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LENGTH- WEIGHT RELATIONSHIP, CONDITION FACTORS AND GROWTH PARAMETERS OF SPOTTED SEA BASS *Dicentrarchus punctatus* (Bloch, 1792) IN BARDAWIL LAGOON NORTH SINAI EGYPT

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ABSTRACT

Length composition data (Total length, TL) of Spotted Sea bass *Dicentrarchus punctatus)*, landed between January 2020 to December 2021 in coastal waters of Mediterranean coast North Sinai Egypt were monthly used to estimate the population parameters and length weight relationship of females, males and combined sexes ($W = 0.0099\ L^{2.9839}$, $W = 0.0108\ L^{2.9555}$, $W = 0.0099\ L^{2.985}$). The average condition factor was 0.93 and the relative condition factor was 1.0. The relative condition factor (Kn) of kawakawa is 0.98 and low in small-sized fish (10-13 cm TL) then tends to stable in size fish 14-21 cm TL, whereas, and fluctuates in mature fish, it shows a declining trend with increasing length. The highest relative condition factor appears at the upper limit of the 20 cm long class at 1.2, and the lowest occurs at the upper limit of the 34 cm long class at 0.95. Generally, the monthly value shows from 0.94 to 1.23. The growth parameters of von Bertalanffy equation were estimated as $L\infty = 37.36.2$ cm, $K = 0.2371$ year $^{-1}$ and $T_0 = -0.7505$ year^{-1} and $W\infty = 488.96$. This study strongly recommended minimizing the fishing activity in this area. Or use fishing methods that preserve the fish stocks of this species and not catch small fish.

INTRODUCTION

Overall purpose of fisheries science is to provide decision-makers with advice on the relative merits of alternative management **(King, 2007)**. This advice may include predictions of reaction of a stock and fishers to varying levels of fishing effort and, conventionally, include an estimate of the level of fishing effort required to obtain the maximum weight or yield that may be taken from a stock on a sustainable basis **(King, 2007).** For a given level of fishing mortality to be sustainable, there must be a balance between the mortality, which reduces population biomass, and reproduction and growth, which increase it **(Jenning *et al.*, 2000**). Yet understanding the population biology of fish species is essential to meet one of the main objective of fishery science, that of maximizing yield to fisheries, while safeguarding the long-term viability of populations and ecosystem **(Jenning *et al.*, 2000)**. Despite the economic importance of this species, little is known about the biology of this fish. Sea basses (*Dicentrarchus labrax* and *D. punctatus*) are common in the Mediterranean Sea, the Black Sea and along the Eastern Atlantic coasts from Great Britain to Senegal. These species are found in marine to slightly brackish environments such as coastal lagoons and estuarine areas. They are euryhaline and eurythermal species, meaning they have tolerances for wide salinity and temperature fluctuations (**Moretti *et al.*, 1999**). Sea basses are predators, consuming small fish and a large

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variety of invertebrates. In this context, the main objective of this study provides biological reference points and other population dynamics information required for management of Spotted Sea bass *Dicentrarchus punctatus*.

MATERIALS AND METHODS

A total of 3286 samples of Spotted Sea bass *Dicentrarchus punctatus*, collected monthly from Bardawil lagoon, North Sinai, Egypt. Length-frequency (total length) data of *Dicentrarchus punctatus* were collected monthly during January 2020 to December 2021 (Fig. 1). Total length (TL) was taken to the nearest cm for all fish and total weight (TW) of individual fish to nearest 0.01 kg was measured. The samples were mainly caught by gill net method in study area.

The length-weight relationship was estimated for the pooled samples using a simple linear regression model. The relationship between length and weight was described by the potential equation ($W = a L^b$, **Ricker, 1975)**, where W is the total weight (g), and L is the total length (cm), a and b are constants. The condition factor was calculated monthly by formula K=(W * 100)/L3 **(Hile, 1936**), Where: K = condition factor W = weight in gram and L = length in centimeter.

For age determination, the scales were removed from the left side of each fish behind the tip of the pectoral fin for 2050 specimens. In the laboratory, the scales were cleaned and stored dry in envelopes for the subsequent study. Later on, scales were soaked overnight in 10% ammonia solution. 5-7 scales were placed between two glass slides and examined by a projector with 33 x magnifications. On the clearest scale from each batch, the total scales radius as well as the radius of each annulus were measured to the nearest 0.01 cm. Ln=[(L-a)×(Sn/S)] + a (**Lee's, 1920). von Bertalanffy Models, (1934 and 1949)**, ($Lt = L\infty (1- e-k(t – t0))$) was used to describe growth in size, where Lt is the length at age t, $L\infty$ the asymptotic length, K the body growth coefficient and defines the growth rate towards $L\infty$ and t0 the hypothetical age at which a fish would have zero length. The values of $L\infty$, K and t0 were estimated by plotting Lt vs Lt+1 **(Ford, 1933, Walford, 1946).** The growth performance index was calculated by using the phi prime test ($\varphi' = \log k + 2\log L\infty$) **(Munro and Pauly, 1983)** which can be used to compare growth rates among species and to evaluate growth performance under environmental stresses **(Pauly, 1984)**.

Fig. 1. Spotted Sea bass *Dicentrarchus punctatus*) from Bardawil lagoon

RESULTS

Length Distribution

The length frequency distribution of Spotted Sea bass *Dicentrarchus punctatus* in Bardawil lagoon, North Sinai, Egypt is 10.1 to -34.7 cm with major Length were from 14 cm to 22.9 Cm. (Fig. 2). These length groups about 81.9% of the total catch from Spotted Sea bass in Bardawil lagoon. Length at first capture was 17.6 cm (Fig. 3).

Length-Weight Relationship

The length-weight relationship of Spotted Sea bass *Dicentrarchus punctatus* in Bardawil lagoon from January 2020 to December 2021 was estimated as $W = 0.0099\ L^{2.9839}$, $W = 0.0108\ L^{2.9555}$ and $W = 0.0099\ L^{2.985}$ for females, males and combined sexes, respectively where 'W' is the weight of the fish in g and 'L' is total length in cm (Figs. 4, 5 and 6).

Condition Factors

The average condition factor (Kc) of *D. punctatus* was calculated using the total weight of all samples (regardless of sex) with value of 0.95 (Fig. 7,8 and 9). Monthly average values of Kn and Kc for the period from January2020 to December 2021 as calculated from the observed total weight and represented in Table 1. From this table it is obvious that both composite (Kc) and relative (Kn) condition factor follows the same trends of fluctuations in both males and females.

The results showed that the highest values for the case factor were in July 2020 and in June in 2021 and decreased in the following month. Also, results cleared that the lowest values for the case factor were in February 2020 and September 2021 (Table 1).

Condition factor of *D. punctatus* was observed. The relative condition factor (Kn) of kawakawa is 0.98 and low in small-sized fish (10-13 cm TL) then tends to stable in size fish 14-21 cm TL, whereas, and fluctuates in mature fish, it shows a declining trend with increasing length. The highest relative condition factor appears at the upper limit of the 20 cm long class at 1.2, and the lowest occurs at the upper limit of the 34 cm long class at 0.95 (Figs. 7, 8 and 9). Whereas the relative monthly condition factor tends to be stable during the observation process. Generally, the monthly value shows from 0.94 to 1.23 (Table 1). The lowest condition factor occurred0.95 in Feb. 2020 and 0.94 in Sep. 2021 and the highest happened in Jul.2020 (1.23) and in Jun. 2021 (1.14). This phenomenon might cause by environmental factor for example transition period

Age Determination

Age ranged from 0 to 5 years of data for Spotted Sea bass *D. punctatus* and ranged from 10.1 to 34.7 cm as a total length and from 9.5 to 368.4 g as a total weight during from January 2020 to December 2021. The total length - Scale radius relationship in the following equations.

$L = 2.7762x + 5.8844$ ($R^2 = 0.894$) (for females 2020 -2021)

$L = 2.8181x + 5.3509$ ($R^2 = 0.9036$) (for males 2020 -2021)

$L = 2.8153S + 5.5569$ ($R^2 = 0.9004$) (for combined sexes 2020-2021)

Five age groups were estimated for males, females and combined sex of *D. punctatus* during fishing seasons 2020, 2021 and 2020-2021 The lengths at the end of each year is shoen in Table 2.

Back – calculation weights at the end of year of life of *D. punctatus* collected from Bardawil lagoon, North Sinai, Egypt during from January 2020 to December 2021 were estimated by applying the length – weight relationship (Table 3).

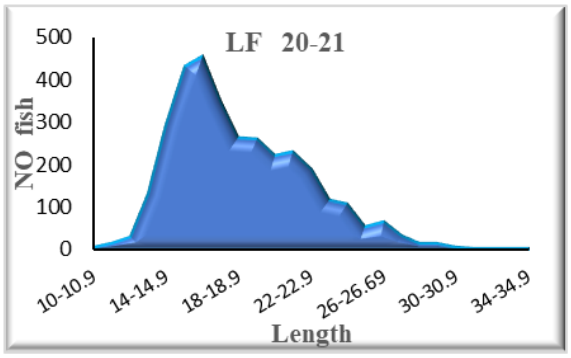

Fig. 2. Length frequency of *D. punctatus* in Bardawil Lagoon during 2020-2021

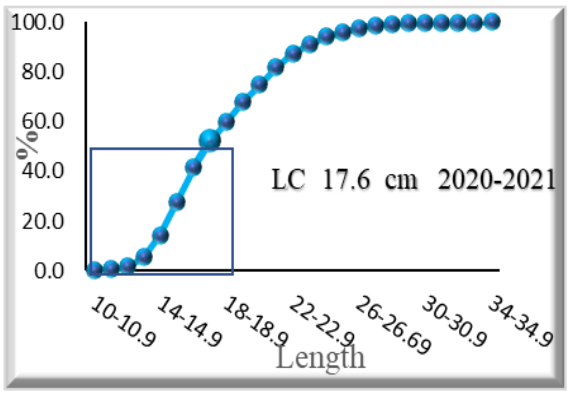

Fig. 3. L_C= 17.4 cm of combined sexes of *D. punctatus* in Bardawil lagoon during 2020-2021

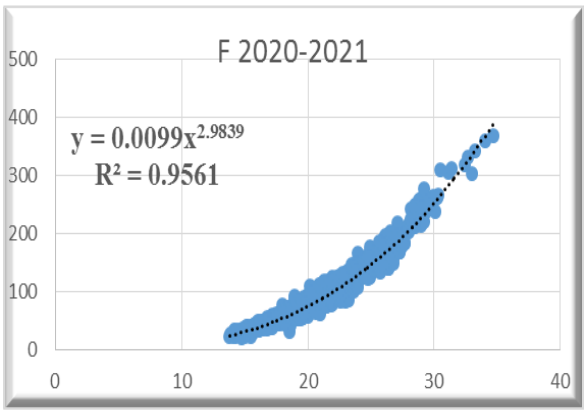

Fig. 4. Length-weight relationship (♀) of *D. punctatus* in Bardawil Lagoon during 2020-2021

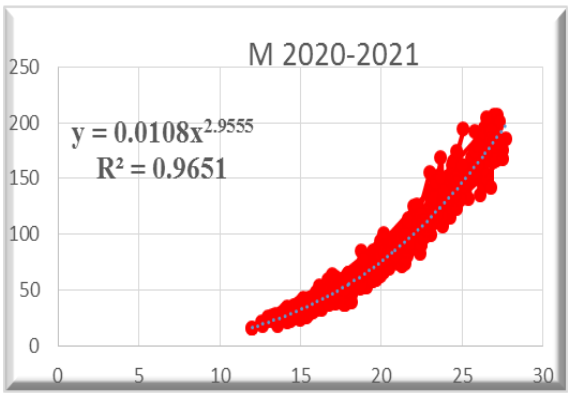

Fig. 5. Length-weight relationship (♂) of *D. punctatus* in Bardawil Lagoon during 2020-2021

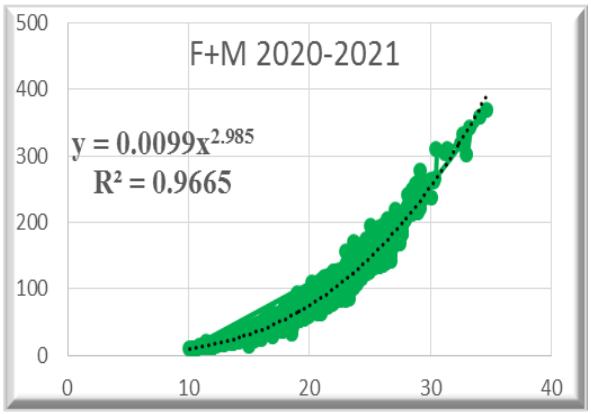

Fig. 6. Length-weight relationship (♀♂) of *D. punctatus* in Bardawil Lagoon during 2020-2021

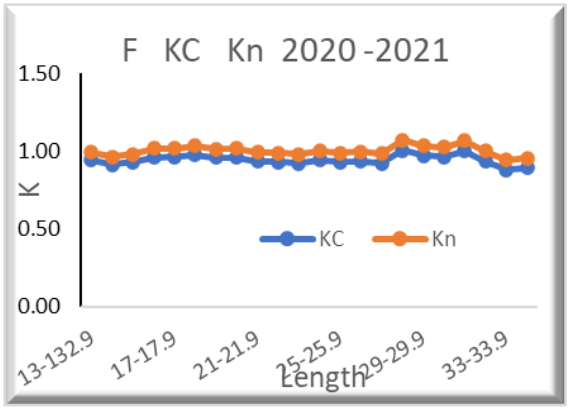

Fig. 7. Average Kc and Kn (♀) of *D. punctatus* in Bardawil Lagoon during 2020-2021

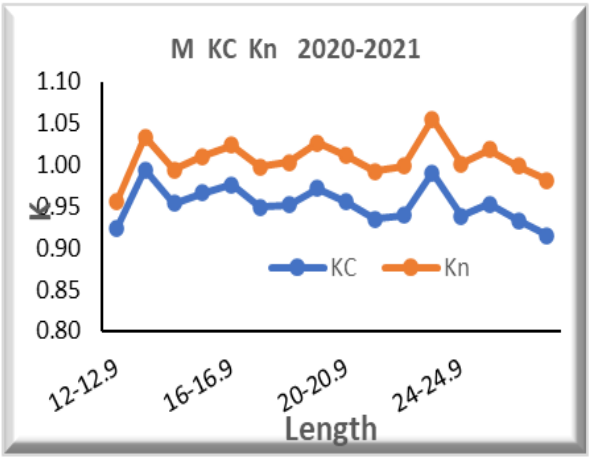

Fig. 8. Average Kc and Kn (♂) of *D. punctatus* in Bardawil Lagoon during 2020-2021

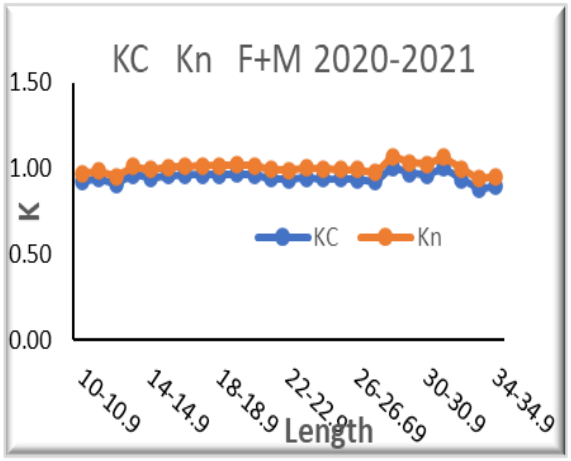

Fig. 9. Average Kc and Kn of combined sexes (♂♀) of *D. punctatus* in Bardawil Lagoon during 2020-2021

Table 1. Monthly variation of the condition factor of (♂, ♀and ♀♂) during 2020 and 2021 of *D. punctatus* in Bardawil Lagoon

Month	2020						2021					
	Female		Male		Combined sex		Female		Male		Combined sex	
	KC	Kn	KC	Kn	KC	Kn	KC	Kn	KC	Kn	KC	Kn
Jan	0.93	1.02	0.97	1.06	0.94	1.03	1.08	1.10	1.12	1.15	1.11	1.13
Feb.	0.86	0.94	0.89	0.97	0.87	0.95	1.05	1.07	1.05	1.06	1.05	1.06
March	0.92	1.01	0.93	1.02	0.92	1.01	1.02	1.04	1.04	1.05	1.03	1.04
April	0.91	1.00	0.93	1.02	0.92	1.00	1.05	1.06	1.13	1.15	1.07	1.08
May	1.01	1.10	1.01	1.10	1.02	1.11	1.10	1.12	1.08	1.10	1.11	1.12
Jun	1.03	1.13	1.07	1.16	1.06	1.15	1.08	1.10	1.23	1.25	1.12	1.14
Jul	1.08	1.18	1.17	1.28	1.13	1.23	1.02	1.04	1.06	1.09	1.04	1.06
Aug.	0.95	1.05	0.98	1.06	0.96	1.04	0.98	1.00	1.00	1.02	0.99	1.01
Sep.	1.00	1.09	1.00	1.10	1.00	1.09	0.92	0.94	0.92	0.94	0.92	0.94
Oct.	0.99	1.08	1.01	1.10	1.03	1.12	1.06	1.08	1.14	1.16	1.08	1.10
Nov.	1.09	1.19	1.06	1.15	1.10	1.20	1.05	1.07	1.10	1.12	1.07	1.09
Dec.	1.04	1.14	1.03	1.14	1.04	1.14	1.00	1.00	1.01	1.00	1.00	1.00
Average	0.98	1.08	1.00	1.10	1.00	1.09	1.03	1.05	1.07	1.09	1.05	1.06

Table 2. Back-calculation length at the end of different life years of males, females and combined sexes of *D. punctatus* in Bardawil Lagoon during 2020-2021

Age	No. of fish	Observed length (cm)	Observed weight (g)	Average back calculated lengths at the end of each year (cm)				
				I	II	III	IV	V
Males (♂)								
0	130	14.9	32.4					
I	200	16.3	42.3	12.1				
II	251	19.7	75.1	12.1	17.4			
III	155	22.7	113.5	11.9	17.5	21.4		
IV	47	24.4	141.9	11.9	17.42	21.4	23.9	
V	10	26.7	174.7	12.2	17.4	21.3	24.9	26
	793	Increment		12.1	5.4	3.9	2.5	2.1
Females (♀)								
0	139	15.8	37.7					
I	276	17.7	54.1	12.6				
II	445	20.8	86.9	12.3	18.2			
III	301	23.1	117.5	12.2	17.5	21.7		
IV	76	25.4	161.2	12.3	18.0	21.6	25.2	
V	20	30.8	281.1	12.4	18.4	22.2	26.2	28.5
	1257	Increment		12.6	5.6	3.5	3.5	3.4
Combined sexes (♀♂)								
0	269	15.4	35.1					
I	476	17.1	49.1	12.3				
II	696	20.4	82.7	12.2	17.9			
III	456	22.9	116.2	12.0	17.4	21.6		
IV	123	25.0	153.8	12.1	17.7	21.5	24.7	
V	30	29.4	245.6	12.3	18.1	21.9	25.8	27.7
	2050	Increment		12.3	5.6	3.7	3.1	3.0

Table 3. Back-calculation weight at the end of different life years of males, females and combined sexes of *D. punctatus* in Bardawil Lagoon during 2020-2021

Age	No. of fish	Observed Length (cm)	Observed weight (g.)	Average back calculated weight at the end of each year (g)				
				I	II	III	IV	V
Males (♂)								
0	130	14.9	32.4					
I	200	16.3	42.3	16.99				
II	251	19.7	75.1	17.27	50.26			
III	155	22.7	113.5	16.44	50.62	91.92		
IV	47	24.4	141.9	16.18	50.27	92.90	127.72	
V	10	26.7	174.7	17.49	50.33	91.40	145.11	164.25
	793		Increment	16.99	33.27	41.65	35.80	36.53
Females (♀)								
0	139	15.8	37.7					
I	276	17.7	54.1	18.9				
II	445	20.8	86.9	17.7	57.0			
III	301	23.1	117.5	17.2	50.5	96.2		
IV	76	25.4	161.2	17.8	55.1	94.7	150.3	
V	20	30.8	281.1	18.2	59.3	102.5	168.4	218.3
	1257		Increment	18.9	38.1	39.2	54.1	68.0
Combined sexes (♀♂)								
0	269	15.4	35.1					
I	476	17.1	49.1	17.8				
II	696	20.4	82.7	17.1	54.4			
III	456	22.9	116.2	16.5	50.2	94.9		
IV	123	25.0	153.8	16.8	52.9	94.0	142.0	
V	30	29.4	245.6	17.6	55.9	99.0	161.8	200.6
	2050		Increment	17.8	36.5	40.5	47.1	58.6

The constants of the Von Bertlanffy Theoretical growth model (L∞, K and t0) calculated by above mentioned methods for males, females and combined sexes of *D. punctatus* in Bardawil lagoon North Sinai during January 2020 to December 2021 from different methods are presented in Table 4.

The theoretical and the back- calculated lengths and weight of combined sexes of *D. punctatus* during 2020 to 2021 the results are given in Figs. 10 and 11. Also, from these figures it clear that there was a good agreement between the mean back calculated and the theoretical calculation.

Estimation Growth Performance Index

Growth performance index (φ) was computed for males, females and combined sexes of *D. punctatus* in Bardawil Lagoon of North Sinai during 2020- 2021 by data of L∞, W∞ and K which estimated by methods of Ford – Walford, Chapman's and Gulland and Holt and the results are given in Table 5.

DISCUSSION

In the present study, the value of (b) for Spotted Sea bass *Dicentrarchus punctatus* was about 2.985 indicating that, the growth in weight for Spotted Sea bass *Dicentrarchus punctatus* in Bardawil lagoon is isometric (The weight follows the cube of length) during fishing 2020- 2021. These results different with the results of Spotted Sea bass *Dicentrarchus punctatus* in Bardawil lagoon from **(Mehanna, 2006)** the value of b was 2.94. The decrease in weight mainly indicated that is greatly influenced by feeding intensity and unsuitability of environmental factors such as salinity of water. These changes will lead to deviation from the isometric growth pattern. **Enin (1994)** mentioned that the parameter b is equal to 3 at isometric growth, when it is less or greater than 3 it is allometric. **Bagenal and Tesch (1978)** mentioned that length-weight relationship 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. The values of (b) can be used to compare the condition of the fish **(El-Sedafy, 1971)**. The value of (b) lying between 1.34 and 3.68 for the different fish stocks **(Hile, 1936)** and ranged between 2.5 and 4 **(Hunts and Jones, 1972)**. The variation may be due to different stages in ontogenetic development, as well as differences in condition, length, age, sex and gonadal development, **Nikolsky (1963)**. Geographic location and some environmental conditions such as temperature, organic matter, quality of food, time of capture, stomach fullness, disease, parasitic loads **Begenal and Tesch (1978)**, temperature, organic matter, quality of food and the water system in which the fish live. **Bilgin *et al*. (2006)** can also affect weight at- age estimates.

The condition factor of Spotted Sea bass *D. punctatus* value ranging from 0.93-1.0 showed that fat or obesity. According to **Effendie (2002)**, whether the fish is good or not can be seen from the value of the condition factor. Condition factor value <1, classified as flatfish, and values 1-3 as fish with a less flat body shape.

This statement is similar opinion to **Ndimele *et al*., (2010)**, the condition factor is a useful index to looking for age, growth rate, and feeding intensity. Then, the feeding intensity and growth rate will explain the age groups are divided to juvenile, immature, mature, and old groups. In addition, the condition factor value can also be affected by density of population, food sex, age, and level of gonad maturity **(Effendie, 2002)**.

Condition factors indicates whether or not fish's weight is good in terms of its physical ability to survive and reproduce **(Effendie, 1997)**. According **(Wujdi, and Suwarso, 2012)**, more than one condition factor value also indicated that the observed fish samples are in good environmental conditions and can be used for consumption.

Table 4. Constant of Von Bertlanffy equation of (♂, ♀ and ♂♀) of *D. punctatus* in Bardawil Lagoon during 2020 to 2021

Sex	Constants of Von Bertlanffy	Ford- Walford Method	Chapman Method	Gulland Holt Method
♂	**L∞**	30.94	30.94	30.96
	K	0.3344	0.3344	0.3306
	To	-0.4758	-0.4758	-0.5011
	W∞	274.55	274.55	275.15
♀	**L∞**	41.94	41.94	42.64
	K	0.1952	0.1952	0.1881
	To	-0.9170	-0.9170	-0.9601
	W∞	687.87	687.87	722.65
♀♂	**L∞**	37.36	37.36	37.61
	K	0.2371	0.2371	0.2324
	To	-0.7505	-0.7505	-0.7804
	W∞	488.96	488.96	498.69

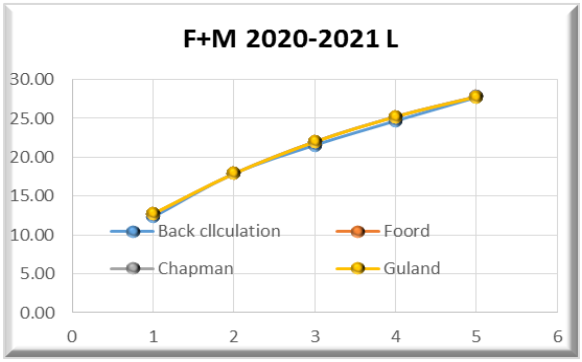

Fig. 10. Theoretical growth in length methods (♂♀) of *D. punctatus* in Bardawil Lagoon during 2020 - 2021

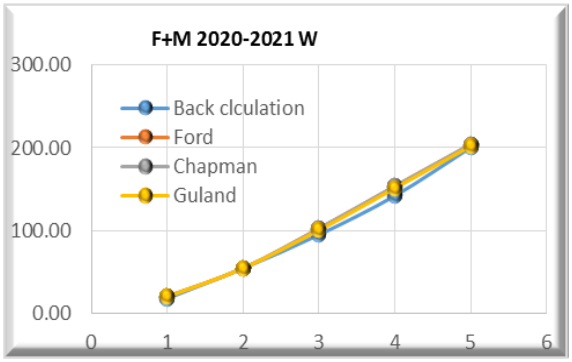

Fig. 11. Theoretical growth in weight methods (♂♀) of *D. punctatus* in Bardawil Lagoon during 2020 - 2021

Table 5. The calculated growth performance indexes by different methods of *D. punctatus* in Bardawil Lagoon during 2020 - 2021

Sex	Method	Ford and Walford	Chapman	Gulland and Holt
Male	length	2.5052	2.5052	2.5010
	weight	0.5179	0.5179	0.5132
Female	length	2.5357	2.5357	2.5341
	weight	0.3722	0.3722	0.3610
Combined sex	length	2.5198	2.5198	2.5168
	weight	0.4232	0.4232	0.4164

Age determination is important tools in fisheries biology, where age, length and weight give an idea on the growth, mortality and exploitation rate of fishes.

According to **Whitney and Carlender (1956)**, the best regression to use is that of body length and scale measurements: y= a+ bx where y is fish length, x is scale measurements, a and b is constant. In the present study, the length scale relationship of Spotted Sea bass *D. punctatus* in Bardawil lagoon during the fishing seasons 2020 and 2021 were found to be linear. The linear equation is given by L=5.5569 + 2.8153x for combined sexes during 2020-2021.

In the present study, the Back – calculation length at the end of different years of Spotted Sea bass *D. punctatus* in Bardawil lagoon during 2020- 2021 was 12.3, 17.9, 21.6, 24.7 and 27.7 cm at age's 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, and 5^{th} respectively. This result was different with **Mehanna (2006)** where they found that, the Back – calculation length at the end of different years of Spotted Sea bass *D. punctatus* in Bardawil lagoon were 20.11, 27.35, 31.67 and 34.05 cm at age's 1^{st}, 2^{nd}, 3^{rd}, and 4^{th}, respectively. In the present study, the growth increment obtained were of Spotted Sea bass *D. punctatus* (combined) in Bardawil lagoon 2020 -2021 was 12.3, 5.6, 3.7 ,3.1 and 3.0 Cm at age's 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} respectively**. Mehanna (2006)** found that the growth increment obtained of Spotted Sea bass *D. punctatus* (combined) in Bardawil lagoon were 20.11, 7.24, 4.32 and 2.38 cm at age's 1^{st}, 2^{nd}, 3^{rd} , and 4^{th}, respectively. The highest annual increment in this study occurred at first year of life, while a noticeable decrease was observed in the second year, reaching its minimal value during the fifth year of life. This result was identifying by previous studies in the same lagoon.

The increasing of weight is very important than increasing of length for fishermen, where the landings are recorded as a weight. The growth in weight of combined sexes valued 17.8, 54.4, 94.9, 142.0 and 200.6 g at the end of 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, and 5^{th} years of life respectively during all 2020-2021. **Mehanna (2006)** found that the back calculated weight were 76.49, 189.18, 291.18 and 360.66, g. for ages 1^{st}, 2^{nd}, 3^{rd}, and 4^{th} years respectively. The growth in the present study was lower than that previous study indicating that, the environmental factors unsuitable during of study period. Also, the growth increment in the present study obtained were of Spotted Sea bass *D. punctatus* (combined) in Bardawil lagoon during 2020 and 2021 was lower.

Recommendations

Must be equal length at first capture (Lc =17.6 CM) with length at first sexual maturity (Lm50) to ensure that 50% of the fish at least has matured and spawn even once before to keep fishing on fish stocks of *D. punctatus* (Lc=Lm50=21.6 cm). The destructive fishing gears such as kalsa and dahbana nets should be banned, meanwhile the technological improvement and biological influence of various fishing methods operating inside the lagoon should be taken into account when we analyse the impact of the fishery on the different fish stocks. The method of fishing and the administration is the biggest contributing factor to the production of fish from Bardawil lagoon.

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الملخص العربي

علاقة الطول والوزن، معامل الحالة وقياسات النمو لأسماك النقط (*Dicentrarchus punctatus*) في بحيرة البردويل شمال سيناء مصر.

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استخدمت بيانات الطول الكلى والوزن الكلى لأسماك النقط *Dicentrarchus punctatus* ببحيرة البردويل شمال سيناء مصر التي تم جمعها شهريا في الفترة من يناير2020 الى ديسمبر 2021 لتقدير علاقة الطول والوزن. ومعامل الحالة والنمو. حيث كانت العلاقة بين الطول والوزن للإناث والذكور والجنسين معا طبقا المعادلات التالية على التوالي (الإناث $W = 0.0099\ L^{2.9839}$) (الذكور $W = 0.0108\ L^{2.9555}$) (الجنسين معا $W= 0.0099\ L\ 2.985$) وكان متوسط معامل الحال 0.95 ومعامل الحال النسبي 1.00. عامل الحالة النسبية (Kn) من *D. punctatus* هو 0.98 وهو منخفض في الأسماك صغيرة الحجم (10-13 سم طول كلى) ثم يميل إلى الاستقرار في الحجم 14-21 سم طول كلى، بينما يتقلب في الأسماك الناضجة، فإنه يظهر انخفاضًا الاتجاه مع زيادة الطول. يظهر أعلى عامل حالة نسبي عند الحد الأعلى للفئة التي يبلغ طولها 20 سم عند 1.2، ويحدث أدنى عامل عند الحد الأعلى للفئة التي يبلغ طولها 34 سم عند 0.95. بشكل عام، تظهر القيمة الشهرية من 0.94 إلى 1.23. قياسات النمو ($L\infty = 37.36$ cm) ($K = 0.2371\ year^{-1}$)، و(t_0: -0.7505)، الطول عند الصيد الأول 17.6 سم، فقد أوصت الدراسة بتقليل نشاط الصيد في هذه المنطقة أو استخدام طرق الصيد التي تحافظ على المخزون من هذه الأسماك ولا يتم صيد الأسماك الصغيرة.

الكلمات الإسترشادية: المرقط *Dicentrarchus punctatus*، العلاقة بين الطول والوزن، العمر، النمو، بحيرة البردويل.

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