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Effect of temperature and salinity on larval growth of the gilthead seabream, *Sparus aurata* 

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#### ABSTRACT

The present study deals with the effect of different temperatures (16°C, 18°C & 20°C) and different salinities (20‰ & 35‰) on growth performance, survival rate, length weight relationship and condition factors of the gilthead seabream, Sparus aurata, larvae over the rearing period of 60 days. Results showed that, fish larvae exposed to temperature 18 °C improved larval growth in length (3.64 cm) and weight (0.71gm) compared with low (16°C) and high (20°C) temperatures, being 3.01cm & 0.47g in the former and 2.47cm & 0.23g in the later. Data showed that, fish larvae exposed to low salinity (20%) were nearly equal in length and weight to those larvae exposed to high salinity (35%), being 3.06 cm & 0.45g in the former and 3.01cm & 0.47g in the later. The total weight gain, average daily gain (g/fish/day), specific growth (%/day), feed intake, feed conversion ratio and survival rate were improved in fish larvae exposed to temperature 18 °C and high salinity (35‰) compared with low and high temperatures and low salinity. The feed conversion ratio in the fish exposed to high salinity (35 ‰) was nearly equal to those in fish exposed to low salinity 20 %; being 0.2136 in the former salinity and 0.2143 in the later one.

Data showed that, all fish treatment groups have a positive allometric growth. The b value in fish exposed to temperature 18 °C is relatively more towards the ideal (4.3) compared with low and high temperatures, being 5.103 & 6.05 respectively. The mean values of condition factors were nearly equal among different temperatures and different salinities. While, the mean values of relative condition factors were slightly different among varying temperatures and salinities.

In conclusion, the fish larvae exposed to temperature 18°C accelerated larval growth in length, weight and improved survival rate of the gilthead seabream, *Sparus aurata* larvae, when the water salinity ranged between 20 to 35‰.

#### **1. INTRODUCTION**

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Most marine fish are characterized by complex life cycles that comprise several distinct developmental stages (egg, larvae, juvenile, adult). The duration of each stage depends on the species and the environmental conditions.

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Both larval and juvenile stages may have a critical influence on fish population structure and dynamics (Di Franco et al., 2013) and on the success of the species culture (Ronnestad et al., 2013). Larval development is greatly affected by biotic (e.g. prey availability) and abiotic (e.g. temperature) conditions. During the larval stage organisms undergo extreme morphological, biochemical, and physiological changes in order to transform into juveniles (Pittman et al., 2006).

Two of the most potent abiotic factors in the life of marine and brackish water organisms are temperature and salinity (Kinne, 1963). The eggs and larvae of many marine fish are euryhaline and eurythermic (Battaglene, 1995), however the tolerance of larvae to combinations of salinity and temperature is species specific, and may change during ontogeny and be influenced by maternal environmental conditions. Salinity can affect yolk utilization and larval growth and survival by influencing the amount of energy needed for osmoregulation (Howell et al., 1998). Temperature usually has a greater effect on fish growth than salinity (Rombough, 1996). Due to the interactive effects of salinity and temperature on osmoregulation they should be considered when determining optimal together conditions for tolerance and performance (Kinne, 1963).

The gilthead seabream, Sparus aurata (Linnaeus, 1758) is an euryhaline marine teleost whose natural habitat stretches from the south of England to Mauritania with its highest abundance occurring in the Mediterranean Sea (Chervinski, 1984). It inhabits brackish and hyper-saline lagoons and estuaries mainly in the summer months (Ben-Tuvia, 1979; Tandler et al., 1995). Reproduction occurs in the open sea where larvae develop before they migrate as juveniles to coastal lagoons and estuaries (Tandler et al., 1995).

Under experimental conditions, *S. aurata* in late larval and juvenile stages are able to survive in salinities ranging from 2‰

to 39‰ (Chervinski, 1984). Populations have also been found in higher salinities up to 60‰ in the Bardawil Lagoon in Egypt (Ben-Tuvia, 1979). This large salinity tolerance of *S. aurata* seems to interact with the temperature of acclimation (Vargas-Chacoff *et al.*, 2009a). Many studies have dealt with short-term effects of salinity and temperature on marine fish eggs, larvae and juveniles (Kinne, 1963; Holliday, 1969; Freddi *et al.*, 1981; Rombough, 1996). However, the effect of long-term exposure to different salinities and temperature on marine fish larval growth performance has attracted a little attention (Hart *et al.*, 1996).

Therefore, the present study aimed to investigate the optimal temperature and salinity for the larval growth of the gilthead sea bream, *Sparus aurata*. This study deals with the effects of different temperatures and salinities on: growth performance parameters, survival rate, and length weight relationship as well as condition factors.

### 2. MATERIAL AND METHODS

A total of 3000 specimens of the gilthead seabream, *Sparus aurata* larvae, with a good condition were obtained from El-Wafaa private farm at Al- Ismailia governorate during February, 2012. Fish transported to El- Mataria Research Station at El- Daqahlia Governorate in large plastic bags filled with oxygen. Fish were acclimatized for one week in a well aerated large fiberglass tank (stock tank); fish were fed daily on a live food.

# **2.1 Experiments of temperature and salinity:**

The experiment of temperature was conducted using 9 separate cylinder tanks each one (1x1x1m) filled with 500 liters sea water. In each tank, 200 fish larvae were kept randomly selected from the stock tank. Fish were exposed to 16°C as a treatment group 1, 18°C as a treatment group 2 and 20°C as a treatment group 3; each group included three replicate tanks. Water salinity of these tanks was adjusted to 35‰.

The experiment of salinity was

conducted using 6 separate cylinder tanks; each one (1x1x1m) was filled with 500 liters sea water. In each tank, 200 fish larvae were kept randomly selected from the stock tank. Fish were exposed to 20 ‰ as a treatment group 4 and 35 ‰ as a treatment group 5; each group included three replicate tanks. Water temperature of these tanks was adjusted at 16°C.

All tanks were provided with aeration; and change of water and tank cleaning were carried out weekly. Fish in each tank were fed twice daily during seven days per a week by a life food. The larvae were fed on a natural food (*Brachionus* and *Artemia*) which contain 70 % protein, obtained from El- Mataria Research Station at El- Daqahlia Governorate. Fish were fed at a rate of 20 % of fresh body weight. The experiment was conducted for 60 days. Dissolved oxygen varied from 7.3 to 9 mg/L; pH values were ranged between 7 and 8.5.

#### 2.2 Growth and survival rate:

Length and weight of 20 randomly selected fish from each treatment were recorded each 15 days. Total length of each fish was measured to the nearest millimetre by plastic ruler. The body weight was also determined to the nearest 0.001 gram. Mortality was recorded for each treatment to calculate the survival rate.

### 2.3 Length-weight relationship:

Length-weight relationship of fish larvae was determined by using the following equation:

#### $W=a L^b$ (Lagler, 1956) Where:

 $\mathbf{W} = \mathbf{W}$ eight of the fish in milligram.

 $\mathbf{L} =$ total length in millimetre.

 $\mathbf{a}$  and  $\mathbf{b}$  = constants , whose values are estimated by the least square method.

#### 2. 4 Condition factors:

Condition factor (k) was calculated from the following equation:

 $K = 100 \text{ W/ } \text{L}^3$  (Hile, 1936) Where:

 $\mathbf{W} =$ fish weight in milligram or gram.

 $\mathbf{L} =$ fish length in centimetre.

The relative condition factor (Kn) was determined by the following formula:

 $\mathbf{W} =$ fish weight in milligram or gram.

 $\mathbf{w}$  = calculated weight estimated from the length weight relationship equation.

#### 2.5Measurements of growth performance:

Total weight gain (**TWG**), average daily gain (**ADG**), specific growth rate (**SGR**), feed intake (**FI**) and feed conversion ratio (**FCR**) in larvae of *S. aurata* were determined according to Recker (1975) and Castell & Tiews (**1980**) as following:

#### TWG (mg/fish) = $(W_T - W_I)$

Where:

 $W_T$  = final means weight of fish (mg).

 $W_I$  = initial means weight of fish (mg).

SGR (% / day) = 
$$100 \times (Ln W_T - Ln W_I)/$$
  
duration period.

Where: Ln= Natural log.

FI = fish weight x feeding level /100 FCR = feed intake (mg)/ total weight gain (mg).

### **3. RESULTS**

# **3.1 Effect of temperature on growth performance:**

Fish larvae of *S. aurata*, exposed to temperature of 18°C showed improved larval growth. Moreover, this treatment gave higher average total length of fish larvae (3.64  $\pm$  0.43 cm) than low temperature of 16°C (3.01  $\pm$  0.23 cm); and high temperature of 20°C had the shortest average total length (2.47  $\pm$  0.23 cm) after the rearing period of 60 days (Table 1).

Also, fish larvae of *S. aurata*, exposed to temperature of  $18^{\circ}$ C, exhibited greater average body weight (0.71 ± 0.23 g) than both of low temperature of  $16^{\circ}$ C (0.47 ± 0.11 g) and high temperature of  $20^{\circ}$ C, which gave the lowest average body weight of larvae (0.23 ± 0.09 g) after the rearing period of 60 days (Table 1).

Exposure time (days)		Temperature			
		16 °C	<b>18</b> °C	<b>20</b> °C	
0	Length cm)	$1.79\pm0.19$	$1.79\pm0.19$	$1.79\pm0.19$	
	Weight (g)	$0.03\pm0.02$	$0.03\pm0.02$	$0.03\pm0.02$	
15	Length cm)	$2.24\pm0.19$	$2.41 \pm 0.2$	$2.07\pm0.13$	
15	Weight (g)	$0.15\pm0.03$	$0.18\pm0.06$	$0.09 \pm 0.01$	
20	Length cm)	$2.68\pm0.19$	$3.03 \pm 0.21$	$2.34\pm0.07$	
30	Weight (g)	$0.27\pm0.04$	$0.32\pm0.09$	$0.15\pm0.03$	
45	Length cm)	$2.85\pm0.20$	$3.34 \pm 0.31$	$2.41\pm0.14$	
43	Weight (g)	$0.37\pm0.07$	$0.52 \pm 0.15$	$0.19\pm0.05$	
60	Length cm)	$3.01 \pm 0.23$	$3.64 \pm 0.43$	$2.47\pm0.23$	
	Weight (g)	$0.47 \pm 0.11$	$0.71 \pm 0.23$	$0.23\pm0.09$	

Table 1: Growth in total length (mean  $\pm$  SD cm) and in total weight (mean  $\pm$  SD g), of *S. aurata* larvae, exposed to different temperatures at different exposure times.

Data in Table (2) showed that, the highest value of total weight gain of *S. aurata* larvae (0.68 g) was recorded in the fish exposed to temperature  $18^{\circ}C$  compared with 0.44 g in the fish exposed to low temperature ( $16^{\circ}C$ ) and 0.20 g in the fish exposed to high temperature ( $20^{\circ}C$ ).

The highest average daily weight gain of *S. aurata* larvae (11.33 mg/fish/day) was found in the fish exposed to mid temperature of 18°C compared with 7.33 and 3.33 mg/fish/day in the fish exposed to low and high temperatures, respectively (Table 2).

Also, the best specific growth rate of S. aurata larvae (5.27 %/day) was detected in

the fish exposed to mid temperature of 18°C, comparing with 4.59 and 3.39 %/day in the fish exposed to low and high temperatures, respectively (Table 2).

The highest amount of feed intake (142 mg/fish) was consumed by the fish exposed to mid temperature comparing to that consumed by the fish larvae exposed to high or low temperatures (Table 2).

The best feed conversion ratio (0.2088) was recorded in the fish exposed to mid temperature compared with the fish exposed to high temperature (0.23) and fish exposed to low temperature (0.2136) (Table 2).

Cuarth itama	Temperature			
Growth items	16 °C	18 °C	<b>20</b> °C	
Initial weight (g/fish)	$0.03\pm0.02$	$0.03\pm0.02$	$0.03\pm0.02$	
Final weight (g/fish)	$0.47\pm0.11$	$0.71\pm0.23$	$0.23\pm0.09$	
Total weight gain (g/fish)	0.44	0.68	0.20	
Average daily gain (mg/day)	7.33	11.33	3.33	
Specific growth rate (%day)	4.59	5.27	3.39	
Feed intake (mg/fish)	94	142	46	
Feed conversion ratio	0.2136	0.2088	0.23	

Table 2: Growth performance items of *S. aurata* larvae, exposed to different temperatures for 60 days.

Results in Table (3) showed that, *S. aurata* larvae exposed to temperature 18°C, over the rearing period of 60 days had improved survival

rate (95 %) than those exposed to 16 or 20  $^{\circ}$ C (93 % and 83 %, respectively).

Table 3: Survival rate (%) of S. aurata larvae, exposed to different temperatures, after different exposure times.

Exposure time	Temperature				
(days)	16 °C	<b>18</b> °C	<b>20</b> °C		
0	100	100	100		
15	97	98	92		
30	95	97	89		
45	93	96	85		
60	93	95	83		

#### **3.2** Effect of temperature on Lengthweight relationship of *S. aurata* larvae:

The fish weight increases gradually with increasing the fish length. But, the fish larvae exposed to 18°C recorded a higher increment in total length and total weight. Thus, the length-weight relationship of the fish groups exposed to different temperatures can be expressed by the following equations:

$W= 0.0018 L^{5.103}$	exposed to 16 °C
$W = 0.0029 L^{4.3}$	exposed to 18 °C
$W = 0.001 L^{6.05}$	exposed to 20 °C

Results of length-weight relationship of *S. aurata* larvae groups exposed to different temperatures showed that, the value of b was 5.103, 4.3 and 6.05 for fish larvae exposed to 16°C, 18°C and 20°C respectively (Figs. 1-3).



T<sub>1</sub> (16 C°)

Fig. 1: Length-weight relationship of S. aurata, exposed to temperature (16°C).





Fig. 2: Length-weight relationship of S. aurata, exposed to temperature (18°C).



Fig. 3: Length-weight relationship of S. aurata, exposed to temperature (20°C).

All fish treatment groups have positive allometric growth. The b value in fish exposed to 18°C was relatively more towards the ideal. The correlation coefficients were **3.3 Effect of temperature on condition** factors of *S. aurata* larvae:

Data revealed that, the composite coefficient of condition (k) and the relative condition factor (kn) varied with the fish size. The mean values of condition factor are nearly equal at different temperatures, being  $1.32\pm0.47$ ,  $1.17\pm0.38$  and  $1.12\pm0.39$  in the

statistically highly significant (r: 0.97, 0.98 and 0.98 for fish larvae exposed to 16°C, 18°C and 20°C respectively).

fish exposed to  $16^{\circ}$ C,  $18^{\circ}$ C and  $20^{\circ}$ C respectively (Table 4). Also, the mean values of relative condition factors were slightly different among different temperatures, being  $0.82\pm0.17$ ,  $0.84\pm0.19$  and  $0.95\pm0.09$  in the fish exposed to  $16^{\circ}$ C,  $18^{\circ}$ C and  $20^{\circ}$ C respectively (Table 4).

Table 4: Effect of different temperatures on the condition factors of *S. aurata* larvae, reared in fiberglass tanks for 60 days.

Exposure	T <sub>1</sub> (16 °C)		T <sub>2</sub> (18 °C)		T <sub>3</sub> (20 °C)	
time(days)	K	Kn	K	Kn	K	Kn
0	0.52	0.74	0.52	0.75	0.52	0.88
15	1.35	1.15	1.30	1.18	1.03	1.13
30	1.4	0.77	1.15	0.75	1.17	0.87
45	1.62	0.76	1.41	0.78	1.37	0.95
60	1.72	0.72	1.47	0.73	1.53	0.96
Range	0.52 - 1.72	0.72 - 1.15	0.52 - 1.47	0.73 - 1.18	0.52 - 1.53	0.87 - 1.13
Average ±SD	1.32±0.47	0.82±0.17	1.17±0.38	0.84±0.19	1.12±0.39	0.95±0.09

## **3.4** Effect of salinity on growth performance parameters of *S. aurata* larvae:

The results in Table (5) showed that, after the rearing period of 60 days, fish larvae exposed to low salinity of 20‰ were nearly equal in length to those larvae exposed to high salinity of 35‰, being 3.04  $\pm$  0.4 cm and 3.01  $\pm$  0.23 cm, respectively.

Also, the average body weight in *S. aurata* larvae exposed to salinity of 35‰ was nearly equal to those in fish larvae exposed to low salinity of 20‰; being 0.47  $\pm$  0.11g and 0.45  $\pm$  0.2g, respectively (Table 5).

Table 5: Growth in total length (mean  $\pm$  SD cm) and in total weight (mean  $\pm$  SD g), of *Sparus aurata* larvae, exposed to different salinities at different exposure times.

Exposure time (days)		Salinity			
		20 ‰	35 ‰		
0	Length cm)	$1.79\pm0.19$	$1.79\pm0.19$		
U	Weight (g)	$0.03\pm0.02$	$0.03\pm0.02$		
1.	Length cm)	$2.26\pm0.17$	$2.24\pm0.19$		
15	Weight (g)	$0.15\pm0.03$	$0.15\pm0.03$		
20	Length cm)	$2.73\pm0.14$	$2.68\pm0.19$		
30	Weight (g)	$0.26 \pm 0.04$	$0.27 \pm 0.04$		
45	Length cm)	$2.90\pm0.22$	$2.85\pm0.20$		
	Weight (g)	$0.36 \pm 0.1$	$0.37 \pm 0.07$		
60	Length cm)	$3.06 \pm 0.30$	$3.01 \pm 0.23$		
	Weight (g)	$0.45 \pm 0.15$	$0.47 \pm 0.11$		

The highest value of total weight gain of *S. aurata* larvae (0.44 g) was recorded in

fish larvae exposed to salinity 35‰ compared with 0.42 g, which recorded in the

fish larvae exposed to low salinity of 20‰ (Table 6).

Also, the best specific growth rate of *S. aurata* larvae (4.59% / day) was recorded in the fish exposed to high salinity 35‰ comparing with 4.51 %/day which recorded in the fish exposed to low salinity 20‰ (Table 6).

The highest amount of feed intake (94 mg/fish) was consumed by the fish exposed to high salinity 35‰, while the fish larvae exposed low salinity 20‰ consumed 90 mg/fish (Table 6). The feed conversion ratio in the fish exposed to high salinity 35‰ was nearly equal to those in fish exposed to low salinity 20‰; being 0.2136 in the former salinity and 0.2143 in the later one (Table 6).

Table 6: Growth performance items of S. aurata larvae, exposed to different salinities for 60 days.

Crowth itoms	Salinity		
Growth items	20 ‰	35 ‰	
Initial weight (g/fish)	$0.03\pm0.02$	$0.03\pm0.02$	
Final weight (g/fish)	$0.45\pm0.15$	$0.47\pm0.11$	
Total weight gain (g/fish)	0.42	0.44	
Average daily gain (mg/day)	7	7.33	
Specific growth rate (%day)	4.51	4.59	
Feed intake (mg/fish)	90	94	
Feed conversion ratio	0.2143	0.2136	

Fish larvae of *S. aurata*, exposed to salinity 35‰ over the rearing period of 60 days, showed improved survival rate than

those exposed to salinity 20%; being 93% in the former and (89%) in the later (Table 7).

Table 7: Survival rate (%) of S. aurata larvae, exposed to different salinities, after different exposure times.

Even agreen time (dave)	Salinity			
Exposure time (days)	20 ‰	35 ‰		
0	100	100		
15	97	97		
30	95	95		
45	93	93		
60	89	93		

### **3.5** Effect of salinity on Length-weight relationship of *S. aurata* larvae:

The fish weight increased gradually with the increasing the fish length. But, the fish larvae exposed to salinity 20% recorded higher growth in total length and total weight (Figs. 4 & 5). Thus, the length-weight relationship of the fish groups exposed to different salinities can be expressed by the following equations:

$W = 0.002 L^{4.9589}$	(for salinity 20%)
$W = 0.0018 L^{5.103}$	(for salinity 35‰)





Fig. 4: Length-weight relationship of S. aurata, exposed to salinity (20 ‰).

S. (35 %)



Fig. 5: Length-weight relationship of S. aurata, exposed to salinity (35 ‰).

The growth of fish treatment groups has a positive allometric growth. The b value is more than the ideal. The correlation coefficients are statistically highly significant (r: 0.969 and 0.971 for fish larvae exposed to 20 ‰ and 35 ‰ respectively).

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## **3.** 6 Effect of salinity on condition factors of *S. aurata* larvae:

The composite coefficient of condition (k) and the relative condition factor (kn) varied with the fish size. The

mean values of condition factor were relatively equal at different salinities, being  $1.18 \pm 0.40$  and  $1.31 \pm 0.47$  in the fish exposed to 20 ‰ and 35 ‰ respectively (Figure 9). Also, the average values of the relative condition factor had slightly differences among different salinities; being  $1.02 \pm 0.21$  and  $0.82 \pm 0.17$  in the fish exposed to 20 ‰ and 35 ‰ respectively (Table 8).

Exposure time	$S_1(2)$	$S_1(20 \%)$		65 <b>%</b> 0)
(days)	K	Kn	K	Kn
0	0.52	0.84	0.52	0.74
15	1.21	1.37	1.35	1.12
30	1.18	1.01	1.40	0.77
45	1.39	0.98	1.57	0.74
60	1.57	0.91	1.72	0.72
range	0.52 - 1.57	0.84 - 1.37	0.52 - 1.72	0.72 - 1.12
Average ± SD	$\textbf{1.18} \pm \textbf{0.40}$	$1.02 \pm 0.21$	$1.31 \pm 0.47$	$\textbf{0.82} \pm \textbf{0.17}$

 Table 8: Effect of different salinities on the condition factors of S. aurata larvae.

#### DISCUSSION

Temperature plays an important role in performance, the tolerance, food consumption, growth, reproduction, survival rate, respiration and distribution of aquatic organisms (Shehata et al., 1996 a&b and Khalaf-Allah, 2009). Early ontogeny in fish is impacted by nearly all environmental including factors, temperature, oxygen content, salinity, pH, insolation, other biotic and anthropogenic factors (Kamler, 2008).

In the present study, the fish larvae exposed to temperature 18°C accelerated

larval growth, since a higher increase in growth in length, growth in weight and survival rate of larvae occurred during the experimental period than that of low (16°C) and high temperatures (20°C). Similar reports showed that, temperature (18°C) improve survival rates and accelerate growth at the same species larvae (Blaxter, 1969; Freddi *et al.*, 1981 and Couto *et al.*, 2008). This result is lower than that recorded at the same species by Chatain (1994), Requena *et al.* (1997) and Zaki *et al.* (2007). They concluded that, temperatures ranged between

19 - 22°C improve survival rates and accelerate growth of *S. aurata* larvae. Polo *et al.* (1991) concluded that, the higher survival rate of *S. aurata* larvae occurred between 16 and 22°C; outside this range mortality and abnormalities increased considerably.

In the present study, total weight gain, average daily gain, specific growth, and feed conversion ratio were recorded a highly rate in the fish fry exposed to temperature (18 C°) compared to larvae exposed to low (16 °C) and high temperatures (20 °C). The growth promoters improve the immunity, productivity and economic efficiency of fish via its improvement body weight of the fish (Carnevali et al., 2006), weight gain (Venkat et al., 2004), feed conversion ratio efficiency (Abdel-Hamid and and Mohamed, 2008).

In the present study, *S. aurata* larvae, exposed to low salinity (20 ‰) over the rearing period of 60 days, nearly equal in length, weight and survival rate with the fish exposed to high salinity (35‰). Similar reports were conducted at the same species larvae (Freddi *et al.*, 1981; and Vargas-Chacoff *et al.*, 2009b). Chatain (1994) concluded that, improved survival rates and accelerated growth of *S. aurata* larvae were obtained at salinity (25‰), when the water temperature adjusted to 22°C.

Conides and Branko (2006) mentioned that, maintenance requirement was found to increase with decreasing salinity. The optimum salinity conditions for sea bass are above 30‰. On the other point of view, Vargas-Chacoff *et al.* (2009b) concluded that, the metabolic effects of salinity are differed depending on the temperature of acclimation. The interactions were different among tissues and parameters displaying different patterns of changes.

In contrast, the growth rate of *S. aurata* larvae was increasing with the decreasing of salinity from 35‰ to 12‰ (Mabrouk, 1999; Mabrouk *et al.*, 2000; Nour *et al.*, 2004). Brett (1979) mentioned that, the spawners of *S. aurata* were collected from salinity 34‰ and the off-springs had a high growth rate at same salinity, this conclusion may be

attributed to heredity factors. Vargas-Chacoff et al. (2009a) mentioned that, the bream, S. gilthead sea *aurata* is an euryhaline and eurithermal species with the capacity of living under different environmental conditions of salinity and temperature.

The present study showed that, the weight of S. aurata increases to power greater than length<sup>3</sup> and this indicates that, the shape change rapidly with the increasing length. There is a close fit between the actual and calculated weights. Similar observations were detected in different fish by many authors notably; Khallaf and Alne-na-ei (1995)Oreochromis niloticus; on Bahnasawy (2000) on Liza ramada; Khalaf-Allah (2001) on *Tilapia zillii*; Farrag (2008) on Lithognathus mormyrus; Kumar et al. (2013) on Anabas testudineus; Kashyap et al. (2014) on Channa punctatus and Al-Zahaby (2015) on Cheilinus lunulatus. However, some contrasts in the results of condition factor that approved the value of condition factor increased with increasing fish length which differs with the present study, it may be due to change location and environmental condition between natural habitats and laboratory conditions.

In the present study, the growth of S. aurata is positive allometric growth in the larvae exposed to different temperatures. While, the b value (4.29) of larvae exposed to temperature (18 °C) is nearest towards the isometric (3) compared to b value in the larvae exposed to low (16 C°) and high temperatures (20 C°), being 5.1 in the former and 6.05 in the later. This means that, the length of the fish increases in growth more than weight and vice versa. The positive allometric growth was recorded in many fish such as Liza aurata (Khalaf-Allah, 2001); Lates niloticus (Albattal, 2002); Scardinus erythroptalmus (Torcu-Koc et al., 2006); and Syngnathus acus (Sule and Ertan, 2007). Also, the present study showed that the growth of S. aurata is positive allometric growth in the larvae exposed to different salinities. Aleen (1938) reported that, the ideal "b" value is 3. However, Hile (1936) and Lecren (1951) reported that, the fish in which the value of "b" ranges between 2.5 to 4 live also in good conditions.

In the present study, the values of composite coefficient of condition "k" were slightly differed (1.12 - 1.32) for S. aurata larvae exposed to different temperatures. This result disagrees with studies of Ameran (1992) and Tharwat et al. (1998). They recorded an average condition factor (K) fluctuating between 1.34 and 1.41 for Sparus aurata at Bardawil Lagoon. The condition factors are based on the hypothesis that, the heavier fish of a given length is in better condition. They are often used to compare the differences related to ecological and biological factors such as fatness, sex, mortality, feeding conditions and gonad weight (Bagenal and Tesch, 1978).

Finally, it may be concluded that, the fish larvae exposed to temperature (18°C) accelerated larval growth in length, weight and improving survival rate of gilthead seabream, *Sparus aurata* larvae, when the water salinity ranged between 20 to 35‰.

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