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ON MORPHOMETRICS AND ALLOMETRY OF
BAGRUS BAYAD (FORSKÅL, 1775)
AND BAGRUS DOCMAC (FORSKÅL, 1775)
FROM THE NILE AT EGYPT
(With 13 Tables and 6 Figures)

By

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**دراسة مورفومترية واللومترية على سمكى
البياض والدقماق من نيل مصر**

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لقد استخدم فى هذا البحث ٣٩ قياساً مورفومترياً وذلك لدراسة انتماط الاختلاف داخل النوع وبيان الانواع لسمكى البياض Bagrus bayad والدقماق Bagrus docmac من النيل عند منطقتي اسيوط (٢٧° شمالي) والجيزة (٣٠° شمالي) ولكى نوضح مثل هذه الانماط من الاختلاف فلقد تم تطبيق تحليل التباين والمعامل الالومترى ثنائى المتغير وتحليلات متعددة المتغيرات. ولقد وجد ان تطبيق التحليل الدالى المميز متعدد المجموعات على مجموعة قياسات الرأس ومجموعة قياسات العمق يعطى فصلاً بين الجنسين والعشرات والانواع تحت الدراسة أفضل من مجموعة قياسات العامة وقياسات الزعناف.

MORPHOMETRICS, ALLOMETRY, *BAGRUS BAYAD* & *BAGRUS DOCMAC*

SUMMARY

In the present investigation, 39 morphometric measurements were used to study intra- and inter-specific patterns of variation of *Bagrus bayad* and *Bagrus docmac* populations from the Nile at Assiut (27° N) and Giza (30° N) areas. In order to reveal such patterns of variation, analysis of variance, bivariate allometric coefficient, cluster analysis and canonical variates analysis were applied. It was found that application of canonical variates analysis on the head and depth measurement sets provided greater separation between sexes, populations and species considered than did the general and fin measurement sets.

INTRODUCTION

The fishes of the genus *Bagrus* represent an economic importance in Egyptian fisheries and fish culture. However, few studies on the various biological aspects of *Bagrus* species from the Nile of Egypt are available (EL-SEDFY, 1977; HASHEM, 1977a,b, 1981a,b and HASHEM & EL-TABBAKH, 1981).

The aim of the present investigation is to examine the patterns of morphometric variability in *Bagrus bayad* and *Bagrus docmac* from the Nile at Assiut and Giza districts. It is hoped that the results of the present study may give a contribution to a better view of the taxonomic status of the aforementioned species.

MATERIALS and METHODS

In the present investigation, random samples of 10 males (292-349 mm in standard length "SL") and 98 females (160-426 mm in SL) of *Bagrus bayad* and 34 males (226-545 mm in SL) and 35 females (149-487 mm in SL) of *Bagrus docmac* were collected from Assiut (Latitude 27° N) fish markets during the period September 1988 - August 1989; also, random samples of 29 males (188-466 mm in SL) and 24 females (175-640 mm in SL) of *Bagrus bayad* and 27 males (180-640 mm in SL) and 27 females (224-390 mm in SL) of *Bagrus docmac* were collected from Giza (Latitude 30° N) fish markets during the same period.

For each fish, 39 morphometric measurements were made on the left side up to the nearest millimeter using a divider and measuring board. The following is a list of such measurements which are diagrammatically represented in figure 1; each

measurement is labelled on this figure by its number indicated in such a list. Those morphometric measurements included:

- 1- Standard length (SL).
- 2- Fork length (FL).
- 3- Snout length (SNL).
- 4- Eye diameter (ED).
- 5- Postorbital length (PTOL).
- 6- Head length (HL).
- 7- Interorbital width (IOW).
- 7- Internasal width (INW).
- 9- Predorsal length (PRDL).
- 10- Postdorsal length (PTDL).
- 11- Preventral length (PRVL).
- 12- Preanal length (PRAL).
- 13- Postanal length (PTAL).
- 14- Pectoral pelvic length (PTPVL).
- 15- Pelvic anal length (PVANL). 16- Body depth 1 (BD1).
- 17- Body depth 2 (BD2).
- 18- Caudal peduncle length (CPL).
- 19- Caudal peduncle depth (CPD). 20- Mouth width (MW).
- 21- Ventral caudal length (VCL). 22- Head depth (HD).
- 23- Head width (HW).
- 24- Nasal barbel length (NABL).
- 25- Maxillary barbel length (MXBL).
- 26- Outer mandibular barbel length (OMBL).
- 27- Inner mandibular barbel length (IMBL).
- 28- Postdorsal origin length (PTDOL).
- 29- Posteye length (PTEL).
- 30- Postdorsal end length (PTDEL).
- 31- Adipose caudal length (ADCL).
- 32- Dorsal fin base length (DFBL).
- 33- Anal fin base length (AFBL).
- 34- Adipose fin depth (ADFD).
- 35- Dorsal fin spine length (DFSL).
- 36- First dorsal fin soft ray length (DFRL).
- 37- Pectoral fin spine length (PFSL).
- 38- Ventral fin spine length (VFSL).
- 39- Anal fin spine length (AFSL).

The aforementioned measurements were treated in terms of the following measurement sets:

- 1- General measurement set which includes PRDL, PTDL, PRVL, PRAL, PTAL, PTPVL, PVANL, CPL, VCL, PTDOL, PTEL, PTDEL and ADCL.
- 2- Head measurement set which includes SNL, ED, PTOL, HL, IOW, INW, MW, HD, HW, NABL, MXBL, OMBL and IMBL.

- 3- Fin measurement set which includes DFBL, AFBL, ADFD, DFSL, DFRL, PFSL, VFSL and AFSL.
 4- Depth measurement set which includes BD1, BD2, CPD and HD.

In the present investigation, the mean \pm standard deviation and the range of the morphometric indices (morphometric measurements as a percentage of SL) for each of males, females and combined sexes of *Bagrus bayad* and *Bagrus docmac* populations considered were calculated.

To clarify intra- and inter-specific variations of the aforementioned *Bagrus* species, the analysis of variance ANOVA and sum of squares simultaneous test procedure (SSSTP) were applied on the morphometric indices. Also, cluster analysis was applied on such indices and canonical variates analysis (CVA) was applied on the morphometric sets of raw data and indices (relative to SL or HL). In cluster analysis, the morphometric indices were coded according to MEKKAWY (1991) using SSSTP.

In the present study, the simple power function or allometric equation of HUXLEY (1932):

$$Y = aX^b$$

was used, where Y and X are dependent and independent variables respectively and a and b (the allometric coefficient) are constants. The parameters a and b of this equation were estimated by fitting a linear equation to the logarithmic values of Y and X according to the least square method. This leads to an equation of the form:

$$\log Y = \log a + b \log X$$

Moreover, the type of allometry was determined by estimating the confidence limits of the allometric coefficient, i.e. whether growth reveals isometry (I), negative allometry (-) or positive allometry (+). The type of allometry was found to be helpful for studying intra-and inter-specific variations of the *Bagrus* populations considered.

The programs of ANOVA, SSSTP (SOKAL and RHOFF, 1981), CVA (BLACKITH and REYMENT, 1971), cluster analysis and linear regression (DAVIS, 1973) were modified to fulfil the aforementioned requirements. Such programs were executed on VME computer system in the Computer Centre of Assiut University. The first three canonical variates (CVI, CVII and CVIII) were only considered in the present study since they explained the highest percentage of the total variability.

RESULTS

The mean (\bar{X}) \pm standard deviation (SD) and the range (R) of 38 morphometric indices of *Bagrus bayad* and *Bagrus docmac* samples considered in this investigation are given in tables (1-4). These Tables give a preliminary idea about intra-and inter-specific variations of the aforementioned species.

From Table 5, discrimination between Assiut and Giza populations of *B. bayad* was recorded only in the indices of SNL, INW, PRAL, PTPVL, BD1, BD2, VCL, HD, HW, NABL, IMBL, PTEL, AFBL and AFSL. Discrimination between Assiut and Giza populations of *B. docmac* was revealed in all morphometric indices considered except those of ED, PTDL, MW, MXBL, PTDOL, DFBL, ADFD, DFSL, DFRL, PFSL and VFSL. Interspecific variation between *B. bayad* and *B. docmac* was displayed only in the indices of IOW, PTDL, PTPVL, PVANL, CPD, MW, HD, HW, MXBL, DFBL, AFBL, ADFD, DFSL, DFRL and PFSL.

Using ANOVA and SSSTP, sexual dimorphism was recorded in *B. bayad* of Giza and *B. docmac* in Assiut and Giza as regards the indices of PRAL ($F=2.712$; 4 and 276 d.F; $P < 0.05$) and AFSL ($F=2.811$; 4 and 276 d.F; $P < 0.05$). No sexual dimorphism was recorded in *B. bayad* of Assiut.

The constants a and b of the allometric equation and the confidence limits of the allometric coefficient b of the morphometric measurements of *B. bayad* and *B. docmac* under investigation are given in tables (6-11). Such tables show that, at 0.05 level of significance, the isometric measurements outnumbered the allometric ones in males of *B. bayad* in each of Assiut and Giza populations, in males of *B. docmac* of Assiut and in females of *B. docmac* of Giza. By contrast, the allometric measurements outnumbered the isometric ones in females of *B. bayad* in each of Assiut and Giza populations, in males of *B. docmac* of Giza, in combined sexes of *B. bayad* of Giza and in combined sexes of *B. docmac* in each of Assiut and Giza populations. The isometric measurements were equal to allometric ones in females of *B. docmac* of Assiut and in combined sexes of *B. bayad* of Assiut. Also the aforementioned tables show the type of allometry (isometry, positive allometry or negative allometry) and accordingly intra-and inter-specific variations in the morphometric measurements of *B. bayad* and *B. docmac* can be revealed.

Cluster analysis of the coded morphometric indices (Fig. 2) give two main clusters; the first includes Assiut and Giza populations of *B. bayad* (1, 2, 3 and 4) and the second includes Assiut and Giza populations of *B. docmac* (5, 6, 7 and 8). The

first cluster divides into two subclusters corresponding to males and females of *B.bayad* of Assiut (1 and 2) and males and females of *B.bayad* of Giza (3 and 4). Also the second cluster divides into two subclusters corresponding to males and females of *B.docmac* of Assiut (5 and 6) and males and females of *B.docmac* of Giza (7 and 8).

The results of CVA'S carried out on the morphometric sets considered are given in tables (12 & 13) and figures (3-6). Table 13 shows that such analyses exhibited different intraspecific (sexual and geographic) and interspecific patterns of size and shape variations.

DISCUSSION

Morphometric indices of fishes were found to be of taxonomic importance in sex, race and species identification by many investigators (PAGE and BRAASCH, 1976; NELISSEN, 1978; EZZAT et al., 1979; RISCH and THYS van den AUDENAERDE, 1981; KHALIL et al., 1982, 1984; HAUG & FEVOLDEN, 1986; MEKKAWY, 1987 and MAHMOUD, 1988, 1991). In the present study, it was possible to reveal intra- and inter-specific variations in *B.bayad* and *B.docmac* populations considered by comparing means of the morphometric indices studied. Also, such variations were displayed by the application of ANOVA and SSSTP on the aforementioned indices.

The type of the allometric coefficient was considered by GOULD (1966) to be of taxonomic value. The type of allometry was used to study intra- and inter-specific variations in some fish species comprising *Mugil cephalus* (GRANT and SPAIN, 1975), *Spectrunculus grandis* (NIELSEN and HUREAU, 1980) *Chrysichthys magnus*, *Gephyroglanis longipinnus* and *Gephyroglanis gigas* (RISCH, 1981), *Mormyrus kannume* (MEKKAWY, 1987), *Clarias lazera* (MAHMOUD, 1988), *Cichlasoma citrinellum* (MEYER, 1990), *Labeo horie* and *Labeo forskalii* (MAHMOUD, 1991). In the present investigation, it was possible to reveal intra- and inter-specific variations of *B.bayad* and *B.docmac* populations from Assiut and Giza according to the type of allometry of the morphometric measurements considered.

KARAKOUSIS et al. (1991) mentioned that the use of morphological characteristics has some limitations and disadvantages. According to them such characteristics that they are polygenically inherited, have low heritability and are subject to considerable environmental plasticity. Thus, unless specific characters are known to have a genetic basis, multivariate analysis of a set of phenotypic characters is regarded as a more appropriate method than the use of a single

character for determining the extent to which populations or species may be genetically diverse (SMITH and CHESSER, 1981). Multivariate methods have been used for investigating intra-and inter-specific morphometric variations in fishes by several authors (WINANS, 1985; MacCRIMMON & CLAYTOR, 1986; MEKKAWY, 1987, 1990; CAWDERY & FERGUSON, 1988; MAHMOUD, 1988, 1991; HEDGECOCK *et al.*, 1989; MEYER, 1990; KARAKOUSHIS *et al.*, 1991; SHEPHERD, 1991 and MEKKAWY & MAHMOUD, 1992). In the present study, intra- and inter-specific morphometric variations were revealed in *B.bayad* and *B.docmac* populations considered by using canonical variates analysis and cluster analysis. Also, it was found that canonical variates analysis on the head and depth measurement sets provided greater separation between sexes, populations and species than did the general and fin measurement sets.

In the present study, intraspecific (geographic) variations in each of *B.bayad* and *B.docmac* populations from Assiut (27° N) and Giza (30° N) can be attributed to environmentally induced phenotypic differences. Further genetic and electrophoretic studies necessary to determine whether such populations constitute separate genotypic entities or do not.

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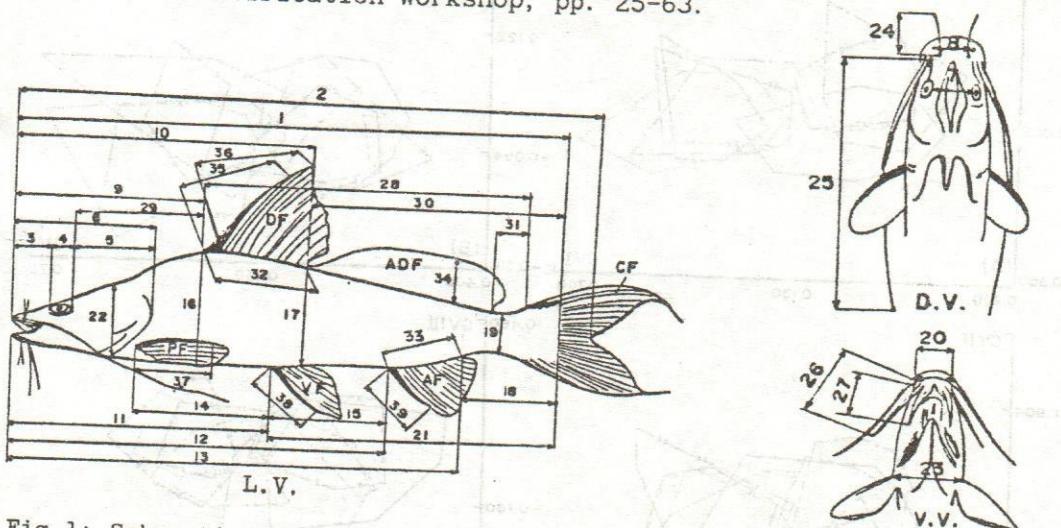


Fig.1: Schematic illustration of the morphometric measurements taken on the body of *Bagrus bayad*, as a representative of the species considered. ADF, Adipose dorsal fin; AF, anal fin; CF, caudal fin; DF, dorsal fin; PF, pectoral fin; VF, ventral fin. L.V.: lateral view; D.V.: dorsal view; V.V.: ventral view. The numbers are the same as those of the list of the morphometric measurements given in materials and methods.

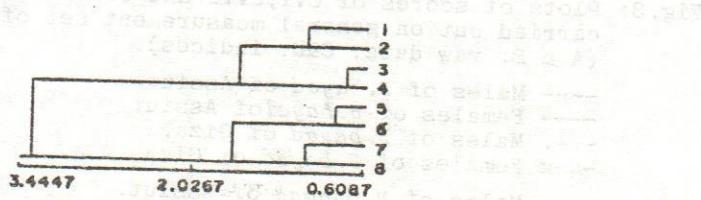


Fig. 2: Dendrogram from weighted pair group method cluster analysis on Euclidian distance matrix of coded morphometric indices of *Bagrus* populations.

1&2: Males and females of *B. bauad* of Assiut.

3&4: 'Males and females of *B. bayad* of Giza'

5&6: Males and females of *B. bayad* of Giza.

7&8: Males and females of *B. daemae* of Assiut

gallstones, not associated with gallbladder diseases, and gallbladder diseases not associated with gallbladder diseases. The results of the CVA analysis showed that the first three axes explained 41.6% of the variance. The first axis explained 18.3% of the variance, the second axis 13.8% and the third axis 10.1%.

The first axis was positively correlated with the following variables: weight, height, liver weight, heart weight, kidney weight, testis weight, and gonadosomatic index. It was negatively correlated with the following variables: liver/gonad weight ratio, heart/gonad weight ratio, and gonadosomatic index.

The second axis was positively correlated with the following variables: weight, height, liver weight, heart weight, kidney weight, testis weight, and gonadosomatic index.

The third axis was positively correlated with the following variables: weight, height, liver weight, heart weight, kidney weight, testis weight, and gonadosomatic index. It was negatively correlated with the following variables: liver/gonad weight ratio, heart/gonad weight ratio, and gonadosomatic index.

The first three axes explained 41.6% of the variance, which is considered acceptable, but other axes may still be significant and may explain more variance.

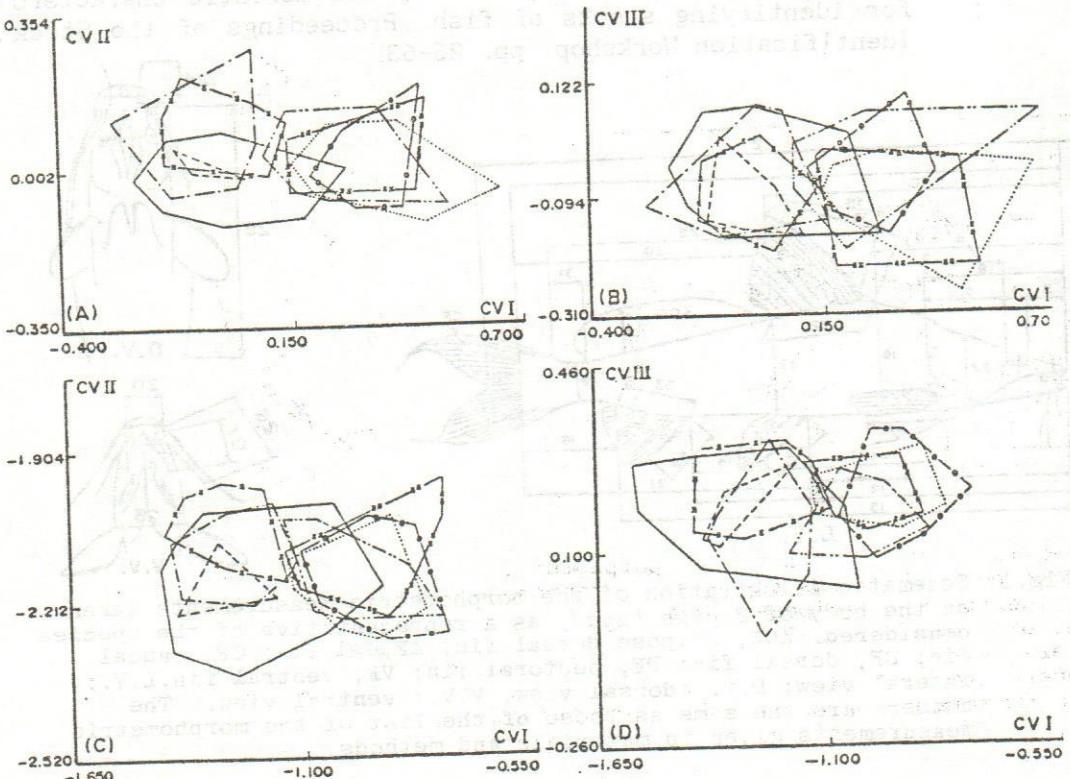


Fig. 3: Plots of scores of CVI, CVII and CVIII derived from CVA carried out on general measurement set of *Bagrus* populations (A & B: raw data; C&D: indices).

- Males of *B. bayad* of Assiut.
- Females of *B. bayad* of Assiut.
- ... Males of *B. bayad* of Giza.
- x-x Females of *B. bayad* of Giza.
- Males of *B. docmac* of Assiut.
- o-o Females of *B. docmac* of Assiut.
- ... Males of *B. docmac* of Giza.
- xx- Females of *B. docmac* of Giza.

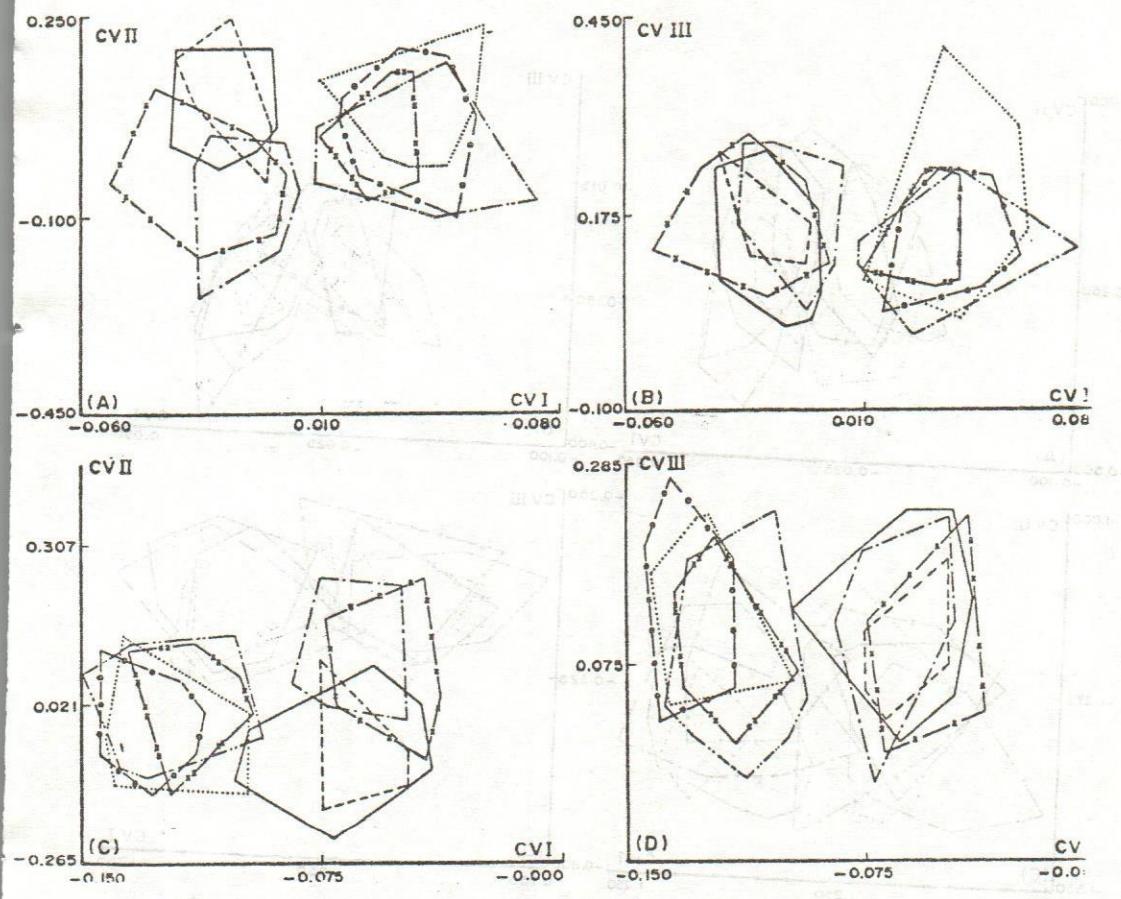
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Fig. 4: Plots of scores of CVI, CVII and CVIII derived from CVA carried out on head measurement set of *Bagrus* populations (A & B: raw data; C & D: indices).

- Males of *B. bayad* of Assiut.
- Females of *B. bayad* of Assiut.
- .- Males of *B. bayad* of Giza.
- x-x Females of *B. bayad* of Giza.
- Males of *B. docmac* of Assiut.
- o-o Females of *B. docmac* of Assiut.
- ...- Males of *B. docmac* of Giza.
- xx- Females of *B. docmac* of Giza.

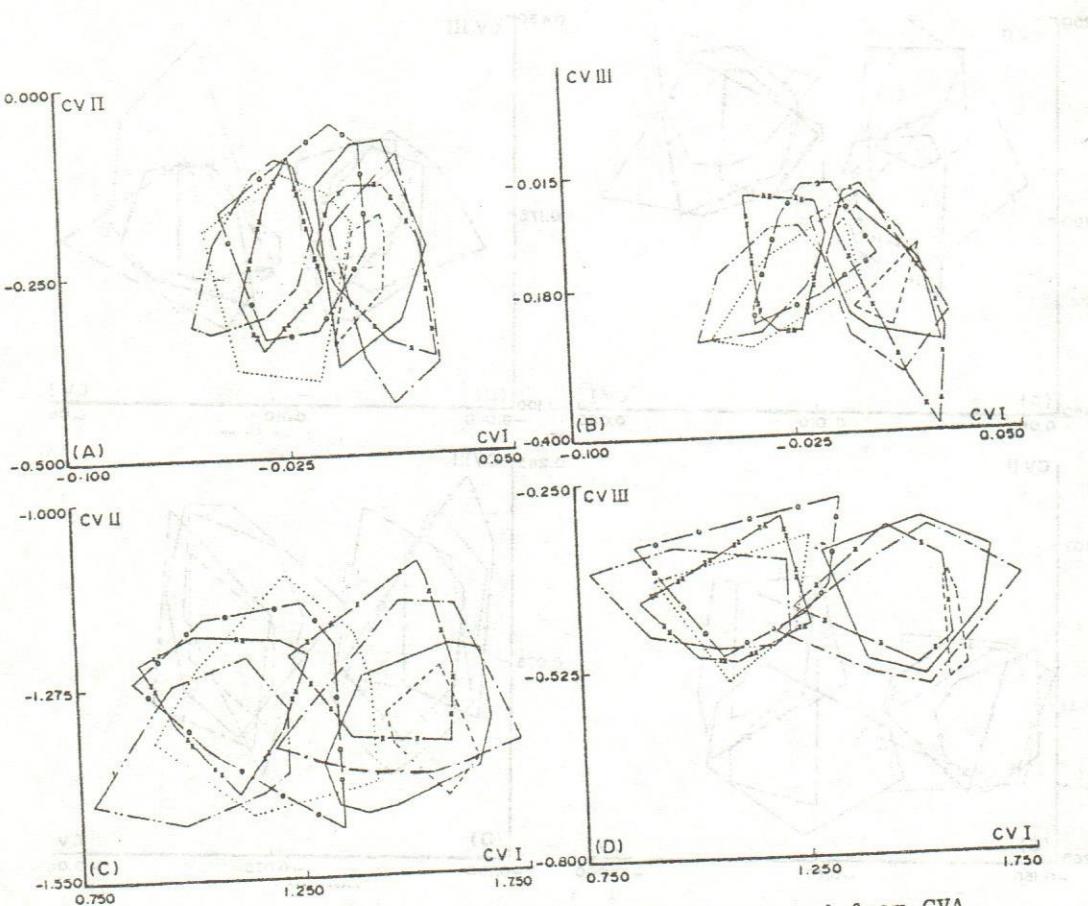


Fig. 5: Plots of scores of CVI, CVII and CVIII derived from CVA carried out on fin measurement set of *Bagrus* populations (A & B: raw data; C & D: indices).

- Males of *B. bayad* of Assiut.
- Females of *B. bayad* of Assiut.
- .- Males of *B. bayad* of Giza.
- x-x Females of *B. bayad* of Giza.
- Males of *B. docmac* of Assiut.
- o-o Females of *B. docmac* of Assiut.
- ...- Males of *B. docmac* of Giza.
- xx- Females of *B. docmac* of Giza.

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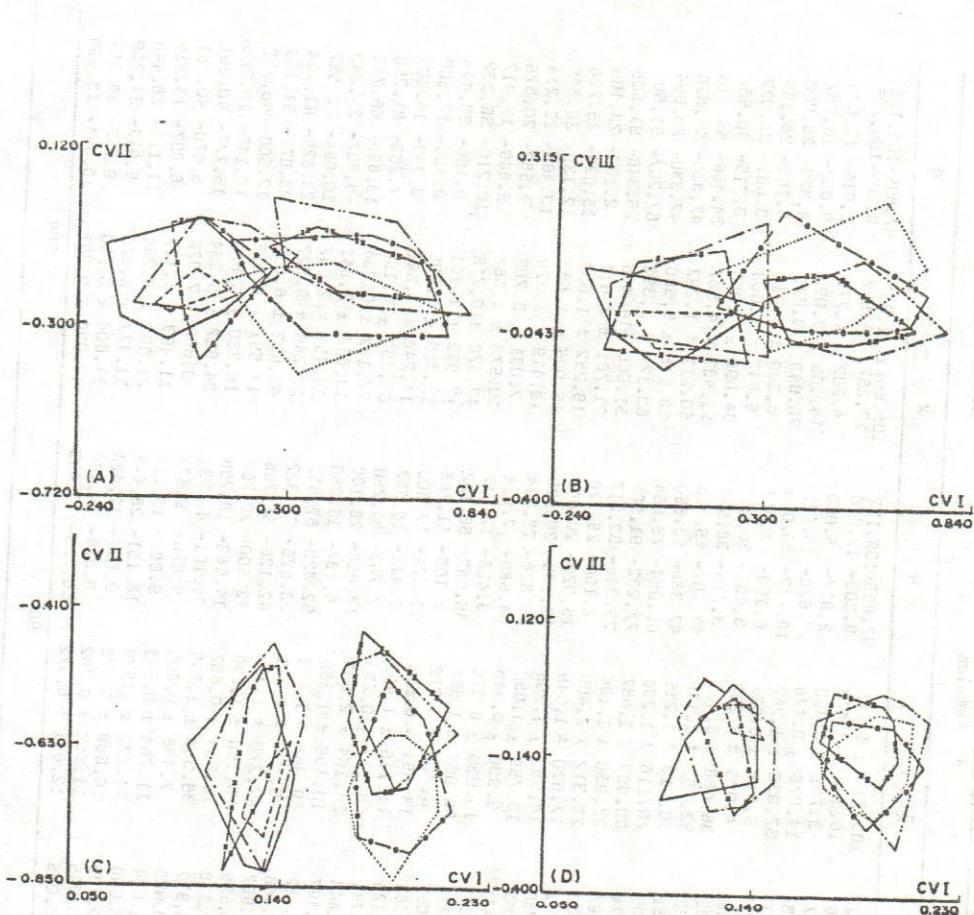


Fig. 6: Plots of scores of CVI, CVII and CVIII derived from CVA carried out on depth measurement set of *Bagrus* populations (A & B: raw data; C & D: indices).

- Males of *B. bayad* of Assiut.
- Females of *B. bayad* of Assiut.
- .- Males of *B. bayad* of Giza.
- x-x Females of *B. bayad* of Giza.
- Males of *B. docmac* of Assiut.
- o-o Females of *B. docmac* of Assiut.
- ...- Males of *B. docmac* of Giza.
- xx- Females of *B. docmac* of Giza.

Table (1) : Mean (\bar{x}), standard deviation (SD) and range(R) of morphometric indices of *Bagrus bavayad* of Assiut. Number of specimens (N) is also given.

Morphometric index*	Males			Females			Combined sexes		
	\bar{x}	SD	R	\bar{x}	SD	R	\bar{x}	SD	R
FL	105.362 ± 0.553	104.665-106.250	105.714 ± 1.411	97.895-109.132	105.681-1.357	97.835-109.132	105.257 ± 24.937	17.257 ± 24.937	9.309-106.725
SNL	10.011 ± 0.390	9.412-10.616	10.248 ± 0.473	9.309-12.676	4.202 ± 1.778	2.915-12.676	14.105 ± 3.093	3.052-16.087	3.052-16.087
ED	3.408 ± 0.263	2.915-3.767	3.739 ± 0.465	2.927-5.000	13.620-16.087	13.620-16.087	26.943 ± 3.671	14.320-30.000	14.320-30.000
PCTL	14.663 ± 0.354	14.118-15.313	14.976 ± 0.478	13.620-16.087	18.712-30.000	18.712-30.000	26.943 ± 3.671	6.103-28.169	6.103-28.169
HL	27.509 ± 0.591	26.822-28.571	37.936 ± 1.287	6.103-7.917	8.309 ± 5.315	8.309 ± 5.315	3.801 ± 3.083	3.801 ± 3.083	3.801 ± 3.083
LOW	6.713 ± 0.391	6.122-7.471	6.816 ± 0.321	3.801-36.082	3.801-36.082	3.801-36.082	5.047 ± 3.083	3.715-38.537	3.715-38.537
INW	4.794 ± 0.724	4.110-6.608	4.908 ± 3.202	3.715-38.537	3.715-38.537	3.715-38.537	34.099 ± 9.056	34.466-55.418	34.466-55.418
INW	36.126 ± 0.538	35.244-36.905	36.486 ± 3.462	51.483 ± 4.587	51.483 ± 4.587	51.483 ± 4.587	50.712 ± 1.297	47.330-54.828	47.330-54.828
PRDL	52.641 ± 1.002	51.724-55.060	52.753 ± 1.145	49.107-55.418	47.330-53.650	47.330-53.650	46.620-53.650	47.330-73.964	47.330-73.964
PTDL	50.285 ± 1.032	48.824-52.381	50.613 ± 1.215	47.330-53.650	66.964-73.964	66.964-73.964	68.618 ± 5.500	68.618 ± 5.500	68.618 ± 5.500
PRVL	71.069 ± 1.742	68.758-74.405	70.116 ± 1.236	67.267-91.505	67.267-91.505	67.267-91.505	80.127 ± 3.392	67.267-91.505	67.267-91.505
PTAL	81.974 ± 1.315	79.539-84.524	80.907 ± 1.887	77.232-91.505	77.232-91.505	77.232-91.505	81.960 ± 14.446	25.346-91.505	25.346-91.505
PTAL	27.735 ± 0.864	26.531-29.167	27.936 ± 1.194	25.346-32.917	21.761 ± 2.811	21.761 ± 2.811	21.761 ± 2.811	2.160-28.168	2.160-28.168
PPVUL	21.958 ± 1.068	20.344-23.739	21.312 ± 2.400	21.160-25.728	18.252 ± 1.633	18.252 ± 1.633	15.029-15.029	15.029-25.728	15.029-25.728
PVANL	18.592 ± 1.009	16.3954-19.771	17.920 ± 1.049	15.029-20.845	15.029-20.845	15.029-20.845	15.005 ± 1.680	12.139-12.139	12.139-12.139
BDI	14.678 ± 0.743	13.699-15.759	14.682 ± 1.206	12.139-20.539	12.139-20.539	12.139-20.539	19.419 ± 1.570	13.468-23.214	13.468-23.214
BG2	19.662 ± 0.959	18.052-21.037	19.759 ± 1.030	16.828-23.214	16.828-23.214	16.828-23.214	19.419 ± 1.570	4.580-20.875	4.580-20.875
CPL	6.173 ± 0.215	5.822-6.471	5.990 ± 0.443	4.580-7.914	7.031 ± 3.709	7.031 ± 3.709	10.573 ± 1.387	5.669-12.917	5.669-12.917
CPO	10.751 ± 0.320	10.313-11.301	10.936 ± 0.576	9.426-12.917	10.573 ± 1.387	10.573 ± 1.387	10.210-10.210	10.210-10.210	10.210-10.210
MW	51.677 ± 0.932	50.000-53.235	50.962 ± 1.595	46.552-56.132	47.938 ± 11.151	47.938 ± 11.151	12.829 ± 11.151	8.108-10.945	8.108-10.945
VCL	9.340 ± 0.430	8.455-10.057	9.706 ± 0.772	8.108-11.785	12.039-11.785	12.039-11.785	13.498 ± 1.505	8.108-17.500	8.108-17.500
HW	13.566 ± 0.494	12.647-14.384	13.851 ± 0.985	11.372-17.500	11.372-17.500	11.372-17.500	11.248 ± 1.548	8.333-14.567	8.333-14.567
NABL	9.382 ± 1.500	7.715-13.125	11.116 ± 1.459	8.421-14.567	10.573 ± 1.387	10.573 ± 1.387	7.763-7.763	6.125-6.125	6.125-6.125
MXBL	60.063 ± 11.297	6.340-73.761	68.017 ± 11.283	7.763-12.917	63.733 ± 16.156	63.733 ± 16.156	13.898-16.156	13.898-66.748	13.898-66.748
OMBL	23.387 ± 2.049	19.198-25.444	24.164 ± 2.635	13.898-29.180	27.137 ± 10.934	27.137 ± 10.934	13.868 ± 2.941	8.437-25.243	8.437-25.243
ADCL	15.433 ± 1.924	15.456-14.497	13.196 ± 1.550	8.437-16.250	13.868 ± 2.941	13.868 ± 2.941	16.454 ± 12.647	10.094-62.557	10.094-62.557
IMBL	12.533 ± 1.445	12.533 ± 1.445	13.958 ± 1.489	52.830-62.557	52.830-62.557	52.830-62.557	27.745 ± 9.327	23.625-23.625	23.625-23.625
PTDOL	60.053 ± 1.845	57.020-63.437	59.168 ± 1.489	23.625-27.327	45.632 ± 6.016	45.632 ± 6.016	23.977-23.977	51.786-51.786	51.786-51.786
PTEL	24.961 ± 0.620	24.069-25.648	25.136 ± 0.711	41.126-51.786	17.551 ± 8.619	17.551 ± 8.619	12.500-12.500	48.732-48.732	48.732-48.732
PTDEL	47.240 ± 1.325	45.559-49.687	47.270 ± 1.343	12.500-20.702	16.230 ± 0.879	16.230 ± 0.879	13.146-13.146	18.266-18.266	18.266-18.266
DFRL	10.987 ± 0.715	10.294-13.095	10.000-13.095	10.000-13.095	11.477 ± 2.870	11.477 ± 2.870	9.836-10.291	24.789-24.789	24.789-24.789
PFSL	11.909 ± 0.316	10.294-13.095	10.000-13.095	10.000-13.095	11.604 ± 0.790	11.604 ± 0.790	9.836-14.167	10.094-13.439	10.094-13.439
AFSL	12.503 ± 0.799	12.503 ± 0.799	12.503 ± 0.799	12.503 ± 0.799	12.030 ± 0.607	12.030 ± 0.607	10.094-10.094	10.094-10.094	10.094-10.094

N

* For abbreviations refer to materials and methods.

Table(2) : Mean (\bar{x}), standard deviation (SD) and range (R) of morphometric indices of *Bagrus bavayi* of Giza. Number of specimens (N) is also given.

Morphometric index*	Males			females			Combined sexes		
	N	\bar{x}	\pm SD	R	\bar{x}	\pm SD	R	\bar{x}	\pm SD
FL	105.096 ± 1.065	103.333 - 108.120		105.165 ± 0.675	103.750 - 106.364		105.130 ± 0.975	103.333 - 108.120	
SNL	9.916 ± 0.533	8.590 - 10.684		10.008 ± 0.656	8.750 - 11.364		9.963 ± 0.596	8.590 - 11.364	
ED	3.745 ± 0.582	2.575 - 4.787		3.595 ± 0.582	2.656 - 4.831		3.669 ± 0.583	2.575 - 4.831	
PTOL	14.919 ± 0.525	13.684 - 16.000		14.965 ± 0.544	13.721 - 16.226		14.942 ± 0.532	13.684 - 16.226	
HL	27.829 ± 1.032	25.771 - 29.434		27.902 ± 1.021	25.833 - 29.310		27.866 ± 1.020	25.771 - 29.434	
TOW	6.964 ± 0.362	6.316 - 7.538		6.882 ± 0.502	4.626 - 7.547		6.922 ± 0.439	4.626 - 7.547	
INW	6.688 ± 0.429	5.924 - 7.407		6.760 ± 0.379	5.895 - 7.429		6.725 ± 0.404	5.895 - 7.429	
PROL	37.354 ± 1.218	35.211 - 39.744		37.533 ± 1.104	35.271 - 39.526		37.445 ± 1.153	35.211 - 39.744	
PTOL	52.545 ± 1.294	49.737 - 55.469		52.545 ± 0.945	49.754 - 54.340		52.545 ± 1.118	49.737 - 55.469	
PRVL	50.197 ± 0.843	48.630 - 52.734		49.969 ± 0.350	48.000 - 54.167		50.031 ± 1.130	48.000 - 54.167	
PRAL	69.307 ± 1.273	66.216 - 71.513		69.284 ± 1.827	65.613 - 73.438		69.295 ± 1.579	65.613 - 73.438	
PTAL	79.640 ± 1.568	76.370 - 82.456		80.547 ± 0.834	77.075 - 106.697		80.099 ± 0.630	76.370 - 106.697	
PTPVL	27.330 ± 1.002	25.126 - 28.906		26.939 ± 1.192	24.865 - 31.0		27.132 ± 1.112	24.865 - 31.0	
PVANL	20.179 ± 1.112	17.905 - 22.511		20.068 ± 1.291	17.778 - 25.156		20.596 ± 1.203	17.778 - 25.156	
BD1	16.862 ± 1.477	13.673 - 20.608		16.813 ± 1.104	14.039 - 19.245		16.837 ± 1.292	13.673 - 20.608	
BD2	14.085 ± 1.373	12.121 - 17.905		14.083 ± 1.065	11.572 - 16.935		14.085 ± 1.218	11.572 - 17.905	
CPL	19.486 ± 0.889	17.811 - 21.145		19.528 ± 0.918	17.736 - 21.754		19.507 ± 0.898	17.736 - 21.754	
CPD	5.967 ± 0.441	5.155 - 7.556		5.792 ± 0.212	5.366 - 6.094		5.870 ± 0.354	5.155 - 7.556	
MW	10.782 ± 0.591	9.217 - 11.698		10.825 ± 0.487	9.486 - 11.594		10.804 ± 0.537	9.217 - 11.698	
VCL	50.012 ± 1.041	47.925 - 51.591		49.781 ± 2.221	36.437 - 52.000		49.895 ± 1.731	38.437 - 52.000	
HD	10.538 ± 1.170	7.359 - 14.737		10.923 ± 0.984	7.344 - 11.795		10.414 ± 1.079	7.344 - 14.737	
HW	13.363 ± 1.008	9.536 - 14.762		13.400 ± 0.882	10.313 - 15.094		13.382 ± 0.940	9.536 - 15.094	
NABL	9.425 ± 2.324	5.909 - 13.617		9.476 ± 2.300	4.844 - 14.599		9.451 ± 2.040	4.844 - 14.599	
MXBL	66.944 ± 14.865	8.108 - 91.710		68.293 ± 3.381	54.688 - 90.000		67.628 ± 12.317	48.108 - 91.710	
GMBL	23.852 ± 1.111	15.639 - 21.952		21.952 ± 3.191	14.375 - 28.182		22.888 ± 5.527	14.375 - 60.135	
IMBL	12.648 ± 2.602	7.709 - 19.257		11.880 ± 2.194	7.423 - 16.571		12.250 ± 4.17	7.423 - 19.257	
PTDOL	53.382 ± 8.324	12.162 - 62.555		60.305 ± 5.723	55.122 - 63.429		59.362 ± 6.022	12.162 - 63.429	
PTEL	26.605 ± 5.723	24.000 - 58.446		26.056 ± 0.774	23.913 - 27.293		26.326 ± 4.034	23.913 - 58.446	
PTDEL	45.143 ± 8.044	4.739 - 49.737		47.487 ± 1.187	44.495 - 50.000		46.332 ± 5.787	4.739 - 50.000	
AOCL	16.499 ± 4.646	12.621 - 46.622		15.718 ± 1.123	12.664 - 17.593		16.103 ± 3.906	12.664 - 46.622	
DFBL	16.161 ± 0.673	14.737 - 17.808		16.056 ± 0.620	14.706 - 17.526		16.118 ± 0.646	14.706 - 17.808	
AFLB	35.122 ± 3.971	15.878 - 42.328		35.425 ± 2.413	25.667 - 38.916		35.276 ± 3.252	15.878 - 42.328	
AOFD	7.788 ± 4.861	5.455 - 35.135		6.964 ± 0.707	5.240 - 8.370		7.370 ± 3.446	5.240 - 35.135	
DFSL	11.648 ± 0.844	8.108 - 13.333		11.730 ± 1.179	9.333 - 16.595		11.689 ± 1.021	8.108 - 16.595	
UFRL	21.949 ± 4.106	11.149 - 36.170		21.921 ± 2.716	15.000 - 27.179		21.935 ± 3.446	11.149 - 36.170	
PFSL	10.887 ± 1.983	8.754 - 21.284		10.480 ± 0.829	8.000 - 13.143		10.631 ± 1.515	8.000 - 21.284	
VFSL	11.638 ± 1.283	9.052 - 13.990		11.383 ± 1.229	8.864 - 13.659		11.509 ± 1.253	8.864 - 13.990	
AFSL	11.525 ± 1.058	9.052 - 13.333		11.484 ± 1.112	8.333 - 13.636		11.504 ± 1.078	8.333 - 13.636	
N									

*For abbreviations refer to materials and methods.

**For allometric equations refer to Table 1.

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MORPHOMETRICS. ALLOMETRY. *BAGRUS BAYAD* & *BAGRUS DOCMAC*

Table (3): Mean (\bar{x}), standard deviation (SD) and range (R) of morphometric indices of *Bagrus docmak* of Assiut. Number of specimens (n) is also given.

Morphometric index*	Males			Females			Combined sexes		
	\bar{x}	\pm SD	R	\bar{x}	\pm SD	R	\bar{x}	\pm SD	R
FL	105.249±0.976	103.386±108.097	105.213±2.116	96.349±108.000	105.215±1.621	96.349±108.097	105.215±1.621	9.426-11.704	9.426-11.704
SNL	10.597±0.511	9.725-11.633	10.590±0.455	9.426-11.704	10.571±0.984	9.426-11.704	10.571±0.984	5.369-2.412	5.369-2.412
ED	3.391±0.558	2.412-4.425	3.688±0.617	2.637-5.369	3.525±0.599	1.3-20.135	3.525±0.599	14.453±0.688	13.20-16.135
PTOL	14.606±0.677	13.636-16.135	14.268±0.667	13.230-16.016	14.530±0.688	25.558-29.046	14.530±0.688	27.606±0.745	25.558-29.046
HL	27.715±0.701	26.720-28.720	27.471±0.788	25.558-29.046	27.612±0.597	6.883-10.163	27.612±0.597	6.883-10.163	6.883-10.163
IOW	8.725±0.549	6.883-9.592	8.606±0.660	7.664-10.163	8.712±0.597	4.787-10.455	8.712±0.597	4.787-14.342	4.787-14.342
TNW	6.991±1.614	4.858-14.342	6.997±1.106	4.787-10.455	6.994±1.394	37.135±1.133	6.994±1.394	34.400-39.450	34.400-39.450
PRDL	37.246±1.200	34.613-39.450	37.00±21.059	34.400-38.864	37.097±1.033	50.997±1.682	37.097±1.033	48.682-53.584	48.682-53.584
PTDL	51.213±1.007	49.505-53.584	50.735±1.032	48.682-52.490	51.291±1.336	49.355-55.602	51.291±1.336	49.355-55.602	49.355-55.602
PRVL	51.479±1.172	49.796-51.878	51.064±1.517	49.355-55.602	56.800±1.990	66.000-75.726	56.800±1.990	66.000-75.726	66.000-75.726
PRAL	69.193±1.740	66.000-71.709	68.324±2.202	66.126-75.726	78.283±4.932	46.197-86.100	78.283±4.932	46.197-86.100	46.197-86.100
PTAL	78.238±6.370	46.197-82.524	78.339±2.362	74.037-86.100	30.335±1.223	27.326-33.186	30.335±1.223	27.326-33.186	27.326-33.186
PTPV	30.255±1.268	27.336-33.186	30.431±1.186	28.803-32.988	18.909±1.155	21.509-21.509	18.909±1.155	21.509-21.509	21.509-21.509
PVANL	19.122±1.171	17.320-21.509	18.652±1.105	16.803-20.539	19.407±1.489	16.774-22.549	19.407±1.489	16.774-22.549	16.774-22.549
BDI	19.753±1.607	16.774-22.519	19.188±1.298	17.279-21.935	17.092±1.341	14.402-20.000	17.092±1.341	14.402-20.000	14.402-20.000
ED2	17.274±1.291	14.615-20.000	16.880±1.395	14.402-19.919	20.942±0.754	18.458-22.568	20.942±0.754	18.458-22.568	18.458-22.568
CPL	20.943±0.657	19.663-22.000	20.942±0.871	18.158-22.568	8.109±0.427	7.273-9.035	8.109±0.427	7.273-9.035	7.273-9.035
CPD	8.144±0.373	7.317-8.951	8.068±0.488	7.275-9.035	12.785±0.893	11.327-15.353	12.785±0.893	11.327-15.353	11.327-15.353
MW	12.723±0.889	11.327-14.815	12.859±0.910	11.388-15.353	12.785±0.893	11.327-15.353	12.785±0.893	11.327-15.353	11.327-15.353
VCL	49.172±1.272	46.748-51.321	49.019±1.763	43.002-51.502	49.116±1.496	43.002-51.502	49.116±1.496	43.002-51.502	43.002-51.502
HD	13.005±1.182	10.143-15.357	12.913±1.164	10.106-14.773	12.963±1.163	10.106-15.357	12.963±1.163	10.106-15.357	10.106-15.357
HW	18.302±0.881	16.139-20.518	17.943±1.052	15.957-19.917	18.140±0.970	15.957-20.518	18.140±0.970	15.957-20.518	15.957-20.518
NABL	8.180±1.066	6.301-10.526	8.412±1.032	6.571-10.738	8.285±1.048	6.301-10.738	8.285±1.048	6.301-10.738	6.301-10.738
FMBL	59.370±7.225	44.204-70.189	60.294±5.758	48.682-70.638	59.788±0.556	44.204-70.638	59.788±0.556	44.204-70.638	44.204-70.638
CMBL	21.496±2.319	16.699-25.660	21.647±1.763	18.803-21.174	21.564±2.118	16.699-26.174	21.564±2.118	16.699-26.174	16.699-26.174
IMBL	11.109±1.368	7.667-13.684	11.173±1.184	9.121-14.765	11.138±1.163	7.667-14.765	11.138±1.163	7.667-14.765	7.667-14.765
PTDOL	57.995±1.051	57.995-62.000	59.586±2.169	52.739-64.794	50.562±3.223	22.500-28.088	50.562±3.223	22.500-28.088	22.500-28.088
PTEL	25.787±1.425	22.500-28.088	25.680±1.096	23.936-27.386	25.738±1.276	22.500-28.088	25.738±1.276	22.500-28.088	22.500-28.088
PTDEL	49.304±0.937	47.495-52.143	49.033±1.787	43.408-52.434	49.181±1.375	43.408-52.434	49.181±1.375	43.408-52.434	43.408-52.434
ADCL	16.444±1.715	12.661-18.846	16.992±1.730	12.576-20.682	16.892±1.728	12.576-20.682	16.892±1.728	12.576-20.682	12.576-20.682
DFBL	30.192±2.653	25.299-37.624	31.009±3.813	24.138-38.630	30.562±3.223	24.138-38.630	30.562±3.223	24.138-38.630	24.138-38.630
AFBL	6.474±0.551	5.140-7.466	6.554±0.449	5.667-7.742	6.509±0.505	5.140-7.742	6.509±0.505	5.140-7.742	5.140-7.742
ADFD	11.312±0.985	9.276-12.975	11.632±0.992	9.533-13.139	11.459±0.992	9.276-13.139	11.459±0.992	9.276-13.139	9.276-13.139
DFSL	21.138±2.192	17.811-28.165	20.763±2.207	16.127-24.832	20.968±2.185	16.227-28.165	20.968±2.185	16.227-28.165	16.227-28.165
DFRL	10.102±0.981	7.333-12.967	10.300±0.828	8.114-11.538	10.194±0.912	7.333-12.967	10.194±0.912	7.333-12.967	7.333-12.967
PFSL	11.344±0.723	9.462-12.621	11.807±1.256	10.373-14.344	11.556±1.018	9.462-14.344	11.556±1.018	9.462-14.344	9.462-14.344
VFSL	12.108±0.687	10.569-13.667	12.294±0.791	10.667-14.094	12.194±0.735	10.569-14.094	12.194±0.735	10.569-14.094	10.569-14.094

* For abbreviations refer to materials and methods.

MORPHOMETRICS. ALLOMETRY. BAGRUS BAYAD & BAGRUS DOCMAC

Table (4): Mean (\bar{X}), standard deviation (SD) and range (R) of morphometric indices of *Bagrus docmac* of Giza. Number of specimens (N) is also given.

Morphometric Index	Males			Females			Combined sexes		
	\bar{X}	SD	R	\bar{X}	SD	R	\bar{X}	SD	R
FL	105.619±1.406	102.163-109.200	105.525±0.806	104.348-107.895	105.572±1.177	102.163-109.200			
SNL	10.901±0.525	9.856-11.201	10.718±0.405	9.722-11.340	10.809±0.474	9.722-12.016			
ED	3.641±1.639	2.500-	3.630±0.418	2.835-	4.386	3.635±0.535	2.500-	5.000	
PTOL	14.931±0.769	13.333-	16.129	14.786±1.555	13.834-	15.894	14.858±0.669	13.333-	16.129
HL	28.483±0.910	26.842-	30.156	28.070±0.573	27.143-	29.193	28.276±0.784	26.842-	30.156
IOW	8.616±0.556	7.668-	9.556	8.495±0.440	7.801-	9.429	8.556±0.502	7.668-	9.556
INW	7.352±0.511	6.316-	8.471	7.197±0.355	6.250-	7.947	7.280±0.444	6.250-	8.471
PROL	37.774±1.523	35.556-	41.094	37.479±0.990	35.849-	39.877	37.627±1.280	35.556-	41.094
PTOL	51.569±1.420	48.930-	54.091	51.230±0.851	49.633-	52.795	51.400±1.167	48.930-	54.091
PRVL	51.806±1.536	48.335-	54.409	50.946±1.320	48.571-	53.681	51.376±1.479	48.333-	54.091
PRAL	69.592±1.814	66.216-72.759	68.833±1.555	65.357-	71.429	69.213±1.714	65.357-	72.759	
PTFVL	79.758±1.891	75.676-	82.474	79.102±1.852	75.357-	82.192	79.430±1.886	75.357-	82.474
PVANL	30.684±2.856	27.222-	43.578	29.706±1.192	27.697-	32.571	30.195±2.224	27.222-	43.578
BDL	18.491±1.389	15.596-	20.984	18.630±1.114	15.951-	21.122	18.630±1.224	15.951-	21.122
BDL	17.725±1.956	15.902-	25.761	17.962±2.990	13.043-	30.132	17.844±2.505	13.043-	30.132
BDL	14.773±1.547	12.460-	19.219	14.907±1.377	11.404-	17.143	14.840±1.452	11.404-	19.219
CPL	20.113±0.925	17.975-	21.018	20.786±0.628	19.536-	21.986	20.450±0.354	17.975-	21.986
CPO	7.664±0.513	6.687-	8.889	7.821±0.433	7.018-	8.589	7.742±0.478	6.687-	8.889
MW	13.130±0.788	11.053-	15.156	12.733±0.494	11.786-	13.576	12.931±0.682	11.053-	15.165
VCL	48.216±1.112	45.349-	50.917	46.741±1.421	45.092-	51.064	48.479±1.286	45.092-	51.064
HO	12.731±1.636	10.833-	19.219	12.334±1.139	10.510-	15.056	12.533±1.411	10.510-	19.219
HW	17.053±1.132	15.263-	20.937	17.470±0.969	16.071-	19.178	17.662±1.018	15.263-	20.937
NABL	7.937±1.471	4.219-	10.417	7.993±0.783	6.111-	9.375	7.965±1.168	4.219-	10.417
MXBL	60.112±7.372	35.938-	73.684	60.729±0.708	51.795-	67.547	60.421±1.134	35.938-	73.784
OMBL	21.807±2.570	16.094-	26.842	21.677±1.339	19.168-	24.000	21.742±2.031	16.094-	26.842
IMBL	11.388±1.333	8.281-	14.400	11.360±0.819	10.191-	13.305	11.274±1.096	8.281-	14.400
PTOL	59.113±1.617	56.269-	62.295	59.463±1.420	55.960-	61.944	59.288±1.513	55.960-	62.295
PTOL	23.889-	28.037	26.054-	24.248	24.151+	36.389	25.952±1.764	23.889-	36.389
ADCL	46.502±0.486	4.545-	50.000	48.306±1.031	46.575-	50.000	47.404±6.055	4.545-	50.000
ADCL	16.636±1.344	14.483-	19.266	17.318±0.910	15.232-	18.667	16.977±1.188	14.483-	19.266
DFBL	15.068±1.309	13.738-	20.270	14.814±0.635	13.660-	15.862	14.941±1.027	13.660-	20.270
AFBL	28.115±2.531	22.812-	36.486	28.686±1.899	23.820-	31.760	28.401±2.235	22.812-	36.486
ADFBL	6.230±0.680	4.839-	7.432	6.346±0.491	5.169-	7.192	6.288±0.590	4.839-	7.432
DFSL	1.1.3.94±0.660	9.844-	12.403	11.414±0.728	10.000-	12.414	11.404±0.688	9.844-	12.414
DFRL	2.1.3.52±2.079	15.469-	24.828	20.646±1.734	17.268-	23.913	20.999±1.929	15.469-	24.828
PFSL	1.0.2.44±0.854	8.437-	11.667	10.209±1.064	7.547-	12.112	10.226±0.956	7.547-	12.112
VFSL	1.1.2.74±0.881	8.906-	13.333	11.707±0.727	10.566-	13.214	11.705±0.800	8.906-	13.333
AFSL	13.048±0.576	12.069-	13.964	12.378±0.563	11.011-	13.448	12.713±0.658	11.011-	13.964

* For abbreviations refer to materials and methods.

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Table (5): Results of ANOVA and SSSTP on the morphometric indices of
Bagrus populations considered showing the effects of
species (S) and locality (L).

Morphometric index@	Morphometric index@		S	L
	S	L		
FL	0.13	4.44* +	HD	37.08*
SNL	9.76	8.65* ++	HW	169.24*
ED	4.27	0.69	NABL	6.64
PTOL	2.53	6.71* +	MXBL	432.10*
HL	0.05	5.68* +	OMBL	8.37
IOW	353.21*	2.99* +	IMBL	9.37
- INW	2.20	17.81* ++	PTDOL	0.48
PRDL	0.83	4.78* +	PTEL	0.14
PTDL	46.95*	2.45	PTDEL	2.06
PRVL	10.73	3.47* +	ADCL	5.91
PRAL	2.43	7.60* ++	DFBL	82.11*
PTAL	6.33	3.49* +	AFBL	31.01*
PTPVL	35.24*	6.59* ++	ADFD	87.40*
PVANL	26.04*	4.77* +	DFSL	37.58*
BD1	1.33	26.37* ++	DFRL	79.85*
BD2	2.03	46.76* ++	PFSL	345.88*
CPL	16.30	5.30* +	VFSL	0.02
CPD	121.14*	12.06* +	AFSL	2.53
MW	466.38*	1.33		16.75* ++
VCL	6.60	13.64* ++		

* Significant difference at 0.05 level.

@ For abbreviations refer to materials and methods.

+ Locality difference in *B. docmac*.

++ Locality difference in each of *B. bayad* and *B. docmac*.

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Table (6) : Bivariate allometric coefficient (b) of morphometric measurements of each of males and females of *Bagrus bayad* of Assiut at Egypt.

Morphometric measurement*	Males				Females			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.932 -	0.871	0.993	1.567	0.981 -	0.968	0.993	1.178
SNL	0.551 I	0.088	1.013	1.363	0.936 -	0.891	0.981	0.146
ED	0.356 I	-0.705	1.417	1.434	0.496 -	0.421	0.571	0.623
PTOL	0.810 I	0.467	1.153	0.443	0.980 I	0.944	1.016	0.167
HL	0.765 I	0.511	1.019	1.081	0.888 -	0.839	0.938	0.521
IOW	1.141 I	0.269	2.013	0.030	0.984 I	0.938	1.031	0.074
INW	1.896 I	-0.035	3.815	0.000	0.759 -	0.530	0.988	0.180
PRDL	0.896 I	0.674	1.118	0.661	0.825 I	0.582	1.069	0.955
PTDL	0.889 I	0.618	1.160	1.004	0.894 I	0.972	1.016	0.545
PRVL	0.870 I	0.578	1.161	1.073	0.980 I	0.953	1.007	0.566
PRAL	1.044 I	0.683	1.404	0.552	1.009 I	0.991	1.028	0.666
PTAL	0.991 I	0.774	1.208	0.884	1.050 +	1.032	1.087	0.612
PTPVL	0.925 I	0.461	1.389	0.428	1.014 I	0.970	1.059	0.258
PVANL	0.850 I	0.125	1.574	0.523	1.011 I	0.756	1.266	0.197
BD1	1.112 I	0.293	1.932	0.097	1.129 +	1.073	1.185	0.087
BD2	1.231 I	0.494	1.967	0.038	1.225 +	1.153	1.298	0.042
CPL	0.770 I	0.049	1.491	0.749	0.998 I	0.942	1.055	0.199
CPO	1.353 I	0.897	1.810	0.008	1.083 +	1.009	1.156	0.038
MW	0.791 I	0.371	1.212	0.362	0.923 -	0.870	0.975	0.169
VCL	0.967 I	0.712	1.222	0.627	1.019 I	0.984	1.053	0.459
HD	1.108 I	0.415	1.800	0.050	0.959 I	0.876	1.042	0.122
HW	0.578 I	0.134	1.022	1.577	0.900 -	0.837	0.964	0.241
NABL	-0.571 I	-2.375	1.233	915.276	0.666 -	0.543	0.788	0.716
MXBL	-2.191 I	-13.001	8.619	594.3x10 ⁵	0.917 I	0.580	1.254	1.053
QMBL	0.235 I	-0.991	1.461	19.901	0.810 -	0.690	0.929	0.697
IMBL	0.155 I	-1.548	1.857	16.892	0.747 -	0.627	0.866	0.541
PTOOL	0.830 I	0.388	1.271	1.640	1.009 I	0.982	1.035	0.572
PTEL	0.902 I	0.541	1.262	0.442	1.030 I	0.999	1.060	0.213
PTDEL	1.007 I	0.590	1.425	0.454	0.989 I	0.960	1.019	0.502
ADCL	0.960 I	-0.723	2.642	0.194	0.952 I	0.868	1.035	0.198
DFBL	0.996 I	0.274	1.718	0.173	1.083 +	1.033	1.134	0.102
AFBL	1.204 I	0.608	1.799	0.115	1.041 +	1.003	1.079	0.289
ADFD	0.720 I	-0.710	2.150	0.378	1.310 +	1.217	1.404	0.013
DFSL	1.294 I	0.450	2.138	0.021	0.919 -	0.861	0.976	0.185
DFRL	1.100 I	-0.910	3.109	0.121	0.957 I	0.864	1.051	0.275
PFSL	0.894 I	-0.106	1.894	0.203	0.960 I	0.904	1.016	0.134
VFSL	1.024 I	-0.025	2.072	0.104	0.887 -	0.822	0.952	0.219
AFSL	0.864 I	-0.189	1.916	0.265	0.901 -	0.855	0.948	0.210

I= isometry, --= negative allometry, + = positive allometry.

CL1 and CL2= confidence limits for bivariate allometric coefficient(b).

a= constant of allometric equation.

* For abbreviations refer to materials and methods.

Table (7): Bivariate allometric coefficient (b) of morphometric measurements of each of males and females of *Bagrus bayad* of Giza at Egypt.

Morphometric measurements*	Males				Females			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.998 I	0.987	1.009	1.061	0.993 -	0.987	0.999	1.093
SNL	0.879 -	0.826	0.932	0.196	0.848 -	0.803	0.803	0.238
ED	0.537 -	0.432	0.642	0.508	0.601 -	0.508	0.695	0.345
PTOL	0.986 I	0.942	1.029	0.162	1.017 I	0.978	1.055	0.136
HL	0.912 -	0.878	0.946	0.458	0.926 -	0.898	0.954	0.426
IOW	0.902 -	0.847	0.958	0.121	0.870 -	0.795	0.945	0.144
INW	0.859 -	0.796	0.922	0.148	0.886 -	0.841	0.932	0.129
PROL	0.958 -	0.920	0.998	0.474	0.965 -	0.936	0.993	0.459
PTDL	0.978 I	0.948	1.008	0.594	0.993 I	0.974	1.013	0.546
PRVL	1.001 I	0.979	1.023	0.499	1.035 +	1.010	1.061	0.409
PRAL	1.017 I	0.995	1.039	0.630	1.057 +	1.039	1.076	0.499
PTAL	1.040 +	1.021	1.059	0.635	1.063 +	1.011	1.115	0.562
PTPVL	1.030 I	0.985	1.075	0.230	1.088 +	1.053	1.124	0.163
PVANL	0.982 I	0.913	1.051	0.226	1.046 I	0.982	1.109	0.159
BD1	1.011 I	0.902	1.121	0.158	1.007 I	0.936	1.078	0.161
BD2	0.926 I	0.812	1.041	0.213	0.982 I	0.902	1.062	0.156
CPL	0.950 I	0.896	1.004	0.258	0.974 I	0.925	1.023	0.227
CPO	0.959 I	0.870	1.047	0.075	1.014 I	0.975	1.054	0.053
MW	0.960 I	0.892	1.028	0.135	0.933 -	0.891	0.975	0.158
VCL	1.008 I	0.982	1.034	0.478	0.931 -	0.885	0.977	0.737
HD	0.997 I	0.858	1.135	0.107	0.781 -	0.708	0.854	0.357
HW	0.944 I	0.844	1.044	0.183	0.937 I	0.867	1.007	0.191
NABL	0.329 -	0.130	0.527	4.086	0.414 -	0.245	0.584	2.596
MXBL	0.539 I	0.071	1.006	8.676	0.688 -	0.599	0.778	4.004
OMBL	0.700 -	0.448	0.953	1.265	0.678 -	0.566	0.791	1.359
IMBL	0.520 -	0.324	0.716	1.874	0.599 -	0.457	0.740	1.151
PTDOL	1.036 I	0.692	1.380	0.466	1.033 +	1.002	1.064	0.499
PTEL	1.037 I	0.852	1.221	0.213	1.012 I	0.980	1.044	0.243
PTDEL	0.709 I	0.214	1.204	2.242	1.012 I	0.987	1.038	0.442
ADCL	0.918 I	0.662	1.174	0.255	0.968 I	0.890	1.046	0.188
DFBL	0.994 I	0.942	1.046	0.167	1.037 I	0.998	1.076	0.130
AFBL	1.024 I	0.841	1.217	0.296	1.018 I	0.939	1.097	0.319
AOFD	0.963 I	0.601	1.325	0.090	0.893 -	0.787	0.999	0.127
DFSL	0.946 I	0.848	1.043	0.158	0.852 -	0.766	0.939	0.271
DFRL	0.791 I	0.565	1.016	0.705	0.777 -	0.665	0.889	0.775
PFSL	0.991 I	0.815	1.167	0.113	0.924 I	0.844	1.004	0.162
VFSL	0.799 -	0.681	0.918	0.360	0.775 -	0.689	0.862	0.408
AFSL	0.818 -	0.721	0.915	0.322	0.802 -	0.719	0.884	0.354

I=isometry, --negative allometry, + =positive allometry.

CL1 and CL2 = confidence limits for bivariate allometric coefficient (b).

a= constant of allometric equation.

* For abbreviations refer to materials and methods.

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Table(8):Bivariate allometric coefficient (b) of morphometric measurements of each of males and females of *Bagrus docmac* of Assiut at Egypt.

Morphometric measurements*	Males				Females			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.980 I	0.971	0.989	1.183	0.963 -	0.936	0.989	1.300
SNL	0.958 I	0.892	1.025	0.135	1.013 I	0.947	1.078	0.098
ED	0.396 -	0.328	0.463	1.129	0.456 -	0.370	0.543	0.794
PTOL	1.124 +	1.079	1.168	0.071	1.071 I	1.009	1.133	0.095
HL	1.005 I	0.968	1.041	0.270	1.004 I	0.961	1.047	0.269
IOW	1.109 +	1.025	1.193	0.046	1.123 +	1.024	1.221	0.043
INW	1.273 +	1.019	1.526	0.014	1.342 +	1.155	1.529	0.010
PROL	1.036 I	0.992	1.079	0.302	1.010 I	0.966	1.053	0.350
PTDL	1.017 I	0.990	1.044	0.463	1.006 I	0.976	1.037	0.490
PRVL	1.031 +	1.002	1.060	0.430	1.040 I	0.999	1.070	0.408
PRAL	1.050 +	1.020	1.080	0.516	1.036 I	0.991	1.080	0.558
PTAL	0.909 I	0.767	1.052	1.321	1.020 I	0.977	1.064	0.690
PTPVL	0.998 I	0.938	1.057	0.306	0.960 I	0.904	1.014	0.384
PVANL	0.995 I	0.908	1.082	0.197	0.999 I	0.899	1.079	0.198
BD1	1.105 I	0.996	1.214	0.107	1.021 I	0.920	1.122	0.170
BD2	1.100 I	0.999	1.200	0.097	0.982 I	0.859	1.105	0.186
CPL	0.968 I	0.925	1.011	0.252	0.908 -	0.858	0.957	0.353
CPD	0.989 I	0.923	1.055	0.087	0.998 I	0.907	1.090	0.081
MW	1.074 I	0.979	1.168	0.083	1.168 +	1.096	1.241	0.049
VCL	0.953 -	0.922	0.984	0.647	0.919 -	0.877	0.962	0.774
HD	1.226 +	1.130	1.322	0.035	1.189 +	1.078	1.300	0.044
HW	1.057 I	0.992	1.122	0.131	1.083 +	1.002	1.164	0.112
NABL	0.663 -	0.532	0.794	0.577	0.814 -	0.648	0.980	0.240
MXBL	0.608 -	0.516	0.699	5.785	0.756 -	0.655	0.857	2.394
QMBL	0.689 -	0.589	0.789	1.307	0.832 -	0.725	0.939	0.560
IMBL	0.744 -	0.590	0.899	0.488	0.865 -	0.730	0.999	0.239
PTDOL	0.993 I	0.968	1.018	0.623	0.953 I	0.902	1.008	0.777
PTEL	1.112 +	1.045	1.178	0.135	1.059 I	0.999	1.118	0.184
PTDEL	0.983 I	0.957	1.009	0.545	0.938 -	0.889	0.986	0.698
ADCL	0.723 -	0.610	0.837	0.819	0.880 I	0.729	1.031	0.334
DFBL	0.999 I	0.942	1.056	0.149	0.956 I	0.781	1.132	0.190
AFBL	0.817 I	0.719	0.916	0.873	0.665 -	0.556	0.774	2.057
ADFD	1.051 I	0.926	1.177	0.048	0.958 I	0.859	1.058	0.083
DFSL	0.915 I	0.791	1.040	0.185	0.773 -	0.688	0.858	0.419
DFRL	0.870 I	0.735	1.006	0.447	0.775 -	0.647	0.902	0.742
PFSL	0.943 I	0.802	1.085	0.140	0.818 -	0.722	0.914	0.289
VFSL	0.881 -	0.799	0.963	0.227	0.871 I	0.726	1.015	0.244
AFSL	0.967 I	0.886	1.048	0.146	0.871 -	0.792	0.950	0.255

I =isometry, --negative allometry, +-positive allometry.
 CL1 and CL2 = confidence limits for bivariate allometric coefficient (b).
 a =constant of allometric equation.

* For abbreviations refer to materials and methods.

Table(9) :Bivariate allometric coefficient (b) of morphometric measurements of each of males and females of *Bagus docmac* of Giza at Egypt.

Morphometric measurements*	Males				Females			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.979 -	0.962	0.997	1.189	0.986 I	0.971	1.001	1.141
SNL	0.993 I	0.927	1.058	0.114	0.998 I	0.904	1.092	0.108
ED	0.487 -	0.375	0.598	0.683	0.390 -	0.250	0.529	1.180
PTOL	1.112 +	1.059	1.166	0.078	1.081 I	0.996	1.167	0.093
HL	1.032 I	0.991	1.073	0.237	0.981 I	0.930	1.031	0.313
IOW	1.098 +	1.020	1.175	0.049	1.178 +	1.075	1.280	0.031
INW	1.065 I	0.975	1.155	0.051	1.020 I	0.898	1.142	0.064
PROL	1.040 I	0.989	1.092	0.299	0.997 I	0.931	1.063	0.382
PTDL	1.028 I	0.991	1.064	0.440	1.002 I	0.961	1.044	0.506
PRVL	1.059 +	1.026	1.092	0.369	1.027 I	0.964	1.090	0.436
PRAL	1.050 +	1.020	1.079	0.523	1.062 +	1.016	1.109	0.482
PTAL	1.038 +	1.011	1.065	0.642	1.058 +	1.006	1.109	0.569
PTPVL	0.975 I	0.864	1.086	0.353	1.025 I	0.930	1.121	0.257
PVANL	1.050 I	0.949	1.150	0.139	0.968 I	0.822	1.114	0.224
BD1	1.154 +	1.037	1.270	0.073	1.356 +	1.029	1.683	0.023
BD2	1.121 I	0.993	1.249	0.073	1.322 +	1.128	1.515	0.024
CPL	0.927 -	0.872	0.982	0.305	0.979 I	0.904	1.054	0.234
CPO	0.950 I	0.861	1.040	0.102	1.084 I	0.953	1.216	0.048
MW	1.127 +	1.063	1.190	0.063	1.102 +	1.016	1.188	0.071
VCL	0.974 I	0.944	1.004	0.560	0.976 I	0.904	1.048	0.558
HD	1.197 +	1.064	1.330	0.041	1.334 +	1.160	1.507	0.018
HW	1.105 +	1.032	1.179	0.097	1.129 +	1.020	1.238	0.084
NABL	0.572 -	0.363	0.781	0.909	0.819 I	0.583	1.054	0.224
MXBL	0.646 -	0.533	0.758	4.556	0.669 -	0.533	0.805	4.006
OMBL	0.750 -	0.624	0.876	0.911	0.899 I	0.752	1.045	0.386
IMBL	0.773 -	0.636	0.910	0.417	0.878 I	0.712	1.045	0.227
PTDOL	0.995 I	0.959	1.031	0.609	1.027 I	0.969	1.085	0.510
PTEL	1.075 +	1.025	1.126	0.168	1.194 +	1.028	1.360	0.086
PTDEL	0.555 I	-0.033	1.142	5.676	1.017 I	0.966	1.068	0.439
ADCL	0.906 I	0.805	1.006	0.285	0.962 I	0.833	1.091	0.215
DFBL	0.961 I	0.854	1.067	0.188	0.958 I	0.854	1.062	0.188
AFBL	0.852 -	0.751	0.953	0.654	0.822 -	0.675	0.968	0.793
AOFD	1.012 I	0.859	1.164	0.058	0.922 I	0.733	1.111	0.099
DFSL	0.920 -	0.847	0.993	0.180	0.899 I	0.746	1.052	0.203
DFRL	0.816 -	0.699	0.934	0.609	0.894 I	0.690	1.097	0.378
PFSL	0.863 -	0.763	0.964	0.224	0.848 I	0.587	1.109	0.242
VFSL	0.829 -	0.749	0.910	0.311	0.860 -	0.720	0.999	0.261
AFSL	0.940 -	0.885	0.994	0.185	0.882 -	0.781	0.983	0.243

I =isometry, - =negative allometry, + positive allometry .

CL1- and CL2 = confidence limits for bivariate allometric coefficient (b) .

a = constant of allometric equation.

* For abbreviations refer to materials and methods.

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Table (10) : Bivariate allometric coefficient (b) of morphometric measurements of combined sexes of *Bagrus bayad* in each of Assiut and Giza at Egypt.

Morphometric measurement*	Assiut				Giza			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.9817 -	0.9704	0.9930	1.1713	0.9956 I	0.9915	1.0000	1.0777
SNL	0.9277 -	0.8851	0.9703	0.1533	0.8652 -	0.8334	0.8969	0.2139
ED	0.5056 -	0.4352	0.5761	0.5911	0.5736 -	0.5058	0.6415	0.4083
PTOL	0.9694 I	0.9349	1.0039	0.1774	1.0063 I	0.9805	1.0322	0.1441
HL	0.8910 -	0.8457	0.9362	0.5140	0.9220 -	0.9014	0.9427	0.4336
IOW	0.9773 I	0.9307	1.0239	0.0772	0.8851 -	0.8403	0.9300	0.1326
INW	0.7996 I	0.5894	1.0097	0.1442	0.8795 -	0.8441	0.9148	0.1331
PRDL	0.8458 I	0.6275	1.0642	0.8550	0.9636 -	0.9417	0.9854	0.4603
PTDL	0.9915 I	0.9705	1.0125	0.5531	0.9883 I	0.9740	1.0026	0.5615
PRVL	0.9775 I	0.9528	1.0022	0.5738	1.0210 +	1.0047	1.0373	0.4443
PRAL	1.0138 I	0.9947	1.0330	0.6494	1.0408 +	1.0269	1.0546	0.5495
PTAL	1.0497 +	1.0339	1.0656	0.6126	1.0547 +	1.0253	1.0841	0.5865
PTPVL	1.0076 I	0.9665	1.0488	0.2673	1.0636 +	1.0354	1.0919	0.1889
PVANL	1.0271 I	0.7977	1.2564	0.1808	1.0219 I	0.9765	1.0674	0.1815
BD1	1.1322 +	1.0790	1.1853	0.0855	1.0110 I	0.9510	1.0710	0.1577
BD2	1.2002 +	1.1319	1.2685	0.0476	0.9614 I	0.8962	1.0265	0.1748
CPL	0.9939 I	0.9413	1.0466	0.2041	0.9658 I	0.9309	1.0006	0.2367
CPD	1.0900 +	1.0224	1.1577	0.0361	0.9906 I	0.9466	1.0346	0.0619
MW	0.9205 -	0.8720	0.9690	0.1704	0.9476 -	0.9121	0.9832	0.1453
VCL	1.0221 I	0.9903	1.0538	0.4506	0.9637 -	0.9362	0.9913	0.6127
HD	0.9457 I	0.8694	1.0220	0.1308	0.8715 -	0.7959	0.9472	0.2149
HW	0.8983 -	0.8401	0.9565	0.2443	0.9428 -	0.8863	0.9994	0.1847
NABL	0.6386 -	0.5214	0.7558	0.8304	0.3834 -	0.2580	0.5089	3.0451
MXBL	0.7876 I	0.4130	1.1622	2.1299	0.6343 -	0.4215	0.8471	5.2491
OMBL	0.8100 -	0.7000	0.9201	0.6957	0.6820 -	0.5548	0.8091	1.3662
IMBL	0.7436 -	0.6312	0.8561	0.5502	0.5624 -	0.4476	0.6772	1.4442
PTDOL	1.0129 I	0.9863	1.0394	0.5586	1.0417 I	0.8889	1.1945	0.4629
PTEL	1.0207 I	0.9916	1.0498	0.2235	1.0226 I	0.9400	1.1052	0.2299
PTDEL	0.9990 I	0.9613	1.0187	0.3998	0.8974 I	0.6739	1.1209	0.8115
ADCL	0.9626 I	0.8803	1.0450	0.1865	0.9464 I	0.8271	1.0657	0.2150
DFBL	1.0876 +	1.0390	1.1362	0.1001	1.0201 I	0.9902	1.0500	0.1437
AFBL	1.0525 +	1.0157	1.0893	0.2714	1.0251 I	0.9328	1.1175	0.3041
ADFD	1.2715 +	1.1805	1.3626	0.0161	0.9197 I	0.7509	1.0885	0.1120
DFSL	0.9289 -	0.8734	0.9845	0.1751	0.8949 -	0.8324	0.9573	0.2116
DFRL	0.9581 I	0.8652	1.0510	0.2743	0.7855 -	0.6704	0.9006	0.7327
PFSL	0.9756 I	0.9204	1.0309	0.1227	0.9512 I	0.8634	1.0390	0.1399
VFSL	0.9088 -	0.8453	0.9723	0.1946	0.7859 -	0.7173	0.8545	0.3861
AFSL	0.9074 -	0.8601	0.9546	0.2026	0.8109 -	0.7509	0.8709	0.3353

I = isometry, - = negative allometry, + = positive allometry.

CL1 and CL2 = confidence limits for bivariate allometric coefficient (b).

a = constant of allometric equation.

* For abbreviations refer to materials and methods.

Table (11) : Bivariate allometric coefficient (b) of morphometric measurements of combined sexes of *Bagrus docmak* in each of Assiut and Giza at Egypt.

Morphometric measurement*	Assiut				Giza			
	b	CL1	CL2	a	b	CL1	CL2	a
FL	0.9735 -	0.9620	0.9851	1.2253	0.9795 -	0.9612	0.9978	1.1871
SNL	0.9900 I	0.9481	1.0319	0.1119	0.9974 I	0.9485	1.0463	0.1096
ED	0.4275 -	0.3775	0.4774	0.9367	0.4659 -	0.3852	0.5466	0.7657
PTOL	1.1041 +	1.0718	1.1365	0.0793	1.1077 +	1.0675	1.1479	0.0801
HL	1.0098 I	0.9869	1.0326	0.2609	1.0231 I	0.9944	1.0518	0.2476
IOW	1.1118 +	1.0542	1.1694	0.0457	1.1197 +	1.0638	1.1757	0.0430
INW	1.2837 +	1.1340	1.4335	0.0134	1.0584 I	0.9923	1.1245	0.0520
PRDL	1.0260 I	0.9989	1.0531	0.3196	1.0320 I	0.9947	1.0692	0.3132
PTDL	1.0160 I	0.9957	1.0362	0.4651	1.0231 I	0.9977	1.0486	0.4502
PRVL	1.0372 +	1.0142	1.0601	0.4140	1.0533 +	1.0220	1.0847	0.3784
PRAL	1.0466 +	1.0230	1.0702	0.5259	1.0527 +	1.0251	1.0803	0.5116
PTAL	0.9636 I	0.8896	1.0376	0.9629	1.0430 +	1.0185	1.0675	0.6209
PTPVL	0.9794 I	0.9429	1.0160	0.3412	0.9915 I	0.9173	1.0657	0.3163
PVANL	1.0059 I	0.9486	1.0632	0.1825	1.0311 I	0.9553	1.1070	0.1549
BD1	1.0747 +	1.0058	1.1437	0.1265	1.2025 +	1.0739	1.3311	0.0555
BD2	1.0527 I	0.9796	1.1258	0.1258	1.1690 +	1.0683	1.2697	0.0561
CPL	0.9453 -	0.9165	0.9741	0.2867	0.9377 -	0.8941	0.9813	0.2919
CPD	1.0006 I	0.9514	1.0499	0.0807	0.9815 I	0.9118	1.0511	0.0859
MW	1.1086 +	1.0513	1.1659	0.0683	1.1258 +	1.0786	1.1731	0.0628
VCL	0.9432 -	0.9177	0.9686	0.6809	0.9738 I	0.9428	1.0048	0.5631
HD	1.1994 +	1.1330	1.2658	0.0410	1.2343 +	1.1368	1.3319	0.0326
HW	1.0758 +	1.0303	1.1214	0.1171	1.1148 +	1.0593	1.1702	0.0914
NABL	0.7427 -	0.6451	0.8404	0.3612	0.6305 -	0.4828	0.7782	0.6530
MXBL	0.6930 -	0.6255	0.7604	3.4772	0.6497 -	0.5696	0.7298	4.4663
OMBL	0.7722 -	0.7019	0.8424	0.7962	0.7872 -	0.6976	0.8767	0.7323
IMBL	0.8141 -	0.7175	0.9107	0.3225	0.7997 -	0.7021	0.8973	0.3564
PTDOL	0.9783 I	0.9534	1.0032	0.6762	1.0022 I	0.9728	1.0316	0.5853
PTEL	1.0839 +	1.0439	1.1240	0.1586	1.1044 +	1.0420	1.1667	0.1425
PTDEL	0.9668 -	0.9398	0.9939	0.5950	0.6555 I	0.3021	1.0088	3.3180
ADCL	0.7996 -	0.7125	0.8867	0.5259	0.9162 -	0.8404	0.9920	0.2736
DFBL	0.9790 I	0.9000	1.0580	0.1672	0.9637 I	0.8929	1.0344	0.1836
AFBL	0.7517 -	0.6814	0.8221	1.2685	0.8446 -	0.7680	0.9212	0.6893
ADFD	1.0018 I	0.9268	1.0769	0.0642	0.9898 I	0.8805	1.0991	0.0664
DFSL	0.8459 -	0.7730	0.9189	0.2770	0.9170 -	0.8520	0.9820	0.1831
DFRL	0.8464 -	0.7573	0.9355	0.5048	0.8401 -	0.7419	0.9382	0.5224
PFSL	0.8829 -	0.8011	0.9647	0.1991	0.8624 -	0.7591	0.9657	0.2238
VFSL	0.8697 -	0.7965	0.9430	0.2436	0.8384 -	0.7732	0.9037	0.2945
AFSL	0.9215 -	0.8690	0.9740	0.1912	0.9337 -	0.8788	0.9886	0.1856

I=isometry, --negative allometry, +- positive allometry.

CL1 and CL2 = confidence limits for bivariate allometric coefficient (b).

a= constant of allometric equation.

*= For abbreviations refer to materials and methods.

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Table [12]: Canonical variates (CVI-CVIII) derived from canonical variates analyses carried out on certain morphometric measurements for each of *Bagrus bayad* and *Bagrus docmac* from the Nile at Assiut and Giza (coefficient x 100).

Morphometric measurement*	General measurement set					
	Raw data			Indices		
	CVI	CVII	CVIII	CVI	CVII	CVIII
PRDL	.02	.20	.11	.03	.18	-.11
PTDL	-.33	-.02	.10	-.56	-.05	-.17
PRVL	.16	-.13	.18	.26	-.42	.01
PRAL	-.23	-.05	.05	-.13	-.12	-.22
PTAL	-.05	.04	.00	-.08	.05	-.02
PTPVL	.68	-.41	.28	.51	-.33	-.26
PVANL	-.09	-.28	-.10	-.09	-.14	.21
CPL	.58	-.42	-.87	.49	-.39	.74
VCL	-.10	-.27	.02	-.26	-.49	.01
PTDOL	.07	.42	-.09	.06	.31	.13
PTEL	.03	.34	-.25	.12	.28	.40
PTDEL	-.00	-.00	-.08	.00	-.03	.14
ACDL	.04	.39	.16	-.05	.28	-.23
Eigenvalue	2.21	0.33	0.13	2.12	0.42	0.12
% variance	82.77	12.36	4.87	79.70	15.79	4.51

Morphometric measurement*	Head measurement set					
	Raw data			Indices		
	CVI	CVII	CVIII	CVI	CVII	CVIII
SNL	.07	.30	-.36	-.08	-.30	-.66
ED	.59	-.43	-.21	-.30	.52	-.06
PTGL	-.38	-.30	.06	.54	.22	.17
HL	-.16	.01	.12	-	-	-
IOW	.52	-.17	.32	-.61	.36	.39
INW	.02	-.38	.04	-.03	.20	-.02
MW	.18	.24	-.78	-.30	-.04	-.52
HD	-.17	-.29	.10	.02	.27	.27
HW	.33	.37	.27	-.36	-.46	.14
NABL	-.21	.43	.13	.12	-.36	.17
MXBL	.00	-.03	.01	.01	.03	.01
OMBL	.01	-.05	.03	.01	.03	.05
IMBL	-.06	.06	.03	.06	-.02	.01
Eigenvalue	5.30	0.62	0.10	9.58	0.63	0.08
% variance	88.04	10.30	1.56	93.08	6.06	0.66

Morphometric measurement*	Fin measurement set					
	Raw data			Indices		
	CVI	CVII	CVIII	CVI	CVII	CVIII
DFBL	-.04	-.01	.06	.20	-.24	-.82
AFBL	.32	.09	-.13	.46	-.06	.16
AOFD	.25	.08	.09	.31	-.01	.17
DFSL	-.22	-.33	.49	-.08	.10	.35
DFRL	.00	-.10	-.16	.02	.10	-.11
PFSL	-.03	-.27	-.05	.02	.01	-.53
VFSL	.05	-.50	.16	.15	.01	-.53
AFSL	-.88	.74	-.85	.23	.25	-.24
Eigenvalue	1.82	0.12	0.07	3.25	0.26	0.04
% variance	90.55	5.97	3.48	91.55	7.32	1.13

Morphometric measurement*	Depth measurement set					
	Raw data			Indices		
	CVI	CVII	CVIII	CVI	CVII	CVIII
BD1	-.16	.03	-.34	-.04	-.36	.27
BD2	-.25	-.48	.50	-.12	-.62	-.48
CPO	.95	-.57	-.73	.97	-.24	.75
HO	.10	.68	.33	.21	.65	-.37
Eigenvalue	2.78	0.18	0.11	7.39	0.47	0.14
% variance	91.15	5.25	3.61	92.38	5.88	1.75

* For abbreviations refer to materials and methods.

Table (13) : Types of canonical variates (vectors) of certain morphometric sets of *Bagrus bavayad* and *Bagrus docmac* from the Nile at Assiut and Giza.

Morphometric set	Type of vector and type of discrimination		Indices
	Raw data		
General measurement set			
CVI	PTPVL & CPL <u>vs</u> PTDL (interspecific).	PTPVL & CPL <u>vs</u> PTDL (interspecific).	
CVII	PTDOL <u>vs</u> CPL & PTPVL (geographic for <i>B. bavayad</i> populations).	PTDOL, PTTEL <u>vs</u> PRVL, PTPVL, CPL & VCL (sexual for each of <i>B. bavayad</i> and <i>B. docmac</i> at Giza).	
CVIII	PTPVL <u>vs</u> CPL (sexual for <i>B. docmac</i> populations).	CPL & PTTEL <u>vs</u> PTPVL (sexual for each of <i>B. bavayad</i> and <i>B. docmac</i> at Giza).	
Head measurement set			
CVI	ED & IOW <u>vs</u> PTOL (interspecific and sexual for <i>B. bavayad</i> at Giza).	PTOL <u>vs</u> IOW (interspecific and sexual for <i>B. bavayad</i> at Giza).	
CVII	NABL <u>vs</u> ED & INW (geographic and sexual for <i>B. bavayad</i> at Giza and <i>B. docmac</i> populations).	ED <u>vs</u> HW (geographic for <i>B. bavayad</i> populations).	
CVIII	IOW <u>vs</u> MW & SNL (sexual for <i>B. docmac</i> populations).	IOW <u>vs</u> SNL & MW (no discriminating power).	
Fin measurement set			
CVI	AFBL <u>vs</u> AFSL (interspecific and sexual for <i>B. docmac</i> populations).	AFBL <u>vs</u> AFSL (interspecific).	
CVII	AFSL <u>vs</u> VFSL (no discriminating power).	AFSL <u>vs</u> VFSL (geographic for <i>B. bavayad</i> populations).	
CVIII	DFSL & VFSL <u>vs</u> AFSL (sexual for <i>B. bavayad</i> at Giza and <i>B. docmac</i> populations).	DFBL & PFSL <u>vs</u> DFSL (sexual for <i>B. docmac</i> at Assiut).	
Depth measurement set			
CVI	CPD <u>vs</u> BD2 (interspecific).	CPD & HD <u>vs</u> BD2 (interspecific).	
CVII	HD <u>vs</u> CPD (sexual for <i>B. docmac</i> at Assiut and geographic for <i>B. docmac</i> populations).	HD <u>vs</u> BD2 (geographic for <i>B. docmac</i> populations).	
CVIII	CPD <u>vs</u> BD2 (geographic for <i>B. docmac</i> populations).	CPD <u>vs</u> BD2 (no discriminating power).	