

Length-weight relationship and relative condition factor of Gorean snapper, *Lutjanus goreensis* (Valenciennes, 1830) in the coastal zone of Lagos, south-west Nigeria

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Abstract

Snappers are highly recommended as choice seafood and as viable candidate for cage culture in the brackish water and marine environments. However, very limited data exists on biological parameters of the snappers, *Lutjanus* species throughout their distribution range. Hence, the present study sought to improve knowledge on Length-Weight Relationship (LWR) and relative condition factor (Kn) of the Gorean snapper, *Lutjanus goreensis* (Valenciennes, 1830) sampled between December 2008 and December 2009 in the coastal zone of Lagos, Nigeria. Specimens were collected from landings of artisanal fisheries and inshore trawl fisheries. A total of 822 unsexed estuarine (7.90 to 34.90 cm and 9.51-695.60 g) and 377 sexed marine (21.90 to 56.10 cm and 156-2 975 g) specimens were analyzed. The overall value of the slope, *b* for the LWR indicated negative allometric growth for unsexed estuarine (2.860); marine male (2.856) and female (2.917) specimens, respectively. The relative condition factor, Kn did not vary significantly from 1. Sex-wise variations of *b* values and Kn were not significant either. The present study presents, for the first time, baseline information on the length-weight relationship parameters and condition of *L. goreensis* in the marine waters of Nigeria and in the Eastern Atlantic Ocean. The results are useful indicators to assess the well-being of wild Gorean snapper populations in Lagos coastal zones for management and under culture conditions.

Keywords: *Lutjanus goreensis*; length-weight relationships; condition factor; Lagos; Nigeria.

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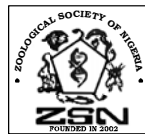
Introduction

Fish size is generally more biologically relevant than age because several ecological and physiological factors are more size-dependent than they are age-dependent. Therefore, variability in size has important implications in fisheries science and population dynamics and is one of the most common measurements in fisheries data (Aura *et al*, 2013). Length-Weight Relationship (LWR) statistics is the basis of the determination of growth quality which is the usual starting point in fisheries (Karachle and Stergiou, 2012) and has several applications.

Both LWR and condition factor are important measures of condition in fishes in that they serve as indicators of tissue energy reserves from which the physiological state of fish populations can be deduced. Also, they are invaluable as indirect means of evaluating ecological relations and effects of different fishery management practices in addition to the selection of species for aquaculture (Murphy *et al*, 1991; Wambiji *et al* 2008).

Red snappers (Lutjanidae) specifically command high market values in regional and international fisheries (Blaberet *al*, 2005, Fry *et al*, 2009; Sustainable Fisheries

Partnership, 2009). The Gorean snapper, *Lutjanus goreensis* is a medium to large and deep-bodied species of snappers common to 50cm but capable of attaining maximum total length of 80cm (Allen, 1985). Snappers are highly recommended as viable candidates for cage culture in the brackish water and marine environments (Ezenwa *et al*, 1985; Ezenwa *et al*, 1990) and also possess great potentials for fingerlings production (Madu, 1996). Length-weight data are lacking for most tropical fish species (Giarrizzo *et al*, 2006). Generally, information on biological aspects of *L. goreensis* and other snapper species in West Africa is very scanty despite their economic importance. Except for studies on length-weight relationships and condition factor of juvenile *L. goreensis* from the Niger Delta in Nigeria (Francis and Sikoki, 2007a; 2007b; 2007c; Orhibabor *et al*, 2011), comparable data for the species in the coastal zone East or West to the Niger Delta are not available. Hence, the present study aims to contribute to knowledge by studying the morphometric relationships between weight and length, and body condition factor of *L. goreensis* sampled from coastal areas in south-west, Nigeria.



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Materials and methods

Study area

Five Cowrie Creek and Lagos Coastal (inshore) waters were selected as fish sampling sites within the coastal zone of Lagos, south-west Nigeria. Stretching approximately 7 km (Latitude 6°26'-6°26'N and Longitude 3° 24'-3°27'E), Five Cowrie Creek is one of the numerous adjoining creeks to the Lagos Lagoon. It is connected to the lagoon at two ends; the Lagos Harbour which opens to the inshore (coastal) waters off Lagos via the Commodore Channel and at the extreme of the eastern part of Ikoyi at Moba, respectively (Vijverberg *et al*, 2012). The creek is also connected to Kuramo Creek which drains the Kuramo Lagoon (Onyema *et al*, 2005/2006). By virtue of channeling into the Atlantic Ocean, the creek serves as a passage or migratory corridor connecting the Lagos Lagoon, a larger juvenile/nursery fish habitat to the Atlantic Ocean, the marine habitat for many economically important estuarine-dependent fishes including the Gorean snapper. The Lagos fishing grounds (6° 24' 54' ' N; 3° 23' 06''E) extend approximately 180 km from the Nigerian-Benin Republic Border in the west to as far as Lekki in the east. To the North, the fishing grounds are bounded by Five Cowrie Estuarine and to the south by the Atlantic Ocean (Ediang and Ediang, 2013). The fishing grounds support major artisanal and trawl fisheries (Adebiyi, 2012).

The present study on LWR was conducted using data based on samples from artisanal and industrial fishing catches harvested with hook and lines, and trawl nets. Sample collection was made monthly from December 2008 to December 2010 resulting in 822 estuarine and 377 marine fish specimens selected without bias on size. Fish samples were transported in a cooler packed with ice to the laboratory. Total Length (TL) and Body Weight (BW) were recorded to the nearest 0.1 centimetre and 0.1 gram using a traditional fish measuring board and an electronic scale, respectively. Sex was determined in marine specimens as males and females only based on the presence of testes or ovary. Scatter diagrams of total length and body weight were plotted for sexed/pooled sexes, male and female, respectively. The length-weight relationship (LWR) and relative condition factor (Kn) were estimated separately for males, females and pooled data using the

power equation of the formula $W = aL^b$ (Froese, 2006) and $Kn = W/aL^b$ where W = body weight of the fish in g; L = total length of the fish in cm, a and b are intercept on the y-axis and slope of the curve, respectively and Kn = relative condition factor. The degree of association of the LWR was calculated using the coefficient of determination (r^2). The 95% confidence interval of parameters, a and b was also estimated.

Statistical analyses

Data were analysed as unsexed, separate and pooled sexes using IBM SPSS statistics software version 20. Student's *t*-test was applied to verify whether estimates of slope b presented a significant difference from the isometric growth of 3 for the length-weight relationships. The 95% Confidence Intervals (CIs) around mean b values were used as an initial assessment of differences between males and females (Pope and Kruse, 2007). The coefficient of determination (r^2) was estimated to determine the strength and pattern of association between body weight and the total length of fish specimens. Student's *t*-test was applied to (i) compare the mean b -values between males and females and (ii) to verify whether mean Kn values significantly differed from 1 and also to test for significant differences between Kn of males and females. Analysis of Variance (ANOVA) was carried out to test the effect of monthly variation of Kn in males and females while Tukey's post hoc tests were used to compare the significant differences. Statistical significance of 95% was chosen for all Student's *t*-test and ANOVA analyses.

Results

Length-weight relationship (LWR)

Estuarine samples consisted of 822 sexually immature specimens with varied total lengths of 7.90 cm to 34.70 cm and body weight ranging from 9.51 g to 695.60 g. Length-weight relationship of 377 specimens sampled indicated, 189 males of length ranging from 21.90 cm to 56.10 cm total length (TL) and weight ranging from 156 g to 2975 g, 188 females of length ranging from 22.60 cm to 47.60 cm TL and weight ranging from 200 g to 2000 g were analysed (Table 1).

Table 1: Descriptive statistics on length-weight relationships and relative condition factor, Kn for *L. goreensis* collected from Lagos coastal waters, south-west, Nigeria.

Sex	N	Samples Characteristics				a	a CI _{95%}	b	b CI _{95%}	r^2	Mean Kn	Range Kn
		TL (cm)	L Range (cm)	W (g)	BW Range (g)							
F	188	33.47	22.60-47.60	669.94	200-2000	0.022	0.015-0.031	2.91	2.82-3.02	0.94	1.02	0.96-1.11
M	189	32.30	21.90-56.10	622.83	156-2975	0.027	0.020-0.037	2.86	2.76-2.95	0.95	1.01	0.80-1.07
P	377	32.89	21.90-56.10	646.32	156-2975	0.025	0.019-0.031	2.88	2.82- 2.95	0.95	0.99	0.91-1.09

N = sample size; F = females; M = males; P = pooled sexes; TL = mean total length; BW = mean body weight; a = mean intercept; b = mean slope; CI = Confidence Interval; r^2 = coefficient of determination; Kn = mean relative condition factor.

Scatter diagrams of length and weight for male, female and pooled sexes exhibited similar curvilinear relationships as shown in Figures 1, 2 and 3. The LWRs fit a power function and the coefficients of determination were high in all cases ($r^2 = 0.94-0.95$). Total lengths in separate and pooled sexes proved to be a very good predictor of the body weights. This was proven by correlation determination of more than 0.90, thus leaving less than 10 percent of the variability between the two variables unaccounted.

Growth was allometric for estuarine and pooled marines sexes ($b \neq 3$; $p < 0.05$). Mean slope (b) estimates for the LWRs were significantly less than the critical isometric value ($b < 3$) in unsexed estuarine samples $W = (0.024) TL^{2.86}$; marine males $W = (0.027) TL^{2.856}$ and marine females $W = (0.022) TL^{2.912}$ indicating that growth patterns were negative allometric. Analysis with 95% CIs around the estimated b values and Student's t -test ($p > 0.05$) showed no significant difference between males and females. Hence, a common power equation was calculated (Figure 3) for both the sexes as: $(W = 0.025) TL^{2.883}$.

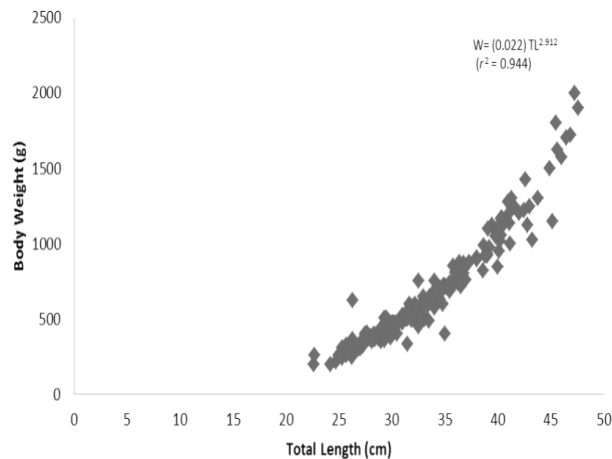


Figure 1: Total length in relation to body weight in 188 female *L. goreensis* from Lagos coastal waters between December 2008 and December 2010.

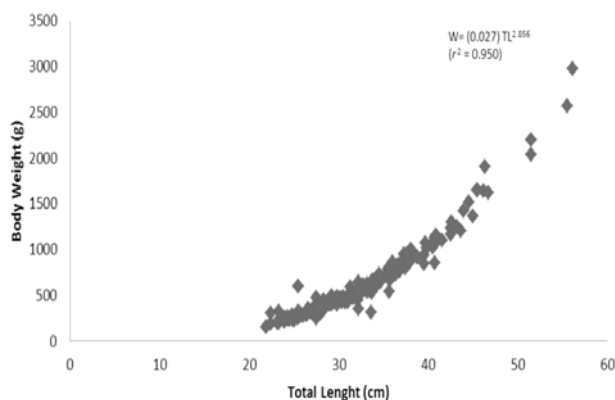


Figure 2: Total length in relation to body weight in 189 male *L. goreensis* from Lagos coastal waters between December 2008 and December 2010.

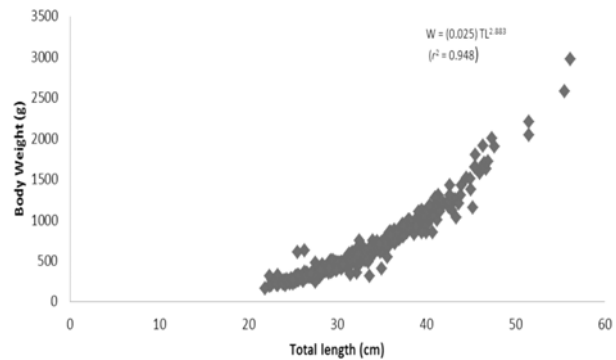


Figure 3: Total length in relation to body weight in 377 combined sexes *L. goreensis* from Lagos coastal waters between December 2008 and December 2010.

Relative condition factor, Kn

Generally, relative condition factor, Kn values were not significantly different from 1 according to the Student's t -test ($p > 0.05$) for estuarine specimens, pooled sexes, males, and females. Kn values ranged from 0.80 to 1.07 in males with a mean value of 1.01 while in females it ranged from 0.96 to 1.11 with a mean value of 1.02 and in combined sexes ranged from 0.91 to 1.09 with a mean value of 0.99. However, no significant variation was detected between mean Kn of males and females ($p > 0.05$).

Temporal trend in Kn is presented in Figure 4 and Figure 5 for *L. goreensis*. Highest mean monthly Kn was recorded between June and July and peaked slightly in July (1.07) while lowest mean value was recorded in May (0.98). Kn values of males and females in different months showed a similar trend. Fluctuations in Kn of males and females were observed between June and September while slight increases were shown in Kn of males and females from January to May. The amplitude of increase was more pronounced in the males and assumed a dome-shape. In July, a peak was observed in males (1.07) while in females it occurred both in June (1.11) and August (1.10), respectively. In males, lowest Kn values were recorded in January (0.81) and June (0.82). In females, mean Kn value was lowest in January (0.96) and increased slightly in

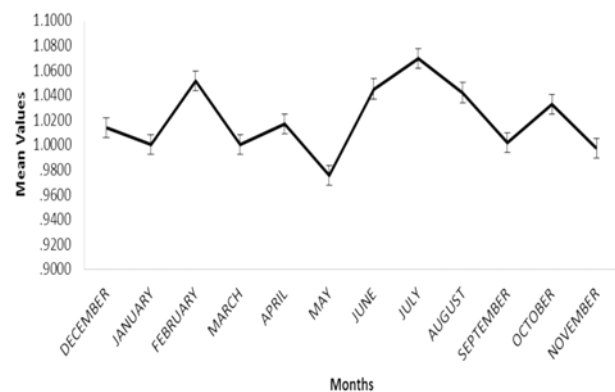


Figure 4: Mean monthly Relative Condition Factor, Kn of 822 unsexed *L. goreensis* from Five Cowrie Creek between December 2008 and December 2010.

February (0.98). A low Kn value was also observed in October (0.98). Similarly, a subtle decline in females was also noted in May (1.00) and July (1.05) between the two maxima in June and August, respectively. However, there was no significant difference in mean monthly Kn values of females and males, respectively ($p>0.05$).

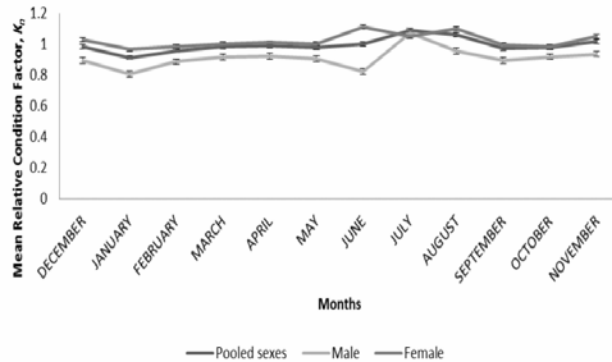


Figure 5: Mean monthly Relative Condition Factor, Kn of *L. goreensis* (377 pooled sexes, 189 males, and 188 females) from Lagos Coastal Waters between December 2008 and December 2010.

Discussion

Allometric growth coefficients for estuarine, sexed and pooled sexes marine samples fell within the expected range of $2.5 < b < 3.5$ (Froese, 2006), indicating that the cubic law could be safely applied within the indicated length. The cubic law states that if an animal is growing isometrically and doubles in length, its weight will increase in relation to the increase in volume; that is by 8 or (2^3) times (King, 2007). Negative allometric growth pattern in *L. goreensis* means that it becomes more slender or less robust as it increases in length. Negative allometric growth patterns were also reported in sampled populations of several fishes studied by King (1996) collected from Nigerian coastal waters. Growth pattern of *L. goreensis* in the present study compared favourably with several other snapper species. Francis and Sikoki (2007a) reported positive allometric pattern for *L. goreensis* from Andoni river system of the Niger Delta. In contrast, Agboola and Anetekhai (2008) reported high “*b*” values for two other juvenile lutjanid species (*Aspilus fuscus* and *Lutjanus agennes*) from Badagry Creek as $b = 3.09$ and $b = 3.08$, respectively, indicating isometry. For many snapper species, growth patterns ranged along a continuum from negative allometry to positive allometry. Negative allometry was reported for *L. malabaricus* (Raesi *et al.*, 2011), *L. guttatus* (Martinez-Andrade, 2003; Gonzalez-Ochoa *et al.*, 2009; Sarabia-Mendez *et al.*, 2010), *Rhomboplites aurorubens* (Manickhand-Heileman and Phillip 1996), *L. fulviflamma* (Grandcourt *et al.*, 2006); isometric growths were indicated for *L. jocu* (Giarrizzo *et al.*, 2006), *L. purpureus* (Manickhand-Heileman and Phillip 1996), *L. biguttatus* (Longenecker *et al.*, 2012), *L. vittatus* (Davis and West, 1993) and *L. argentiventris*

(Pinonet *et al.*, 2009; García-Contreras *et al.*, 2009; Bonilla-Gomez *et al.*, 2013).

The parameters *a* and *b* in this study should only be considered as the mean annual values because data used were not representative of a specific season of the year as *L. goreensis* specimens were collected over four seasons spanning two years (Raesi *et al.*, 2011). In addition, for more precise weight estimations, application of these length-weight relationships should also be limited to the observed length ranges; otherwise, it may be erroneous (Giarrizzo *et al.*, 2006).

As noted by Irigoyen-Arredondo *et al.* (2016), environmental factors, feeding, and reproduction affect the condition of organisms. In this study, temporal variation in the condition factors observed in the species was evaluated for the purpose of habitat quality assessment of the juvenile creek and marine adult environments. For both creek and coastal samples, there are presently no comparable reference studies except for the study of Francis and Sikoki (2007b) for samples from the Andoni river system in the Niger Delta. In this study, mean Kn in separate sexes indicated a relatively good state of health. Insignificant variations in the monthly Kn indicated stability of habitat quality which enables optimized growth. In creek samples, this result is in agreement with Francis and Sikoki (2007b) who determined K values of 0.69-2.88 for *L. goreensis* using a modified formula for calculating K in fishes with allometric growth.

Subtle fluctuations observed from February through October were attributed to the occurrence of large-sized snappers, normal seasonal variations in metabolic balance, maturation patterns and subsequent release of reproductive products which strongly influences body proportions (Froese, 2006; Bhattacharya and Banik, 2012). Relatively higher Kn values during June to August for males and from May to September for females hinted at gonadal maturation in these months.

Conclusion

This study presents supplementary data for the species in the estuarine environment while in the marine environment, first-time baseline data on the LWR and annual condition factor of the Gorean snapper in any part of Eastern Atlantic Ocean are documented. Thus, this information albeit restricted to the observed length ranges in this study will permit use for estimation of standing stock, yield and biomass throughout the species distribution range, and also to assess well-being of the fish as a cultivable species.

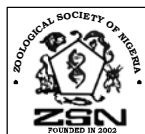
References

- Adebiyi, F. A. 2012. Dietary items and feeding habits of Big Eye Grunt *Brachydeute rusaaritus* (Valenciennes, 1832). *Journal of Fisheries International* 7(1): 1-5.
- Allen, G. R. 1985. FAO Species Catalogue. Snappers of the world. An annotated and illustrated catalogue of Lutjanid species known to date. *FAO Fisheries Synopsis*, (6)125: 1-208.
- Andrade-Rodriguez, H. A. 2003. Age determination in the

- snapper *Lutjanus guttatus* (Pisces, Lutjanidae) and investigation of fishery management strategies in the Pacific Coast of Guatemala. M.Sc. Thesis. Norwegian College of Fisheries Science, University of Tromsø, Norway, 45pp.
- Aura, C. M., Rashid, O. Anam, R. O., Musa, S. and Kimani, E. 2013. Length-weight relationship and condition factor (K constant) of *Dentexma roccanus*, Valenciennes 1830 (Family Sparidae) at Malindi, Kenya. *Western Indian Ocean J. Mar. Sci.*, 12(1): 79-83.
- Bhattacharya, P. and Banik, S. 2012. Length-weight relationship and condition factor of the pabo catfish *Ompokpabo* (Hamilton, 1822) from Tripura, India. *Indian J. Fish.* 59(4): 141-146.
- Blaber, S. J. M., Dichmont, C. M., Buckworth, R. C., Badruin, A., Sumiono, B., Nurhakim, S., Iskandar, B., Fegan, B., Ramm, D. M., and Salini, J. P. 2005. Shared stocks of snappers (Lutjanidae) in Australia and Indonesia: Integrating biology, population dynamics and socioeconomics to examine management scenarios. *Rev. Fish Biol.* 15 (1-2): 111-127.
- Bonilla-Gomez, J. L., Robles, Y.A., and Vega, A. J. 2013. Length-weight relationship and biological information of the yellow snapper *Lutjanusa rgentiventris* from a tropical estuary: Rio Cate, Gulf of Montijo, Panama. *Journal of Applied Ichthyology*, 30 (1): 227-229.
- Davis, T. L. O. and West, G. J. 1993. Maturation, reproductive seasonality, fecundity, and spawning frequency in *Lutjanus vittus* (Quoy and Gaimard) from the north-west shelf of Australia. *Fishery Bulletin*, 91: 224-236.
- Ediang, O. A. and Ediang, A. A. 2013. Beyond data regulation: finding a solution to the persistent problem of marine debris and sea surface temperature measurement along the coastline of Lagos, Nigeria. *Data Science Journal* 12: 129-133.
- Ezenwa, B. I. O. 1994. Aquaculture development and research in Nigeria, pp. 41-80. In: Coche, A. (Ed). Aquaculture development and research in sub-Saharan Africa – National Reviews. *CIFA Technical Paper No. 23*, Roma, 397p.
- Ezenwa, B. I. O., Alegbeleye, W. O., Anyanwu, P. E and Uzukwu, P. U. 1990. Cultivable fish seeds in Nigerian coastal waters: A research survey (second phase: 1986-1989). *NIOMR Technical Paper No. 66*, 37p.
- Fakoya, K. A., Anetekhai, M. A., Akintola, S. L., Saba, A. O. and Abass, M. A. 2015. Life-stages, exploitation status and habitat use of Gorean snapper, *Lutjanus goreensis* (Perciformes: Lutjanidae) in coastal marine environments of Lagos, South-West Nigeria, *Rev. Biol. Trop.* 63 (1).
- Francis, A. and Sikoki, F. D. 2007a. Length-weight relationship of fish species from the Andoni, River System, Niger Delta, Nigeria-1. *Environment and Ecology (Kalyani)* 25(2): 439-443.
- Francis, A. and Sikoki, F. D. 2007b. Condition factor of fishes from the Andoni River system, Niger Delta, Nigeria. *Environment and Ecology (Kalyani)* 25 (2): 411-415.
- Francis, A. and Sikoki, F. D. 2007c. Condition factor of fishes from the Andoni River system, Niger Delta, Nigeria. *Environment and Ecology (Kalyani)* 25 (2): 411-415
- Froese, R. 2006. Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *J. Appl. Ichthyol.*, 22(4): 241-253.
- Fry, G., Milton, D. A., Van Der Velde, T., Stobutzki, I., Andamari, R. B. and Sumiono, B. 2009. Reproductive dynamics and nursery habitat preferences of two commercially important Indo-Pacific red snappers *Lutjanusery thopterus* and *L. malabaricus*. *Fish. Sci.* 75: 145-158.
- Giarrizzo, T., Silva de Jesus, A. J., Lameira, E. C., Araújo de Almeida, J. B., Isaac, V. and Saint-Paul, U. 2006. Weight-length relationship for intertidal fish fauna in a mangrove estuary in Northern Brazil. *Journal of Applied Ichthyology*, 22: 325-327.
- Grandcourt, E. M., Abdessalaam, T. Z. and Francis F. 2006. Age, growth, mortality and reproduction of the blackspot snapper, *Lutjanus fulviflamma* (Forsskal, 1773) in the southern Arabian Gulf. *Fisheries Research* 71(2-3): 203-210.
- Irigoyen-Arredondo, M. S., Arín-enríquez, X. G. Moreno-Sánchez, L.A., AbItIAcárdén, A. S. and Rámirez-Pérez, J.S. 2016. Weight-length relationship and condition factor of leopard grouper *Mycteroperca rosacea* (Perciformes: Serranidae) from the Gulf of California. *California. Fish and Game* 102(2): 50-54.
- Karachle, P. K. and Stergiou, K. I. 2012. Morphometrics and allometry in fishes. In: C. Wahl (Ed.), *Morphometrics*, 108p.
- King R. P. 1996. Length-weight relationship of Nigeria coastal water fishes. *NAGA ICLARM Q.19*: 53-58.
- King, M. 2007. *Fisheries Biology, Assessment and Management. 2nd Edition*. Blackwell Publishing, 382p.
- Longhurst, A. R. 1969. Species assemblages in tropical demersal fisheries. In: *Proceedings of the symposium on the oceanography and fisheries resources of the tropical Atlantic. Results of ICITA and GTS*. Abidjan, Ivory Coast, 20-28 October 1966, pp. 147-168. UNESCO Publications, Paris.
- Longenecker, K., Langston, R. and Bolick, H. 2012. Rapid reproductive analysis and length- dependent relationships of *Lutjanus biguttatus* (Perciformes: Lutjanidae) from Papua New Guinea. *Pacific Science*, 67(2): 1-13.
- Madu, C. T. 1996. Potentials for a marine fish hatchery production in Nigeria. *Proceedings of the 13th Annual Conference of the Fisheries Society of Nigeria (FISON), 3rd-8th November, 1996*, New Bussa, Niger State, pp. 290-293.
- Manickhand-Heilemann, S.C. and Philip, D. A. T. 1996. Reproduction, age and growth of the Caribbean red snapper (*Lutjanus purpureus*) in waters off Trinidad and Tobago, pp. 137-149. In: F. Arregun-Sanchez, J. L. Munro, M. C. Balgos and D. Pauly, (Eds). *Biology, fisheries and culture of tropical groupers and snappers ICLARM Conf. Proc.* 48: 44pp.
- Manickhand-Heilemann, S. C. and Philip, D. A. T. 1999. Contribution to the biology of the vermilion snapper, *Rhomboplite saurorubens* in Trinidad and Tobago. West Indies. *Environmental Biology of Fishes* 55: 413-421.
- Murphy, B. R., Willis, D. W. and Springer T.A. 1991. The relative weight index in fisheries management: Status and needs. *Fisheries (Bethesda)* 16(2): 30-39.

- Onyema, I. C., Nwankwo, D. I. and Oduleye, T. 2005/2006. Diatoms and Dinoflagellates of an Estuarine Creek in Lagos. *Journal of Scientific Reserach and Development*, 10: 73-82.
- Orhibabor, B. J., Ogbeibu, A. E. and Udo, M. T. 2011. The length-weight relationships of brackish water/marine fish species assemblage in a Niger Delta Mangrove Creek, Nigeria. *Current Research Journal of Biological Sciences*, 3(6): 616-621.
- Pinon, A., Amezcua, F. and Duncan, N. 2009. Reproductive cycle of female yellow snapper *Lutjanus argentiventris* (Pisces, Actinopterygii, Lutjanidae) in the SW Gulf of California: gonadic stages, spawning seasonality and length at sexual maturity. *Journal of Applied Ichthyology* 25: 18-25.
- Pope, K. L. and Kruse, C. G. 2007. Condition. In: *Analysis and interpretation of freshwater fisheries data*. C. S. Guy and M. L. Brown (Eds.). American Fisheries Society, Bethesda, MD, pp. 423-471.
- Raeisi, H., Daliri, M., Paighambari, S.Y., Shabani, M.J., Bibak, M. and Davoodi, R. 2011. Length-weight relationships, condition factors and relative weight of five fish species of Bushehr waters, Northern Persian Gulf. *African Journal of Biotechnology* 10(82): 19181-19186.
- Sarabia-Méndez, M., Gallardo-Cabello, M., Espino-Barr, E. and Anislado-Tolentino, V. 2010. Characteristics of population dynamics of *Lutjanus guttatus* (Pisces: Lutjanidae) in Bufadero Bay, Michoacán, Mexico. *Hidrobiológica* 20(2): 147-157.
- Sustainable Fisheries Partnership. 2009. Supply Chain Analysis of Red Snapper in Indonesia. Available at http://www.Snapper%20White%20Paperupdated%20June%202011_Draft-98e3b8f6.pdf (accessed on 10 December, 2011).
- Vijverberg, T., Reneerkens, M. J. J., Winterwerp, J. C., Scholl, J. C. O. and Haruna, Y. 2012. Sediment dynamics in Lagos harbour reconnaissance on effects of dredging. In: Lynett, P. and Smith, J.M. (Eds.), *Proceedings of the 33rd International Conference on Coastal Engineering 2012 (ICCE 2012) Vol. 33. Coastal Engineering Proceedings*, pp. 1-12.
- Wambiji, N., Ohtomi, J., Fulanda, B., Kimani, E., Kulundu, N. and YeaminHossain, M. D. 2008. Morphometric relationship and condition factor of *Siganus stellatus*, *S. canaliculatus* and *S. sutor* (Pisces: Siganidae) from the Western Indian Ocean Waters. *South Pacific Studies* (29)1: 1-15.

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