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Study of the Length–Weight Relationship and Condition Factor of Five Fish Species from Nkoro River, Niger Delta, Nigeria

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Abstract: The length-weight relationship and condition factor of five fish species from Nkoro River in the Niger delta region of Nigeria was studied for twelve months using data obtained from fishers. The fishers used a wide range of fishing gear such as hook and line, long line, cast nets, gill nets and traps. Fish specimen randomly and identified using keys and descriptions. Specimens were stored in coolers containing ice and transported to the laboratory for further analysis. Total length and weight were measured using standard methods. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT. The degree of association between the length and weight was computed from linear regression analysis. The respective exponential equation for the length weight relationship are: *Ethmalosa fimbrata* ($W_t = 0.0162\ (TL)^{3.199}$); *Ilishia africana* ($W_t = 0.5998(TL)^{2.719}$) *Sardinella maderensis* ($W_t = 0.0478(TL)^{3.580}$) and *Cynoglossus senegalensis* ($W_t = 0.0326(TL)^{3.508}$). All species studied exhibited isometric growth ($b \approx 3$) except *S. maderensis* and *C. senegalensis with* $b \approx 3.6$ and 3.5 respectively that exhibited positive allometric growth. The condition factor ranged from 0.917(*I. africana*) to 0.985 (*C. senegalensis*). There was difference in the condition factors for the combined fish species and the monthly factor for each fish species studied: *E. fimbrata* (0.85±0.015), *I. africana* (0.96±0.061), *S. maderensis (*0.87±0.072) *and E. senegalensis (*0.62±0.011), while *C. senegalensis* was 1.10±0.042. All species studied were in good condition ($k \leq 0.5$).

Key words: Fresh water fish, species, length, weight, condition factor and Niger Delta

INTRODUCTION

Fish plays an important role in the development of a nation. Apart from being a cheap source of highly nutritive protein, it also contains other essential nutrients required by the body (Sikoki and Otobotekere, 1999). The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group (Beyer, 1987) and in assessing the relative well being of a fish population (Bolger and Connoly, 1989).

Consequently, lengt-weight studies on fish are extensive. Notable among these are the reports Shenouda *et al.* (1994), for *Chrysichthys* spp. from the Southern most part of the River Nile (Egypt), Alfred-Ockiya and Njoku (1995) for mullet in New Calabar River, Ahmed and Saha (1996) for carps in Lake Kapital, Bangladash, King (1996) for Nigeria fresh water fishes, Hart (1997) for *Mugil cephalus* in Bonny Estuary; Diri (2002) for *Tilapia guineensis* in Elechi creek.

Condition factor compares the wellbeing of a fish and is based on the hypothesis that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). Condition factor has been used as an index of growth and feeding intensity (Fagade, 1979). Condition factor decrease with increase in length (Bakare, 1970; Fagade 1979); and also influences the reproductive cycle in fish (Welcome, 1979). Condition factors of different species of cichlid fishes have been reported by Siddique (1977); Fagade (1978, 1979, 1983), Dadzie and Wangila (1980), Arawomo (1992) and Oni *et al.* (1983). Some condition factors reported for other fish species include; Alfred-Ockiya (2000), *Chana chana* in fresh water swamps of Niger Delta and Hart (1997), *Mugil cephalus* in Bonny estuary, Hart and Abowei (2007), ten fish species from the lower Nun River, and Abowei and Davies (2009), *Clarotes lateceps* from the fresh water reaches of the lower Nun river.

Unfortunately, to the best of my knowledge no work has been done on the length – weight relationship of *Ethmalosa fimbrata, Ilishia africana, Sardinella maderensis, Cynoglossus senegalensis* and *Elops senegalensis* from the Nkoro River. A study of the Length-Weight relationship of five fish species from the Nkoro River adds more information on the families: Clupeidae, Cynoglosidae and Elopidae to compliment the existing data in the management and culture of the species in the Nkoro River, Niger Delta.

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MATERIALS AND METHODS

Study Area: The Nkoro River is a distributory of the Andoni River in the Niger Delta area of Nigeria. The Nkoro River lies between latitudes 4º 28' to 4º 45' N and longitudes 7º 45'E. The Niger Delta is one of the world largest wetlands covering an area of approximately 70,000 km^2. The area is economical important and rich in biodiversity. Numerous activities such as oil exploration and production and agricultural activities go on in the region. Most of Nigeria's oil and gas reserves and production, which account for over 80% federal government's revenue, is located within the Niger Delta region.

The Red and white mangroves (*Rhizophora* and *Avicennia* spp.) mangrove swamps and flood plains border the river and Hs numerous creeks; and these are well exposed at low tides.

Fish Sampling: Fish specimens were procured from artisanal fishers and middlemen at their landing site for the study. Sampling of landed catches was done twice in a month for a period of twelve months The fishers used a wide range of fishing gear such as hook and line, long line, cast nets, gill nets and traps. From the catches, fish specimen randomly and identified using keys and descriptions by Reed *et al.* (1967), Holden and Reed (1972) and Loveque *et al.* (1991). Specimens were stored in coolers containing ice and transported to the laboratory for further analysis.

The Total Length (TL) of the fish was measured from the tip of the anterior or part of the month to the caudal fin using meter rule calibrated in centimeters. Fish were measured to the nearest centimeter. Fish weight was measured after blot drying with a piece of clean hand towel. Weighing was done with a tabletop weighing balance, to the nearest gram. The length measurements were converted into length frequencies with constant class intervals of 2 cm. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT (Gayando and Pauly, 1997).

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

$$W=aL^b \qquad (1)$$

Where

W=Weight of fish in (g)
L=Total Length (TL) 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. The correlation (r^2),that is the degree of association between the length and weight was computed from the linear regression analysis:

$$R = r^2 \qquad (2)$$

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

$$K = \frac{100\ W}{L^3} \qquad (3)$$

Where

K= condition factor
W= weight of fish
L= length of fish (cm)

RESULTS AND DISCUSSION

Table 1 shows the length-weight relationship and condition factors of five fish species. The sample size varied with fish species. The condition factor ranged from 0.917(*I. africana*) to 0.985 (*C. senegalensis*), *E. fimbrata, I. africana,* and *E. senegalensis* were isometric in their growth, while *S maderensis* and *C senegalensis* were positively allometric. The respective exponential equation are: *E. fimbrata* (W_t =0.0162(TL)$^{3.199}$); *I. africana* (W_t=0.5998(TL)$^{2.719}$) *S. maderensis* (W_t=0.0478(TL)$^{3.580}$) and *C. senegalensis* (W_t=0.0326(TL)$^{3.508}$).

The graphical presentations of the condition factors of all species studied are shown in Fig. 1, while the monthly condition factor for each species is presented in Fig. 2 to 6. There was difference in the condition factors for the combined fish species and the monthly factor for each fish specie studied: *E. fimbrata* (0.85±0.015), *I. africana* (0.96±0.061), *S. maderensis* (0.87±0.072) *and E. senegalensis (*0.62±0.011), while *C. senegalensis* was 1.10±0.042.

Length - Weight Relationship: The values obtained for the weight – length relationship showed that *E. fimbrata, I. africana, and E. senegalensis* were isometric in their growth, while *S. maderensis* and *C. senegalensis* were positively allometric. Several authors have reported both isometric and allometric growth for different fish species from various water bodies. King (1991) reported allometric growth patterns for *Tilapia* species from Umuoseriche Lake. King (1996) reported isometric growth for *Pseudotolithus elongatus* from Qua Iboe Estuary. Ekeng (1990) also reported an isometric growth pattern for *E. fimbriata* from Cross River estuary in Cross River state. Marcus (1984) obtained an isometric growth patterns for *E. fimbriata* from coastal and brackish water of Akwa Ibom state. Shenouda *et al.* (1994) also observed an isometric growth patterns for *Chysichthys auratus* from the southern most parts of River Nile and Egypt.

Table 1: Length - weight relationship for the five fish species

Fish Species	N	K	Exponential equation
E. fimbrata	1200	0.946	$W_t = 0.0162(TL)^{3.199}$
I. africana	1130	0.917	$W_t = 0.5998(TL)^{2.719}$
S. maderensis	1324	0.947	$W_t = 0.0478(TL)^{3.580}$
C. senegalensis	1800	0.985	$W_t = 0.0326(TL)^{3.508}$
E. senegalensis	1325	0.941	$W_t = 0.0153(TL)^{3.066}$

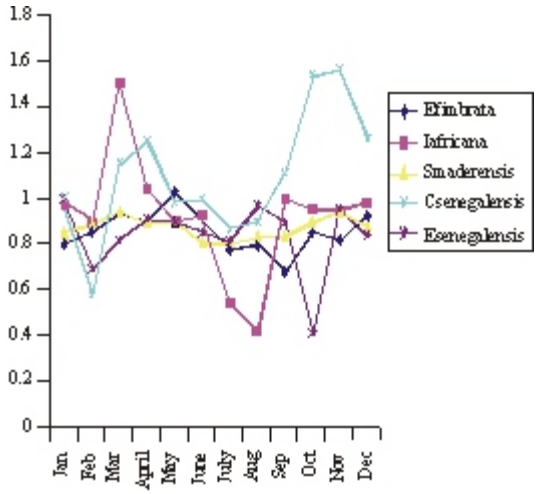

Fig 1: Monthly condition factor for the species Jan –Dec 2006 (combined).

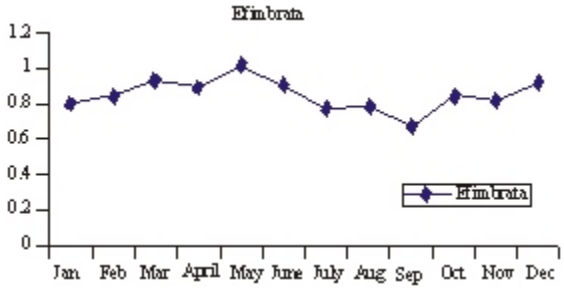

Fig 2: Condition factor for *E. fimbrata*

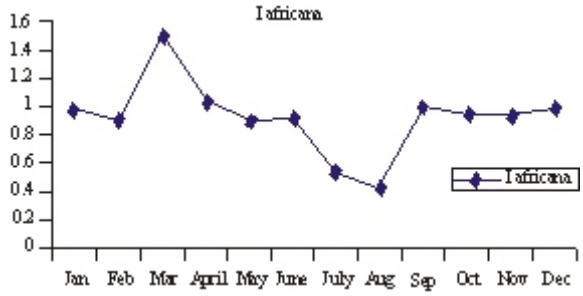

Fig 3: Condition factor for *I africana*

The transformed length fitted over weight gave linear growth indicating the three dimensional growth structures of most fish species (Lagler *et al*., 1977). Values of the length exponent in the length-weight relationship being isometric implies that the fish species did not increase in weight faster than the cube of their total lengths.

Fig. 4: Condition factor for *S. maderensis*

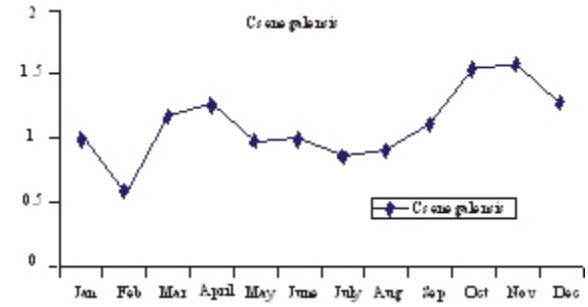

Fig 5: Condition factor for *C. senegalensis*

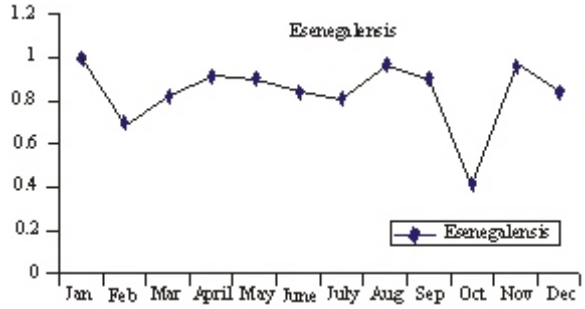

Fig. 6: Condition factor for *E. senegalensis*

However, the weight of the rest species increased faster than the cube of their total lengths.

Length-weight relationships give information on the condition and growth patterns of fish (Bagenal and Tesch, 1978). Fish are said to exhibit isometric growth when length increases in equal proportions with body weight for constant specific gravity. The regression co-efficient for isometric growth is '3' and values greater or lesser than '3' indicate allometric growth (Gayando and Pauly, 1997).

Condition Factor: In fish, the factor of condition (K) reflects, through its variations, information on the physiological state of the fish in relation to its welfare. From a nutritional point of view, there is the accumulation of fat and gonadal development (Le Cren, 1951). From a reproductive point of view, the highest K values are reached in some species (Angelescu *et al*., 1958). K also gives information when comparing two populations living in certain feeding, density, climate and other conditions; when determining the period of gonadal maturation and

when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source (Bagenal and Tesch, 1978). From the above assertions we could conclude that the five species in this work reproduce between May to October since they recorded the lowest K at about this period.

Furthermore, Vazzoler (1996) confirmed that lowest K values during the more developed gonadal stages might mean resource transfer to the gonads during the reproductive period. Braga (1986), through other authors, showed that values of the condition factor vary according to seasons and are influenced by environmental conditions. The same may be occurring in the environment under study since the floodplain is influenced by many biotic and abiotic factors, which favor the equilibrium of all the species in the ecosystem.

The mean condition factors ranging from 0.941–0.985 obtained in this study varied slightly with the results from other studies. Ajayi (1982), reported K=0.77–0.81 for *Clarotes filamentosus* in lake Oguta; Nwadiaro and Okorie (1985) obtained K = 0.49–1.48 in Andoni river. The value obtained from the study showed that all species studied were in good condition. Gayando and Pauly (1997) reported that certain factors often affect the well - being of a fish. These include: data pulling, sorting into classes, sex, stages of maturity and state of the stomach.

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