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المجلد الأول – العدد الثاني - 2026

العمر ومعدلات النمو عند اسماك السوري Sargocentron rubrum (Forsskal. 1775) في المياه البحرية السورية (شاطئ طرطوس)

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(الإيداع: 4 آب 2026، القبول: 8 أيلول 2026)

الملخص

تم خلال هذا البحث دراسة العمر ومعدلات النمو لأسماك النوع *Sargocentron rubrum* في المياه البحرية الشاطئية لمدينة طرطوس . جمعت عينات شهرية عشوائية خلال عام كامل من آب 2022 وحتى آب 2023 وبلغ عدد الأسماك المفحوصة 318 فرداً سمكياً، كان عدد الذكور 216 فردا (67.92%) مقابل 102 فردا من الإناث (32.08%). تراوحت الأطوال الكلية (T.L.) للعينات 9.7-18.2 سم والأوزان الكلية (T.W.) غ 20.31-98.13.

دلت نتائج دراسة العلاقة بين الطول والوزن للعينات السمكية أن نمط النمو هو negative Allometric Growth (b<3) مع عدم وجود اختلاف معنوي بين كل من الذكور والإناث (P>0.05) . كما دلت نتائج دراسة التركيب العمري بطريقة الحساب الرجعي على تحديد /6 / مجموعات عمرية للذكور مقابل / 5/ مجموعات عمرية للإناث. تم خلال الدراسة معاملات النمو النظري للأسماك المدروسة (Von–Bertalanffy growth) وكانت قيم هذه المعاملات للذكور L_∞=23.75cm ,K=0.13,t_0=-1.0&W_∞=218g بينما للإناث كانت L_∞=21.90 cm, K=o.24, t_0=-0.7 & W_∞=229g مقابل L_∞=22.78cm, K=0.094, t_0=-1.0 & W_∞=234g للعينة ككل.

الكلمات المفتاحية: سمك السوري *Sargocentron rubrum* - العمر- النمو- المياه البحرية - طرطوس (سورية).

*أستاذ مساعد في كلية الصيدلة - جامعة حماة

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Age and growth of *Sargocentron rubrum* (Forsskal. 1775) in Syrian Marine Waters (Tartous Coast).

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Abstract

This study was carried out to determine the age and growth of *Sargocentron rubrum*, in the marine waters of Tartous. Atotal of (318) individuals were examined by random sampling monthly from August 2022 to august 2023. The examined samples were 216 (67.92%) males and 102 (32.08%) females, was ranged 9.7-18.2 cm in length, T.L. and 20.31- 98.13g, for weight T.W.

The length-weight relationship results showed an negative Allometric Growth type in the studied species ($b<3$), with no significance between males and females ($P>0.05$). The results show that the life span of the sampled fish was six years for males and five years for females.

Von–Bertalanffy growth (theoretical growth) parameters were estimated, for males (L_∞=23.75cm, K=0.13,t_0=-1.0&W_∞=218g.), females (L_∞=21.90 cm, K=o.24,t_0=-0.7 & W_∞=229g.) and all samples (L_∞=22.78cm, K=0.094, t_0=-1.0 & W_∞=234g.).

Keywords: Sargocentron rubrum, age, growth, Marine waters, Tartous, Syria.

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1-Introduction:

Lessepsian migration from Red Sea via Suez Canal is the most popular way to the Mediterranean waters (Por, 1978). It has both positive and negative impacts including commercial and non-commercial species (Farrag, 2014). The squirrel fish *Sargocentron rubrum* (Forsskal, 1775) is among members of family; Holocentridae, it is migrated to the Mediterranean Sea via Suez Canal and became the common immigrant Holocentrid species. *Sargocentron rubrum* can be found between the depths of 1-84 m in the Mediterranean Sea (Randall,1998) is a benthopelagic species, usually seen alone or in small groups (Erguden, *et al*., 2023). It is inhabits in caves and cracks (Kuiter & Tonozuka, 2001); coastal reefs (Lieske & Myers, 1994), silty reefs, wreck in lagoons,bays, and harbours (Randall, 1998). This species feed on the small fishes, shrimps, and rabs (Göthel, 1992).

S. rubrum, its distributed in Red Sea to the western Pacific (from southern Japan to New Caledonia, Vanuatu and New South Wales, Australia) (Randall *et al*., 2003). It can reach maximum 32 cm in length (Williams & Greenfield, 2016). Also, Theoretical maximal lengths and weights for *S. rubrum*, its can reach 35.64 cm and 331.85 g. (Kabakli & Erguden , 2022; Farrag, *et al.* 2018). The lack of information about the biological characteristics of the family Holocentridae is indicative of the need for more data on the fishes belonging to the family Holocentridae (El-Mahdy *et al*. 2023). In Syrian marine water, Galyia & Ibrahim (2004) were studied Food Spectrum of Squirrelfish. Also, Lahlah (2015) was studied Variations quantity (abundance & biomass) for this species.

2-Aim of work:

In this present study, some less known properties (population dynamics and growth performance) of lessepsian fish species *S. rubrum* in the Syrian Marine Waters (Tartous Coastal). In Syria, it is commonly appears in commercial fishery landings. However, there is not available data with respect to its fishery and biology. The present work aimed to highlight the fishery biology of this species in Eastern Mediterranean particularly the Syrian coasts.

In light of the climate changes that have occurred over the past two decades, it was necessary to update the biological studies of fisheries to assess the current status of the environmental impact of these changes, on the one hand, and to provide a clearer understanding of fish stocks on the other. The information provided by this study contributes to providing an understanding of the age structure of the Squirrel fish population, and to determining the age at which these fish reach the permissible size for fishing. This will contribute to the development of laws and principles governing fishing periods with the aim of protecting them and increasing the opportunities for their optimal exploitation ((Mehanna, 1996, El-Mahdy *et al*. 2023).

3-Materials and Methods:

318 individuals of sargocentron rubrum were collected from the sea waters opposite the city of Tartous (34º 53' N 35º 53'53' E), where random sea sorties were carried out during the daytime at a rate of once a month during the period between 15/08/2022 and 14/08/2023, and the water depth in the fishing area ranged between 10-85m. For this purpose, coastal trammels nets were used with a length of approximately 150m, a height of 1-2m, and hole diameters of approximately 18mm. Total length (cm) and total weight (g) were taken for each fish. The scales was removed from under lateral line for each sample and examination by

using microscope (40x). Age determination was carried out by reading growth rings on 318 scales. The lengths at the end of different years of life were computed using the Lee equation (Lee, 1920). The growth in weight was estimated by applying the length-weight equation on the back-calculated length of different age groups.

Growth of a fish can be described as an increase in either length or weight. Several mathematical equations have been created to model fish growth from which the von Bertalanffy growth model (V.B.G.M.), is the most used growth model of fishes. Von Bertalanffy growth model described as $Lt= L_\infty (1- e–k (t- t_0))$ where Lt is the total length (cm) at time t (year), $L\infty$ the asymptotic length, K the growth coefficient, and t_0 the theoretical age at length equal zero. And for weight: $Wt = W_\infty (1- e^{-k (t-t_0)})^{b}$ (Beverton & Holt, 1957). Descriptive statistics were derived using SPSS 21.0 package program.

4-Results:

Length-weight relationship:

Overall length weight relationships of *Sargocentron rubrum* were computed for males, females and combined sexes. These relationships were found to be represented by the following equations (Fig. 1):

For males:

$$\text{Log (TW)= 2.738 Log (TL) -1.406} \qquad R^2 = 0.95$$

For females:

$$\text{Log (TW)= 2.872 Log (TL) -1.485} \qquad R^2 = 0.95$$

For combined sexes:

$$\text{0Log (TW)= 2.820 (TL) – 1.456} \qquad R^2 = 0.95$$

We notice here that the value of ‘b’ is less than 3, which means that length–weight relationship here also shows negative allometry i.e. the fish puts on weight at a lower rate than its growth in length.

Upon comparison of weights of males and females of the same length group, we can see that in general the males are heavier than the females. By comparing the value of the exponent ‘b’, we can see that for weights the exponent ‘b’ for the females is higher than that of the males (2.872 & 2.738, respectively). Concerning the combined sexes, it appears that the value of ‘b’ was slightly higher than both sexes (2.820).

Body length-scale radius relationship:

Length-scale relationship, according to the present data for about 318 specimens collected throughout the present study, was found to be linear and is expressed by the following equation:

$$T.L=2.11+1.97\ S.R. \qquad R^2=0.94$$

Age and growth (Length & Weight):

Growth in length:

From Table (1) , it appears that, the length at age for males is slightly higher than the females. The highest rate of growth was by the end of the first year of life, the percent of annual increments were 59.17, 62.28 and 58.43 % for the males, females and combined sexes. The least increment was by the end of the fifth year in both males and females.

Growth in weight:

Using the equation expressing the length-weight relationship did estimations of body weights by the end of each year of life for *S. rubrum*. These were calculated for males, females and the whole sample (combined sexes). The obtained values are shown on Table (2) , the calculated weights for the males by the end of each year life of the females of the same age, these were, 14.71, 28.89, 48.96, 49.96, 75.05 and 91.20g. for the six successive age groups in the males, and 18.09, 23.41, 44.71, 63.86, and 72.44g. respectively for the five studied age groups of the females. The highest rate of growth for the males, was by the end of five year of life, while that of the females, was by the end of the three the year of life. The least percent increment for the males, was by the end of the fourth year of life, while that of the females, was by the end of two year of life.

Theoretical growth in length and weight:

Von-Bertalanffy growth equation in length and weight of males, females and combined sexes of *S. rubrum*, are as follows :

For length:

$$L_t=23.75\ [1-e^{-0.13\ (t-\ (-1.0))}] \quad \text{For males}$$

$$L_t=21.90\ [1-e^{-0.24\ (t-\ (-0.7))}] \quad \text{For females}$$

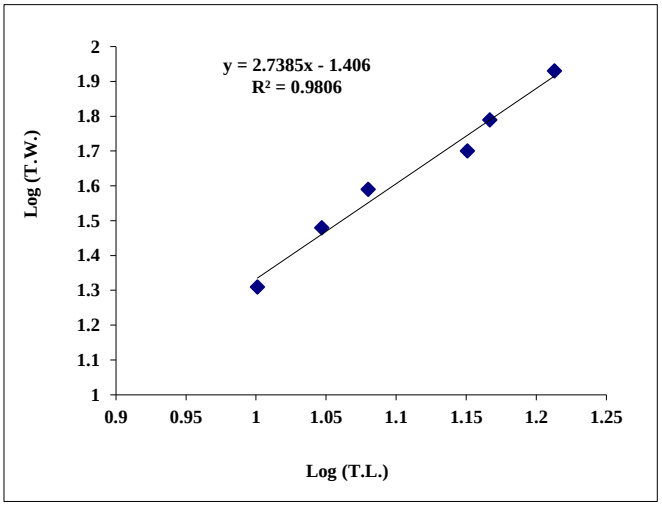
$$L_t=22.78\ [1-e^{-0.094\ (t-\ (-1.0))}] \quad \text{For combined sexes}$$

For weight:

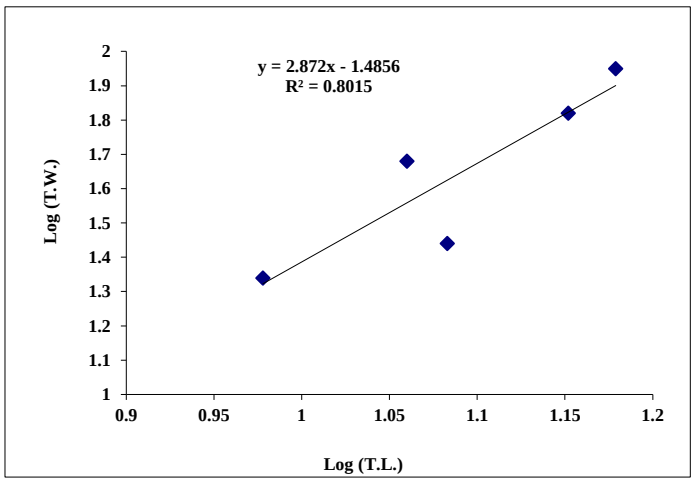
$$W_t=218\ [1-e^{-0.13\ (t-\ (-1.0))}]^{2.738} \quad \text{For males}$$

$$W_t=229\ [1-e^{-0.24\ (t-\ (-0.7))}]^{2.872} \quad \text{For females}$$

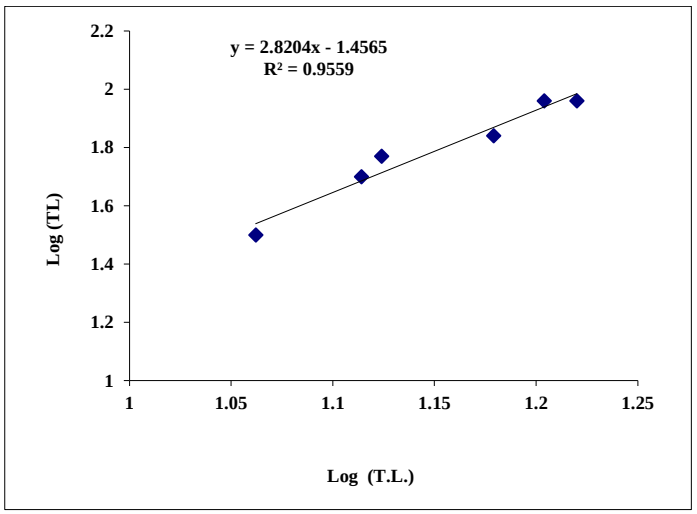
$$W_t=234\ [1-e^{-0.094\ (t-\ (-1.0))}]^{2.820} \quad \text{For combined sexes}$$



A



B



C

Fig. 1. Length-weight relationship of male (A), females (B) and C. sexes (C) of *S. rubrum*.

Table (1): The mean calculated lenghth at the end of each year of life (-A: males, -B: females, -C: combined sexes) of *S. rubrum*.

-A

Age (year)	N	%	TL(cm)	TL(cm)					
				TL1	TL2	TL3	TL4	TL5	TL6
1	41	18.98	10.03	9.13					
2	57	26.39	11.15	9.01	11.05				
3	43	19.91	12.03	8.33	9.73	11.83			
4	28	12.90	14.15	9.81	9.44	12.03	13.88		
5	25	11.51	14.90	9.11	11.41	12.14	13.71	14.71	
6	22	10.19	16.34	9.02	11.05	11.33	13.02	13.91	15.33
Mean ±SD				**9.07±0.43**	**10.54 ± 0.79**	**11.83± 0.31**	**13.53 ± 0.37**	**14.31± 0.40**	**15.33±0.0**
Increment				**9.07**	**1.47**	**1.29**	**1.70**	**0.78**	**1.02**
Increment(%)				**59.17%**	**9.59%**	**8.42%**	**11.09%**	**5.09%**	**6.65%**

-B

Age (year)	N	%	TL(cm)	TL(cm)				
				TL1	TL2	TL3	TL4	TL5
1	17	16.67	9.50	9.31				
2	32	31.37	12.69	9.37	10.31			
3	20	19.61	12.77	8.33	10.05	12.70		
4	18	17.65	14.19	9.21	10.44	13.02	14.01	
5	15	14.71	15.09	9.01	9.91	12.51	13.81	14.53
Mean ±SD				**9.05± 0.38**	**10.18± 0.21**	**12.74± 0.21**	**13.91 ± 0.01**	**14.53± 0.00**
Increment				**9.05**	**1.13**	**2.56**	**1.17**	**0.62**
Increment(%)				**62.28 %**	**7.78%**	**17.62%**	**8.05%**	**4.27%**

C

Age (year)	N	%	TL(cm)	TL(cm)					
				TL1	TL2	TL3	TL4	TL5	TL6
1	58	18.24	10.93	9.51					
2	89	27.99	11.55	9.21	11.09				
3	63	19.81	13	9.41	11.14	13.11			
4	46	14.47	14.31	9.13	11.33	13.21	13.91		
5	40	12.58	15.11	9.05	11.05	12.33	13.04	14.97	
6	22	6.92	16.34	9.02	11.05	11.33	13.02	13.91	15.33
Mean ±SD				**9.22±0.20**	**11.13 ± 0.11**	**12.50± 0.87**	**13.32 ± 0.51**	**14.44± 0.75**	**15.33± 0.0**
Increment				**9.22**	**1.91**	**1.37**	**0.82**	**1.12**	**0.89**
Increment(%)				**60.14 %**	**12.46%**	**8.94%**	**5.35%**	**7.31%**	**5.81**

Table (2): The mean calculated weight at the end of each wyear of life (-A: males, -B: females, -C: combined sexes) of *S. rubrum*.

-A

Age (year)	N	%	TW (g)	TW (g)					
				TW1	TW2	TW3	TW4	TW5	TW6
1	41	18.98	20.31	16.26					
2	57	26.39	30.13	13.80	26.30				
3	43	19.91	39.41	15.14	28.17	48.97			
4	28	12.90	50.33	13.80	28.18	48.98	56.23		
5	25	11.51	61.24	13.80	26.30	38.90	44.68	72.44	
6	22	10.19	85.31	15.48	35.48	48.97	48.98	77.62	91.20
Mean ±SD				**14.71±1.06**	**28.89 ± 3.80**	**48.96± 8.20**	**49.96 ± 5.84**	**75.05± 3.64**	**91.20±0.0**
Increment				**14.71**	**14.18**	**20.07**	**1**	**25.09**	**16.15**
Increment(%)				**16.13 %**	**15.54%**	**22%**	**1%**	**27.52%**	**17.72%**

-B

Age (year)	N	%	TW (g)	TW (g)				
				TW1	TW2	TW3	TW4	TW5
1	**17**	**16.67**	**22.02**	19.94				
2	**32**	**31.37**	28.13	19.95	25.70			
3	**20**	**19.61**	48.39	14.54	24.54	46.77		
4	**18**	**17.65**	67.14	18.62	27.54	61.66	66.07	
5	**15**	**14.71**	**89.25**	17.38	15.85	25.70	61.66	72.44
Mean ±SD				**18.09±2.25**	**23.41 ± 5.19**	**44.71± 18.07**	**63.86 ± 3.12**	**72.44± 0.0**
Increment				**18.09**	**7.35**	**29.41**	**19.15**	**8.58**
Increment(%)				**24.97 %**	**7.35%**	**29.41%**	**26.44%**	**11.84%**

-C

Age (year)	N	%	TW (g)	TW (g)					
				TW1	TW2	TW3	TW4	TW5	TW6
1	58	18.24	23.01	20.12					
2	89	27.99	31.35	18.41	30.84				
3	63	19.81	50.33	19.53	31.25	49.24			
4	46	14.47	58.41	17.92	32.85	50.35	58.52		
5	40	12.58	69.76	17.51	30.51	41.68	48.63	72.53	
6	22	6.92	85.31	18.20	29.51	31.62	50.11	60.25	81.28
Mean ±SD				**18.62±0.99**	**30.99 ± 1.24**	**43.22± 8.20**	**52.42 ± 5.28**	**66.39± 8.68**	**81.28±0.0**
Increment				**18.62**	**12.37**	**12.23**	**9.2**	**13.97**	**14.89**
Increment(%)				**22.90 %**	**15.22%**	**15.05%**	**11.32%**	**17.19%**	**18.32%**

5-Discussion

Fish growth is a resultant of the interaction between the fish and its environment. Various parameters are studied to elucidate fish growth rate in a certain habitat. The exponent ‘‘b” of such relation has been used for the status of growth mode. From Table (3), the present exponent ‘‘b” was estimated as 2.738, 2.872 and 2.820 for males, females and combined sexes respectively; reflecting a negatively allometric growth. The parameter “b” of length–weight relationships was insignificantly different (P> 0.05).

It was nearly the same (b < 3 negatively allometric growth) for those recorded by Letourneur *et al*. (1998), Yanagawa (1994), Anbalagan *et al*. (2016), Kabakli & Erguden (2018), Ragheb (2023) and Farrag *et al*. (2018), but was less than (b>3 positively allometric growth) those reported by Taskavak & Bilecenog˘lu (2001), Can *et al.*, (2002), Krishna *et al.* (2015) and Kabakli & Erguden (2022). This variation in the exponents could be attributed to different stages in ontogenetic development, as well as to differences in age, maturity and sex, geographic location and associated environmental conditions (Ragheb, 2023); for example, differences in the water thermal regime are known to influence fish growth (Jobling, 1997), other condition such as seasonality (date and time of capture), stomach fullness, disease and parasite loads (Dulčić *et al.*, 2000), can also affect the value of ‘b’.

Length-scale relationship in the two species understudy, were found to be linear. The highest rate of growth in *S. rubrum*, was in the first year of life. Linear growth rate decreases thereafter gradually with age for both sexes this is a known phenomenon in fish growth (Nikolsky, 1963).

Back calculated lengths in *S. rubrum* , the lengths of the males by the end of first, second, third, fourth, fifth and sixth years of life were 9.07, 10.54, 11.83, 13.53, 14.31 and 15.33 cm TL. The females reached 9.05, 10.18, 12.74, 13.91 and 14.53 cm TL by the end of the first, second, third, fourth and fifth years of life. These data show that the males have bigger sizes than the females, This may be due to the fact that the growth performance (ϕ) by males (2.848) is greater than that recorded for females (2.808) (Anbalagan *et al*. (2016).

Growth in weight, the present data show that the weight of a males, is about 14.71 g. T.W. by the end of the first year of life and 28.98, 48.96, 49.96, 75.05 & 91.20 g. T.W. by the end of the second, third, fourth, fifth and sixth years of life. For the females, the weight by the end of the first year of life was 18.09 g. T.W. and it was 23.41, 44.71, 63.86 and 72.44 g. T.W. for the second, third, fourth and fifth years of life. From these data, we notice that the males are heavier than the females of the same age group (Anbalagan *et al*. 2016). The highest rate of growth for males was by the end of the first year of life, while that of the female was by the end of the third year of life. From the second year of life onward we notice that the least percent increment of weight for the males and females were by the end of the fifth year of life. However, growth in fish are affected by exogenous factors which are the environmental conditions i.e. temperature, salinity, pH, photoperiod and Pollution, which is affecting marine waters in these days, affects the environmental conditions under which the fish live and hence exert its effect on their growth rate. Also, In most fishes decline in growth with an increase in age has been reported (El-Serafy, *et al.*, 2015, Hassanien, 2017, Mohammad, *et al*., 2020 and Mehanna & Hassanien, 2023). It sounds to be normal when the younger stages of fishes are known to have higher growth rates since the energy is spent for somatic growth while in matured or older fishes the energy is utilized for reproduction (Lester *et al.*, 2004; Pecquerie, *et al.*, 2009; El-Mahdy, 2023).

Table (3): Length weight relationship parameter (b) of *S. rubrum* from different locations.

Author	Location	Parameter (b)		
		Males	**Females**	**Combined sexes**
Yanagawa (1994)	Rayong, Gulf of Thailand	-	-	2.685
Letourneur *et al*. (1998)	Lagoon, New Caledonia	-	-	2.294
Taskavak & Bilecenog˘lu, (2001)	East. Medit.	-	-	3.015
Can *et al.,* (2002)	Iskenderun Bay	-	-	3.267
Krishna et al. (2015)	East Coast of India			3.102
Farrag *et al*. (2018)	East. Medit. (Egypt)	2.9746	2.751	2.8112
Anbalagan *et al*. (2016)	Southern Coast of India	2.848	2.808	-
Özvarol &Tatlises (2017)	Mediterranean Sea (North Cyprus)	-	-	3.0915
Kabakli & Erguden (2018)	Southeastern Medit. Sea, Turkey	-	-	2.678
Kabakli & Erguden (2022)	Iskenderun Bay, Northeastern Medit. Sea	3.1453	3.1742	3.1576
Ragheb (2023)	Egyptian Medit. waters off Alexandria.	-	-	2.7248
At present study	Syrian Marine Waters (Tartous Coastal)	2.738	2.872	2.820

Generally, despite relatively consistent increases in ocean temperatures globally, we have observed a decrease in the growth rate of fish in temperate regions. The declines in growth performance likely reflect legacy effects, shaped by overfishing, on changes in the underlying size structure and demographic processes of fished stocks. Therefore, the potential impacts of warmer temperatures on growth performance may be overwhelmingly masked by the impacts of overfishing (Yan, *et al*. 2026) .

Theoretical maximal lengths and weights for *S. rubrum*, were 23.75 cm T.L. & 218 g. T.W. for males and 21.90 cm T.L & 229 g. T.W. for females. From the above, it appears that both max length and max weight are higher in males than the females in the species understudy. The value of the growth coefficient 'K' and t_o for male, the estimated 0.13 and -1.0/ year, while for female were 0.24 and –0.7, respectively.

From table (4), the variations in theoretical growth parameters of *S. rubrum* from different locations are explained by the permanence or the variations of the habitat of each of the species throughout their life (Ana & Moli, 1997). The same species may have different natural mortality rates in different areas depending on the density of predators and competitors, whose abundance is influenced by fishing activities (Sparre *et al*., 1989). In conclusion, growth of fish in eastern Mediterranean is generally low (Somarakis & Machias, 2002).

The present study reveals that the growth of females was slower than that of males, whereas larger males occurred in considerable numbers compared to large females recorded. Similar findings were observed for *Sargocentron rubrum* collected from the Eastern Mediterranean coast. However, the differential growth between the sexes might be due to biological parameters, and further research is needed to address this issue. The slight variation in growth parameters of the same fish family from different regions might be due to differences in environmental parameters or size structure at the specified localities, as well as differences in fishing gears and methodologies adopted for studying these parameters. In addition, this may result in overfishing of many bentho-demersal species. Slight variations in growth parameters of the same fish family from different region might be due to differences in environment parameters or size structure at the specified localities cause by different gear used methodology adopted for the parameters (Anbalagan *et al*. 2016, El-Mahdy, 2023) .

Table (4): Theoretical growth parameters of *S. rubrum* from different locations, (M: male, F: female & C: combined sexes).

Author	Location	Parameters			
		L_∞ (cm)	W_∞ (g)	K	t_0
Farrag *et al*. (2018)	East. Medit. (Egypt)	27.26 C	331.85	0.276	-1.021
Anbalagan *et al*. (2016)	Southern Coast of India	24.43 M 23.63F	-	1.18 1.15	-0.1417 -0.1468
Kabakli & Erguden (2022)	Iskenderun Bay, Northeastern Medit. Sea	35.36 M 35.64 F 35.53 C		1.065 1.015 1.113	-0.112 -0.110 -0.113
At present study	Syrian Marine Waters (Tartous Coastal)	23.75 M 21.90 F 22.78 C	218 229 234	0.13 0.24 0.094	-1.0 -0.7 -1.0

6-Conclusions:

-The present study indicated that male of *S. rubrum* exhibited higher growth rates in length and weight than females of the same age.

-The length-weight relationship results showed a negative Allometric Growth type in the studied species ($b<3$) with no significance between males and females ($P>0.05$).

-The results show that the life span of the sampled fish was sixth years for males and fifth years for females

- The study of determining the theoretical growth coefficients of fish using Von Bertalanffy equations indicated the extent to which the fish stock in the studied area is being depleted as a result of overfishing.

7-Recommendations:

The lack of information about the biological characteristics of the family Holocentridae is indicative of the need for more data on the fishes belonging to the family Holocentridae . So, the findings of this study are significant to have scientific data on its biology and dynamics helping in managing of this species in the area.

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