REPRODUCTIVE BIOLOGY OF *DIPLODUS SARGUS* (FAMILY : SPARIDAE), IN THE MEDITERRANEAN ENVIRONMENT

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Abstract

The maturity stages of *Diplodus sargus* were detected through the morphological examination of the gonads by the naked eyes into seven stages (thread; immature; mature; nearly ripe; ripe; spawning and spent stages). The length at which *D. sargus* attains its first sexual maturity in the present study was 16.5 cm. However, all *D. sargus* fish of total length longer than 19.5 cm are mature. The monthly distribution of the maturity stages revealed that *D. sargus* has a long breeding season : from January to April with a peak in March.

Keywords: Fish, Eastern Mediterranean Sea

Introduction

Bream species offer good prospects for new fish culture in the Mediterranean Sea. Most of the approximately 100 species belonging to family Sparidae had been found in the tropical and temperate marine waters, while some had been adapted to very cold water. It has been reported (1) that fish species of the family Sparidae represent about 17% of the total tonnage landed from Egyptian Mediterranean waters. These demersal fish are captured mainly by bottom trawling or poles with baited lines. The present study aims to the investigation of the important aspects of the reproductive biology and physiology of the white sea bream *D. sargus* in the Mediterranean Sea.

Materials and methods

Specimens of living *D. sargus* ranging in length from 11.0 to 29.6 cm were collected monthly from the Mediterranean coast near Kayet Bay castle at Anfoushy region, Alexandria from September 1996 to August 1997. The fish was dissected to determine sex and maturity stage, the gonadal weight (Wg) was recorded and after removal of the organs from the abdominal cavity, "gutted weight" (Wa) was recorded. Gonadal weight and gutted weight were used to calculate the gonadosomatic index: Wg/Wa x 100 to estimate fecundity, the ripe ovaries of 30 fish specimens were calculated during the breeding season.

The paired ovaries were weighed to the nearest milligram, and then 0.1 gm of ovary was preserved in 4% neutral formalin. The number of eggs in the weighed sample was counted and the total number of eggs in the ovaries were estimated by the following equation :

$$\text{Total no. of ova} = \frac{\text{weight of ovary}}{\text{weight of sample}} \leftarrow \text{no. of eggs in thr sample}$$

To estimate the egg diameter, known portion of the ovary preserved in 4% neutral formalin were spread in a small Petri dish and the diameter of all eggs were measured using eye piece micrometer. The measurements were then converted into microns.

Results and discussion

To demonstrate the reproductive biology of *D. sargus*, many important parameters were studied. These parameters are : maturity stages, length at first sexual maturity, monthly distribution of maturity stages, gonadosomatic index (GSI), egg diameter during the spawning season and fecundity. The maturity stages were determined first by morphological characters of the gonads by the naked eyes. In the present study, seven maturity stages, including the thread, were recorded in the scheme of Zaki *et al.* (2) : stage I (thread); stage II (immature stage); stage III (maturation stage); stage IV (nearly ripe stage); stage V (Ripe stage); stage VI (Spawning stage); and stage VII (Spent stage).

The length at first sexual maturity is very important item for fisheries management and induced spawning. The length at which the species attain its first sexual maturity is different from one species to another. In the present work, *D. sargus* less than 16.5 cm were immature. However, the percentage of mature individuals increased with the increase of the fish length, where all fish of total length longer than 19.5 cm are mature. The same idea about the relation between the length and the sexual maturity was observed in many fish species, as reported for *Dicentrarchus labrax* and for *Rhabdosargus haffara* (3). The monthly distribution of the maturity stages is one of the methods used for the determination of the beginning and duration of the spawning season.

In the present study, the monthly distribution of the different sexual maturity stages for *D. sargus* revealed that this species has a long breeding season extending from January to the end of April with a peak in March. From June to November, specimens of the studied *D. sargus* were localized in the first three stages, which are thread, immature or mature. In December, stage IV (nearly ripe stage) started to appear, while the ripe stage appeared in January. In February, the majority of the fish are ripe. The spawning stage started to appear in March reached its peak at the end of March and during April. By the end of April, the majority of the fish were observed in the spent stage. In May, all the fish were in the spent stage.

Gonadosomatic index represents the percentage of gonad weight to the body weight. It is assumed that the period during which GSI value is highest corresponds to the breeding season. Gonadosomatic index is usually established for males and females alike, although the development of gametes is not reflected by this index in an identical way in both sexes.

The monthly distribution of gonadosomatic index values indicated that GSI values were very high from January to March i. e. during the breeding season. The maximum value was attained in February for both sexes. It was 5.89 ± 1.15 for females and 5.29 ± 1.24 for males. During March, the gonadosomatic index values decreased due to the discharge of ova and sperms during the spawning process. A sharp decrease in the Gonadosomatic index values for males and females was observed in April due to the discharge of most ova and sperms. This decrease continued until it reached its lowest value in August.

However, the gonadosomatic index value of the females throughout the year is greater than that of the males. This is due to the fact that the eggs as the end product of ovogenesis in the females are much heavier than the spermatozoa or the end product of spermatogenesis of males. This observation was noticed by many authors for *Mugil cephalus* (4) and for *Diplodus cirvinus hotentotus* (6). The analysis of ova diameter is of great importance in the determination of the spawning frequency and the duration of the spawning season.

The ovary of *D. sargus* showed three batches of eggs. The first batch includes the eggs with diameters less than 0.35 mm. It represents the minute and immature eggs. The minute ones have a round shape while the larger may have polygonal or rectangular shape. This batch represents the oocyte stock. The second batch includes the larger eggs, which are yellow in colour and their diameters ranged from 0.35mm to less than 0.6mm. The third batch includes the largest ova, which are transparent and yolky with ova diameters ranging from 0.6 mm to 0.8 mm.

The present study demonstrated the monthly distribution of egg diameters from the beginning of December to the end of April. During December, the majority of eggs are within the first and the second batches. During January a new class of large egg size started to appear with a very low percentage value (1%) and a maximum egg diameter about 0.68 mm. Another new class of large egg appeared at the end of January with a diameter of 0.765 mm.

During February, the frequency distribution curve of the ova was shifted towards the higher values of egg diameters. During March, the fish started to discharge some of the ripe ova. Due to the discharge process, the frequency distribution curve was shifted towards the smaller egg diameter. During April, the discharge process continues until the frequency of the large ova becomes very small. Also, the GSI value decreased sharply during this month.

One of the most important items in the study of reproductive biology is the estimation of fecundity. In the fecundity estimation, it is necessary to take into account whether the fish has a short or long spawning period. However, the present study showed that the *D. sargus* has a long spawning season. The fecundity was estimated from the fully ripe ovaries. All groups of yolky eggs were counted, and could be conveniently assorted in those ovaries.

The present study showed that there is a good agreement between the observed and the calculated values of both absolute and relative fecundity. This observation indicates the fitness of the equations expressed the relations between the absolute fecundity and the length as well as the weight of the fish.

The mean observed absolute fecundity ranges from 33665 to 168449 eggs for mean total lengths ranging from 18.4 to 31.5cm while the corresponding observed relative fecundity ranged from 1830 to 5348 egg per cm.

The results of the present study followed the same trend like those of Abou Shabana (5) for *Diplodus cirvenus hotentottus* and Abdallah(6) for *Diplodus vulgaris*.

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