

STUDY OF LENGTH-WEIGHT RELATIONSHIPS AND CONDITION FACTORS OF SOME FISH SPECIES

¹Buba, S.A., ¹Abdulkarim, M. ¹Mancha, Y.P., ²Yusuf, Z.A. & ¹Mahmood, S.1

¹Department of Animal Production, Abubakar Tafawa Balewa University, Bauchi, Nigeria

²Department of Biological Sciences, Abubakar Tafawa Balewa University, Bauchi, Nigeria

Corresponding Author: email: Salisububa336@gmail.com

ABSTRACT

This review investigated the length-weight relationships (LWR) and condition factors (K) of *Tilapia zilli*, *Tilapia mariae*, *Oreochromis niloticus*, *Barbus occidentalis* and *Barilius loati* from Lower Usuma Reservoir in Abuja. Two thousand four hundred and fifty two (2,452) fish samples were collected for morphometric measurements. The results obtained showed that the growth pattern of the fish species had negatively allometric growth with b values range from 1.4 to 2.3. There was significant difference between LWR ($P < 0.001$). There were strong correlation (0.86 – 0.73) between the length and weight of all the species, except *Tilapia mariae* which was weakly correlated (0.54). The condition factor (K) range from 1.06- 2.02, these were an indication that the fish species were thriving very well in the Reservoir. Furthermore, LWR and K of 5 fish species in Nkoro River Niger delta were reviewed. The exponential equation for the LWR were: *Ethmalosa fimbrata* ($W_t = 0.0162 \times T_l^{3.199}$) and *Cynoglossus senegalensis* ($W_t = 0.0326 \times T_l^{3.508}$). All species studied exhibited isometric growth pattern with the value of b = 3 except *S. maderensis* and *C. senegalensis* with value of b = 3.6 and 3.5 respectively that exhibited positive allometric growth. The value of K ranged from 0.92 to 0.99 for *Ilisha. africana* to *C. senegalensis*). There was difference in the condition factors for the monthly K for *E. fimbrata* (0.85 ± 0.015) and *I. africana* (0.96 ± 0.061). LWR and K of *Clarias gariepinus*, in Kiri reservoir had a b value of 3.80 which indicated the fish species had allometric growth pattern. Monthly K range from 0.65 - 1.21 with a mean value of 0.78 ± 0.09 and 1.04 ± 0.12 . Condition factors of the *C. gariepinus* were not in a good condition of wellbeing.

INTRODUCTION

The condition factor in fish serves as an indicator of physiological state of the fish in relation to its welfare (Le Cren, 1951). Condition factor play an important role in understanding the life cycle of fish species and it contributes to adequate management of these species, hence, maintaining the equilibrium in the ecosystem (Imam *et al*, 2010).

This study reviewed the length and weight relationships (LWR) and condition factors (K) of *Ethmalosa fimbrata*, *Ilishia africana*, *Sardinella maderensis*, *Cynoglossus senegalensis* and *Elops senegalensis* from the Nkoro River and also to assess LWR and K of *Tilapia zilli*, *Tilapia mariae*, *Oreochromis niloticus*, *Barbus occidentalis* and *Barilius loati* from Lower Usuma Reservoir in Abuja as well as *Clarias. gariepinus* in Kiri Reservoir Adamawa State.

STUDY AREA

The Nkoro River is a tributary of the Andoni River in the Niger Delta area of Nigeria. Lower Usuma Reservoir was located in Bwari Area council in Abuja. Kiri reservoir had a coordinates of 9°40'47"N 12°00'51"E on the southern part of Adamawa State, It was situated within Shelleng Local Government Area and Numan Local Government. The Dam is 1.2 km long, 20 m high zoned embankment with an internal clay blanket.

FISH SAMPLING TECHNIQUES

Fish species were caught twice a month for a period of twelve months. The fish species were stored in coolers containing ice and transported to the laboratory for further analysis.

DATA COLLECTION

Total Length (TL) of fish species were each measured from the tip of the anterior or part of the month to the caudal fin. The weight of fish species were each measured with digital weighing balance after blot drying with a piece of clean hand towel.

STATISTICAL ANALYSIS

LWR analysis were carried out following the format accepted by FISAT (Gayando and Pauly, 1997). The LWR of the fish species was expressed by equation (Pauly, 1997):

$$W=aL^b$$

W=Weight of fish in (g), L=Total Length (TL) of fish in (cm), a=Constant (intercept) and b = The Length exponent (slope)

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

$$K = 100/L^3$$

K= condition factor, W= weight of fish and L = length of the fish species.

RESULTS AND DISCUSSIONS

Table 1: Length-weight Relationships of Fish species in Lower Usuma Reservoir

Fish species	Number of Fish species	Sex	a	b	95% CI for b	r	Significance of r	Pattern
<i>T. zilli</i>	601	M	0.541	2.301	2.279-2.323	0.844	0.001	Negative allometric
	604	F	0.552	2.275	2.251-2.299	0.861	"	Negative allometric
	1205	M+F	0.545	2.291	2.279-2.303	0.857	"	Negative allometric
<i>T. mariae</i>	120	M	0.700	1.570	1.541-1.599	0.536	"	„
	234	F	0.730	1.442	1.422-1.462	0.543	"	„
	354	M+F	0.720	1.486	1.470-1.502	0.539	"	„
<i>O. niloticus</i>	236	M	0.539	2.328	2.295-2.361	0.861	0.001	Negative allometric
	298	F	0.577	2.198	2.165-2.231	0.862	"	"
	534	M+F	0.559	2.259	2.249-2.269	0.866	"	"
<i>B. occidentalis</i>	81	M	0.684	1.945	1.908-1.982	0.700	"	„
	225	F	0.640	2.168	2.144-2.192	0.740	"	Negative allometric
	306	M+F	0.650	2.11	2.088-2.132	0.731	"	"

* N = Number of sample size; a and b = regression coefficients; CI = confidence interval; r = correlation coefficient

Source: Dan-kishiya, (2013)

Table 1 shows that LWR of the fish species from lower Usuma Reservoir. The 95% confidence interval values of the exponent 'b' in the LWR varied between 2.2 and 2.3 for *Tilapia zilli*, 1.4 and 1.6 for *Tilapia mariae*. *Oreochromis niloticus* had values that range between 2.1 to 2.3 while *Barbus occidentalis* and *Barilius loati* had values that range between 1.9 to 2.2 and 2.3 to 2.4, respectively. Analysis of both the males and females separately and combined showed that all the species exhibited negative allometric growth pattern. Similarly, Ibrahim *et al.* (2012) observed allometric growth pattern in Kontagora reservoir in Niger state. There was strong correlation 0.536 between the length and the weight of all the species except *Tilapia mariae* which was weakly correlated. Model equation for *Tilapia zilli*: Weight = 0.541+ 2.301 length. LWR of *C. gariepinus* in River Kiri revealed that b value was 3.18, which exhibited allometric growth and showed linear relationship with significant correlation coefficient of 0.122 (p<0.05). King (1991) also reported allometric growth patterns for *Tilapia* species from Umuoseriche Lake.

Table 2. Mean condition factor (K) of five fish species from Lower Usuma Reservoir

Fish species	Number of fish species	Sex	Mean K	Mean TL(cm)	Mean W(gm)	STD	SE
<i>Tilapia zilli</i>	601	M	2.02	10.397	22.747	0.26	0.011
	604	F	1.96	11.490	29.733	0.29	0.012
	1205	M+F	2.00	10.945	26.249	0.28	0.008
<i>Tilapia mariae</i>	120	M	1.82	7.360	7.215	0.16	0.015
	234	F	1.94	7.465	8.063	0.15	0.010
	354	M+F	1.90	7.429	7.776	0.16	0.009
<i>Oreochromis niloticus</i>	236	M	1.93	10.742	23.891	0.25	0.016
	298	F	1.87	11.944	31.942	0.29	0.017
	534	M+F	1.91	11.413	28.384	0.12	0.005
<i>Barbus occidentalis</i>	81	M	1.31	10.021	13.233	0.17	0.019
	225	F	1.24	10.266	13.406	0.19	0.013
	306	M+F	1.26	10.201	13.361	0.18	0.010
<i>Barilius loati</i>	53	M+F	1.06	12.102	18.759	0.14	0.019

* N = Number of sample size; K= Condition factor; TL= total length; W= weight; STD= standard deviation; SE= standard error

Source: Dan-kishiya, (2013)

There were differences in the condition factors for the males and females as well as combined sexes and the monthly K- factor for each fish species studied. The condition factor for the 5 species recorded ranged from 1.06 to 2.02. *Tilapia zilli* had a range of 1.96 – 2.02 while, *Tilapia mariae* had a range of 1.82 – 1.94 with a monthly range of 1.55-2.85 (fig.2). Others were *Oreochromis niloticus*, *Barbus occidentalis* and *Barilius loati* with mean K- values of 1.87 – 1.93, 1.24 – 1.31 and 1.06 while there monthly values range from 1.52-2.2 (fig.3), 1.04-1.52 (and 0.82-1.58, respectively. While Ahmed and Saha (1996) recorded a K value that ranged from 0.506 to 3.415 which indicated that the fish species were doing well.

Monthly condition factor for *C. gariepinus* in Kiri reservoir (July) varied between 0.84 and 1.02 with mean value of 0.93 ± 0.07 , while in December varied between 0.95 and 1.21 with a mean value of 1.04 ± 0.12 . This support the findings of Jafaru (2011) who reported an increase in K during dry season as a result of water clarity during the period. The mean K value obtained in River Nkoro ranged from 0.941 – 0.985 slightly varied with results from others studies. The K value in the study showed the fish species were in good condition. Pauly (1997) reported that data pulling, sex, stages of maturity and stage of stomach affects K value of fish species.

CONCLUSIONS

Growth pattern of the fish species were mostly allometric. However *I. Africana* and *E. senegalensis* had isometric growth pattern. There is direct relationships between the length and weight of *C. gariepinus*. The fish species had moderate condition factors.

REFERENCES

- Ahmed, K.K., and Saha, S.B. (1996). Length- weight relationships of major carps in Kaptai Lake. Bangladesh. NAGA. ICLARM Q., **19**(2):28.
- Dan Kisha, A.S. (2013). Length – weight relationship and condition factor of five fish species from a tropical water supply reservoir in Abuja, Nigeria. **1** (9): 175 – 187.
- Gayando, F.C., and Pauly, D. (1997). FOA ICLARM stock assess tools (FISAT): Reference manual, FOA computerized information series (Fisheries) (8): 262p.
- Imam, T. S., Bala, U., Balarabe, M. L. and Oyeyi, T. I. (2010). Length-weight relationship and Condition factor of four fish species from Wasai Reservoir in Kano, Nigeria. *African Journal of General Agriculture*. 6(3): 125-130
- Jafaru, A. (2011). Length – weight and condition factor of *Sarotherondon galilaeus* from River Benue, Yola, Adamawa State, Nigeria. *Adamawa State University Journal of Scientific Reseach*. **1**(2): 7 -12.
- King, R.P. (1991). The biology of *Tilapia mariae* Boulenger 1899 Perciformes: (Cichilidae) in a Nigeria rain forest stream. Ph.D. thesis department of zoology, University of Port Harcourt, Nigeria.
- Le Cren, E.D. (1951). The length-weight relationship and seasonal cycle in gonad weight and Condition in the perch *Perca fluviatilis*. *J. Anim. Ecol.*, 20(2): 201-219.
- Pauly, D. (1997). Some Simple methods for the assessment of tropical fish Stock. FAO Fish Tech. Paper No. 234. 52p.