Age and Growth of Spotted Sea Bass *Dicentrarchus punctatus* (Bloch, 1792) in the Bitter Lakes, Suez Canal, Egypt

Islam Hassan[1] and Amal El-Feky[2]

[1]Aquatic Hatchery Production Department, Fish Farming and Technology Institute, Suez Canal University, Ismailia, Egypt
[2]Animal Production Department, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt

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Abstract: A total of 397 fish specimens of the Spotted Sea Bass *Dicentrarchus punctatus* (Bloch, 1792) were random sampled monthly during the period from September 2019 to August 2020. They were obtained from fish landing site at Bitter Lakes, which is located along the Suez Canal for studying Length-weight relationships and condition factors. Also, in 2020 455 fish specimens of the Spotted Sea Bass from different fishing sites for studying age and growth. The calculated slope "b" value for length weight relationship reveled isometric growth (b= 3.1331). The maximum life span was four years for length range of 13.1-36.1 cm TL. The parameters of the von Bertalanffy growth function were: For growth in length: $L_t = 37.48\ (1\text{-}exp^{-0.58)\ t + 0.23)})$; For growth in weight: $W_t = 478.30\ (1\text{-}exp^{-0.58)\ t - 0.23)})$. Mean lengths at age were back-calculated for *D. punctatus* as 20.12; 27.36; 31.68 and 34.05 cm at the 1st, 2nd, 3rd and 4th year of life respectively.

Keywords: Family Moronidae, *Dicentrarchus punctatus*, Age and growth, Bitter Lakes, Suez Canal

INTRODUCTION

The Bitter Lakes have an important role as a part of very important waterway; Suez Canal, and as a valuable fishing area (Madkour, 1992). Fisheries activities are considered as food source for people in the area of study and as a source of employment for fishermen. The coast of Bitter Lakes is the principal fishing ground of the Suez Canal, the actual role of the coast as nursery and feeding ground for several commercial fishes (El-Mor, 1993).

The Moronidae are a family of perciform fishes, commonly called the temperate basses, consisting of at least six freshwater, brackish water, and marine species. The members of this family are most commonly found near the coastal regions of eastern North America (including the Gulf of Mexico), northern Africa, and Europe (Nelson, 2006). The family includes the genera *Morone* and *Dicentrarchus*. *Dicentrarchus punctatus* and other species in temperate waters are valued as commercially important (Hureau and Monod, 1978).

The spotted sea bass (*Dicentrarchus punctatus*) is one of the most important commercial fish species in Egypt and it is commonly used in aquaculture. Few authors have studied the biology of the spotted sea bass, *Dicentrarchus punctatus* (Bloch, 1792) (Rafail, 1971; El-Emary, 1987; Sharaf, 1987; El-Mor, 1993, 2002; Mehanna, 2006; El-Shebly, 2009; Ahmed, 2011).

The aim of the present work is to investigate the first time the biology of *Dicentrarchus punctatus* in Bitter Lakes, Suez Canal. These data will be valuable to those who involved in assessment and managements of fisheries and Aquaculture of *Dicentrarchus punctatus*.

MATERIALS AND METHODS

Study area

The Great Bitter Lake 30°20′ N 32°23′ E (Fig. 1) is a saltwater lakes in Egypt, connected to the Mediterranean Sea and the Red Sea via the Suez Canal. It is connected to the Small Bitter Lake, through which the canal also runs.

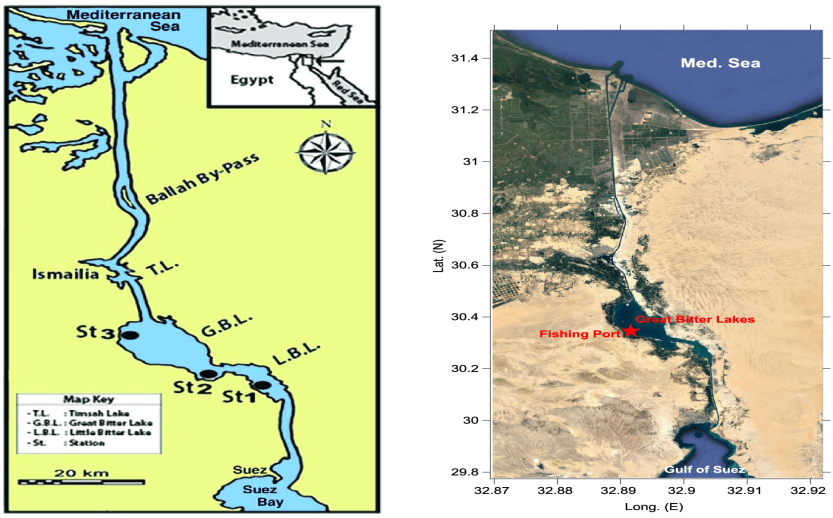


Fig. (1): The Suez Canal and fishing sites on the Bitter Lakes, Suez Canal

*Corresponding author e-mail: amal_elfeky@yahoo.com

In general, the surface sediments of the bottom floor of the Bitter Lakes were sandy-clay to sandy mud. The intertidal zone was mainly rocky from the building structures and jetties along shore line. The sub tidal zone was mainly soft bottom, covered with sea grasses composed of submerged *Halophila stipulacea* and too much lesser extent of *Holodule uninervis*. There was little representation of seaweeds including Chlorophyta as *Caulerpa prolifera* and *Ulva* sp., Rhodophyta as *Laurencia* sp., *Acanthophora* sp. and *Sarconema* sp.

Dicentrarchus punctatus

English name: The spotted Sea Bass (Fig. 2).

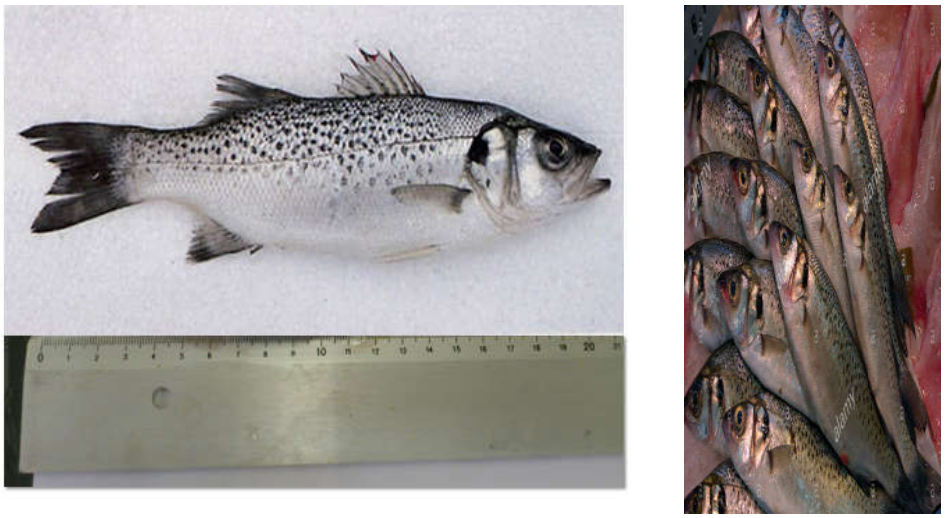


Fig. (2): The Spotted Sea Bass *Dicentrarchus punctatus* (Bloch, 1792)

Field work:

A total of 397 specimens of the Spotted Sea Bass *Dicentrarchus punctatus* were random sampled monthly during the period from September 2019 to August 2020. They were obtained from fish landing sites in Deversior, Fayed and Fanara. On return to the laboratory, the fishes were identified according to (Golani *et al*., 2006).

Biological studies

The morphological measurement:

The fish length was taken using a ruler graduated in mm. each fish was wet weight (T.W) to nearest 0.1 gm.

The length weight relationship was described by the power relation based on (Beckman, 1948; Le-Cren, 1951).

$$W = a\ L^b$$

Where

W= total weight (gm) L= total length (cm) a and b constants

Each fish was dissected and alimentary tract and gonads were removed from the body cavity, then measurement of gutted weight (G.W) to the nearest 0.1 gm. was achieved.

Age and growth

Scales preparation:

Samples of 15 to 20 scales was removed from each fish from beneath the pectoral fin and stored in a labeled envelope to dry. The scales were cleaned in 5% KOH solution to remove adhering- tissues and finally washed in distilled water. The scales were then pressed while drying in order to avoid their curling. After proper cleaning of the scales, the counting of growth rings was performed. The age of the fish was determined using scale Reader in Marine science fisheries Lab. Scales were washed with distilled water and mounted dry between two glasses slides then examined using measuring projector "LEITZ TP 300" connected to an electronic reversible counter LEITZ VRZ U with 2×10 and 4.5×10 zooming. The total radius of each scale and the radius of each annulus were measured to the nearest 0.001 mm. The fish scale was used to determine the age. Scale samples were prepared according to Lagler (1956), which is a common method. In order to determine the age, the annulus determination way suggested by Bagliniere and Loarn (1987), was followed. Regression analyses of scales maximum radius on total length was calculated by the method of least squares. Back-calculated lengths-at-age were computed by using the Lee method (Lagler, 1956).

To assess the overall growth rate of fish the von Bertalanffy growth equation was fitted to the data (King, 2013):

Growth curves, based on biological ages were constructed using the von Bertalanffy growth function as:

$$L_t = L_\infty\ (1 - \exp^{-K)\ t - t0)})$$

Where: L_t =length at time t,

L_∞ = asymptotic length, the theoretical maximum length a fish may grow (cm) $year^{-1}$K = growth coefficient,

t = time and t_0 = age at time zero.

The parameters of the growth curve were fitted using a nonlinear regression in R (King 2013).

Various methods were used to determine the growth parameters. They were; The Von Bertalanffy Growth Formula VBGF in the notation of Beverton and Holt (1959) for length growth.

RESULTS

Length weight relationship

Length-weight relationship for was *Dicentrarchus punctatus* were calculated for total population (Table 1) and represented by the following equation:

$$W = 0.00641 \times L^{3.1331} \text{ (Fig. 3)}$$

n = 397 $R^2 = 0.9918$

L = total length (cm) (22.5 - 44.4 cm)

W =total weight (gm) (119.7 - 821.5 gm)

Table (1): Average empirical, calculated weight and condition factor (K_F) and (K_C), per length groups of 397 *Dicentrarchus punctatus* from Bitter Lake, Suez Canal

Total length (cm)			Aver. Obser.	Cal.	Condition factor	
Range	Average	No. of fish	weight (g) ± S.D.	weight (g)	KF± S.D.	K(C)± S.D.
22.5-24.4	**23.5**	**37**	119.7 ± 17.89	126.6	0.99±0.09	0.72±0.07
24.5-26.4	**25.4**	**28**	156.2 ± 29.65	161.6	1.05±0.09	0.78±0.06
26.5-28.4	**27.6**	**35**	236.5 ± 31.56	209.6	1.11±0.11	0.83±0.09
28.5-30.4	**29.4**	**26**	254.9 ± 33.23	255.5	1.17±0.13	0.91±0.11
30.5-32.4	**31.4**	**57**	296.7 ± 37.34	313.1	1.21±0.16	0.94±0.13
32.5-34.4	**33.7**	**34**	419.3 ± 39.34	391.8	1.23±0.19	0.97±0.18
34.5-36.4	**35.6**	**35**	467.5 ± 43.56	464.3	1.25±0.22	0.99±0.21
36.5-38.4	**37.4**	**26**	550.5 ± 54.23	542.1	1.28±0.28	1.16±0.27
38.5-40.4	**39.4**	**57**	613.6 ± 57.34	638.3	1.30±0.33	1.19±0.29
40.5-42.4	**41.7**	**34**	797.1 ± 61.39	762.7	1.31±0.39	1.22±0.29
42.5-44.4	**43.5**	**28**	821.5 ± 74.39	871.8	1.33±0.42	1.25±0.32

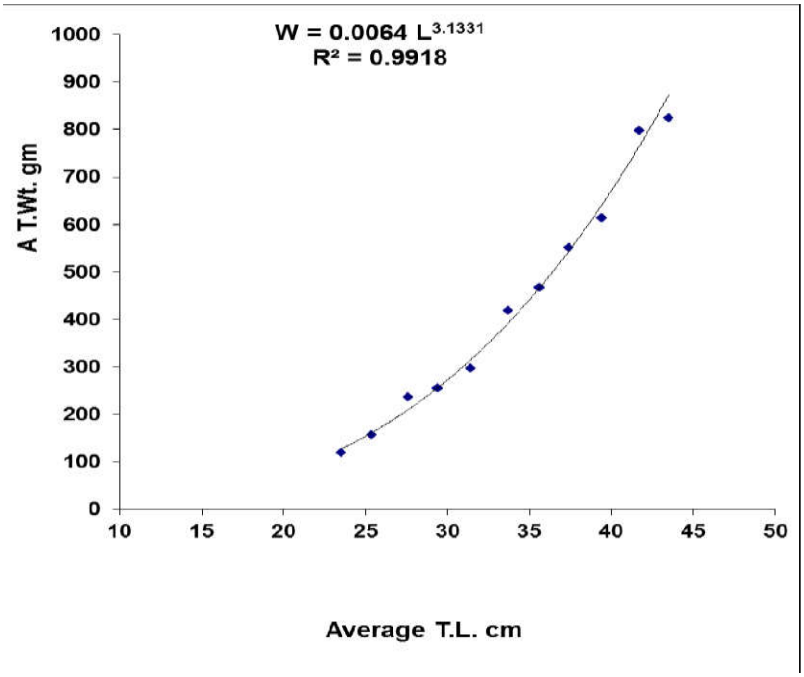


Fig. (3): The relation between average total length (cm) and average total weight (gm) for *Dicentrarchus punctatus* from Bitter Lakes, Suez Canal

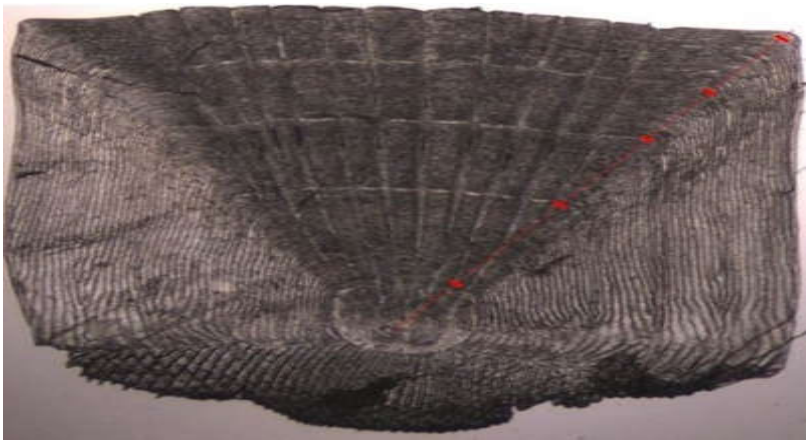
The equation showing highly satisfactorily fit agreement between the averages of observed and calculated weights for each length group (Fig. 3).

The calculated slope "b" value for length weight relation was isometric growth (b = 3.1331).

Age and growth

Back-calculation and Growth in length

Mean lengths at age were back-calculated for *D. punctatus* were 20.12; 27.36; 31.68 and 34.05 cm at the 1st, 2nd, 3rd and 4th year of life, respectively. The observed (empirical) lengths were consistently higher than the back-calculated lengths for individual - age groups, indicating that seasonal growth had occurred since formation of a new annulus .Differences between back-calculated lengths-at-age and observed lengths were in the range of observed seasonal growth (Table 2) and (Fig. 5). Greatest incremental growth in TL occurred during the first year and then declined rapidly thereafter (Fig. 4).



(Fig. 4): The maximum life span was four years

Table (2): Back-calculated lengths (cm) and weights (g) at the end of each year of Life for *Dicentrarchus punctatus* from Bitter Lakes, Suez Canal

Age (yr)	No. of fish	Empirical length	Back-calculated length (cm)				Calculated weights (g)			
			1	2	3	4	1	2	3	4
I	**233**	**21.76**	20.12				76.5			
II	**124**	**28.84**	20.02	27.36			75.39	189.2		
III	**76**	**32.29**	19.89	27.22	31.68		73.95	186.6	291.4	
IV	**22**	**34.55**	19.84	27.09	31.56	34.05	73.41	183.9	288.1	360.7
Increment			20.11	7.24	4.32	2.38	76.49	112.7	102.2	69.3
%			66.53	22.18	2.00	9.29	21.21	31.24	28.33	19.22

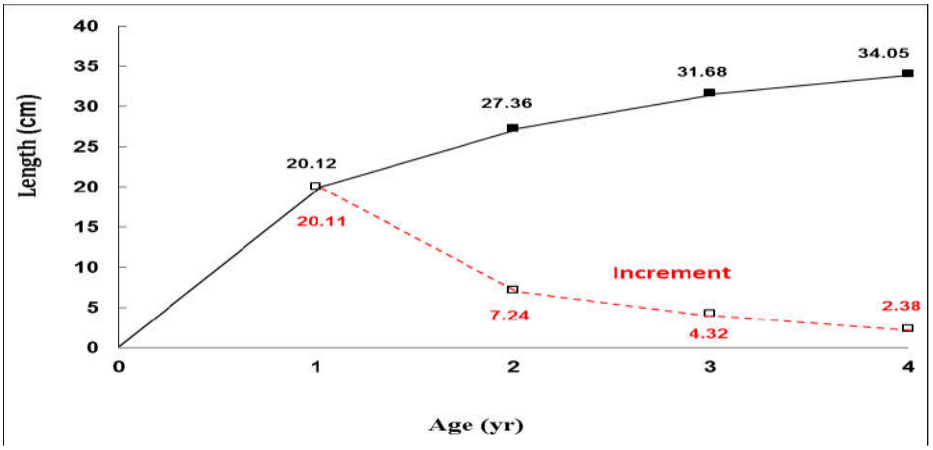


Fig. (5): Growth in length and growth increment of *Dicentrarchus punctatus* in Bitter Lakes, Suez Canal

Growth in weight

The calculated weights by age groups were 76.5, 189.2, 291.4 and 360.7 g for the 1st, 2nd, 3rd and 4th year of life respectively. The growth rate in weight was much slower during the first year of life increasing to reach its maximum at the end of the second year of life, then decreasing with further increasing in age (Fig. 6).

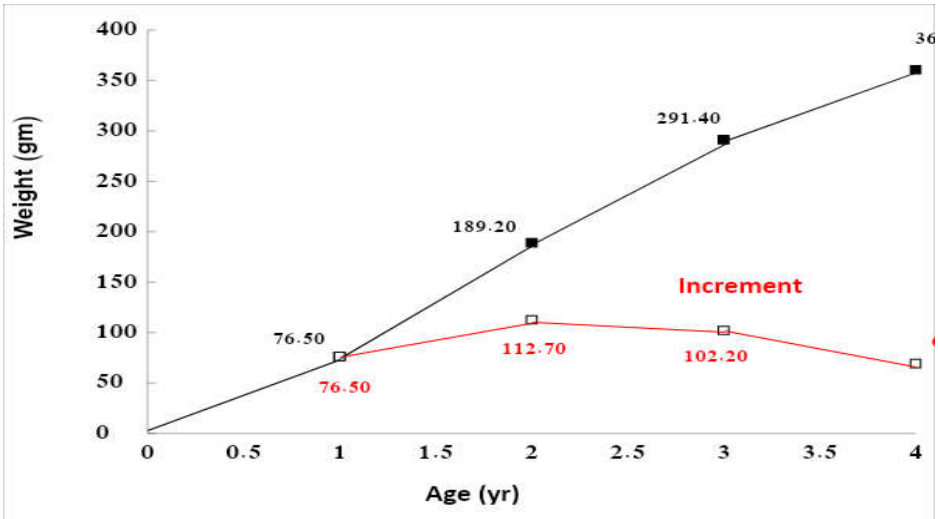


Fig. (6): Growth in weight and growth increment of *Dicentrarchus punctatus* in Bitter Lakes, Suez Canal

Growth parameters

The von Bertalanffy growth parameters (L_∞ and K) were as follows:

For growth in length: $L_t = 37.48\ (1 - \exp^{-0.58)\ t + 0.23)})$

For growth in weight: $W_t = 478.30\ (1 - \exp^{-0.58)\ t - 0.23)})$

DISCUSSION

There are a few of published works on length-weight relationship of the spotted sea bass *Dicentrarchus punctatus* (Rafail, 1971; Goncalves *et al*., 1997; El-Mor, 2002; Erguden and Turan, 2005; Mehanna 2006; Shalloof *et al*., 2019). A number of factors are known to influence the length weight relationship in fishes including growth phase, sex, size range, temperature and preservation techniques (Clark (1928). Beckman (1948) mentioned that the coefficients of length- weight relationship were different not only between species but sometimes also between stock of the same species due to sex season and maturity stage. Rafail (1971), stated that b = 3.188 (isometric growth), for the same species studied in the present work, in Egyptian Mediterranean water. The length weight relationship for *D. punctatus* in Portugal coast, was described by the following parameters a = 0.0093 and b = 3.440 (Goncalves *et al*., 1997).

El-Mor (2002) stated that b = 3.231 (isometric growth) for *D. punctatus* in Port Said coast on Mediterranean Sea. Mehanna (2006) concluded that "b" value (2.9448) is isometric growth for *D. punctatus* in Bardawil Lagoon. Shalloof *et al*. (2019) concluded that "b" value (3.0067) is isometric growth for *D. punctatus* in Bardawil Lagoon, North Sinai, Egypt. These results were found to be close to the data obtained in the present work.

In the present study, a total of 455 specimens of the spotted sea bass were collected during 2020. The maximum life span was four years for length range of 13.1-36.1 cm TL. The parameters of the von Bertalanffy growth function were:

For growth in length: $L_t = 37.48\ (1 - \exp^{-0.58)\ t + 0.23)})$

For growth in weight: $W_t = 478.30\ (1 - \exp^{-0.58)\ t - 0.23)})$

Mean lengths at age were back-calculated for *D. punctatus* as 20.12; 27.36; 31.68 and 34.05 cm at the 1st, 2nd, 3rd and 4th year of life respectively. The observed (empirical) lengths were consistently higher than the back-calculated lengths for individual - age groups, revealing the seasonal growth had occurred since formation of a new annulus .Differences between back-calculated lengths-at-age and observed lengths are in the range of observed seasonal growth. Greatest incremental growth in TL occurred during the first year and then declined rapidly thereafter. The calculated weights by age groups were 76.5, 189.2, 291.4 and 360.7 g for the 1st, 2nd, 3rd and 4th year of life respectively. The growth rate in weight was much slower during the first year of life increasing to reach its maximum at the end of the second year of life, then decreasing with further increasing in age. The same finding was recorded in the previous studies (Mehanna, 2006; Ahmed, 2011; Shalloof *et al*., 2019).

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العمر ومعدل النمو لسمكة النقط في البحيرات المرة وإمكانية تغذية الصغار على مجافيات الأقدام

إسلام حسن & أمال الفقي

تعتبر عائله المورونيدى Family Moronidae من العائلات السمكية الهامة في شرق البحر المتوسط وقناة السويس من ناحية مصائدها أو إنتاجيتها من الاستزراع البحري. توجد اسماك هذه العائلة في معظم بحار ومحيطات العالم خاصة في مياه البحر المتوسط. قناة السويس. تنتمي سمكة النقط The spotted Sea bass إلى عائلة المورونيدى والتي تعيش في المياه المالحة والمياه الشرب في أعماق اقل من ٣٠ متر. تعيش هذه الأسماك في المياه الشبه الاستوائية بداية من سواحل بريطانيا إلي شمال الساحل الإفريقي المطل على البحر المتوسط وجزر الكناري وتمتد إلى قناة السويس والبحيرات المصرية. تهدف الدراسة إلى دراسة بعض الصفات البيولوجية لسمكة النقط خاصة العلاقة بين الأطوال والأوزان. ولتحقيق هذا الهدف تم تجميع عدد ٣٩٧ عينه من اسماك النقط من محطات تجميع الأسماك في الدفرسوار وفايد وفناره على ضفاف البحيرات المرة – قناة السويس في الفترة من سبتمبر ٢٠١٩ إلى أغسطس ٢٠٢٠م. وبدراسة العلاقة بين طول ووزن السمكة مثلت بعلاقة خطيه بالمعادلة التالية:

$$W = 0.00641 * L^{3.1331}$$

$n = 397$ $R^2 = 0.9918$

L = total length (cm) (22.5 - 44.4 cm)

W =total weight (gm) (119.7 - 821.5 gm)

وكانت قيمه b مثاليه ٣.١٣٣١ ومعامل الارتباط عالي ٠.٩٩١٨

كما تم دراسة العمر والنمو لعدد ٤٥٥ عينه اسماك تم تجميعها خلال عام ٢٠٢٠ م وكان أقصى عمر للسمكة أربعة أعوام للأطوال من ١٣.١ إلى ٣٦.١سم طول كلى. ومعامل النمو للسمكة محل الدراسة قد مثل بالمعادلات التالية:

For growth in length $L_t = 37.48\ (1 - \exp^{-0.58)\ t + 0.23)})$

For growth in weight $W_t = 478.30\ (1 - \exp^{-0.58)\ t - 0.23)})$

وكان متوسط الطول المحسوب لسمكة النقط كما يلي: **20.12**سم في العام الأول، ٢٧.٣٦سم في العام الثاني، ٣١.٦٨سم في العام الثالث و ٣٤.٠٥سم في العام الرابع وكان متوسط الوزن المحسوب لسمكة النقط كما يلي: **76.5**جم في العام الأول، ١٨٩.٢جم في العام الثاني ٢٩١.٤جم في العام الثالث و ٣٦٠.٧جم في العام الرابع. وتوصى الدراسة بعدم صيد سمكة النقط في فصل الشتاء لإعطاء الفرصة لإتمام موسم التكاثر وتنمية مصائده.