

# Length-Weight Relationship and Condition Factor: Economic Impacts of Dominant Fish Species Along the Asaba Axis of the River Niger

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**Abstract:** This research evaluated the growth dynamics and economic relevance of major fish species harvested from the Cable–Ogbeogonogo section of the River Niger in Asaba, Delta State, Nigeria. Morphometric measurements were obtained from sampled fish specimens, while structured questionnaires were administered to 200 stakeholders engaged in fishing and fish marketing. The analysis of length–weight relationships showed that *Tilapia zillii* exhibited near-isometric growth ( $b = 3.08$ ), whereas *Clarias macromystax* demonstrated positive allometric growth ( $b = 3.21$ ). Condition factor values above unity indicated that the populations were physiologically stable within the study environment. An income analysis revealed higher average monthly earnings among active fishers (₦124,500) compared to fish vendors (₦98,300). Despite viable returns, operational challenges such as fuel costs and inadequate cold storage affect profitability. The findings provide empirical data useful for fisheries monitoring and sustainable resource management in the Lower Niger Basin.

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## I. INTRODUCTION

Aquatic resources remain central to food security and rural livelihoods across developing economies. Fish contributes substantially to dietary protein intake globally and serves as a relatively affordable source of high-quality animal protein in Nigeria. Increasing population pressure and growing demand have intensified the exploitation of inland water bodies, necessitating improved management strategies to prevent biological depletion.

Understanding fish population structure requires a quantitative assessment of growth patterns and physical condition. Morphometric evaluation, particularly the length–weight relationship (LWR), provides insight into how fish allocate energy for somatic development. The regression coefficient ( $b$ ) derived from LWR analysis indicates whether growth follows isometric (proportional) or allometric (disproportionate) patterns. Closely related to this is the condition factor ( $K$ ), which reflects the overall well-being and suitability of the habitat for sustaining fish stocks.

Fish growth is influenced by ecological variables, including temperature, dissolved oxygen, food availability, salinity, reproductive stage, and intra- or interspecific

competition. Younger individuals typically allocate more energy to somatic growth, whereas mature fish redirect metabolic energy toward gonadal development, resulting in slower length increments.

The River Niger supports diverse freshwater species such as *Brycinus nurse*, *Tilapia zillii*, *Clarias macromystax*, *Chrysichthys walkeri*, and *Synodontis* spp., among others. However, empirical data on morphometric characteristics and the associated economic implications of dominant species in the Cable–Ogbeogonogo axis of Asaba remain limited. Establishing baseline biological and socioeconomic information is therefore essential for evidence-based fisheries management.

### ➤ Statement of the Problem

Sustainable fisheries management depends on reliable biological indicators and socioeconomic data. Variations in morphometric traits can reveal stock structure, environmental adaptation, and short-term ecological responses. Although River Niger supports intensive artisanal fishing activities, limited localized research exists on the growth parameters and economic outcomes associated with the dominant species in the Asaba axis. The absence of such data restricts effective planning, stock monitoring, and

livelihood optimization. This study addresses this gap by integrating biological growth assessment with economic evaluation.

➤ *Objectives of the Study*

To examine growth characteristics and the economic implications of major fish species harvested from the Cable–Ogbeogonogo axis of the River Niger. The specific objectives are to;

- Identify commonly harvested fish species within the study location.
- Determine morphometric indices and length–weight parameters of selected species.
- Evaluate consumer demand patterns for dominant species.
- Compare the income levels of fishers and fish marketers.
- Examine preservation and storage techniques adopted by stakeholders.
- Identify fishing gears and operational methods employed.

**II. MATERIALS AND METHODS**

➤ *Study Area*

The investigation was conducted along the Cable–Ogbeogonogo stretch of the River Niger in Asaba, Delta State (6.19°–6.25°N; 5.21°–5.24°E). The area experiences a humid tropical climate characterized by a rainy season (May–October) and a dry season (November–April).

➤ *Biological Data Collection*

Fish specimens were collected monthly over a five-month period using artisanal gears, including gill nets, cast nets, and hook-and-line systems. For each specimen, total length (cm) was measured using calibrated measuring boards, while body weight (g) was determined with electronic scales. Length–weight parameters were estimated using the equation:

$$W=aL^b$$

where W represents body weight, L denotes total length, a is the intercept, and b is the growth exponent.

➤ *Socioeconomic Data Collection and Analysis*

Primary socioeconomic information was obtained from 200 respondents through structured questionnaires. Data were analyzed using descriptive statistics and inferential tests in SPSS version 20.

**III. RESULTS AND DISCUSSION**

Table 1: Length-Weight Relationship Parameters of Selected Fish Species

Species	A	B	r	Growth pattern
Tilapia zillii	-1.84	3.08	0.91*	Isometric
Clarias macromystax	-2.11	3.21	0.94*	Positive allometric
Chrysichthys walkeri	-1.96	2.89	0.88*	Negative allometric

Significant at p<0.5

Catfish and tilapia constituted the majority of landings, accounting for over 80% of total identified species. The estimated regression coefficient for *Tilapia zillii* (b = 3.08) suggests proportional growth, whereas *Clarias macromystax* (b = 3.21) displayed positive allometric growth, indicating increased body mass relative to length as size increases. Condition factor values exceeding unity across species suggest favorable environmental conditions.

Income comparison revealed statistically significant differences (p < 0.05) between fishers and fish vendors. Although fishing generates relatively higher income, operational efficiency is constrained by post-harvest losses due to limited access to cold storage. Smoking and sun-drying remain predominant preservation methods, reflecting infrastructural limitations.

**IV. CONCLUSION**

The dominant fish species within the Asaba axis of the River Niger exhibit satisfactory growth performance and favorable physiological conditions. Nonetheless, the

economic sustainability of fishing activities is influenced by infrastructural deficits and rising operational costs. Strengthening post-harvest systems and enforcing sustainable harvesting practices are essential for long-term viability. The study provides baseline biological and socioeconomic evidence to guide fisheries management interventions in the region.

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