BATCH FECUNDITY OF PICAREL *SPICARA SMARIS* (L.) IN THE SARONIKOS GULF (GREECE)

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Abstract
Relative batch fecundity was studied for the multiple spawner *Spicara smaris* in the Saronikos Gulf (Greece) and compared with fecundity values reported in Greek waters. The picarel relative batch fecundity was estimated by the hydrated and migratory-nucleus method and was found to be equal to 339 oocytes per g fish weight.
Keywords : Aegean Sea, Demersal, Fishes, Spawning.

Introduction
Picarel (*Spicara smaris* L.), is a very common species in the Mediterranean and the Black Sea but it is also found in the eastern Atlantic from Portugal to Morocco including the Canary Islands, inhabiting *Posidonia* beds and muddy bottoms at about 15-100 m [1]. The national catch recorded for 2003 was 4025 t constituting 5% of the total fish yield in Greek waters [2]. The fecundity of picarel has been estimated in Greek waters by counting the total number of oocytes above a certain size threshold [3]. However, this method results in the underestimation of the potential annual fecundity of a species characterized by batch spawning. Picarel is a multiple spawner [4] with a peak of spawning in April-May in the Saronikos Gulf [5]. Batch fecundity of picarel has been primarily estimated in the Saronikos Gulf [5]. In the present work additional females were examined and the overall batch fecundity estimate is compared with fecundity values eported in Greek waters.

Materials and Methods
Samples of picarel were monthly collected in the Saronikos Gulf during 2003 from February to March by beach seiners and in April and May by nets and trawlers respectively. Specimens were randomly taken from the catch and were measured (total length) to the nearest mm and sexed; their total weight was measured to the nearest g. Females were classified to reproductive stages according to Nikolsky's [6] scale. Ovaries of macroscopically mature females (greater than stage II) were removed, weighed to the nearest 0.1 g and preserved in 10% neutral buffered formalin for histological examination. A piece of each preserved ovary was then dehydrated and embedded in paraffin wax. Sections (3 micron) were taken and stained with Harrish aematoxylin followed by eosin counter stain (H+E). From each ovary two subsamples of approximately 0.050 g were taken and after connecting membrane removal, were weighed to the nearest 0.001 g. The diameters of each oocyte in both subsamples were measured under the stereoscope using the Image Analysis Pro Plus 5.0 and the mean values were taken. Batch fecundity (F_b, number of oocytes per spawn) was taken to be the number of migratory-nucleus stage oocytes (MN) or the number of hydrated oocytes (H), still within their follicles, in the ovary [7]. The estimation of F_b was done by the gravimetric method [8]. Hydrated oocytes were easily recognized by naked eye. During histological examination it was also observed that the diameter of an oocyte with migratory nucleus ranged from 500 to 800 micron. Therefore, the size of 500 micron was taken as a threshold in order for all the migratory-nucleus stage oocytes to by counted. The ovaries used to estimate F_b were taken from samples at the peak of spawning (April-May).

Results and Discussion
The presence of post ovulatory follicles (pofs) in some ovaries in March showed that the spawning period has already started, while in February samples no spawning characteristics existed (MN, H or pofs). Thirty eight appropriate ovaries (10 with H oocytes and 28 with MN oocytes) ranging in weight from 7.1 to 50.2 g (ovary-free weight) were used for batch fecundity estimation. The numbers of oocytes per g fish weight between spawning states (MN and H) did not differ significantly (ANOVA, P=0.26). The relation between female weight (W, without ovary weight) and batch fecundity (F_b) was determined by linear regression analysis. In the resulting equation: F_b= 369.1+321.7 W with R^2=84.3%, the intercept for the regression of F_b to W did not differ from zero (t=0.68). Therefore, the regression line (Fig. 1) was forced through zero (by multiple regression: [9]), weighting the regression line by the inverse of fish weight for each observation, in order that a minimum variance and unbiased estimates of regression coefficients could be obtained [7]. Thus, the resulting equation was: F_b = 339 W with R^2=96.0% and confidence interval equals to 316-362. Accordingly, the relative batch fecundity (F_{bw}) was estimated as F_{bw} = 339 oocytes per g fish weight. Vidalis [3] estimates for the same species in Greek waters the relative fecundity equal to 358 oocytes per g fish weight. Although this author has used a size threshold (250 micron) for counting the total of oocytes to be mature, his estimation should be considered as underestimated when compared to the present work, as batch fecundity represents here only the number of oocytes for one spawn (339 oocytes per g fish weight).

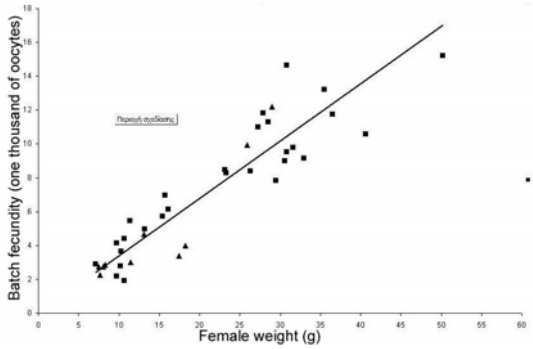

Fig. 1. Batch fecundity (F_b) of picarel, *Spicara smaris*, as a function of female weight (W, ovary-free). Batch fecundity was estimated by counting hydrated oocytes (triangles) or migratory-nucleus stage oocytes (squares). Regression line (forced through zero) is: Fb=339 W.

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