

Length-weight relationship and condition factor of the smoothmouth marine catfish (*Carlarius heudelotii*) in the gulf of Guinea, Niger delta, Nigeria

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Abstract: This study was conducted on the length-weight relationship of the smoothmouth marine catfish, *Carlarius heudelotii*, caught from the Gulf of Guinea by artisanal fishermen and landed at the Ukpenekeang fish-landing site near Ibeno, Akwa Ibom State, Nigeria. The 'r' value for the 233 specimens of *C. heudelotii* sampled during the three months study period (April-June 2009) was 0.97. No significant difference in 'R²' (P>0.05) was noticed in the analysis of covariance between the fishes of different size-classes and sampling dates. The equation for length-weight relationship was $W=1.02L^{2.4}$ for the overall sample. The overall condition factor was 1.29 (greater than one).

Key words: fish landings, length-weight relationship, condition factor, condition index, *Carlarius heudelotii*, smoothmouth marine catfish.

Introduction. The relationship between body length and weight of fish presents great importance in fisheries biology and population dynamics where many stock assessment models require the use of length-weight parameters (Garcia-Arteaga et al 1997). Length-weight relationships of fishes are used broadly for different purposes, namely to know length value, to convert growth equations in length into equivalent ones in weight, to compare inter specific and intrapopulation morphometry, and to determine the index of wellbeing of individual fish (Bolger & Connolly 1989).

Length and weight data are useful standard results of fish sampling programs (Morato et al 2001). In fish, size is generally more biologically relevant than age, mainly because several ecological and physiological factors are more size-dependent than age-dependent. Consequently, variability in size has important implications for diverse aspects of fisheries science and population dynamics (Erzini 1994). Length-weight regressions have been used frequently to estimate weight from length because direct weight measurements can be time-consuming in the field (Sinovcic et al 2004). One of the most commonly used analyses of fisheries data is length-weight relationship (Mendes et al 2004).

The present investigation was on the length-weight relationship and condition index of the smoothmouth marine catfish, *Carlarius heudelotii* (Valenciennes, 1840), in the Gulf of Guinea, off the Atlantic Coast of Akwa Ibom State, Nigeria.

Materials and methods. The study area encompassed the coastal waters of the continental shelf off Ibeno Local Government Area in the southern end of Akwa Ibom State. This local government area occupies a vast coastal area of over 1,200 sq. km. It stretches from Okposi 1 at the eastern flank, bordering Mbo Local Government Area and Bakassi peninsula to Atabrikang village on its western flank. Ibeno occupies the largest Atlantic coastline of more than 129km in Akwa Ibom State (Figure 1).

Three easily distinguishable, vegetation types found here are: the saline water swamp forest, the fresh water swamp forest and the rainforest. The dominant plants consists of thick mangrove forests consisting of red mangrove (*Rhizophora racemosa* and *R. mangel*). In some areas, the white mangrove (*Avicenna africana*) interspersed with *Nypa* palms are found. The lowest inter-tidal zone is usually bare of vegetation, with clay, peat and sand deposit (Jamabo et al 2009). With respect to the climate, mean annual rainfall is reported to be 3,500 mm, relative humidity ranging between 60 to 90 percent, evaporation rate of 4 mm/day and average temperatures ranging between 23°C to 31°C.

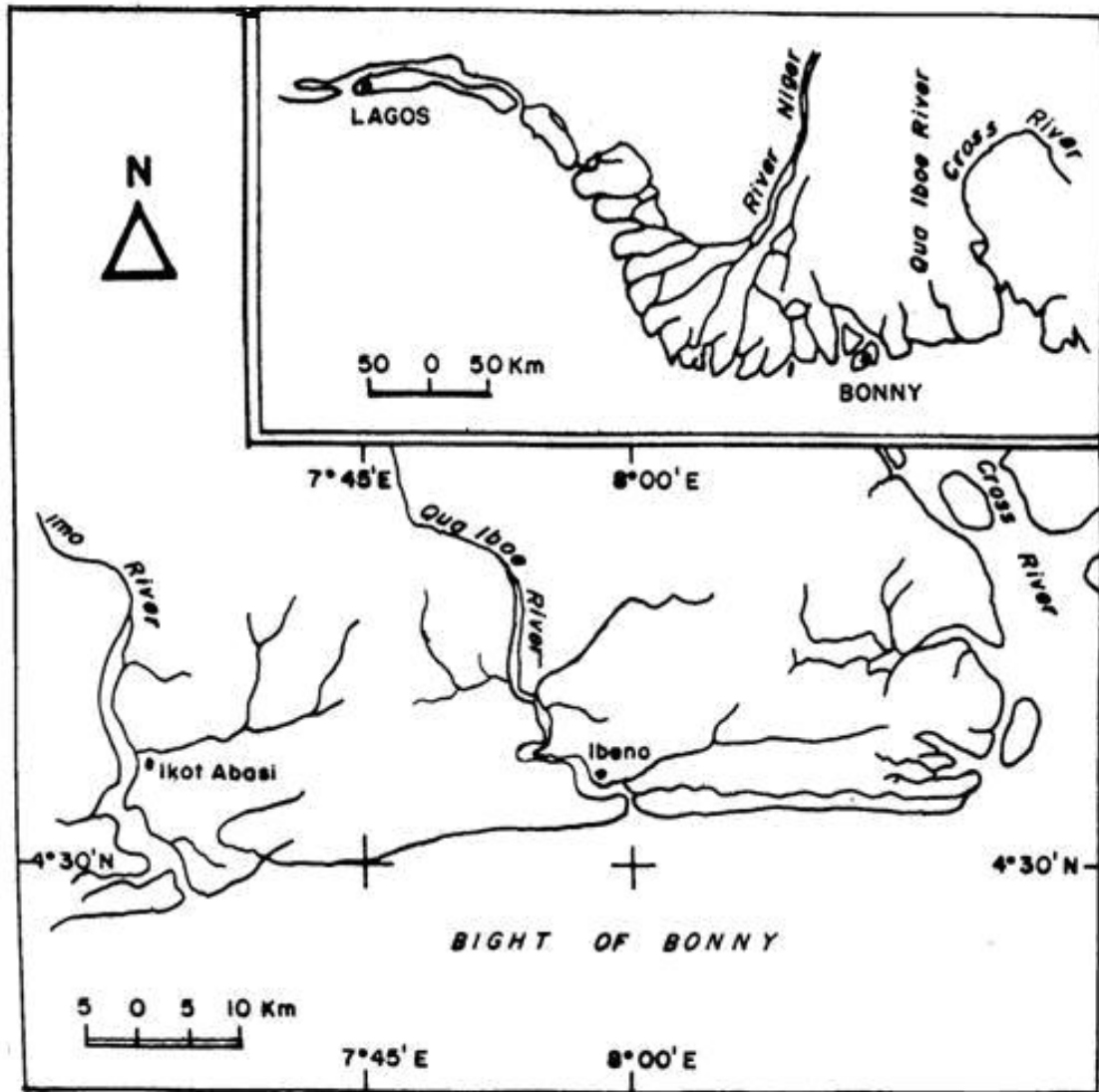


Figure 1. Study area.

The length-weight relationship (LWR) of *C. heudelotii* was determined from 233 individuals collected from the Ukpenekang fish landing site/market. They were collected from the fish folks, frozen and bagged, from the month of April 2009 to June 2009. Total and standard length (cm) of individual fish was taken from the tip of the snout to the tip of the caudal fin and caudal peduncle, respectively, using a measuring board. Body weight was taken to the nearest gram using a top loading meter balance after blot-drying excess water and ice from the body. Length-weight relationship was expressed by the equation $W = aL^b$. The "b" is an exponent with the value 2.4 demonstrating normal growth dimension or interpretation of relative well being (Bagenal & Tesch 1978; King 1996). Linear transformation was made using natural logarithm at the observed lengths

and weights (Zar 1984). The expression of the relationship is represented by the following formula:

$$\log W = b \log L + \log a$$

where: W = the weight of the fish in grams,

L = the standard length of the fish in centimeters,

a = exponent describing the rate of change of weight with length,

b = the slope or allometric coefficient.

The condition factor of the fish which is the degree of well-being or relative robustness of the fish expressed by "coefficient of condition" was measured using the equation:

$$K = 100w/L^b$$

where: W = weight of the fish in grams,

L = the total length of the fish in centimeters,

b = the value obtained from the length-weight equation formula.

The relationship between length and weight of the fish species was determined by simple linear regression analysis.

Results. The total lengths of the sampled fish ranged between 13.7 cm and 23.0 cm, with corresponding standard lengths of 9.6 cm minimum and 21.1 cm maximum.

Fish weights ranged between 400 g and 1800 g.

The length-weight relationship is expressed in the regression equation: $\log W = 1.002 + 2.405 \log L$ and Figure 2. No significant difference in 'R²' ($p > 0.05$) was noticed in the analysis of covariance between the fishes of different size-classes and sampling dates.

The condition factor (k) for this species was 1.29, showing that the K value was more than one.

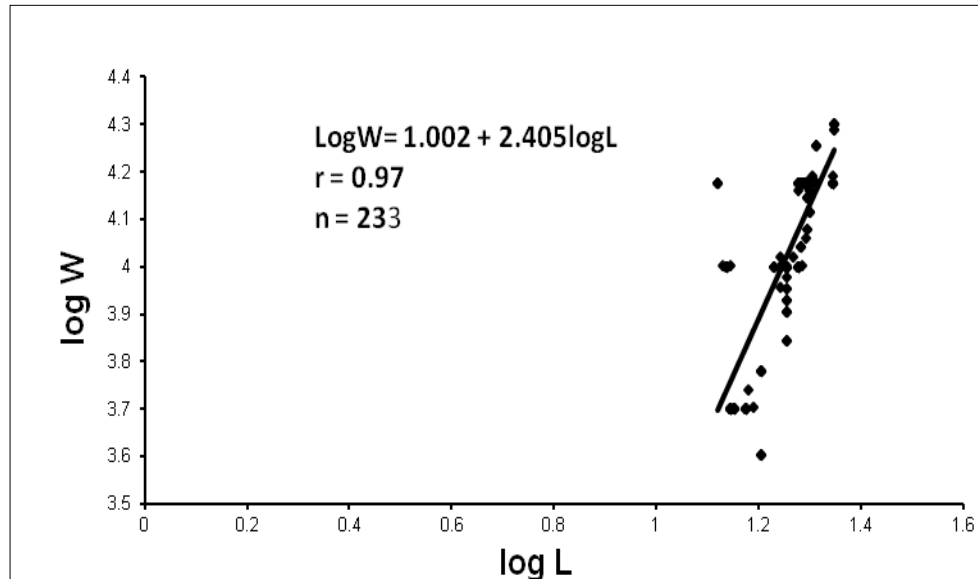


Figure 2. Length-weight relationship of *Carlarius heudelotii*.

Discussion. The landings of *Carlarius* catfish in this study showed allometric growth ($b=2.4$) of the total number of 233 specimens sampled within the three months of sampling. This result agrees with the findings of Fafioye (2005) on some related fish species (*Chrysichthys nigrodigitatus* (Lacepède, 1803), *C. walkeri* Günther, 1899 and *Clarias gariepinus* (Burchell, 1822)), in Epe lagoon, Nigeria. Olurin & Sotubo (1989) also reported allometric growth in three cichlids (*Chromidotilapia guntheri* (Sauvage, 1882), *Tilapia mariae* Boulenger, 1899 and *Hemichromis fasciatus* Peters, 1857) in Owa stream, South-west Nigeria. Abowei (2009), Nieto-Navarro et al (2010), Royce (1957, 1972),

Levent et al (2006) and King (1996) also observed negative allometry for species studied (in the genera: *Chrysichthys*, *Pellonula*, *Ethmalosa*, *Mugil*, *Cynoglossus*, *Trachinotus*, *Pseudotolithus*, *Liza*, *Periophthalmus*, *Goboides* etc.). Wootton (1992) however opined that $b < 3$ indicates that the fish gets relatively thinner as they grow larger while $b > 3$, it is plumper as it grows larger.

Regression coefficients obtained from length-weight relationships (L-W) which are indicative of isometric or allometric growths differ not only between species but sometimes also between stocks of same species. The development of fish involves several stages, each of which has its own length-weight relationships. There may also be differences in the relationships due to sex, maturity, season and environmental conditions (e.g. pollution).

C. heudelotii in the study was observed to be in good condition, as the value of "k" was higher than one. A number of factors (e.g. sex, seasons, environmental conditions, stress, preservation, maturity, sex, availability of food) also affect the condition of fish. Stewart (1988) observed one of the causes of stress in *Oreochromis niloticus* (Linnaeus, 1758) in lake Turkana, Kenya, to be as a result of the reduction in the breeding and nursery grounds thereby contributing to dramatically lower condition factors. Pollution was also seen to affect the condition factors of *O. niloticus* in lake Mariut, Egypt (Bakhom 1994).

Variations in condition factor with seasons and pollution have also been documented by Khallaf et al (2003) in Shanawan drainage canal in Egypt.

Conclusions. An important contribution of this study is the provision of base-line data on the length-weight relationship and condition factor of the smooth mouth marine catfish, *C. heudelotii*, common in this portion of the Nigerian coastline which harbours many oil rigs and petroleum exploration installations.

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