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AGE AND GROWTH OF GILTHEAD SEA BREAM (*Sparus Aurata)* FROM BARDAWIL LAGOON, NORTH SINAI, EGYPT

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ABSTRACT
A total of 688 gilthead bream *Sparus aurata* was collected from Bardawil lagoon fishery during 2017 season. Total length ranged from 10.2 to 31.0 cm while total weight ranged from 13 to 442.5 g. The length-weight relationship parameters were a = 0.0132 and b = 3.0224. Age was determined using otolith radius reading technique and the longevity of this species was found to be 5 years. and the parameters of the von Bertalanffy growth model were K = 0.338 year^{-1}, L_∞ = 32.16, t_0= -1.324 cm and W_∞ = 523.8g. Growth performance index φ′ was estimated as 2.5. The mortality estimates were 0.792year^{-1}for total mortality (Z), 0.153year^{-1}for natural mortality (M) and 0.554 year^{-1} for fishing mortality (F). The exploitation rate (E = 0.803) indicates that the stock of sea bream in the Bardwell lagoon is heavily exploited. The catch of *Sparus aurata* in Bardawil lagoon composed mainly of small sized individuals where up to 54.1% of this species lie in age group 0.

INTROUDACTION

Gilthead seabream is a member of the Sparidae family that contains a large number of species in several genera. The Gilthead sea bream (*Sparus aurata)* is an important species in the Egyptian coasts of Mediterranean Sea and the Bardawil lagoon fisheries. It was found in a wide variety of marine habitats, from rocky to sandy bottoms, at depths between 0 to 500 m, although it is usually more common at less than 150m deep (**Abecasis *et al.*, 2008**).

It is an expensive good food so; it is a target for intensive fishing. Recently, it has been widely cultured in many countries including Egypt. In the wild it spawns in the winter months but in aquaculture farms it is conditioned to breed all year round under controlled methods (**Moretti *et al.*, 1999**, **Lloris, 2005**).

MATERIALS AND METHODS

The study was carried out in the Bardwell lagoon from May 2017 to January 2018. The lagoon covers an area of 693 km^2, in an arid area in the Mediterranean Sea by along narrow sand bar and it communicates with the Mediterranean Sea water by two bays. Sampling was collected from commercial trammel net between May 2017 and January, 2018.

A total of 688 individuals of *S. aurata* were randomly collected from the commercial catch of trammel net from the Bardawil lagoon. Each fish was measured to the nearest mm for total length and weighed to the nearest 0.1 gram total weight. Otoliths were removed, cleaned and stored dry in labeled vials. Annual rings on otoliths were counted using an optical system consisting of Nikon Zoom-Stereomicroscope focusing

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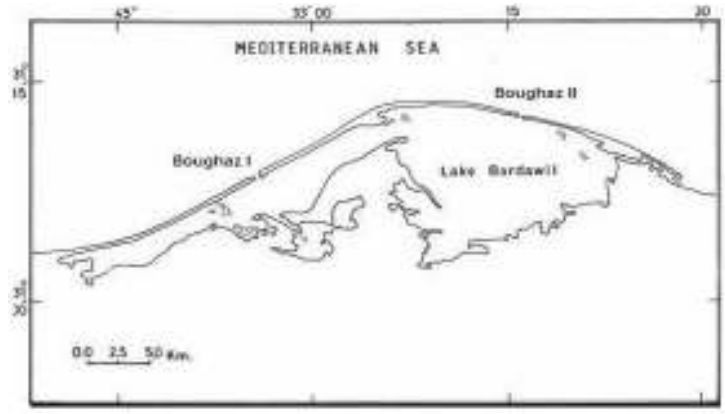

Fig. 1. Bardwell lagoon

block, Heidenhain's electronic bi-directional read out system VRX 182, under transmitted light. The total radius of the otolith "S" and the distance between the focus of the otolith and the successive annuli were measured to the nearest 0.001 mm. The otolith's measurements from specimens were used to describe the relationship between the total length and the otolith radius. Lengths by age were back-calculated using equation (**Lee, 1920**).

The back-calculated lengths-at-ages were fitted to the von Bertalanffy growth model and Ford-Walford plot was applied to estimate the von Bertalanffy growth parameters (L_∞ and K). The relationship between length and weight was described by the potential equation (W = a*Lb, **Ricker, 1975**), where W is the total weight (g), and L is the total length (cm), a and b are constants. The calculated weight at the end of each year was estimated by applying length-weight equation. The growth performance index (φ') was computed according to the formula of **Pauly and Munro (1984)** as φ' = Log10 K + 2 Log10 L_∞. The total mortality coefficient Z was estimated using the method of **Pauly (1983**). The natural mortality coefficient M was estimated as the geometric mean of three methods; Taylor's, equation as (**Taylor's, 1960**) $M = 3/t_{max}$ where t_{max} is the maximum age attainable by individual specimens in the given population, equation **(Urisn, 1967)** and formula **(Pauly, 1980)**. While the fishing mortality coefficient F = Z– M and the exploitation rate E was estimated as E = F/Z (**Gulland, 1971**).

RESULTS AND DISCUSSION

Otolith reading of *Sparus aurata* in Bardwell lagoon during the fishing season 2017 for 688 individuals showed five age classes. The percentage occurrence of these groups were 54.1, 28.6, 8.4, 4.1, 2.5 and 2.3% for 0, 1, 2, 3, 4and 5 year, respectively. This indicated that, the dominate of the young fish (0 and 1-groups, illegal size) while the age gropes four and five were the least age groups in the catch. This results were confirmed by **Salem (2010) and Mosbh (2013)**. The maximum estimated age (5 years) for *Sparus aurata* in Bardwell lagoon was recorded by **Khalifa (1995).**

The mean lengths at age were back-calculated for *Sparus aurata* as 19.1, 23.1, 25.2, 27.0 and 28.5 cm TL the 1st, 2nd, 3rd, 4th and 5th year of life, respectively. The greatest incremental growth in length occurred during the first year and then declined rapidly thereafter (Fig. 2).

The back-calculated lengths from the present study compared with those reported in the previous studies are given in Table 1.

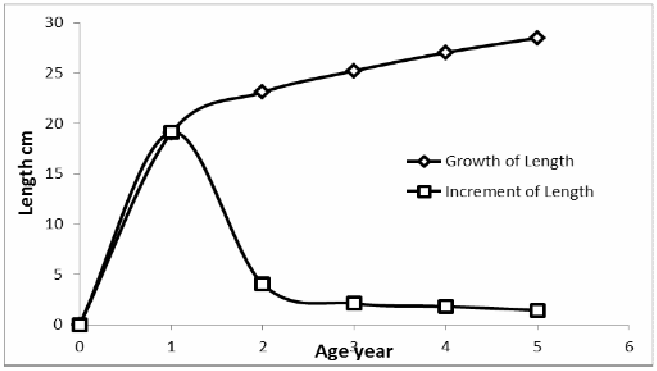

Fig. 2. Growth in length and growth increment of *Sparus aurata* from Bardwell lagoon

Table 1. The length at the end of life year of *S. aurata* given by different authors

Region	Total length at the end of life (year)						References
	1	2	3	4	5	6	
Alexandria Bardwell Lagoon	17.67	26.16	32.31	39.8	44.11		**(Wassef, 1978)**
Bardwell lagoon, fishing season, 1986	19.5	23.67	26.89	-	-		**(Ameran, 1992**
Bardwell lagoon, fishing season, 1986	19.36	23.67	26.29	28.39	-	32.16	**(Khalifa, 1995)**
Bardwell fishing season 2000	19.36	23.83	28.45	31.54	32.84	-	**(Salem, 2004)**
Lagoon fishing season 2001	20.2	25.2	27.6	29.8	32.3	-	
Port Said	21.26	27.8	32.25	34.3	-	-	**(Mehanna, 2007)**
Bardwell lagoon, fishing season, 2008	22.82	27.09	30.03	31.5	-		**(Salem, 2010)**
Bardwell lagoon	17.5	23.5	27.3	30.10	-	-	**(Mehanna, 2014)**

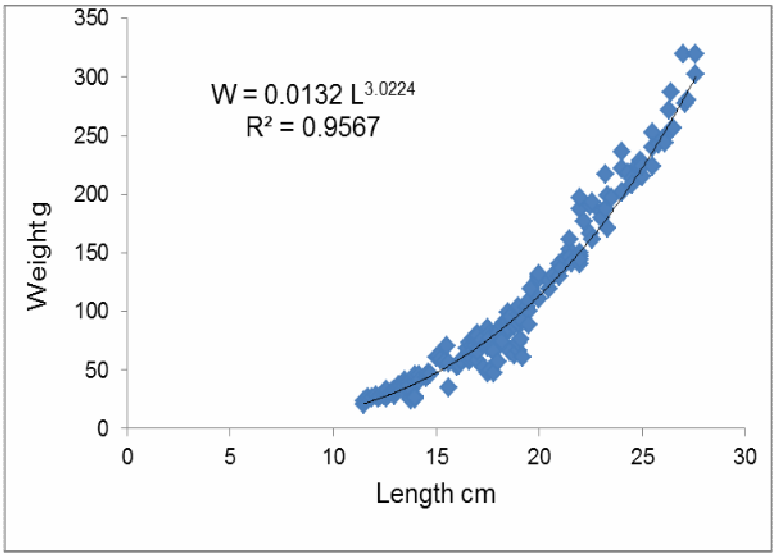

Fig. 3. Length-Weight relationship of *Sparus aurata* from Bardwell lagoon

The results are agree with **Wassef (1978)** and **Mehanna (2007 and 2014)** while the back-calculated lengths of the present study were higher than those given by **Ameran (1992)** and **Khalifa (1995)** who reported different values for the same species during the three years of study at the Bardwell lagoon.

The total length ranged from 10.2 to 31.0 cm while the total weight ranged between 13 and 442.5g. The length – weight relationship (Fig. 3) was described by the power equation as: $W = 0.0132\ L^{3.0224}$, the positive algometry was established as the value of ($b < 3$). These results agrees with **Tharwat *et al.* (1998)**, **Salem (2004),** they found that, the values of (b) equals 3.03 and 3.024 for the same species, respectively in lagoon. **Salem *et al.* (2008) and Mosbh (2013)** reported that, the length – weight relationship *S. aurata* in Bardwell lagoon equals 2.76 and 2.822, respectively. The differences in length-weight relationship might be interpreted as being due to differences in growth and morphometry between regions (**Barnabè, 1976**) and it is a practical index of the condition of fish, and varies over the year according to factors such as food availability, feeding rate, gonad development and spawning period (**Bagenal and Tesch, 1978**).

The values of von Bertalanffy growth parameters "$L\infty$ and K" estimated by the method of **Ford (1933) and Walford 1946)** were $L_\infty = 32.16$ cm, K= 0.338 per year, t_0= -1.324 and $W_\infty = 523.8$g. **Mcllwain *et al.* (2005)** mentioned that the differences in growth parameters due to age, sex, maturity and sampling period for the same species. The value of growth performance index (Φ') was calculated as 2.5. Length weight relationship and the growth parameters of *S. aurata* in Bardwell lagoon and different regions were illustrated in Table 2.

The total mortality coefficient Z was estimated as 0.792 $year^{-1}$. The natural mortality coefficient M was 0.153 $year^{-1}$, while the fishing mortality coefficient F was 0.554 $year^{-1}$. The exploitation rate E was computed as 0.803. The present exploitation rate is higher than that optimally exploited stock (50%) according to **Gulland (1971)**. In the present study, F was higher than the value of F indicating that the stock of *Sparus aurata* in Bardwell lagoon is over exploited. The increasing of fishing mortality linked with increasing of effort by starting work with shrimp trawl fishing.

Table 2. Length weight relationship and the growth parameters of *S. aurata* in Bardawil lagoon.

Regions	Constants of length-weight relationship and growth parameters						Authors
Egypt	**a**	**b**	**L_∞**	**K**	**t_0**	**φ'**	
Bardawil lagoon	0.025	2.81	36	0.39	-1.68	6.22	**(Salem, 2011)**
	0.014	2.98	38	0.34	-0.96	-	**(Khalifa, 1995)**
	0.024	2.79	35.5	0.4	-	2.7	**(Mehanna, 2014)**
Port said	0.012	3.02	38	0.5	-0.6	-	**Mehanna, 2007)**
	0.030	2.76	34.2	0.48	-0.78	6.33	**(Salem, 2010)**
Other regions							
Thau (France)	0.0226	2.88	62	0.22	-0.07	6.7	**(Lasserre and Labourge, 1974)**
Ebro (Spain)	$112*10^{-7}$	3.05	62.1	0.17	-0.63	6.494	**(Suau and Lopez, 1976)**
Mirna (Croatia)	0.0112	3.05	59.8	0.15	-1.71	6.30	**(Kraljevic and Duleic, 1997)**
Bardawil lagoon	0.0132±SE	3.02±SE	32.1±SE	0.33±SE	-1.33±SE	2.5±SE	**The present study**

Conclusion

The present work was done to estimate the basic parameters required for suggestion some regulatory measurements for management of *Sparus aurata* in Bardawil lagoon fishing.

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الملخص العربي

عمر ونمو أسماك الدنيس بمنخفض البردويل شمال سيناء- مصر

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تم تجميع عدد ٦٨٨ عينة من أسماك الدنيس من مصيد منخفض البردويل خلال موسم صيد ٢٠١٧م. حيث تراوح الطول الكلي من ١٠,٢ إلى ٣١ سم، بينما كان الوزن الكلى ما بين ١٣ إلى ٤٤٢,٥جم. وبدراسة العلاقة بين الطول والوزن وجد ان قيمة a تساوى 0.0132 وb تساوى ٣,٠٢٢٤. وتم تحديد العمر عن طريق قراءة حصاة الأذن ووجد أنها تقع في خمس مراحل عمرية، كما تم حساب معاملات النمو باستخدام معادلة النمو لـ Von Bertalanffy وكانت كالتالي معامل النمو = ٠,٣٣٨ والطول عند مالا نهاية = ٣٢,١، العمر عند الطول صفر = -١،٣٢٤ سنة والوزن عند مالا نهاية = ٥٢٣,٨، وأيضًا تم حساب دليل معامل النمو = ٢,٥. كما تم حساب معاملات النقوق الكلى، الطبيعي والنفوق بالصيد وكانت كالتالي ٠,٧٩٢، ٠,١٥٣ و٠,٥٥٤ على الترتيب، وكان معدل الاستغلال = ٠,٨٠٣. وهذا يشير إلى أن مصيد أسماك الدنيس بمنخفض البردويل يتعرض للصيد الجائر.

الكلمات الإسترشادية: العمر، النمو، أسماك الدنيس، بحيرة البردويل، مصر.