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Reproductive biology of *Rhabdosargus haffara* (Teleostei, Sparidae) in the Arabian Gulf

Heyam Abdulla Al Abdulhadi [1] and Amany M. Osman[2]

1-Faculty of Science, Dammam,Girls College, King Faisal University, Kingdom of Saudi Arabia
2-Faculty of Science, Alexandria University, Egypt.
E-mail: amosman88@yahoo.com

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Abstract

The present study on reproductive biology of *Rhabdosargus haffara* revealed that the spawning season lasted from December to March for both males and females. Study of the size at onset of sexual maturity showed that *Rhabdosargus haffara* reach sexual maturity at 15.3 cm for males and 16.5 cm for females. The sex ratio was 1: 1.68 males to females in the present sample. Fecundity analysis revealed significant relationships for absolute fecundity with length and weight.

Keywords: *Rhabdosargus haffara,* sexual maturity, Fecundity analysis, Arabian Gulf

1. Introduction

Rhabdosargus haffara is a tropical fish living in the western Indian Ocean; it is more or less common in the north of the Arabian Gulf. It inhabits shallow waters, mainly around coral reefs and over sandy or muddy - sandy bottoms. This species is of economic importance, it is esteemed as fish food in most tropical countries. Biological and fisheries studies on this species in the Arabian Gulf (KSA) are rare however some studies were done on its fishery biology in the Suez gulf, Egypt. (Al-Oraimi, 1996; El- Boray, 1997 & 2003; Ibrahim1999; Mehana, 2001; and El- Halafawy, 2001).

2. Materials and methods

A total of 575 specimens of *Rhabdosargus haffara* ranging from 12-27 cm total length were obtained by random sampling from the commercial landed catch off Dammam coasts, Arabian Gulf, Kingdom of Saudia Arabia.

2.1. Spawning season

The spawning season was determined following the monthly changes in percentage frequency of maturity stages and the mean values of gonadosomatic index. The parameters under investigations were computed as follows:

2.1.1. Gonadosomatic index (G.S.I.)

The data of gutted weights (gm) and gonad weights (gm) were used to determine the gonadosomatic index G.S.I. according to Schaefer and Orange (1959)
G.S.I = (gonad weight / gutted weight) x 100
Monthly variations in this index were determined.

2.1.2. Maturity stages

Determination of maturity stages were done according to Nikolsky (1963) as follows, stage I (immature) where the gonads are thread like, stage II is maturing, the female gonads are regular straight creamy to rosy pink and occupy less than one third of the body cavity and male gonads are pale pink in color and transparent. Stage III is mature, the testis looks like a narrow ribbon, white in color and opaque, and it appears just under the kidneys and occupies the whole body cavity. The ovaries are rose to faint pink in color with orange tint and is more or less of equal diameter and extends throughout ¾ of the body cavity. Stage IV is the prespawning, the testis is dirty white in color, ribbon like throughout its length and opaque, the diameter of the gonad has increased. The ovary is rounded, yellow to orange in color, compact and occupies the whole length of the body cavity. Large ova can be detected by the naked eye. Stage V, is the spawning, the testis is still ribbon like and milky white in color, upon pressing on the belly of the fish, milt gets out from the genital opening. The Ovary is reddish orange, rounded filled with ripe yellowish eggs. Eggs could be released with a gentle pressure on the belly. Stage VI is the spent. The testis is flaccid and dirty white in color, some residual milt is still in the gonad. The ovary shrunken loose, folded and flaccid, dark

violet in color, transparent with few yellow large ova could be detected.

2.2. Sex ratio

The sex ratio was calculated as the ratio between total numbers of males to total number of females.

2.3. Onset of sexual maturity

The estimation of length at sexual maturity (L_{50}) was calculated according to the formula:

Ln (P/ 1-P)= a+ b L (Guderson, 1977) where:

P: is the proportion of mature individuals in each length interval.

L: is the mean length.

a and b are constants.

2.4. Fecundity

For fecundity determination, ovaries of females at stage V were kept in 10% formalin. The weight of each ovary was determined. Only yolked eggs were counted from each ovary. Three random subsamples of the ova were taken, the weight of each subsample was obtained to the nearest 0.1 gm and then each was counted separately for the number of ova present. Total number of eggs (N) (in both ovaries) was calculated using the formula:

N = Ns (Wt / Ws) where:

Wt: ovaries weight (gm)

Ws: weight of sub sample (gm)

Ns: number of eggs in sub sample

3. Results

Monthly variations in gonadosomatic index (G.S.I.) are shown in (Figure 1), it appears that the mean value of G.S.I. in both males and females reached its maximum from December to March. The monthly variations in G.S.I. took the same trend in both males and females. This shows that the spawning season of the species understudy lasts from December to March.

Monthly variations in sexual maturity stages were determined for both males and females. Concerning the males (Figure 2) and females (Figure 3), it appears that stage IV appeared in November and lasts until the month of March, while stage V was observed from December to March. Post spawning (stage VI) was observed from March to June for males and females.

These results show that the spawning season for both males and females *Rhabdosargus haffara* takes place from December to March and this is in accordance with the results of G.S.I. Size at onset of sexual maturity was determined by applying the equation:

Ln (p / 1-P) = a = b L (Gunderson, 1977)

From this equation, it appears that the length at which 50% of the individuals are sexually mature was 15.3 cm for males and 16.5 cm for females.

From 577 fish samples examined, 215 were males and 362 were females, so the overall sex ratio of males to females was 1: 1.68.

The relationship between total length and absolute fecundity (Figure 4) was found to be curvilinear and represented by the following formula:

$$\text{Log } F = -1.2732 + 4.37 \text{ Log } L \quad r^2 = 0.848$$

The relationship between gutted weight and absolute fecundity (Figure 5) was also curvilinear and represented by the following equation:

$$\text{Log } F = -1.5856 + 2.6714 \text{ Log } w \quad r^2 = 0.9604$$

F is the absolute fecundity, L is the total length in cm and w is the gutted weight in gm.

4. Discussion

Study of sexual cycle of *Rhabdosargus haffara* shows that the spawning season lasted from December to March and this is in accordance with El- Boray (1997) who found the same results in his study on the same species in the Gulf of Suez. The gonadosomatic index is a common method of describing the relative size of the gonads with respect to gutted body weight. This index has some disadvantages (Wootton 1990), yet it is considered by many authors to be a tool to determine the time of spawning for a certain fish species. Its monthly variations together with monthly variations in sexual maturity stages are considered satisfactory to determine the time of breeding. According to monthly variations in G.S.I., it was found that this fish species spawns from December to March in the Arabian Gulf. Monthly variations in maturity stages show that the ripe fish are abundant in the catch from December till the month of March.

El- Boray (1997) showed that the spawning season for this species in the Gulf of Suez extended from December to March. According to Wootton (1990), a fish should reproduce at the time of year that will tend to maximize its life time production of offspring, this time is affected by temperature. According to Ashan (1966), De Valming (1972), Breton and Billard (1977), Chan and Yeung (1983), Lam (1983), Bye (1984) and Stacey (1984), environmental factors such as photoperiod, temperature, salinity and stress are known to influence activities in both sexes of a fish species. Within Sparid fishes, timing of reproduction changes from a species to another. Thus *Diplodus sargus* spawns in winter, (Micale *et al.*, 1987). On the other hand, *Lithognathus mormyrus* spawns in summer and *Boops boops* spawns in spring (Osman, 2000). The present results revealed that females reach sexual maturity at 16.5 cm (T.L.) while males reach sexual maturity at 15.3 cm (T.L.).In the Gulf of Suez this species was found to reach sexual maturity at 11.88 cm (T.L) for females and 10.3 cm for males. Griffiths *et al*

(2002) noted that the length of onset of sexual maturity in *Rhabdosargus globiceps* were 18.6 and 15.3 cm (forked length) for males and females respectively.

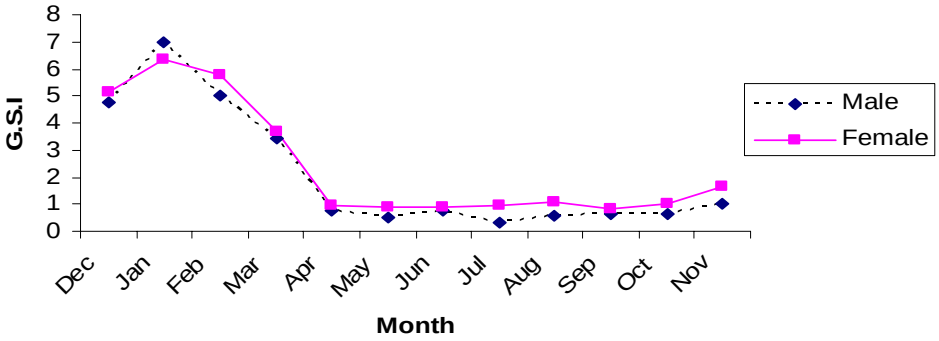
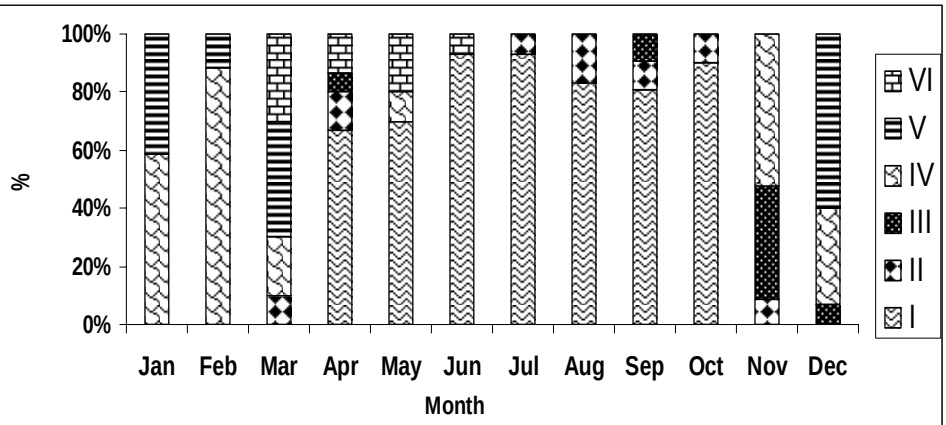
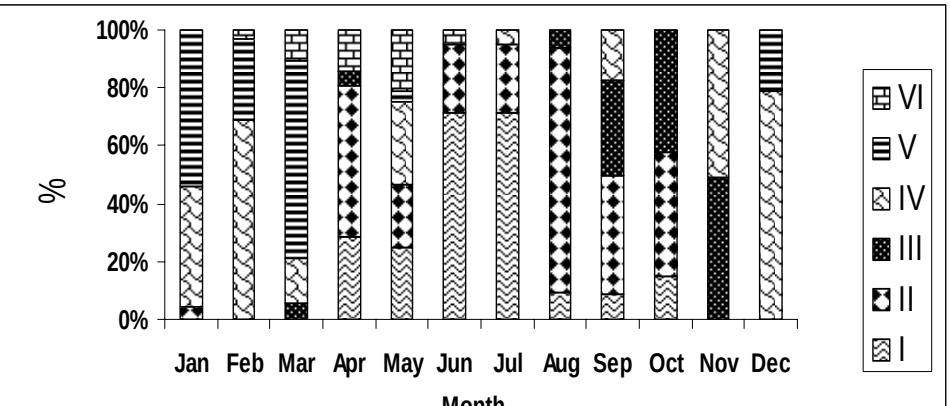


Fig.(1) Monthly variations in gonadosomatic index (G.S.I) for males & females *Rhabdosargus haffara*



Fig(2) Monthly distribution of maturity stages for male *Rhabdosargus haffara*



Fig(3)Monthly distribution of maturity stages for female *Rhabdosargus haffara*

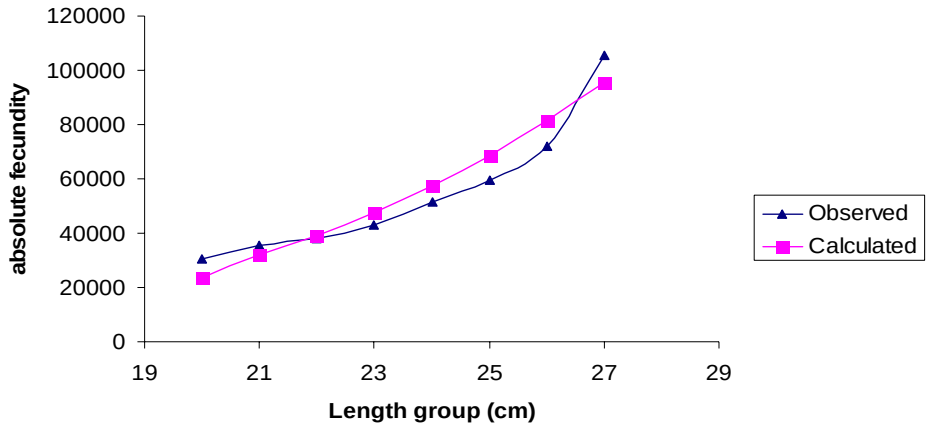


Fig.(4) Relation between absolute fecundity and total length for *Rhabdosargus haffara*

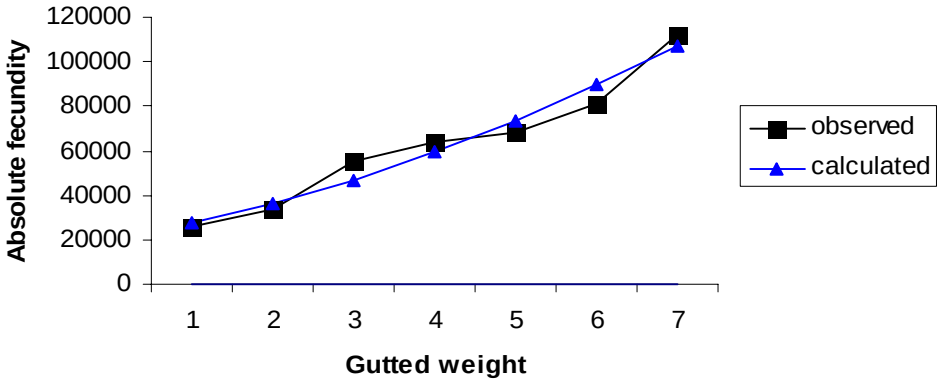


Fig.(5) Relation between absolute fecundity and gutted weight for *Rhabdosargus haffara*

This difference between the present study and that of El-Boray (1997), could be due to variations in environmental conditions. The present results are in agreement with those of the last author in that males reach sexual maturity earlier than females. This result is known also in other fish species (Wootton, 1990; Zaki *et al*, 1995; Osman, 2000 and Lahlah, 2004).

The sex ratio in a fish population is one of the important biological characters for a fishery biologist. The overall sex ratio of *Rhabdosargus haffara* (male to female) was found to be 1: 1.68. This means that females outnumber males. This value is in accordance with that given by Ibrahim (1999) and El-Boray (1997). Manooch (1976) found that the ratio of males to females in red Porgies *Pagrus pagrus* varied from 1:1.9 to 1:1.33 in a three years period. According to Pajuelo and Lorenzo (1996), this ratio was 1: 3.29 for the same species off Canary islands.

Fecundity analysis revealed a curvilinear relationship between fecundity and total length, as well as between fecundity and gutted weight. In the present study however, the value of the exponent was 4.37 when fecundity was related to length and 2.67 when fecundity was related to weight. It should be noted that fecundity of a fish is affected by its environmental conditions as well as its feeding activities (Hashem, 1983 and Wootton, 1990).

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