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STUDY ON CONDITION FACTOR AND HEPATOSOMATIC INDEX OF *Bagrus bayad* (FORSSKAL, 1775) AND *Synodontis nigrita* (VALENCIENNES, 1840) FROM KANGIMI RESERVOIR, KADUNA STATE, NIGERIA

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ABSTRACT
A study was conducted to determine the condition factor and hepato-somatic index of Bagrus bayad and Synodontis nigrita in a reservoir. The body weight and total length of specimens collected was used for condition factor determination. The range of condition factor for Bagrus bayad was from 0.972 to 2.118. Condition factor variation for Synodontis nigrita was between Synodontis nigrita and 3.050. The monthly condition factor values variation was significant at P<0.05. There was significant variation between male and female condition factor. Seasonal fluctuation in both species was not significant. Hepato-somatic index for Bagrus bayad changed from 1.772 to 4.132 to 1.772. That of Synodontis nigrita was within the range of 1.304 and 2.299. . Hepato-somatic index varied significantly at P<0.05. Sexual hepato-somatic index difference was not significant. Bagrus bayad hepato-somatic index seasonal difference was not significant. The dry and rainy season difference was for Synodontis nigrita was significant. The recommended range of condition factor is above the range obtained in the present study.
Key words: Condition factor, Hepato-somatic index, Bagrus bayad, Synodontis nigrita

INTRODUCTION

Fresh and salt water body harbor many species of plants animals. Fish is an important animal inhabiting inland and coastal waters. *Bagrus bayad* and *Synodontis nigrita* are commercially important freshwater fish species in Nigeria. The two species belong to the class of fish called Actinopterygii - ray-finned fishes. The fish species order is known as Siluriformes – Catfish. *Bagrus bayad* and *Synodontis nigrita* family name is called Bagridae and Mochokidae respectively (Froese and Pauly, 2017). The common habitats of this species are lakes, swamps and rivers (Olaosebikan and Raji (2013).

In fisheries science, condition factor is calculated to determine well-being of species. Investigation into condition factors of many fish species has been done (Dan-Kishiya, 2013; Assefa and Getahun, 2014, Musa *et al*., 2016). The biotic and abiotic conditions of the aquatic environment influence condition factor (Dutta and Banerjee, 2016). Information on the general health condition of a fish can be obtained through hepato-somatic index determination. Hepato-somatic index is an important indicator of fish condition status (Ighwela *et al*., 2014) including its metabolic health (Sadekarpawar and Parikh, 2013). The index is used as a measure of the energy reserves of an animal, especially in fish.

This reservoir supports subsistence fisheries. Paucity of information on condition factor and hepato-somatic index of fish species in the reservoir necessitated the work. Data generated is needed for adequate management of the fishery.

MATERIALS AND METHODS

Study Site

The study was conducted at Kangimi reservoir, Igabi Local Government Area, Kaduna State (Figure 1). The reservoir is located between latitude 10°42'30"N and longitude 7°42'30"E. The need for potable water supply to Kaduna metropolis and irrigation necessitated the impoundment of river Kangimi. Fish are caught by residents of nearby villages.

Sample Collection and Identification

Fish samples were collected from two sites (Goro and Kangimi). From the fishermen catch, purposive sampling of *Bagrus batad* and *Synodontis nigrita* was done at each of the sampling station. Sampling covered a period of 12 calendar months, June, 2015 to May, 2016. Fish samples were collected once a month,

between 7:00am and 10:00am at each occasion. Fish were identified using identification keys by Reed *et al.* (1967); Idodo-Umeh (2003); Olaosebikan and Raji (2013). Sex of fish was determined based on the possession of a genital papilla by the male using a binocular dissecting microscope. The sex of some specimens was done by dissecting the abdomen, open ventrally from the anus to the pectoral fin, with a scalpel or knife to examine the gonad.

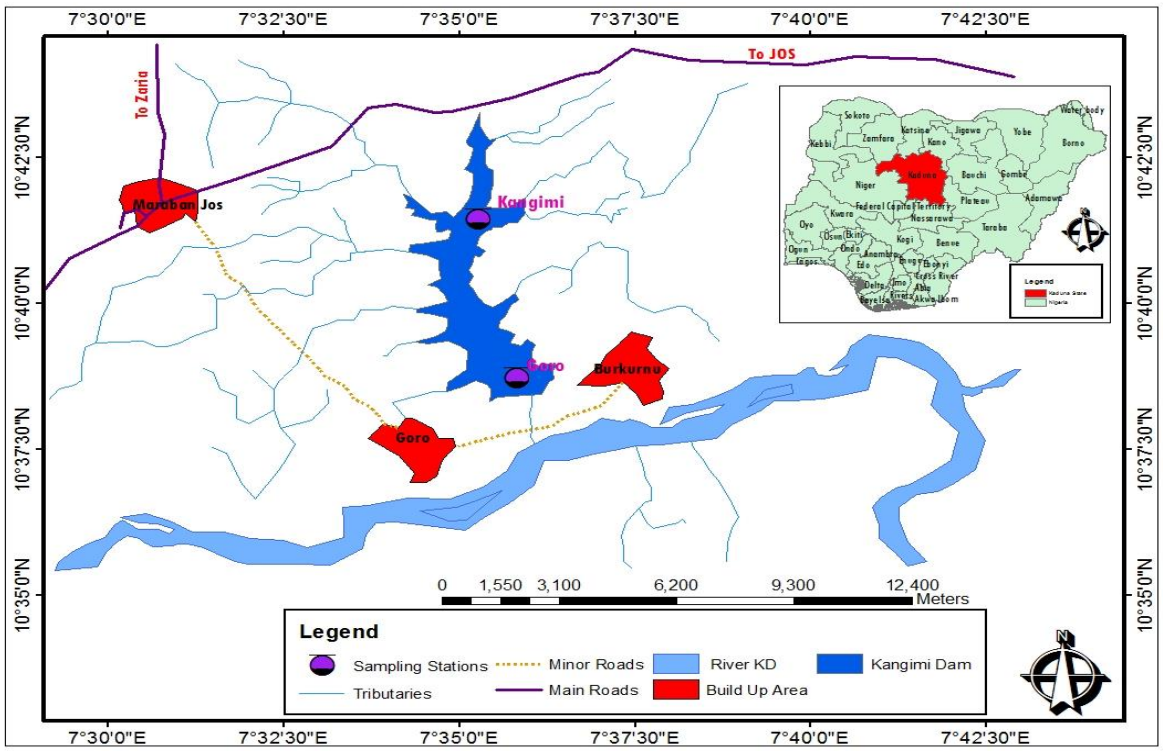

Figure:1. Map of Kangimi Reservoir Showing Sampling Stations
Source: G.I.S & Remote Sensing Lab Geography Department & Environmental Management A.B.U. Zaria.

Morphometric Measurement

The body weight was measured with Ohaus sensitive electric balance (Model: SE3001F) to the nearest gram. Total length of the fish was measured from the tip of the snout to the end of the caudal fin. Length measurements was done with a meter rule and recorded in centimeter.

Condition Factor and Hepato-Somatic Index

Condition factor (K) for the fish species sampled was calculated using the equation: $K = W/L^b$

Where: W= fish weight in grams, and L= fish total length in cm, b= geometric growth pattern value (Tudorancea *et al.*, 1988).

Hepato-somatic index was calculated by using the equation: HSI = LW / BWT × 100

Where: LW= weight of liver in grams, and BWT= fish body weight in grams (Shalaka and Parikh, 2013).

Data Analysis

The mean and standard error of body weight, total length and condition factor were calculated. Student's t-test was used to test for significant difference between male and female fish condition factor and hepato-somatic index. Male and female mean hepato-somatic index in the dry season were compared with the rainy season values using t-test at 0.05 levels. Variation observed in the mean values of body weight and total length analyzed was tested to determine significant difference using Analysis of Variance (ANOVA) at 0.05 levels. Ranking of mean was done using Duncan Multiple Range Test (DMRT) where difference is significant.

RESULTS AND DISCUSSION

Condition Factor

The condition factor for the fish species investigated was calculated. The condition factor for *Bagrus bayad* ranged from 0.972 in November to 2.118 in September. Higher values of condition factor in the rainy season (June to October) were recorded in the *Bagrus bayad* and *Synodontis nigrita*. Condition factor of fish species are known to fluctuate, decrease during times of low temperatures and/or low availability of food, an increase towards the spawning season, a sharp decline after spawning and a second increase after spawning (Froese, 2006).

The condition factor variation for *B. bayad* from 0.972 to 2.118 in this study covers the range of 0.50 to 3.26 for five fish species from Ibiekuma stream, Ekpoma, Edo state, Nigeria (Obasohan *et al.*, 2012). Ayoade (2011) obtained condition factor range of 1.15 to 1.09 for *Labeo ogunesis* in Asejire Lake. It falls within 0.977 to 3.050 condition factor range for *S. nigrita* in this study.

The condition factor of the species studied varied from those of other species in different location. This might have been due to difference in water quality parameter, morphology of fish, physiological condition, etc.

The monthly condition factor values variation was significant at P<0.05 (Table 1). Condition factor for *S. nigrita* had the lowest (0.977) and highest (3.050) in January and September, respectively. The variation of the values was significant at P<0.05.

Males condition factor for the two species were not significantly different (P>0.05) from the females. This is not similar to Nwani, 2006 finding. In his work he reported that, *D. brevipinnis* male condition factor value was significantly different from that of the female. The finding of the present work agrees with Nwani, 2006 report of no significant difference in the mean condition factor between male and female *Distichodus rostratus* and *D. engycephalus*.

The mean condition factor for *B. bayad* and *S. nigrita* in the dry season were not significantly different from the rainy season at P>0.05 (Table 2).\This result is comparable with the work of Offem *et al.*(2008) who reported no significant difference in rainy and dry season condition factor between specimens of *Chrysichthys nigrodigitatus* in the Cross River, Nigeria.

Physical and biological conditions including water quality parameters, stress, feeding conditions, parasitic infections and physiological factors impact on the well-being of a fish (Khallaf *et al.*, 2003). The condition factor range considered suitable for most fish species inhabiting fresh water is 2.9 to 4.8 (Bagenal and Tesch, 1978). The range of condition factor 0.972 to 2.118 in *B. bayad* and 0.977 to 3.050 in *S. nigrita* obtained in the present study falls below the recommended range.

Hepato-somatic index

Hepato-omatic index for *B. bayad* fluctuated from 4.132 in June to 1.772 in December (Table 3). The mean monthly values of hepato-somatic index for *S. nigrita* varied from 2.299 (March) to 1.304 (June). The monthly hepato-somatic index values variation for both species were significant at P<0.05 (Table 3). Information on the general health condition of a fish can be obtained through Hepato-somatic Index (HSI) determination. In a poor environment, fish usually have liver with less energy reserved in it. Higher HSI values were recorded in the wet season for *B. bayad*. Fresh water bodies tend to experience increased levels of nutrients during the rainy season. This might have favoured higher values of HSI in *B. bayad*. It means that gonads development did not limit somatic growth. Good water quality levels might account for the observed trend.

In *S. nigrita* lower values was observed within the rainy months. Huge investment of energy into reproductive activities might have accounted to the decrease.

Difference between male and female hepato-somatic index is presented in Table 4. Males hepato-somatic index for both species were not significantly different (P>0.05) from the female. Table 5 show that mean hepato-somatic index in the dry season for males, females and combined sex for *B. bayad* were not significantly different (P>0.05) from the rainy season. The dry and rainy season difference was for male and combined sex of *Synodontis nigrita* was significant. The HSI variation for *B. bayad* from 1.772 to 4.132 in this study is higher than 0.74 to 1.63 for *Oreochrmis niloticus* in Abu-Zabal Lake, Egypt (Shalloof and Salama, 2008). The highest HSI value of 4.132 in the present work is greater than 2.80 for *Pseudotolithus senegalensis* in Tombo western rural district of Sierra Leone reported by Olapade and Tarawallie (2014).

The HSI variation for *S. nigrita* from 1.304 to 2.299 in this investigation is within the 0.19 and 5.07 for *Pellonula leonensis* in the Lower Nun River, Niger Delta, Nigeria reported by Kingdom and Allison (2011). Osho and Usman (2019) obtained a lower range (0.55 and 0.64) in *Parachanna obscura* from the Anambra River. Both studies indicate there was significant variation (P<0.05) in the monthly and seasonal HSI values.

TABLE 1: Monthly values of condition factor *Bagrus bayad* and *Synodontis nigrita* from Kangimi reservoir

	B. bayad			***S. nigrita***		
Month	**Min**	**Max**	**Mean±SE**	**Min**	**Max**	**Mean±SE**
June	0.200	7.482	2.010^{de}±0.20	0.391	11.22	2.941^{cde}±0.25
July	0.243	7.766	2.140^{de}±0.25	0.337	8.979	2.740^{cde}±0.27
August	0.236	7.131	2.009^{bcd}±0.16	0.241	9.598	2.477^{cd}±0.31
September	0.229	7.157	2.118^{c}±0.21	0.208	8.294	3.050^{e}±0.23
October	0.269	9.349	1.556^{bc}±0.24	0.227	6.498	1.954^{bc}±0.19
November	0.200	3.308	0.972^{a}±0.08	0.374	3.405	1.382^{abc}±0.12
December	0.149	3.811	1.020^{a}±0.10	0.205	3.265	1.192^{ab}±0.09
January	0.126	3.030	0.860^{a}±0.10	0.139	3.982	0.977^{a}±0.20
February	0.063	6.134	1.271^{ab}±0.15	0.133	4.488	1.156^{ab}±0.12
March	0.103	3.541	1.198^{ab}±0.11	0.124	6.674	1.125^{ab}±0.22
April	0.126	3.183	1.003^{a}±0.10	0.175	2.830	1.020^{a}±0.08
May	0.037	3.278	1.262^{ab}±0.11	0.147	6.812	1.279^{ab}±0.17
Total			1.451±0.14			1.774±0.23

Means with different superscript in each column are significantly different (P<0.05)

TABLE 2: Sexual and seasonal condition factor of fish species collected

Species	**Season**	**Mean±SE**	**P-Value**	**Sex**	**Mean±SE**	**P-Value**
B. bayad	Dry	1.12±0.08	0.068	Male	1.555±0.15	0.487
	Rainy	1.90±0.16		Female	1.336±0.14	
S. nigrita	Dry	1.25±0.12	0.518	Male	1.814±0.25	0.183
	Rainy	2.49±0.31		Female	1.717±0.21	

Mean ± SEM

TABLE 3: Monthly values of hepato-somatic index of *Bagrus bayad* and *Synodontis nigrita* from Kangimi reservoir

	B. bayad			***S. nigrita***		
Month	**Min**	**Max**	**Mean±SE**	**Min**	**Max**	**Mean±SE**
June	1.752	7.698	4.132^{d}±0.31	0.276	2.727	1.304^{a}±0.09
July	1.646	7.161	4.023^{d}±0.25	0.623	2.168	1.364^{bcde}±0.12
August	1.180	5.276	3.019^{c}±0.17	0.946	2.342	1.521^{abc}±0.09
September	0.931	6.545	2.394^{b}±0.26	0.539	2.810	1.305^{a}±0.18
October	1.598	5.604	2.895^{bc}±0.24	0.548	3.468	1.612^{abc}±0.13
November	0.671	3.726	2.128^{a}±0.15	0.391	3.053	1.719^{abcd}±0.14
December	0.422	3.593	1.772^{a}±0.13	0.504	5.170	2.077^{cde}±0.21
January	0.964	3.295	1.963^{a}±0.12	0.465	4.034	1.768^{abcde}±0.35
February	0.893	3.15	1.948^{a}±0.12	0.462	3.630	1.684^{abcd}±0.18
March	0.921	4.054	2.154^{a}±0.14	0.580	4.752	2.299^{de}±0.24
April	0.744	0.744	2.067^{a}±0.12	0.511	5.924	2.383^{e}±0.28
May	0.599	4.732	1.815^{a}±0.15	0.594	3.411	2.001^{bcde}±0.25
Total			2.526±0.23			1.753±0.10

Means with different superscript in each column are significantly different (P<0.05)

TABLE 4: Sexual hepato-somatic index of fish species collected

Species	Sex	Mean±SE	P-Value	Species	Sex	Mean±SE	P-Value
B. bayad	Male	2.59± 0.26	0.803	*S. nigrita*	Male	1.90± 0.15	0.202
	Female	2.50± 0.24			Female	1.66± 0.11	

Mean ± SEM

TABLE 5: Seasonal hepato-somatic index of fish species collected

Species	Sex	Dry	Rainy	P-Value
B. bayad	Male	2.20± 0.21	3.13± 0.49	0.078
	Female	2.12± 0.13	3.03± 0.46	0.053
	Combined	2.13± 0.14	3.08± 0.45	0.065
S. nigrita	Male	2.19±0.18	1.50± 0.08	0.012*
	Female	1.73±0.10	1.56± 0.24	0.489
	Combined	1.93±0.12	1.52± 0.13	0.036*

Mean ± S.E.M; * = Significant difference ($P < 0.05$)

CONCLUSION

The two species recorded higher condition factor during the rainy season. The range of 0.972 to 2.118 for *B. bayad* and 0.977 to 3.050 for *S. nigrita* condition factor are below the recommended range. Rainy season HSI values were higher in *B. bayad* while in *S. nigrita* lower values were observed within the rainy months. The well-being of the species is generally good in the wet season.

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