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Identification and Growth of Gilthead Sea Bream (*Sparus aurata*) in Bardawil Lagoon, North Sinai, Egypt

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ABSTRACT

In this study, a total of 1339 specimens of *Sparus aurata* were collected over a nine-month period, from May 2022 to January 2023, from Bardawil lagoon. The present study was conducted to identify and describe the morphological characteristics of *S. aurata* based on the external morphological features such as body shape, color, mouth position and fin arrangement. Also, to study growth pattern of this species collected from. The obtained morphological observations confirmed that the examined specimens were belonging to *S. aurata*. Its total length ranged from 11.4 to 29.9 cm, while its total weight ranged from 19 to 366 g. The length-weight relationship equation was $W=0.0111\ L^{3.0673}$ ($R^2 = 0.9705$). Its age was determined using otolith radius reading technique and the age composition of this species was found to be 5 years. The von Bertalanffy growth parameters were: $K=0.32y^{-1}$, $L_\infty= 30.81$ cm, $t_0= -1.38y$, and $W_\infty = 408.86g$. The estimated growth performance index (φ) was 2.48.

Keywords: Gilthead sea bream, *Sparus aurata*, morphology, growth, Bardawil lagoon.

INTRODUCTION

Bardawil lagoon is a shallow (0.3 - 3 m depth) and hypersaline lagoon on the northern coast of Sinai. It is an important source of an important fish in North Sinai (Mehanna *et al*., 2010). Bardawil lagoon is one of Egypt's most significant lakes, providing high quality fish and serving as an important wildlife habitat. It is regarded as the main ecological and economic natural resource of the North Sinai region (GAFRD, 2001).

The gilthead seabream (*Sparus aurata*) belongs to the family Sparidae, which includes numerous species across several genera. Denis is the most commonly name of *Sparus aurata* fish in Egypt, Aura in Algeria, Orata in Italy and Ajâj in Lebanon as reported by (Linnaeus, 1758). *S. aurata* is considered one of the important fish species along the Egyptian Mediterranean coast and in the Bardawil Lagoon. This species inhabits a wide range of marine environments, from rocky to sandy substrates, occurring at depths between 0 and 500 meters, though it is most frequently found at depths shallower than 150 meters (Abecasis *et al*., 2008).

Family Sparidae has highly similar morphological features and includes species that are recognized for common morphological features such as structure and positioning of the fins and specialized dentition. Therefore, morphological identification can only be achieved by skilled taxonomists (Smith and Smith, 1986). However, even when whole specimens are available, the great similarity between different species of family Sparidae is very confusing, making

it almost very difficult to differentiate between prepared or processed products during examinations (Ibrahim *et al*., 2020). The effectiveness of sustainable fisheries management and biodiversity conservation depends largely on the ability to accurate identification of commercially this important fish species (Nour *et al*., 2025).

The length weight relationship (LWR) plays a crucial role in understanding fish biology. The length and weight of fish are key morphometric parameters that represent valuable tools for taxonomic studies and fish stock assessment. Also, it is important for comparative growth studies (Moutopoulos and Stergiou, 2002; Froese, 1998 and Salem, 2010). However, this relationship can vary across seasons or even within short time intervals (De Giosa *et al*., 2014).

The current work aims to identify and describe the morphological characteristics of *Sparus aurata* and to evaluate its growth pattern through the analysis of the length weight relationship, condition factor and von Bertalanffy growth parameters to assess the status of species in Bardawil lagoon to provide the required information necessary for fisheries management of this important species of *Sparus aurata*.

MATERIALS AND METHODS

Study area:

Bardawil lagoon is in an arid region at El-Arish, North Sinai governorate, Egypt (Fig 1). It is a shallow, highly saline lagoon covers approximately 595 km², with a maximum length of 95 km and a width of up to 22 km. The water depth ranges from 0.5 m to 3 m (GAFRD, 2019). It is in the northern part of the Sinai Peninsula, Egypt, and it is separated from the Mediterranean Sea by a sandbar that varies in width from 100 meters to 1 kilometer. Water currents from the sea drain into the lagoon through two inlets which effect on the hydrographic conditions in this region (GAFRD, 2015).

Fig. (1): Satellite Map of Bardawil lagoon, Egypt.

Sampling:

Over nine months from May to January during 2022 and 2023, random samples of Gilthead sea bream (*Sparus aurata*) were collected. The identification of the specimens was carried out based on external morphological characteristics following the taxonomic descriptions of *S. aurata* by FAO (1984), Carpenter & Niem (2001). The identification relied on general body shape, color pattern, and distinctive external features typical of the family Sparidae. The identification was confirmed visually according to the diagnostic features described in standard fish identification guides, and it was conducted prior to any biological or genetic analysis. Each fish was measured to the nearest mm

for total length and weighed to the nearest 0.1 g total weight.

Length –weight relationship of *Sparus aurata* was determined by power equation (Le Cren, 1951) for combined sexes by using the following equation: $W=aL^b$, where

W= is the total weight in gram, L= is the total length in cm, a &b are constants.

The otoliths were gently removed from the portion directly behind the brain of the bony fish, cleaned and stored dry in labeled vials. Using binocular microscope, the examination and measurement of growth annuli were carried out. 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 the equation of Lee (1920):

$Ln=(Sn/S)\ (L-a) + a$

Where: Ln = is the length at the end of (nth) year.

Sn = is the radius of the otolith to (nth) annulus.

S = is the total radius of the otolith.

L = is the total length at capture.

a=Slop of otolith- length relationship.

The growth parameters were estimated by using the von Bertalanffy growth equation:

$L_t=L_\infty\ (1-e^{k(t-to)})$

Where: Lt = the length at age t . L_∞ (the asymptotic length) = is the mean length the fish would reach if they were to grow to a very old age (indefinitely, in fact).

K = growth coefficient.

t_o = the hypothetical age (in years) the fish would have had at zero length.

For comparing the growth performance of the species with that of the same species in others area, the growth performance index (φ) was computed according to the formula of Pauly and Munro (1984) as follows: $\varphi=Log10\ K+ 2Log10\ L_\infty$

RESULTS

Morphology and distinctive characters

This species is characterized by an oval-shaped body that is relatively deep and laterally compressed. Its head profile is regularly convex and curved, featuring small eyes, scaly cheeks and a scaleless preopercle. The mouth is positioned at the front of the head, pointing forward and a thick Lips. The color is silvery grey on top and gray white on the ventral side. There is a large black blotch at the origin of the lateral line, with black spot on the edge of opercula, bordered below by a reddish area (Fig. 2). A golden band runs across the front of the head between the eyes, bordered by two dark areas (Fig. 3). It has a single dorsal fin with sharp spines and a dark band appears on the fin. The fork and tips of the dorsal fin are edged with black (Fig. 4).

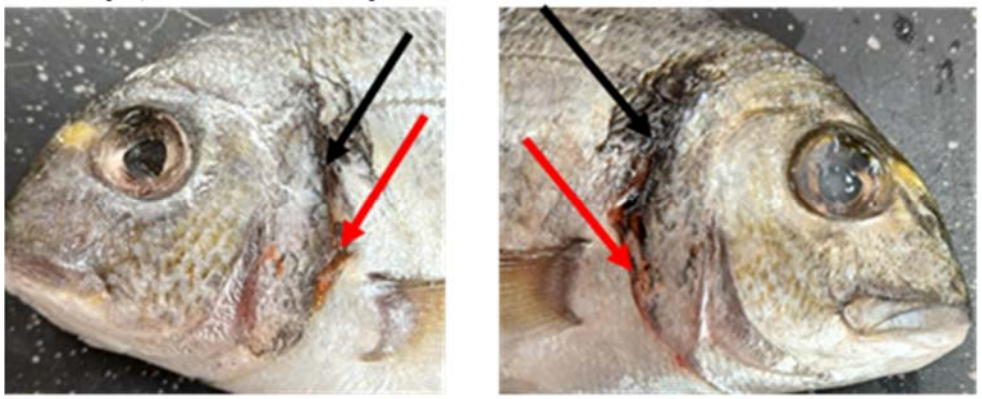

Fig. (2). Black spots on the edge of opercula and the lips are thick.

Fig. (3). Golden bands bordered by two dark areas.

Fig. (4). Dark band on the dorsal fin.

Based on these morphological characteristics, the examined specimens were confirmed to be gilthead seabream (*S. aurata*).

Body length – otoliths radius relationship:

In the present work, the age determination of Gilthead seabream, *Sparus aurata* was based on the otoliths reading for 1339 sample. Age ranged 0 to 5 years. The total length/ otolith radius relationship was presented in Figure (5).

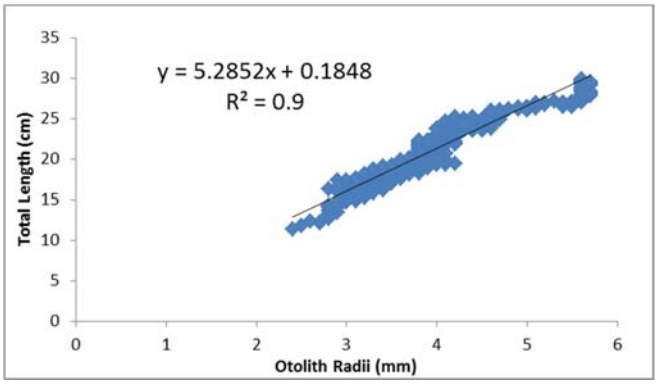

Fig. (5). The relationship between total length (TL) and otolith radius of *S. aurata*.

Length-weight relationship:

In the present study the total length of Gilthead seabream, *S. aurata* varied from 11.4 to 29.9 cm with weights ranging between 19 and 366g. It was used to estimate the Length & weight relationship of gilthead seabream. The length-weight relationship of *S. aurata* was isometric represented by equation: $W=0.0111\ L^{3.0673}$ ($R^2= 0.9705$).

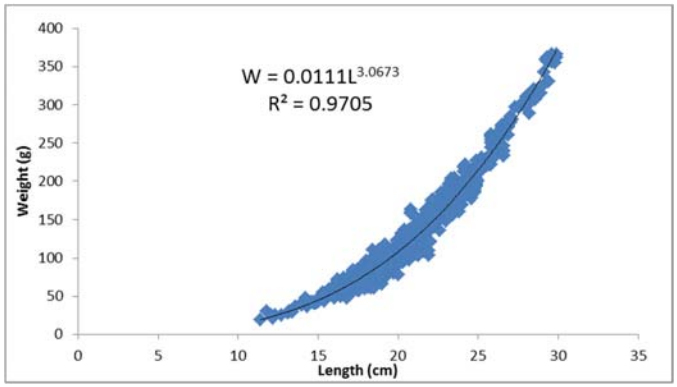

Fig. (6). Length-weight relationship of *S. aurata* from Bardawil lagoon.

Age and growth in length:

Five age groups for *S. aurata* was estimated. The lengths at the end of each year for combined sex were 16.40, 20.32, 23.21, 25.21 and 26.77 cm for the 1st, 2nd, 3rd , 4th and 5th year of life, respectively. The highest increment occurred during the first year of life with rate 61.1%, while a noticeable decrease was observed in the second year, reaching to minimal value during the fifth year of life (Fig. 7).

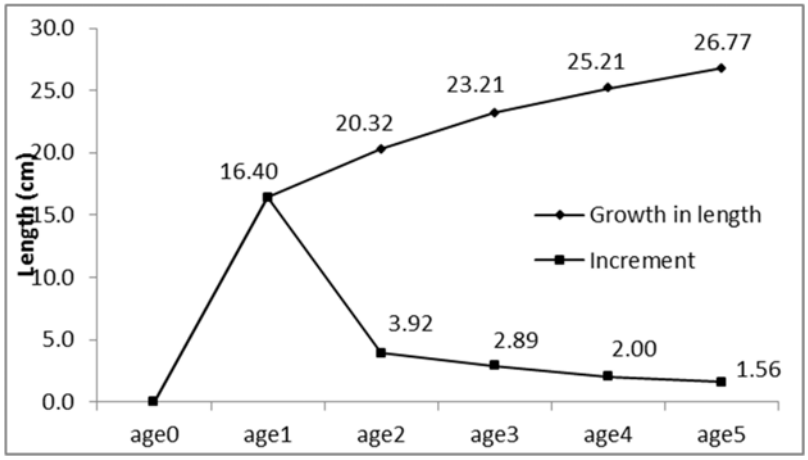

Fig. (7). Growth and annual increment in length of *S. aurata* from Bardawil lagoon

Von Bertalanffy growth parameters:

In the present study, the growth parameters of von Bertalanffy for the Gilthead seabream (*S. aurata*) were as follow: L_∞, K, t_0 and W_∞ values obtained from Ford-Walford method were 30.81cm, $0.32y^{-1}$, -1.38y and 408.8623g, respectively.

The growth performance index (φ) was computed in length and weight for combined sexes of *S. aurata* during season 2022-2023 in Bardawil lagoon using the values of L_∞ and K. φ = 2.48.

DISCUSSION

The study of Sallam *et al.* (2025) confirmed the presence of three species: *Sparus aurata, Diplodus sargus, and Boops boops* in Bardawil Lagoon. The observed morphological characteristics in

the current examined specimens confirmed their identification as gilthead seabream (*S. aurata*). The diagnostic features consistent with the descriptions reported by FAO (1984) and Carpenter & Niem. (2001) such as the deep, laterally compressed body and the distinct golden band between the eyes. Therefore, the present results emphasize the importance of using morphological identification as a primary and reliable tool for species recognition.

The length weight relationship equation showed an isometric value (b = 3); the value of (b) equals 3.0673 cm. These results agree with Chaoui *et al*. (2006) who reported b value equal 3.067 in Mellah lagoon Algeria, Mehanna (2007) who found that the value of (b) equals 3.0284 for *S. aurata* in Port Said fishery and Mokbel *et al*. (2020) who recorded (b) value equal 3.0224 for *Sparus aurata* from Bardawil Lagoon. On other hand, the (b) value in this study was higher than that recorded for *S. aurata* by Akyol and Gamsiz (2011) (2.737) in Gulluk Bay,Turkey. Also, it was higher than that reported for the same species in Bardawil lagoon by Salem (2011) (2.813), Mehanna *et al*. (2014) (2.79) Salem (2019) (2.911). Variations in the length-weight relationship may be interpreted as being due to differences in growth patterns and body morphology across regions (Barnabè, 1976). Variations in the value of b are believed to reflect differences in feeding intensity, overall health condition, and gonadal development stages (Zaher *et al.,* 2015).

The von Bertalanffy growth parameters ($L\infty$, K, and t_0) are fundamental inputs for various models used to assess the status of fishery resources. Additionally, data on size or instantaneous growth rates at different ages provide valuable insights when integrated into theoretical growth models. These models allow for a generalized description and comparison of growth patterns across different species or within the same species at various times and locations. Growth parameters and the growth performance index of *S. aurata* in Bardwill lagoon and different regions were illustrated in Table (1).

Table (1). Growth parameters (L_∞, K and t_0) and the growth performance index (φ) for S. aurat in different places for previous studies.

Stations	L_∞ (cm)	K (y-1)	t_0 (y)	Φ	Authors
Bardawil lagoon	29.4-33.6	0.29-0.87	-	5.79-6.6	**Sara et al., 2024**
Bardawil lagoon	32.16	0.338	-1.324	2.5	**Mokbel *et al*., 2020**
Bardawil lagoon	31.63	0.53	-	-	**Salem, 2019**
Gulluk Bay,Turkey	64.97	0.14	-2.47	2.77	**Akyol and Gamsiz, 2011**
Bardawil lagoon	35.5	0.4	-	2.7	**Mehanna *et al*., 2014**
Bardawil lagoon	36	0.39	-1.68	6.22	**Salem, 2011**
Port Said fishery	38	0.5	0.60	-	**Mehanna, 2007**
Bardawil lagoon	30.81	0.32	-1.38	2.48	**Present study**

The growth parameters vary depending on factors such as species, population, age groups within the same population, maturity, sampling period for the same species, and even sex (Tirasin, 1993 and Mcllwain *et al*., 2005). Therefore, the differences observed in various locations can be considered normal. Generally, fish with a small K value take longer to reach their maximum length, while a higher K value indicates faster growth toward $L\infty$, with a shorter lifespan (Sparre and Venema, 1999). The differences in values are attributed to both internal and external factors. Internal factors include genetic influences, parasites, and diseases, while external factors encompass temperature and food availability also, different techniques used (Effendie, 2002 and El-Desoki, 2020).

Conclusion:

Based on their distinct morphological characteristics, including body shape, coloration, and the golden band between the eyes, the present study confirmed that the examined specimens were *Sparus aurata*. The results also demonstrated that morphological identification remains a reliable and practical approach for distinguishing *S. aurata* from other closely related Sparidae species in the Mediterranean region.

The current study was conducted to estimate the essential parameters required for understanding the biological performance and population structure of this important species. Integrating morphological identification with growth analysis contributes to more effective fishery management and support the conservation of *Sparus aurata* stocks in Bardawil Lagoon.

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تعريف ونمو سمك الدنيس الذهبي (*Sparus aurata*) في بحيرة البردويل، شمال سيناء، مصر

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المستخلص

في هذه الدراسة، تم جمع عدد إجمالي قدره 1339 عينة من سمك الدنيس (*Sparus aurata*) خلال فترة تسعة أشهر، من شهر مايو 2022 حتى يناير2023، من بحيرة البردويل. وقد أُجريت هذه الدراسة بهدف تحديد ووصف الخصائص المورفولوجية استنادًا إلى السمات الشكلية الخارجية مثل شكل الجسم، ولونه، ووضع الفم، وترتيب الزعانف، بالإضافة إلى دراسة نمط النمو لأسماك الدنيس الذهبية المجمعة من بحيرة البردويل، مصر. أكّدت الملاحظات المورفولوجية التي تم الحصول عليها أن العينات المفحوصة تنتمي إلى النوع*Sparus aurata* . تراوحت الأطوال الكلية بين 11.4 و29.9 سم، بينما تراوحت الأوزان الكلية بين 19 و366 جم. وتمثلت علاقة الطول بالوزن فى المعادلة: $W = 0.0111\ L^{3.0673}$ ($R^2 = 0.9705$). وكانت العلاقة مثالية بين الأطوال والأوزان. تم تحديد العمر باستخدام تقنية قراءة حصاة الأُذن، وتبين أن التركيب العمري لهذا النوع يتكون من خمس فئات عمرية. أما معاملات نموذج النمو لفون برتالانفي فقد كانت كالتالي: $K = 0.32\ y^{-1}$, $L\infty = 30.81cm$, $t_0 = -1.38y$ and $W\infty = 408.86g$. وقد قُدّر مؤشر كفاءة النمو (φ) بمقدار 2.48.

الكلمات المفتاحية: الدنيس الذهبي، *Sparus aurata*، الشكل الظاهري، النمو، بحيرة البردويل.