MORPHOMETRIC VARIATIONS AMONG THREE *Distichodus* SPECIES OF ANAMBRA RIVER, NIGERIA

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ABSTRACT

Studies on the morphometric variations of three Distichodus species namely D. rostratus, D. brevipinnis and D. engycephalus from Anambra river were investigated from November 2002 to October 2003. Fish specimens were collected monthly at Otuocha and Ogurugu area using hook and line, traps, baskets, gillnets, dragnets, surface drift nets and cast nests of various mesh sizes. Specific differences among the Distichodus species occurred in 2 raw characters; pelvic fin height and pectoral-pelvic fin space and 6 ratio (transformed) characters notably pelvic fin height, anal fin height, pectoral-pelvic fin space, pelvic-anal fin space, head length and caudal peduncle depth. Sexual dimorphism occurred in two ratio characters namely pectoral-pelvic fin space and pelvic-anal fin space among Distichodus brevipinnis. These characters are recommended as key characters in the taxonomy of Distichodus.

Keywords: Anambra river, *Distichodus*, Taxonomy, Morphometric character

INTRODUCTION

Fish unlike crude oil is a renewable natural resource, which when conservatively managed could meet about 50 % of Nigeria's animal protein and other nutritional requirements (Olayide and Akinwumi, 1980). This applies also to most other developing countries currently ravaged by hunger and malnutrition. Fish exploitation in Nigeria is confined to the marine, brackish and inland waters. A major component of the inland waters in Eastern Nigeria is the Anambra river, and its drainage systems – Anambra river basin. The major occupation of the people in the area is fishing and farming (including fish farming). *Distichodus* species are among the major exploitable fish species of the Basin. Distichodus belongs to the family Distichodontidae with three species occurring in the Basin: *Distichodus rostratus* Gunther 1864, *D. engycephalus* Gunther 1864, and *D. brevipinnis* Gunther 1864. Teugels *et al* (1992) reported that they are widely distributed in Nigeria, Nilo-Sudan, Niger, Volta, Chad and Nile basins. *Distichodus* species are extensively used in aquaculture on account of their good qualities, which according to Satia (1990) include high availability of seed for stocking, good adaptation to climate, ability to support high population densities, ability to feed on grasses and weeds in ponds and popularity among the consumers. In Nigeria *Distichodus* species are cultured in fish farms and numerous lentic water bodies because of their ability to feed on grasses and weeds.

Socio-culturally, dried *Distichodus* species are widely used in conjunction with other fishes like *Heterotis*, *Gymnarchus*, *Channa* etc. to prepare fish pepper soup used during traditional marriage ceremonies, cultural festivals and entertainment of special guests in the riverine states of Nigeria. Teugels et al. (1992) reported that the popularity among the consumers has made the fish to be of commercial importance and are often seen in piles of smoke-cured fishes. Reports on the taxonomy of *Distichodus* species, (Reed *et al.*, 1967; Holden and Reed 1972) were based on the number of scales on the lateral line and size of the adipose fin. The dependence on these characters for identification of *Distichodus* species may pose taxonomic problems due to overlapping number of the scales among the various *Distichodus* species. Moreover, the size of adipose fin is age, sex and size dependent thus not a foolproof character in delimiting *Distichodus* species. Morphometric and meristic features of many species have been used widely in separating different species of fishes. Ezenwaji (1986) stated that meristic counts and other measurements may be employed in separating different clariid species but warned that these measurements must be used with caution. Madu *et al.* (1993) used morphometric and meristic characteristics to distinguish between *Heterobranchus bidorsalis* and *Heterobranchus bidorsalis* vs. *Clarias anguillaris* hybrid. Similarly, Eyo (1997, 2002, 2003) discriminated members of the genus *Clarias* of Anambra river using biometrical variations. Otobo (1976) separated *Pellonula afzelusis* from *Sierathrisa leonensis* using meristic characters like number of fin rays, spines and sizes of the fins among others. Anyanwu and Ugwumba (2003) used morphometric parameters, meristic counts and electrophoresis techniques to separate *Pseudotolithus senegalensis* caught from three zones in the Nigerian Economic Exploitable Zone (EEZ) of the coast of Lagos. Ugbomeh (1989) developed a key for the identification of the Nigerian Grey Mullets (Mugilidae)

using meristic and morphometric characters and observed that the useful diagnostic characters were:

1. The number and form of the pyloric caeca.
2. The number of annuli on the cephalic scales
3. The size and number of scales on the lateral line of the body and
4. The number of anal fin rays.

This study therefore employs morphometric measurements as means of delimiting *Distichodus* species of Anambra river to ensure unmistakable identification.

MATERIALS AND METHODS

Fish samples were collected monthly at Otuocha and Ogurugu (Figure 1) from November 2002 to October 2003 using gill, drag, drift and cast nets of mesh sizes of between 70 to 120 mm. Baskets, traps and hook and line were also used. Fish specimens were also purchased from the local markets at Otuocha and Ogurugu to ensure adequate representation of all sizes of *Distichodus*.

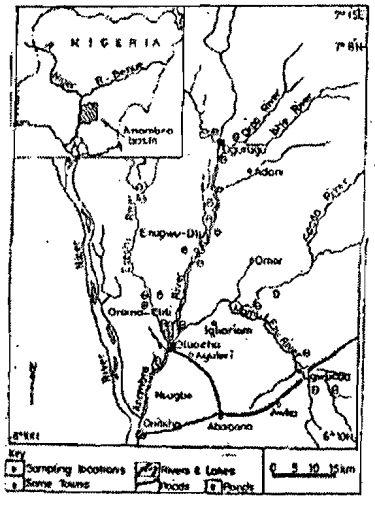
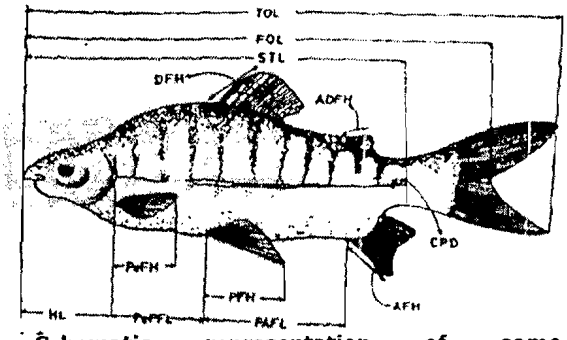


Figure 1: Map of Anambra river basin showing sampling locations

Fish were measured to the nearest 0.01 centimeters using venire Caliper, dividers and a fish measuring board. The fresh weight of the fish was taken to the nearest 0.01 gram using a mettler PC 2000 electronic balance. Identification of the fish collected was done using the keys of Holden and Reed (1972) and Lowe-McConnell (1972). The sex of the fish specimens was determined by examining their gonads after dissection. The determination of sexes in very young fish was problematic. In such cases, the excised gonads were pressed between two slides and examined under the microscope for immature eggs or sperm. Schematic representations of measured morphometric characteristics are shown in Figure 2.

All measurements were taken on the left side of the fish. The description of morphometric parameters used for the study are given below:



Schematic representation of some morphometric character measurements for Distichodus species of Anambra river, Nigeria. Lateral view [codes are explained in the text]

Standard Length (SL): The length from the tip of the snout to the anterior base of the caudal fin/posterior base of the caudal peduncle.

Total length (TL): The length from the tip of the snout to the end of the caudal fin.

Fork Length (FOL): The length from the tip of the snout to the shortest median caudal fin ray.

Head Length (HL): The length measured from the tip of the snout to the posterior end of the membranous margin of the gill opening of the body.

Dorsal fin Height (DFH): The length from the base of the adipose fin to the tip.

Pelvic fin Height (PFH): Taken as the length of the tallest pelvic fin ray.

Pectoral fin Height (PeFH): Taken as the length of the tallest pectoral fin ray.

Anal fin Height (AFH): The length form the base of the anal fin to the tip.

Pectoral Pelvic Fin Space (PPeFS): The ventro-basal distance between the posterior end of the pectoral fin and anterior end of the pelvic fin.

Pelvic Anal fin space (PAFS): The ventro-basal distance between the posterior end of the pelvic fin and anterior end of the anal fin.

Caudal Peduncle Depth (CPD): The dorso-ventral distance at the end of base of the caudal peduncle.

Data Analysis: Analysis of Variance (ANOVA) and Fisher's Least Significant Difference (F-LSD) (Steel and Torrie 1984) were employed to analyze the data.

RESULTS AND DISCUSSION

The size and weight ranges of *Distichodus* species in Anambra river are presented in Table 1. A total of 169 *Distichodus rostratus* made up of 84 males with size range of 11.0 – 32.0 cm total length and 45 – 576 weight and 85 females of 13.0 - 34.0 cm total length range and weight range of 50-675 g weight were collected. 167 *D. brevipinnis* consisting of 81 males of 12.0 - 34.0 cm total length and 53 – 831 g weight and 86 females ranging from 13.0 - 38.8 cm total length and 58 – 976 g weight were also collected. 79 males of 9.0 – 27.0 cm total length and 34 – 540 g weight and 84 females of 10.0 - 30.0 cm total length and 40-650 g weight of *D. engycephalus* were also used for the study.

Table 1: Size and weight ranges of *Distichodus* species in Anambra river

	D. rostratus	
Number	**M**	**F**
of fish	84	85
Size range	11.0-32.0	13.0 34.0
(mean)	(22.03)	(22.99)
Weight range	45-576	50-675
(mean)	(227.00)	(303.78)
Number	***D. brevipinnis***	
of fish	81	86
Size range	12.0 –34.0	13.0-38.8
(mean)	(23.57)	(24.57)
Weight range	53-831	58-976g (218.27)
(mean)	(332.00)	
Number	***D. encycephalus***	
of fish	79	84
Size range	9.0-27.0	10.0-30.0
(mean)	(20.23)	(21.62)
Weight range	34-540	40-650
(mean)	(218.27)	(213.73)

The specific difference in raw and ratio morphometric data among *Distichodus rostratus, D. brevipinnis* and *D. engycephalus* at P > 0.05 considering twelve morphometric measurements are shown in Table 2. Specific differences in raw morphometric character data occurred in 2 (16.67 %) of the studied characters namely the pectoral-pelvic fin space and pelvic fin height. Previous fisheries taxonomists notably Teugels (1982) in his key to the subgenera of the genus *Clarias,* Ezenwaji (1986) while reviewing the problems of *Clarias* taxonomy and Nwadiaro and Okorie (1985) in Biometric characteristics of *Chrysichthys filamentosus* (Pisces Bagridae) from Oguta lake did not recognize pelvic fin height and pectoral – pelvic fin space (raw data) as important diagnostic characters. However, Eyo (2003) noted that among four *Clarias* species (*Clarias ebriensis, C. albopunctatus, C. gariepinus* and *C. anguillaris),* congeneric differences occurred in 2 raw (pectoral fin base length and frontal width), 9 transformed (pelvic fin base length, Pectoral spine height, dorsal fin height, maxillary teeth band width, premaxillary teeth band depth, frontal, fontenelle length, internasal space, pelvic fin-anal fin space and prenasal barbell length) and 6 residual characters (Total Length, prepectoral length, pectoral fin base length, dorsal fin base length, outer mandibular barbel space and eye diameter).Specific differences among *Distichodus* species vis-à-vis the ratio data occurred in 7 (58.33 %) of the studied characters. The pelvic fin height, the dorsal fin height, the anal fin height, pectoral-pelvic fin space, pelvic anal fin space, head length and caudal peduncle depth were of significant taxonomic importance in discriminating all the studied *Distichodus* species. These characters are considered key characters for *Distichodus* taxonomy. Some of these characters like the ratio data of the pelvic fin height, dorsal fin height, anal fin height and the head length have been employed frequently but mainly for the taxonomy of *Clarias.* Other characters unexploited by some previous fisheries taxonomists but important in taxonomy are the percentage standard lengths of the pectoral pelvic fin space, pelvic-anal fin space, head length and caudal peduncle depth.

Observation from this study indicated that these character ratio data were heterogeneously distributed among the examined *Distichodus* and were significantly different at P > 0.05 in all the species thus indicating their valuability as key characters.

The sex dimorphic characters used to differentiate between male and female *Distichodus* species of Anambra river are presented in table 3. From the data, the ratios of adipose fin height, pectoral fin height, pelvic fin height, total length as well as anal fin height were statistically insignificantly different among males and females of all *Distichodus* species sampled (P > 0.05). An evaluation of the dorsal fin height ratios revealed the occurrence of significant difference among males and females of *D. brevipinnis* (P > 0.05). Similarly the fork length ratios were also significantly different between males and females of the species. There was also a significant difference in anal fin height between the males and females *D. engycephalus.* An assessment of sex dimorphism in pectoral-pelvic fin ratios indicated significant difference between males and females *D. brevipinnis.* Additionally, the pelvic-anal fin space ratios were significantly different among males and females of *D. rostratus* (P > 0.05) and *D. brevipinnis* (P > 0.05). Sex discriminating characters have been widely used by fish taxonomists in separating male and female species. Libovarsky and Bishara (1987) demonstrated sexual differences in three characters (snout length + eye diameter, predorsal length and maximum body depth) in *Oreochromis niloticus,* seven characters (standard Length, Snout length, Iris diameter, head length, pre-dorsal length, pre-pelvic length and prenasal length, in *O. aureus,* two characters (snout length and head length) in *sarotherodon galilaeus* and four characters (snout length, snout length + eye diameter, head depth and maximum body depth) in *Tilapia zilli.* Also Eyo (2002) reported that conspecific differences among males and female clariids inhabiting Anambra river systems occurred in 7, 11, 20 and 26, morphometric characters for *Clarias ebriensis C. albopunctatus, C. gariepinus* and *C. anguillaris.* This finding was

Table 2: Specific differences in raw and ratio morphometric data among *Distichodus* species of Anambra river Nigeria employing F-LSD

Morhometric character	Raw Data				Ratio Data			
	F-LSD Values	*D. rostratus*	*D. brevipinnis*	*D. engy cephalus*	F-LSD Values	*D. rostratus*	*D. beevipinnis*	*D. engy cephalus*
Adipose fin height (ADFH)	1.97	2.08ac	2.37ab	1.55bc	1.04	8.95ac	9.65ab	9.31bc
Pectoral fin height (PFH)	0.27	4.37ac	3.98ab	3.55bc	0.34	16.68ab	16.71b	16.43bc
Pelvic fin height (PFH)	0.24	4.56a	4.19b	4.33c	0.37	20.46a	17.48b	16.10c
Dorsal fin height (DFH)	0.32	5.10a	4.51b	4.30bc	1.00	22.47a	18.56b	20.66bc
Fork length (FOL)	0.44	25.29a	25.29ab	22.99c	1.82	113.72a	109.84b	108.66bc
Total length (TOL)	1.36	28.74a	35.47bc	34.99ac	3.00	130.01ab	127.71b	123.88c
Anal fin height (AFH)	0.21	3.02ab	3.31b	3.21c	0.65	18.36a	16.87b	15.71c
Pectoral-pelvic fin space (PPFS)	0.32	5.89a	5.46b	5.46c	0.59	27.01a	28.57b	25.38c
Pelvic-Anal fin space (PAFS)	1.40	4.55ac	5.16ab	3.83bc	0.48	19.50a	21.39b	18.14c
Head Length (HL)	0.42	6.14a	5.15b	4.83bc	0.70	26.71a	21.49b	23.70c
Caudal peduncle Depth (CPD)	0.63	3.99ac	3.50ab	3.50bc	1.97	17.66a	15.39b	13.59c
Standard Length (SL)	1.56	22.52ac	24.08ab	20.99bc	-	-	-	-

Key: a, b and c indicates significant corresponding means at P = 0.05 D.= Distichodus

Table 3: Sex Dimorphism in ratio data (Percentage standard length) among the *Distichodus* species of Anambra river, Nigeria

Morhometric character	*Distichodus rostratus*				*Distichodus brevipinnis*				*Distichodus engycephalus*			
	Males	Fe-males	T. Values	2 Tail Prob.	Males	Fe-males	T. Values	2 Tail Prob.	Males	Fe-males	T. Values	2 Tail Prob.
Adipose fin height (ADFH)	9.15± 3.67	8.76± 3.48	0.71	0.48	9.39± 3.03	9.90± 4.56	-0.78	0.44	9.96± 11.09	8.69± 3.22	1.00	0.32
Pectoral fin height (PFH)	19.51± 3.64	19.85± 3.56	-0.61	0.54	16.58± 3.03	16.84± 3.64	-0.49	0.63	16.47± 2.92	16.41± 2.42	0.15	0.88
Peivic fin height (PFH)	20.52± 3.55	20.40± 3.04	0.23	0.82	17.52± 3.88	17.44± 4.91	0.13	0.90	15.89± 2.98	16.30± 2.73	-0.91	0.37
Dorsal fin height (DFH)	22.36± 5.62	22.57± 5.82	-0.24	0.81	18.03± 5.18	19.06± 3.93	1.44	0.05*	21.40± 5.44	20.54± 6.26	0.93	0.93
Fork length (FOL)	114.87± 20.72	112.60± 22.10	0.69	0.49	107.54± 19.55	111.62± 13.00	1.41	0.05*	110.08± 10.73	107.30± 13.92	1.42	1.43
Total length (TOL)	128.75± 25.42	131.23± 17.81	0.73	0.46	127.93± 8.16	127.49± 8.21	0.34	0.73	124.41± 10.60	123.36± 12.60	0.42	0.67
Anal fin height (AFH)	18.16± 2.37	18.56± 2.97	-0.82	0.41	16.66± 3.35	17.06± 4.54	-0.65	0.52	15.16± 3.36	16.25± 3.60	1.99	0.05*
Pectoral-pelvic fin space (PPFS)	27.17± 4.10	26.85± 3.08	0.57	0.57	27.88± 5.65	29.21± 5.04	1.61	0.01*	26.26± 7.66	24.54± 7.11	1.48	0.04*
Pelvic – Anal fin space (PAFS)	19.04± 3.06	19.94± 3.69	1.72	0.04*	20.48± 4.36	22.25± 4.36	2.62	0.01*	18.37± 6.17	17.92± 5.47	0.49	0.62
Head Length (HL)	26.15± 8.09	27.24± 8.55	-0.85	0.40	21.74± 6.09	21.25± 6.43	0.51	0.61	23.57± 5.15	23.83± 4.84	-0.31	0.74
Caudal peduncle Depth (CPD)	17.67± 4.19	17.66± 4.29	0.02	0.98	15.73± 9.18	15.07± 4.96	0.59	0.56	13.13± 5.92	14.03± 5.11	-1.04	0.30

** Significant difference @ P = 0.05.*

supported by Nwani (2004) who reported sexual dimorphism in one transformed (dorsal fin base length) and four raw (Total length, standard length, dorsal fin base length and anal fine base length) morphometric characters among M*ormyrus rume, Hyperopisus bebe, Campylomormyrus tamandua* and *Gnathonemus petersii* occurring in Anambra river system.

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