

**RELATIONSHIPS BETWEEN THE BROOD STOCKS AGE AND SIZES (WEIGHT AND LENGTH) AND THE FIRST FISH MATURATION FOR BOTH MALES AND FEMALES OF GILTHEAD SEA BREAM, *Sparus aurata* (L.)**

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**ABSTRACT**

The objectives of this study aimed to evaluate the relationships between the brood stocks age and sizes ( weight and length) and the first fish maturation for both males and females of gilthead sea bream , *Sparus aurata* (L.),

Five hundred juveniles sea bream(3month age) with average weight 4.6 g and length 5.9 cm were used in the present study through the period 2001 to 2004 (3years).

It could be concluded that the complete sexual maturity of male and female occurred at 36month of age . The first maturation in females was recorded at 15 months of age, at weight 267.8g, length 22.4cm, and percentage 0.96 % of the tested sample, while in males was recorded at 12 months with a ratio of 13 % of the tested sample, weight was 73.4- 92.2g and length was 14.9-16.2 cm. The complete sexual maturity of female occurred at 36 months of age at body weight ranging from 461.9 to 934.6g and, which the total length was 30.3-42.4cm, but in males at the same age and average body weights ranging from 340 to 669.4 g with length 29.5-34.6cm. The sea bream male and female fish reached 100% maturation with a sex ratio 1:1.38 for female and male, respectively.

**Keywords:** Brood stocks age and sizes, first fish maturation, gilthead sea bream, *Sparus aurata* (L.).

**INTRODUCTION**

Gilthead sea bream (*Sparus aurata*) is amongst the most important fish species cultured in the Mediterranean region (Oliva,2000). Gilthead seabream (*Sparus aurata*) is one of the most important marine fish species for Mediterranean aquaculture. Gilthead seabream production reached up to 128.943 tonnes in 2008 with major suppliers from Greece (47%), Turkey (21%), Spain (19%) and Italy (7.4%) (FEAP, 2009). The demand and high value of this species led to farm this fishes under extensive condition in Egypt. The gilthead sea bream. *Sparus aurata*, has traditionally been considered as a high value fishery product of Mediterranean and Atlantic waters, with present annual landings of 3000-5000 ton The demand and high value of this species led to efforts to farm this fish under extensive system in Italy during the early part of the century (KirK, 1987). At present, gilthead sea bream is one of the major farmed fish in Mediterranean Europe. The gilthead seabream has traditionally been cultured in Mediterranean coastal lagoons and brackish/salt water ponds, especially in the northern Adriatic *valli* in Italy and the Egyptian *hosha*. These extensive fish rearing systems acted as like natural fish traps, taking advantage of the natural trophic migration of juveniles from the sea. Restocking was usually performed with wild fry and

juveniles, collected by specialised fishermen. By the late 1970s, the reduced availability of wild fry and the increasing demand from intensive farms enhanced the development of induced spawning techniques, establishing by the end of the 1980s (Dimitriou,2000)).

In 2004, the world capture production of gilt head sea bream was of 8.914 tones, i.e. less than 10% of aquaculture production (FAO, 2006)).

The sea bream is a protandrous hermaphrodite: it is a functional male in the first two years and at over 30 cm in length becomes female. During the male phase, the bisexual gonad has functional testicular, with asynchronous spermatogenesis, and non functional ovarian areas (Zohar *et al.*, 1978 and Zohar,1989).Ovarian development is also asynchronous, and females are batch spawners that can lay 20 000-80 000 eggs per day for a period of up to 3 months. In the Mediterranean,they reproduce between October and December. The eggs are spherical and pelagic,with a diameter slightly lower than 1 mm and a single large oil droplet. The planktonic larval stage lasts about50days at17-18° C. (Boglione *et al.*, 2003)

Large-scale cultivation of these species for human consumption demands when the resource be easily renewable. It is clearly disadvantageous to cultivate marine finfishes when the supply of young cannot easily be replenished; yet the history of aquaculture has been dogged by just this problem. There are two solutions to this problem: the first is eminently practical and has been the historical answer- to collect fry from natural resources. Yet, the difficulties inherent in this method are many, for it is time consuming, requires considerable skill and experience and relies utterly on the productivity of the natural spawning grounds. The second solution is more direct: learn how to make the brood stock marine finfishes reproduce in captive(Barnabe ,1994). The minimum length of ripe *S. aurata* males was 18 cm, while that of female was 20 cm. Fish larger than 21 cm for males and 23 cm for females were all mature. Therefore, the length at first maturity is 19-20 cm for males and 23 cm females. Another approach was tried to assess size at first maturation considering the work of Boglione *et al.*, (2003) who has shown the presence of an all metric relation, in the covrse of growth between body weight of fish and that gonad. By plotting the log of gonadal weight per group weight, the straight line representing this relation is brocken at point corresponding to first body weight at the time of puberty (Boglione *et al.*, 2003). Gilt-head sea bream is a protandrous hermaphroditic species (Zohar *et al.*, 1978). In captivity, all fish function as males during the first year of their life. Under certain environmental conditions all fish remain males during their second year of life. From the first or second year onwards a certain percentage of the males undergo sex reversal, so that over succeeding years the ratio of females in the population increases (Zohar *et al.*, 1978 and 1984). All females start to develop ovaries at the end of the spawning season (May). When their gonads become am bisexual, with the final commitment to changing sex into mature female made by September (Zohar *et al.*,1978). Males that enter into the am bisexual stage but ultimately do not become females, develop testes once more and become functional males again. Some studies showed that the proportion of males reversing sex is socially controlled (Zohar,1991).

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However, it is only during the period of May through September that the final sex of the am bisexual fish can be influenced by social and hormonal actors. Thus refer to this period as the sensitive period for sex determination. The presence or addition of young fish (Potential males) during the sensitive period increases the number of older fish that change sex into females. On the other hand the presence or addition of older female will inhibit sex reversal in younger fish and cause them to develop back into male (Zohar,1989).

The sex ratio is defined as number of males to females in the population (Andrades *et al.*, 1994 and Boglione *et al.*, 2003). On the other hand, the sex ratio was shifted to females at the length group of 25 cm. The sex ratio was shifted to male at length group value ranged from 21 to 21.9 cm. According to the sex ratio relative to length group, the sex ratio of female to male was 1.86 %.The ration showed that about1.86 of female was needed for one male (Zaki *et al.*,1998). Sex was shifted to female at the length group of 24:24.9cm.The sex ratio of female to male was 1.863:1.

The objectives of the present investigation were to carry out the relationships between the brood stocks age and sizes(weight and length)of gilt-head sea bream, *Sparus aurata* at first sexual maturity for both males and females, in the marine finfishes hatchery which belongs to the General Authority for Fish Resources and Development.

## **MATERIALS AND METHODS**

The present study was conducted in Marine Finfishes Hatchery located at the 21 Km. west of Alexandria, Matruh governorate. The hatchery belongs to the General Authority for Fish Resources Development (GAFRD), Ministry of Agriculture and Land Reclamation, ARE.

### **Experimental Fish**

In this experiment a total number of 500 developed juveniles (males and females) gilt-head sea bream, *Sparus aurata* at ages of about 3 months, weighed at experimental start  $4.6 \pm 206$  g and a total length of  $5.9 \pm 10.21$  cm were stocked in a circular concrete tanks with a total water volume of  $50 \text{ m}^3$  sea water each. The experimental juveniles remain two years in these tanks, thereafter the experimental fish were transferred to a race-way rectangular concrete tank (4x20x1m) with a total water volume of  $80 \text{ m}^3$  each during the last year of the experiment.This water of the experimental tanks was changed completely and the tanks were supplied with continuous air through a blower of 15hp.capacity which provided  $15 \text{ m}^3$  air per second.. The sea bream juveniles used in this experiment were produced from the mating of parent stock of the hatchery. In this experiment, all fish were monthly transferred to another clean tank with the same specification to avoid infection with bacteria or parasites.

**Table (1): Ingredient and Proximate Composition of First experiment test diet used for gilthead sea bream, *Sparus aurata* juveniles from 12-36 months of age.**

Ingredient	%
Fish meal (KM)*	68
Rice bran (RB)	11
Yellow corn flour(YC)	10
Soybean meal **	3
Cotton seed meal (decorticated)	4
Cod liver oil***	2
Mineral +Vitamins mixture****	2
Total	100
<b>Proximate analysis ( % ) :</b>	
Dry matter	88.4
Crude Protein (CP)	47.6
Total lipids (TL)	17.2
Ash	19.5
Crude Fiber(CF)	19
NFE <sup>1</sup>	13.8
Gross energy (GE) (kcal/100 g DM) <sup>2</sup>	434.3

\*Source from Brazil \*\* Solvent extracted \*\*\* Cod live oil product by Iceland

\*\*\*\*Each gram of vitamin premix contains(NRC1993),20.000IUvit.A2000IUvit.D3,400vit.E,20 mg Niacin, 4,5 mg ribotlavin. 3 mg pyridoxine, 0.013 mg vit. B12, 100 mg chorine chloride and 2 mg vit K. Each gram contains 0.83 Ca, 0.63 P, 0.78 Na, 0.018 Mn, 0.011 Zn and 0.001Cu.The mixture was prepared by mixing 35parts of dicalcium phosphate, 3 parts of mineral premix and 2 part of common salt.

<sup>1</sup> Calculated by differences

<sup>2</sup> Growth energy was calculated using values of 5.65 , 4.1 and 9.45 Kcal /g protein , carbohydrate and lipid , respectively ( Jobling, 1983) .

**Table (2): Experimental periods , lasted for 5 consecutive periods for gilthead sea bream, *Spams aurata* juveniles rearing .**

Period	Age	Feed and rate for feeding
Period. 1	From 3-9 month	Minced tilapia -12%
Period .2	From 9-12 month	Minced tilapia- 10%
Period. 3	From 12-15month	Dry food-8%
Period.4	From 1 5-24 month	Dry food-6%
Period.5	Form 24-36 month	Dry food-3%

#### Experimental diet

During this experiment , the experimental gilthead sea bream, *Sparus aurata* juveniles (mixed sexes) were daily fed during the first period (Table 3), from 3 to 9 months of age on minced tilapias bodies at a rate of 12% of the fish biomass. Whereas from 9 to 12 months of age (2<sup>nd</sup> period) the experimental diet contained minced tilapias flesh daily rate of 10%. of biomass . During this period 12 to 15 months experimental for gilt-head sea bream juveniles were fed on pelleted dry food 47.6% crude protein at a daily rate of 8% of biomass, and period from 15- 24 months of age feed the same test diet but at a daily rate of 6% of fish total biomass. From the 24 to 36 months of age the experimental fish were fed on the same diet, but at a daily rate of 3 % of fish biomass (Table 1 and 2).

**Sea water supply system:**

Sea water was drawn directly from an intake point in the shore by subs and well point (150 µm slots, 3 pipes PVC, 3m length). Sea water was pumped by 4 kW polypropylene centrifuge pump to three concrete reservoirs of 60m<sup>3</sup> capacity, 13m diameter x 1.5m depth. The reservoir was used as a setting to the coarser suspended particles before the water was filtered. Water was pumped from reservoir to two constant head tanks (5m<sup>3</sup> capacity) to distribute for maturation and spawning tanks, and pumped to larval tanks.

**Drainage System:**

All the tank facilities were provided with two drainage system, one for cleaning water and other for removing water used in experimental fish rearing.

**Air Supply System:**

The air supply system consists of three air blowers work alternating at 24-hour interval. Air distribution network was constructed of PVC pipes and control valves.

**Measurements and Records**

Age of both males and females sea bass was recorded. Total weight and total length of each individual fish were recorded to the nearest 0.1 g and 1 mm, respectively. Both weight and length of the experimental fish were recorded every 3 months till the end of the third year after experiment started. Age at sexual first maturity was determined by inserting a plastic cannula in the urino-genital opening to collect the eggs from the females, while semen was collected from males by stripping on the abdominal area towards tail fin.

**Water quality parameters**

Physical and chemical water parameters in experimental tanks were determined according to Boyd (1990). Water temperature in °C was daily recorded in all experimental tanks using a simple thermometer. Water pH was measured in the present experiment every week using a digital pH meter (model up Hep). Dissolved oxygen (mg O<sub>2</sub>/L) was monitored within all experimental tanks every week using a digital meter (YSI model MP57). Water salinity was determined in all experimental tanks at the periods previously mentioned in the experiment using a refractometer (model U-81150-20). Ammonia mg NH<sub>4</sub>-N/L was determined using colorimeter (Model HAC).

**Analytical feed methods :**

Feed ingredients and experimental diets were analysed for proximate composition according to AOAC (1990).

**Growth performance data**

Fish were counted and batch - weighed at stocking and at harvest. Mortality was monitored daily and survival was defined as the fraction of the stocked fish that were harvested. Average initial (W<sub>i</sub>) and final fish body weight (W<sub>f</sub>) were calculated. Rearing time (t) was defined as the period from the first to the last day that the fish were fed.

**Statistical analysis**

Statistical analysis of the experimental results was conducted using SAS (2005) program. Duncan's multiple range test (1955) was carried out to test the significance among intervals means (P < 0.05).

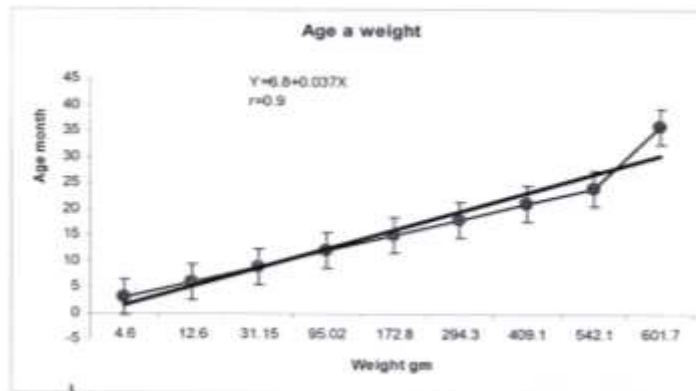
## RESULTS AND DISCUSSION

Growth rate in weight (g) and length (cm) as well as percentage maturity was monitored for sea bream *S. aurata* raised in concrete tanks at 3 month intervals up to the 3-year of life. Results of Table (3) and Fig 1,2,3,4,5 and 6 showed the effect of age; body length and weight on sexual maturity of female and male of sea bream. Results revealed that in both sexes averages of body weight increased significantly ( $P < 0.05$ ) with each advance in age from the age of 6 month till the age of 36 month, however differences in body weight between ages 3 and 6 months were insignificant. Results of Table 3 and Fig. 1 indicate that sea bream (male and female) average of BW at the experimental start (3months of age) was 4.6 g and it increased in order with each advance in age to reach 601.7 g at 36 month increased its BW by 130.8 g folds during the period from the third to the 36- months of age in both sexes. Results of the same Table indicate that the correlation coefficient ( $r = 0.9$ ) between age and body weight was found to be highly significant ( $P < 0.05$ ).

**Table (3): Effect of age, body weight and total length on percentage maturation of gilthead sea bream, *Sparus aurata***

Age Month	Variable	Weight g Mean $\pm$ sd	Length cm Mean $\pm$ sd	% Mature Mean $\pm$ sd
3		4.6 <sup>n</sup> $\pm$ 1.34	5.9 <sup>f</sup> $\pm$ 1.09	0 <sup>e</sup> $\pm$ 0
6		12.6 <sup>n</sup> $\pm$ 2.3	8.4 <sup>n</sup> $\pm$ 0.9	0 <sup>e</sup> $\pm$ 0
9		31.15 <sup>g</sup> $\pm$ 3.9	13.05 <sup>g</sup> $\pm$ 0.8	0 <sup>e</sup> $\pm$ 0
12		95.045 <sup>i</sup> $\pm$ 12.9	16.2 <sup>f</sup> $\pm$ 0.9	17.3 <sup>d</sup> $\pm$ 0.38
15		172.8 <sup>e</sup> $\pm$ 29.1	19.6 <sup>g</sup> $\pm$ 0.96	18.2 <sup>d</sup> $\pm$ 0.38
18		294.3 <sup>d</sup> $\pm$ 54.7	24.1 <sup>h</sup> $\pm$ 1.22	25.3 <sup>c</sup> $\pm$ 0.43
21		409.4 <sup>c</sup> $\pm$ 103.9	28.6 <sup>c</sup> $\pm$ 1.19	75.5 <sup>b</sup> $\pm$ 0.43
24		542.1 <sup>b</sup> $\pm$ 122.2	29.7 <sup>b</sup> $\pm$ 1.39	79.3 <sup>b</sup> $\pm$ 0.4
36		601.7 <sup>a</sup> $\pm$ 174.3	33.15 <sup>a</sup> $\pm$ 3.5	100 <sup>a</sup> $\pm$ 0
L.S.D.		17.9 sig.***	0.3 sig.***	0.06 sig.***

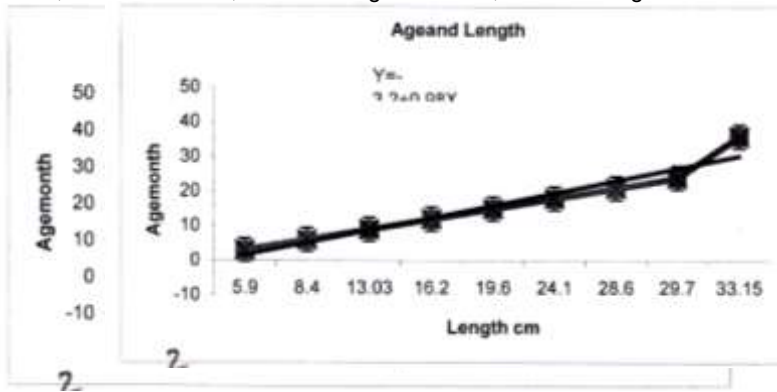
\* Means with the same letters in the same row are not significantly difference ( $P < 0.05$ )



**Fig. (1): The relation between weight(g)and age(months)of gilthead sea bream. *Spaus aurata***

During the period from 3 to 36 months of age, the relationship between age and weight of male and female sea bream is illustrated in the following equation.  $Y=6.8+ 0.03 X$ , where  $y$  = age in month and  $X$  = weight in Concerning body length (male and female) of sea bream, average of body length BL at the experimental start (3 months of age) was 5.9 cm and it increased in a significant ( $P < 0.05$ ) order with each advance in age to reach 33.15 cm at 36 months of age which indicate that sea bream (males and female) grow 5.6 folds at 36 months of age compared to its length at 3 months of age (Table 3 and Fig. 2)

The calculated regression coefficient between age and length during the period of study (3 to 36 months of age) was  $r = 0.9$  and the statistical evaluation showed that the correlation (age / length) was highly significant and the relation between age and length is illustrated in the following equation,  $Y=-3.2 +0.09 X$ , where  $Y$  is age in month, and  $X$  is length in cm



**Fig. (2): The relation between length(cm)and age(months)of gilthead sea bream, *Sparus aurata***

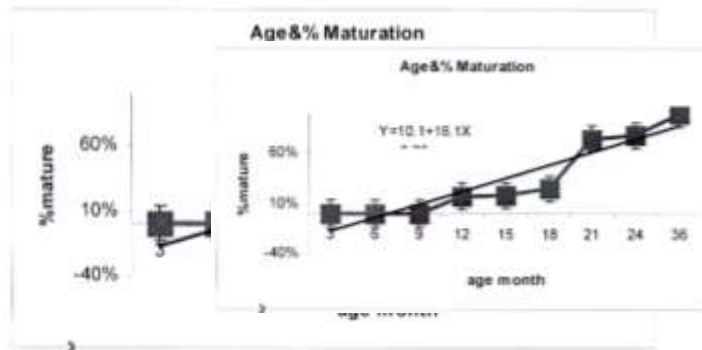


Fig. (3): The relations between percentage maturity and age (months) of gilthead sea bream, *Sparus aurata*

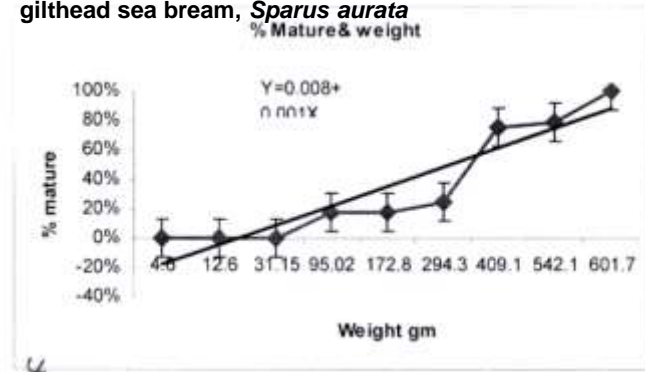


Fig. (4): The relation between weight(g) and maturity percentage of gilthead sea bream, *Spams aurata*

Results of Table 3 and Fig. 3 indicate that no maturation in both sexes of sea bream was observed during the ages 3; 6 and 9 months of age. At the age 12 months, 17.3% were mature (male and female), the relationship was highly significant ( $P < 0.05$ ).

At age 15, 18, 21, 24, and 36 months of age, percent of mature male and females were found to be 18.2, 25.0, 75.0, 79.0, and 100% , respectively. The correlation coefficient between age and maturation ( both sexes) was highly significant with a value of  $r = 0.75$  and the relationship between age and percent of male and female maturation is expressed in the following equation,  $Y = 10.1 + 16.1 X$  ,where  $Y =$  age in month ,and  $X =$  % of maturation

Result of Table 3 and Fig. 4 revealed that these were highly significant ( $P < 0.05$ ) correlations ( $r = 0.72$ ) between body weight, body length and percent of maturation in both male and female sea bream. The relation between body weight and percent of maturation is expressed as:  $Y = 0.008 + 0.001X$  ,where  $Y =$  % of maturation, and  $X =$  body weight in g

Results (Table 3 and Fig. 5) revealed also that there was highly significant ( $P < 0.05$ ) correlation ( $r = 0.75$ ) between % of maturation and body length of both sexes of sea bream. The relation between length and maturation is expressed in following equation  $Y = -0.34 + 0.03 X$  ,where  $Y =$  percent of maturation and  $X =$  length in cm

As present in Table 3 and Fig. 6, results revealed that weight of sea bream correlated highly significant ( $P < 0.05$ ) with a value of  $r = 0.94$  and the relationship between both is expressed as following :  $Y = -10.4 + 0.037 X$  , where  $Y =$  is the fish length in cm and  $X =$  is the fish weight in g.





Fig. (5): The relation between length (cm) and maturity percentage of gilthead sea bream, *Spams aurata*

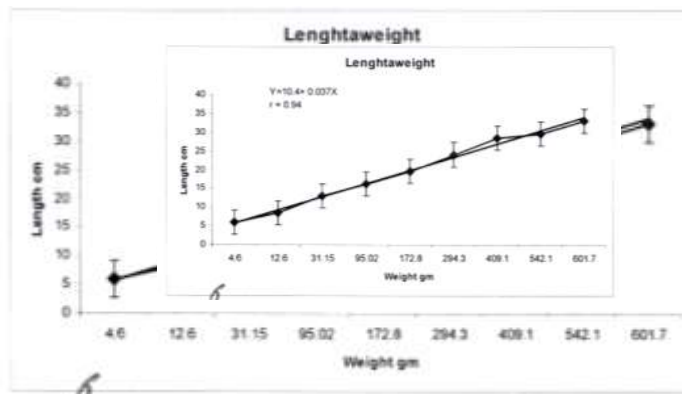


Fig. (6): The relation between weight (g) and length (cm) of gilthead sea bream, *Spams aurata* during experimental period ( 3 years )

As presented in Table 4, results revealed that during the period from 3 to 9 months of age no maturation was observed in both female and male sea bream. At age of 12 months no maturation of female was detected, however at this age, 17.3% of the males in the sample show maturation with a length ranging from 14.9-16.2 cm and weight ranging from 73.1 to 92.2 g. At 15 months of age, 18.2% of the brood stock showed maturation where 0.97% of the female were mature with an average length 22.4 cm and weight 267.8 g .At this age, 17.3 males in the sample showed maturation with an length and weight ranges between 17.7-18.9 cm and 127.7 to 152.6 g., respectively. At 18 months of age, 25.3 % of both sexes showed maturation where 4.7 % of the female were mature with an average length 25.7 to 28.5 cm and weight 391.4 to 415.3g. At this age, 20.6 % males in the sample showed

maturation with an length and weight ranges between 22.1 to 22.5 cm and 129.7 to 257g, respectively .

**Table (4): Effect of age, weight and total length on percentage of gilthead sea bream, *Sparus aurata* maturation**

Age after hatch (month)	Fish No.	Total length cm	Total weight g	%of mature fish		Female		Male	
				No.	%	No.	%	No.	%
3	106	5.9	4.6	0	0	-	0	-	0
6	156	8.4	12.6	0	0	-	0	-	0
9	112	13.05	31.15	0	0	-	0	-	0
12	75	16.2	95.045	13	17.3	-	0	13	17.3
Length range	-	-	-	-	-	-	-	14.9-16.2	-
Weight range	-	-	-	-	-	-	-	73.1-92.2	-
15	104	19.6	172.8	19	18.2	1	0.96	18	-
Length range	-	-	-	-	-	22.4	-	17.7-18.9	17.3
Weight range	-	-	-	-	-	267.8	4.7	127.7-152.6	-
18	63	24.1	294.3	16	25.3	3	-	13	-
Length range	-	-	-	-	-	25.7-28.8	-	22.1-22.5	-
Weight range	-	-	-	-	-	391.4-415.3	-	195.7-257	20.6
21	94	28.6	409.1	71	75.5	25	26.6	46	48.9
Length range	-	-	-	-	-	28-32.8	-	26.3-28.3	-
Weight range	-	-	-	-	-	339.9-698.7	-	289.1-434.5	-
24	97	29.7	542.1	76	79.3	31	31.9	46	47.9
Length range	-	-	-	-	-	29.9-35.2	-	27.2-30	-
Weight range	-	-	-	-	-	541.1813.5	-	332-587	-
36	112	33.15	601.7	112	100	47	41.9	65	58.02
Length range	-	-	-	-	-	30.3-42.4	-	29.5-34.6	-
Weight range	-	-	-	-	-	461.9-934.6	-	340-669.4	-

At 21 months of age, 75.5% of sample individuals showed maturation where females represented 26.6 % and males 48.9 % of the matured individuals. The length at females maturation was between 28 to 32.8 cm and the weight between 339.9 to 698.7 g. The length of males mature was between 26.3 to 28.3 cm and the weight 289.1 to 434.5 g.

At 24 months of age, percent of matured fish in the sample was 79.3% and female contributed fish in sample 31.9% and males by 47.4% (Table 4) , the length from female between 29.9 to 35.2 cm and the weight between 541.1 to 813.5 g, and length from male matured in this sample was 27.2 to 30 cm and weight was 332 to 587 g. At 36 months of age 100% of the brood stock (males and females) were mature and matured females represented 41.9% of matured fish and matured males represented 58.02% of the sample. The ranges of body length and weight at 36 months were 30.3 to 42.4 cm and 461.9 to 934.6 g for female and 29.5 to 34.6 cm and 340 to 669.4 g for male, respectively. At the age of 36 months after hatch, all sea bream male and female fish reached 100% maturation with a sex ratio 1:1.38 for female and male, respectively.

In this connection Zaki *et al.*, (1998) reported that at length group of sea bream 18.20 cm, all fish were hermaphrodite, while in our study a male sea bream were detected at length group 14.9 - 16.2 cm and 12 months age. Also, Zaki *et al.*, (1998) indicated that the sex ratio shifted to male at length group 21 -21.9 cm and the percentages of female were 48, 76.12 and 83.35

% for length groups 21 - 21.9 cm; 22 -22.9 cm and 23 - 23.9 cm., respectively. Results of tables (4 - 5) are also in close to results of Zaki *et al.*, (1998), Zohar *et al.*, (1978) studied the gonadal development of *Sparus aurata* during the first year of life and concluded that entire gonads act as testis (males) at the second year of life then the sex changes to female from the end of that year.

In the same field, Carnevali *et al.*, (1992) reported that *Sparus aurata* is a hermaphrodite species since the male sex expressed on the second year of life and later changed into females which led to a numerical gradual depletion of males from the population .Also results of Table 5 are in partial agreement with the findings of Barnabé (1994), who stated that 100 % of male and female of sea bream in nature reached maturity at 24 cm. length. She added that first maturity was reached at 19-20 cm. in males and 23 cm. in females. The same author reported also that *S. aurata* became mature during second year of age.

It could be conclude that the complete sexual maturity of male and female occurred at 36 month of age .

**Physico-chemical characteristics of experimental tanks water :**

Results of Table (5) show the physico-chemical characteristics of experimental tanks water during 36 successive months from May 2001 to December 2004. Water quality parameters including water temperature ( $^{\circ}\text{C}$ ) , dissolved oxygen (DO) , pH, ammonia ( $\text{NH}_3$  -N) and salinity (ppt‰) were measured throughout the experiment . All water quality parameters were within the permissible levels for sea bass aquaculture. The chemical equilibrium between undissociated ammonia and total ammonia is a function of salinity, temperature and, to a large extent, pH (Miller *et al.*, 1990; Soderberg and Meade, 1991; Boyd, 1990). For equal initial concentration values of total ammonia, a pH variation from 7 to 8 leads to a 10-fold increase in the formation of the toxic fraction(Lloyd, 1992).

**Table (5): Physical and chemical water parameters in experimental tanks(Mean values $\pm$ SE)**

Parameters	Minimum	Maximum	Mean $\pm$ SE
Water temperature ( $^{\circ}\text{C}$ )	14.4	29.4	21.9 $\pm$ 7.4
Dissolved oxygen (DO, mg/l)	6.1	6.5	6.3 $\pm$ 0.21
pH	7.4	8.0	7.7 $\pm$ 0.30
Ammonia ( $\text{NH}_3$ -N, mg/l)	0.033	0.061	0.047 $\pm$ 0.014
Salinity (‰)	30.2	35.4	32.8 $\pm$ 2.6

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### العلاقات بين عمر وحجم (وزن وطول) مخزون آباء سمك الدنيس عند بدء النضج الجنسي لكل من الذكور والإناث

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أجريت هذه الدراسة في المفرخ البحري التابع للهيئة العامة لتنمية الثروة السمكية، التابعة لوزارة الزراعة واستصلاح الأراضي، وهو يقع في محافظة الإسكندرية على الحدود الغربية عند الكيلو 21 غرب مدينة الإسكندرية على طريق الإسكندرية مطروح، واستغرقت هذه الدراسة على مدار 3 سنوات من الفترة 2001 إلى 2004. واستهدفت هذه الدراسة إيجاد العلاقة بين الوزن والطول والعمر لأسماك الدنيس عند بدء النضج الجنسي، وفي هذه التجربة تم استخدام عدد 500 إصباغية من الدنيس/ وكان عمرها عند بداية التجربة ثلاث شهور وكان متوسط طول ووزن الدنيس وقت بداية التجربة 4.6 جم و 5.9 سم،

وكانت النتائج كما يلي:

- 1- سجل أول نضج للإناث عند عمر 15 شهراً، بينما في الذكور كان عند عمر 12 شهراً عندما كانت النسبة الأسماك الناضجة 13% في العينة تحت الدراسة.
- 2- في عمر 18 شهراً كانت نسبة الأسماك الناضجة 4.7% و 20.6% من الإناث والذكور، كما أن مدي أوزان الأسماك الناضجة كان 391.4 - 415.3 و 193.7 - 257 جم للإناث والذكور، على التوالي، وعند عمر 21 شهراً 26.6% من إناث العينة قد نضجت بينما كان يتراوح وزنها ما بين 339.9 - 698.7 جم، وفي نفس العمر كان نسبة الذكور التي نضجت 48.9% في العينة كان يتراوح وزنها ما بين 289.1 - 434.5 جم.
- 3- وفي عمر 24 و 36 شهر كانت نسبة الإناث الناضجة في العينة 31.9% و 41.9% بينما في الذكور كانت 47.9% و 58.02% في نفس العمر على الترتيب.
- 4- واكتمل النضج الجنسي للإناث في عمر 36 شهراً عندما كان متوسط مدي الوزن من 461.9 إلى 934.6 وفي الذكور كان متوسط مدي الوزن من 345 إلى 669.4 جم.
- 5- وجد أن عمر الذكور والإناث في الدنيس كان له تأثير معنوي على كلاً من الطول الكلي والوزن الكلي و النسبة المنوية للنضج.
- 6- سجل معامل الارتباط معنوياً بين كلاً من العمر والوزن الكلي، والعمر والطول الكلي، والطول الكلي والوزن الكلي والعمر ونسبة المنوية للنضج في الذكور والإناث أثناء الفترة من 3 إلى 36 شهراً.

قام بتحكيم البحث

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