DIFFERENCES IN MERISTIC COUNTS OF THE GENUS *Clarias* (PISCES: CLARIIDAE) IN ANAMBRA RIVER, NIGERIA

EYO, Joseph Effiong
Fisheries and Hydrobiology Research Unit, Department of Zoology, University of Nigeria, Nsukka, Enugu State, Nigeria. Email: divinelovejoe@yahoo.com

ABSTRACT

Specific differences in meristic counts were exhibited in both the anal fin ray count and the vertebral count in the clariids of Anambra river, Nigeria. There was a close numerical relationship between the number of anal fin rays and the number of vertebrae. The present study further justifies the taxonomic importance of anal fin ray count in differentiating Clarias species.

Key words: Meristic Counts, *Clarias,* Clariidae, Anambra River

INTRODUCTION

Congeneric and conspecific variations in fifty-four morphologic characters among *Clarias* species have been reported (Eyo, 2002 a, b). *Clarias ebriensis* and *C. albopunctatus* as well as *C. gariepinus and C. anguillaris* have overlapping morphologic character ranges. Congeneric differences among the clariids occurred in 2 raw and 9 ratio but not easily detected in 6 residual morphologic characters (Eyo, 2002 a). These are key characters which have ecological and taxonomic implications.

Sex discrimination among male and female clariids inhabiting the Anambra river system was evident in 7, 11, 20 and 26 morphologic characters for *C. ebriensis*, *C. albopunctatus*, *C. gariepinus* and *C. anguillaris* respectively. The observed increase in number of sex differentiating characters with clariid definitive size may be connected with variances in specific growth rates (Eyo, 2002 b).

The present study focuses on congeneric and conspecific differences in meristic counts among four *Clarias* species in Anambra River, Nigeria. The specific objectives of the study were (1) to provide taxonomic and descriptive statistical data on the meristic counts within and between *Clarias* species of Anambra river, (2) to evaluate the presence of sexual dimorphism in meristic counts and (3) to validate differences in meristic counts between the species.

MATERIALS AND METHODS

Clarias species were sampled from three locations (Onitsha, Otuocha and Ogurugu) along the Anambra River, Nigeria (Fig. 1). The fish were captured using set nets (mesh sizes 70 mm - 120 mm) and long lines baited with earthworm, pieces of meat and ripe palm fruits. Specimens were also bought from the major landing river port at Otuocha to ensure good representation of all sizes of the catfishes. All specimens were frozen and kept under refrigeration until used.

Fishes were properly identified and classified to their subgeneric level using Teugels (1982). Members of the subgenus *Clarias (Clarias) w*ere identified to the species level using Lowe-McConnel (1972) and Sydenham (1983), whereas those of the subgenera *C. (Clarioides)* and *C. (Anguilloclarias)* were identified using Ezenwaji (1989). The keys relevant to the taxonomy of the Anambra river catfishes of the genus *Clarias* have been presented elsewhere (Eyo, 1997). Data on 7 meristic counts (Fig. 2) obtained from 52 *C. gariepinus,* 56 *C. anguillaris,* 60 *C. ebriensis* and 90 *C. albopunctatus* were analysed.

All fish specimens were dissected and their sexes identified. Males and females of each species were treated separately to demonstrate conspecific differences and then combined to illustrate congeneric differences among studied meristic counts. Caudal fin ray count (CFRC) (the number of all the rays in the caudal fin), anal fin ray count (AFRC) (the number of rays in the anal fin), dorsal fin ray count (DFRC) (the number of the dorsal fin rays), pectoral fin ray count (PFRC) (the number of rays in the pectoral fin), pelvic fin ray count (PeFRC) (the number of rays in the pelvic fin), gill raker count (GRC) (the number of all the gill rakers on the first left gill arch) and vertebrae count (VC) (the

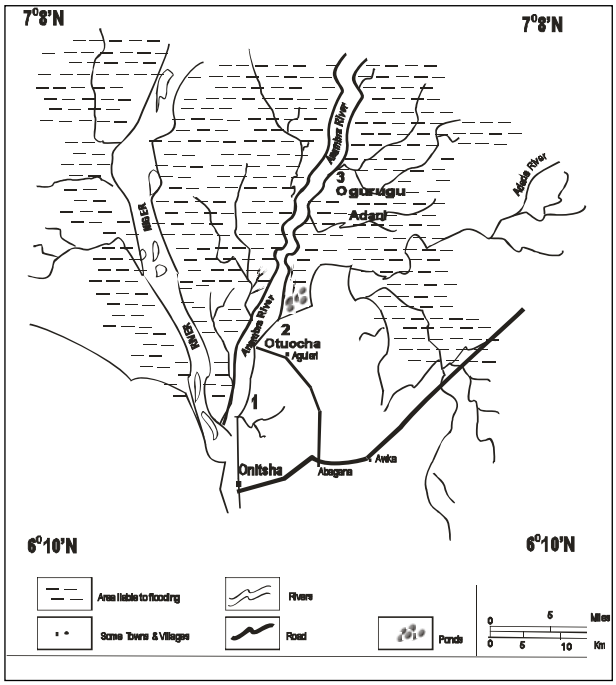

Figure 1: Map of Anambra river basin showing the sampling locations 1, 2 and 3.

number of all the vertebrae from the occipital to the end of the caudals) were carefully recorded. Before the vertebral count, an articulated skeleton of the catfish vertebrae was prepared using hot water maceration method. The fish specimen was defleshed and introduced into 0.01 N boiling solution of NaOH and left for 5 - 8 mins. The resulting soft flesh adhering on the skeletal part was cleared using a soft brush and the skeleton washed in water. The vertebrae were then counted and packaged. Means rather than modal counts were analysed. Mean, rather than modal, counts were analysed.

RESULTS

The distribution of meristic counts in the *Clarias* species of Anambra river, Nigeria is presented in Table 1. The specific differences in meristic counts among the examined species employing F-LSD are presented in Table 2. The means of the CFRC in males, females and combined sex of *C. ebriensis* and *C. albopunctatus* were identical (18.00 ± 0.00). Slight variations were displayed in the means of this count in males (19.00 ± 1.04), females (18.50 ± 0.89) and combined sex (18.73 ± 0.98) of *C. gariepinus* and in males (18.50 ± 0.94), females (18.38 ± 0.81) and combined sex (18.47 ± 0.86) of *C. anguillaris*. The test for significant differences indicated that the count was statistically similar among the males, females and combined sex of all the species studied.

The means of the AFRC varied in males (61.71 ± 2.69), females (60.23 ± 2.89), and combined sex (61.40 ± 2.54) of *C. ebriensis* and in males (54.50 ± 1.70), females (54.21 ± 1.72) and combined sex (54.30 ± 1.70) of *C. albopunctatus*. Furthermore, the means of the count differed in males (52.93 ± 2.27), females (52.56 ± 2.37) and combined sex (52.73 ± 2.29) of *C. gariepinus* and in males (62.93 + 3.15), females (63.69 ± 3.42) and combined sex (63.33 ± 3.26) of *C. anguillaris.* The F – LSD test for specific differences indicated that the counts were statistically similar in all the *Clarias* species females, different in all the *Clarias* species combined sex and identical among males of *C. ebriensis* vs *C. albopunctatus, C. albopunctatus* vs *C. gariepinus* and *C. albopunctatus* vs *C. anguillaris.*

The means of the DFRC varied in males (78.06 ± 3.15), females (78.85 ± 2.88) and combined sex (78.40 ± 3.00) of *C. ebriensis* and males (70.63 ± 2.19) females (70.36 ± 1.19) and combined sex (70.50 ± 1.90) of *C. albopunctatus.* The count means differed in males (72.36 ± 3.97), females (71.44 ± 2.99) and combined sex (72.07 ± 3.60) of *C. gariepinus* and in males (71.43 ± 2.82), females (71.00 ± 2.48) and combined sex (71.20 ± 2.60) of *C. anguillaris*. The F – LSD test for specific differences indicated not significant differences in males and females of all species, while the combined sex of *C. albopunctatus* vs *C. gariepinus* and *C. anguillaris* were statistically similar.

The means of the PeFRC in males, females and combined sex (6.00 ± 0.00) of *C. albopunctatus*, *C. gariepinus* and *C. anguillaris* were identical. Slight variations were observed in the means of males (6.71 ± 0.99), females (7.08 ± 1.04) and combined sex (7.27 ± 1.25) of *C. ebriensis*. The F – LSD test showed not significant difference among males, females and combined sex of all catfish species studied.

The means of the PFRC for males, females and combined sex of *C. ebriensis* and *C. albopunctatus* were the same (8.00 ± 0.00). Furthermore, the means for males, females and combined sex of C. *gariepinus* and *C. anguillaris* were identical (9.00 ± 0.00). The F-LSD test of significance indicated not significant difference among the males, females and combined sex of all *Clarias* species examined. The means of the GRC varied in males (16.65 ± 1.41), females (16.77 ± 1.30) and combined sex (16.70 ± 1.34) of *C. ebriensis* and males (16.63 ± 0.50), females (16.43 ± 0.51) and

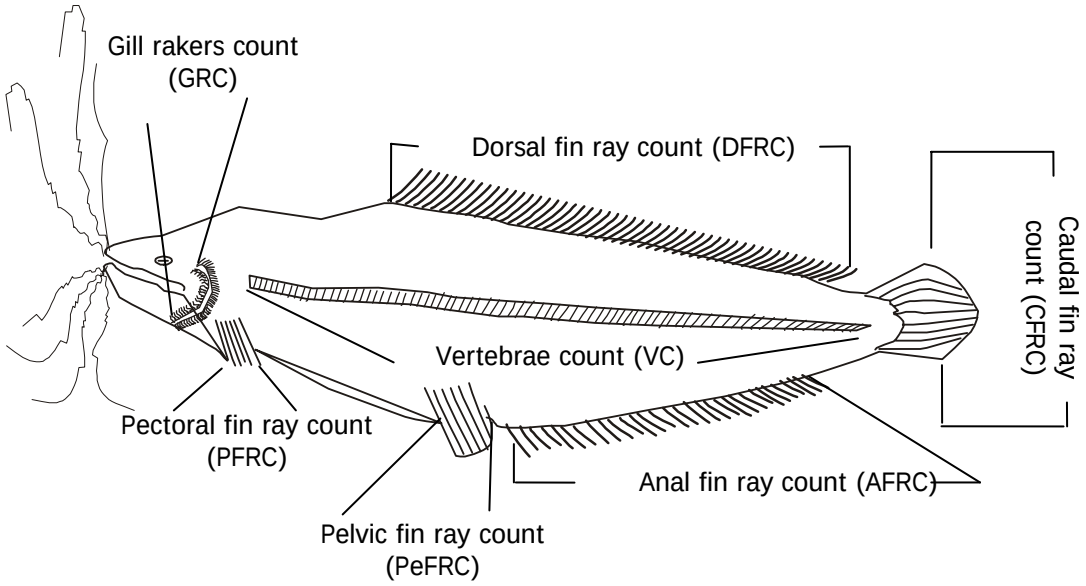

Figure 2: Schematic representation of meristic counts among *Clarias* species of Anambra river, Nigeria.

Table 1: Distribution of meristic counts in the *Clarias* species of Anambra river Nigeria

Meristic	Males			Females			Combined Sex		
Counts	Mean	SD	RV	Mean	SD	RV	Mean	SD	RV
				C. ebriensis					
CFRC	18.00	0.00	0.00	18.00	0.00	0.00	18.00	0.00	0.00
AFRC	61.71	2.69	9.00	60.23	2.89	9.00	61.40	2.54	9.00
DFRC	78.06	3.15	9.00	78.85	2.88	9.00	78.40	3.00	9.00
PeFRC	6.71	0.99	2.00	7.08	1.04	2.00	7.27	1.25	2.00
PFRC	8.00	0.00	0.00	8.00	0.00	0.00	8.00	0.00	0.00
GRC	16.65	1.41	4.00	16.77	1.30	4.00	16.70	1.34	4.00
VC	55.59	1.62	4.00	56.00	1.58	4.00	55.77	1.59	4.00
				C. albopunctatus					
CFRC	18.00	0.00	0.00	18.00	0.00	0.00	18.00	0.00	0.00
AFRC	54.50	1.71	5.00	54.21	1.72	6.00	54.30	1.70	6.00
DFRC	70.63	2.19	5.00	70.36	1.69	5.00	70.50	1.90	5.00
PeFRC	6.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00	0.00
PFRC	8.00	0.00	0.00	8.00	0.00	0.00	8.00	0.00	0.00
GRC	16.63	0.50	1.00	16.43	0.51	1.00	16.53	0.51	1.00
VC	50.94	1.12	4.00	50.71	0.83	2.00	50.77	0.82	2.00
				C. gariepinus					
CFRC	19.00	1.04	2.00	18.50	0.89	2.00	18.73	0.98	2.00
AFRC	52.93	2.27	7.00	52.56	2.37	8.00	52.73	2.29	8.00
DFRC	72.36	3.97	9.00	71.44	2.99	8.00	72.07	3.60	9.00
PeFRC	6.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00	0.00
PFRC	9.00	0.00	0.00	9.00	0.00	0.00	9.00	0.00	0.00
GRC	42.64	1.15	3.00	43.44	1.46	5.00	43.07	1.39	5.00
VC	57.21	1.31	4.00	56.88	1.36	4.00	57.03	1.33	4.00
				C. anguillaris					
CFRC	18.27	0.94	2.00	18.38	0.81	2.00	18.47	0.86	2.00
AFRC	62.93	3.15	9.00	63.69	3.42	9.00	63.33	3.26	9.00
DFRC	71.43	2.82	6.00	71.00	2.48	8.00	71.20	2.60	8.00
PeFRC	6.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00	0.00
PFRC	9.00	0.00	0.00	9.00	0.00	0.00	9.00	0.00	0.00
GRC	35.57	3.16	9.00	36.38	2.47	9.00	35.00	6.63	9.00
VC	59.29	1.49	4.00	59.06	1.53	4.00	59.17	1.49	4.00

Table 2: Specific differences in meristic counts in the *Clarias* species of Anambra river Nigeria employing F-LSD

Meristic Counts	F-LSD Value	*Clarias ebriensis*	*Clarias albopunctatus*	*Clarias gariepinus*	*Clarias anguillaris*
			Males		
CFRC	2.49	18.00	18.00	19.00	18.57
AFRC	7.75	61.71a	54. 50ab	52. 93bc	62. 93bd
DFRC	8.54	78.06	70.63	72.43	71.43
PeFRC	0.79	6.71	6.00	6.00	6.00
PFRC	1.19	8.00	8.00	9.00	9.00
GRC	6.85	16.65a	16. 63ab	35.57d	42.64c
VC	7.37	55.59a	50.94b	59.29d	57.21c
			Females		
CFRC	3.72	18.00	18.00	18.50	18.38
AFRC	11.99	60.23	54.21	52.56	63.69
DFRC	34.50	78.85	70.36	71.44	71.00
PeFRC	1.38	6.77	6.00	6.00	6.00
PFRC	1.69	8.00	8.00	9.00	9.00
GRC	3.08	16.77a	16.43ab	43.44c	36.38d
VC	11.19	56.00	50.71	56.68	59.06
			Combined Sex		
CFRC	2.35	18.00	18.00	18.73	18.47
AFRC	1.35	61.40a	54.30b	52.73c	63.33d
DFRC	1.48	78.40a	70.50bc	72.07c	70.50bd
PeFRC	0.84	6.73	6.00	6.00	6.00
PFRC	1.09	8.00	8.00	9.00	9.00
GRC	2.42	16.70a	16.53ab	43.07c	35.00d
VC	0.61	55.77a	50.77b	57.03c	59.17d

combined sex (16.53 ± 0.51) of *C. albopunctatus*. In addition, the means of the count differed in males (42.64 ± 1.15), females (43.44 ± 1.46) and combined sex (43.07 ± 1.39) of *C. gariepinus* and males (35.57 ± 3.16) female (36.38 ± 2.17) and combined sex (35.00 ± 6.63) of *C. anguillaris*. The F-LSD test for specific differences indicated that all the males, females and combined sex were significantly different except for the male of *C. ebriensis* and *C. albopunctatus*.

The means of the VC differed in males (55.59 ± 1.63), females (56.00 ± 1.58) and combined sex (55.77 ± 1.59) of *C. ebriensis* and in males (50.94 ± 1.12), females (50.71 ± 0.83) and combined sex (50.79 ± 0.82) of *C. albopunctatus*. The count means differed in males (57.21 ± 1.31), females (56.88 ± 1.36) and combined sex (57.03 ± 1.33) of *C. gariepinus* and males (59.17 ± 1.49), females (59.06 ± 1.53) and combined sex (59.17 ± 1.49) of *C. anguillaris*. Their F-LSD test for specific difference indicated that the males of *C. albopunctatus* and *C. gariepinus* differed significantly from the rest of the males while the females were not significantly different among the species. Furthermore, the count among the combined sex was significantly different in all the catfish species.

DISCUSSION

Specific differences in AFRC and VC distribution were exhibited among the clariids. Observation from the present study indicated that there was a close numerical relationship between the number of anal fin rays and the number of vertebrae. Thus, the mean AFRC varied from 53 in *C. gariepinus* to 63 in *C. anguillaris,* whereas the mean VC differed from 51 in *C albopunctatus* to 59 in *C. anguillaris*. Sydenham (1978) reported a modal number of vertebrae for the African *Clarias* species to be 60, with intraspecific variation in the order of 2 – 3 vertebrae. Species of the subgenera *C*. (*Clarias)* and *C. (Allabenchelys)* have VC close to the generic mode ranging from 59 to 63. Species of C. (*Clarioides)* however, show much greater interspecific variation with counts ranging from 50 - 68 (Sydenham, 1978). In *C. agboyiensis* and *C. isheriensis* ranges of 52 to 57 VC have been reported (Sydenham, 1980). Furthermore, in *C. aboinensis,* Sydenham and Olawoye (1981) reported vertebrae range of

between 58 and 60. Teugels and Thys Van Den Audenaerde (1981) reported vertebrae ranges of 59 to 62 in *C ebriensis* and 59 to 64 vertebrae in *C. dahomeyensis.* The VC in the present study falls within the 50 – 68 distribution of vertebrae in the genus *Clarias* (Sydenham, 1978).

Teugels and Thys Van Den Audenaerde (1981), while comparing the original description of two nominal species, *C. ebriensis and C. dahomeyensis,* observed that only the number of the dorsal and the anal fin rays can be indicated as being strikingly different. *C. ebriensis* had 70 - 73 dorsal and 53 - 62 anal fin rays, while they were 80 - 87 and 62 - 75 respectively in *C. dahomeyensis.* Teugels (1980) had already demonstrated that the systematic value of these counts was doubtful because of their wide variation. It is worthy to observe that the rejection of AFRC by Teugels (1980) based on wide variation may be invalid reasoning because all meristic counts examined by Teugels (1980) as well as those examined in the present study exhibited heterogeneous variance within stipulated ranges. Furthermore, species classification using morphological features is not based on one key character but on a wide range of key characters. In *C. angolensis,* Sydenham (1978) recorded 70 anal fin rays. Other numbers recorded for AFRC were 46 - 53 in *C. liberiensis* = *C. buettikoferi, 64 - 66 in C. submarginatus = C. albopunctatus,* 70 in *C. laeviceps,* 57 in *C. walkeri* = *C. camerunensis* and 63 – 71 in *C. longior* (Sydenham, 1978), 66 – 73 in *C. agboyiensis,* 51 – 60 in *C. isheriensis* = *C. agboyiensis* and 59 to 62 in *C. aboinenesis* (Sydenham and Olawoye, 1981). The observed range of the AFRC in all the species falls within the established range of 46 – 73 for the genus *Clarias*. Other authors have strongly supported the systematic values of both AFRC and VC.

Considering the use of meristic counts in differentiating other fish species, the AFRC was a major character in discriminating among *Oryzias* species (Uwa and Parenti, 1988). Similarly, Ferguson and Liskauskas (1995) employed both AFRC and VC in discriminating among populations of the brook charr (*Salvelinus fontinalis*). Thus, the present study further justifies the taxonomic importance of AFRC and VC in differentiating between clariids.

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