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LENGTH-WEIGHT RELATIONSHIP, SEX RATIO AND CONDITION FACTOR OF BLUE SWIMMER CRAB (*Portunus pelagicus*) IN BARDAWIL LAGOON, EGYPT

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ABSTRACT

More than 1085 ton from blue swimmer crab (BSC) annually captured from the fisheries of the Bardawil Lagoon waters. since the last 30 years, an increasing has been witnessed in the production of this species (the production recorded 2100 ton in 2009). For management purposes, information about the fishery's biology and population structure is required. Hence, monthly samples of P. pelagicus were collected from the commercial catch of Tlul Bardawil Lagoon, Egypt during the period from May to December 2021. A number of 6441 specimens were measured for morphometric relationships, sex ratio, age determination using carapace width frequency, population structure, mortality rate and exploitation ratio. The study revealed that P. pelagicus was targeted by trawl net (kalca) small bottom trawler as a by-catch and trammel nets. Carapace width- total weight relationship showed positive allometric growth (b-value= 3.1866). Higher condition factor was observed in the Carapace width 8 cm. Four age groups were determined and age group +II was dominant by number (55.0%). Parameters of the von Bertalanffy equation were 16.28 cm, 1.4 year^{-1}, and -0.0988 year^{-1} for CW∞, K and to, respectively. The carapace width at first capture was estimated (CW50 = 9.5 mm). The mortality rates were calculated as 7.91, 2.45 and 5.46 year-1 for total, natural and fishing mortalities, respectively. The blue swimmer crab fisheries on the Bardawil Lagoon is over-exploited (E= 0.69). Some management measures were suggested to maintain its stock for sustainability.

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INTRODUCTION

Blue swimmer crab (BSC), *Portunus pelagicus*, is a tropical species belonging to family Portunidae and is found in estuaries and inshore marine waters. It is widely distributed in the Indian and the Pacific oceans (**Svane and Hooper, 2004**). *P. pelagicus* is one of the most commercially important crabs along the Egyptian coast and has a great demand for their esteemed food delicacy and also supporting the value of fishery **(Redzuari *et al.*, 2012**). Due to the high demand in local market, the blue swimmer crab is heavily exploited and rapidly decreasing in the population size **(Kunsook *et al.*, 2014).** It can be found in different water depths across many countries in Asia, Australia and Africa **(La Sara *et al.*, 2017).** The blue swimmer crabis a large commercially valuable crab found within tropical and subtropical regions of the Indo-West Pacific. Over 80 species are encountered under the genus Portunus worldwide **(Stephenson, 1972**).

Globally, it was estimated that *P. pelagicus* contributed with about 0.4% (298000 ton) of the world total capture production, representing about 5.0% of the global crustacean fisheries **(FAO, 2020**).

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Notably, few studies have been conducted on the fisheries' biology of crab in Bardawil lagoon. Therefore, this study was focused to determine the biological characters and population structure of *P. pelagicus*. to enrich the literature with information required for the implementation of a sustainable policy for the welfare of the blue swimmer crab' fishery in Bardawil Lagoon waters

MATERIALS AND METHODS

Study area Bardawil Lagoon is a small, hyper saline lagoon in an arid area, located in the middle of Sinai's Mediterranean coast, from a point about 45 km east of Port Said and extending to a point 20 km west of Al-Arish. The total surface area of the lagoon of about 550 km² with a maximum length, along the east-west axis, of 90 km and a maximum width, along the north-south axis, of 22 km. The water depth ranges from 0.5 m to a rather rare 3 m. The lagoon is separated from the Mediterranean Sea by an arc-shaped sedimentary bar of about 100 m long, with a maximum width of 1 km **(Mehanna and El-Aiatt, 2011**).

The others are mainly outlets from the lagoon. The bottom of the lagoon is sandy along its shores, silt-muddy in the deepest part. The rest of the area is composed of muddy-sand substrate (**Tom *et al.*, 1984**). The salinity is 38.2-57.4 ppt and the water temperature ranges from 13.2^{o}C in January to 30.1^{o}C in June (**Mosbh, 2013**). The fishery is seasonal, starts from the beginning of May to the end of December.

Random samples of blue swimmer crab, *Protunus pelagicus* were monthly collected from the commercial catch of trammel nets at Tlul area in the Bardawil Lagoon during the period from May to December 2021. A number of 6441 blue swimmer crab, *Portunus pelagicus* (BSC) specimens were measured for morphometric and biological estimations. For each specimen, the carapace width (CW), carapace length (CL), were measured using digital caliper to the nearest 0.1 cm, while the total body weight (Wt) was recorded to the nearest 0.1 g.

The condition factor (K) is calculated by the following formula: K= 100 W /CW^3 **(Le Cren, 1951)**.

The values of CW∞ (Theoretical maximum expected carapace width) and K (Coefficient of growth) were estimated from the linear regression between (CWt) and (CWt+1) using the least square method (**Ford, 1933)** as follows: CW∞ = a / (1- b), and K = - ln b, where; a and b are the intercept and the slope of the regression, respectively to (age at CW zero) is estimated according to the method of **Pauly (1984**) where; to = To = t + 1/k Ln (L∞ - Lt)/L∞. The growth performance index, ϕ(=log K+2 log L∞). Depending on ELEFAN 1 using carapace width frequencies, FISAT II (**Gayanilo *et al.*, 2005**) program was applied for age determination. Total mortality (Z) was estimated from length-converted catch curve. Natural mortality (M) was calculated according to **Pauly (1983**); in (M) = - 0.0152 - 0.279 ln (L∞) + 0.6543 ln (K) + 0.463 ln (T) where; T is the water temperature. Fishing mortality is estimated by the successive equation: (F) = Z- M. Relative yield and biomass per recruit and the virtual population analyses were evaluated using FiSAT II program. Carapace width at first capture (CW50) was assessed using the accumulation proportion curve (**Pauly, 1985**).

RESULTS

Random samples of blue swimmer crab, *Protunus pelagicus* 6441 specimens (2928 males and 3513 females) were collected from the commercial fisheries of Bardawi Lagoon, during the period from May to December 2021. The blue swimmer crab carapace width ranged from 4 to 15.5 cm (males; from and combined sexes). For males, the total weight ranged from 2.5 to

241.0 g, and for females the total weight ranged from 1.5 to 237.0 g.

Carapace Width Frequencies

Figs. 1 and 2 shows the carapace width frequencies' distribution of blue swimmer crab in Bardawil Lagoon catch. The peak was recorded at a length of 9.0 cm, and the number of males were greater than the females at this carapace width and the male's agreement with females at carapace width 5 cm but the females were greater than the males at carapace width 6,8,10 and 14 cm. On the other hand, monthly frequencies' distribution was recorded for males and females during 12 subsequent months. In all samples, males' frequencies were relatively higher than those of females except in June, July. Aug. and December.

For each specimen, the carapace width (CW), total weight (Wt) and carapace length (CL), Table 1 and Fig. 3 showing that the relationships between the carapace width and other measurements and the best regression.

***Carapace width (CW) – total weight (W) relationship: the relation is represented by a power regression as follows:

Females: $TBW=0.0502\ CW^{3.1653}$ $R^2 = 0.9609$

Males: $TBW = 0.0445CW^{3.2117}$ $R^2 = 0.963$

Combined sexes: $TBW = 0.0475CW^{3.1866}$ $R^2 = 0.9617$

***Carapace Length (CL) – total weight (W) relationship: the relation is represented by a power regression as follows:

Females: $TBW = 0.3006CL^{3.0151}$ $R^2 = 0.9168$

Males: $TBW = 0.2671CL^{3.0411}$ $R^2 = 0.9182$

Combined sexes: $TBW = 0.2857CL^{3.0253}$ $R^2 = 0.916$

***Carapace width (CW) - carapace length (CL) relationship: the regression was represented by the following equations;

Females $CW_{(cm)} = 1.5217\ CL_{(cm)} + 0.5637$ $R^2 = 0.9495$.

Males $CW_{(cm)} = 1.4954CL_{(cm)} + 0.5549$ $R^2 = 0.9603$

Combined sexes $CW_{(cm)} = 1.5093\ CL_{(cm)} + 0.562$ $R^2 = 0.9531$

Condition Factor

For male, the condition factor was ranged from 4.48 to 8.50 with an average of 6.80. On the other hand, the condition factor of females ranged from 4.67 to 8.46 with an average of 6.99. In whole sample, the average condition factor of *P. pelagicus* in the Bardawil Lagoon was 6.91 during fishing season 2021 (Fig. 4).

Monthly variation in condition factor (Fig. 5): lower K-values (7.65) for males, 8.0 for females and 8.19 for combined sex) were recorded during Sep. Jun. and Jun, respectively, will higher values be recorded (9.89, 9.79 and 9.66 for males, females and combines sex respectively) during in Dec., May and May, respectively.

Age Determination

Using FISAT II program based on carapace width frequencies, four age groups were determined in BSC in the present study. About 20.3% of the total crab number (2.5% of the sample weight) was belonging to age group (I+) with individuals 5.07 cm carapace width. Age group (II+) represented by about 55.0% of sample individuals (45.3% of the sample weight) average carapace width 9.24 cm. Age group (III+) average carapace width 11.98 cm that represented by 18.0% of crab number (34.0% of the sample weight). Age group (IV+) was represented by 6.6% of crab number (18.2% of the sample weight) and was average carapace width 13.5 cm. The average weights of age group (I+), group (II+), group (III+) and group (IV+) were 8.38, 65.47, 129.81 and 189.94 g, respectively. The growth parameters were estimated; Sympathetic carapace width ($CW\infty$) = 16.28 cm, growth coefficient (K) = 1.4 $year^{-1}$, age at zero size (to) = -0.0988 $year^{-1}$ and $W\infty$=344.9 g. Growth performance index, ϕ =2.567.

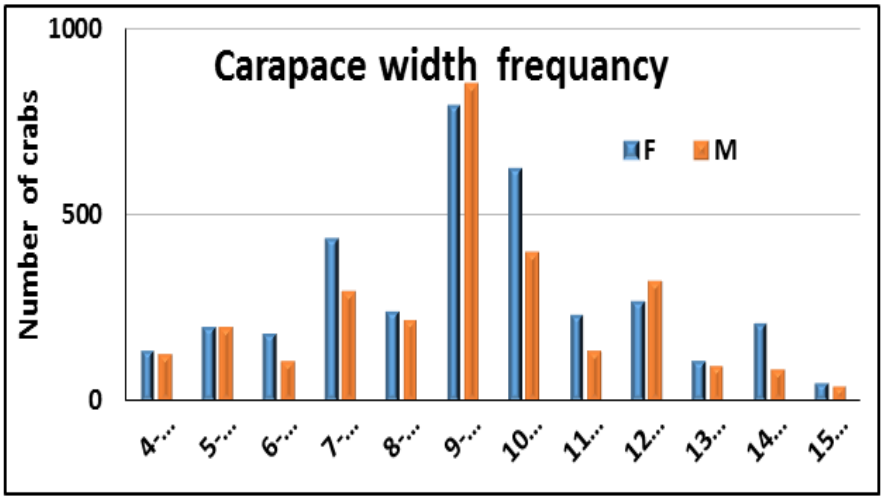

Fig. 1. Carapace width frequencies of females and males of blue swimmer crab in Bardawil Lagoon catch during 2021

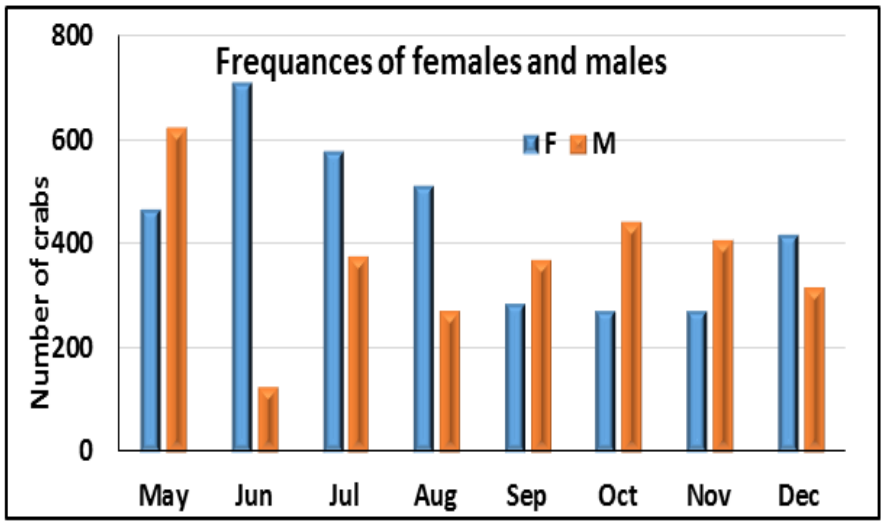

Fig. 2. Monthly frequances of females and males of blue swimmer crab in Bardawil Lagoon catch during 2021

Table 1. Relationship constants [W = a cw^b] between weight and carapace width (CW) and [W = a cL^b] between weight and carapace length (CL) for the blue crab caught in Bardawil Lagoon (2021)

	TBW = a CW^b			TBW = a CL^b			TBW= a+ b cL		
	Power equation			Power equation			Liner equation		
	a	b	R^2	a	b	R^2	a	b	R^2
Females	0.0502	3.1653	0.9609	0.3006	3.0151	0.9168	0.5637	1.5217	0.9495
Males	0.0445	3.2117	0.963	0.2671	3.0411	0.9182	0.5549	1.5954	0.9603
Combined	0.0475	3.1866	0.9617	0.2857	3.0253	0.916	0.562	1.5093	0.9531

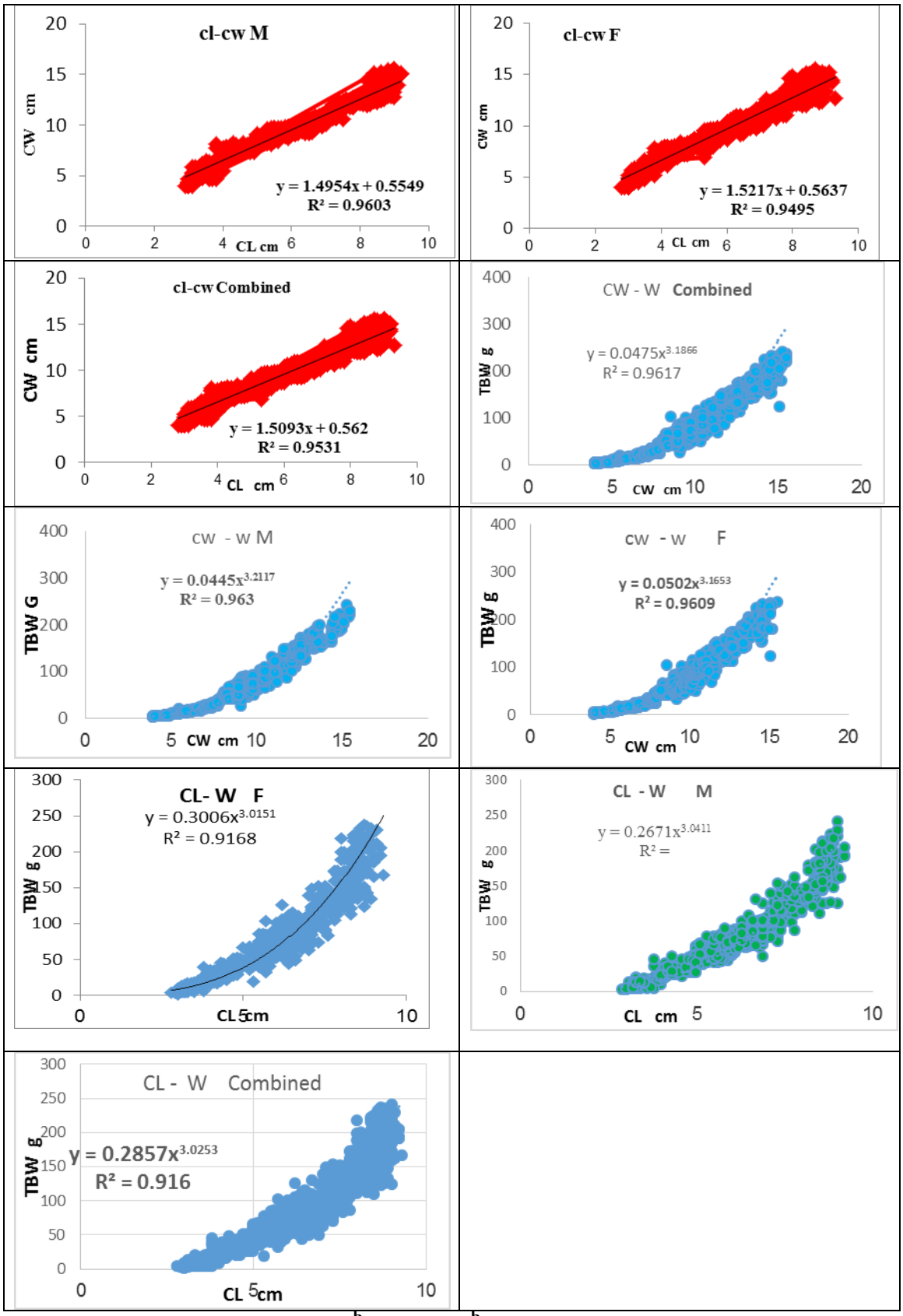

Fig. 3. The Relationships [W=a cw^{b}] [W=a cL^{b}] CW cm= a+CL for the blue crab caught in Bardawil Lagoon during 2021

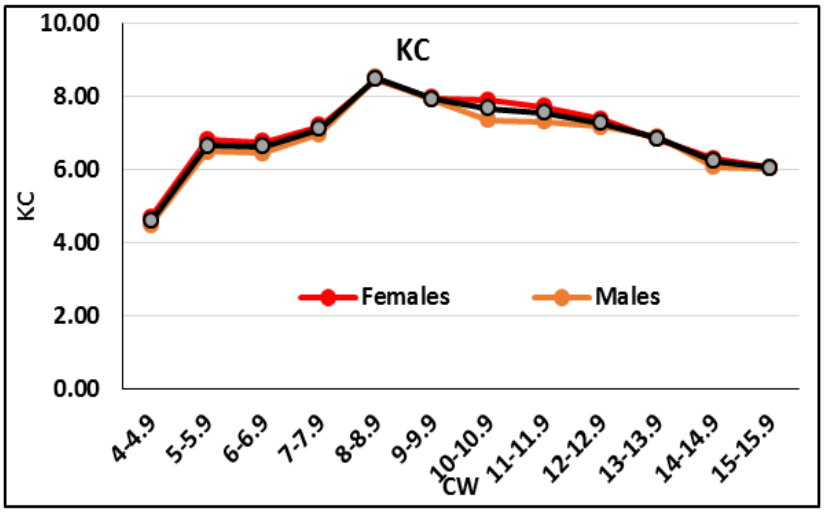

Fig. 4. The average condition factor for the different carapace width groups for females, males and combined sexes in Bardawil Lagoon during 2021

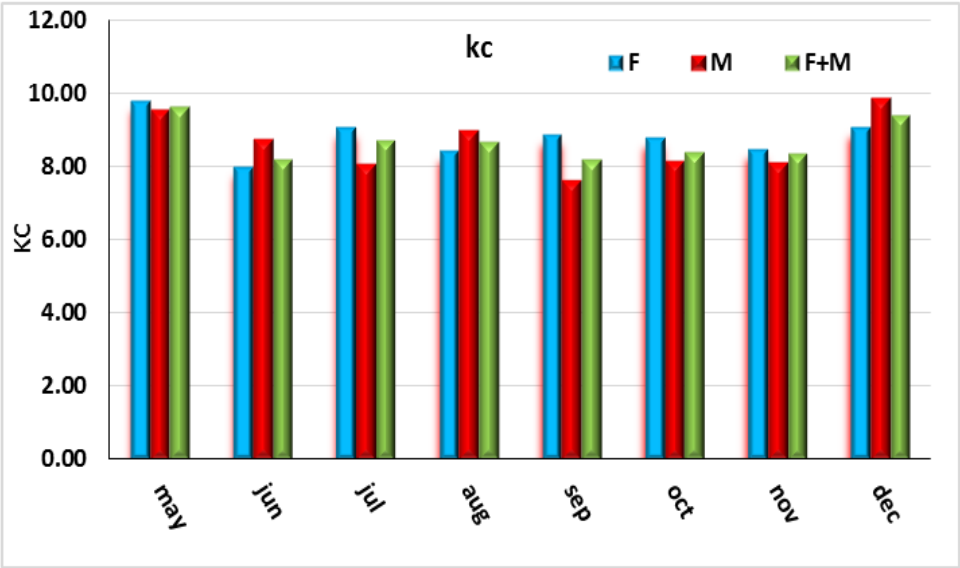

Fig. 5. Bimonthly means of the condition factor Kc for females, males and combined sexes of *P. pelagicus* captured from Bardawil Lagoon during 2021

Population Structure

Population parameters of blue swimmer crab in Bardawil Lagoon were determined using random sample of 6441 specimens with 4, 15.5 and 9.55 cm minimum, maximum and average of carapace width respectively. Carapace width at first capture (CWc) was estimated from the catch cumulated carve as 9.5 cm. The total mortality (Z) was estimated from length converted catch curve (Fig. 6) based in age as 7.91 year^{-1}. The nature mortality (M) was estimated from **Pauly (1983)** equation using the growth parameters (CW∞ and K) and average water temperature (T= 23.5 C$^{\circ}$) as 2.45. The fishing mortality (F) calculated to be 5.46 year^{-1} and the exploitation ratio (E) was 0.69 (over-exploited). Blue swimmer crab catch in the Bardawil Lagoon was 1089 MT during the period of study and the stock [P (stock) = C (catch)/E (exploitation rate), (**Ricker, 1975**) is estimated to be about 1578 MT.

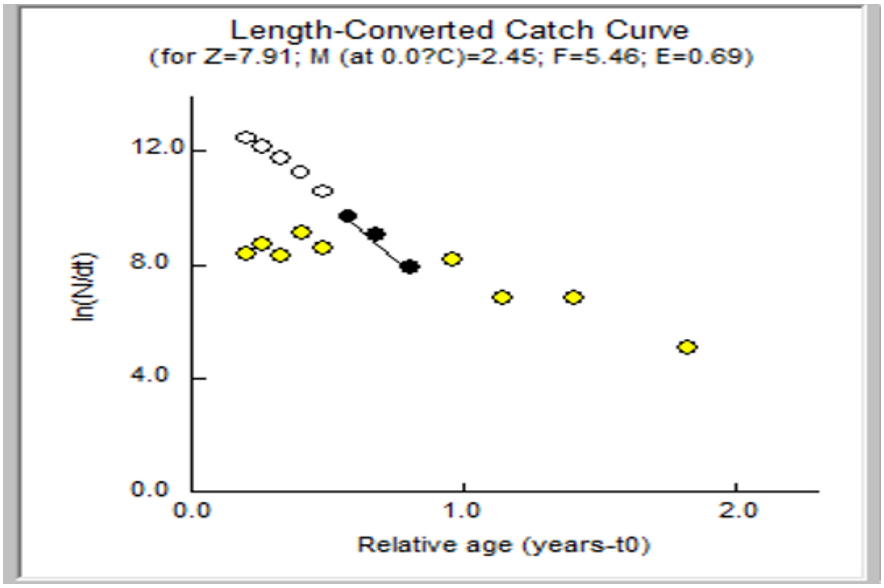

Fig. 6. Length-converted catch curve of combined sexes of *P. pelagicus* from Bardawil Lagoon during 2021

DISCUSSION

Information about individual body weight-length/width relationships in populations is important for estimating the population size, specifically for the purpose of its exploitation. For evaluating crustacean populations, the width or length-weight relationships are regarded as more suitable (**Atar and Secer, 2003; Gorce *et al*., 2006; Sangun *et al*., 2009**).

The relationships between carapace width and body weight are used as indicators of condition, biomass calculation and comparison between populations (**Lagler, 1968; Binohlan and Pauly, 2000**). In the present study, the growth generally exhibited a positive allometry indicating that the weight of the animal increases as it matures although the b value of females *P. pelagicus* (3.1653) was slightly lower than that of males (3.2117). This is in agreement with results of **Emam (2011) and Abd El-Razek *et al*. (2006)** in the same lagoon. Generally, b values vary according to shape and fatness of species, sex, age, seasons, feeding and various factors as temperature and salinity. Table 2 shows the variation in "b" values according to species for *P. pelagicus*.

The carapace width frequency distribution data were used to determine the growth parameters (CW∞ and K). The current study results (CW∞= 16.28 cm and K=1.4 $year^{-1}$) were compared to previous studies from different areas (Table 3). The difference between these values were may be because of different factors affecting the growth parameters methods by which crabs were caught in those localities, in addition to ecological and environmental factors affect the growth rate.

The growth rate also differs from stock to stock (**Adam, 1980; Devaraj, 1981; Sparre *et al.*, 1992**). It was observed that the growth parameters were correlated with each other which means that higher the K values lower the CW∞ values and *vice versa* (**Pauly and Morgan, 1987).**

The positive to values shows that the juveniles were slow grower while negative to values indicated that crab species were fast grower during juvenile stage (**Sparre and Venema, 1998; King, 2007**).

Table 2. The constant of a, b and R^2 for the carapace width/weight relationship of *P. pelagicus*

Sex	a	b	R^2	Locality	Author/ Year
Males	0.0502	3.1653	0.9609	Bardawil Lagoon, Egypt	Present study
Females	0.0445	3.2117	0.963		
Combined	0.0475	3.1866	0.9617		
Males		3.097	0.9327		**Abd El-Razek *et al.*, (2019**)
Females		2.9124	0.9072		
Males	0.001	3.44	0.95		**Kilada and Ibrahim (2016)**
Females	0.001	3.13	0.90		
Males	0.041	3.229	0.91		**Emam (2011)**
Females	0.056	3.063	0.98		
Combined	0.047	3.162	0.90		
Males	0.4045	3.2269	0.9031		**Abd El-Razek *et al.*, (2006)**
Females	0.4678	3.1458	0.9537		
Males	0.103	3.187	0.97		**Ameran (2004)**
Females	0.179	2.877	0.97		
Combined	0.139	3.022	0.96		
Males	0.0513	3.1281	0.8815	Red Sea	**El-Kasheif *et al.*, |(2021)**
Females	0.0574	3.009	0.8459		
Combined	0.0541	3.1012	868		
Males	0.001	2.97	0.83	Lake Timsah	**Kilada and Ibrahim (2016)**
Females	0.001	2.72	0.84		
Males	0.5841	3.057	0.98	Bitter Lakes, Egypt	**Mehanna (2005)**
Females	0.6642	2.968	0.98		
Combined	0.6363	2.996	0.98		

Table 3. Comparison of Growth parameter (CW∞ and K) and growth performance index (*ϕ*) of *Portunus pelagicus* with some of the previous studies in different locations

Author	sex	CW∞	K	ϕ	Location
Present Study	Combined	16.66	1.40		Bardawil Lagoon Egypt
El-Kasheif *et al.* (2021)	Combined	21.19	0.414		Hurghada region, Egypt
El-Far *et al*. (2018)	Combined	18.30	0.27		Mediterranean coast, Egypt
Afzaal *et al.* (2016)	Combined	17.85	1.70		Northern Arabian Sea, Pakistan
Hamid and Wardiatno (2015)	Males	15.2	0.93	4.33	Lasongko Bay, Indonesia
	Females	17.3	0.68		
Mehanna *et al.*, (2013)	males	10.8	1.70		Oman coastal,water
Mehanna and Al-Aiatt, (2011)	Combined	8.40	2.04		Bardawil Lagoon Egypt
Emam (2011)	Combined	16.70	1.75	2.69	Bardawil Lagoon Egypt
	Combined	17.30	1.5	2.65	
Mehanna and Haggag (2007)	Combined	20.92	1.52	2.82	Port Said
Josileen and Menon (2007)	Males	22.30	0.95	2.67	Mandapam coast, India
	Females	19.50	1.00	2.58	
Mehanna (2005)	Combined	20.10	1.62	2.81	Bitter lakes
Ameran (2004)	Combined	12.00	2.09	2.48	Bardawil Lagoon Egypt
Sukumaran and Neelakantan (1997)	Males	21.10	1.14	2.7	
	Females	20.40	0.97	2.6	
Sumpton *et al*. (1994)	Males	17.50	1.59	2.68	Australia
	Females	17.00	1.61	2.66	

For any fishery, the estimation of growth performance index is important for the stock assessment as stated by **Pauly and Munro (1984**) **and Sparre and Venema (1998)**. In the present studies ϕ = 2.561 shows that the environmental conditions of the Bardawil Lagoonlagoon waters were suitable for the growth of BSC. Growth performance values may be different because of the ecological and geological conditions as well as input values of growth parameters **(Devaraj, 1981)**.

Fish natural mortality is caused by many reasons such as parasites and diseases (**Landau, 1979**), aging factor (**King, 1991),** predation by large animals **(Otobo, 1993**) and environmental factors **(Chapman and Van Well, 1978)**. In the present study, the total mortality rate of blue swimmer crab, *Portunus pelagicus*, was estimated using

length-converted catch curve based on values of growth parameters. The total, natural and fishing mortality of blue swimming crab were estimated at 7.91, 2.45 and 5.46 year^{-1}, respectively.

Information on mortality is extremely critical to the study of population dynamics **(Sukumaran and Neelakantan, 1996).** The current total mortality (Z = 7.91 y^{-1}) derived from the length converted catch curve analysis for combined sexes of *P. pelagicus* is much greater than that obtained for the same species in Bardawil Lagoon (Z = 5.143 y^{-1}; **Ameran (2004) and** (**El-Kasheif *et al*. (2021),** Z=2.929) in Red Sea. However, it is lower than the values given by **Mehanna and Haggag (2007)** in Port Said. They estimated the values of total mortality coefficient (Z) for *P. pelagicus* as 10.04, 10.37 and 11.1 y^{-1} for males, females and pooled data, respectively On the other hand, the present value is more or less similar to those reported by **Mehanna (2005**) in the Bitter lakes for the same species. She estimated the total mortality coefficient (Z) from the length converted catch curve **(Pauly, 1984)** as 8.57, 9.48 and 9.56 y^{-1} for males, females and combined sexes, respectively and **Emam (2011)** in Bardawil Lagoon was the value of total mortality coefficient (Z) for *P. pelagicus* as 8.86 y^{-1}. Part of these differences may be attributed to different methods of estimation and temperatures **(Leffler, 1972)**.

In the present study, the fishing mortality of *P. Pelagicus* in Bardawil Lagoon was 5.46 y^{-1} and the respective exploitation rate was 0.69. The exploitation rate assesses if a stock is overfished or not. The current exploitation value showed that *P. pelagicus* with an exploitation rate of 0.69 is lower than that which gives the maximum yield per recruit (E_{max} = 0.72) and higher than that which maintain 50% of the stock biomass ($E_{0.5}$ = 0.36). These populations therefore stand the risk of intensive exploitation; for management purpose, the current exploitation rate should be reduced from 0.69 to 0.36 (about 32% reduction) to maintain a sufficient spawning biomass. *Portunus pelagicus* resources are overexploited by trammel net in the Red Sea (E = 0.69) as in most of the previous studies in many areas. According to **Patterson (1992**), exploitation rate. Table 4 show that Parameter of total, natural and fishing mortality and exploitation rate in different Locations of *Portunus pelagicus.*

Conclusion

The blue swimmer crab resources are overexploited by trammel net in the Bardawil Lagoon (E = 0.69) as in most of the previous studies in many areas. According to **Patterson (1992)**, exploitation rate should not be greater than 0.4 for the sustainability of the resource. The carapace width at first capture (CWc =9.5 cm) indicated that the catch went to the small length which smaller than the reported (CWm > 10.3 cm) length at first sexual maturity. Length frequency data used in the present study gives valuable information about growth, mortality and life history parameters of blue swimmer crab, P. *pelagicus.* In the light of above results, the blue swimmer crab fishery was overexploited by the trowel net in Bardawil Lagoon water during present study. Regarding to the present study, we may suggest that the fishery managers should take some serious steps to save this commercially important crab species in Bardawil Lagoon waters for future and should maintain the stock of crab fishery so that shareholders can get more benefit from the stock.

Some measures could be considering *e.g*.

1-Minimum landing size (greater than 10.0 cm carapace width)

2- Control the fishing effort.

3- Not using the trowel craft (kalca) completely in Bardawil Lagoon.

4- Not using the illegal nets.

Table 4. Parameter of total, natural and fishing mortality and exploitation rate in different Locations of *Portunus pelagicus*

Author	sex	Z	M	F	E	Location
Present Study	Combined	7.91	2.45	5.46	0.69	Bardawil Lagoon Egypt
El-Kasheif *et al*. (2021)	Combined	2.929	1.285	1.644	0.655	Red Sea
Hamid and Wardiatno, (2015)	Males	2.8	1.09	1.71	0.61	Lasongko Bay, Indonesia
	Females	2.95	0.86	2.09	0.71	
Ihsan *et al*. (2014)	Males	2.53	1.44	1.09	0.43	Pangkep coast
	Females	3.22	1.27	1.95	0.6	
Ernawati (2013)	Males	6.24	1.27	4.97	0.8	Indonesia
	Females	6.19	1.18	5.01	0.81	
Safaie *et al.* (2013)	Males	5.97	1.47	4.5	0.75	Oman Gulf
	Females	3.94	1.42	2.52	0.64	
Mehanna *et al.* (2013)	Males	7.85	3.15	4.7	0.60	Oman coast
Sunarto (2012)	Males	2.52	1.53	0.98	0.391	Indonesia
Kembaren *et al.* (2012)	Males	9.21	1.33	7.88	0.86	Bone Bay, Sulawesi, Indonesia
	Females	6.9	1.21	5.69	0.82	
Kunsook (2011)	Males	8.15	3.98	4.53	0.56	Kung Krabaen Bay, Thailand
	Females	6.95	2.07	4.88	0.7	
Kamrani *et al.* (2010)	Males	2.48	1.21	1.27	0.51	Bandar Abas, Persian Bay, Iran
	Females	2.44	1.13	1.31	0.54	
Emam (2011)	combined	8.86	2.8	6.06	0.68	Bardawil Lagoon Egypt
Sawusdee and Songrak (2009)	Males	9.23	1.61	7.62	0.83	Tang Coast, South Thailand
	Females	8.85	1.61	7.24	0.82	
Dineshbabu *et al.* (2008)	Males	6.2	2.2	4.1	0.65	South-west India
Josileen and Menon (2007)	Males	4.54	2.76	2.45	0.54	Mandapam Coast, India
	Females	3.03	2.11	1.57	0.53	
Sukumaran (1995)	Males	5.6	1.7	3.9	0.53	Karnataka Coast, South - west India
	Females	4.9	1.6	3.2	0.65	

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الملخص العربي

علاقة الطول والوزن والنسبة الجنسية ومعامل الحالة للكابوريا الزرقاء (*Portunus pelagicus*) ببحيرة البردويل مصر

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تم اصطياد أكثر من 1085 طن من الكابوريا الزرقاء من مياه بحيرة البردويل عام 2021. وخلال الثلاثين عامًا الماضية، لوحظ زيادة في إنتاج هذا النوع خاصة في عام 2009 حيث كان الإنتاج 2100 طن. ولعمل إدارة جيدة يجب جمع معلومات حول بيولوجيا الكابوريا الزرقاء. ومن ثم، تم جمع عينات شهرية من الكابوريا الزرقاء (*P. pelagicus*) من المصيد التجاري بمرسى التلول ببحيرة البردويل، مصر خلال الفترة من مايو إلى ديسمبر 2021. وتم قياس عدد 6441 عينة من الكابوريا الزرقاء للعلاقات الظاهرية، ونسبة الجنس، وتحديد العمر باستخدام تردد عرض الدرع، ومعدل الوفيات ونسبة الاستغلال. وأظهرت الدراسة أن الكابوريا الزرقاء (*P. pelagicus*) تم استهدافها بشباك الجر الصغيرة (الكلسة) كمصيد عرضي وشباك ترامل. وأظهرت علاقة الوزن الكلي نموًا إيجابيًا في القياس قيمة (3.1866) = b، كما لوحظ ارتفاعاً في معامل الحالة في عرض الدرع 8 سم. كما تم تحديد أربع فئات عمرية وكانت الفئة العمرية + الثانية هي المسيطرة بالعدد (55.0%). وكانت معاملات معادلة فون برتالانفي 16.28 سم و1.4 سنة $^{-1}$ و -0.0988 سنة لـ CW_∞ و Kو to على التوالي. وتم تقدير عرض الدرع عند الالتقاط الأول (CW = 9.5) مم . وتم حساب معدلات الوفيات على أنها 7.91 و2.45 و5.46 سنة $^{-1}$ للوفيات الإجمالية والطبيعية والوفيات بسبب الصيد، على التوالي. كما تتعرض الكابوريا الزرقاء للصيد في بحيرة البردويل بالاستغلال المفرط .(E = 0.69) تم اقتراح بعض تدابير الإدارة للحفاظ على مخزونها من أجل الاستدامة.

الكلمات الاسترشادية: بحيرة البردويل، السلطعون الأزرق السابح، نسبة الجنس، عرض الدرع عند الالتقاط الأول، عامل الحالة.

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