International Journal of Innovative Studies in Aquatic Biology and Fisheries
Volume 3, Issue 3, 2017, PP 12-17
ISSN 2454-7662 (Print) & ISSN 2454-7670 (Online)
DOI: http://dx.doi.org/10.20431/2454-7670.0303003
www.arcjournals.org

Length-Weight Relationships and Condition Factor of Two Cyprinid Fish of the Genus *Enteromius*: *E. macrops* (Boulenger, 1911) and *E. leonensis* (Boulenger, 1915) in Kogon and Tinguilinta Rivers Basins (Republic of Guinea)

Charles Koffi Boussou[*1], Gustave N'guessan Aliko[1], Félix Koffi Konan[1], Mexmin koffi Konan[2], Edia oi Edia[2], Allassane Ouattara[2].

[1]*Departement of Environment, Jean Lorougnon Guédé University, POB 150 Daloa, Côte d'Ivoire*
[2]*Aquaculture Department, Nangui Abrogoua University, POB 801Abidjan 02, Abidjan, Côte d'Ivoire.*

***Corresponding Author:** *Charles Koffi Boussou, Department of Environment, Jean Lorougnon Guédé University, POB 150 Daloa, Côte d'Ivoire*

Abstract: *This study was conducted to determine length-weight relationship and condition factor (K) of two cyprinid Enteromius macrops and Enteromius leonensis. Fish sampling was carried out in Kogon and Tinguilint Rivers basins (Republic of Guinea) between Novembers 17th, 2013 and December 07th, 2013. Values of allometric coefficient b obtained from the length-weight relationships (LWRs) of E. macrops were 3.355 in Kogon and 3.241in Tinguilinta and those of E.leonensis were 2.877 in Kogon and 3.585.Analyses showed that E.macropshas a positive allometric growth in the two basins whereas E.leonensisdisplayed an isometric growth in the Kogon basin and a positive allometric growth in Tinguilinta. Studies on these fishes condition factor (K) showed that Enteromius species from the Tinguilinta basin had better condition compared to those from Kogon.*

Keywords: *Enteromius macrops- Enteromius leonensis- Length-weight relationship- Condition Factor- Kogon and Tinguilinta Rivers basins- Republic of Guinea*.

1. INTRODUCTION

The results of length-weight relationship can be used for (a) conversion of growth in length equations to growth in weight, for use in stock assessment models; (b) estimating biomass from length data; (c) calculating total weight of fish caught from length-frequency data; (d) measuring changes in health of fish species (relative to past or future samples at the same place and season); (e) determining the relative condition factor of small fish compared to large fish; and (f) for comparison between region life-histories of certain fish species [1,2,3,4, 5, 6]. [7] and [8]asserted that although it is desirable to use the already established length-weight relationship for a species in other sites or country, local data are better for quantitative assessments in the area because according to [9] and [10], these parameters have spatial disparities. Moreover, [10] said that the value of the coefficient estimated for a species can vary between stocks and even between areas.

Most of the rivers of Republic of Guinea are threatened by anthropic activities. An example is the case of Kogon and Tinguilinta rivers that have in their catchment area an important extractive industrial mining activity. These activities could potentially influence negatively these ecosystems, ecological function in general and particularly the fish communities and their life-history [11, 12, and 13]. Knowledge on fish species biology from this region is scarce. Accordingly, the aim of this work is to study some aspects of biology, namely the weight-length relationship and the condition factor, of two largely encountered cyprinid fishes *Enteromius macrops* (Boulenger, 1911) and *E. leonensis* (Boulenger, 1915) in this area.

2. MATERIALS AND METHODS

2.1.Study Area

Samplings were conducted in Kogon and Tinguilinta Rivers basins. These basins are located in "Low Guinea" in the North-West of Guinea Republic (Fig. 1). Kogon and Tinguilinta basins encompass respectively areas of 7288 Km^2 and 4850 Km^2 [14]

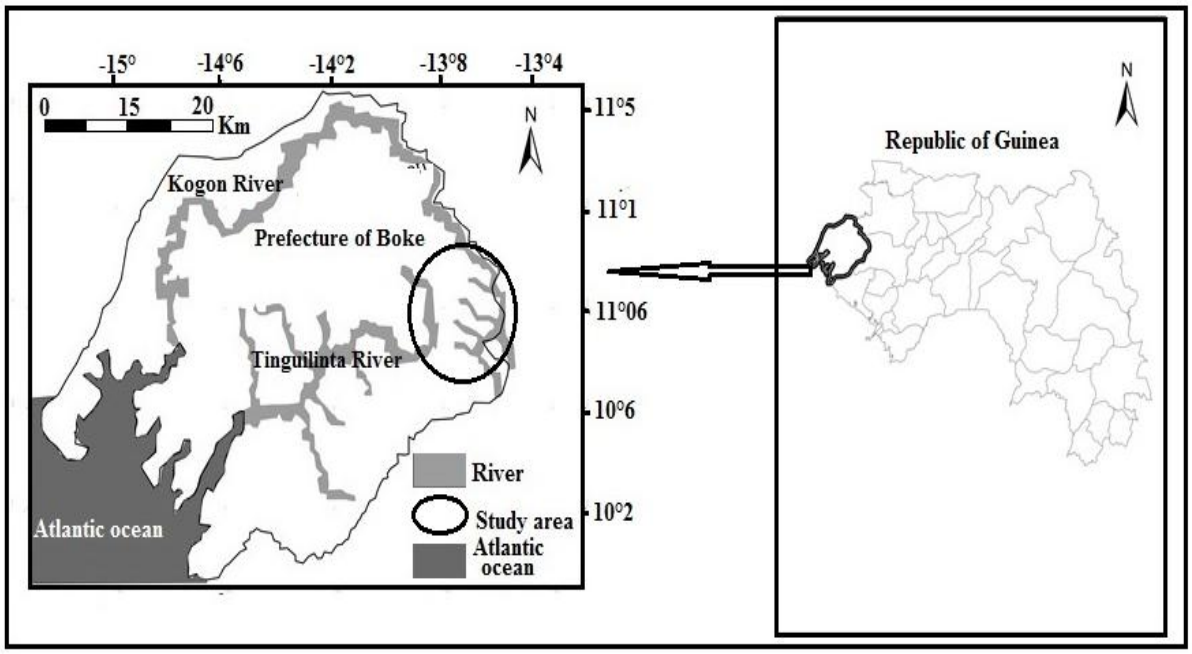

Figure1. *Location of the study area in Kogon and Tinguilinta basins in Guinea Republic.*

2.2.Sampling

Samplings were carried out between November 17th and December 07th of 2013. Fishes were caught through experimental fishing with gill nets which were usually set during the afternoon at about 16:00 h and lifted the following morning at about 07:00 h. Fish traps and hawk nets were also used. Fish were then identified according to the identification keys of [15], [16] and [17] and preserved in **formalin 10% for later laboratory observations. At laboratory, each specimen was measured (standard** length and total length) to the nearest millimeter with a calipers and weighed to the nearest gram using an electronic balance.

2.3.Data Analysis

The condition of each specimen was evaluated by the allometric condition factor (*Ka*), described by the equation: $Ka=Wt/Lb^{\cdot}*100$; where *W*t is the total weight in grams, *Ls* the standard length in centimeter and *b* a constant related to fish growth [18, 10, 19, 20]. This constant *b* was obtained from the length-weight relationship linearization: $Wt=axLs^b$ using the logarithmic transformation: ln (*Wt*) =ln (*a*) +*b*xln (*Ls)* [21]; where *a* is the intercept and *b* the regression coefficient. This coefficient *b* is used to calculate the condition factor.

Spatial comparison of fish length was carried out through a Two-sample test.

All the tests were carried out using the software Paleotological Statistic (PAST) version2.16 [22].

3. RESULTS

3.1. Spatial Variation of Length of Enteromius macrops and E. leonensis

In Kogon basin (152 individuals), the size of *E. macrops*varied from 9.86 mm to 87.3 mm SL with an average of 41.88 mm (Fig.2). In Tinguilinta basin (62 individuals), the minimal length encountered was 21.2 mm SL while the maximalwas 80.62 mm SL. Then, the mean value of *E. macrops* length is 45.78 mm SL.

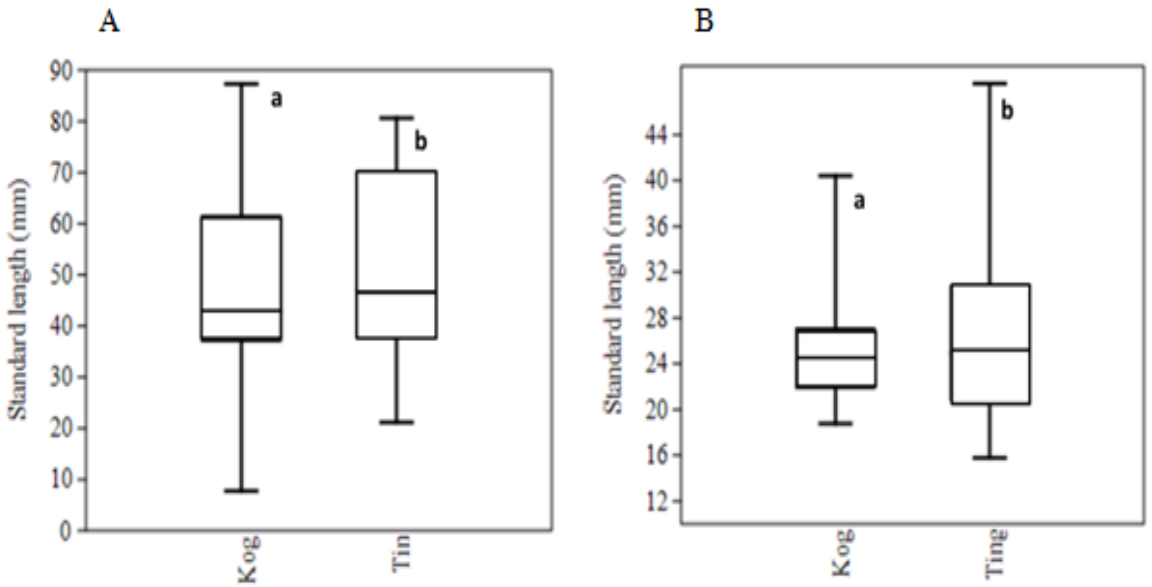

Figure2. *Spatial variations of standard length of the Enteromiusmacrops (A) and E. leonensis (B) sampled in basins of Kogon (Kog) and Tinguilinta (Ting) in Guinea Republic. Box plots with different exponent letters show values statistically different.*

Specimens of *E. leonensis* sampled in the Kogon basin (91 individuals) showed standard length varying from 18.78 mm to 40.42 mm, with an average of 25.66 mm (Fig.2). In Tinguilinta basin (109 individuals), the smallest individual measured 15.78 mm SL and the highest size was 48.48 mm SL. The average size was 26.3 mm SL.

Spatial comparison showed that individuals of both species from Tinguilinta were significantly greater (*t*-test*;* $p<0.05$) than those from Kogon.

3.2. Length-Weight Relationship (LWR)

The results of the LWR of the two species of *Enteromius* are summarized in Table I. For *E. macrops*, values of coefficient were 3.355 in Kogon basin against 3.241 in Tinguilinta basin. These values were significantly higher than 3 (Student t–test: $p < 0.05$) indicating positive allometric growth for this species in these basins.

Table1*: Parameters of length-weight relationship (LWR) of Enteromiusleonensis and E. macrops from Kogon and Tinguilinta basins in Guinea republic*.

		Length-Weight Relationship Parameters		
Species	**Basins**	**a**	**b**	**R2**
E. macrops	*Kogon*	0.0048	3.355*	0.987
	Tinguilinta	0.0057	3.241*	0.993
E. leonensis	*Kogon*	0.0098	2.877	0.851
	Tinguilinta	0.0036	3.585*	0.976

a: constant; b: regression's slope; R^2: coefficient of determination; * *value significantly different from 3 (Student t-test, p<0.05)*

The value of coefficient *b* for *E. leonensis* was 2.877 in Kogon basin. This value is not statistically different from 3 (Student t–test: $p > 0.05$) showing an isometric growth of this species in Kogon. In Tinguilinta basin, the coefficient *b* determined was 3.585 and is significantly higher than 3(Student t–test: $p < 0.05$).Then *E. leonensis* displayed positive allometric growth ($b > 3$) in Tinguilinta basin.

3.3. Condition Factor (K)

Condition factor values of *E. macrops* varied between 0.702 and 1.253 with an average of 1.036 ± 0.01 in Kogon basin whereas it ranged from 0.931 to 1.424 in Tinguilinta with an average of 1.177 ± 0.013.The mean value of coefficient K in Tinguilinta basin was significantly higher (Student t–test: $p < 0.05$) than that obtained in Kogon basin.

Table2: *Conditions factor (K) of Enteromius macrops and E. leonensis from Kogon and Tinguilinta basins in Guinea republic.*

	Kogon				*Tinguilinta*			
Basins	**Nb**	**Min**	**Max**	**Mean**	**Nb**	**Min**	**Max**	**Mean**
E. macrops	152	0.702	1.253	1.036^{a} ±0.01	62	0.931	1.424	1.177^{b}±0.013
E. leonensis	91	1.135	2.583	1.857^{a} ±0.106	109	0.634	1.562	0.958^{b} ±0.018

Nb: Number of individuals; Min.: Minimum; Max. : Maximum; *Mean values in same row with different exponent letter are statistically different*.

Concerning *E. leonensis*, *K* value evolved between 1.135 and 2.583 with an average of 1.857 ± 0.106 in Kogon basin. For Tinguilinta basin, it ranged between0.634 and 1.562 with an average of 0.958 ± 0.018.The average of K in Kogon was statistically higher (Student t–test: $p < 0.05$) than that calculated in Tinguilinta basin.

4. DISCUSSION

The study of size variations of the two cyprinid species *Enteromius macrops* and *E. leonensis* in the two basins showed that these species are greater in Tinguilinta basin than in Kogon basin. Indeed, mean length in Tinguilinta are 51.78 mm SL and 26.3 mm SL respectively for *E.macrops* and *E. leonensis* against 47.08 mm SL (*E. macrops*) and 25.06 mm SL (*E. leonensis*) in Kogon. These differences in growth could be due to differences in ecological conditions in the two basins. Indeed, according to [23], Kogon basin would be under high anthropic disturbance compared to Tinguilinta because it comprises all the ancient and current sites of bauxite exploitation.

The maximum size of *E. leonensis* recorded in this study (48.48 mm SL in Tinguilinta Basin) is higher than the maximum length (33 mm SL) reported by [24] on this species. [25] and [26] asserted that growth and the maximum size observed in a species can vary between locations because of the ecological disparities.

The mean coefficient of allometry of *Enteromius macrops* was 3.355 and 3.241respectively in Kogon and Tinguilinta rivers. These values are significantly higher than 3 (Student t–test: $p = 0.05$) indicating that in this species, gain in weight is more than gain in length in these hydrosystems. However, [27] reported a coefficient of allometry of 2.94 for this species.

With regard to *Enteromius leonensis*, the mean values of coefficient of algometry (*b)* were 2.877 in Kogon and 3.585 in Tinguilinta basins respectively. Compared to the value 3, this species showed an isometric growth in Kogon basin and a positive allometric growth in Tinguilinta basin. These values are close to that indicated by [27] who reported the value of 2.96 as allometric coefficient of *E. leonensis*.

The coefficients *b* from length-weight relationships of fishes are affected by a number of factors including sex, gonad maturity, health, season, habitat, nutrition, environmental conditions (such as temperature, salinity), area, degree of stomach fullness, differences in the length range of the caught specimens and fishing gears [18,28,29].In the present study, the two basins(Kogon and Tinguilinta) belong to the same climatic area; sampling was carried out at the same season with same methodology, similar sizes of samples (91 in Kogon and 109 in Tinguilinta), and the same gears. Differences between the *b* values of the two species of *Enteromius* between these two rivers basins would be due to the environmental conditions characterizing each one of these watery ecosystems.

The study of the condition factor reveals a spatial disparity of this parameter in *E. macrops* (1.177 and 1.036) and *E. leonensis* (0.958 and 1.857) respectively in Kogon and Tinguilinta basins. [30] And [6] assumed that variability in condition factor for a fish species in different locations is related to food availability and sexual maturity of the individuals.

5. CONCLUSION

This study provided the basic information on length-weight relationships and condition factor for *E. macrops* and *E. leonensis* in Kogon and Tinguilinta hydrosystems from Republic of Guinea. The exponent *b* for length-weight relationships of all caught specimens showed that *E. macrops* gains more in weight than in length during its growth in these two hydro systems. *E. leonensis*, showed an

isometric growth in Kogon basin and positive allometric growth in Tinguilinta basin. The condition factor *K* showed spatial variation in the plumpness and could be due to disparity in ecological conditions between the two basins.

ACKNOWLEDGEMENTS

We are grateful to the Guinea Bauxite Company (CBG) and Sylvatrop Consulting directed by Mr. Sylvain DUFOUR and Michel BUREAU for their valuable help and advice. This study was carried out as a part of the environmental and social impact study of the project of extension of the activities of the Guinea Bauxite Company.

REFERENCES

[1]. Aliko G. N., Da Costa S. K., Ouattara A., Konan F. K., Gourène G., Structure démographique d'un Labeo africain, *Labeocoubie* Rüppel, 1832 (Pisces : Cyprinidae), dans le lac de barrage de Taabo (bassin du Bandama, Côte d'Ivoire). Agr. Afr., 22(3): 207 – 216(2010).

[2]. Andrade H. A., Campos R. O., Allometry coefficient variations of the Length-weight relationship of skipjack tuna (*Katsuwonuspelamis*) caught in the southwest South Atlantic. Fish. Res., 55: 307 – 312(2002).

[3]. Bengen D., Lim P., Belaud A., Qualité des eaux de trois bras morts de la Garonne: variabilité spatio-temporelle. Rev. Sci. Eau, 5 : 131-156 (1992).

[4]. Boussou K. C., Variations morphométriques, biologie et écologie du Cichlidae*Chromidotilapiaguntheri* (Sauvage, 1882) dans des hydro systèmes de l'Est et du Sud de la Côte d'Ivoire. Thèse de Doctorat de l'Université NanguiAbrogoua (Côte d'Ivoire), 161p. (2013).

[5]. Diallo S. T., Camara M., Guilavogui A. L., Diallo B., Sow M. Rapport synthèse sur le secteur de la pêche en Guinée ; Projet de recherche-action Adaptation des politiques de pêche aux changements climatiques en Afrique de l'Ouest à l'aide de savoirs scientifiques et de connaissances endogènes (APPECCAO), 60p. (2009)

[6]. Ecoutin J. M, Albaret J. J., Relation longueur-poids pour 52 espèces de poissons des estuaires et lagunes de l'Afrique de l'Ouest. Cybium, 27(1) : 3 – 9 (2003).

[7]. Sylva trop, Etude d'impact environnemental et social du projet d'extension des activités de la compagnie de bauxite de Guinée : inventaires des poissons et des macros invertébrés aquatiques. Rapport préparé pour Sylva trop Consulting, 2014, 53p.

[8]. Eschmeyer W. N., Fricke R., van der Laan R.,Catalog of Fishes, electronic version (January 2014). San Francisco, CA (California Academy of Sciences).

[9]. Froese R. Cube law, condition factor and weight-length relationships history, meta-analysis and recommendations. J. Appl. Ich., 22: 241-253(2006).

[10]. Froese R., Pauly D., Fish Base. World Wide Web electronic publication.www.fishbase.org, version (10/2014).

[11]. Froese R., Thorson J., Reyes Jr. R. E., A Bayesian approach for estimating length-weight relationships in fishes. J. Appl. Ich., 30(1): 78 - 85(2014).

[12]. Gonçalves J. M. S., Bentes L., Lino P. G., Ribeiri J., Canario A. V. M. and Erzini K., Weight–length relationships for selected fish species of small–scale demersal fisheries of the south and south–west coast of Portugal. Fish. Res., 30: 253–256 (1997).

[13]. Gonzales E. J., Palla H. P., Mishina H., Length–weight relationships of five Serranids from Palawan Island, Philippines. Naga ICLARM Q., 23(3): 26–28(2000).

[14]. Hammer O., Harper D. A. T., Ryan P. D., Paleontological Statistics Software Package for Education and Data Analysis. Pal. Elec., 4(1): 1 – 9 (2001).

[15]. Kalhoro M. A., Liu Q., Waryani E. Memon H. K., Growth and Mortality of Brushtooth Lizardfish, *Saurida undosquamis*, from Pakistani Waters. Pak. J. zool., 46(1): 139 - 151(2014).

[16]. Lévêque C., Réponses aux conditions extrêmes. *In* : Lévêque C. & Paugy D. (Eds.) : Les poissons des eaux continentales africaines. Diversité, écologie, utilisation par l'homme.Edition IRD, Paris, 1999.PP. 191 – 198.

[17]. Lévêque C., Daget J., Cyprinidae. *In:* J. Daget, Gosse J. P., Thys van den Audenaerde D. F. E. (Eds.). Check-list of the freshwater fishes of Africa (CLOFFA). ORSTOM-Paris & MRAC-Tervuren, 1984, 1 pp.217-342.

[18]. Lizama M., de Los A. P., Ambrósio A. M., Condition factor in nine species of fish of the Characidae family in the upper Paraná River floodplain, Brazil. Braz. J. Biol., 62 (1): 113 - 124(2002).

[19]. Mir J.I., SarkarU.K. Dwivedi A.K., Gusain O.P., Pal A., Jena J.K., Pattern of intra basin variation in condition factor, relative condition factor and form factor of an Indian Major Carp, *Labeo rohit a* (Hamilton-Buchanan, 1822) in the Ganges Basin, India. *Europ. J. Biol. Sci*., 4, 126-135 (2012).

[20]. Moutopoulos D. K. and Stergiou K. I., Length-weight relationships of fish species from the Sea (Greece). J. App. Ich., 18(3): 200-203(2002):

[21]. Noakes D. L. G., Balon L. K., Life histories of tilapias: an evolutionary perspective. *In*: ICLARM Conferences Proceedings. The biology and culture of tilapias. Manilla, 7: 61-82(1982).

[22]. Paugy, D., Lévque, C., Teugels, G. G., Poissons d'eaux douces et saumâtres de l'Afrique de l'Ouest, édition complète. Tome I & II. Edition IRD, MNHN, MRAC, (2003), 458 + 816 p.

[23]. Pauly D, Fish byte Section Editorial Naga. The ICLARM Quarterly: 16-26(1993).

[24]. Petrakis, G. and Strergiou, K. I., Weight–length relationships for 33 fish species in Greek waters. Fish. Res., 21, 465–469 (1995).

[25]. Roux D. J., Nel J. L., Ashton P. J., Deacon A. R., de Moor F. C., Hardwick D., Hill L., Kleynhans C. J., Maree G. A., Moolman J. & Scholes R. J., Designing protected areas to conserve riverine biodiversity: Lessons from a hypothetical redesign of the Kruger National Park. Biol.Cons. 141: 100 - 117(2008).

[26]. Sparre, P., Ursin, E., Venema, S. C., Introduction to tropical fish stock assessment. Part I. Manual. FAO Fisheries Technical Paper N° 306.1, 377p (1989).

[27]. Tesch F. W., Age and growth. *In*: Ricker W.E. (Ed.). Methods for Assessment of Fish production in Fresh Waters. Blackwell Scientific Publications, Oxford, 1971, pp. 99-130.

[28]. Vazzoler, A. E. A. de M., Sintese de conhecimentosobre a biologia da corvina, *Micropogonias furnieri* (Desmarest, 1823), da costa do Brasil. Atlântica, Rio Grande, 13: 55–74(1991).

[29]. Wootton, R.J, *Fish ecology.* Glasgow, London, New-York. Blackie and Son**.** (1992).

[30]. Zar, J. H., Biostatistical Analysis. 4th Edition. Prentice–Hall, Englewood Cliffs, New Jersey, 1999, 662p.

Citation: C. K. *Boussou, " Length-weight relationships and condition factor of two Cyprinid Fish of the genus Enteromius: E.macrops (Boulenger, 1911) and E.leonensis (Boulenger, 1915) in Kogon and Tinguilinta Rivers basins (Republic of Guinea) ", International Journal of Innovative Studies in Aquatic Biology and Fisheries, vol. 3, no. 3, p. 12-17, 2017. http://dx.doi.org/10.20431/2454-7670.0303003*