Journal of Experimental Research

MARCH 2024, Vol 12 No 1

Email: editorinchief.erjournal@gmail.com
editorialsecretary.erjournal@gmail.com

Received: January, 2024
Accepted for Publication: March, 2024

LENGTH-WEIGHT RELATIONSHIP, GROWTH RATE AND CONDITION FACTORS OF FISH SPECIES OF OGUN COASTER WATER, NIGERIA

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ABSTRACT

Sustainable exploitation of freshwater fish species for commercial value is sacrosanct for fishery to continuously play its role in Nigeria socio-economic growth and development. Five commercially available fish species (*Oreochromis niloticus, Elops saurus, Raiamas senegalensis, Hyperopisus bebe and Gobionellus oceanicus*) in Ogun coastal water, Iwopin, Ogun State, Nigeria were appraised for the length-weight relationship, growth rate and condition factors. Fifty samples of each fish species were collected from fishermen at the landing sites weekly between January and April, 2023. Length-weight indices showed *Elops saurus, H. niloticus* and *R. senegalensis*. Condition factor recorded in the fish species of *E. saurus*, *R senegalensis*, *H. bebe* and *G. oceanicus* were not significantly different to each other, but showed negative allometric growth. Conclusively, the study provided length-weight relationships for *Oreochromis niloticus, Elops saurus, Raiamas senegalensis, Monodactylus sebae and Gobionellus oceanicus* exhibited different growth patterns, and showed a strong association between length and weight of the fishes. Furthermore, the study will be useful for fishery biologist for sustainable fishery management.

Keywords: Allometric growth, Fish, *Oreochromis niloticus*, Total length

INTRODUCTION

The study of the biology of some fish species with preference to length-weight relationship (LWR) and condition factor (k) is an important aspect in fish biology. Growth is the change in absolute weight (energy content)or length of fish over time (Bake et al. 2013) and also as a function of fish size (Akombo and Araoye, 2011). Growth can be any changes in size or part of body, regardless of whether the change is positive or negative, temporary or long-lasting (Nordgarden et al. 2003). Abowei and George (2009) reported that Length-weight relationship (LWR) in fish is the growth index which is an important management tool used in estimating the average weight at a given length growth. LWR is of great importance in fishery assessments (Ayoade and Ikulala, 2007) which provides knowledge on the fish stock, age, life span, mortality, growth and reproduction (Kumar and Narayan, 2014).

Condition factor is the degree of well-being of the fish (Faradonbeh et al. 2015) in their habitat as coefficient of condition such as stress, sex, season, availability of feeds, water quality (Khallaf et al. 2003; Haruna et al. 2015) and as a useful index for monitoring physiological conditions and growth rates in fish (Ujjania et al.2012). Fisheries remain a reliable agricultural part that contributed significantly to the nation's Gross Domestic Product which can be measured and considered as fundamental components for human feeding and employment (Ricker, 2004).Studies on fish biology and ecology are important in fishery management and conservation (Atama e*t al.* 2013), while the difference and variability morphomeristic characters provide information on genetic improvement of fish species (Akombo and Araoye, 2011)for proper exploitation and management.

Various studies (Fafioye and Olubanjo, 2005;Abowei, 2007; Agboola and Anetekhai,

2008; Abowei, 2009; Kumolu-Johnson and Ndimele, 2010; Atama et al. 2013; Bolarinwa and Popoola, 2013; Fafioye et al. 2018; Osho and Usman, 2019; Oladunjoye et al. 2022) have been carried-out on the LWR and condition factors of fishes in Nigeria. However, scanty information exists on LWRs of different fish species in the Ogun State Coastal Water, which necessitate the study to assess the water viability through fish growth pattern and well-being. The results will assist in decision making and fisheries management and conservation. The aim of the research is to establish the length-weight relationship, growth rate and condition factor of *Oreochromis niloticus, Elops saurus, Raiamas senegalensis, Gobionellus oceanicus* and *Hyperopisus bebe* in Ogun Coastal Water, Iwopin, Ogun State, Nigeria.

MATERIALS AND METHODS

Description of Study Site

This study was carried out on Ogun Coastal Water, Iwopin, Ogun State, Southwest, Nigeria (Figure 1). It is situated between4° 23' 59.99" E and 6° 28' 59.99" N which was bounded in the East by Lekki Lagoon and South by Bight of Benin. The Lagoon covers an area of 26km^2 (Famoofo and Abdul, 2020). Fishing activities are carried out with motorised and non- motorized canoes which include gillnet, seine net, cast net, non-return valve trap sand brush park fish aggregator, bamboo trap among others. Hydrologically, the water body falls into the western littoral area with semi-diurnal offshore tides.

Samples Collection

Fifty (50) fish species were collected and rapidly labeled and packed in white plastic bucket containing ice blocks to prevent post-harvest spoilage. Total lengths (±0.01cm) of the fish species were taken from the tip of the snout (mouth closed) to the extended tip of the caudal fin using a measuring board in centimeters (cm). The body weights of the fish were measured with a top loading Metler balance as suggested by Fafioye and Olubanjo (2005) and Oladunjoye et al.(2022) and recorded to the nearest (±0.01) gram. The sex (male or female) of each of the sample was recorded for all the fish species by the presence of secondary sexual papillae located behind the anus.

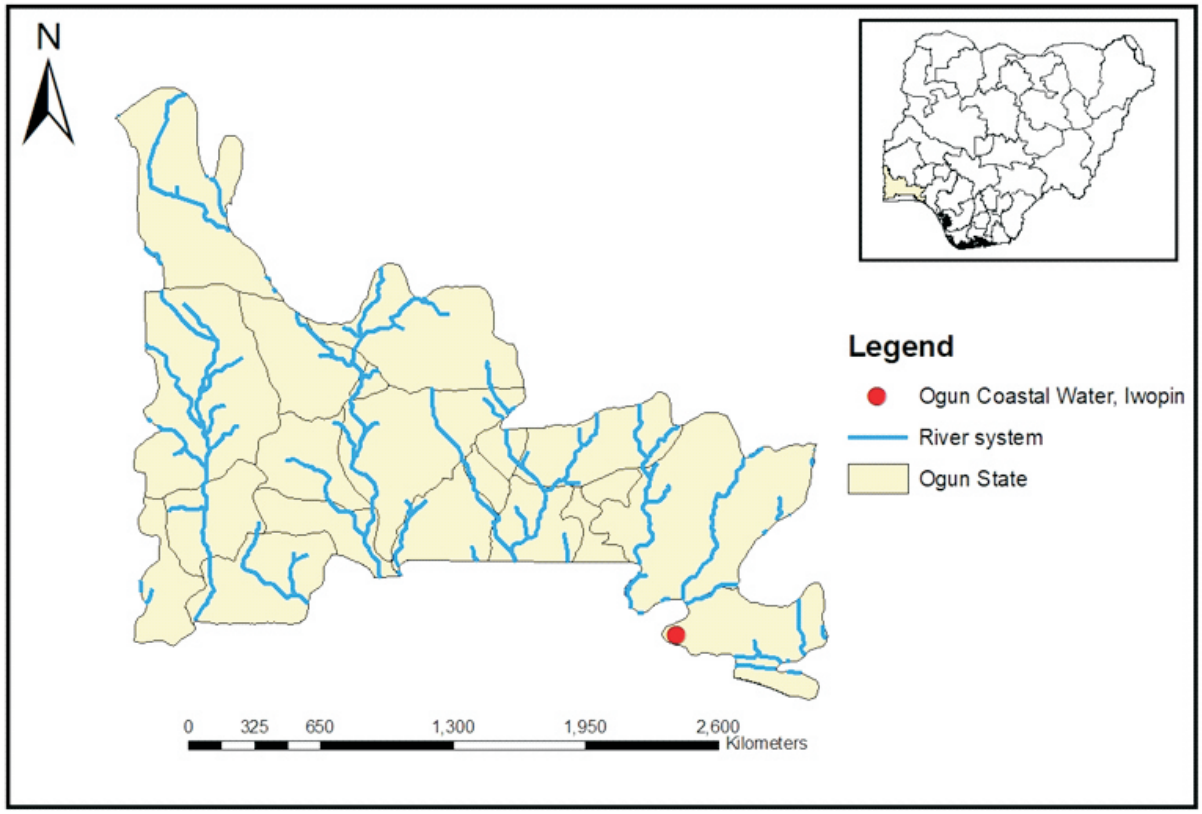

Figure 1: Map of Ogun Coastal Water, Iwopin, Ogun State, Nigeria

Determination of length-weight relationship, growth rate and condition factor

The LWR was estimated using the equation opined by Pauly (1983), Froese (1998) and Froese et al. (2019)

$W = aL^b$

Where; W -weight of fish in (g),
L - Total length (TL) of fish in (cm),
a –(constant) describe the rate of change of weight with length (intercept)
b - weight at unit length (slope).

The equation was log transformed to estimate the parameters 'a' and 'b' (Oliva-Paterna et al. 2009)

$\text{Log } W - \text{Log } a + b \text{ Log } L$

a and *b* values were obtained from a linear regression of the LWRs of fish. The squared correlation (r^2), which is the extent of reliability was computed. Meanwhile, the value of *b* gives information on the kind of growth pattern of fish: the growth is isometric if $b=3$ and allometric if $b \neq 3$. Therefore, if $b > 3$, it is positive allometric pattern or negative allometric if < 3 (Nehemia et al. 2012). The condition factor which shows the degree of well-being of the fish in their habitat was determined by using the equation, $K = 100W/ L^b$ (Gomiero and Braga, 2005). Where by K = condition factor; W = the weight of the fish in gram (g); L = the total length of the fish in centimeters (cm); and b = the value obtained from the length-weight equation.

Statistical Analysis

Data obtained were subjected to statistical analyses using SPSS version 20.0 (IBM Corp, 2011). Mean values of condition factors, body weight, total length and standard length were compared using ANOVA. Results were presented as Mean±Standard deviation, while Post-hoc tests were done using the Student-Newman-Keuls (SNK). P value less than 0.05 was considered to be statistically significant. The *b* value was estimated for each fish species and tested for significant difference from 3 at 95% confidence limit.

RESULTS

Length-weight relationship of *O. niloticus, E. saurus, R. senegalensis, G. oceanicus* and *H. bebe* fish species in Ogun Coastal Water, Iwopin, Ogun State is presented in Table1. Mean body weight was significantly higher in *O. niloticus* than the other fish species, while the total length and standard length were significantly higher in *H. bebe*. The length-weight relationship recorded in the *E. saurus* was strong (r = 0.550), but not significant (p = 0.15), while *O. niloticus, R. senegalensis, H. bebe* and *G. oceanicus* were very strong and significant (Table 1).

The condition factors of O. *niloticus, E. saurus, R. senegalensis, G. oceanicus and H. bebe* fish species in Ogun coastal water, Iwopin, Ogun state Nigeria is presented in Table 2. Condition factor was significantly higher in *O. niloticus* than other fish species, while *E. saurus, R. senegalensis, H. bebe* and *G. oceanicus* condition factors were not significantly different. The growth pattern and exponential equation of fish species in Ogun Coastal Water, Iwopin, Ogun State shows negative allometric growth type (Table 2).

Table 1: Length-weight relationship of fish species in Ogun Coastal Water, Ogun State, Nigeria

Fish Species	TL (cm)	SL (cm)	Weight (g)	A	b	R	R^2	p -value
Oreochromis niloticus	26.73±2.79^b	21.17±2.41^b	354.17±77.39^a	14.73	0.03	0.941	0.885	0.01*
Elops saurus	15.54±3.13^c	11.00±3.37^c	21.80±5.81^c	6.82	0.40	0.742	0.550	0.15
Raiamas senegalensis	13.80±3.42^c	11.06±2.62^c	18.20±3.77^c	2.29	0.88	0.974	0.948	0.01*
Hyperopisus bebe	36.20±1.15^a	30.94±1.20^a	245.00±80.64^b	32.84	0.01	0.962	0.925	0.01*
Gobionellus oceanicus	17.00±4.76^c	12.68±4.60^c	20.40±4.45^c	4.51	1.05	0.986	0.973	0.01*

^{abc}Means (±Standard deviation) in the same column having similar superscripts are not significantly different ($p > 0.05$)

Keys;
R^2 - Coefficient of determination
R - Correlation co-efficient
a - Rate of change of weight with length (intercept)
b - Weight at unit length (slope)

Table 2: Condition factor and growth pattern of fish species of Ogun Coastal Water, Ogun State

Fish Species	Condition factor	*b*	Growth Type	Exponential Equation
Oreochromis niloticus	1.85±0.25[a]	0.03	Negative Allometric	$Wt = 14.73(TL)^{0.04}$
Elops saurus	0.68±0.46[b]	0.40	Negative Allometric	$Wt = 6.92(TL)^{0.4}$
Raiamas senegalensis	0.82±0.43[b]	0.88	Negative Allometric	$Wt = 2.29(TL)^{0.88}$
Hyperopisus bebe	0.51±0.12[b]	0.01	Negative Allometric	$Wt = 32.84(TL)^{0.01}$
Gobionellus oceanicus	0.51±0.27[b]	1.05	Negative Allometric	$Wt = 4.51(TL)^{1.05}$

[abc]Means (±Standard deviation) in the same column having similar superscripts are not significantly different ($p > 0.05$)

Keys;
Wt - Body weight
TL - Total length
b - weight at unit length (slope)

DISCUSSION

The LWR of the fish species in Ogun coastal water are growth values which ranges from 0.01 - 1.05 and far below Fafioye and Olubanjo (2005) findings which document 2.790 and 2.880 for *Clarias garienpinus* in Epe Lagoon. However, the fishes show negative allometric growth pattern in line with Fafioye and Olubanjo (2005) and Oladunjoye et al. (2022) findings on *Clarias gariepinus* exposed to quarry particles. Meanwhile, the study did not conform to the reports of Abowei and Ezekiel (2013), Ezekiel and Abowei (2014), Olarenwaju et al. (2017) and Fafioye et al. (2018) which documented positive allometric growth pattern in fish species of different rivers.

These variations (*b* values) may be attributed to the ecological conditions of the habitats or variation in the physiology of fish in both sex and season (Hossain et al. 2006; 2009), feeding rate, gonad development and growth pattern (Hossain et al.2011). In addition, it can be as a result of differences in habitat (Oladunjoye et al. 2022), season (Ibrahim, 2012), stomach fullness, gonad maturity, sex, health and preservation techniques of the fish species (Oliva-Paterna et al. 2009; Sarkar and Sarkar, 2013). The use of length-weight relationship to determine the growth rate and condition factor is not limited to finfishes, rather, it applied to shellfishes (Kumari et al. 2013; Fafioye et al. 2018).

The LWR correlation value (0.742 - 0.986) obtained was far above what was reported by Fafioye *(*2009), while it correlates with Arimoro and Meye (2007) findings. Therefore, there is a strong correlation that exists between the length and weight of the fish species which was similar to Adeyemi (2010; 2011) report on fish species ofIdah, River Niger. The TL and weight observed was between 13.80±3.42 - 36.20±1.15 and 18.20±3.77 - 354.17±77 falls within and below the ranges documented by Olanrewaju et al.(2017) findings respectively.

The condition factor of the fish species of Ogun coastal water documented (0.51±12 - 1.85±0.25) was far below Olanrewaju et al. (2017) and Lawal (2019) reports which recorded 2.04±1.76 for *H. niloticus* and 1.97±1.98 for *R. senegalensis*. The results indicated that fish species

in the water are not doing well as opined and suggested by Ezekiel and Abowei (2013) and contrary to Abdul (2009) and Abowei et al. (2009) findings which might be due to the season, place of collection or environmental factors. Negative allometric growth pattern in fish species have been earlier reported in similar findings reported by Adeyemi et al.(2009) and Midhat et al. (2012).

Conclusively, the study provided information on the length-weight relationships of *Oreochromis niloticus, Elops saurus, Raiamas senegalensis, Hyperopisus bebe and Gobionellus oceanicus* which is baseline knowledge for fisheries sustainability and managements. Fish species of Ogun coastal water Nigeria are not in good condition which might affect fisheries resources and production. There is need for adequate provision or regulations on fishes of the river water to foster sustainable fisheries production and managements.

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