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Biometric study and length–weight relation of the sea-bream *Sparus aurata* (sparidae) in the two gulfs of Skikda and Annaba (Northern east of Algeria)

Faiza Oudjane*[1], Naziha Bourenane[2], Tahar Wafa[2]

[1]*Department of Vegetal Biology and Environment, NLS, University of Annaba BP 12, Annaba, Algeria*

[2]*Department of Naturel Sciences. NLS Department, University of Badji Mokhtar, Annaba, Algeria*

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Abstract

This study deals with growth biometrics of royal sea-bream *Sparus aurata,* Sparidae of Annaba and Skikda gulfs (Northeast of Algeria). Several biometric studies were carried out on Algerian northeastern coast's sea bream "sparidas" (Derbal *et al.*, 2007; Chaoui *et al.*, 2001), but the main part of the investigated subjects is *Sparus aurata* of lagoon origin. This study aims at bringing complementary knowledge to further studies, on royal sea-bream marinates, in the gulf of Annaba where these species take advantage of the Mediterranean climate, in order to make new data available, referring to the gulf of Skikda. All the measures were taken from April 2013 to May 2014, on149 specimens, of a length ranging between 17 cm and 48 cm, and a weight ranging between 65 g and 1440 g.In biometrics differents aspects are dealth with,regarding the relation Length (L)–weight(W). The morphological study shows that metric characters concerned do not grow all in isometric way compared tooverall or cephalic length. Cases of raising or undervaluing allometry are highlighted. The number of branchiospines on the level of the first left branchial arc is in fact the numerical character representing greatest dispersion.The number of branchiospines on its first branchial left arc holds a modal value equal to 12. In general, the weight of *S. aurata* grows proportional to its length, mathematical expression of length-weight relation is monthly and globally established to the whole population. The results highlight a highly significant correlation between the general length and weight of the fish.

* **Corresponding Author:** Faiza Oudjane ✉ oudjanefaiza@hotmail.com

Introduction

The general decline of natural resources is largely perceived on the level of the whole world, it is subject of vast information campaigns, nowadays. In order to understand certain behaviors, such as the concept of geographical structure of the fish, required in the study of populations dynamics and fisheries stock control, it would be better to carry out a biometric analysis.

In this way, quantification of morphological characters of a group of individuals can show the degree of speciation, contributing to various stocks identification. Indeed, in a given species, certain morphological specificities evolve with biotic characteristics, such as age and sex. The meristic and morphometric characters are always employed to determine genic divergence of the fish. The normal objective of biometrics is to enable us to distinguish -within the same population- differences either specific inside the same species, subspecies or racial groupings, according to certain morphological parameters related or not to environmental conditions.

Materials and methods

The metric characters and méristiques

The goal of this study is to characterize initially Algerian population of both gulfs of Annaba (Latitude 36°52' 34 ' ' North, longitude of 6°54' 33 ' ' east), on one hand, and Skikda (Latitude 36°53' 59 ' ' North, longitude 7°46' 00 ' ' east), to check if there exist possible morphological differences between the sexes as well as growth allometrieson the other hand. Biometric measures were carried out on a total of 149 individuals.

The main part of the captures was carried out from April 2013 to May 2014, in the northeast coast of Algeria by means of professional fishing; their overall length varies from 17 cm, to 48 cm and their total weight from 65 g, to 1440 g.

16 measurements are taken into account, carried out in millimeter according to the overall (Lt) or cephalic length (Lc).

Six meristic characters are taken into consideration; the number of hard rays and soft rays of dorsal and anal fins, the number of branchiospines on the first left branchial arc. We described their evolution by straight regression equation of reduced major axis, recommended by (Teissier, 1948).

The allometrytype is determined by test of Student (Dagnélie, 1975) for biometric studies. All statistical calculations were made by means of specific software (Minitab, 2014; Xlstat, 2016). We also established a total length-weight relation of an annual typical sample ($N = 380$, $18.1 \leq Lt \leq 40.1$ cm, $65 \leq Pt \leq 849$ g) by means of specific software Fishparm (Prager *et al.*, 1989).

Results and discussion

Biometrical approches

Table 1 shows that all the measured parameters are significantly correlated with the overall or cephalic length ($0.74 = r = 0.99$; $P = 0.001$).

The various examined metric characters of the whole population have significant coefficients of correlation ($P \leq 0.0\ 01$) expressing their strong relation to the overall (Lt) and the cephalic length (Lc). The character related to cephalic length is inter-orbital with ($r = 0.38$).

All in all, the growth isometry concerns five characters (Ls; Lf; Lc; Lpd; Lminf), other dimensions grow in allometric majoring way, compared to overall or cephalic length. The parameters (Ec; Hpc; Lm sup; Eio) have undervaluing allometry.

The sea-bream of the northeast of Algeria has a dorsal fin with 11 hard rays and 13 soft ones. The number of branchiospines on its first branchial left arc holds a modal value equal to 12. The statistical distribution of these characters is determined in table 2.

Table 3 represents various measured parameters according to the sexes and their statistics. It should be noted that certain parameters do not grow in the same way or both sexes such as (Ls; Lc; LPp; Lpp; Hpc; Do; Lpo; Lm inf).

Table 1. Coefficients of correlation and allometry relations between the various couples lengths at *S. aurata* of the two gulfs of Skikda and Annaba (Northeast of Algeria).

Function	Relation of allometry	r	Value Limits (cm)	t obs (α=0.01)
Ls = f (Lt)	Ls = 0.847 Lt $^{1.015}$	0.991	15 <Ls<38.5	*1.86
Lf=f (Lt)	Lf = 0.995 Lt $^{0.964}$	0.988	17 < Lf <42.5	*0.08
Lc=f (Lt)	Lceph = 0.37 Lc$^{0.942}$	0.934	4.5 <Lceph<13	*1.66
Lpd=f (Lt)	LPd1 = 4.139 Lt $^{0.552}$	0.742	4.6 < LPd1 <12.5	*0.14
LPp=f (Lt)	LPp = 3.939 Lt $^{0.726}$	0.820	5 <LPp<14	**4.86
Lpp=f (Lt)	Lpp = 1.735 Lt $^{0.928}$	0.856	6 <Lpp<21	**6.89
Lpa=f (Lt)	Lpa = 2.345 Lt $^{0.67}$	0.917	8.5 <Lpa<23	**7.55
Ec=f (Lt)	Ec = 0.172 Lt $^{1.01}$	0.853	2.2 <Ec<7	**8.33
Hc=f (Lt)	Hc = 4.088 Lt $^{0.656}$	0.971	5.6 <Hc<17.4	**2.88
Hpc=f (Lt)	HPc = 0.357 Lt $^{0.816}$	0.893	1.2 <HPc<4.7	**4.26
Do=f(Lc)	Do = 0.514 Lc $^{0.684}$	0.949	1.2 < Po <3.4	**2.57
Lpo=f (Lc)	po = 1.64 Lc$^{0.739}$	0.875	1.7 <po<5.5	**5.01
LPo=f (Lc)	Po = 1.101 Lc$^{0.716}$	0.973	1.3 < Do <3	**3.91
Lm sup=f (Lc)	Lm sup = 1.535 Lc$^{0.745}$	0.849	1.7 < Lm sup <4.9	**4.12
Lm inf=f (Lc)	Lm inf = 0.18 Lc$^{0.966}$	0.901	1.2 < Lm inf<3.9	* 1.44
Eio=f (Lc)	Eio = 0.292 Lt $^{1.019}$	0.389	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**.

In general, the weight of *S. aurata* grows in proportional way to its length, mathematical expression of length-weight relation is established every month and globally to the whole population. The statistical results show a highly significant correlation between the global fish length and its weight (Fig. 1); (r = 0.998; P≤ 0.001).

The growth allometry is (b = 1.56; P ≤ 0.01) with the equation (P = 0.996 Lt $^{1.560}$) the ponderal growth of the fish evolves according to its linear growth.

Table 2. Statistical distribution of the various meristic characters investigated in *S. aurata* of the two gulfs of Skikda and Annaba (Northeast of Algeria).

Numerical characters	Average	Standard deviation	Mode	Extreme Values
Number of lower branchiospines	7.348	0.573	7	6-9
Number of higher branchiospines	4.887	0.688	5	4-8
Number of hard rays of anal fin	14.016	0.125	14	14-15
Number of soft rays of anal fin	13.016	0.125	13	13-14
Number of hard rays of dorsal fin	23.898	0.469	11	9 - 12
Number of soft rays of dorsal fin	22.890	0.475	13	8 - 14

The biometrics of the sea-bream *Sparus aurata, as a* result of natural environment, constitutes a useful reference, which allows firstly, to differentiate possible distinct populations and to identify the morphological anomalies observed in aquaculture (Loy *et al.*, 1999), on the other hand, it influences the product quality and its commercial value (Koumoundouros *et al.*, 1997).

The various metric characters examined in the whole population have significant coefficients of correlation ($0.74 \leq r \leq 0.99$; $P \leq 0.001$), expressing their strong relation to the overall length (Lt) or the cephalic one (Lc).

The character which seems related to the size is orbital. All in all, the growth isometry is checked as 31.25 % of the considered characters.

However, 43.75 % of the parameters present a major in gallometry, it's about pre-anal length, body height, orbital diameter, post and pre-orbital, pre-pectoral and finally post-pectoral length.

Table 3. Coefficients of correlation and allometry relations between various lengths couples in both sexes of *S. aurata* in the two gulfs of Skikda and Annaba (Northeast of Algeria). * isometry; ** allometry.

Function	Female			Male		
	r	Relation of allometry	Limiting Value (mm)	r	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)	0.820	**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 Lc1.115	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	0.890	*Lm inf=0.13 Lc 0.991	1.2 < L inf<3.9
Eio=f(Lc)	0.000	*Eio=0.051 Lc 3.141	1.7 <Eio<4.9	0.127	*Eio=0.13 Lc 1.791	1.3 <Eio<4

The remaining 25% of the parameters reflect growth of an undervaluing allometric type, compared to other coastal sea bream of Annaba's gulf results.

The allometric growth shows differences from a species to another. In the zebra sea bream *Diplodus cervinuscervinus* for instance, some characters have majoring growth (Harrag, 2002).

Where as in *Diplodus annularis* and marbled *Lithognathus mormyrus* Sar common *D. vulgari s* (Nouacer, 2002; Derbal *et al.*, 2007) the same parameters grow in isometric way. It was also noted that standard and cephalic lengths evolve in isometric way in all the species of Sea bream investigated in this area.

These morphometric differences can be attributed to external morphology which varies according to sea bream species.

In contrast, these lengths have allometric majoring growth in the striped sar, *D. sargus* of Tunis's gulf. (Mouine *et al.*, 2004).

The allometric growth evolves in different way for both distinct sexes. The males, 68.75 % of the measured parameters have an isometric growth whereas 31.25 % of them present an allometric growth.

The females however, 75 % of the investigated characters have allometric growth.

These differences in growth are frequent in marine sea-breams as well as in the lagoon sea-Breams (Chaoui *et al.*, 2001).

However, females sow some morphological specificities compared to males. The fork, the inter-orbital, and upper maxilla length present isometry with body thickness, in females.

In males, the latter shows an under valuing allometry due-may be-to the volume of the gonads in females. These characters could thus be regarded as indicators of sexual dimorphism.

The inter-orbital diameter presents isometry to both sexes.

The values of the numerical characters of *S. aurata* in the northeast coast of Algeria are close or equal to those reported by (Whitehead *et al.*, 1986)Table 2 compares six meristic characters of the whole Mediterranean population.

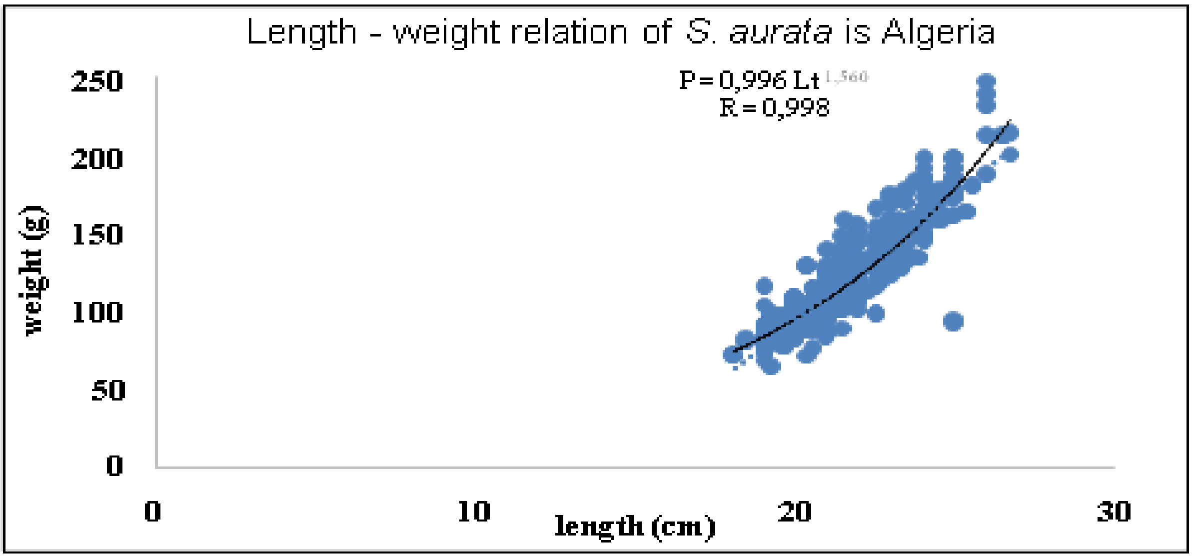

Fig. 1. Length-weight relation of the whole population of *Sparus aurata* (Northeast of Algeria).

The results show that the number of branchiospines have4-8 dispersion for the higher branchiospines and 6-9 for the lower ones, in a total mode of 12. The dorsal fin of *S. aurata* is possess 11 hard rays and 13 to 14 soft ones. In general, sea bream fins are made up of 13 to 15 spines and 12 to 16 soft rays (Whitehead *et al.*, 1986; Fischer *et al.*, 1987) in our area; this species has the same anal radial formula as that given by the same authors.

Conclusion

The growth of the various body parts of *S. aurata* of the northeast to Algeria, is not always isometric compared to the overall or cephalic length. We can observe, within the same relation, the existence of a growth disparity between males and females. When it exists in both sexes, the growth allometry has always the same sign. The comparison of the latter revealed several characters of sexual dimorphism; it is about pre-dorsal, pre-anal length, thickness and height of the body. The remaining characters present growth isometry in both sexes. Other parameters are implied in the morphological reshuffle during the growth. We could distinguish that the dorsal fin of sea-bream is made up of 11 spines and 13 soft rays while the anal fin contains 14 spines and 13 soft rays. The results show a highly significant correlation between the overall length of the fish and its weight (r = 0,998; P ≤ 0,001) and a growth allometry ($P = 0.996\ Lt^{1.560}$), which means that the ponderal growth of the fish evolves according to its linear growth.

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References

Chaoui L, Quignard JP, Kara MH. 2001. Différenciation morphologique de deux populations marine et lagunaire de daurade *Sparus aurata* (Linné, 1758). Rapport Communiquer internationale Mer Méditerranée **36,** 371.

Dagnélie P. 1975. Théorie et méthodes statistiques, Vol. 1: la statistique descriptive et les fondements de l'inférence statistique. Duculoted., Gembloux. 378 p.

Derbal F, Nouacer S, Kara MH. 2007. Composition et variations du régime alimentaire du sparaillon *Diplodus annularis* (Sparidae) du golfe d'Annaba (Est de l'Algérie). Cybium **31,** 443-450.

Fischer W, Bauchot ML, Schneider M. 1987. Fiches FAO d'identification des espèces pour les besoins de la pêche. (Révision 1). Méditerranée et mer Noire. Zone de pêche 37. Volume **2**. Vertébrés. FAO (Rome), 761-1530.

Harrag A. 2002. Contribution à la biologie du sar tambour *Diplodus cervinuscervinus* (Lowe, 1838) des côtes est algériennes. Mémoire d'Ingénieur.

Koumoundouros G, Gagliardi F, Divanach P, Boglione C, Cataudella S, Kentouri M. 1997. Normal and abnormal osteological development of caudal fin in *Sparus aurata* L. fry. Aquaculture, **149(3-4),** 215-226.

Loy A, Boglione C, Cataudella S. 1999. Geometric morphometrics and morphoanatomy: a combined tool in the study of sea bream (*Sparus aurata*) shape. Journal ApplideIchthyology **15,** 104-110.

Minitab Inc. 2014. Statistical software (release 16). Computer software. State college, PA: Minitab, INC www.minitab.com

Mouine N, Chakroun-Marzouk N, Ktari MH. 2004. Caractéristiques morphologiques et méristiques de *Diplodu ssargus* (Linnaeus, 1758) du golfe de Tunis. Rapport Communiquer internationale Mer Méditerranée., **37,** 404 p.

Nouacer S. 2002. Biologie et écologie du sparaillon *Diplodus annularis* du Golfe d'Annaba, Thèse de Magister, Université d'Annaba, Algérie, 62 p + Biblio. Annexes.

Prager MH, Saila SB, Recksiek CW. 1989. Fishparm: a microcomputer program for parameter estimation of nonlinear models in fishery science. Second edition. Old Dominion University. Oceanography Technical Report 87-10.

Teissier G. 1948. La relation d'allométrie: sa signification statistique et biologique. Biometrics, **4 (1),** 14-53.

Xlstat. 2016. Data Analysis and Statistical Solution for Microsoft Excel. [Addinsoft]. Paris, France (2016).

Whitehead PGP, Bauchot ML, Hureau JC, Nielsen J, Tortonese E. 1984-1986. Fishes of the north eastern Atlantic and the Mediterranean, Volume **I-III**. Paris: UNESCO.