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Characterization of the reproductive biology of the Sparid fish: *Rhabdosargus haffara* in Suez Bay, Red Sea

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ABSTRACT

Family Sparidae is represented in Suez Bay by seven species; the most dominant species of them is the Haffara seabream, *Rhabdosargus haffara*. Samples were collected during the fishing season 2018-2019. A total of 254 specimens were collected comprising 132 female and 122 male, the sex ratio is 1: 1.08 M: F. The chi square test showed no significant difference between male and female. The spawning season was found to be extended from November to March. The length at first sexual maturity is 12.3 and 12.7cm for male and female, respectively. The variation of maturity stages during the period of study was recorded. *R. haffara* is characterized by high fecundity as the absolute fecundity ranged from 32258 ova to 65500 ova with an average of 50245 ova. Relative fecundity ranged from 333.6 to 521.4 oocytes g^{-1} with an average of 431.5 oocytes g^{-1}.

INTRODUCTION

Suez Bay is a shallow extension of the Gulf of Suez, roughly elliptic in shape, with its major axis in NE SW direction. The average length along the minor axis of the bay is 18.8 km, while the mean depth is 10 m and its surface area is 77.13 km^2 (Meshal, 1970). The fishing methods in Suez Bay are dominated by small scale artisanal fisheries, the fleet composed of about 475 fishing boats. The length of boat ranges from 10 to 15 meter and powered by engine of about 70-150 hp. (GAFRD, 2015). The main landing site on the Bay is El-Slakhana in Suez city.

Family Sparidae, known as seabreams, are distributed in tropical and temperate seas (Froese & Pauly, 2013).

They are demersal species live in shallow to relatively deep water on sandy or muddy bottoms (Siddiqui *et al*., 2014). It is one of the most commercial families in the small scale fishery in Suez bay. *Rhabdosaragus haffara* is the most common sparid species in trammel and gill nets catches.

The reproductive biology studies on family Sparidae are rare in spite of its commercial importance in Suez bay. El Boraay (2004) studied some reproductive aspects for male of *R. haffara* in Suez bay.

Because of the commercial benefits of family Sparidae this study comes to shed light on some reproductive aspects of *R. haffara* to help in its fishery management.

MATERIALS AND METHODS

The study area (Suez bay) is located between latitudes 29° 50` and 29$^{O}$ 57` N and longitudes 32° 27` and 32$^{O}$ 36` E (Hassan and Mohamed, 2017) (Fig. 1). A total of 254 specimen of *R. haffara* were collected, comprising 132 females and 122 males.

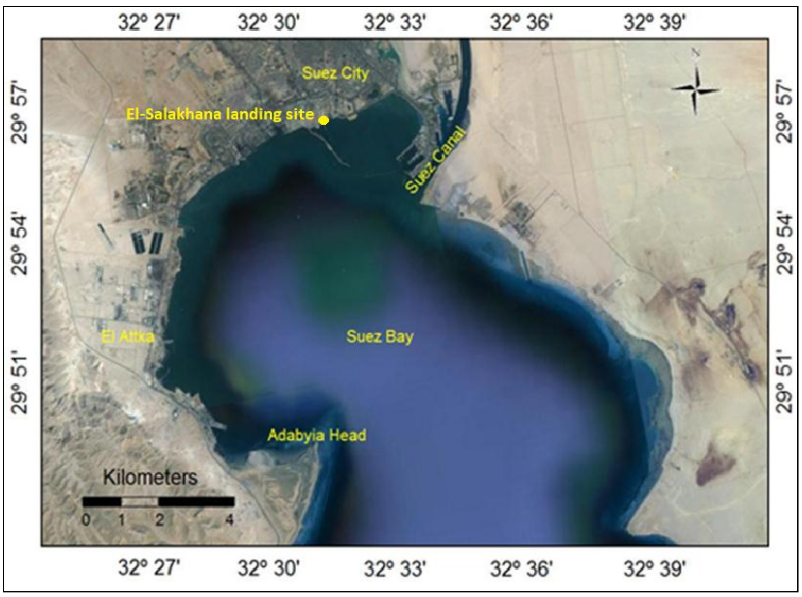

Fig. 1: Map showing the study area, Suez Bay.

Specimens were collected monthly from the local landing site operating in Suez Bay (El-slakhana) during the fishing season 2018-2019. Samples were transferred to the Lab. Total lengths to the nearest millimeter and total weights to the nearest gram were recorded then samples were dissected for determination of different biological parameters such as sex and weight of gonads. Maturity stages of males and females *R. haffara* were determined according the maturity scale described by Elganainy (1992) (Table 1).

Table 1: Maturity scale applied in this study for maturity stage determination in male and female *R. haffara* from Suez Bay according to El ganainy (1992):

I Immature	Male	The testes appeared as thin transparent cord extending to 1/3 of body cavity
	Female	The ovary appeared as thin transparent cord extending to 1/3 of body cavity
II Maturing virgin	Male	Translucent white-gray testes its length about 1/2 of body cavity no milt exuded by presser on it
	Female	Translucent red-reddish gray ovary with compact wall under binocular microscope eggs can be distinguished as polygonal shaped
III Developing	Male	Opaque, white with blood capillaries evident compact testes with occupying about 2/3 the body cavity
	Female	Opaque, reddish-orange ovary, thicker than in stage 2, extending about 2/3 length of body cavity. Eggs are clearly recognizable
IV Gravid mature	Male	Opaque white testes with definite length of 2/3 body length, very compact and with pressure white milt runs out slowly
	Female	Opaque orange ovary very compact filling 3/4 body cavity, immature, maturing and mature ova present mature ova are more numerous
V spawning	Male	Soft and creamy white testes milt oozes out on pressing the gonad, extended about 3/4 body cavity.
	Female	Long and broad, ovary filling the body cavity red or reddish-yellow in color, opaque mature ova more numerous than maturing ova
VI Fully spent	Male	Very loose wall and rich blood capillaries testes the color gray with no milt comes out
	Female	Ovary with loose walls sometimes with folds very much shorter and bloody deep red in color

Sex ratio is the proportion of the total numbers of males to females (M: F) and the percentage of males and females was determined for different length groups and different months. A chi-square test for a 0.05 significance level is calculated according to Ochieng *et al*, (2015).

Gonado- Somatic Index was investigated according to Sokal and Rohlf (1969).

$$\textbf{G. S. I.} = \textbf{gW*100/ GW}$$

Where,

gW = weight of the gonad, whether testes or ovaries,

GW= gutted fish weight.

Length at first sexual maturity for males and females was determined according to Pauly (1983) by plotting the cumulative curve for probability of capture by length.

Absolute fecundity was calculated according to Sujatha *et al.* (2015) where;

$$F = \frac{X * OW}{SW}$$

F= absolute fecundity

OW= total weight of the ovary

SW= weight of subsample

X= the average number of ova in the subsample.

The relative fecundity was calculated according to Qadri, *et al.* (2015) formula:

Relative fecundity = Absolute fecundity/ Total fish weight

RESULTS

Sex ratio: females constituted about 52% of the total sample size. Male to female sex ratio was 1:1.08. The value of chi-square is *P*=0.5303 this value showed no significant difference between both sexes.

The percentage of males and females was determined for different length groups and different months (Figure 2 and 3). Which revealed that females outnumbered males in length groups from 16 to 22 cm and males outnumbered females in large length groups (more than 22cm) and very small length groups, less than 16cm.

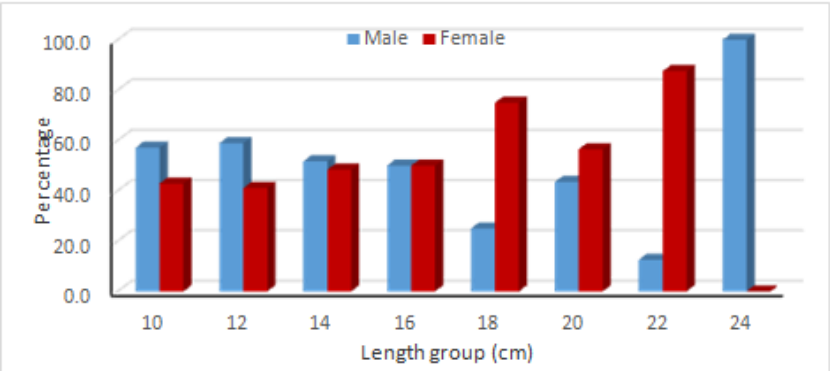

Fig. 2: Percentage of males and females of *R. haffara* in different length groups in Suez Bay

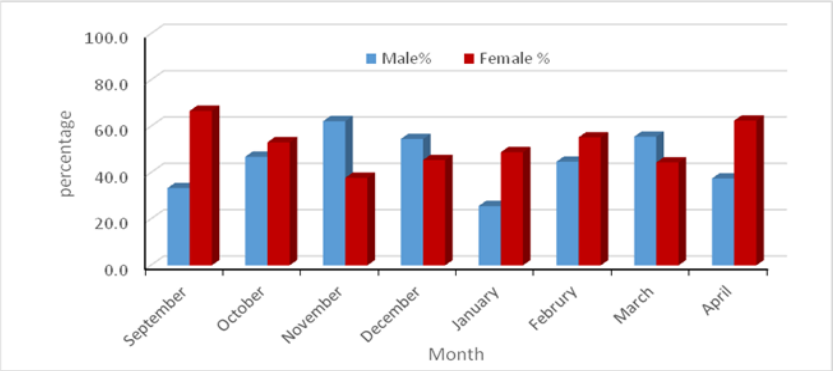

Fig. 3: Percentage of males and females of *R. haffara* in different months in Suez Bay

According to months female were dominant in September, October, January, February and April whereas males were dominant during November, December and March.

Maturity stages distribution: Maturity stage (III) recorded during September to October for male and from the end of September to November in female. The ripe stage (IV) started from the end of October to February for males and females. Running stage (V) extended from October to march for male and from November to March for female. More than 80% of males were found to be spent, stage (VI) from January to March while about 40% of females became spent during March. During April all samples were in recovery stage (Figs. 4, 5).

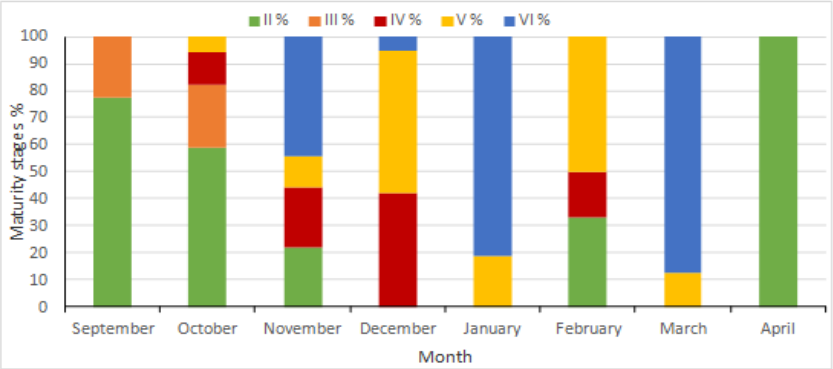

Fig. 4: Monthly distribution of maturity stages of male *R. haffara*

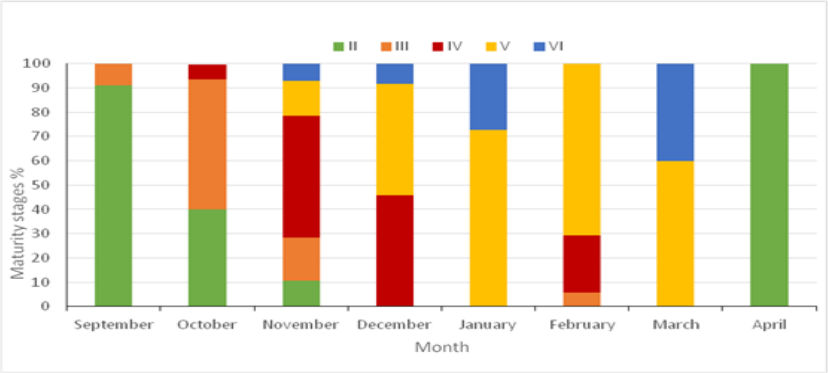

Fig. 5: Monthly distribution of maturity stages of female *R. haffara*.

Gonado-Somatic Index: GSI values varied with months and they were generally higher in females than that of males (Fig. 6). The highest values of GSI started from

November to March for both sexes which indicated that the spawning season for *R. haffara* in Suez Bay is from late autumn to late winter.

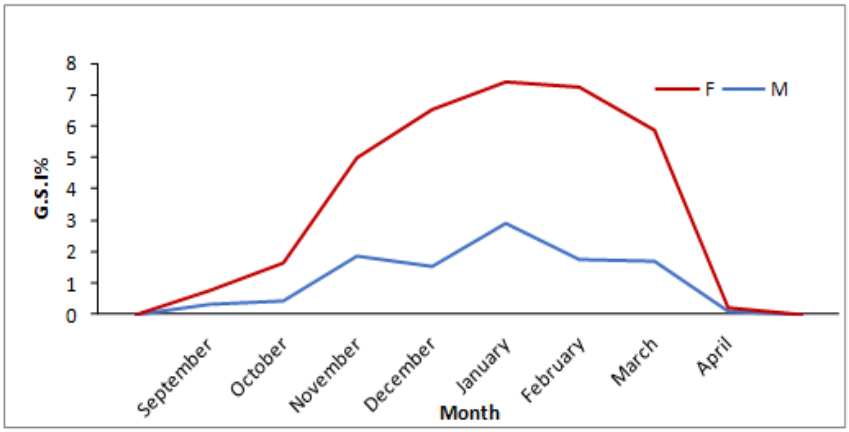

Fig. 6: Monthly variation of G.S.I for male and female *R. haffara* in Suez Bay

Length at First sexual maturity L_{m50}: Length at first maturity of *R. haffara* is shown in Figure (7), male reach the maturity before female as $\mathbf{L_{m50}}$ for males and females were 12.3 cm and 12.7cm, respectively

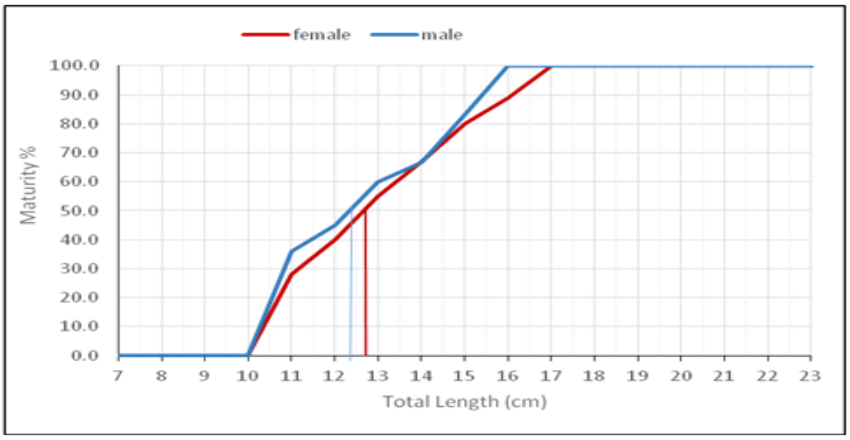

Fig. 7: Length at first sexual maturity for males and females of *R. haffara* in the Suez Bay.

Fecundity:

Absolute Fecundity:

Absolute fecundity for *R. haffara* was estimated during its spawning season and it ranged from 32258 ova to 65500 ova with an average of 50245 ova.

Relative Fecundity

The relative fecundity for *R. haffara* ranged from 333.6 oocytes $g^{-1}$to 521.4 oocytes g^{-1} with an average of 431.5 oocytes g^{-1}.

The relationship between absolute fecundity and the total length;

There was a positive relationship between the absolute fecundity and the total length for females of *R. haffara* (Fig. 8). The absolute fecundity ranged from 32258 ova to 65500 ova with an average of 50245 ova for fish lengths ranging from 16.2 to 23.4cm. The regression equation for the absolute fecundity was as follows:

$$Log\ F_{abs}=2.007+2.0785\ log\ L \qquad (R^2=0.68).$$

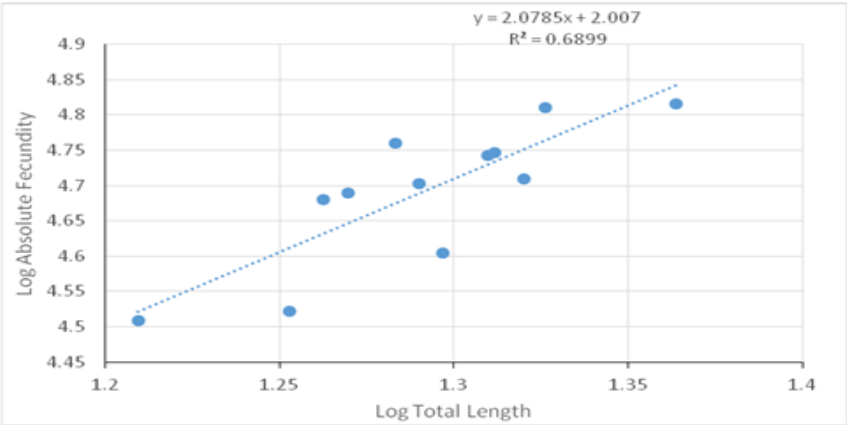

Fig. 8: Logarithmic relationship between absolute fecundity and total length of *R. haffara* in the Suez Bay

The relationship between absolute fecundity and total weight:

The relationship between the absolute fecundity and the total weight of female *R .haffara* is represented in Figure (9) the derived regression equation is as follows:

$$(Log)F_{abs}=3.2087+0.7194 \log (W)$$

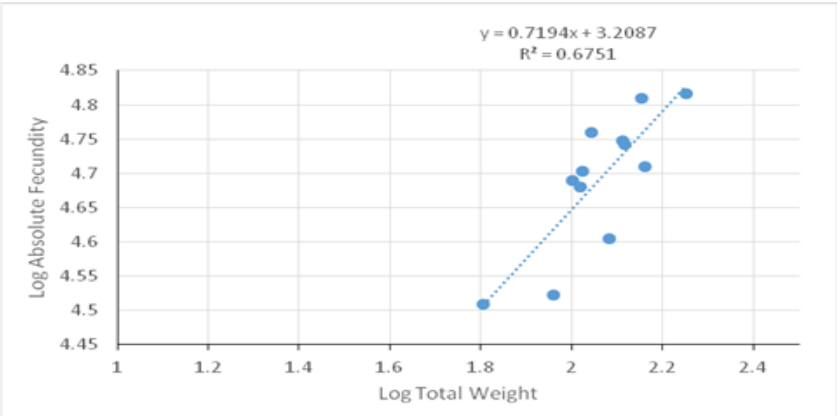

Fig. 9: Logarithmic relationship between absolute fecundity and total weight of *R. haffara* in the Suez Bay.

DISCUSSION

Reproductive biology of any fish species is very important for fishery management, as it gives a predictable future for recruitment in the fishery (Osman, 2016). Family Sparidae is one of the considerable commercial families in the small scale fishery of Suez bay, with most dominant species *R. haffara.* The results of the current study showed that females of *R. haffara* are slightly dominant than males without a significance difference. However, El Boraay (2004) reported that females outnumbered males in Suez Bay with a significant difference between male and female. Furthermore, Al Abdulhadi and Osman (2009) found that females are more dominant than males with a significant difference between male and females of *R. haffara* population in the Arabian Gulf. The estimated length at first sexual maturity is 12.3 and 12.7cm for both sexes male and female respectively; this is less than that recorded by Al Abdulhadi and Osman (2009), as they showed that L_{m50} is 15.3 and 16.5 cm for male and female in the Arabian Gulf. El-Boraay, (2004) estimated the L_{m50} for male *R. haffara* as 10.3cm in the Suez bay. These differences may be

attributed to the different recorded maximum length of the species in the different localities.

The spawning season for *R. haffara* in Suez Bay extended from November to March which agreed with EL-Boraay, (2004) and Al Abdulhadi and Osman (2009) in Suez Bay and the Arabian Gulf. As well as Abuzinadah (2001) indicated that the average GSI of *R. haffara* male and female peaks in December and January in the red sea, Saudi Arabia. Amir *et al*, (2018) revealed that the spawning season for *R. sarba* in Pakistan is extended from November to February. Sheaves, (2006) indicated that for the family, genera, species and individuals, Sparidae as a whole, there was a consistent pattern; Spawning at lower latitudes was concentrated close to the month of lowest sea surface temperature, while spawning at higher latitudes was more variable with greater deviations from the month of minimum sea surface temperature. Maturity stages distribution during the period of study showed that the spawning period start in November and ended during March as the running or spawning stage were represented during this time.

R. haffara in Suez Bay is distinguished by high fecundity as its absolute fecundity ranged from 32258 ova to 65500 ova with an average of 50245 ova. The absolute fecundity is directly proportional to the length and weight which agreed with Al Abdulhadi and Osman (2009), Sujatha *et al.* (2015), Qadri, et *al*., (2015), and Osman *et al*, 2018.

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