Greener Journal of Agricultural Sciences
ISSN: 2276-7770; ICV: 6.15
Vol. 6 (11), pp. 342-348, December 2016

http://gjournals.org/GJAS

Research Article (DOI: http://doi.org/10.15580/GJAS.2016.11.121916216)

Seasonal Variation in Length-Weight Relationship and Condition Factor of Five Fish Species from Kolo Creek, Niger Delta

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ARTICLE INFO

Article No.: *121916216*
DOI: *10.15580/GJAS.2016.11.121916216*

Submitted: *19/12/2016*
Accepted: *21/12/2016*
Published: *27/12/2016*

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Keywords:
Condition factor, Fisheries, Length-weigh relationship, Kolo creek

ABSTRACT

Weight-length relationship and condition factor of a fish is frequently used to evaluate the well-being of such fish in its environment. This study investigated the seasonal variation in length-weigh and condition factor of five important fish species from Kolo creek, Niger Delta region of Nigeria. The fish samples were obtained from the creek using different fishing gears with assistance of local fishermen. The length-weigh relationship and condition factor were computed following standard biometric methods. Results obtained showed that all the fish species showed negative allometric growth in both climatic regimes except *Tilapia guineensis* during the wet season. The condition factor ranged from 0.70 - 2.46 for both climatic condition. The condition factor fluctuates among the various seasons for each of the fish species. This suggests that the fish species adapt different at same environmental condition and can be influenced by seasons.

INTRODUCTION

Kolo Creek is one of the numerous creeks in the Niger Delta. Kolo creek is found in Ogbia Local government area of Bayelsa State. The creek bifurcates from the Orashi river. Several economic activities such as oil and gas are carried out in the area. According to Inengite *et al*. (2012), Kolo Creek has been urbanized and industrialized due to the quest for crude oil. Kolo creek is one the oldest flow station in the region. The creek transverse through several communities in the area including Imiringi, Otuasega and Oruma etc (Inengite *et al*., 2010). The creek is also a nursery and breeding ground for several fish species.

Due to the activities of human in the creek, its productivity, species distribution and abundance could be altered. Fisheries is an essential source of animal protein (Ineyougha *et al*., 2015; Izah and Angaye, 2015). Fish has high quality nutrients and vitamins. According to Raufu *et al*. (2009), fish contain high quality proteins, fats, vitamins, calcium, iron and essential amino acids. Fisheries are important in national food security (Nazeef and Abubakar, 2013) in many countries that has high inland coastal water ways.

Fisheries are obtained from the wild i.e. natural stock and pond (Izah and Angaye, 2016). Fish rearing is a major source of livelihood/ employment to several families (Izah and Angaye, 2016; Amiye and Erondu, 2010). According to Amiye and Erondu (2010), fish from the wild and its products are rich food for teaming people in developing countries especially in rural area that has natural aquatic ecosystem. Fish species in the wild are being threatened and many species are endangered as such their productivity in natural water ways has reduced (Angaye *et al*., 2015; Amiye and Erondu, 2010).

Risk of fish species going into extinction has necessitated the packaging of the management of fisheries mainly in the tropical region to ensure sustainable conservation of biodiversity and sustainable use of the fishery resource (Amiye and Erondu, 2010). As such, several biometric indices have been used to assess condition of a fish in its ecosystem including length-weight relationship and condition factor (Abowei, 2006, 2009, 2010; Abu and Agarin, 2016; Nehemia *et al*., 2012; Keyombe *et al*., 2015; Seiyaboh *et al*., 2013, 2016a,b; Onimisi and Ogbe, 2015; Atama *et al*., 2013; Mahmood *et al*., 2012).

According to Abu and Agarin (2016), Length - weight relationship and condition factor are important tool in fish biology studies. Length-weight relationship allows the conversion of growth-in-length equations to growth-in-weight in which a biometric model is used in the estimation of biomass from length and condition (Abu and Agarin, 2016; Kouamé *et al*., 2016). In the other hands, Condition factor is useful in assessing growth rate, age and feeding intensity and general well-being of fish (Abowei, 2006; Oribhabor *et al*., 2011; Abu and Agarin, 2016; Kumolu-Johnson and Ndimele, 2010; Onimisi and Ogbe, 2015). These fish condition indices can also be used to assess life cycle of fisheries (Iyabo *et al*., 2015) and relationship between the between biotic and abiotic factors in aquatic ecosystem (Lalrinsanga *et al*., 2012). Information about the weight-lenght relationship from Kolo creek is scares. Hence this study aimed at evaluating the length-weight relationship and condition factor of five important fish species from Kolo creek, Niger Delta region of Nigeria.

2.0 MATERIALS AND METHOD

2.1 Study Area

Kolo Creek is a narrow stream that bifurcates from the Orashi, in Rivers state and passes through several communities in Ogbia Local Government Area of Bayelsa State. Kolo creek is a major inland water ways emanating from a major river in the Niger Delta. The creek receives organic and chemical wastes arising from rapid industrialization cum high population, unhygienic habits (Aghoghovwia and Ohimain, 2014). Two predominant climatic conditions are observed in Kolo creek just as other locations in the Niger Delta. The climatic condition of the creek has been previously reported by Ogamba *et al*. (2015).

2.2. Fish Sampling

Fish sampling was carried out during the month of March (dry season) and September (wet season) in Kolo creek covering five communities including Kolo II, Kolo III, Elebele, Imiringi, and Otuasaga. Sampling were carried out using different fishing gears including hook, gill nets, bonga driftnets, cast nets and various types of traps and stakes. The five fish species studied were caught with the assistance of local fishermen in the area. The fishes were conveyed in thermos cool boxes to the laboratory on each sampling day. Fish specimens were identified using monograph descriptions, checklists and keys (Boseman, 1963; Reed *et. al.,* 1967; Holden and Reed, 1972; Poll, 1974; Whyte, 1975; Jiri, 1976; Reed & Sydenham, 1978; Otobo, 1981; Alfred Ockiya, 1983; Whitehead, 1984; Loveque *et al.,* 1991). The total length of each fish was measured from the anterior tip of the fish to the caudal fin using the metre rule calibrated in centimeter. Fish weight was obtained after drilling water from the buccal cavity and blot drying with a dry piece of clean hand towel, weighing was done in a table top weighing balance to the nearest grams (Seiyaboh *et al*., 2013, 2016a,b)

2.3. Length Weight Relationship

The relationship between the length (L) and weight (W) of the various fish species were expressed by the exponential equation (Pauly, 1983):

$W=aL^b$ (Eqn. 1)

Where

W=Weight of fish in (g)
L= Total Lenght of fish in (cm)
a= Constant (intercept)
b= The Length exponent (Slope)

The "a" and "b" values were obtained from a linear regression of the length and weight of fish. When b is equal to three (3), isometric pattern of growth occurs but when b is not equal to 3, allometric pattern of growth occurs, which may be positive if >3 or negative if <3 (Nehemia *et al*., 2012; Keyombes *et al*., 2015; Seiyaboh *et al*., 2016a, b). The correlation (r) that is the degree of association between the length and weight was computed from the linear regression analysis.

2.4 Condition Factor

The condition factor (K) of the experimental fish was estimated from the relationship:

$K=100W/L^3$ (Eqn. 2)

Where;

K= Condition Factor
W= Weight of Fish (g)
L= Length of Fish (cm)

2.5 Analysis of Experimental Data

Regression and Correlation Analysis (RECA) for linear regression of length and weight of fish, Microsoft Excel (2014) for computation of means and standard deviation; Statistical Package for Social Sciences (SPSS) and FISAT (Gayando and Pauly, 1997) for descriptive statistics, length-weight relationship and condition factor of fish.

3.0 RESULTS AND DISCUSSION

The length-weight relationship of five fish species under study from Kolo creek for dry and wet season is presented in Table 1. The length-weight relationship "b" value in the dry season ranged from 0.546 (*Synodontis ocellifer*) to 2.516 (*Tilapia guineensis*) while in wet season the "b" value ranged from 0.761 (*Polypterus senegalus*) to 3.328 (*Tilapia guineensis*). The regression trend indicate that in the dry season, all fish species exhibit negative allometric growth pattern, with length exponent "b" value range from 0.546 (*Synodontis ocellifer*) to 2.516 (*Tilapia ocellifer*). In the wet season all fish species exhibit negative allometric growth pattern with length exponent "b" value range from 0.761 (*Polypterus senegalus*) to 2.817 (*Synodontis ocellifer*), except *Tilapia guineensis* which exhibit positive allometric growth pattern in the wet season with length exponent "b" value ranged 3.328.

Length-weight regression equation, correlation coefficient (r), coefficient of determination (r^2), and significance of correlation showing the various fish species for dry and wet season is presented in Table 2. In the dry season, the correlation coefficient "r" value range from0.374 (*Hepssetus odoe)* to 0.610 (*Polypterus senengalus*) while in the wet season the "r" value ranged from 0.413 (*Polypterus senegalus*) to 0.935 (*Hepssetus Odoe*). All the fish species under both climatic regimes is <3 apart from *Tilapia guineensis* during wet season. This is an indication that most fish species in Kolo creek has negative allometric pattern of growth. This trend have been variously reported in different fish species in surface water in Nigeria including 20 fish species from Ologe lagoon (Kumolu-Johnson and Ndimele, 2010), 8 fish species from River Okura (Onimisi and Ogbe, 2015), 5 fish species from Lower Usuma Reservoir in Abuja (Dan-Kishiya, 2013), *Auchenoglanis occidentalis* from Lake Akata (Ikongbeh *et al*., 2013). Negative allometric growth could be due to variation in water quality parameters (salinity, temperature, etc), maturing, age, sex and organ development. Changes in water quality parameters can be influenced by the nature of anthropogenic activities in the creek and season.

Table 1: Length-Weight Relationship of Various Fish Species in Kolo Creek

Species	Season	Tot.	Length Range	Min.	Max.	Mean±S.E	Weight Range	Min.	Max.	Mean±S.E	`a	b	R	r^2	Growth Pattern
Hepssetus odoe	Dry	100	19.01	10.00	29.01	14.79±0.40	128.99	1.01	130.00	52.49±2.38	0.488	1.014	0.374	0.140	NA
	Wet	100	19.50	10.00	29.50	17.76±0.44	189.00	31.00	220.00	83.60±2.78	0.246	1.336	0.935	0.874	NA
Tilapia guineensis	Dry	100	3.50	10.00	13.50	11.47±0.12	32.90	21.00	53.90	33.20±1.82	0.855	2.516	0.518	0.268	NA
	Wet	100	4.50	10.00	14.50	11.59±0.09	33.71	20.19	53.90	39.04±1.34	0.506	3.328	0.655	0.429	PA
Protopterus annectens	Dry	100	22.50	12.00	34.50	22.83±0.42	856.93	43.07	900.00	115.15±9.07	0.570	1.065	0.491	0.241	NA
	Wet	100	21.99	12.01	34.00	22.76±0.50	270.00	30.00	300.00	103.49±6.12	0.077	1.395	0.623	0.388	NA
Polypterus senegalus	Dry	100	18.45	12.05	30.50	24.93±0.40	114.80	40.20	155.00	103.23±2.80	0.496	1.077	0.610	0.372	NA
	Wet	100	12.95	17.06	30.00	25.89±0.49	106.00	50.50	156.50	112.12±3.68	0.965	0.761	0.413	0.170	NA
Synodontis ocellifer	Dry	100	13.60	9.00	14.50	13.95±1.36	50.00	16.00	66.00	32.62±1.43	0.864	0.546	0.485	0.235	NA
	Wet	100	7.00	9.50	16.50	12.72±0.19	43.00	16.00	59.00	36.37±1.56	0.632	2.817	0.921	0.848	NA

Table 2: Length – Weight Regression Equation, Correlation Coefficient (r), Coefficient of Determination (r^2) and Significance of Correlation for Various Fish Species in Kolo Creek

Fish Species	Season	Regression Equation	R	r^2	Significance of Correlation
Hepssetus odoe	Dry	LogW=0.488+1.014LogL	0.374	0.140	P<0.05; t=3.99, df=99
	Wet	LogW=0.246+1.336LogL	0.935	0.874	P<0.05; t=26.03, df=99
Tilapia guineensis	Dry	LogW=0.855+2.516LogL	0.518	0.268	P<0.05; t=3.92, df=99
	Wet	LogW=0.506+3.328LogL	0.655	0.429	P<0.05; t=8.58, df=99
Protopterus annectens	Dry	LogW=0.570+1.065LogL	0.491	0.242	P<0.05; t=5.58, df=99
	Wet	LogW=0.077+1.395LogL	0.623	0.388	P<0.05; t=7.88, df=99
Polypterus senegalus	Dry	LogW=0.496+1.077LogL	0.610	0.372	P<0.05; t=7.63, df=99
	Wet	LogW=0.965+0.761LogL	0.413	0.170	P<0.05; t=3.07, df=99
Synodontis ocellifer	Dry	LogW=0.864+0.546LogL	0.485	0.235	P<0.05; t=5.49, df=99
	Wet	LogW=0.633+2.817LogL	0.921	0.848	P<0.05; t=23.40, df=99

The condition factor of various fish species in Kolo creek showing the value for both dry and wet season is presented in Figure 1. During the dry season the mean condition factor ranged from 0.74 (*Polypterus senengalus*) to 2.17 (*Tilapia guineensis*), while in the wet season, the mean condition factor value ranged from 0.70 (*Polypterus senegalus*) to 2.46 (*Tilapia guineensis*). Jan and Ahmed (2016), De Giosa *et al*. (2014) reported that variation in condition factor of fish under two climatic condition (season) could be associated to low feeding intensity and degeneration of ovaries during winter (wet season) and high feeding intensity and full development of gonads during summer (dry season). The findings of this study also suggest that species have different adaptation strategies. This could be the reason why there is fluctuations in condition factor of fish species studied under the different climatic condition. The findings of this study has some similarity with the findings of other authors in different surface water bodies including Nkoro River (Abowei, 2006; 2009), New Calabar River (Abu and Agarin, 2016), river Benue (Akombo *et al*., 2014), Lake Akata (Ikongbeh *et al*., 2013), Ologe Lagoon (Kumolu-Johnson and Ndimele, 2010), Dadin Kowa Dam (Nazeef and Abubakar, 2013), Odi River (Ogamba *et al*., 2014), River Okura (Onimisi and Ogbe, 2015), Sangana river (Seiyaboh *et al*., 2016), Brass river (Seiyaboh *et al*., 2016), Igbedi creek (Seiyaboh *et al*., 2013). The variation could be due to differences in fish species, sex, age and water quality parameters. Typically surface water is frequently affected by wastes discharged into the water and/ or effect of runoff resulting from rainfall.

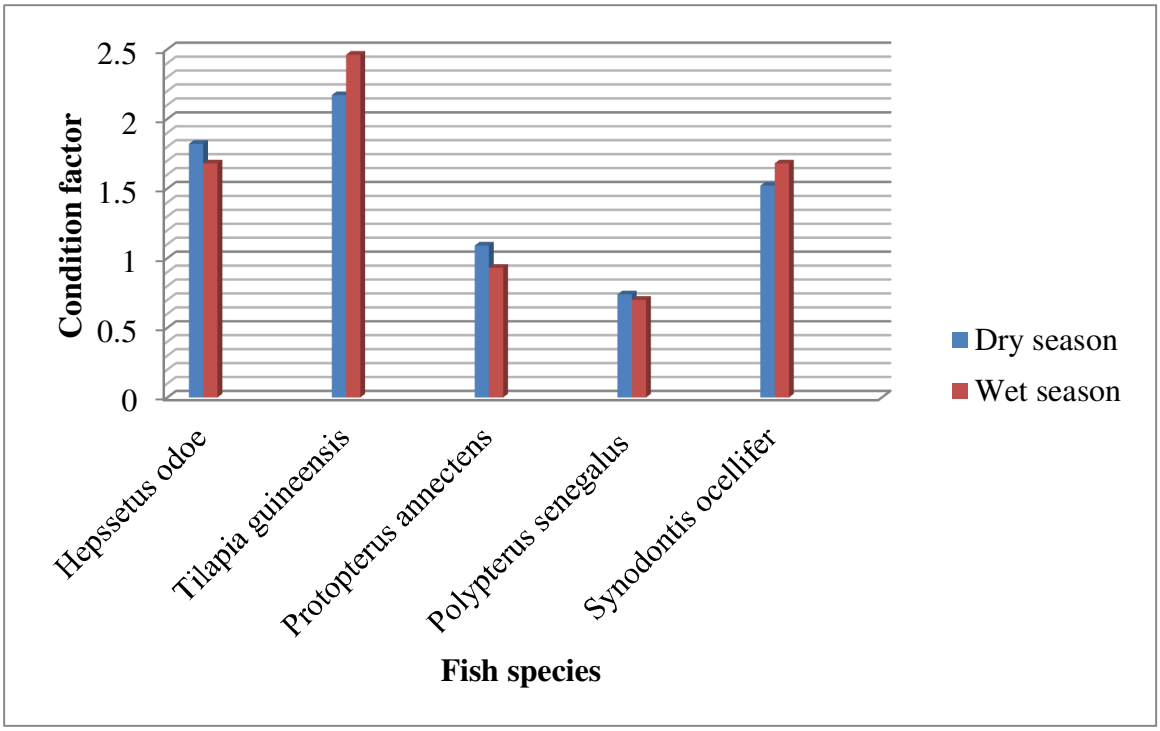

Figure 1: Condition factor of some selected fish species from Kolo creek, Niger Delta

4.0 CONCLUSION

In conclusion the length-weight relationship and condition factor give an insight of conditions of a fish in its environment. This study assessed seasonal variation in five important fish species from Kolo creek. The study found that most fish species exhibited negative allometric growth condition apart from *Tilapia guineensis* which exhibit positive allometric growth pattern during the wet season. *Hepssetus odoe, Tilapia guineensis* and *Synodontis ocellifer* had condition factor greater than 1, while *Polypterus senegalus senegalus* has condition factor <1. The length-weigh relationship suggests the fish species could be affected by anthropogenic activities in the area.

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Cite this Article: Seiyaboh EI, Izah SC and Okogbue BC (2016). Seasonal Variation in Length-Weight Relationship and Condition Factor of Five Fish Species from Kolo Creek, Niger Delta. Greener Journal of Agricultural Sciences, 6(11): 342-348, http://doi.org/10.15580/GJAS.2016.11.121916216.