ORIGINAL RESEARCH

Length-Weight Relationship and Condition Factor of Five Fish Species from River Brass, Niger Delta

Enetimi Idah SEIYABOH[1], Gijo Ayibapreye HARRY[1], Sylvester Chibueze IZAH[1]*
[1]Department of Biological Sciences, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.
*Corresponding Author email: chivestizah@gmail.com

ABSTRACT
This study evaluated the length-weigh and condition factor of five species of fish from Brass River. The fish samples were obtained from the river using different fishing gears. The length-weigh relationship and condition factor were determined using known biometric methods. Results obtained showed that length-weight regression trend of the five fish species exhibited negative allometric growth with length exponent (b) ranging from 0.971 (*Polydactylus quadrifilis*) to 1.743 (*Mugil cephalus*) for dry season and 0.661 (*Mugil cephalus*) to 1.054(*Micropoganias undulatus*) for wet season. The mean condition factor for dry and wet season of fishes from Brass River was 0.58 and 0.65 respectively (*Pomadasys Peroteti*), 0.65 and 0.70 respectively (*Micropogonias undulates*), 0.60 and 0.88 respectively (*Mugil cephalus*), 0.61 and 0.65 respectively (*Polydactylus quadrifilis*) and 0.49 and 0.68 respectively (*Caranx latus*). Hence, seasons affect condition factor of fish from Brass River.

KEY WORDS: *Condition factor, Fisheries, Length-weigh relationship.*

Introduction

Fish plays an important role in the development of a nation (Ndiaye *et al.*, 2015). According to Atama *et al.* (2013), inland open water fishery resources play a significant role in the economy, culture, tradition and food habits of the people of a nation. As such information about the biology and ecology of fish are essential to improve fishery management and conservation (Atama *et al.*, 2013). Fish are found in the aquatic ecosystem, which is frequently contaminated by anthropogenic peculiar to the region and to lower extent by natural effect (Izah and Angaye, 2016) including pesticides (Inyang *et al.*, 2016a,b), effluents from oil palm processing (Izah *et al.*, 2016), cassava processing, pharmaceutical and oil and gas industry. Typically the effluents are products of by-products of economic development and technological advancement (Chandel and Tank, 2016).

Environmental degradation has impact on the organism found in such environment. In aquatic ecosystem in could reduce growth rates and will cause a decrease in the average age of the fish (Samat *et al.*, 2008), cause alteration in fish toxicological indices (Inyang *et al.*, 2016a,b). Furthermore, the interactions between environmental changes and growth rates for of organisms are believed to be complex as such well difficult to explain (Samat *et al.*, 2008).

Several indices are used in assessing the condition of a fish with regard to factors that affect their distribution and abundance, alteration in food, spawning and breeding grounds. Some common indices used to assess fish status is the length-weight, length-length relationship, growth factor and condition factor (King, 2007; Mahmood *et al.*, 2012).

These indices require biometrics relationship to show the status of the fish life in a given ecosystem.

Understanding the quantitative aspects such as length-weight relationship is vital in studying fish biology (Nehemia *et al.*, 2012). According to Musa *et al.* (2016), Length in fish science is used to assess biomass from underwater length observations. It is also vital in parameter zing yield equations and in estimations of stock size (Musa *et al.*, 2016). In length-weigh relationship, fisheries can attain either isometric or allometric, which can either be positive or negative (Nehemia *et al.*, 2012). Isometric growth is associated with no change of body shape as an organism (Nehemia *et al.*, 2012).

Condition factor is essential in understanding the life cycle of fish species and it also contribute to adequate management of the species (Iyabo, 2015). Also condition factor reflect the interactions between biotic and abiotic factors in the physiological condition of the fishes (Lalrinsanga *et al.*, 2012). Condition factor is also a useful index for monitoring of feeding intensity, age, and growth rates in fish (Musa *et al.*, 2016). In fish, the condition factor reflects information on the physiological state of the fish in relation to its welfare (Atama *et al.*, 2013). The condition factor which show the level of well-being of the fish in their habitat is expressed by 'coefficient of condition' also known as length – weight factor (Nehemia *et al.*, 2012). When condition factor value is higher it means that the fish has attained a better condition (Nehemia *et al.*, 2012).

Length-weight relationship of a fish is vital fishery management tool (Abowei, 2010; Lalrinsanga *et al.*, 2012; Ndiaye *et al.*, 2015; Mahmood *et al.*, 2012). This is because a change in length and weight tells about the age of this fish, the data can be used to estimate the mortality rate, and assess the sustaining power of the fishery stock (Samat *et al.*, 2008).

The environment of aquaculture is multifaceted; as such management of the water and sediment quality is an important fisheries science. This is because the environment condition affects the fish body condition, growth performance and yield (Nehemia *et al.*, 2012). Hence this study aimed as assessing the weight-length relationship of five commonly consumed fish from River Brass.

Materials and Methods

Study Area

The Brass River is one of major rivers in Brass River in Brass Local Government Area of Bayelsa State Nigeria. The river stretches from Nembe creek into the Atlantic Ocean and has many adjoining tributaries and creeks. The shore line of Brass River is characterized by soft-dark mud flats, usually exposed during low ride, mangrove swamps with mangrove trees.

Fish Sampling

Fish sampling was carried out during the month of March to September where different fish specimens were obtained from fishers using hook, gill nets, bonga driftnets, cast nets and various types of traps and stakes. And 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.

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):

$$W = aL^b \qquad \text{(Eqn. 1)}$$

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). The correlation (r) that is the degree of association between the length and weight was computed from the linear regression analysis.

Condition Factor

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

$$K=100W/L^3 \qquad \text{(Eqn. 2)}$$

Where;

K= Condition Factor

W= Weight of Fish (g)

L= Length of Fish (cm)

Analysis of Experimental Data

The following statistical tools were used to analyzed the data obtained; Regression and Correlation Analysis (RECA) for linear regression of length and weight of fish Microsoft Excel (2010) for computation of means and standard deviation; statistical package for social sciences (SPSS) and FISAT (Gayando and Pauly, 1997) for description statistics, length-weight relationship and condition factor of fish.

Results and Discussion

The length-weight relationship of various fish species in Brass River for both Dry and Wet Season is presented in Table 1. The length-weight relationship was determined following log-log transformation. The length-weight regression equation, correlation coefficient (r), coefficient of determination (r^2) and significance of correlation for various fish species for both Dry and Wet Seasons in Brass River are shown in Table 2. The regression trend indicated that in Brass River, all fish species exhibited negative allometric weight growth with length exponent (b) ranging from 0.971 (*Polydactylus quadrifilis*) to 1.743 (*Mugil cephalus*) for Dry season, and the length exponent "b" for Wet season ranges from 0.661 for (*Mugil cephalus*) to 1.054 for (*Micropoganias undulatus*). High correlation coefficient "b" value has also been reported by different authors in various fish species from different water bodies (Ginah, 2007; Hart and Abowei, 2007).

The mean condition factor for dry and wet season of some fishes from Brass river was 0.58 and 0.65 respectively (*Pomadasys Peroteti*), 0.65 and 0.70 respectively (*Micropogonias undulates*), 0.60 and 0.88 respectively (*Mugil cephalus*), 0.61 and 0.65 respectively (*Polydactylus quadrifilis*) and 0.49 and 0.68 respectively (*Caranx latus*) (Table 3). The condition factor reported in this study is lower than the report of other authors in different fish species. Iyabo (2015) reported overall mean condition factor of *Chrysichthys nigrodigitatus* in Ebonyi River as 1.21. Abowei (2010) reported condition factor of 0.999 in *Ilisha africana* from Nkoro River in the Niger Delta area of Nigeria between January-December 2008. Atama *et al.* (2013) reported condition factor of condition factor of six cichlid fish species including *Chromidotilapia guntheri* (2.68), *Hemichromis bimaculatus* (1.75), Tilapia zillii (2.47), *Hemichromis fasciatus* (1.79), *Tilapia mariae* (1.76), and *Oreochromis niloticus* (1.93) inhabiting River Anambra. But higher than the condition factor of 0.043 – 0.081 for male and 0.0021 – 0.119 for female *Oreochromis niloticus* from Shirmu lake, Hungu, Kano state, Nigeria.

The correlation factor in this study is close to 0.930 reported by Iyabo (2015). High positive correlation coefficient and significant (p <0.05) suggests that the species lengths and weights were growing proportionally (Iyabo, 2015). The fish samples showed negative allometric. The trend have been reported in fish samples from different surface water in Nigeria including river Anambra (Atama *et al.*, 2013), Nkoro River (Abowei, 2010), river Igbedi (Seiyaboh *et al.*, 2013).

The variation in condition factor of fisheries in different location among different species could be attributed to the sediment and water quality. The quality of a river depends on the drainage structure and are affected by runoff resulted from precipitation and wastes discharged into the water especially in communities aligning surface water in the Niger Delta. Thus, variation in river quality (water and sediment) could affect migration and feeding pattern in fisheries. Abowei (2010) reported that variation in condition factor of a fish between two or more location of same species could be associated to differences in fishing and industrial activities in the different rivers. According to Atama *et al.* (2013), temporal variations in condition factor recorded this study was influenced by many biotic and abiotic factors such as phytoplankton abundance, predation, water temperature and dissolve oxygen concentrations among others which may not favour the survival of all the species in the ecosystem. Furthermore, Samat *et al.* (2008) reported that the size attained by the individual fish may also vary because of variations in food supply, and these in turn may reflect variations in climatic parameters and in the supply of nutrients or in the degree of competition for food.

Table 1: Length-Weight Relationship of Various Fish Species in Brass River

Species	Season	Tot.	Range	Min.	Max.	Mean±S.E	Range	Min.	Max.	Mean±S.E	`a	b	r	r²	Growth Pattern
Pomadasys Peroteti	Dry	100	21.00	11.00	32.00	17.19±0.49	32.00	12.00	44.00	24.24±0.74	0.146	0.999	0.874	0.764	NA
	Wet	100	22.00	10.00	32.00	17.54±0.53	32.00	13.00	45.00	27.40±0.89	0.186	1.002	0.871	0.759	NA
Micropogonias undulatus	Dry	100	10.50	10.00	20.50	15.28±0.26	18.00	12.00	30.00	20.84±0.39	0.000	1.000	1.000	1.000	NA
	Wet	100	15.00	10.00	25.00	16.38±0.46	27.00	15.00	42.00	24.92±0.82	0.111	1.054	0.895	0.800	NA
Mugil cephalus	Dry	100	10.00	10.00	20.00	14.96±0.29	26.00	6.00	32.00	19.12±0.62	0.779	1.743	0.926	0.858	NA
	Wet	100	17.00	10.00`	27.00	16.06±0.41	22.00	20.00	42.00	27.88±0.59	0.647	0.661	0.799	0.638	NA
Polydactylus quadrifilis	Dry	100	10.30	10.00	20.30	15.71±0.33	19.00	11.00	30.00	20.16±0.53	0.138	0.971	0.834	0.696	NA
	Dry	100	14.00	11.00	25.00	17.16±0.32	20.00	20.00	40.00	29.58±0.62	0.276	0.966	0.848	0,719	NA
Caranx latus	Dry	100	18.00	10.00	28.00	16.81±0.41	27.00	7.00	34.00	20.24±0.60	0.118	1.157	0.858	0.735	NA
	Wet	100	15.00	10.00	25.00	17.10±0.40	27.00	18.00	45.00	28.04±0.66	0.422	0.830	0.825	0.681	NA

Table 2: Length – Weight Regression Equation, Correlation Coefficient (r), Coefficient of Determination (r²) and Significance of Correlation for Various Fish Species in Brass River

Fish Species	Season	Regression Equation	R	r²	Significance of Correlation
Pomadasys peroteti	Dry	LogW=0.146+0.999LogL	0.874	0.764	P<0.05; t=17.80, df=99
	Wet	LogW=0.186+1.002LogL	0.871	0.759	
					P<0.05; t=17.56, df=99
Micropogonias undulates	Dry	LogW=0.000+1.000LogL	1.000	1.000	P<0.05; t=0.00, df=99
	Wet	LogW=0.111+1.054LogL	0.895	0.800	P<0.05; t=19.82, df=99
Mugil cephalus	Dry	LogW=0.0779+1.743LogL	0.926	0.858	P<0.05; t=24.35, df=99
	Dry	LogW=0.647+0.661LogL	0.799	0.638	P<0.05; t=13.14, df=99
Polydactylus quadrifilis	Dry	LogW=0.138+0.971LogL	0.834	0.696	P<0.05; t=14.91, df=99
	Wet	LogW=0.276+0.966LogL	0.848	0.719	P<0.05; t=15.85, df=99
Caranx latus	Dry	LogW=0.118+1.157LogL	0.858	0.735	P<0.05; t=18.50, df=99
	Wet	LogW=0.422+0.830LogL	0.825	0.681	P<0.05; t=1447, df=99

Table 3: Condition Factor of Various Fish Species in Brass River

Species	Season	Total No	Range	Min.	Max.	Mean±S.E
Pomadasys Peroteti	Dry	100	1.04	0.13	1.18	0.58±0.03
	Wet	100	1.59	0.14	1.73	0.65±0.04
Micropogonias undulatus	Dry	100	1.16	0.34	1.50	0.65±0.03
	Wet	100	1.50	0.20	1.70	0.70±0.04
Mugil cephalus	Dry	100	0.82	0.38	1.20	0.60±0.02
	Wet	100	1.96	0.21	2.16	0.88±0.06
Polydactylus quadrifilis	Dry	100	1.24	0.26	1.50	0.61±0.03
	Wet	100	1.28	0.22	1.50	0.65±0.03
Caranx latus	Dry	100	0.70	0.15	0.85	0.49±0.02
	Wet	100	1.78	0.22	2.00	0.68±0.04

Conclusion

This study investigated the length-weigh relationship and condition factor of five fish species from Brass river, Niger Delta, Nigeria. The study found that *Pomadasys Peroteti, Micropogonias undulates, Mugil cephalus, Polydactylus quadrifilis* and *Caranx latus* have negative allometric pattern of growth. The condition factor were in the ranged of 0.49 – 0.65 and 0.65 – 0.88 for dry and wet season respectively. As such season could affect the condition factor and weight-length relationship of a fish.

References

Abowei, J.F.N. (2010). The Condition Factor, Length – Weight Relationship and Abundance of Ilisha africana (Block, 1795) from Nkoro River Niger Delta, Nigeria. *Advance Journal of Food Science and Technology, 2*(1): 6-11.

Alfred-Ockiya, J. F. (1983) Field characteristics of some common fresh water fishes of the Niger \ Delta, Nigeria. Department paper. No. 3. 36pp.

Atama C.I., Okeke O.C., Ekeh F.N., Ezenwaji N.E., Onah I.E., Ivoke N., Onoja U.S. and eyo J.E. (2013.) Length-Weight Relationship and Condition Factor of Six Cichlid (Cichilidae: Perciformis) Species of Anambra River, Nigeria. *Journal of Fisheries and Aquaculture*, 4(2): 82-86.

Boseman, M. (1963) Annotated list of fishes from the Niger Delta. *Zool. Verh. Lediden* 61:1-48

Chandel, M. and Tank, S.K. (2016). Cytogenetic Study of Allium cepa Root Tip Cells treated with Textile Effluent. *Biotechnological Research.,* 2(3):100-103.

Gayando, F. C. Jr. and Pauly, D. (1997) eds. FAO-ICLARM Stock Assessment Tools (FiSAT) Reference manual FAO Computerised Information series (Fisheries) No. 8 Rome, FAO, 262p.

Ginah, A.B. (2007). A study of the Length weight relationship an condition factor of *Bostricus Africana* from the Nembe River, Niger Delta. B.Sc project, Niger Delta University, Wilberforce Island,

Bayelsa State. 26pp.

Hart, A. I. and Abowei, J. F. N. (2007). A study of the length-weight relationship, condition factor and age of ten fish species from the lower Nun River. Niger Delta. *Afr. J. Appl. Z Zool. Environ. Biol.,* 9:13-19.

Holden, M. and Reed, W. (1972). West African Fresh water fishes. Longmans Limited London 33p.

Inyang, I.R., Okon, N.C. and Izah, S.C. (2016a). Effect of glyphosate on some enzymes and electrolytes in *Heterobranchus bidosalis* (a common African catfish). *Biotechnological Research,* 2(4):161-165.

Inyang, IR, Akio K and Izah SC (2016b). Effect of dimethoate on lactate dehydrogenase, creatinine kinase and amylase in Clarias lazera. *Biotechnological Research,* 2(4): 155- 160.

Iyabo, U.B. (2015). Length-Weight Relationship and Condition Factor of Chrysichthys nigrodigitatus (Lacepede: 1803) of Ebonyi River, South Eastern Nigeria. *American Journal of Agricultural Science,* 2(2): 70-74.

Izah, S.C. and Angaye, T.C.N. (2016). Heavy metal concentration in fishes from surface water in Nigeria: Potential sources of pollutants and mitigation measures. *Sky Journal of Biochemistry Research,* 5(4): 31-47.

Izah, S.C., Angaye, T.C.N. and Ohimain, E.I. (2016). Environmental Impacts of Oil palm processing in Nigeria. *Biotechnological Research,* 2(3):132-141

Jiri, C. (1976). A colour guide of familiar fresh water fishes. Octopus Books Ltd. London 25p.
Kings, M. (2007). Fisheries biology, assessment and management. Wiley Black-well.

Lalrinsanga, P.L., Pillai, B.R., Patra, G., Mohanty, S., Naik, N.K. and Sahu, S. (2012). Length Weight Relationship and Condition Factor of Giant Freshwater Prawn *Macrobrachium rosenbergii* (De Man, 1879) Based on Developmental Stages, Culture Stages and Sex. *Turkish Journal of Fisheries and Aquatic Sciences,* 12: 917-924.

Loveque, C., Pyugy, O. and Teugels, G. G ed (1991). The fresh and brackish water fishes of WestAfrica. Vol. 1 Musee Royale de. 1 Afrique Centrale. Tervurem, Belgique, Editions de lORSTOM: 384 p.

Mahmood, K., Ayub, Z., Maazzam, M. and Siddiqui, G. (2012). Length-weight relationship and condition factor of Ilesha melastoma (Clupeiformes pristigasteridae) off Pakistan. *Pakistan Journal of Zoology,* 44(1): 71 – 77.

Musa, H., Ya' u, A.A., Hassan, M. I. and Bashir, S. I. (2016). Length Weight Relationship, Condition Factor and Stomach Contents Analysis of Oreochromis Niloticus in Shirmu Lake Hungu, Kano state, Nigeria. *Global Advanced Research Journal of Agricultural Science,* 5(7): 315-324

Ndiaye, W., Diouf, K., Samba, O., Ndiaye, P. and Panfili, J. (2015). The Length-Weight, Relationship and Condition Factor of white grouper (Epinephelus aeneus, Geoffroy Saint Hilaire, 1817) at the south-west coast of Senegal, West Africa. *International Journal of Advanced Research,* 3(3): 145-153.

Nehemia, A., Maganira, J.D. and Rumisha, C. (2012). Length-Weight relationship and condition factor of tilapia species grown in marine and fresh water ponds. *Agriculture and Biology Journal of North America,* 3(3): 117-124.

Otobo, A.J.T. (1981) Identification of fish species in a stretch of River Nun. HND Project Rivers State University of Science & Technology, Port Harcourt.

Pauly, D. (1983). Some simple methods for the assessment of tropical fish stock FAO Fish Tech. paper No. 234. 52p.

Poll, M. (1974): Synopsis and Geographical Distribution of the clupeidea in Africa Firewater. Distribution of three New species. Bull. De Ca Class Des Sci: 5 Sere Tom LX (2) 141- 161.

Reed, W., Burchard, J., Jennes, J. and Yaro I., (1967). Fish and fisheries of Northern Nigeria MOA 226pp. [AQF] [FISR]

Reid, G.M. and Sydenham, H. (1978). A check list of lower Benue River Fishes and on ichtho geographical review of the Benue River. *J. Nat Hist* **13**(1) 41-67.

Samat, A., Shukor, M. N., Mazlan, A.G., Arshad, A. and Fatimah, M.Y. (2008). Length-weight Relationship and Condition Factor of Pterygoplichthys pardalis (Pisces: Loricariidae) in Malaysia Peninsula. *Research Journal of Fisheries and Hydrobiology,* 3(2): 48-53

Seiyaboh, E.I., Ogamba, E.N., Utibe, D.I. and Sikoki, F.D. (2013). Impact of Dredging on the Fisheries of Igbedi Creek, Upper Nun River, Niger Delta, Nigeria. *IOSR Journal of Environmental Science, Toxicology And Food Technology,* 7 (5):38 – 44.

Whitehead, P. J. P. (1984). Family clupeidae Daget, J. Gosse, J. P. Thys. Van den. Audennerede, D. F. S (eds). Checklist of the freshwater fishes of Africa vol. 1 ORSTOM: 11-20.

Whyte, S.A. (1975) Distribution, trophic relationship and breeding habits of the fish population in a tropic lake basin. Lake Busumtwi, Ghana. *J. Zool. Lond.* 177:25-56.