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Study Biometrique and Length–Weight Relationships in Sea-Bream *Sparus Aurata* (*Sparidae*) of the Two Gulfs, Skikda and Annaba (Northern is Algeria)

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ABSTRACT

This study is devoted to the biometrics of growth in the royal sea-bream Sparus aurata (L, 1758), Sparidae of the two gulfs of Annaba and Skikda of (the Algerian North-East). Measurements are taken from April 2013 at May 2014, out of 149 specimens, lengths ranging between 17 cm and 48 cm, and of weight ranging between 65 g and 1440 g. Différents aspects are approached with biometrics and with the relation Length (L) – weight (W). The morphological study shows that the metric characters considered do not grow all in the isometric way compared to the overall length or cephalic. Cases of raising or undervaluing allometry are highlighted. The number of branchiospines on the level of the first left arc branchial is the numerical character which represents greatest dispersion. Generally the weight of S. aurata believes in a way proportional to its length, the mathematical expression of the relation length-weight is established monthly and overall for the total population. The results highlight a highly significant correlation between the overall length of fish and its weight.

Keywords: *Sparidae*; *Sparus aurata;* Biometric; Algeria; Morphologic

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INTRODUCTION

The general decline of the natural resources is largely perceived on a world level and is the subject of a vast information campaign. For better including certain behaviors, such as the concept of structuring geographical in fish, necessary to the study of the dynamics of the populations and the inventory control halieutics, it would be judicious to carry out a biometric analysis. In this concept, the quantification of the morphological characters of a group of individuals can show the degree of speciation, thus contributing to the identification of various stocks. Indeed, at a given species, certain morphological characteristics evolve with the biotic characteristics, such as the age and the sex. The characters meristic and morphometric are always employed to determine the genic divergence of fish. The most traditional objective of biometrics is to make it possible to distinguish within the same population from the differences, either specific, or inside the same species, under racial species, or groupings, according to certain morphological parameters related or not to the environmental conditions. Several biometric studies were carried out on sparides of the Algerian North-eastern coasts [1-3], but the major part of the subjects covered on *Sparus aurata* are of lagoon origin. This work aims to bring knowledge complementary to the studies already made, on royal sea-bream marinates, of the gulf of Annaba where the species profits from a Mediterranean climate and to bring new data which refer to the gulf of Skikda.

MATERIALS AND METHODS

The goal of this study is to initially characterize the Algerian population of the two gulfs of Annaba (Latitude 36°52' 34 ' ' North, longitude of 6°54' 33 ' ' Is) on the one hand and of Skikda (Latitude 36°53' 59 ' ' North, longitude 7°46' 00 ' ' Is) and to check if there are possibly morphological differences between the sexes as well as allometries of growth on the other hand. Biometric measurements were carried out on a total of 149 individuals. The main part of the captures was carried out from April 2013 at May 2014 on the Algerian North-eastern coast by means of fishing professional, their overall length vary from 17 cm to 48 cm and their total weight of 65 g to 1440 g. It takes account of 16 measurements carried out with the millimeter and expressed near according to the overall length (Lt) or of the cephalic length (Lc). Six characters meristic are taken into account with knowing, the number of hard rays and the number of soft rays of the dorsal fin and anal, the number of branchiospines on the first left arc branchial. We described their evolution by an equation of straight regression line of type centers major tiny room, recommended by. The type of allometry is determined by the test of Student [4] for the biometric studies. All statistical calculations were made under application software's [5-8]. We also could establish a total relation length-weight for an annual sample representative (N = 380, 18.1≤ Lt ≤ 40.1 cm, 65 ≤ Pt ≤ 849 g) thanks to an application software Fishparm [9-11].

RESULTS AND DISCUSSION

Table 1 shows that all the measured parameters are significantly correlated with the overall length or the cephalic length (0.74 = r = 0.99; P = 0. 001).

Table 1: Coefficients of correlation and relations of allometry between the various couples lengths at *S. aurata* of the two gulfs of Skikda and Annaba (North-eastern Algerian)

Function	Relation of allometry	r	Value Limits (cm)	t obs (α=0.01)
Ls = f (Lt)	$Ls = 0.847\ Lt^{1.015}$	0.99	15 < Ls <38.5	*1.86
Lf=f (Lt)	$Lf = 0.995\ Lt^{0.964}$	0.99	17 < Lf <42.5	*0.08
Lc=f (Lt)	$Lceph = 0.37\ Lc^{0.942}$	0.93	4.5 < Lceph <13	*1.66
Lpd=f (Lt)	$LPd1 = 4.139\ Lt^{0.552}$	0.74	4.6 < LPd1 <12.5	*0.14
LPp=f (Lt)	$LPp = 3.939\ Lt^{0.726}$	0.82	5 < LPp <14	**4.86
Lpp=f (Lt)	$Lpp = 1.735\ Lt^{0.928}$	0.86	6 < Lpp <21	**6.89
Lpa=f (Lt)	$Lpa = 2.345\ Lt^{0.67}$	0.92	8.5 < Lpa <23	**7.55
Ec=f (Lt)	$Ec = 0.172\ Lt^{1.01}$	0.85	2.2 < Ec <7	**8.33
Hc=f (Lt)	$Hc = 4.088\ Lt^{0.656}$	0.97	5.6 < Hc <17.4	**2.88
Hpc=f (Lt)	$HPc = 0.357\ Lt^{0.816}$	0.89	1.2 < HPc <4.7	**4.26
Do=f(Lc)	$Do = 0.514\ Lc^{0.684}$	0.95	1.2 < Po <3.4	**2.57
Lpo=f (Lc)	$po = 1.64\ Lc^{0.739}$	0.88	1.7 < po <5.5	**5.01
LPo=f (Lc)	$Po = 1.101\ Lc^{0.716}$	0.97	1.3 < Do <3	**3.91
Lm sup=f (Lc)	$Lm\ sup = 1.535\ Lc^{0.745}$	0.85	1.7 < Lm sup <4.9	**4.12
Lm inf=f (Lc)	$Lm\ inf = 0.18\ Lc^{0.966}$	0.9	1.2 < Lm inf <3.9	* 1.44
Eio=f (Lc)	$Eio = 0.292\ Lt^{1.019}$	0.39	1.3 < Eio <4	** 10.91

Lt: overall length; Lf: length with the caudal fork; Ls: standard length; Lc: cephalic length; Hc: height of the body; Hpc: height of the caudal stalk; LPd: length pre-dorsal; LPp: pre-pectoral length; Lpp: post-pectoral length; LPa: pre-anal length Do: diameter of the eye; LPo: pre-orbital length; Ec: thickness of the body; Lpo post-orbital length; Lm sup: length of the upper maxilla; Lm inf: length of the lower maxilla; Eio: inter-orbital space * isometry; ** allometry

The various metric characters examined at the total population have significant coefficients of correlation (P ≤ 0.0 01) which express their strong relationship to the overall length (Lt) and the cephalic length (Lc). The character related to the cephalic length is inter-orbital with (r = 0.38). All in all, the isometry of growth relates to five characters (Ls; Lf; Lc; Lpd; Lminf), other dimensions grow in an allometric way rising compared to the overall length or cephalic. Only parameters (Ec ; Hpc; Lm sup; Eio) have an undervaluing allometry.

The sea-bream of North - Is Algerian has a dorsal fin with 11 hard rays and 13 soft rays. The number of branchiospines on its first arc branchial left a modal value equalizes to 12. The statistical distribution of these characters is specified in Table 2. Table 3 represents the various measured parameters according to the sexes and their statistics. It will be observed that certain parameters do not grow same manner at the two sexes such as (Ls; Lc; LPp; Lpp; Hpc; Do; Lpo; Lm inf).

Table 2: Statistical distribution of the various characters meristic studied at *S. aurata* of the two gulfs of Skikda and Annaba (North-eastern Algerian)

Numerical characters	Average	Standard deviation	mode	extreme Values
Number lower branchiospines	7.348	0.573	7	06-Sep
Number higher branchiospines	4.887	0.688	5	04-Aug
A number of hard rays of anal fin	14.016	0.125	14	14-15
A number of soft rays of anal fin	13.016	0.125	13	13-14
A number of hard rays of dorsal fin	23.898	0.469	11	09-Dec
A number of soft rays of dorsal fin	22.89	0.475	13	Aug-14

Table 3: Coefficients of correlation and relations of allometry between the various couples lengths at the two sexes of *S. aurata* of the two gulfs of Skikda and Annaba (North-eastern Algerian). *isometry; **allometry

Function	r	Female		r	Male	
		Relation of allometry	Limiting Value (mm)		Relation of allometry	Limiting Value (mm)
Ls = f (Lt)	0.991	**Ls =0.926 Lt 0.988	15 < Ls <21	0.996	*Ls =0.909 Lt 0.992	15 < Ls <38
Lf=f(Lt)	0.988	*Lf=0.894 Lt 0.961	17 < Lf <23	0.992	*Lf=0.753 Lt 1.015	17 < Lf <42.5
Lc=f(Lt)	0.934	**Lc=0.317 Lt 0.92	4.9 < Lc <26.6	0.923	*Lc=0.186 Lt 1.09	4.5 < Lc <13
Lpd=f(Lt)	0.742	**LPd=0.018 Lt 1.439	4.6 < LPd <6.8	0.731	**LPd=0.124 Lt 0.835	4.6 < LPd <12
LPp=f(Lt)	0.82	**LPp=0.011 Lt 1.565	5 < LPp <7.5	0.715	*LPp=0.064 Lt 1.037	5 < LPp <14
Lpp=f(Lt)	0.856	**Lpp=0.017 Lt 1.704	6 < Lpp <11.2	0.788	*Lpp=0.076 Lt 1.191	6 < Lpp <21
Lpa=f(Lt)	0.917	**Lpa=0.171 Lt 1.295	8.5 < Lpa <12	0.924	**Lpa=0.214 Lt 1.211	8.5 < Lpa <23
Ec=f(Lt)	0.853	**Ec=0.016 Lt 1.609	2.2 < Ec <7	0.908	**Ec=0.037 Lt 1.338	2.2 < Ec <7
Hc=f(Lt)	0.971	**Hc=0.239 Lt 1.098	5.6 < Hc <9	0.968	**Hc=0.258 Lt 1.0739	5.6 < Hc <17.4
Hpc=f(Lt)	0.893	*Hpc=0.019 Lt 1.544	1.2 < Hpc <4.7	0.873	**Hpc=0.075 Lt 1.088	1.2 < Hpc <4.7
Do=f(Lc)	0.949	**Do=0.297 Lc 1.028	1.3 < Do <3.4	0.965	*Do=0.225 Lc 1.129	1.3 < Do <3
Lpo=f(Lc)	0.875	**Lpo=0.174 Lc 1.262	1.7 < Lpo <5.5	0.918	*Lpo=0.269 Lc 1.126	1.7 < Lpo <5.5
LPo=f(Lc)	0.973	**LPo=0.413 Lc 1.031	1.2 < LPo <3.4	0.976	*LPo=0.3 Lc 1.129	1.2 < LPo <3.4
Lm sup=f(Lc)	0.849	*Lm sup=0.01 Lc 1.699	1.7 < Lm sup <4.9	0.815	*Lm sup=0.06 Lc 1.115	1.7 < Lm sup <4.9
Lm inf=f(Lc)	0.901	**Lm inf=0.051 Lc 1.311	1.7 < Lm inf <3.9	0.89	*Lm inf=0.13 Lc 0.991	1.2 < L inf <3.9
Eio=f(Lc)	0	*Eio=0.051 Lc 3.141	1.7 < Eio <4.9	0.127	*Eio=0.13 Lc 1.791	1.3 < Eio <4

Generally the weight of *S. aurata* believes in a way proportional to its length, the mathematical expression of the relation length-weight is established monthly and overall for the total population. The statistical results highlight a highly significant correlation between the overall length of fish and its weight (Figure 1); ($r = 0.998$; $P \leq 0.001$). The allometry of growth is ($b = 1.56$; $P \leq 0.01$) with an equation ($P = 0.996\ Lt^{1.560}$) what means that the ponderal growth of fish evolves according to its linear growth (Figure 1).

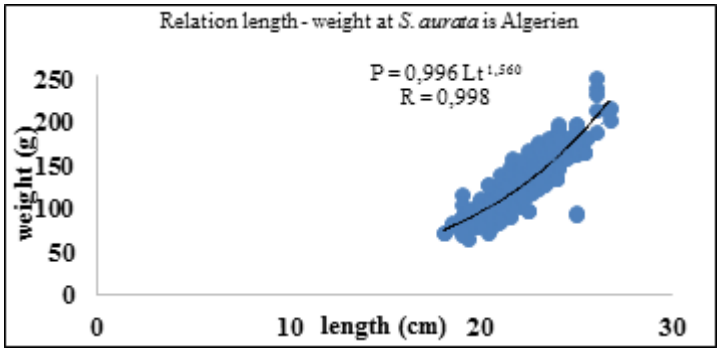

Figure 1: Relation length -weight at the total population of *Sparus aurata* (North-eastern Algerian)

The biometrics of the sea-bream *Sparus aurata*, resulting from the natural environment, constitutes a useful reference allowing on the one hand to differentiate from possible distinct populations and to identify the morphological anomalies observed in aquiculture [7], on the other hand. These last are reflected on the quality of the product and its commercial value [6]. The various metric characters examined at the total population have significant coefficients of correlation ($0.74 \leq r \leq 0.99$; $P \leq 0.001$), which expresses their strong relationship to the overall length (Lt) or the cephalic length (Lc). The character which seems related to the size is the orbital one. All in all, the isometry of growth is checked for 31.25% of the characters considered. However, 43.75% of the parameters present a raising allometry, it acts the pre-anal length, the height of the body, the diameter orbital and the length post and pre-orbital, pre-pectoral and finally post-pectoral. The 25% of the parameters remaining translate growth of an allometric type undervaluing. Compared with the results obtained at others sparides coastal of the gulf of Annaba, the allometric growth shows differences in a species to another. At the sar drum *Diplodus cervinus cervinus* for

example, certain characters have a raising growth [5] whereas at *Diplodus annularis* and marbled *Lithognathus mormyrus* sar common *D. vulgaris* [3,10] these same parameters grow in an isometric way. On the other hand, it was noted that the standard and cephalic length evolves in an isometric way at all the species of sparides studied in this area. These morphometric differences can be allotted to the external morphology which differs according to the species from sparides. Conversely, these lengths have an allometric growth rising at the striped sar, *D. sargus of* the gulf of Tunis [9]. The allometric growth evolves in a different way at the two separate sexes. In the males, 68.75% of the measured parameters have an isometric growth whereas 31.25% present an allometric growth. In the females, 75% of the studied characters have an allometric growth. These differences in growth are frequent in marine sea-breams as well as in the sea-breams lagunaire [1]. However, the females have some morphological characteristics compared to the males. Indeed, the length with the fork and the orbital one, the length upper maxilla present in the females a isometry with the thickness of the body. At the males, this last watch an allometry undervaluing due probably, with the volume of the gonads in the females. These characters could thus be regarded as indicators of sexual dimorphism. The inter-orbital diameter presents a isometry at the two sexes. The values of the numerical characters at *S. aurata* of the North-eastern coasts Algerian, are close or equal to those reported by [12-14]. Table 2 compares six characters meristic at the total population Mediterranean. The results show that the number of branchiospines have a dispersion 4-8 for the higher branchiospines and 6-9 for the lower branchiospines with a total mode of 12. The dorsal fin of *S. aurata* is provided with 11 hard rays and 13 to 14 soft rays. In general, sparides fins made up from 13 to 15 spines and 12 to 16 soft rays have [4,14]. In our area, this species has the same anal radial formula as that given by these same authors.

CONCLUSION

The growth of the various parts of the body of *S. aurata* of the Algerian North-East, is not always isometric compared to the overall length or cephalic. We can note, for the same relation, the existence of a disparity of growth between the males and the females. The allometry of growth, when it exists at the two sexes is always of the same sign. The comparison of the latter revealed several characters of sexual dimorphism; it acts the length pre-dorsal, the pre-anal length, the thickness and the height of the body. The remainder of the characters presents an isometry of growth at the two sexes. Other parameters are implied in the morphological rehandlings during the growth. One could distinguish that the dorsal fin of sea-bream is made up of 11 spines and 13 soft rays while the anal fin understands 14 spines and 13 soft rays. The results highlight a highly significant correlation between the overall length of fish and its weight ($r = 0{,}998$; $P \leq 0{,}001$) and an allometry of growth ($P = 0.996\ Lt^{1.560}$), which means that the ponderal growth of fish evolves according to its linear growth.

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