FSN-PW 0008

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF TWO *Hydrocynus* SPECIES IN LAKE KAINJI, NIGERIA

Olowosegun O.M[1] and Ataguba, G.A.[2]
[1]National Institute for Freshwater Fisheries Research New-Bussa, Niger State.
[2] Department of Fisheries and Aquaculture,University of Agriculture, Makurdi, Benue State.

This paper was prepared for presentation at the 25th Annual International Conference and Exhibition in Administrative Staff College of Nigeria (ASCON), Topo-Badagry, Lagos, Nigeria, 25th – 29th October, 2010.

ABSTRACT

In the study and understanding of fish biology, characterization and morphology, the length-weight relationship is of great importance. The genus hydrocynus, is of high economic importance to the fisheries of Lake Kainji. This study investigated their length-weight relationship to establish the growth pattern of species within this genus. The 'b' values of the length-weight relationship for these species are less than 3. There was negative allometric growth (b<3) for all samples of the Hydrocynus species. The correlation coefficients (r) are 0.9713 and 0.9888, for Hydrocynus forskali and H.brevis respectively. Condition factors ranged from 1.313 for H. forskali to 1.431 for H. brevis.

INTRODUCTION

Ricker (1968) had expressed the importance of length-weight relationships in population assessments. One of the most commonly used analyses of fisheries data is length - weight relationship (Mendes *et al.*, 2004). Length and weight data are useful standard results of fish sampling programs (Morato *et al.*, 2001). 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).

The condition and length-weight parameters of aquatic species are relevant to understanding their growth and well-being (Pauly, 1993). Length-weight relationships are useful for a wide number of studies, such as estimating growth rates, age structure and other aspects of fish/shrimps population dynamics (Tsoumani *et al.*, 2006). Length-weight relationships have been extensively used for estimation of weight from length due to technical difficulties and the amount of time required to record weight in the field, conversion of growth in length equations to growth in weight for use in stock assessment models, estimation of the biomass from length observations and estimation of the condition factors of the aquatic species. In addition to the above, length-weight relationships are useful for between region comparisons of life histories of a certain species (Nurul-Amin *et al.*, 2009).

Abdurahiman *et al* (2004) stated that the length-weight relationship (LWR) is an important factor in the biological study of fishes and their stock assessments. The LWR is particularly important in parameterizing yield equations and in estimations of stock size. This relationship is helpful for estimating the weight of a fish of a given length and can be used in studies of gonad development, rate of feeding, metamorphosis, maturity and condition (Le Cren, 1951). Length-weight relationships are also originally used to provide information on the condition of fish and may help determine whether

somatic growth is isometric or allometric (Ricker, 1975).

The African Characiformes were formerly included in the Characidae family (Paugy *et al*., 2004). Since the publication of the first edition of this fauna, a new denomination, Alestidae, was proposed to separate African members from the neotropical Characidae, because joined together the two geographical groups formed a polyphyletic unit (Géry, 1995; Buckup, 1998). Later, some new works on the osteological characters (Murray and Stewart, 2002) support the monophyly of Alestidae.

Ogbe *et al* (2008) reported the growth parameters of *Hydrocynus forskali* and *Alestes nurse* in River Benue, Nigeria. The length-weight relationship equations are: Log W=0.3393 + 1.11958Log L (r^2 = 0.6182) and Log W= -0.0919 + 1.5362LogL (r^2 = 0.7134) for *H. forskali* and *A. nurse*, respectively. They also reported that *H. forskali* had a mean condition factor of 1.23±0.22 whereas *A. nurse* had 1.88±0.29. Hence the growth pattern of the two species was negative allometry, the slope 'b' in the length-weight relationship of both species being much lower than 3.

Offem *et al.* (2009) reported the length-weight relationships, condition factor and sex ratio of forty-six important fishes of the Cross River inland wetlands of Nigeria. These authors reported 'b' values of 2.1 (*H. vittatus*), 1.9 (*A. nurse*) and 0.9 (*A. macrolepidotus*). They also reported that 65% of the samples had condition factor greater than 0.77 ± 0.12.

MATERIALS AND METHODS

Sampling sites on Lake Kainji were visited fortnightly from August 2008 to July 2009 and on each visit, fishermen's catches were sampled and gears used recorded and targeted fish samples were examined in their fresh state and immediately identified using identification keys by Olaosebikan and Raji (1998) and Paugy *et al* (2004), the standard length (cm) and the weight (g) for each of the species were recorded.

For samples of each *Hydrocynus species*, the parameters 'a' (intercept) and 'b' (exponent) of the Length-weight Relationship (LWR) were determined as follows:

$W= aL^b$ that is log transformed as Log W= a + b Log L; with length expressed in 'cm' and weight in 'g'. FISAT II (Fish Stock Assessment Tools) was used for this analysis. 'a' and 'b' are the coefficients of the functional regression between W and L (Ricker, 1973).

The Fulton condition factor (*K*) for each species was calculated from the equation:

$$K=\frac{100.W}{L^3}$$

Where: *K* = condition factor,
L = standard length (cm),
W = weight (g).

RESULTS AND DISCUSSION

Individual fish length and weight observations were recorded for two hundred and eighty four (284) specimens of the genus *hydrocynus* analyzed in this study. Sample sizes were 241 individuals for *hydrocynus forskali*, while *hydrocynus brevis* were 43. Tables 1 and 2 give the summary of the sample size, minimum and maximum lengths and weights, length-weight relationships, % CI of 'b' values, coefficient of correlation (r), growth type (isometric or allometric), for each species.

TABLE 1: GROWTH PARAMETERS OF TWO SPECIES OF THE GENUS *Hydrocynus* OF LAKE KAINJI

TABLE 2:

Species	a(±S.D)	Confidence Interval 'a'	b (±S.D.)	Confidence Interval 'b'	Correlation Coefficient (r)
H. forskali	-0.344±0.0371	-0.4172 - -0.2716	1.809±0.0287	1.753 - 1.8651	0.9713
H. brevis	-0.014±0.0471	-0.1065 - 0.0783	1.570±0.0371	1.498 - 1.6429	0.9888

CONDITION FACTOR FOR TWO SPECIES OF THE GENUS *Hydrocynus* OF LAKE KAINJI

Species	n	Minimum	Maximum	Condition Factor (±S.E.)
H. forskali	241	0.656	2.885	1.313±0.018
H. brevis	43	0.863	2.125	1.431±0.044

n-sample size; SE-standard error

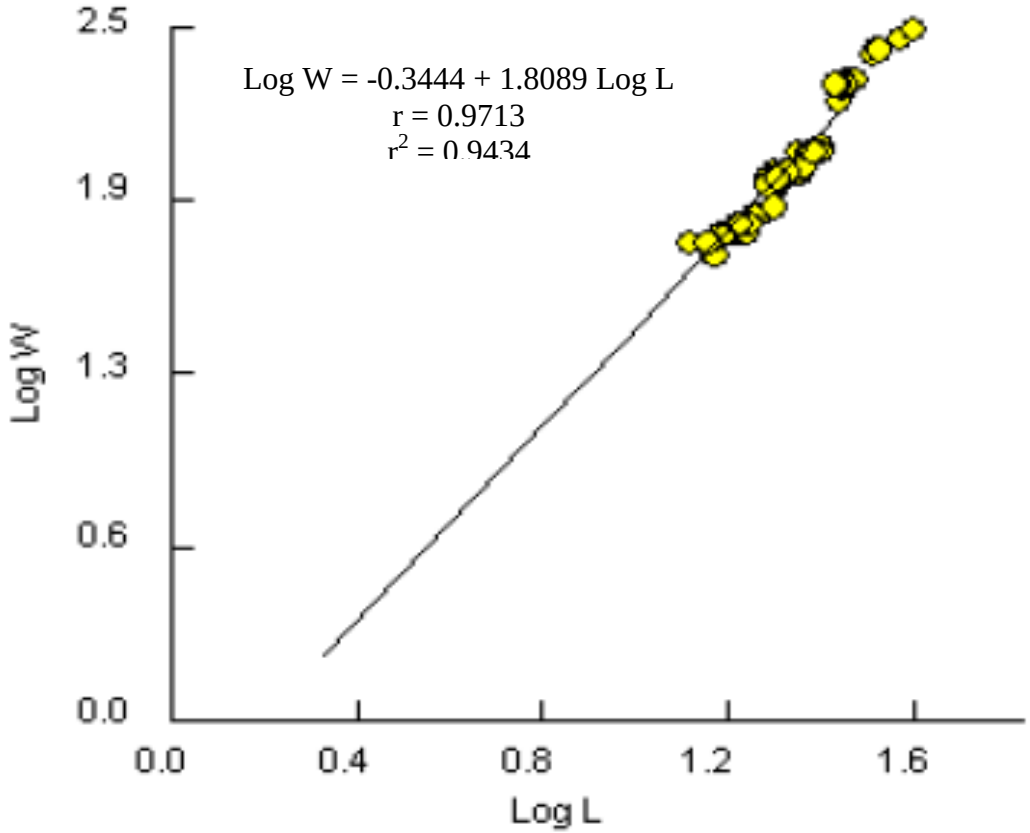

Fig.1: Length-weight relationship of *Hydrocynus forskali* of Lake Kainji

The length–weight relationship of the two *Hydrocynus* species is presented in Figures 1 and 2. The values of 'b' for these species are less than 3 (Table 1). The growth was negative allometric (b<3) for overall samples of the *Hydrocynus* species. The correlation coefficients (r) are 0.9713 and 0.9888, for *Hydrocynus forskali* and *H.brevis*.

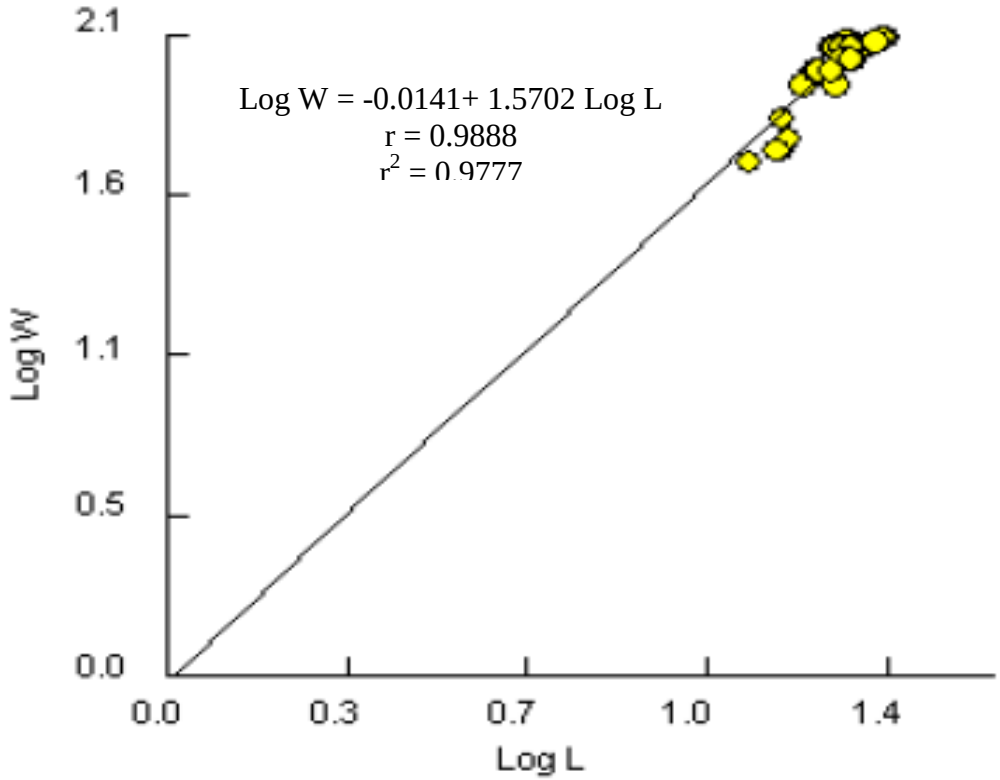

Fig.2: Length-weight relationship of *H. brevis* of Lake Kainji

For all of the studied species in this study, the 'b' values were generally in agreement with previous results. It is well known that the functional regression 'b' value represents the body form, and it is directly related to the weight affected by ecological factors such as temperature, food supply, spawning conditions and other factors, such as sex, age, fishing time and area and fishing vessels (Ricker, 1973).

All the species showed negative allometric growth (Table 3). Etim (2000) in a similar work carried out on *Chrysichthys nigrodigitatus* reported 2.951 for the pooled 'b' value, this is higher than the value obtained in this study and this disparity could be due to the environmental differences, length ranges and difference in the sampled species.

The 'b' value obtained is significantly different from 3 (Student t–test: p = 0.05). Ogbe *et al* (2008) reported 'b' values of 1.11958 (*H. forskali*) and 1.5362 (*Brycinus nurse*) in the Lower Benue Basin. On the other hand, Ecoutin and Abaret (2003) observed that the *b* value of 52 species of the lagoon and estuary of West Africa did not differ significantly from 3. This was also observed by Entsua –Mensah *et al* (1995) for 45 fresh water species of Ghana. The difference between these results could be related to the types of habitats. Several other factors could explain this variation in 'b' values such as sexual dimorphism (Artigues *et al.*, 2003), period of year and stage of maturity (Weatherley and Gill, 1987), water quality or food available for fish growth (Mommsen, 1998), sampling procedure (sample size and length range) (Ecoutin and Abaret, 2003).

The condition factors obtained for all the fish samples was 1.31 for *H.forskali* and1.431 for *H.brevis* (Table 2). The mean condition factor recorded during the study is within the range 1.53 – 2.55 reported by Ekanem (2000) from Cross River but higher than 0.79 ± 0.15 as reported by Fafioye and Oluajo (2005) from Epe Lagoon in Lagos. In addition, Ogbe *et al* (2008) also reported the condition factors of two Alestids in River Benue, Nigeria. The mean values reported are: 1.23±0.22 (*H. forskali*) and 1.88±0.29 (*B. nurse*). The differences could be due to a difference in the conditions of the habitats such as the physico – chemical parameters, plant and animal communities and also a difference in the weight of individual species sampled, period of sampling and availability of food.

CONCLUSION

Length-weight relationships derived in this study generally compared favorably with those of other published studies. Analysis of these data provided insights into areas such as length range or sample size for some species, in which additional sampling can be targeted in future studies. Conclusively, the two species studied exhibited negative allometric growth.

REFERENCES

Abdurahiman, K.P; Harishnayak, T; Zacharia, P.U. and Mohamed, K.S. (2004). Length-weight relationship of commercially important marine fishes and shellfishes of the southern coast of Karnataka, India. *NAGA, WorldFish Center Quarterly* Vol. 27 (**1**) and 2: 9 – 14.

Artigues, B., Morales–Nin, B., Balguerias E. (2003). Fish length–weight relationships in the Weddell Sea and Bransfield Strait. *Polar Biol*., 26, 463–467.

Buckup P.A. (1998). Relationships of the Characidiinae and phylogeny of characiform fishes (Teleostei: Ostariophysi). In Phylogeny and classification of neotropical fishes, Malabarba L.R., Reis R.E; Vari R.P; Lucena Z.M.S. and Lucena C.A.S. (eds). EDIPUCRS, Porto Alegre, Brazil: 123-144.

Ecoutin, J. M and Albaret, J. J. (2003). Rélation longueur–poids pour 52 esp~ces de poissons des estuaires

et lagunes de l'Afrique de l'Ouest. *Cybium*, 27, (1), 3–9.

Ekanem, S.B. (2000). Some Reproductive Aspects of *Chrysichthys nigrodigitatus* (Lacepede) from Cross River, Nigeria. NAGA. Fisheries Section of the Network of Tropical Aquaculture and Fisheries Professionals (NTAFP) *The ICLARM Quarterly*. Vol 23, No.2

Entsua–Mensah, M; Osei–Abunyewa, A and Palomares, M. L. D. (1995). Length–weight relationships of fishes from tributaries of the Volta River, Ghana: part I. Analysis of pooled data sets. Naga ICLARM Q., 18, 36–38.

Etim, L. (2000). Length–weight relationship of eight fish species from the Cross river, Nigeria. *Global Journal of Pure and Applied Sciences* 6 (4): 571 – 575.

Fafioye, O.O. and Oluajo, O.A. (2005). Length – weight relationship of five fish species in Epe lagoon, Nigeria. *African Journal of Biotechnology*. 4 (7): 749 – 751.

Gamble, R. (1959) Investigations of the sub-division of North Sea whiting populations. Part I. Further observations on the vertebral counts of whiting in the North Sea area. ICES CM /36. Near Northern Seas Committee. 3 pp

Géry, J. (1977). Characoids of the World. Tropical Fish Hobbyist Publications, Neptune City, New Jersey. 672 pp

Géry J. (1995). Description of a new or poorly known Alestinae (Teleostei: Characiformes, Alestidae) from Africa with a note on the generic concept in Alestinae. *Aquat. J. Ichthyol. Aquat. Biol*., 1, 4: 37-64.

Le Cren, E.D. (1951). The length – weight relationship and seasonal cycle in gonad weight and condition in the Perch (*Perca fluriatilis*). *Journal of Animal Ecology*, 20:201 – 219.

Mendes, B., Fonseca, P. and Campos, A. (2004). Weight-length relationships for 46 fish species of the Portuguese west coast. *J. of Applied Icht*., 20: 355-361.

Mommsen, T. P. (1998). Growth and metabolism. *In* Evans, D. H. (Ed.) The physiology of fishes. CRC Press, New York, 65–97.

Morato, T. P; Afonso, P; Lourinho, P; Barreiros, J. P; Santos, R. S. and Nash, R. D. M. (2001). Length-weight relationships for 21 coastal fish species of the Azores, north-eastern Atlantic. *Fisheries Research***,** 50: 297-302.

Nurul -Amin, S. M.; Arshad, A.; Siraj, S. S. and Bujang, J.S. (2009). Population structure, growth and length weight relationship of Sergestid shrimps (*Acetes spp*.) from the Coastal Waters of Malacca, Peninsular Malaysia. *Sains Malaysiana* 38(2): 159–169.

Offem, B.O.; Samsons, Y. A and Omoniyi, I. T. (2009). Length-weight relationship, condition factor and sex ratio of forty six important fishes in a tropical flood river. *Research Journal of Fisheries and Hydrobiology*, 4(2): 65-72

Ogbe, F.G. Ataguba, G. A. and Okosuwe, E.H. (2008). Feeding habits and growth parameters of *Hydrocynus forskali* and *Alestes nurse* in River Benue, Nigeria. *Journal of Applied Biosciences* **11**: 576 - 583.

Olaosebikan B.D and Raji A. (1998). Field Guide to Nigerian Freshwater Fishes Federal College of Freshwater Fishes, New Bussa, Niger State. 106pp.

Paugy, D, Leveque C and Teugels G. G. (2004). The Fresh and Brackish Water Fishes of West Africa Vol. 2 Melanie Stiassny, Guy G. Teugels and Carl D. Hopkins (Eds). IRD 815pp

Pauly D. (1983). Some simple methods for the assessment of tropical fish stocks. FAO. Fisheries Technical Pap. No. 234. FAO, Rome.

Pauly, D., (1993) Fishbyte Section Editorial. Naga, ICLARM Quart., 16: 26.

Ricker, W. E. (1973). Linear regressions in fishery research. *Journal of the Fisheries Research Board of Canada*, **30**: 409-434.

Ricker W.E (1975). Computations and interpretation of biological statistics of fish populations. *Fisheries Research Board Canada Bulletin*, 191: 382.

Sinovcic, G., Franicevic, M., Zorica, B. and Ciles-Kec, V. (2004). Length-weight and length-length relationships for 10 pelagic fish species from the Adriatic Sea (Crotia). *J. of Applied Ichthyology*, **20**: 156-158.

Tsoumani, M.; Liasko, R; Moutsaki, P; Kagalou, I. and Leonardos, I. (2006). Length-weight relationships of an invasive Cyprinid fish (*Carassius gibelio*) from 12 Greek Lakes in relation to their trophic states. *Journal of Applied Ichthyology* 22: 281-284.

Weatherley, A. H., Gill, H. S. (1987): The biology of fish growth. Academic Press, London, 325p.