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Some Aspects of Water Quality and the Biology of *Clarias gariepinus* in Vimtim Stream, Mubi Adamawa State, Nigeria

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Abstract: Some aspects of water quality and the biology of *Clarias gariepinus* in Vimtim stream in Mubi North Local Government of Adamawa State was investigated to ascertain the physiochemical factor of the stream. A total number of 180 (121 male and 59 female) fish were sampled, the mean standard length for male and female ranged between 22.52 and 22.23cm, respectively. The regression analysis 'b' for male and female were 3.17 and 2.67, respectively. Correlation coefficient 'r' between lengths and weights for males and females were 0.82 and 0.56, respectively. Monthly mean condition factor for male and female (0.96, 0.98, 1.98 and 1.00) and (0.95, 1.09, 1.14 and 1.11) from June-September respectively. Stomach content analysis showed that out of 180 fish sampled, 105 (56.67%) were with food and 78 (43.33%) were without food. Insect part dominated the dietary food item while molluscs and crustaceans were the lowest. Mean fecundity estimate was 4387.75 ± 1806.18. Monthly mean and station mean of water quality parameters were within the range recommended for fresh water fishes.

Key words: Water · Biology · *Clarias gariepinus* and Vimtim Stream

INTRODUCTION

Water is a vital resource for fish, it is the medium in which the fish lives and therefore the growth of any fish is directly related/dependent to the quality of the water [1]. Water quality is the sum total of the physical, chemical and biological characteristics of a water body [2]. Water used for the growth of fish will not give maximum production if the condition is not optimal for the fish and other aquatic organisms. The environmental properties of water need to be condusive for fish to grow well; therefore an ideal water condition is a necessity for the survival of fish since the entire life process of fish wholly depends on the quality of its environment [3]. One of the major environmental issues of our time is the growing concern about the quality of water suitable for use both by humans and animals particularly fish [4]. It is a well known fact that water quality conditions are constantly being threatened by pollution, this has resulted in the widely distributed sources of pollution and thereafter created a significant problem in rivers, lakes and dams [5]. The increasing level of using chemical herbicides, pesticides, insecticides and fertilizers, improper disposal of sewage as well as global warming in Nigeria has created a growing awareness of the rationale management of aquatic resources and control of waste discharge from the environment [6]. Environmental contamination is commonly exposing aquatic organisms like fish to pollution and other problems of the biology including growth and reproduction and both of which are important considerations [7].

The stream of Vimtim serves many purposes, majority fishing, irrigation as well as a source of drinking water for humans and animals, especially cattle. A number of miscellaneous water users also participate in this value chain. Many depend on the resources of this water as their main sources of food and family income as a result the water have been subjected to intensive use. Against this background, the study was designed to investigate the physiochemical factors of this stream and its effect on *Clarias gariepinus*.

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MATERIALS AND METHODS

Description of the Study Area: Vimtim stream is located in Mubi North Local Government Area of Adamawa State in Nigeria. The area is located between latitude 9°33" north of the equator and longitude 13° and 13°45" east of the Greenwich Meridian [8].

The source of the stream is from two mountains located in southern and eastern part of the community [8].

Description of *Clarias gariepinus:* *C. gariepinus* is named after its locality the Gariep River, a Hontentot name for Orange River in South Africa [9]. It has a wide tolerance to temperature, as well as low dissolved oxygen and high salinity [10]. Also Hatch *et al.* [11] reported that because of its high fecundity and growth rate, it has become an important commercial species. This fish specie is more abundant in this stream and this triggered the study.

Sampling Site and Procedures: Fish were sampled from Vimtim Stream forthnightly for the periods of four months (June-September, 2009).

Laboratory Measurement/Analysis: Length-Total and Standard length of the fish were determined from the mouth snout to the tip of the caudal fin and the hypural bone, respectively as recommended by Reed *et al.* [12]. Weight of the fish was determined by an electronic weighing balance. Sex was determined by physical examination and by dissecting and examining the gonads for the presence of eggs or milt. Stomach content was determined by dissecting the fish lengthwise and the stomach was removed and also dissected under the dissecting microscope whereas the content of the stomach was viewed. The point method was used as recommended by Hynes [13] since the method for analysis of dietary items was for both quantitative and qualitative. Fecundity was determined by dissecting and removing the matured ovary with eggs. The fecundity estimate was obtained by weighing the ovary and calculated using the formular recommended by Khanna and Sigh [14]. The length-weight relationship was determined using the formular described by Lecren, [15]. The well being of the fish was known as the condition factor which was determined by the formula recommended by Warthinston and Richardo [16].

Field and Laboratory Measurement of Parameters: Three sampling stations were selected along the stream for the study. The stations included the inlet of the stream as station A, middle of the stream as station B and outlet of the stream as station C. water samples were collected fortnightly for the periods of four months (June-September). Water temperature was determined at the site using mercury bulb thermometer. Dissolved oxygen was determined using Jenway DO metre Model 9500. Transparency was measured using Secchi disc. Conductivity was measured using Hatch Conductivity meter Model EC500. Ammonia was determined by ammonia testing kits. Hydrogen ion concentration (pH) was measured by combined pH and conductivity meter Jenway Model 3540.

The TDS metre-model EC500 phosphate contents were determined using Hatch Kit Model Po 19A [17].

Statistical Analysis: Data collected were subjected to Analysis of Variance (ANOVA) and mean separation by standard deviance and standard error as described by Steel and Torrie [18].

RESULTS

Size Distribution: The total (male and female) numbers of fish sampled were 180 (Table 1). The standard length of males and females ranged from 12.20-30.20 and 16.39-27.50 with a mean of 22.52 and 22.23cm, respectively. The weight of males and females ranged from 15.70-19.50-204.30g with a mean of 115.05 and 112.27g, respectively. This result is show on Table 2.

Length-weight Relationship: The regression analysis 'b' value for males and female were 3.17 and 2.67, respectively which shows isometric growth. Correlation coefficient 'r' between lengths and weight for males and females were 0.82 and 0.56, respectively which were not significant. This result is shown on Table 3.

Condition Factor: The monthly mean condition factor for males and females are shown Table 4 and 5. The values showed that fish were at relatively stable condition.

Stomach Content Analysis and Fecundity Estimates are shown on Table 6 and 7, respectively. Insects' parts and digested food dominated the dietary items. The fecundity estimate in this study showed that out of 59 female fish sampled only 32 had eggs. The result of the fecundity showed that there was a great variability in the number of eggs in the fish of the same length and weight.

Table 1: Number of Fish Examined

	Males	Female	Sex Ratio
June	34	20	1:0.83
July	45	10	1:0.33
August	30	19	1:0.88
September	12	10	1:98
	121	59	

Table 2: Length (cm) and Weight (g) Measurements for both Males and Females

	Sex	No. Examined	Min	Max	Mean	Standard
Standard	M	121	12.2	30.2	22.52	21.16
length (cm)	F	59	16.39	27.5	22.23	20.44
Weight (g)	M	121	15.7	247.2	115.05	54.15
	F	59	19.51	204.3	112.29	37.75

Table 3: Length-Weight Correlation/Regression Analysis of Male and Female *C. gariepinus*

Sex	No examined	Leg a	'b'	Correlation Coefficient 'r'
Male	121	1.03	3.17	0.84
Female	59	1.60	2.67	0.58

Table 4: Monthly Mean Condition Factor for Male

		Condition Factor		
Months	Total Fish Examined	Range	Mean	Standard Deviation
June	34	0.58-1.24	0.96	0.21
July	45	0.38-1.47	0.98	0.26
August	30	0.23-2.47	1.98	0.48
September	12	0.18-1.00	1.00	0.22

Table 5: Monthly Mean Condition Factor for Female

		Condition Factor		
Months	Total Fish Examined	Range	Mean	Standard Deviation
June	20	0.57-1.14	0.95	0.25
July	10	0.83-1.41	1.09	0.20
August	19	0.17-2.35	1.14	0.50
September	10	0.13-2.00	1.11	0.35

Table 6: Stomach Content of *C gariepinus*, Number of fish with food 102 (56.67%), Number of fish without food 78 (43.33%)

Food Items	Percentage of Frequency of Occurrence (%)	Percentage of Total Points (%)
Insects	60.62	41.87
Algae	56.69	20.03
Insect larvae	40.58	10.10
Worms	40.15	11.06
Molluscs and crustaceans	1.57	0.50
Unidentified digested food materials	59.84	15.20

Table 7: Fecundity Estimate

No. of Fish with eggs	Minimum	Maximum	Range	Standard deviation
32	1.40	8772.75	4387.08	1806.18

Table 8: Monthly Mean Water Quality Parameters

Months	T °C	P^H	Turbidity (cm)	Conductivity μcms^{-1}	DO mgl^{-}	TDS (mgl^{-})	Ammonia (mgl^{-})	Phosphate Conc.
June	23.30± 0.11	6.45± 0.06	0.17± 0.02	54.10± 0.14	6.20± 0.02	20.72± 0.10	0.27± 0.02	0.08±0.02
July	25.70± 0.14	7.10± 0.11	0.20± 0.24	54.21± 0.13	5.04± 0.01	21.58± 0.11	0.31± 0.04	0.06± 0.01
August	25.48± 0.14	6.90± 0.12	0.21±0.02	53.28± 0.12	4.02± 0.01	24.57± 0.14	0.35± 0.05	0.08± 0.01
September	25.10± 0.14	7.00± 0.10	0.25± 0.06	52. 90± 0.10	4.00± 0.01	25.00± 0.15	0.60± 0.07	0.08± 0.01

Table 9: Station Mean Water Quality Parameters

Station	T °C	P^H	Turbidity (cm)	Conductivity μcms^{-1}	DO mgl^{-}	TDS (mgl^{-})	Ammonia (mgl^{-})	Phosphate Conc.
A	24.87± 0.13	6.70± 0.09	0.82± 0.03	53.37± 0.12	4.00± 0.01	21.60± 0.11	0.20± 0.13	0.06± 0.01
B	24.70± 0.13	6.76± 0.12	0.84± 0.03	53.93± 0.13	5.02± 0.01	21.95± 0.13	0.28± 0.12	0.06± 0.01
C	24.53± 0.13	6.95± 0.01	0.86 ± 0.03	54.37± 0.13	5.04± 0.01	21.57± 0.11	0.35± 0.011	0.06± 0.01

Water Quality Parameter: The monthly mean and station mean values of the water parameters recorded in this study are shown on the Table 8 and 9, respectively.

DISCUSSION

The analysis of size ranges of *C. gariepinus* showed that the mean standard length and weight of males were higher than that of females. The length-weight regression analysis showed that 'b' value for males was greater than that of female. In this study the male exhibit isometric growth while the female exhibit allometric growth. This is in line with the work of Ayuba [19]. The correlation regression 'r' between length and weight for both males and females were closer to 1. This means that the relationship between length and weight of both males and females were high as the length of the fish increases, the weight also increases. The mean condition factor 'k' indicated that the male fishes were not in good conditions in the months of June and July. The mean conditions factor 'k' for female showed that the female were not in good conditions in the month of June. Report by Largler [20] pointed out that the value of 'k' of a fish can be influenced by sex difference, changes in season, gonad maturity level, stomach fullness and length weight of fish. Analysis of stomach content revealed that *C. gariepinus* were omnivorous since their diets comprised of insects parts, algae, worms and small fishes. This work is in line with the work of Ejike [21] whereas he reported that insects parts, crustaceans and algae dominated the diet of *C . gariepinus.* The results of this study also revealed some rates of empty stomach. This can be attributed to the fact that gill nets were used in catching the fish, some as a result of regurgitation as well as scarcity of food as reported by Arowomo [22]. Fecundity estimate showed a great variation in the number of eggs in fish of the same length and weight. Haylor [23] reported the same thing. The various physiochemical water parameters recorded for the four months and the three stations were within the ranges recommended for fresh water fishes.

CONCLUSION

The physiochemical water parameters recorded in the study showed that water was within the range recommended for fresh water fish hence favourable for the survival of *C. gariepinus.*

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