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Biological Parameters of *Lethrinus nebulosus* in the Arabian Gulf on the Saudi Arabian Coasts

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

In the present study about 277 specimens of *Lethrinus nebulosus* were used to determine some biological parameters which are needed in stock assessment in the region of Arabian Gulf on the Saudi Arabian coasts. The period of spawning was estimated using maturity indexes to April, Mai and June. This species is gonochoric, nevertheless some cases of hermaphrodism are noted. The length relationships were determined showing a correlation between total length and standard length, and between total length and fork length. The weight- length relationship is allometric minorante. The model of Von Bertalanffy was estimated for the studied species and it is as follows: Lt = 600 *(1-exp $^{(-0.135*(t+1.69))}$) for both sexes, Lt = 600 (1-exp $^{(-0.166*(t+0.746))}$) for females and Lt = 555 *(1-exp $^{(-0.153*(t+1.62))}$) for males.

Keywords: Lethrinus nebulosus; Saudian Coasts; Arabian Gulf; growth; biology reproduction.

1. INTRODUCTION

The biological Information on fish are needed not only in stock assessment but also in evaluation of several parameters effect, such as climatic or environmental pollution, on the abundance and dynamic population of different marine species.

The most important biological parameters to attend this aim are the fish's growth and

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reproduction. Both these parameters can be established using monthly sampled landing fish during one year in order to cover the species biological cycle.

We chose *Lethrinus nebulosus* species, locally named "shaari" for two main reasons. Firstly, because it is the most important fished and commercialized species in the studied region. Secondly, because the biology of this species is well known in different regions rather than in the Saudi Arabian coasts (in the Arabian Gulf). The knowledge of a historical data specifically growth, is extremely helpful to assess the state of the stock correctly as well as to survey the changes which can be related to natural parameters such as climatic or anthropic changes, like pollution and overfishing.

Lethrinus nebulosus is a benthic fish species which is distributed from the Indo-West Pacific: Red Sea, Persian Gulf and East Africa to southern Japan and Samoa [1]. It is one of the Perciforme species from the Lethrinidae family. Its nourishment is based on echinoderms, mollusks, crustacean and some aquatic worms and fishes. It is known by its hermaphrodism [2].

The first maturity size was studied and estimated for females to be 46 cm in the pacific [3] and 40.8 cm in New Caledonia coasts [4].

The spawning period was estimated to occur in April and Mai on Emirate coasts [5] and along the year in the north of Arabian gulf [1].

The determination of the fish growth is well realized by estimation of the Von Bertalanffy Model. This equation was established on Kuwait coasts by [5], in Egypt by [1] and on Abu Dhabi Coasts by [6].

In the present study we are interested in *Lethrinus nebulosus* parameters in Arabian Gulf on Saudi coasts.

2. MATERIALS AND METHODS

2.1 Materials

From March 2014 to February 2015, a mean number of about 25 *Lethrinus* fish of (Table. 1) were monthly obtained from commercial landing which were collected from Jubail coasts (Fig. 1). A total of 277 fishes were used in this study with different size ranges (Table 1). On each fish the lengths (Total length, standard length and length to fork) were measured by ichthyometer to the nearest mm and weight measurement (Total weight and eviscerated weight) to the nearest 0.1g are realized using balance.

In the second step, scales and otoliths were collected from every specimen. Afterwards, they were both cleaned with water and alcohol: therefore scales were conserved between two slides and then they were numbered. Concerning Otoliths, they were labeled and stored in small envelopes for future process to determine the fish age.

To determine the age, otoliths and scales were examined through a reflected light stereo microscope observation, by counting the increments or structure on the calcified pieces.

Using otoliths to identify age was not that easy, because it is so opaque and it needs much preparations and materials. However, the uses of scales in ageing were easier and realizable in 99% of the samples.

We have to note that sampling in July 2014 was not accomplished due to of the summer holidays, but that did not disturb the results of this work.

In, the third step gonads and livers were taken and weighed using a balance with 0.1g precision. The states of gonads were noted on every specimen in order to determine the sex and the maturity of each specimen (Fig. 2).

The females' gonads are red, and the males' are white.

2.2 Methods

To determine the growth parameters (L_{inf}, t_0 and K), the Von Bertalanffy model was applied:

$$L_t = L_{inf} *(1-\exp^{(-k(t-t0)}$$

Where L_t is the length at the moment t

L_{inf} is the asymptomatic length,

t_0 is the theoretical age corresponding to size 0 and k is the growth coefficient.

The adjustment of the growth curve was made with statistical software "STATISTICA".

The length-weight relationship was studied according to the following equation:

$W_t = a*L_t^b$

Where W_t is the total fish weight, a and b are the coefficient of weight growth and Lt is the total length.

To study the reproduction and especially the period of spawning, the monthly evolution of some reproductive indexes, shown below were used:

$GSR= 100*(W_g/W_t)$
$HGR= 100*(W_h/W_t)$

Where GSR is gonadosomatic report, W_g: gonad weight, W_t: total weight of the fish.

And HSR is hepatosomatic report, W_h: livers weight.

For other relationship curves Excel software was used.

3. RESULTS

3.1 Length and length weight relationship of *Lethrinus nebolosus*

The total length and fork length relationships and the total length and standard length are isometric with a high determination coefficient (Fig. 3 and Fig. 4).

The weight length relationship is determined (Fig. 5) and it is $W_t = 2E\text{-}05\ L_t^{2,931}$ for both sexes.

The coefficient b= 2.931 means that *Lethrinus nebolosus* has an allometry minorante growth.

3.2 Growth of *Lethrinus nebulosus*

Using scales for ageing is easier than using otoliths (Fig. 6). So the age length relationship was determined using this method.

Fig. 1. The area of study (Saudi Arabian Coasts on the Persian Gulf)

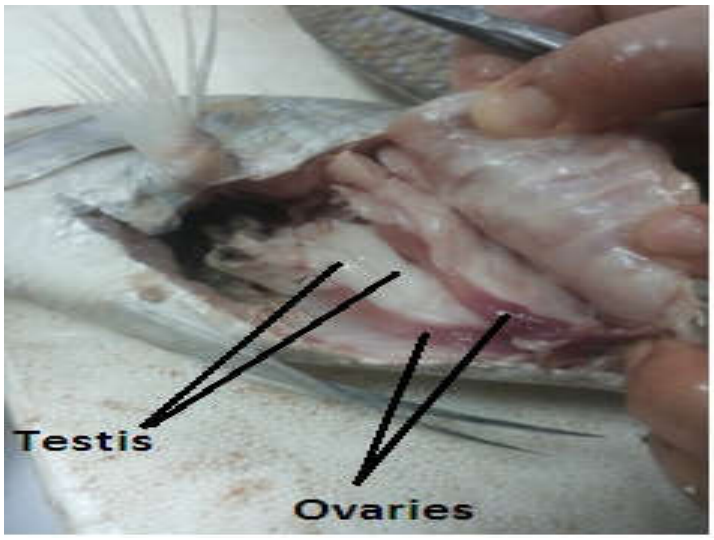

Fig. 2. Example of gonads of *Lethrinus nebulosus*

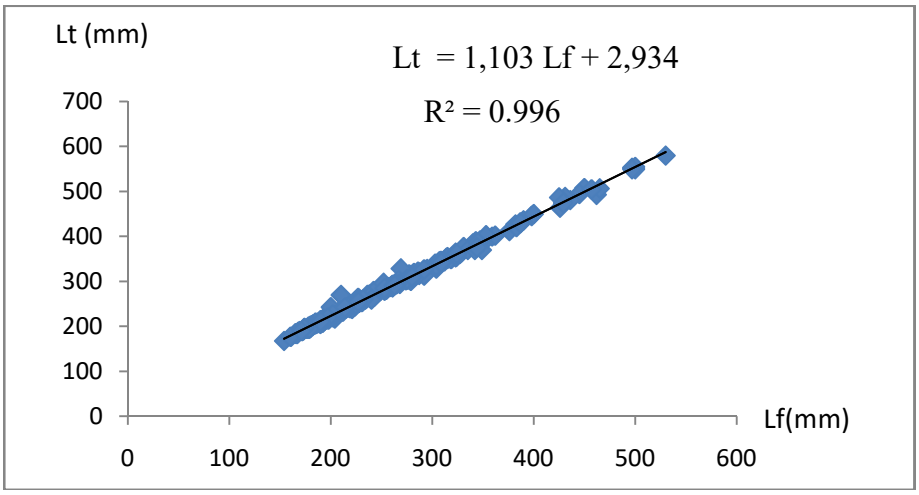

Fig. 3. Relationship between total length and fork length of *Lethrinus nebulosus*

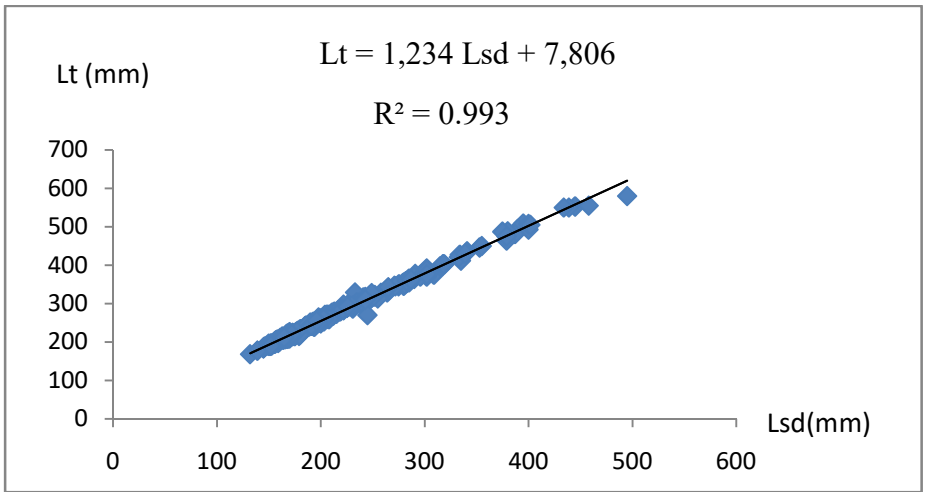

Fig. 4. Relationship between total length (Lt) and standard length (Lsd) of *Lethrinus Nebulosus*

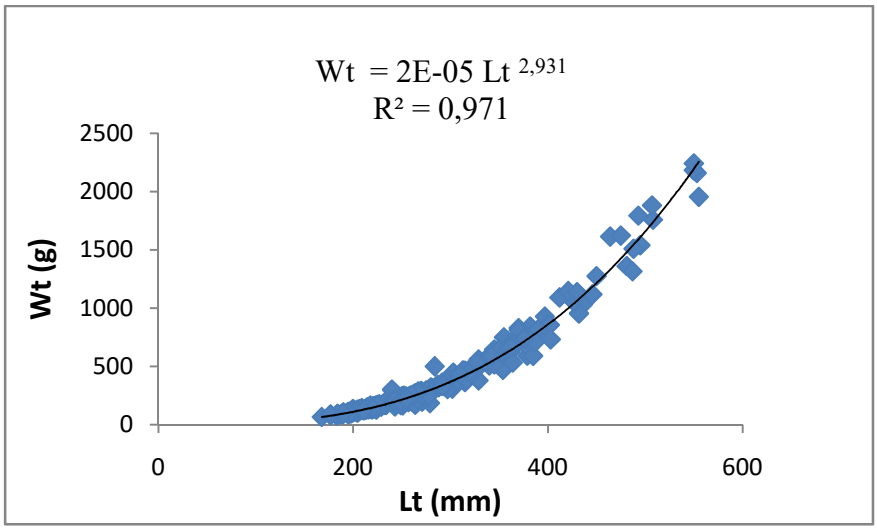

Fig. 5. Total weight- total length relationship *Lethrinus nebulosus*

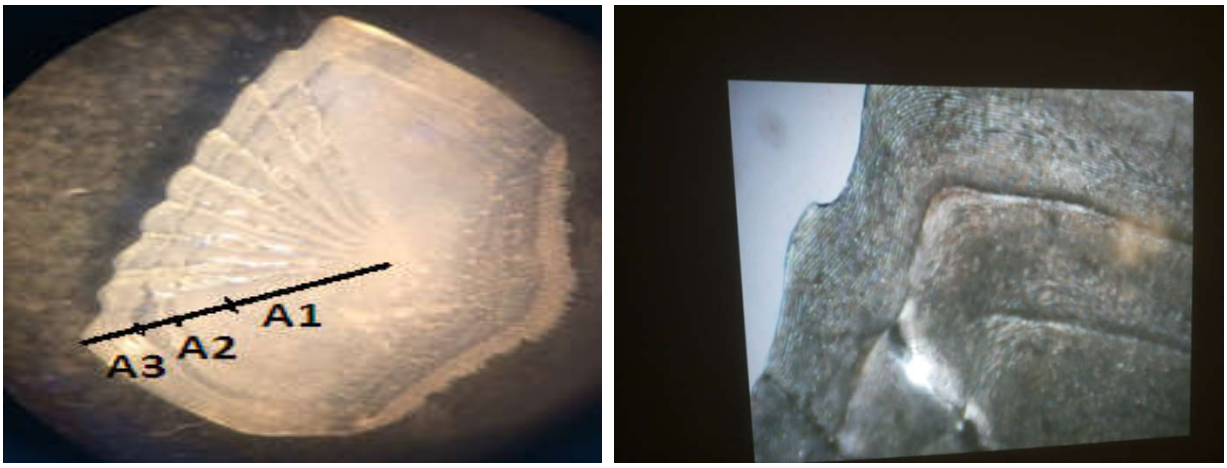

Fig. 6. a- An example of scale showing 3 ornamentations of *Lethrinus nebulosus* aged 3 years, b- The extremity of scale of *Lethrinus nebulosus* showing the easiness of age lecture from scales

Table 1. Measurements realized on sampling on *Lethrinus nebulosus* from March 2014 to February 2015

Months	Number of individual	Range of length (mm)	Range of weight (g)
March 2014	25	251- 553	166-2159
April 2014	27	224- 481	131- 1360,9
May 2014	32	184- 550	90- 2184
June 2014	20	185- 493	89- 1794
August 2014	26	205- 488	107- 1510
September 2014	29	168- 555	67- 1956
October 2014	23	177- 346	84- 583
November 2014	23	197- 507	105- 1882
December 2014	22	202- 475	121- 1623
January 2015	27	215- 580	130- 2310
February 2015	23	195- 550	89- 2241
Total	277	168- 580	67- 2310

The equation of Von Bertalanffy which describes the length age relationship is determined for *Lethrinus nebulosus* for both sexes (Fig. 7), for females (Fig. 8) and for males (Fig. 9).

3.3 Reproduction of *Lethrinus nebulosus*

The monthly GSR evolution shows 3 different progressions: From March to April; an increase of GSR, reaching the maximum value. From May to June: of SGR, remains stable till the end of the year. That means that the spawning period of *Lethrinus nebulosus* occurs in late April, May and June (Fig. 10).

The evolution of the HSR index shows that the species uses lipid reserves in the spawning period and develops it in the other periods.

The Length-length relationships of *Lethrinus nebulosus* are correlated.

The length weight relationship of *Lethrinus nebulosus* is allometric minorante.

Table 2 shows the estimated parameters of Von Bertalanffy model for the present study and other studies in other regions.

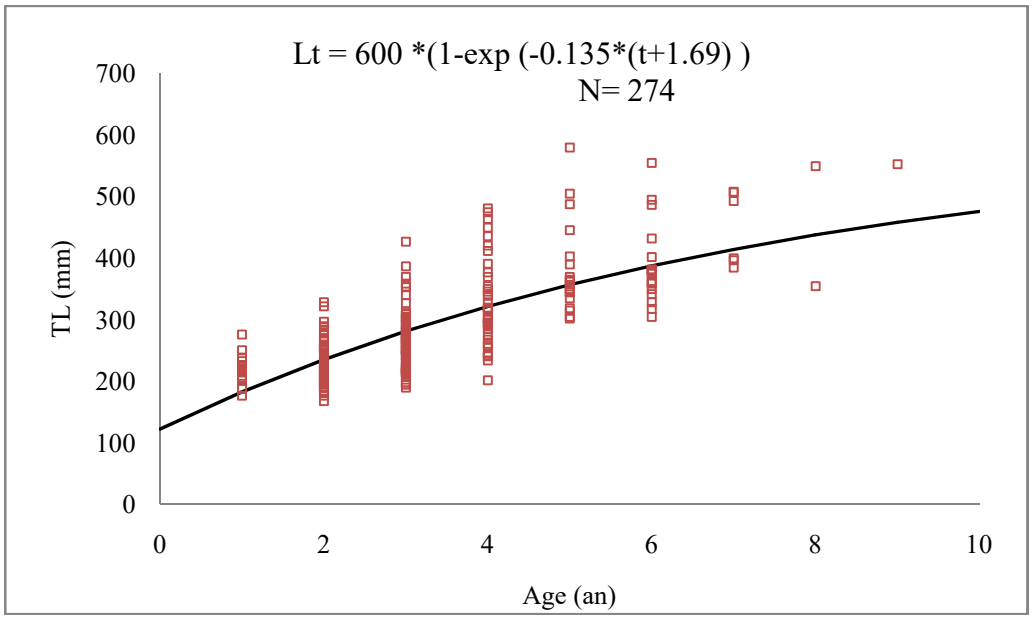

Fig. 7. Age- Length relationship of both sexes of *Lethrinus nebulosus*

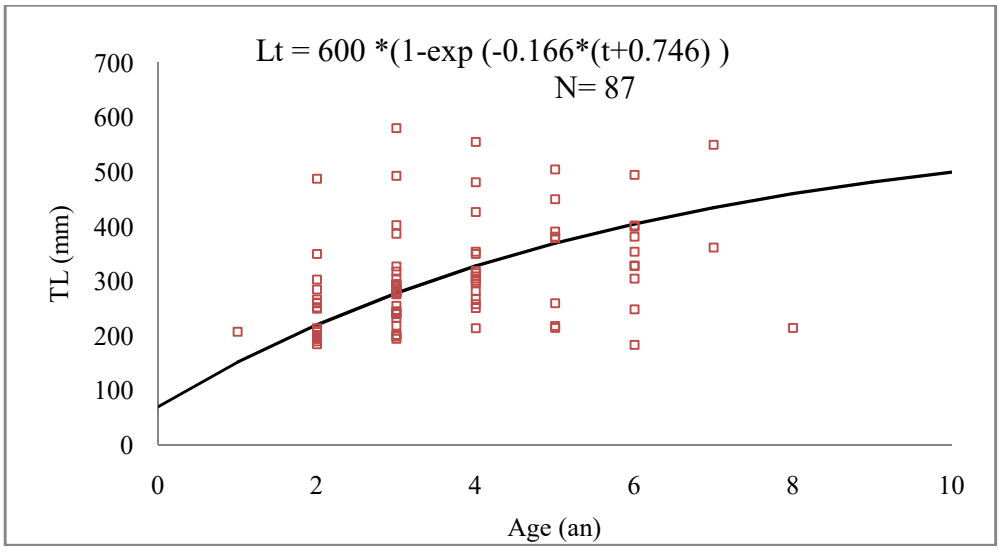

Fig. 8. Age- Length relationship of females of *Lethrinus nebulosus*

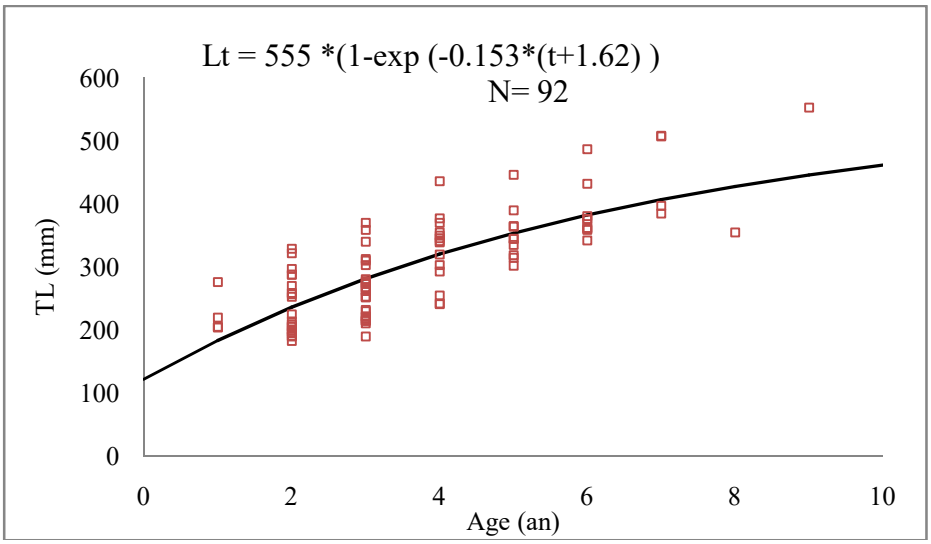

Fig. 9. Age- Length relationship of males of *Lethrinus nebulosus*

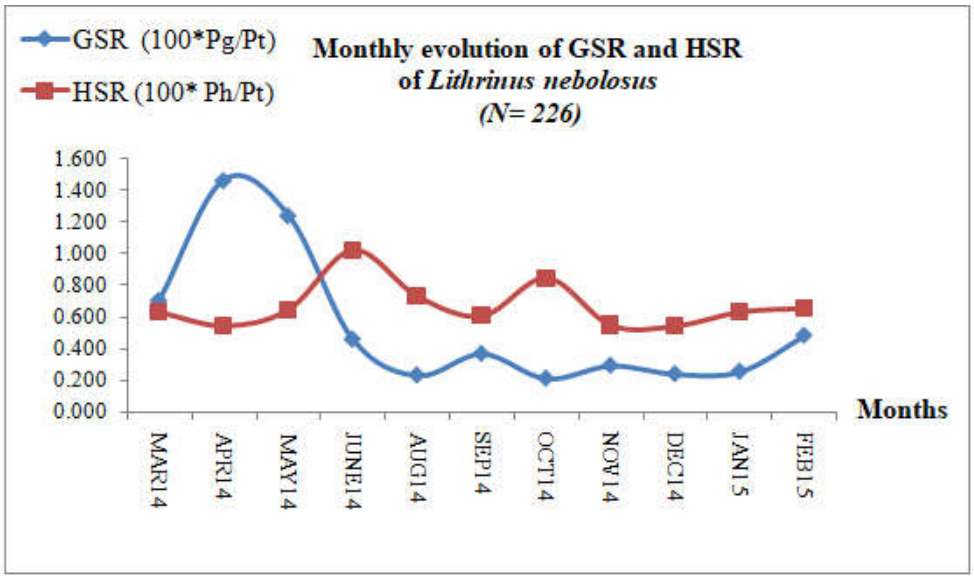

Fig. 10. Monthly evolution of indexes of reproduction (GSR; gonadosomatic report, HSR; hepatosomatic report)

Table 2. Parameters of Von Bertalanffy model in different coasts

Parameters of Von Bertalanffy Model	L_{inf} (mm)	K	T0	Sexes	Used length	Reference
Australia (Northwest)	527	0.13	-1.16	Female	LF	[7]
Australia (Northwest)	611	0.11	-0.88	Male	LF	[7]
Kuwait	627	0.19	-0.04	Unsexed	LT	[8]
Abu Dhabi	652	0.11	-2.90	F	LF	[5]
Abu Dhabi	699	0.10	-3.30	M	LF	[5]
Present study (Arabian Saudi)	600	0.166	-0.75	F	LT	Present study (2015)
Present study (Arabian Saudi)	555	0.153	-1.62	M	LT	Present study (2015)

The maximum of spawning as estimated by maturity indexes is in April, May and June.

4. DISCUSSION AND CONCLUSION

The ageing and growth parameter estimations are fundamental prerequisites for the stock assessment. In order to evaluate and manage marine stock resources we need growth parameters particularly. Several works have studied the *Lethrinus nebulosus* biology and growth by different methods in other locations.

The estimation of ageing fish can be undertaken by different methods. In the case of *Lethrinus nebolus,* scalimetry is more useful than the otolithometry.

Our study shows that the length-length relationships of *Lethrinus nebulosus* are correlated, the length weight relationship of *Lethrinus nebulosus* is allometric minorante as on Abu Dhabi Coasts: $Wt= 0.03Lt^{2.88}$ [5] and in Yemen $Wt= 0.035 Lt^{2.81}$ [9], but it is isometric in Kuwait with $Wt= 0.017 Lt^{3.01}$ [10].

Table 2 shows different values of estimated Von Bertalanffy model parameters. The present study shows that a K value more important than on Abu Dhabi coasts a relatively faster growth but slower than in Kuwait coasts.

The spawning period estimated by maturity indexes is at its maximum on April, May and June. This result is similar to that in Abu Dhabi costs, where the period of spawning is in April and May on [5]. But, it is different from other coasts such as North Arabian Gulf where the species spawns throughout the year [1].

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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