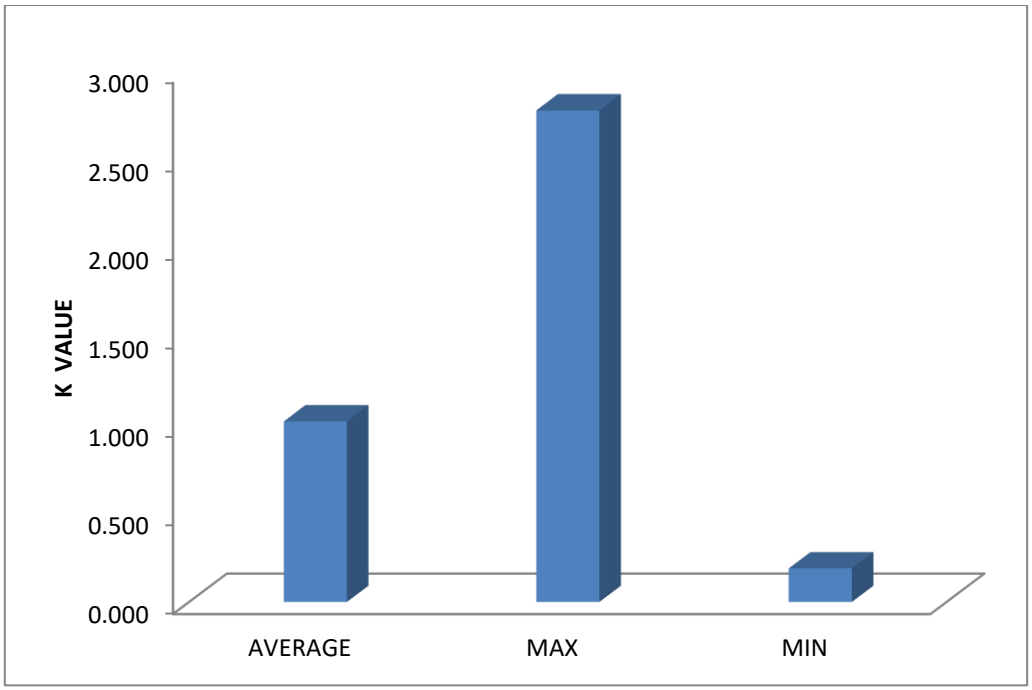

Fig .6 Condition factors of Male and Female *Clarias gariepinus* obtained from Ajiwa reservoir, Batagarawalocal government area, Katsina State

4. DISSCUSION

The long-term sustainability of fishing resources necessitates the effective regulation of all breeding processes. It also necessitates in-depth knowledge of demographic factors such as the length-weight relationship. This critical length-weight relationship allows for the determination of the mean weight of fish from a specific length group, exposes the well-being of individual fish, and defines the probable discrepancies between distinct unit stocks of the similar species [22]. The length-weight relationship of *Clarias gariepinus* caughtfrom Ajiwa Artificial lake exhibited an allometric pattern of growth.*Clarias gariepinus* "b" values were less than 3.0, indicating a negative allometric growth increase, which meant that the fish weight rose at a slower pace than the cube of the body length. This result is similar to the reports of [23] whose study showed that the b value of fish species from both Atbara River and Khashm el-Girba reservoir in Sudan were within the range of 2.278 and [24] who also recorded b value range of 2.5 to 4.0 for many fish species. Also the result recorded in this work is similar with the findings of [25]; [26];[27];[28] and [29] on some freshwater fishes of Nigeria. The length-weight relationships' b values govern the growth pattern of the fish species. Normally, the isometric value of b for an ideal fish that maintains dimensional equality would be 3.0. This value has only been observed on rare occasions. For a given length, an A, **b** value less than 3.0 indicates that the fish becomes lighter (negative allometric), whereas an A, **b** value larger than 3.0 indicates that the fish becomes heavier (positive allometric) [30].

When the "K" value is less than 1.0, the fish is considered to be in poor physiological condition; when the value is greater than 1.0, the fish is considered to be in good physiological health [1]. All fish species sampled in the current study had condition factors greater than one, and the "K" values obtained for male (1.01), female (1.03), and combined sex (1.02) samples met the criteria recommended by [1,] which states that a condition factor greater than one indicates a good level of feeding and appropriate environmental conditions. The condition variables "K" of the fish

species studied in this study were comparable to those found in other tropical water bodies.Condition factor (K) is a morphometric indicator that offers information on the physiological status of fish in their various environments in relation to their welfare. It is founded on the premise that fish with a faster growth rate are in better condition.[31] stated that fish with a poor condition index are likely to have had an unpleasant physical environment or inadequate nutrition. All of the fish species sampled in the current study had condition factors 1 and were within the normal ranges recommended by [32], who stated that condition factors greater or equal to one are good, indicating a good level of feeding and proper environmental condition. The condition factor "K" of the fish species studied in this study was comparable to those found in other tropical bodies of water. The condition factors "K" of freshwater fish species has been described [33; 34; 35]. In Nigeria, [36] reported K values ranging from 1.02-1.52 to 1.06-2.02. [37] found K values ranging from 0.93 to 3.40 in Wasai Reservoir in Kano, while [38] obtained a "K" value ranging from 0.91 to 8.46 in Lagos' Ologe Lagoon. However, [35] found a mean "K" value of 1.98 0.35 in Niger State's Kontagora Reservoir.

5. CONCLUSION

The results obtained on the *C. gariepinus* showed that they exhibited negative allometric growth. Similarly, the **K** values found shown that the fish samples were ingood situation. An important contribution of this study is the provision of base line data on the length-weight relationships and condition factors of *C. gariepinus* species in Ajiwa Reservoir. Therefore, the results of the present study can serve as baseline data for these species and for comparisons for future studies.

RECOMMENDATIONS

Finally, additional studies on physicochemical parameters of water, food abundance, length-weight relationship, and condition factor of other fish species, as well as stock assessments, are recommended to be conducted in Ajiwa artificial lake in order to provide extra important scientific proof. One notable strength of the study is its meticulous analysis of the length-weight relationship, providing a comprehensive overview of the growth patterns and body conditions of *Clarias gariepinus* in Ajiwa Reservoir. The utilization of these metrics is essential for assessing the health and sustainability of fish populations, which is crucial for both ecological conservation and fisheries management. Furthermore, the examination of the condition factor offers valuable information about the overall well-being of the fish population in the reservoir. Understanding the factors influencing the condition factor is imperative for making informed decisions regarding habitat conservation, water quality management, and sustainable fisheries practices. The implications of this research extend beyond academia and have practical applications for fisheries management and conservation efforts in Katsina State, Nigeria. I believe that the findings presented in this study have the potential to guide policymakers, environmentalists, and fisheries professionals in making informed decisions for the sustainable utilization and preservation of aquatic resources in the Ajiwa Reservoir. This research will be a valuable addition to the scientific literature and will contribute to the on-going efforts to understand and manage fish populations in Ajiwa Reservoir.

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