

Study on Morphometric and Meristic Characters of *Acanthopagrus bifasciatus* (Forsskål, 1775) from Southern Red Sea, Egypt

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Abstract: Based on 120 males (225 – 550mm TL) and 62 females (217 – 547 mm TL) of *Acanthopagrus bifasciatus* collected from southern red Sea (Hurghada to shalateen), the morphometric and meristic characters were investigated. The results proved that, sexual dimorphism in *A. bifasciatus* from the Red Sea sector of Egypt was possible by using morphometric indices. Morphometric characters of the aforementioned species showed allometric growth except AIVCFL for males and CD, DIDCFL, VIAOFL and DIVOFL for females. No sexual dimorphism was found to be in meristic characters of *Acanthopagrus bifasciatus*.

Keywords: Red Sea, Egypt, *Acanthopagrus bifasciatus*, morphometric, meristic.

1. Introduction

Morphometric characters of fishes were found to be of taxonomic importance in sex, race and species identification by many investigators (Mekkawy, 1987 & 1994; Mahmoud, 1988, 1991 & 1993; Harabawy, 1993 & 2000; Khalilet. al. 1983 & 1984; Oliveira and Almada, 1995; Osman, 2000; Mekkawy and Mohammad, 2011; Abbaspouret. al., 2013 and Safi et. al., 2014).

The meristic characters were also found to be valid in sex, race and species identification (Mahmoud and Mekkawy, 1991; Mahmoud, 1991, 1993 & 2002; Mekkawy, 1991 & 1997; Turan, 2004; Mekkawy and Mohammad, 2011 and Abbaspouret. al., 2013).

The present study aimed to display sexual dimorphism in the morphometrics and meristics of *Acanthopagrus bifasciatus* from the Southern Red Sea of Egypt.

2. Materials and Methods

Morphometrics: A total of 120 males (225 – 550mm in total length) and 62 females (217 – 547 mm in total length) of *Acanthopagrus bifasciatus* were collected from commercial harbors of southern red Sea (Hurghada to shalateen) during the period January 2015 – December 2015. The fish specimens were transported in ice chest to the laboratory where measurements started immediately.

For each fish, nineteen morphometric measurements were made on the left side up to the nearest millimeter using divider and a measuring board. They are diagrammatically represented in Fig. (1), the numbers in the figure correspond with those given below:

- 1- Total length (TL)
- 2- Fork length (FL)
- 3- Standard length (SL)

- 4- Head length (HL)
- 5- Head depth (HD)
- 6- Body depth (BD)
- 7- Eye diameter (ED)
- 8- Snout Length (SNL)
- 9- Dorsal fin base length (DFBL)
- 10- Anal fin base length (AFBL)
- 11- Caudal peduncle depth (CD)
- 12- Distance between anal fin insertion and dorsal caudal fin origin (AIDCFL)
- 13- Distance between dorsal fin insertion and ventral caudal fin origin (DIVCL)
- 14- Distance between anal fin insertion and ventral caudal fin origin (AIVCFL)
- 15- Distance between dorsal fin insertion and dorsal caudal fin origin (DIDCFL)
- 16- Distance between ventral fin insertion and anal fin origin (VIAOFL)
- 17- Distance between dorsal fin insertion and ventral fin origin (DIVOFL)
- 18- Distance between dorsal fin origin and anal fin insertion (DOAIFL)
- 19- Distance between the ventral fin origin and the anal fin origin (VOAOFL)

Meristics

The following meristic counts were recorded:

- 1- Number of the Dorsal fin soft rays (DFR)
- 2- Number of the Anal fin soft rays (AFR)
- 3- Number of the Caudal fin soft rays (CFR)
- 4- Number of the Pectoral fin soft rays (PFR)

Statistical analysis: The basic statistics of certain morphometric indices (relative to total length, TL) and meristic characters were estimated. The allometric coefficients of the raw morphometric characters and their relationships with fish size (TL) were estimated using power function equation and linear regression model respectively. The type of allometry was evaluated by testifying the significance of the allometric coefficients (b) ($b=1$, $b<1$ and $b>1$ for isometry, negative allometry and positive allometry respectively) that

serves as criterion for the intensity of differential increase in the morphological characters relative to a certain reference length. The means of meristic characters considered is testified by T-test to discriminate between males and females of *Acanthopagrusbifasciatus*.

Statistical analyses for morphometric and meristic data were performed using the SPSS version 16 software package and Excel (Microsoft office, 2010).

3. Results

The mean (\bar{x})± standard deviation (SD) and the range (R) of morphometric indices of *Acanthopagrusbifasciatus* considered in the present investigation are given in Table 1. This table gives a preliminary idea about sexual dimorphism of the aforementioned species.

The relationship between the morphometric measurements and fish size (TL) were best described by the linear regression equations (Table 2).

The patterns of variations in the morphometric characters of *Acanthopagrusbifasciatus* were considered in terms of their mode of growth i.e. their type of allometry. Except for AIVCFL for males and CD, DIDCFL, VIAOFL and DIVOFL for females, all characters of the *Acanthopagrusbifasciatus* exhibited allometric growth (Table 3).

The frequencies, means and standard errors of DFR, CFR, AFR and PFR of *Acanthopagrusbifasciatus* are given in Table 4. No sexual dimorphism was found in the meristic characters of the aforementioned species.

4. Discussion

In the present investigation, sexual dimorphism was revealed in some morphometric indices of *Acanthopagrusbifasciatus* studied. Sex, race and species identification was studied by several investigators (Mahmoud, 1991, 1993 & 2002; Mekkawy and Mahmoud, 1992; Myers *et. al.*, 2004; Cadrin, 2005; Mekkawy and Mohammad, 2011; Abbaspouret. *al.*, 2013 and Safi *et. al.*, 2014).

In the present investigation, it was possible to elucidate sexual dimorphism according to the type of allometry of the morphometric measurements considered. Many authors used the type of allometry to display sexual dimorphism in fish species comprising *Mormyruskanumme* (Mekkawy, 1987) *Clariaslazera* (Mahmoud, 1988), *Labeohorie* and *Labeoforskali* (Mahmoud, 1991) *Bagrus bayed* and *Bagrusdocmac* (Mahmoud, 1993) and *Oreochromismossambicus* (Olivera and Almada, 1995).

In the present study, no sexual dimorphism was found in the meristic characters of *Acanthopagrusbifasciatus*. This result is in agreement with results on some fish species comprising *Labeohorie* and *Labeoforskali* (Mahmoud, 1991).

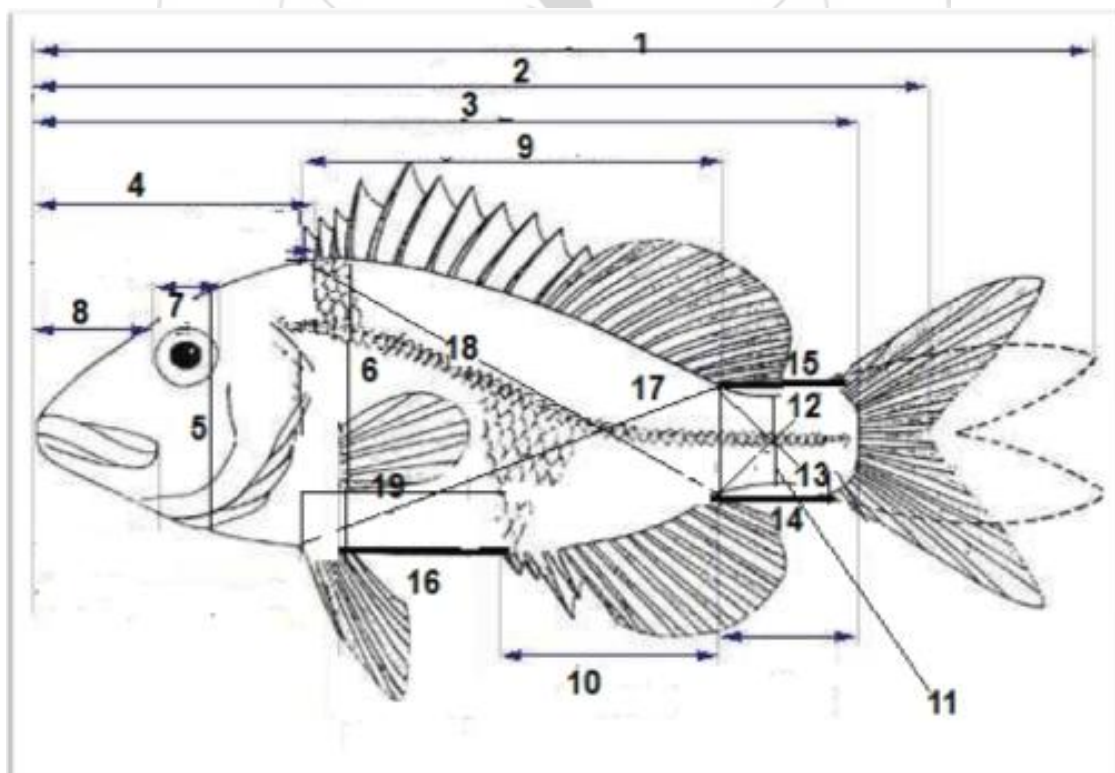


Figure 1: Schematic illustration of measurements taken on the body of *Acanthopagrusbifasciatus* from the Southern Red Sea, Egypt.

Table 1: Mean (\bar{x}), standard deviation (SD) and range (R) of morphometric indices (relative to total length, TL) of *Acanthopagrus bifasciatus* from Southern Red Sea, Egypt

Morphometric index ⁻ (%TL)	Males		Females	
	$\bar{x} \pm$ SD.	R	$\bar{x} \pm$ SD.	R
FL	91.66 ± 2.08	82 - 96	92.18 ± 1.46	89 - 95
SL	78.18 ± 2.50**	68 - 84	79.53 ± 1.52**	76 - 83
HL	26.35 ± 1.39**	23 - 30	27.50 ± 1.55**	25 - 32
HD	29.7 ± 2.37*	24 - 36	30.09 ± 2.19	26 - 35
BD	42.18 ± 2.37*	31 - 49	41.44 ± 1.63	38 - 46
ED	5.03 ± 0.65	4 - 7	4.88 ± 0.40	4 - 6
SNL	15.43 ± 1.41**	12 - 18	15.67 ± 1.39	11.82 - 18
DFBL	44.39 ± 1.91**	40 - 50	43.53 ± 1.77	40 - 47
AFBL	13.59 ± 1.10	9 - 17	13.13 ± 1.01	11 - 17
CD	12.68 ± 0.87**	10 - 15	12.81 ± 0.75	11 - 15
AIDCFL	17.45 ± 1.14**	15 - 21	17.18 ± 0.84*	14 - 19
DIVCL	17.75 ± 0.90**	15 - 20	17.97 ± 1.11*	15 - 20
AIVCFL	11.73 ± 1.01**	10 - 15	11.89 ± 1.25*	9 - 16
DIDCFL	10.81 ± 0.88	8 - 13	10.79 ± 1.15	8 - 14
VIAOFL	22.89 ± 1.84**	18 - 27	23.43 ± 1.90*	19 - 27
DIVOFL	43.01 ± 1.86**	38 - 48	42.74 ± 1.75	38 - 47
DOAEFL	52.12 ± 1.95**	46 - 56	51.91 ± 1.75	47 - 57
VOAOFL	25.78 ± 1.77**	22 - 31	26.08 ± 1.75	23 - 30

** Correlation with TL is significant at the 0.01 level.

* Correlation with TL is significant at the 0.05 level.

-For abbreviations refer to materials and methods.

Table 2: The relationship between some parameters of morphometric characters and total length (TL) of *Acanthopagrus bifasciatus* from Southern Red Sea, Egypt for future prediction of missing parameters

Males		Females	
The equation	R**	The equation	R**
FL= -0.43+ 0.93*TL	0.99	FL= -0.78+ 0.94*TL	0.99
SL= -1.70 + 0.83*TL	0.98	SL= -1.36 + 0.83*TL	0.99
HL= -0.94 + 0.29*TL	0.96	HL= -2.07 + 0.32*TL	0.93
HD= -1.17 + 0.33*TL	0.91	HD= -2.60 + 0.36*TL	0.88
BD= 1.10 + 0.39*TL	0.95	BD= 0.14 + 0.41*TL	0.94
ED= 0.71 + 0.03*TL	0.76	ED= 0.42 + 0.04*TL	0.71
SNL= -0.21 + 0.16*TL	0.88	SNL= -0.21 + 0.16*TL	0.75
DFBL= 1.61 + 0.40* TL	0.91	DFBL= 0.99 + 0.41* TL	0.93
AFBL= 0.40 + 0.12* TL	0.88	AFBL= 0.63 + 0.12* TL	0.76
CD= -0.28 + 0.14* TL	0.94	CD= -0.28 + 0.13* TL	0.88
AIDCFL= 0.10 + 0.17*TL	0.93	AIDCFL= -0.70 + 0.19*TL	0.93
DIVCL= -0.50 + 0.19*TL	0.96	DIVCL= -0.35 + 0.19*TL	0.87
AIVCFL= 0.06 + 0.12*TL	0.88	AIVCFL= -0.52 + 0.13*TL	0.74
DIDCFL = 0.30 + 0.10*TL	0.87	DIDCFL = 0.308 + 0.10*TL	0.65
VIAOFL= -1. 24 + 0.26*TL	0.96	VIAOFL= -1. 59 + 0.27*TL	0.85
DEIVOFL= -0.28 + 0.44*TL	0.96	DIVOFL= 0.01 + 0.43*TL	0.93
DOAIFL= 0.45 + 0.51*TL	0.97	DOAIFL= 0.96 + 0.50*TL	0.95
VOAOFL= -0.97 + 0.28*TL	0.94	VOAOFL= -1.36 + 0.29*TL	0.88

(**) correlation is significant at the 0.01 level.

- For abbreviations refer to materials and methods.

Table 3: The allometric coefficient (b) of morphometric measurements of each of males and females of *Acanthopagrus bifasciatus* from Southern Red Sea, Egypt.

Morphometric measurements*	Males			Females		
	b	a	R**	b	a	R**
FL	1.02-	0.83	0.99	1.02-	0.82	0.99
SL	1.06+	0.53	0.99	1.05+	0.61	0.99
HL	1.08+	0.17	0.98	1.18+	0.09	0.98
HD	1.08+	0.19	0.96	1.22+	0.08	0.96
BD	0.93-	0.64	0.97	1.01+	0.40	0.98
ED	0.60-	0.52	0.87	0.78-	0.18	0.88
SNL	1.00-	0.15	0.93	1.02+	0.14	0.88
DFBL	0.92-	0.72	0.99	0.98-	0.51	0.97
AFBL	0.93-	0.21	0.94	0.90-	0.25	0.90
CD	1.07+	0.08	0.97	1.02I	0.11	0.95
AIDCFL	0.98-	0.20	0.96	1.11+	0.09	0.97
DIVCL	1.08+	0.11	0.98	1.07+	0.12	0.95
AIVCFL	0.97I	0.14	0.94	1.08+	0.07	0.87
DIDCFL	0.93-	0.16	0.94	0.94I	0.15	0.84
VIAOFL	1.14+	0.10	0.96	1.19I	0.07	0.94
DIVOFL	1.03+	0.36	0.99	1.00I	0.43	0.97
DOAEFL	0.98+	0.58	0.99	0.94-	0.73	0.98
VOAOFL	1.10+	0.14	0.97	1.13+	0.12	0.95

(-) = Negative allometric growth.
 (+) = Positive allometric growth.
 (I) = Isometric growth.
 a = constant of allometric equation.
 (**) correlation is significant at the 0.01 level.
 * For abbreviations refer to materials and methods.

Table 4: Certain meristic characters of *Acanthopagrus bifasciatus* from southern Red Sea, Egypt

	DFR		N	$\bar{x} \pm SE$	T-value
Counts	12	13			4.45
Males	43	77	120	12.64 ± 0.04	
Females	19	43	62	12.69 ± 0.06	

	CFR				N	$\bar{x} \pm SE$	T-value
Counts	17	18	19	20			3.03
Males	43	57	17	3	120	17.83 ± 0.07	
Females	48	9	4	1	62	17.32 ± 0.08	

	AFR		N	$\bar{x} \pm SE$	T-value
Counts	10	11			5.94
Males	64	56	120	10.64 ± 0.05	
Females	46	16	62	10.26 ± 0.06	

	PFR				N	$\bar{x} \pm SE$	T-value
Counts	12	13	14	15			2.22
Males	44	61	13	2	120	12.77 ± 0.06	
Females	47	9	2	4	62	12.40 ± 0.11	

* For abbreviations refer to materials and methods.

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