Research Article **Buzaid, 10(11-12): Nov/Dec, 2019:6388-6396]**
CODEN (USA): IJPLCP ISSN: 0976-7126

INTERNATIONAL JOURNAL OF PHARMACY & LIFE SCIENCES
(Int. J. of Pharm. Life Sci.)

Biometric study of Common Guitarfish *Rhinobatus rhinobatus* in Dernah coast, Libya (June – December 2016)

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Abstract

Eighty two specimens of Common Guitarfish *Rhinobatus rhinobatus* were collected from long-lined boats in Dernah coasts, in duration of June to December 2016, to establish their morphometric characters. Specimens ranged in size from 45.2 to 93.0 cm and from 150.44 to 700.80 gm. of total weights. Results showed constant value B of the length-weight relationship was 1.467, meaning so negative allometric growth. The condition factors K_f and K_c decreased significantly from 2.35 and 1.37 respectively, in the youngest fish size group (49.4 cm), to K_f = 0.22 and K_c = 0.16 as a nadir values in the largest group (93.0 cm.). Length frequency distribution illustrated that the mid-size group (65.7 cm) peaked above the quarter of the studied specimens. Morphometric characters of the guitarfishes were related to total length in percentages. Female bodies were deeper than in males' bodies, and wider head and pectoral fins as well.

Key words: *Rhinobatus rhinobatus*, Length-weight relationship, Condition factor, Length frequently distribution Morphometric characters, Dernah coasts.

Introduction

The Mediterranean is characterized with diversity of cartilaginous fishes (recording 49 sharks and 36 rays), which many of them are threatened nowadays. [1-2]. Fishes are essential component in the Libyan coast, which constitutes 36% of the Arabic coasts in the Mediterranean [3]. However, database of the elasmobranches fisheries in the eastern Libyan coast, has not yet been established and a satisfactory database is still lacking [4-5].

The common guitarfish *Rhinobatos rhinobatos* is a shallow water benithic elasmobranch, inhabits in the Eastern Atlantic and the Mediterranean [6-7], in sandy or muddy substrate to depth of 100m, and measured in sizes till 162 cm in length [8-10].

This species is stated as endangered by IUCN, because of the oversfishing catches [11-12], especially in the inshores, where adult males and pregnant females congregate for mating [13]. This species is one of the caught fishes by longline and trammels in Libya [14].

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The growth and biometrics of this species, was studied in the Mediterranean, using annual deposition of growth rings and Von Bertalanffy parameters based on length at age data for fish in Gulf of Gabès [15]. Rather than, other study methods, such as Length frequency distribution, length-weight relationship and condition factors, all of them in the present work will give approximate estimate of growth.

In Iskenderun Bay, Mediterranean Turkish coasts [16], value of (B) in the Length-Weight relationship was 3.1915, as an isometric growth for males and females by 3.1947 and 3.1672, respectively, and 3.096 in the Libanese coasts as well [17]. [18] mentioned that Age– frequency of the same species in Iskenderun Bay varied from 1 to 15 years for males and to 24 years for females. The most abundant age group was age third year for males, and age the second and third years for females. Altough [19] indicated to the adult females of blackchin guitarfish *Rhinobatos cemiculus* in the Tunisian waters had a lower growth completion rate, K, than in males.

In Gulf of Gabès, [18] females made up 51.8%, to be mature at at 138.1 cm, reaching a larger than males (at 111.8 cm).The regressions of total length-weight slopes in all and eviscerated fish did not make significant difference [19].

These studies, to collect age and growth data, are essential factor to understand biology and ecology of elasmobranches, and to establish better fisheries management for them [20 - 22]. This work aims to provide some some morphometric measurements and parameters of common violinfish in Derna coast, to compare the data with that available from other areas.

Material and Methods

Study area (Derna Harbour - 32° 16′ 00″ N, 22° 39′ 12″ E):

This work started at Demah harbor's pavements, located in the Libyan eastern coast. Eighty two of Common Guitarfish *Rhinobatus rhinobatus* specimens were collected from long-line boats, and measured in landing port in duration from June to December 2016. The coast line of Derna area is from Pomba Gulf to Karsa site, centerd by Derna city which is located between west of Tubruk (164 km) an east of Al Bayda (91 km), characterized with modern harbor, powermen inside between commercial, navy, and fishing crafts, waters in offshore are deeper than 35 meters, as well as, it is permanent landing site, with offshore cage farming [23-27].

Morphometrics:

The collected 82 guitarfish individuals were identified according to [29 – 37]. Their biometrics was scaled to the nearest 0.1cm, and 0.01 gm. as following [38-40]:

Fig. (1): Derna Harbour (32° 16′ 00″ N, 22° 39′ 12″ E) [28]. The sampling of *Rhinobatus rhinobatus* individuals, from Derna Harbour, June - December 2016.

a.	Total length (TL)	b.	Standard length (SL)	c.	Disc length
d.	Disc width	e.	Length of tail	f.	Preorbital length
g.	Interorbital width	h.	Spiracle length	i.	Preoral length
j.	Snout to nostrils	k.	Snout to first gill slit	l.	Snout to disc
m.	Snout to first dorsal	n.	Snout to pelvic	o.	Snout to spiracle
p.	First to second dorsal	q.	Between dorsal bases	r.	Pelvic to anal
s.	Second dorsal to upper caudal	t.	Anal to lower caudal	u.	Pelvic to median tip
v.	Upper caudal	w.	Lower caudal	x.	Mouth width
y.	Internasal width	z.	Interspiracular width	aa.	Width between first gill slit
bb.	Width between fifth gill slit	cc.	1st gill slit	dd.	2nd gill slit
ee.	3rd gill slit	ff.	4th gill slit	gg.	5th gill slit
hh.	Horizontal eye diameters	ii.	Vertical eye diameters	jj.	Distance between eyes

A. **Length-weight relationship (LWR)** was estimated according to the following equation: $\mathbf{W = aL^b}$ [41-44]**:** Where: W = Total weight, L = Total Length, a and b are constants [45]

B. **Condition factors :** Were calculated as:

1. ***Fulton's method :*** $\mathbf{K_F = 100\ W_t L^{-3}}$ W_g = Total weight (gm), L = Total Length (cm) [46].
2. ***Clark's method:*** $\mathbf{K_c = 100\ W_t L^{-3}}$ W_g = Gutted weight (gm), L = Total Length (cm) [47].

Statically studies: MS Excel 2010 was used for statistical analysis in this work.

Results and Discussion

Total weight of all specimens was 73.290 gm. The size range was 45.5 to 93.0 cm corresponding to total weight of 180.21 to 3125.73 gm. Averages and standard deviations of the collected *Rhinobatus rhinobatus* are mentioned in Table 1.

The length-weight relationship was obtained in fig. (2): $W = 2.4032 * L^{1.9064}$, $R^2 = 0.9312$. The consonant value (B = 1.467) reflected a negative allometric growth significantly (B<3).

Fulton and Clark's condition factors (K_f and K_c) values of *Torpedo torpedo* dropped significantly while length was increasing, Starting from 2.35 and 1.37 for the size group of 49.4 cm and to less than a 1.0 in the mid-sized class (65.7) with $K_f = 0.61$ and $K_c = 0.47$. These values decreased further deeply, to the lowest values of $K_f = 0.22$ and $K_c = 0.16$ in the largest size group (93.0 cm.) (fig. 3).

Total length-frequency was distributed in figure (4). The youngest size-groups (49.4 and 57.5) recorded around 38.5% in this stock. Meanwhile the mid-sized group (65.7 cm) had the peak value till 27.0% approximately, and then it dropped dramatically to 7.7 % in the largest size group (93.0 cm).

Morphometric measurements of the largest female and male in the 82 collected specimens of *Rhinobatus rhinobatus*, are related to total length in table (2) and figure (5). Eye width in both genders was 1.1 cm, and twice than the vertical demintions, lengths of gill slits were ranged between 1.1 – 1.5% of the whole bodies, length of snout in both specimens represented 2.9%, nostril ridgeses from the snout took about 14.6 and 14.8% and 43.0%in male and female. However, female bodies were deeper than in males' bodies, and wider head and pectoral fins as well, with desk takes 30.5% of the total body in the female, compare to the male (28.0%).

The constant value of length-weight relationship in the studied specimens (1.467) showed negative growth (b<3), with the high coefficient of determination ($R^2 = 0.9312$). This (b) value was lower significantly, compare to [48-50] who studied the biometrics of the same species in Turkish, Mixican and Libanese waters. Length weight relationship in fishes is influenced by many of factors, such as growth phase, sex, size range, and temperature, as well as the techniques of preservation [51]. Length-weight relationship has different coefficients, between different species, and even between stocks of the same species; this might be related to sex, spawning seasons and maturity stage [52-53]. This estimated negative allometric growth is not accepted [54 – 58].

Table (1): Averages of total lengths and their ranges, observed and calculated weight and condition factors (K_F) and (K_C) of the 82 *Rhinobatus rhinobatus* individuals, from Derna Harbour, June - December 2016.

No.	Total Length Range (cm)	Total Length Average (cm)	Count Of fish	T. W. Observed (gm.) (Mean±S.D.)	Cal. wt. (gm.)	K (F) (Mean± S.D.)	Gutted Weight gm.) (Mean±S.D.)	K (C) (Mean± S.D.)
1	45.2-53.1	49.4	14	235.27 ± S69.05	252.81	2.35 ± 1.31	140.17 ± 49.24	1.37 ± 0.76
2	53.2-61.1	57.5	18	550.85 ± 185.28	471.59	1.25 ± 0.31	393.82 ± 165.15	0.88 ± 0.03
3	61.2-69.1	65.7	22	939.45 ± 140.14	864.75	0.61 ± 0.14	727.17 ± 121.44	0.47 ± 0.09
4	69.2-77.1	73.5	13	1037.44 ± 115.96	1241.91	0.31 ± 0.05	811.52 ± 61.03	0.25 ± 0.05
5	77.2-85.1	80.2	9	1352.69 ± 42.15	1566.37	0.25 ± 0.02	993.41 ± 29.71	0.18 ± 0.01
6	85.2-93.1	93.0	6	2732.53 ± 393.73	2330.21	0.22 ± 0.02	2255.53 ± 345.90	0.16 ± 0.02
			82					

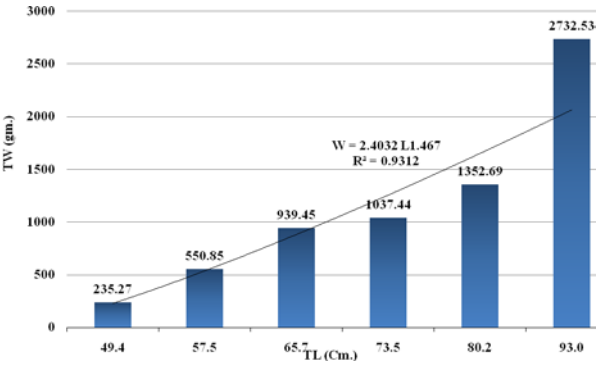

Fig. (2): The relation between average total length (cm) and average total weight (gm) for 82 *Rhinobatus rhinobatus* individuals, from Derna Harbour, June - December 2016.

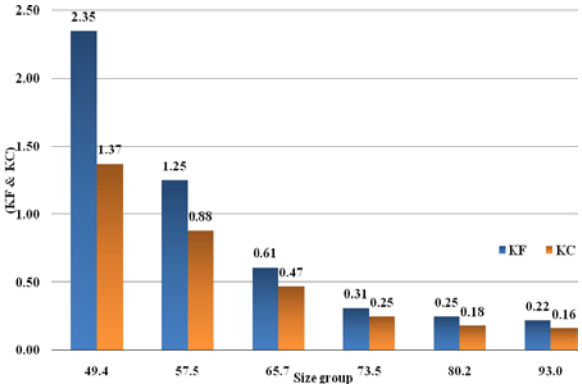

Fig. (3): The relation between the condition factors and total length of 82 *Rhinobatus rhinobatus* individuals, from Derna Harbour, June - December 2016.

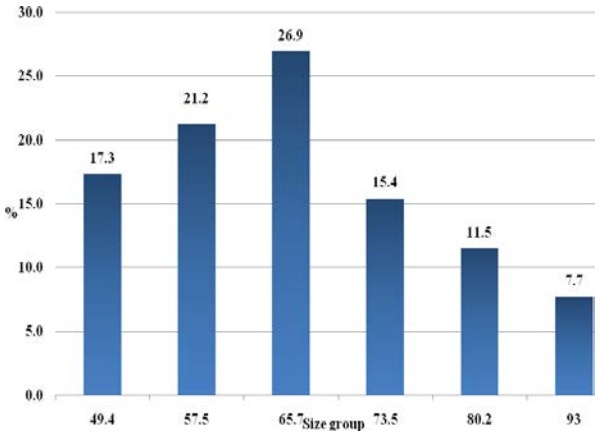

Fig (4): Length frequency distribution per size groups of 82 *Rhinobatus rhinobatus* individuals, from Derna Harbour between June - December 2016.

Table (2): Morphometric measurements of the largest male and female encountered in the 82 collected individuals of *Rhinobatus rhinobatus*. (Sample 1. Total Weight: 3010.94 gm., Sex: Male; Sample 2. Total Weight: 2454.12 gm., Sex: Female) from Derna Harbour, June - December 2016.

Measurements	Male		Female		Measurements	Male		Female	
	Cm.	% TL	Cm.	% TL		Cm.	% TL	Cm.	% TL
Total length (TL)	93.9	100	93.3	100	Snout to spiracle	16.1	17.1	16.0	17
Standard length	76.8	81.8	76.3	86.2	First to second dorsal	15.2	16.2	15.1	15.8
Desk length	26.2	28.0	28.7	30.5	Between dorsal bases	9.5	10.1	9.4	9.8
Length of Tail	18.0	19.2	17.9	13.8	Pelvic to anal	5.1	5.4	5.0	5.6
Length of Snout	2.9	3.1	2.9	2.9	Second dorsal to upper caudal	9.7	10.3	9.6	10.4
Mouth Width	5.9	6.3	5.9	6.4	Anal to lower caudal	39.7	42.3	39.5	42.8
Horizontal eye diameters	1.1	1.2	1.1	1.1	Pelvic to median tip	17.1	18.2	17.0	18.1
Vertical eye diameters	0.6	0.6	0.6	0.6	Upper caudal	15.3	16.3	15.2	15.8
Distance between eyes	2.9	3.1	2.9	2.9	Lower caudal	6.0	6.4	6.0	6.2

Preorbital length	14.2	15.1	14.1	14.8	Internasal width	3.2	3.4	3.2	2.8
Interorbital width	4.8	5.1	4.8	5.2	Interspiracular width	5.6	6	5.6	5.5
Spiracle length	2.3	2.5	2.3	2.3	Width between first gill slits	12.3	13.1	12.2	13.6
Preoral length	16.1	17.1	16.0	17.3	Width between fifth gill slits	8.4	8.9	8.3	9.1
Snout to nostrils	13.7	14.6	13.6	14.8	1st gill slit	1.0	1.1	1.0	1.2
Snout to first gill slit	22.6	24.1	22.5	23.2	2nd gill slit	1.2	1.3	1.2	1.3
Snout to disc	13.2	14.1	13.2	14.4	3rd gill slit	1.4	1.5	1.4	1.4
Snout to first dorsal	56.4	60.1	56.1	61.1	4th gill slit	1.4	1.5	1.4	1.5
Snout to pelvic	34.2	36.4	34.0	36.1	5th gill slit	1.1	1.2	1.1	1.3

In counted violinfishes from Demah harbor, the KF and KC values diminished as increase as fish size observed, this was similar to that stated to *Galeorhinus galeus* individuals in Susah coasts, Libya [58], although this drop was deeper dramatically. The guitarfish specimens may be considered if they were juveniles and adults. Condition factor reflects the biotic and abiotic factors interactions in the physiological condition, and the welfare of fish populations [59], and this drop in differnces between KF and KC values in larger specimens, seems as females of *R. cemiculus* in the Gulf of Gabès [60], this result might shows low feeding or low fecundity during the mating season, an indicating to probable stress, according to [60-62]

The mid-sized guitarfishes encountered in the present study had around the quarter of the stock, considering to the age, this regressions of the large size groups slopes made significant difference, despite of [63] records.

In percentage values, related to the total length; the female sample was smaller than the male one, on the contrary of [64].The occurrence of sexual differences in some elasmobranchs, females are growing slower usually [65-68] [2-5]. Eigther [69] stated that total lengths are significantly different from males to females; hypothecally, females can grow an older age and reach larger size than males later. In general; these size differences might be due to a fact that in some areas specimens mature at a smaller size and consequently reach a larger maximal size [70]. In this work, vertical and horizontal diameters of eyes were compared to the total length. Instead to [71] that compared to the head length. Female speciemen's body was wider and deeper, wider dorsal bases and tail was shorter than male in this work, it may provide more space for embryos in their wombs, as a many other ovoviviparous species [72-73]. This species, according to [74] has late maturity and low fecundity as most elasmobranchs, that results low reproductive potential and regeneration capacity for population. These characters made these species sensitive biologically to fishing [75].

Conclusion

Common Guiterfish is a known species in the Libya coast. However, only very few times this species was studied. The present work recommends and requires for more studies, to create database for Libyan elasmobranches.

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How to cite this article
Buzaid E.M.K. (2019). Biometric study of Common Guitarfish *Rhinobatus rhinobatus* in Demah coast, Libya (June – December 2016). Int. *J. Pharm. Life Sci*., 10(11-12):6349-6354.
Source of Support: Nil; Conflict of Interest: None declared

Received: 10.10.19; Revised: 16.11.19; Accepted: 08.12.19