



Morphological Characteristics and Meristic Count of *Clarias gariepinus* and *Heterobranchus longifilis* Strains from Kano, Nigeria

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Abstract

The aim of this study was to investigate the morphological characteristics and meristic counts of two strains of Clariid fish species in Kano State in relation to location and sex. One hundred and seventy seven (177) Clariid fish samples (143 *Clarias gariepinus* and 34 *Heterobranchus longifilis*) were collected from six water bodies (Thomas, Ghari, Tiga dam, Duddurun Gaya, Karaye and Bagwai) in Kano state. Body weight, twenty-two (22) morphometric characteristics and four (4) meristic counts were taken on each fish sample to determine the influence of location, strain and sex. Body weight was measured in grams using sensitive scale, (GT4100 model), the morphometric characters were measured in centimetres using fish measuring board while meristic counts were by visual appraisal. Data obtained were analysed using GLM procedures of SAS 9.4, Duncan multiple range test was used for mean separation. Body weight, morphometric measurements and meristic counts were significantly ($P < 0.01$) affected by location and strain while sex had effect ($P < 0.01$) only on total length, standard length, dorsal fin length, dorso-caudal length, caudal peduncle depth, anal fin length, head length, inter-orbital distance, eye diameter and length of occipital fontanelle. The study indicated that location and species of fish had a significant influence on Clariid fish morphometric characters and meristic counts.

Key words: Fish, morphological characteristics, meristic counts, kano, sex

Introduction

Variability is the fundamental and basic characteristic of life. Every level of organization of life displays variation in some parameters, in space or time, within and between cells, tissues, organisms, populations and communities. The existence of variation in natural populations of organisms is a necessary condition for evolution. While variability is both a product and foundation of the evolutionary process, biologists are still confronted with the basic problems of explaining the nature, extent and causes of this web of complexity (Reynaldo and Cesar, 2014). Morphological differentiation is one of the several approaches which have proved useful in studying variability, including molecular markers.

There is little information on the morphometric characteristics and meristic count of *Clariid* species of fish in natural waters in Kano State. Therefore, the objective of this study was to determine the effects of strain, location and sex on the morphometric measurements and meristic counts of *Clariid* fish species in Kano Rivers.

Materials and Methods

Study Location

The study was conducted in six selected water bodies in Kano State, namely, Rivers Thomas and Ghari to the North, River Dudurun Gaya to the East, Tiga dam to the South, Rivers Karaye and Bagwai to the western part of the state. The first three locations were selected due to their independent flow and disconnected tributaries. The remaining three locations have the same origin as Kano River, but the Tiga section of the

river flows towards the south while the Karaye river flow towards the western part of the state. Kano state is located in the semi-arid area of North-western Nigeria (latitude 10°33' and 12°27' north, longitude 7°34' and 9°29' east).

The fish samples were identified using an exposition for identification by (Moses and Olufeagba, 2009), and confirmed using local names provided by the fishermen. Live fish samples of *Clarias gariepinus* (143) and *Heterobranchus longifilis* (34) from the six locations described above were purchased from commercial catches of the fishermen. The samples were transported in large bowls to the Laboratory of the Department of Animal Science, Bayero University Kano, where measurements and counts were taken immediately. Sex was determined by identifying the presence of papillae in male and absence in female.

Morphometric measurements

Body weight (BW):- This was taken in grams using sensitive weighing electronic balance (GT4100 model), Total length (TL):- The distance between the snout and the end of the caudal fin, Standard length (SL):- The distance between the snout and the origin of caudal fin, Predorsal distance (PDD):- The distance between the snout and the origin of dorsal fin, Preanal distance (PAD):- The distance between the snout and origin of anal fin, Preventral distance (PVD):- The distance between the snout and origin of pectoral spine, Prepectoral distance (PPD):- The distance between the snout and the origin of pectoral fin, Dorsal fin length (DFL):- The distance of the dorsal fin from origin to the end, Anal fin length (AFL):- The distance of the anal fin from origin to the end, Pectoral fin length (PFL):- The length of the pectoral fin from origin to the end, Pectoral spine length (PSL):- The length of the pectoral spine from origin to the end, Dorso-caudal length (DDCF):- The distance between the dorsal and the caudal fin, Dorso-occipital length (DODF):- The distance between the

occipital process and dorsal fin, Caudal peduncle depth (CPD):- The thickness of the body from the end of the dorsal fin to the end of the anal fin, Body depth at anus (BDA):- Thickness of the body from the spine to the anus, Head length (HL):- Longitudinal distance from the snout to the base of the head, Head width (HW):- Lateral distance across the head, Snout length (SNL):- The distance between frontal position of the eye to the tip of the mouth, Inter-orbital distance (ID):- The distance between the eyes across the head, Eye diameter (ED):- The diameter of the spherical eye, Length of occipital fontanelle (OFL):- The longitudinal length of the knob at the base of the head, Width of occipital fontanelle (OFW):- The lateral length of the knob at the base of the head and Snout-occipital length (DSO):- Distance between snout and origin of occipital fontanelle.

Meristic counts

DFRC: - Dorsal fin ray count, PFRC: - Pectoral fin ray count and AFRC: - Anal fin ray count.

Data Analysis

The data from the morphometric measurements and meristic counts were analysed using GLM procedures of SAS (2000) and Duncan Multiple Range Test was used to separate the means where applicable. Coefficient of variability were estimated by dividing standard deviation with mean of the measurements and multiplied them by one hundred (100). The following statistical model was used for the analysis of morphometric characters and meristic counts:

$$Y_{ijk} = \mu + C_i + X_j + S_k + e_{ijk}$$

Y_{ijk} = Morphometric characteristics and meristic counts

μ = Population mean

C_i = Fixed effect of i^{th} strains (i = *Clarias gariepinus* and *Heterobranchus longifilis*)

X_j = Fixed effect of j^{th} sex (j = male and female)

S_k = Fixed effect of k^{th} location (k = six selected water bodies)

e_{ijk} = Error term (random error)

Results

Table 1 shows the summary statistics for the morphometric characteristics measured in *Clarias gariepinus* and *Heterobranchus longifilis*. In *Clarias gariepinus*, the average body weight was 190.54 g with coefficient of variability of 72.73% while it was 67.39% in *Heterobranchus longifilis* with average body weight of 318.73 g. The body weights of the two strains showed a significantly wide variation indicating a lot of differences within the strains when body weight is considered. On the measurements taken on the body, *Heterobranchus longifilis* recorded higher values compared to *Clarias gariepinus*, these are total length, standard length, pre-dorsal distance, pre-anal distance, pre-pectoral distance, pre-ventral distance, caudal peduncle depth and body depth at anus. The coefficient of variation of *Claria gariepinus* ranged from 21.34% for pre-anal distance to 59.73% for pre-ventral distance. The coefficient of variation of *Heterobranchus longifilis* ranged from 13.71% for total length to 51.00% for pre-ventral distance. These showed that the variation observed in them were moderate to high and could be regarded as variable. Dorsal fin length and anal fin length were higher in *Clarias gariepinus* compared to *Heterobranchus longifilis* due to the presence of adipose tissue on the dorsal part of *Heterobranchus longifilis* while *Heterobranchus longifilis* gave a higher measurements in pectoral fin length and pectoral spine length than *Clarias gariepinus*. The coefficient of variation for fin

Tables 3, 4 and 5 shows the effects of location, strain and sex on the morphometric measurements of Clariid fish. Most of the parameters showed a highly significant difference ($P < 0.01$) for location and strain and significant difference ($P < 0.05$) for standard length, pre-dorsal distance and head length. Sex

measurements in *Clarias gariepinus* ranged from 21.61% for dorsal fin length to 51.48% for pectoral fin length while ranged from 21.80% for dorsal fin length to 47.01% for anal fin length in *Heterobranchus longifilis*. The variability observed were high and optimally wide apart. The head region measurements, *Clarias gariepinus* had higher measurements for head length and inter-orbital distance while *Heterobranchus longifilis* had higher measurements for head width, dorso-caudal length, dorso-occipital length, snout length, eye distance, length of occipital fontenale, width of occipital fontenale and snout occipital length. The coefficient of variation for *Clarias gariepinus* ranged from 20.59% for head length to 32.45% for eye distance while coefficient of variation for *Heterobranchus longifilis* ranged from 13.21% for snout occipital length to 62.08% for dorso-caudal length. These showed moderate to high variability and they are widely separated in terms of phenotypic plasticity. Table 2 shows the summary statistics for the meristic counts taken on the samples. The ray counts are the number of webbed rays on the fins that aid locomotion. *Clarias gariepinus* recorded a higher count in dorsal fin, anal fin and pectoral fin ray count while *Heterobranchus longifilis* only had a higher caudal fin ray count. The coefficient of variation for *Clarias gariepinus* on meristic count were 5.33, 6.87, 22.17 and 24.50% for caudal, pectoral, anal and dorsal fin ray count. The corresponding values for *Heterobranchus longifilis*, were 5.26, 7.05, 47.06 and 58.31, respectively. Pectoral and caudal fins ray counts showed a very low percentage of variation while dorsal and anal fins ray count were moderate to high.

only had significant ($P < 0.01$) effect on total length, standard length, dorsal fin length, dorso-caudal length, caudal peduncle depth, anal fin length, head length, inter-orbital distance, eye diameter and length of occipital fontanelle. *Clariid* strains of River Thomas recorded the highest body weight of 460.33 g while those of

River Duddurun Gaya had the lowest (114.01 g).

Table 1. Descriptive Statistics for the Morphometric Characteristics of the fish Populations in the study area

Characteristics (cm)	<i>Clarias gariepinus</i>		<i>Heterobranchus longifilis</i>	
	Mean±SE	CV%	Mean±SE	CV%
Body measurements				
Body Weight (g)	190.54±11.59	72.73	318.73±42.12	67.39
Total Length	29.63±0.55	22.11	39.23±1.06	13.71
Standard Length	26.23±0.50	22.63	29.05±1.04	18.24
Pre-Dorsal Distance	8.64±0.16	21.60	11.46±0.41	18.30
Pre-Anal Distance	13.96±0.25	21.34	20.52±0.68	16.99
Pre-Pectoral Distance	10.28±0.21	24.82	11.74±0.71	30.79
Pre-Ventral Distance	6.55±0.33	59.73	9.79±0.99	51.00
Caudal Peduncle Depth	2.10±0.05	25.82	2.29±0.11	24.98
Body Depth at Anus	5.18±0.10	22.84	6.60±0.29	22.53
Fin measurements				
Dorsal Fin Length	15.69±0.28	21.61	5.33±0.23	21.80
Anal Fin Length	12.88±0.39	35.99	3.67±0.35	47.01
Pectoral Fin Length	2.48±0.11	51.48	4.44±0.21	24.43
Pectoral Spine Length	2.98±0.07	28.29	4.79±0.21	22.80
Head region				
Head Length	7.34±0.13	20.59	7.10±0.25	17.99
Head Width	5.60±0.10	21.64	6.17±0.18	15.14
Dorso-caudal length1.	64±0.04	28.81	8.44±1.03	62.08
Dorso-Occipital length	6.14±0.14	26.30	9.37±0.35	18.21
Snout Length	1.73±0.04	28.08	2.59±0.13	24.52
Inter-orbital Distance	3.30±0.06	21.38	2.46±0.09	19.06
Eye Distance	0.34±0.01	32.45	0.65±0.03	22.16
Occipital Fontanelle Length	1.96±0.04	25.55	4.58±0.19	21.51
Occipital Fontanelle Width	0.45±0.01	30.27	0.67±0.04	28.67
Snout Occipital length	1.77±0.04	24.35	2.11±0.06	13.21

CV = Coefficient of variation, SE = Standard error.

Table 2. Descriptive Statistics for the Meristic Characteristics of the Populations

Character	<i>Clarias gariepinus</i>		<i>Heterobranchus longifilis</i>	
	Mean±SE	CV%	Mean±SE	CV%
Dorsal Fin Ray Count	7.83±0.05	24.50	3.29±0.02	58.31
Pectoral Fin Ray Count	2.33±0.01	6.87	2.27±0.02	7.05
Anal Fin Ray Count	6.92±0.04	22.17	3.26±0.04	47.06
Caudal Fin Ray Count	4.28±0.02	5.33	4.34±0.03	5.26

CV = Coefficient of variability

SE = Standard error.

Clariid strains of River Thomas also gave higher ($P<0.01$) measurements for most of the morphometric measurements except pre-ventral distance, dorso-caudal distance, snout length, eye diameter and snout-occipital length. With regards to the effect of strain, *Heterobranchus longifilis* was higher ($P<0.01$) in body weight and some of the morphometric measurements except pre-pectoral distance, dorso-caudal length, caudal peduncle depth, anal fin length, dorsal fin length, head width, head length, snout length, inter-orbital distance, eye distance and snout-occipital length. *Clarias gariepinus* was only higher in dorsal and anal fin length. There were significant difference between males and females with males having higher values for total length, standard length, dorsal fin length, anal fin length, caudal peduncle depth, head length, inter-orbital distance, body weight, pre-dorsal distance, pre-anal distance, pre-ventral distance, pre-pectoral distance and body depth at anus. The females on the other hand, had higher pectoral fin length, snout length, eye diameter, dorso-caudal length, snout-occipital length and length of occipital fontanelle. However, sex did not significantly affect body weight (BW), predorsal distance (PDD), preanal distance (PAD), preventral distance (PVD), prepectoral distance (PPD), pectoral fin length (PFL), pectoral spine length (PSL), dorso-occipital length (DODF), body depth at anus (BDA), head width (HW), snout length (SNL), length of occipital fontanelle (OFL and snout occipital length (DSO).

Table 6 shows the effects of location, strain and sex on the meristic counts of *Clariid* fish.

Location had significant effect ($P<0.01$) on dorsal pectoral and anal fin ray counts with no significant effect on caudal fin ray count ($P>0.05$). River Thomas had higher meristic counts compared to the remaining rivers followed by Rivers Duddurun Gaya and Ghari. Strain and sex on the other hand had significant effects ($P<0.01$) on dorsal and anal fin ray counts but not on pectoral and caudal fin ray counts ($P>0.05$). *Clarias gariepinus* gave higher counts, due to the presence of dorsal adipose tissue on the *Heterobranchus longifilis* that halved the dorsal parts of the latter strain. On the effect of sex, dorsal and anal fin ray counts were higher ($P<0.05$) in the males than females; but pectoral and caudal fin ray counts were similar for the sexes.

Discussion

Clariid population in River Thomas were distinctive in attributes measured and most divergent from others due to higher morphometric measurements recorded. This might indicate that the River is much more habitable for the *Clariid* species for good growth and development compared to the remaining location. This was closely followed by River Karaye. Morphometric characteristics can show high plasticity in response to differences in environmental conditions, such as food abundance and temperature. The study has shown that morphometric parameters can be highly variable among and within conspecific populations, either correlating with geographical and habitat variation or having a genetic component, based on differences among groups in a common environment.



Table 3: Morphometric Characteristics of Clariid Species in relation to location, strains and sex

Factor	N	WT	TL	SL	PDD	PAD	PVD	PPD	DFL
Location									
River Thomas	4	460.33 ^a ±111.44	42.75 ^a ±2.87	38.00 ^a ±2.68	13.34 ^a ±0.94	19.13 ^a ±3.07	8.00 ^b ±0.58	17.00 ^a ±1.46	25.75 ^a ±1.83
River Ghari	27	260.70 ^b ±22.48	31.03 ^b ±0.99	27.92 ^b ±0.86	8.87 ^b ±0.31	14.30 ^b ±0.51	5.21 ^d ±0.25	11.69 ^b ±0.40	16.36 ^b ±0.52
River D/Gaya	50	114.01 ^c ±8.09	25.74 ^c ±0.81	22.64 ^c ±0.77	7.53 ^c ±0.16	12.32 ^b ±0.25	4.58 ^d ±0.11	10.29 ^b ±0.21	14.51 ^b ±0.46
River Karaye	33	323.47 ^b ±35.87	37.46 ^b ±1.29	31.30 ^b ±1.06	11.15 ^b ±0.43	18.58 ^a ±0.78	15.04 ^a ±0.47	6.59 ^d ±0.24	12.16 ^c ±0.75
River Tiga	21	259.12 ^b ±43.11	33.28 ^b ±0.94	24.73 ^c ±0.54	10.09 ^b ±0.22	18.08 ^a ±0.47	6.36 ^c ±0.11	12.86 ^b ±0.26	4.12 ^d ±0.21
River Bagwai	42	160.16 ^d ±8.75	30.03 ^c ±0.76	26.22 ^d ±0.54	8.71 ^c ±0.21	14.37 ^b ±0.46	5.01 ^d ±0.13	11.63 ^b ±0.28	15.47 ^b ±0.61
Strain	177								
<i>C. gariepinus</i>	143	190.54 ^b ±11.59	29.63 ^b ±0.55	26.23 ^b ±0.50	8.64 ^b ±0.16	13.96 ^b ±0.25	6.55 ^b ±0.33	10.28 ^b ±0.21	15.69 ^a ±0.28
<i>H. longifilis</i>	29	318.73 ^a ±42.12	39.23 ^a ±1.06	29.05 ^a ±1.04	11.46 ^a ±0.41	20.52 ^a ±0.68	9.79 ^a ±0.98	11.74 ^a ±0.71	5.33 ^b ±0.23
Sex	177	NS			NS	NS	NS	NS	
Male	83	233.93 ^a ±18.06	32.40 ^a ±0.78	28.36 ^a ±0.69	9.28 ^a ±0.22	15.12 ^a ±0.39	7.05 ^a ±0.44	10.94 ^a ±0.34	15.99 ^a ±0.49
Female	94	191.57 ^a ±15.13	29.82 ^b ±0.72	24.86 ^b ±0.51	8.98 ^a ±0.23	15.11 ^a ±0.43	6.99 ^a ±0.44	10.28 ^a ±0.25	11.49 ^b ±0.52

a,b,c,d means within the same column and factors with different superscripts differ significantly **=P<0.01, *=P<0.05
 WT= weight, PAD = pre-anal distance, DFL = dorsal fin length, SL=standard length, PPD = pre-pectoral distance, TL= Total length
 PDD=pre-dorsal distance, NS- Not significant PVD = pre-ventral distance

Table 4: Morphometric Characteristics of Clariid Species in relation to location, strains and sex

Factor	N	PFL (cm)	PSL (cm)	DDCF (cm)	DODF (cm)	CPD (cm)	AFL (cm)	BDA (cm)
Location								
River Thomas	4	4.03 ^a ±0.27	4.53 ^a ±0.30	2.78 ^a ±0.29	10.10 ^a ±1.36	3.00 ^a ±0.71	19.13 ^a ±1.23	7.18 ^a ±0.69
River Ghari	27	2.55 ^b ±0.14	3.18 ^b ±0.17	1.79 ^a ±0.07	5.76 ^b ±0.39	2.07 ^c ±0.10	12.63 ^b ±0.70	5.33 ^b ±0.24
River D/Gaya	50	2.21 ^b ±0.27	2.43 ^b ±0.06	1.32 ^a ±0.05	5.96 ^c ±0.11	1.82 ^d ±0.05	9.73 ^b ±0.20	4.53 ^b ±0.11
River Karaye	33	3.75 ^b ±0.24	4.43 ^a ±0.21	2.35 ^b ±0.18	8.17 ^b ±0.37	2.67 ^{ab} ±0.09	16.71 ^a ±1.37	6.79 ^a ±0.26
River Tiga	21	3.58 ^a ±0.09	3.98 ^a ±0.08	3.12 ^a ±0.34	8.18 ^b ±0.28	2.39 ^b ±0.16	2.52 ^c ±0.14	5.88 ^b ±0.20
River Bagwai	42	2.49 ^b ±0.14	3.05 ^b ±0.14	1.79 ^a ±0.07	5.85 ^c ±0.25	2.07 ^c ±0.06	10.88 ^b ±0.45	5.16 ^b ±0.14
Strain	177							
<i>C. gariepinus</i>	143	2.48 ^b ±0.11	2.48 ^b ±0.07	1.64 ^b ±0.04	6.14 ^b ±0.14	2.10 ^a ±0.05	12.88 ^a ±0.39	5.18 ^b ±0.10
<i>H. longifilis</i>	29	4.44 ^a ±0.21	4.79 ^a ±0.21	8.44 ^a ±1.03	9.37 ^a ±0.34	2.29 ^a ±0.11	3.67 ^b ±0.35	6.60 ^a ±0.29
Sex	177	NS	NS		NS			NS
Male	83	2.68 ^a ±0.10	3.30 ^a ±0.11	2.02 ^b ±0.19	6.47 ^a ±0.21	2.27 ^a ±0.07	13.48 ^a ±0.59	5.56 ^a ±0.15
Female	94	2.94 ^a ±0.18	3.30 ^a ±0.12	4.11 ^a ±0.49	6.85 ^a ±0.21	2.09 ^b ±0.06	8.92 ^b ±0.32	5.34 ^a ±0.14

a,b,c,d means within the same column and factors with different superscripts differ significantly. **=P<0.01, *=P<0.05 AFL=anal fin length, PFL=pectoral fin length, PSL=pectoral spine length, DDCF=dorso-caudal length, DODF=dorso-occipital length, CPD=caudal peduncle depth, BDA=body depth at anus, NS – Not significant

Table 5: Morphometric Characteristics of Clariid Species in relation to location, strains and sex

Factor	N	HL	HW	SNL	ID	ED	OFL	OFW	DSO
Location		**	**	**	**	**	**	**	**
River Thomas	4	10.48 ^a ±0.88	8.00 ^a ±0.61	2.25 ^b ±0.20	4.55 ^a ±0.40	0.53 ^b ±0.08	2.63 ^b ±0.24	0.65 ^b ±0.12	1.70 ^c ±0.15
River Ghari	27	7.88 ^{bc} ±0.21	5.84 ^c ±0.21	1.72 ^c ±0.08	3.30 ^b ±0.09	0.42 ^b ±0.02	1.99 ^d ±0.14	0.50 ^b ±0.02	1.80 ^c ±0.05
River D/Gaya	50	6.24 ^d ±0.12	4.86 ^d ±0.12	1.51 ^c ±0.05	2.93 ^c ±0.07	0.26 ^c ±0.01	1.78 ^d ±0.05	0.39 ^c ±0.02	1.57 ^c ±0.06
River Karaye	33	8.40 ^b ±0.28	6.42 ^{bc} ±0.22	2.53 ^b ±0.12	3.60 ^b ±0.16	0.40 ^b ±0.03	3.21 ^{ab} ±0.25	0.52 ^b ±0.05	2.18 ^b ±0.09
River Tiga	21	7.21 ^c ±0.34	6.81 ^b ±0.38	3.04 ^a ±0.26	2.32 ^d ±0.08	0.86 ^a ±0.09	3.51 ^a ±0.28	0.51 ^{bc} ±0.03	2.65 ^a ±0.20
River Bagwai	42	7.41 ^c ±0.15	5.76 ^c ±0.15	1.68 ^d ±0.06	3.21 ^b ±0.10	0.44 ^b ±0.02	1.99 ^d ±0.09	0.50 ^b ±0.02	1.80 ^c ±0.05
Strain	177	NS	NS	NS	**	**	**	**	**
C. gariepinus	143	7.34±0.13	5.60±0.10	5.60±0.04	3.30 ^a ±0.06	0.34 ^b ±0.01	1.96 ^b ±0.04	0.45 ^b ±0.01	1.77 ^b ±0.04
H. longifilis	29	7.10±0.25	6.17±0.18	6.17±0.13	2.46 ^b ±0.09	0.65 ^a ±0.03	4.58 ^a ±0.19	0.67 ^a ±0.04	2.11 ^a ±0.05
Sex	177	**	NS	NS	**	*	*	NS	NS
Male	83	7.80 ^a ±0.17	5.95±0.15	1.92±0.06	3.41 ^a ±0.08	0.39 ^b ±0.02	2.15 ^b ±0.08	0.46±0.02	1.90±0.05
Female	94	7.00 ^b ±0.14	5.70±0.14	2.02±0.10	2.91 ^b ±0.07	0.47 ^a ±0.03	2.53 ^a ±0.14	0.49±0.02	1.91±0.07

a,b,c,d means within the same column and factors with different superscripts differ significantly. **=P<0.01, *=P<0.05

HL=head length, HW=head width, ED= eye diameter, SNL=snout length, ID=inter-orbital distance, OFW=width of occipital fontanelle, DSO=snout-occipital length.

ID=inter-orbital distance, NS=not significant

Table 6: Meristic Counts of Clariid Species in relation to location, strains and sex

Factor	N	DFRC	PFCR	AFRC	CFRC
Location					
River Thomas	4	8.15 ^a ±0.11	2.64 ^a ±0.19	6.83 ^{ab} ±0.35	4.41±0.12
River Ghari	27	7.01 ^c ±0.15	2.26 ^c ±0.02	6.46 ^c ±0.14	4.29±0.04
River D/Gaya	50	7.97 ^{ab} ±0.07	2.39 ^a ±0.03	7.03 ^a ±0.06	4.24±0.03
River Karaye	33	6.56 ^d ±0.33	2.31 ^b ±0.02	5.99 ^d ±0.28	4.30±0.06
River Tiga	21	3.11 ^c ±0.06	2.31 ^b ±0.02	3.17 ^c ±0.04	4.31±0.02
River Bagwai	42	7.74 ^{ab} ±0.24	2.26 ^c ±0.01	6.69 ^{bc} ±0.20	4.32±0.03
Strain	177				
C. gariepinus	143	7.83 ^a ±0.05	2.33±0.01	6.92 ^a ±0.04	4.28±0.02
H. longifilis	29	3.29 ^b ±0.02	2.27±0.02	3.26 ^b ±0.04	4.34±0.03
Sex	177				
Male	83	7.54 ^a ±0.25	2.30±0.02	6.75 ^a ±0.06	4.30±0.12
Female	94	6.40 ^b ±0.33	2.34±0.03	5.72 ^b ±0.04	4.28±0.03

a,b,c,d means within the same column and factor with different superscripts differ significantly. **=P<0.01, *=P<0.05. DFRC=dorsal fin ray count, PFCR=pectoral fin ray count, AFRC=anal fin ray count, CFRC=caudal fin ray count. NS – Not significant



The mean values of the morphometric characteristics and meristic counts were close to those reported by Eyo (2003) for *Clariid* strains with mean Total length of 24.02 cm, Standard length of 20.61 cm, Pre-dorsal distance of 7.21 cm, Pre-pectoral of 4.64 cm, Pre-anal distance of 11.68 cm. However, the reported values were lower than those of Fagbuaro *et al.* (2015) who reported mean body weight and total length of 530.67 g and 42.53 cm and 507.02 g and 42.40 cm for controlled and uncontrolled fish populations, respectively. This might be due to the nature of the water bodies.

The non-significant variation in mature male and female morphology from the Rivers investigated might be as a result of sex specific convergence on a common shape or increased movement and mixing of mature individuals. The result of this study concurred with those of Turan *et al.* (2005) who reported negligible sex variation in *C. gariepinus* from six wild populations in Turkey. With regards to strains, *Heterobranchus longifilis* revealed higher

morphometric measurements compared to *Clarias gariepinus*. The most important morphological difference between *Clarias gariepinus* and *Heterobranchus longifilis* is the presence in the latter strain of a large adipose fin originating immediately behind the rayed dorsal fin and reaching the caudal fin base. The results were in agreement with those of Uiblein, (1995), Hurlbut and Clay (1998) and Turan *et al.* (2005) who observed that different strains of fish exhibited divergent morphological characteristics in various habitats in response to the factors prevailing in the water bodies.

Conclusions

Location and strain contributed strongly to morphological and meristic variations in *Clariid* species than variation from sex in this study. Morphometric characteristics in fish alongside meristic count were found to be influenced by location and genotype of the fish studied, hence could be used to generate reliable information for stock discrimination.

References

- Eyo, J. E. (2003). Congeneric Discrimination of Morphometric Characters among members of the Pisces Genus *Clarias* (*CLARIIDAE*) in Anambra River, Nigeria. *The Zoologist* Vol. 2(1) 1- 17.
- Fagbuaro, O., J. A. Oso, M. B. Olurotimi, and O. Akinyemi. (2015). Morphometric and Meristic Characteristics of *Clarias gariepinus* from Controlled and Uncontrolled Population from Southwestern Nigeria. *Journal of Agriculture and Ecology Research International* 2(1): 39-45.
- Hurlbut, T. and Clay, D. (1998). Morphometric and meristic differences between shallow and deepwater populations of whitehake (*Urophycis tenuis*) in the southern Gulf of St. Lawrence. *Canadian Journal of Fisheries and Aquatic Sciences* 55: 2274-2282.
- Moses, Y. and Olufeagba, S.O. (2009). An Exposition on Field Identification of *Clariid* Catfishes as an Important Tool in Fish Breeding and Genetics. Manual of the National Institute for Freshwater Fisheries Research, New Bussa, Niger state.
- Reynaldo, A.L. and Cesar, G.D. (2014). Enzyme polymorphism among natural population of damselfish collected in selected reefs of Iligan Bay and Camiguin Island, Philippines. *European Journal of Zoological Research* 3(2): 18-22.

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- SAS, (2000). The statistical analysis system for windows. SAS^R Software, version 9.0. Cary, NC. USA.
- Turan, C., Sukran, Y., Funda, T., Emel, O. and Ihsan, A. (2005). Morphometric comparisons of African catfish, *Clarias gariepinus*, population in Turkey. *Folia Zoology* 54(1-2): 165-172.
- Uiblein F. (1995). Morphological variability between populations of Neobythites (Pisces: Ophididae) from the deep Red Sea and the Gulf of Aden. *Marine Ecology Progress Series* 124: 23-29.