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Original Article

Length-weight relationship and condition factor of the Thinlip Grey Mullet (*Liza ramada*) in the Bardawil Lagoon, North Sinai, Egypt

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ABSTRACT

A random sample of 273 fish of Mugilidae species the thinlip grey mullet (*Liza ramada*) was taken from Bardawil lagoon, North Sinai Egypt, from October to April during fishing season 2020/2021. The length-weight relationship, condition factor, and length at first capture parameters were analyzed. In the present study, the sizes for all individuals of *Liza ramada* ranged between 14.2 – 39.3 cm in length and 25 -503 g in weight. The length-weight relationship was $W = 0.0173\ L^{2.7695}$ (R^2 = 0.9788), $W = 0.0104\ L^{2.9269}$ (R^2 = 0.9836) and $W = 0.0125\ L^{2.8699}$ (R^2 = 0.9813) for males, females and combined sexes of *Liza ramada* respectively. The value of b indicated negative allometric growth. In the present study, the condition factor of *Liza ramada* during this study was ranged between 0.67-0.94 in males, 0.71-0.91 in females, and 0.69-0.94 in combined sexes. The condition factor was high during (May, June, and July) and low during April.

Key word: *Liza ramada*, Bardawil lagoon, Length-weight relationship, Condition factor

1. INTRODUCTION

The family Mugilidae (referred to as mullets or grey mullets) are bony fish that inhabit coastal and brackish waters of all tropical and temperate regions worldwide. The family Mugilidae includes 17 genera and 72 species, most of which are classified into the genera *Mugil* and *Liza*, which include 18 and 24 species respectively (Thomson, 1990; Nelson, 2006). It tolerates extreme salinity in addition to important variations in water quality (Thomson, 1990; Jardas, 1996; Katselis *et al*., 2006).

Rochard and Elie (1994) described *Liza* as a fusiform body with a massive head, flattened above the eyes, smallmouth, snout short and blunt. The scientific classification of the thinlip mullet starts with the Kingdom: *Animalia*, Phylum: *Chordata*, Subphylum: *Vertebrata*, Class: *Actinopterygii*, Order: *Mugiliformes*, Family: *Mugilidae*, and Genus and Species: *Liza ramada*. It lives on schools on the coasts, lagoons, and rivers in the tropical and subtropical waters (Mcdowal, 1988).

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Also, (Redub *et al*., 1997) described that the thinlip mullet has an elongated body compressed laterally. *Liza ramada* plays a vital economical role in Egyptian fisheries since it constitutes more than 12.3% of the total catch of the Bardawil lagoon and about 35% of the Mugilidae catch. (GAFRD,2016). In fishery biology, length-weight relationships are useful for the conversion of growth-in-length equations to growth-in-weight or for use in stock assessment models and to estimate stocks biomass from limited sample sizes (Binohlan and Pauly, 1998). The establishment of a relationship between weight and length is essential for the calculation of the production and biomass of a fish population (Anderson and Gutreuter, 1983; Moutopoulos and Stergiou, 2002) and also morphological comparisons among species and populations of the same species from different habitats and/or regions (Moutopoulos and Stergiou, 2002).

The condition factor or the 'fatness' (k) is used to assess the well-being of the population with the assumption that the growth of fish in ideal conditions maintains an equilibrium between length and weight (Hile, 1936).

This study aims to estimate the relationship between length and weight, and the condition factor of one of the most important commercial species in the Bardawil lagoon, North Sinai, Egypt.

2. MATERIALS AND METHODS

2.1. Study area:

The study was carried out in the Bardawil lagoon (fig. 1). inlets the lagoon is separated from the Mediterranean Sea by a sandy bar with two narrows.

It is considered as a natural depression with range in depth from 0.3 to 5 m. The surface water temperature varied between a minimum of 14.8 C during January to a maximum of 29.4 C in August, with annual mean of 22.7 C (Mehanna, 2014). The fishing is seasonal, begins from April to the end of December, (El -Ganainy *et al.*, 2002).

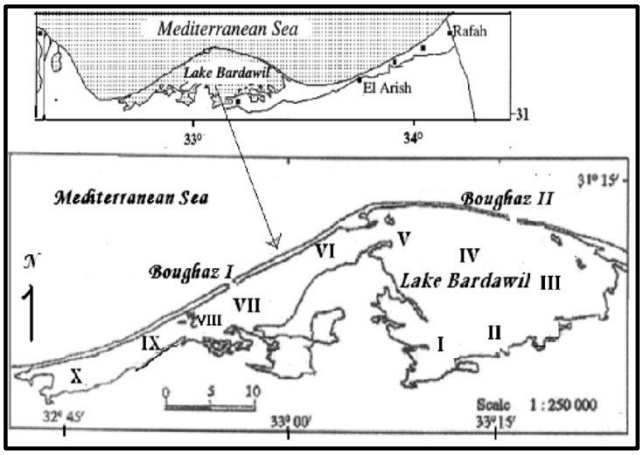

Fig (1): Map of Bardawil lagoon, North Sinia, Egypt

Seven species (sea bream, sea bass, grey mullet, common sole, Egyptian sole, thin lip grey mullet and shrimp) are targeted in the lagoon. Fishermen usually use small boats with engines and fish with nets, hooks and lines.

2.2. Sampling

Monthly random samples of thin-lipped gray mullet, *Liza ramada* (273 individuals) were collected from the different landing sites of the Bardawill lagoon, North Sinai.

Samples was randomly done during the fishing season from October to April of the 2020-2021 season. In the laboratory, total length to the nearest centimeter and total weight to the nearest 0.1 gram was recorded for 273 specimens.

2.3. Data analysis:

The length-weight relationship

The length-weight relationship was determined by Le Cren (1951) equation for males, females, and combined sexes as follows:

$$W = a L^b$$

W= is the total weight in grams, L= is the total length in centimeters

and a and b are constants whose values were estimated by the least square method.

Coefficient of condition

The composite coefficient of condition was calculated monthly during the study period, and

the coefficient of condition factor was calculated by two methods, namely: **Composite coefficient of condition factor "K"**

$K = (W * 100) / L^3$ (Hile, 1936)

K = composite coefficient of condition W = weight in gm. L = length in cm.

Relative coefficient of condition "Kn"

$Kn = W / W^*$ **(**Le Cren, 1951)

Kn = relative coefficient of condition W = observed weight in gm.

W* = calculated weight in gm.

3. RESULTS

Length frequency distribution

The length measurements of *L. ramada* that collected from Bardawil lagoon was grouped into class intervals of one cm size TL. 273 of *L. ramada* were measured as a total length (cm). The total length ranged from 14.2 to 39.3cm and from 25 to 503 g as a total weight. The length frequencies were calculated and plotted against the size groups for each month as illustrated in figure (2).

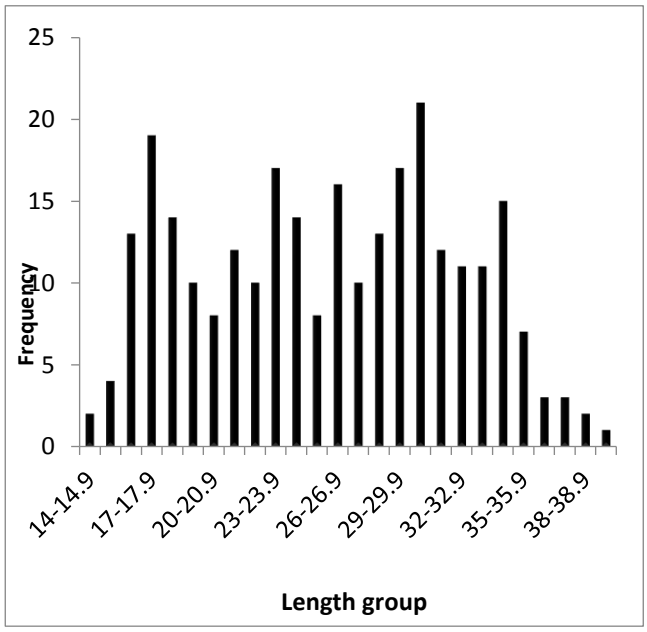

Fig (2): Length frequency groups of combined sexes of *L. ramada* in Bardawil lagoon during period study.

Length weight relationship

In present study, the sizes for all individual of L. ramada are ranging between 14.2 to 39.3 cm in length and 25 -503 g weight. The length-weight relationship of L. ramada (both sexes) is presented in figures (3, 4 and 5). The equation thus derived in respect of length-weight relationship is as follows:

Male: W = 0.0173 L2.7695 (R2 = 0.9788)

Female: W = 0.0104 L2.9269 (R2 = 0.9836)

Combined sexes: W = 0.0125 L2.8699 (R2= 0.9813).

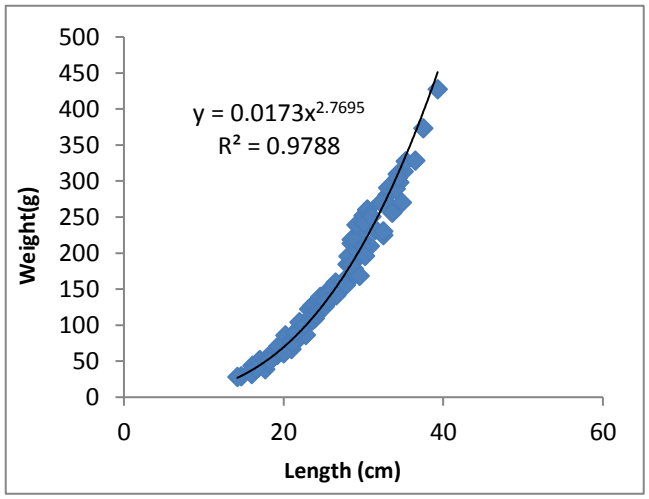

Fig (3): Length-weight relationship (♂) of *L.ramada*

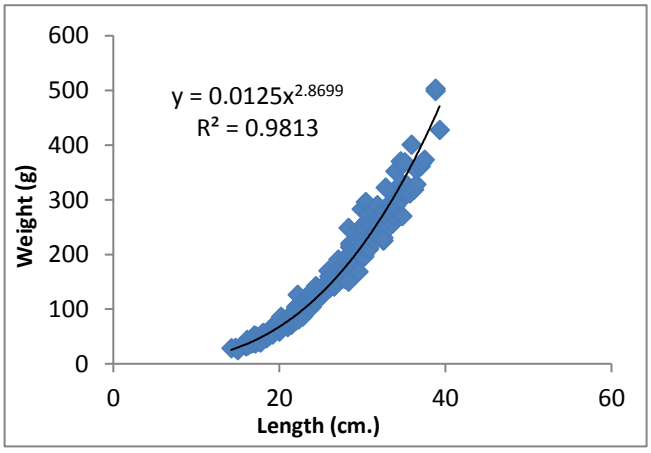

Fig (4): Length-weight relationship (♀) of *L. ramada*

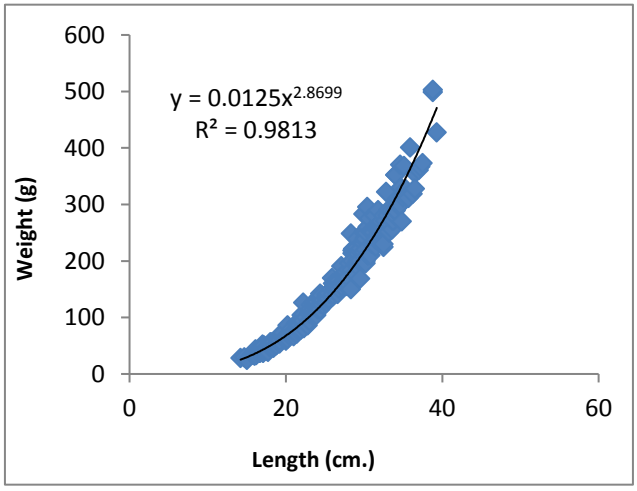

Fig (5): Length-weight relationship (♀♂) of *L. ramada* collected from Bardawil lagoon during 2020-2021

In the present study the relationship equation showed a negative allometric (b<3) in which b= 2.7695, 2.9269 and 2.8699 for males, females and combined sexes .

Condition factor:

Figures (6, 7 and 8) were used for describing the variation of condition factor with age and length. Monthly average values of Kn and Kc for the period from April to December during 2020-2021 as calculated from the observed total weight and represented of *L. ramada* in table (1) and figures (9, 10 and 11) from these tables and figures it is obvious that both composite (Kc) and relative (Kn) condition factor follows the same trends of fluctuations in males, females and combined sexes.

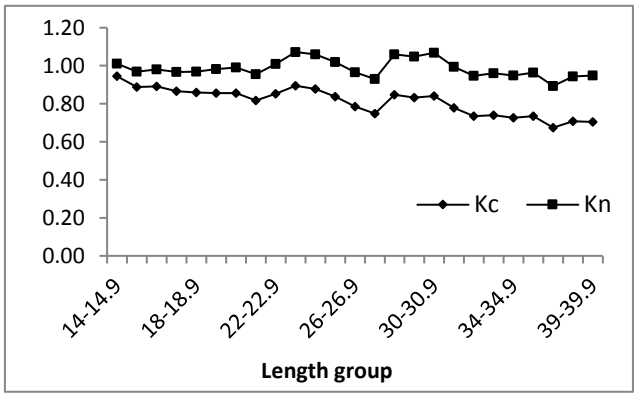

Fig (6): Average Kc and Kn of combined sexes (♂) of L. ramada in Bardawil lagoon during period study.

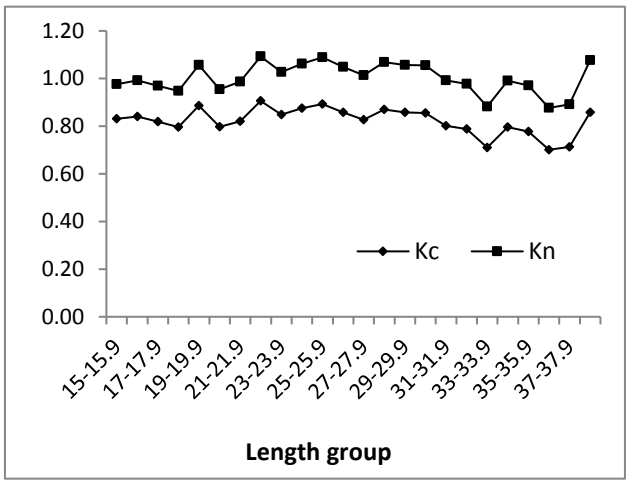

Fig (7): Average Kc and Kn of combined sexes (♀) of *L. ramada* in Bardawil lagoon during period study

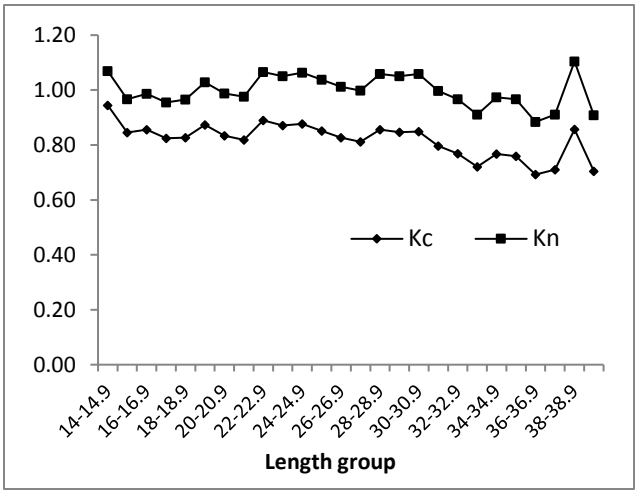

Fig (8): Average Kc and Kn of combined sexes (♂♀) of *L.ramada* in Bardawil lagoon during period study.

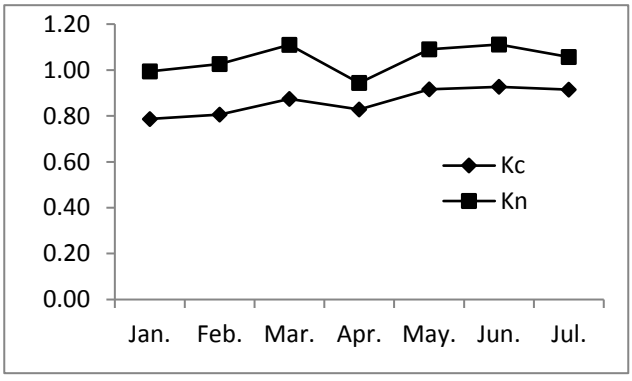

Fig (9): Monthly variation of the condition factor as (♀) of *L. ramada* during period study

Table (1): monthly variation of the condition factor of (♂, ♀and ♀♂) of *L. ramada* during period study

Month	Males		Females		Combined	
	Kc	Kn	Kc	Kn	Kc	Kn
Jan.	0.79	0.99	0.77	0.96	0.78	0.97
Feb.	0.81	1.03	0.82	1.03	0.83	1.04
Mar.	0.87	1.11	0.83	1.03	0.86	1.07
Apr.	0.83	0.94	0.81	0.94	0.82	0.96
May.	0.92	1.09	0.91	1.09	0.91	1.10
Jun.	0.93	1.11	0.96	1.18	0.96	1.18
Jul.	0.91	1.06	0.93	1.10	0.93	1.09
	0.86	1.05	0.86	1.05	0.87	1.06

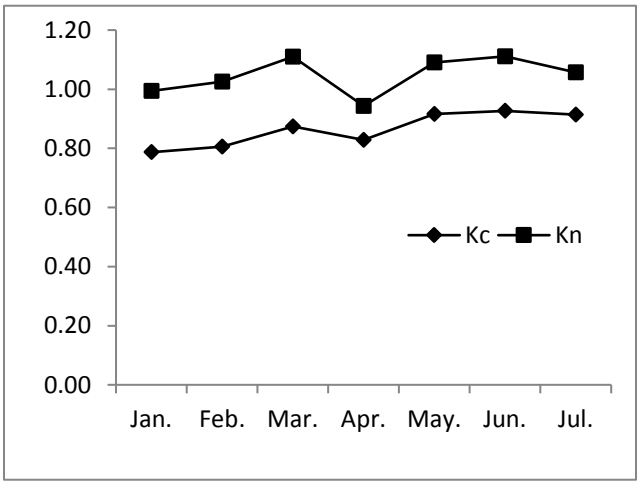

Fig (10): Monthly variation of the condition factor as (♀♂) of L. ramada during period study

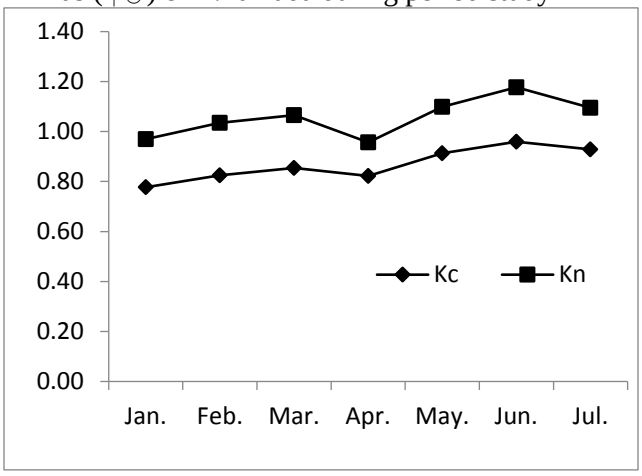

Fig (11): Monthly variation of the condition factor as (♀♂) of L. ramada during period study

In the present study, the condition factor for *Liza ramada* during period study was about 0.86 in males, 0.86 in females and 0.87 in combined sexes.

4. DISCUSSION

The value of b indicated negative allometric growth. In the present study, the condition factor of *Liza ramada* during this study was ranged between 0.67-0.94 in males, 0.71-0.91 in females, and 0.69-0.94 in combined sexes. The condition factor was high during (May, June, and July) and low during April.

Our result of constat (b) is agree with that of (Salem *et al.* 2010) who found that, the value of (b) equals 2.7642 for *L.ramada* in Bardawill lagoon and (Amana *et al.*, 2016) founded the value equals= 2.847 ain El-Ghazala lagoon, eastern Libya. And agree with (Attia and Kariman, 2018) pointed that, the (b) value was 3.0727, 2.98 and 2.9505 for males, females and combined sexes respectively in Bardawil lagoon. (Mehanna *et al.* 2019) who resulted that, $W=0.0173L^{2.7695}$ for males and $W=0.0173\ L^{2.7687}$ for females.

The (b) value in fish species is specific and varies with sex, age, seasons, physiological conditions, growth increment and nutritional status of fish, health, habitat, nutrition, environmental conditions (such as temperature and salinity), area, degree of stomach fullness, differences in the length range of the caught specimen, maturity stage and techniques of sampling fishing gear (Tesch, 1968; Le Cren, 1951; Bagenal and Tesch, 1978).

The values of a and b differ between species, through the year and through the spawning season (Ahemed, 1987). On other hand, this result disagrees with that of (Mehanna, 2006) who found that, the (b) value in this study was lower comparing with previous studies recorded by (b =3.13), and also different with (El- Aiatt and Shalloof, 2018) where the value of b=2.9505.

The condition factor was high during (May, June and July) and low during April. These results disagree with (El-Aiatt and Shalloof, 2018) found that, monthly condition factor values were generally low in September, and the highest values were recorded in October and December. While (Amana et al., 2016) found condition factor of *L. ramada* was high during summer (1.11) and low during winter (0.99).

This difference may be due to the consumption of food as fish gonads are developed in spawning season. Those observations were discussed by (Zaki et al., 1996; El-Okda, 1998; Tharwat and Al-Owafier, 2003). (Attia and Kariman, 2018) Monthly condition factor values were generally low in September, and the highest values were recorded in October- December.

CONCLOSION

This study reveals the value of the relationship between length-weight on *L. ramada* at the Bardawil lagoon compared with other geographic locations in the Mediterranean Sea. On the other hand, the condition factor of the relation between length and body weight was high in spring where fishes start the reproduction period.

Author Contributions:

All authors are responsible for the experiment design, collection of the samples, in-field data records, laboratory examination, data analysis, and general design of the *manuscript.*

Conflicts of interest

This manuscript has not been published and is not under consideration for publication elsewhere. We have no conflicts of interest to disclose.

Ethical Statement

The care and use of experimental animals, sampling and analysis techniques used in this work are consistent with Egyptian fish and fisheries legislation No. 124 / 1982

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