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Meristic Counts and Morphometric Measurements of *Schilbe mystus* (Linnaeus, 1758)

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Abstract

Five meristic counts and 21 morphometric measurements were studied and compared between males and females *Schilbe mystus*. Statistical analysis showed no significant differences in the number of meristic counts. Students t-test showed that the mean of the 21 morphometric measured traits was significantly ($p<0.001$) higher in females than males. The regression analysis of the various morphometric measurements of *S. mystus* against the standard length yielded significantly correlated equations ($p<0.05$ to $p<0.001$) with females showing higher degree of correlation (r value) than males, except for the preorbital length and prepelvic length.

Keywords: *Schilbe mystus*; Meristic and Morphometric

Introduction

In their diagnostic description of the morphology of the Nile fishes, Boulenger, Sandon, Abu Gideiri used proportional differences expressed as ratios [1-3]. Such proportions might have wide numerical ranges within a species and are difficult to quantify and compare objectively, if the sample eco-regions are widely separated Strauss or the sample size is inadequate Bookstein et al. [4,5]. According to Kesteven expression of different body dimensions by covariance and regression equations are more appropriate and useful criteria for diagnosing and assessing interspecific relationship than the ratio indices [6]. In line with this are several studies on meristic counts and morphometric measurements.

Interest in meristic counts and morphometric measurements in *S. mystus* is due to Ayoade from Asejire and Oyan Lakes in Nigeria, by Dan-kishiya from Usuma Reservoir in Nigeria and by Kareem et al., from Erelu Lake and Asejire Reservoir in Nigeria, respectively [7-11]. A similar study in *Schilbe uranoscopus* was due to Famoofo and Abdul [12].

The growth performance for *S. mystus* was studied by Ayoade, by Dan-kishiya and by Kareem et al.

Fish morphometries quantifies variability in size and shape of a body trait within a species the work on *Labeo niloticus* by Idris and Mahmoud on *Brycinus* nurse by Ahmed, et al. [13,14]. It compares between regions the work on *Macrognathus aculeatus* by Sarower-E-Mahfuj et al., Omer et al., and between species the work on *Oreochromis niloticus*, *Sarotherdon galilaeus* and *Coptodon zillii* by Hassan and Mahmoud [15-17].

Advanced morphometric methods developed for identification and analysis of fish stocks, are truss network measurement, image analysis, univariate comparisons, bivariate, multivariate, principal components analysis Cadrin, Yakubu, and Okunsebo, Mojekwu and Anumudu [18-20].

The fish *Schilbe mystus* (African butter catfish) is distributed in the Nile and its tributaries in Sudan Abu Gideiri and African basins. It is among the highly appreciated table fish due to its good quality and tasty white flesh in Sudan Babiker and elsewhere in Africa.

The objective of this work is to quantify meristic counts and morphometric measurements of *S. mystus* (family *Schilbeidae*) collected from the White Nile near Khartoum.

Materials and Methods

Fresh specimens of *S. mystus* (71 females and 56 males) were collected from fishers operating on the White Nile near Khartoum using different nets. From the left side of each specimen, 6 meristic traits were counted and 21 morphometric measurements to 0.1 cm were made following Idris and Mahmoud.

Student t-test was used to compare the differences between males and female in the measured traits. The simple linear regression analysis was used to assess the relationship of the various measured traits with the standard length.

Results

Meristic counts

Analysis of the mode of some meristic counts of *S. mystus* showed that the number of the counted traits was similar in both sexes with no statistical differences (p>0.05) between them Table 1.

Table 1: The mode of some meristic counts of females and males of *Schilbe mystus.*

Number of:	Female N=71	Male N=56	p-value
Gill rakers of the first gill arch	13	13	p>0.05
Caudal fin rays	22	22	p>0.05
Pectoral fin rays	9	9	p>0.05
Pelvic fin rays	6	6	p>0.05
Anal fin rays	57	57	p>0.05

Morphometric measurements

Students t-test showed that the mean of various morphometric measurements was significantly (p<0.001) very high in females than males of *S. mystus*, except for the snout length which showed significant difference (p<0.05) (Table 2).

Table 2. Comparison between morphometric measurements of females and males of *Schilbe mystus*.

Parameter	Female M ± SD N=71	Male M ± SDN=56	P
Total length	23.49 ± 4.01	21.66 ± 2.68	p<0.001
Head length	3.14 ± 0.61	2.74 ± 0.47	p<0.001
Snout length	0.99 ± 0.25	0.89 ± 0.16	p<0.05
Periorbital length	1.09 ± 0.23	0.92 ± 0.17	p<0.001
Postorbital length	1.99 ± 0.28	1.75 ± 0.28	p<0.01
Mouth length	1.73 ± 0.36	1.47 ± 0.31	p<0.001
Mouth width	1.06 ± 0.21	0.95 ± 0.15	p<0.001
Maximum body width	1.57 ± 0.33	1.30 ± 0.25	p<0.001
Minimum body width	0.95 ± 0.15	8.23 ± 1.15	p<0.001
Maximum body depth	5.92 ± 1.05	5.20 ± 0.88	p<0.01
Primary predorsal length	5.64 ± 1.01	4.86 ± 0.72	p<0.001
Primary postdorsal length	7.35 ± 1.36	6.36 ± 0.86	p<0.001
Secondary predorsal length	16.58 ± 2.91	14.43 ± 2.21	p<0.001
Secondary postdorsal length	16.82 ± 0.29	14.43 ± 2.21	p<0.001
Prepectoral length	3.67 ± 0.79	3.17 ± 0.52	p<0.001
Postpectoral length	4.31 ± 0.78	3.72 ± 0.59	p<0.001

Prepelvic length	7.66 ± 1.94	6.60 ± 0.97	p<0.001
Postpelvic length	8.14 ± 1.37	7.06 ± 1.03	p<0.001
Preanal length	9.49 ± 1.68	8.32 ± 1.15	p<0.001
Caudal length	5.97 ± 0.98	4.91 ± 0.85	p<0.001

The regression analysis of the various morphometric measurements of *S. mystus* against the standard length yielded correlated equations raging from significant (p<0.05) to very highly significant (p<0.001). The females *S. mystus* showed higher degree of correlation (r value) than males, except for the preorbital length and prepelvic length (Table 3). All morphometric measurements were found to increase linearly with the increase of the standard length.

Table 3: Statistical analysis (t-test) and CV% of females and males of *Schilbe mystus.*

Parameter *vs.* Standard length	Female			Male		
	Y=a + bX	r	p	Y=a + bX	r	P
Total length	Y=12.05+1.15X	0.995	p<0.001	Y=39.62+1.01X	0.845	p<0.001
Head length	Y=0.17X-3.29	0.952	p<0.001	Y=0.08X-3.48	0.804	p<0.001
Snout length	Y=0.06X-1.39	0.815	p<0.001	Y=0.56X-0.99	0.749	p<0.001
Preorbital length	Y=2.41+0.04X	0.611	p<0.001	Y=0.07+2.27X	0.812	p<0.001
Postorbital length	Y=5.34+0.07X	0.88	p<0.001	Y=0.89+0.09X	0.711	p<0.001
Mouth length	Y=0.10X-2.98	0.956	p<0.001	Y=0.12X-5.61	0.806	p<0.001
Mouth width	Y=1.52+0.05X	0.759	p<0.01	Y=2.10+0.04X	0.606	p<0.001
Maximum body width	Y=0.08X-0.91	0.864	p<0.001	Y=0.08X-1.47	0.717	p<0.001
Minimum body width	Y=0.23X-4.24	0.55	p<0.01	Y=2.20+0.02X	0.404	p<0.05
Maximum body depth	Y=2.02+0.82X	0.917	p<0.001	Y=0.35X-10.59	0.868	p<0.001
Primary predorsal length	Y=0.28X 1.17	0.967	p<0.001	Y=0.32X-7.30	0.945	p<0.001
Primary postdorsal length	Y=0.38X-3.39	0.973	p<0.001	Y=0.40X-6.67	0.96	p<0.001
Secondary predorsal length	Y=0.82X-0.15	0.994	p<0.001	Y=1.83+0.79X	0.772	p<0.01
Secondary postdorsal length	Y=1.66+0.82X	0.994	p<0.001	Y=7.54+0.78X	0.768	p<0.001
Prepectoral length	Y=0.19X-1.79	0.95	p<0.001	Y=0.22X-7.60	0.918	p<0.001
Postpectoral length	Y=1.52+0.21X	0.913	p<0.001	Y=0.25X-0.71	0.909	p<0.001

Prepelvic length	Y=0.40X-4.48	0.72	p<0.001	Y=0.41X-6.24	0.907	p<0.001
Postpelvic length	Y=5.32+0.38X	0.944	p<0.001	Y=0.43X-5.16	0.903	p<0.001
Preanal length	Y=2.25+0.47X	0.946	p<0.001	Y=0.49X-4.24	0.914	p<0.001
Upper caudal length	Y=6.38+0.26X	0.948	p<0.001	Y=1.51+0.25X	0.69	p<0.001
Lower caudal length	Y=1.09+0.22X	0.934	p<0.001	Y=1.54+0.26X	0.868	p<0.001

Boulenger raw data was statistically analyzed during this study and compared with an unsexed random sample of *S. mystus*. The comparison showed correlated equations raging from significant (p<0.05) to very highly significant (p<0.001) in the measured traits of *S. mystus* (Table 4).

Table 4. Regression analysis of Boulenger (1909) raw data and the present study.

Parameter	Boulenger, 1909	R	P	Present study	r	P
Head length	Y=0.17X-0.24	0.992	p<0.001	Y=0.18X-0.11	0.954	p<0.001
Snout length	Y=0.08+0.40X	0.981	p<0.001	Y=0.32X-0.87	0.986	p<0.001
Mouth width	Y=0.29+0.07X	0.913	p<0.01	Y=0.11X-0.46	0.966	p<0.001
Eye diameter	Y=0.31+0.03X	0.954	p<0.001	Y=0.50+0.02X	0.587	p<0.05

Discussion

Meristic counts and morphometric measurements studies play a vital role in the identification of fish species in an area and between areas.

This study showed that the meristic counts of *S. mystus* from the White Nile were not statistically different and with identical scores in both sexes. Ayoade in his study of *S. mystus* from Asejire and Oyan Lake, Nigeria, found no significand differences (p>0.05) in dorsal fin spine, pectoral fin spines, dorsal fin rays and pectoral fin rays; but significant difference (p<0.05) in anal fin rays with counts being higher in samples from Asejire Lake. The differences in the count of right and left gill rakers of *S. mystus* from Oyan Lake and fewer anal rays compared to Asejire Lake reported by Ayoade suggests environmental differences between both Lakes. Famoofo and Abdul reported in *Schilbe uranoscopus* 4 rays in the dorsal fin, 7 rays in the pectoral fin, 6 rays in the pelvic fin, 17 rays in the caudal fin and 58 rays in the anal fin from Lekki Lagoon, Ogun State, Nigeria.

No variation in meristic counts was found in female *Epiplatys bifasciatus* by Guma'a [21], *Labeo niloticus* Idris and Mahmoud, *O. niloticus*, *S. galilaeus* and *C. zillii* Hassan and Mahmoud and *Brycinus* nurse Ahmed et al. A noticeable variation in the gill rakers counts on the first arch was found by Tave in *O. nilotius* (formerly *Tilapia nilotica*) [22].

In *S. mystus* the calculated mean values were (1.01 ± 0.20 cm) for preorbital length and (2.94 ± 0.54) for head length. These were slightly lower than the corresponding values of (1.7 ± 0.25) and (3.1 ± 0.17) for *S. mystus* from Oyan Lake, and (1.7 ± 0.18) and (2.9 ± 0.36) from Asejire Lake reported in the same species by Ayoade. The mean pectoral fin length (3.42 ± 0.66) was clearly higher than the corresponding values of (2.3 ± 0.4) and Oyan Lake and (2.4 ± 0.29) from Asejire Lake reported by Ayoade.

In *S. mystus* all morphometric measurements showed a linear relationship with the standard length in both sexes. Ayoade studied some morphometric traits of *S. mystus* from Asejire and Oyan Lake, Nigeria. He found no significand differences (p>0.05) in body depth, pectoral fin length but the head length and anal fin length were significantly different (p<0.05) with anal fin being longer in samples from Asejire Lake. Ogbe et al., reported in *S. mystus* total length ranging from 14.40 to 16.80 cm in the same species from Asejire Reservoir [22]. Kareem et al. reported a total length of 11.5 to 22.0 cm in *S. mystus* in Asejire Reservoir, Nigeria. They concluded that females *S. mystus* grows bigger Asejire Reservoir than males. The present study reported a mean of 23.49 ± 4.01 cm in females and 21.66 ± 2.68 cm in males *S. mystus* confirming the findings Kareem et al. Famoofo and Abdul reported from 13.5 to 19.6 cm total length, from 1.9 to 2.9 cm head length and from 2.7 to 3.9 cm in *S. uranoscopus*.

The relationship between total length as a dependent variable and other morphometric traits showed very high positive correlation in *S. mystus*. This implies that increase in total length results in increasing body dimensions. A similar trend was reported in female *E. bifasciatus* by Guma'a in 0+*Brycinus* (=Alestes) nurse by Guma'a and Yassin in *O. nilotius* by Tave [23,24]. Expression of morphometric measurements as ratio

indices was found to be of little significance as a taxonomic character in *Corydorus spp*., Strauss and in *Chondrastoma polylepsis* and *Rutilus arcass* Gallares-Perers and Coeihe. Bookstein et al., and Callares-Perera and Coelho reported that the higher r value of a trait, the less useful its ratio in taxonomic studies [25].

The similarity between the present study and the quantified raw data of Boulenger probably indicates the stability of its phenotypic and genotypic characters.

Conclusion

Statistical analysis showed no significant differences in in the number of meristic counts between males and females. Students t-test showed that the mean of the 21 morphometric measured traits was significantly ($p<0.001$) higher in females than in males. All morphometric measurements were found to increase linearly with the increase of the standard length. The information may help in fish stock management.

Ethics approval, consent to participate and publish, human and animal rights and availability of data and material are not applicable.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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