

Fecundity and spawning of *Abralia verany* (Rüppell, 1844) (Cephalopoda: Enoploteuthidae) in the Aegean Sea*

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SUMMARY: A total of 24 female *Abralia verany* specimens, with a mantle length between 26-47 mm, were investigated. The mean potential fecundity (PF) and mean relative fecundity (RF) of ovaries were calculated as 26584 eggs and 4379 eggs g⁻¹, respectively. The mean egg number determined in the oviduct was 251. Diameters of ripe eggs in the oviduct were approximately 1.01 mm. According to the findings given above the PF values of *A. verany* in the eastern Mediterranean are higher than the ones off northwest Africa.

Keywords: *Abralia verany*, fecundity, Aegean Sea, eastern Mediterranean.

RESUMEN: FECUNDIDAD Y DESOVE DE *ABRALIA VERANY* (RÜPPELL, 1844) (CEPHALOPODA: ENOPLOTEUTHIDAE) EN EL MAR EGEO. – Se estudiaron un total de 24 hembras de *Abralia verany*, entre 26-47 mm de longitud del manto. La fecundidad potencial media (PF) y la fecundidad relativa media (RF) de los ovarios se calcularon como 26584 huevos y 4379 huevos g⁻¹ respectivamente. El número medio de huevos en el oviducto fue de 251. El diámetro de los huevos maduros en el oviducto fue de 1.01 mm aproximadamente. Según los resultados obtenidos los valores de PF de *A. verany* del Mediterráneo oriental son más altos que los del noroeste de África.

Palabras clave: *Abralia verany*, fecundidad, Mar Egeo, Mediterráneo Oriental.

INTRODUCTION

Squid of the family Enoploteuthidae are the “myctophid fishes” of the squid world (Young and Harman, 1985), and play an important role in both epipelagic and mesopelagic trophic webs (Arkhipkin, 1996; Laptikhovsky, 1999a). The life span of Enoploteuthids is short, ranging from six months to one year (Young and Mangold, 1994; Laptikhovsky, 1999a). *Abralia verany* (Rüppell, 1844), is widely distributed throughout the tropical and subtropical

Atlantic, and in the Mediterranean basin including the Aegean Sea (Mangold and Boletzky, 1987; Nesis, 1987; D’Onghia *et al.*, 1992). This species inhabits mesopelagial and bathyal habitats in the daytime and rises to the surface at night (Nesis, 1987).

The reproductive biology of this species was briefly investigated in waters off northwest Africa, where it was suggested to be an intermittent spawner (Laptikhovsky, 1999b). Other representatives of the family seem to be multiple spawners (Young and Harman, 1985; Laptikhovsky, 1999a). No data on the reproduction of *A. verany* in the Mediterranean Sea

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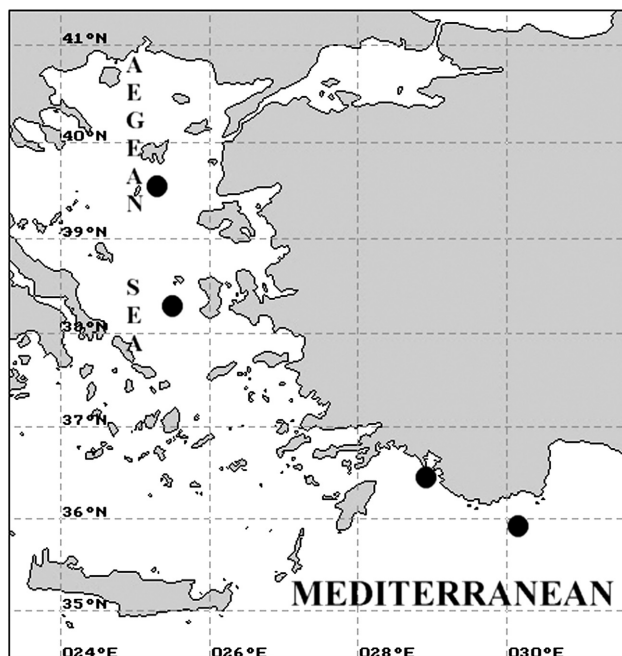


FIG. 1. – Sampling stations

is currently available. This study aims to investigate the reproductive biology of *A. verany* inhabiting the Aegean Sea, and to compare it with results obtained in the more typical oceanic habitat of the Atlantic Ocean.

MATERIALS AND METHOD

A total of 24 females with mantle lengths (ML) between 26–47 mm, and body weights (BW) between 1.5–6.7 g were investigated. Samples were collected by the R.V. “K.Piri Reis” between 1991–1993 in seasonal periods, during 446 bottom trawling hauls carried out at depths ranging from 20 to 500 m along the Aegean Sea and eastern Mediterranean Sea coasts of Turkey (Fig.1). *A. verany* specimens were only observed at depths between 300 to 480 m. Surface water temperature was determined at each trawling station by Sea Bird SBE Model 11 CTD. A commercial bottom trawl net (30 m in total length, mesh size 20 mm) was used. For each animal the ML was measured to the nearest 1 mm and BW to the nearest 0.1 g, then the squid were fixed in 4% formalin, and later transferred to 70% alcohol.

In the laboratory, the animals were dissected and their reproductive organs removed (ovary, oviducal gland and oviduct). The gonadosomatic index (GSI) was calculated for each female ($GSI = (GW/BW) \times 100$) (GW: Gonad weight; BW: Body weight), and

TABLE 1. – Percentage of *A. verany* females in each maturity stage for each 5 mm size class (ML: Mantle length; ST: Stage).

ML (mm)	N	Size Class				
		ST-1	ST-2	ST-3	ST-4	ST-5
26-30	3	100.0				
31-35	3	66.7	33.3			
36-40	4		50.0	50.0		
41-45	11			9.1		90.9
46-50	3					100.0
Total	24	5	3	3		13

a sample of 10–20% of the ovary volume was weighed to within 0.0001 g. The sample was investigated under 20X magnification. The reproductive stage was identified according to the criteria of Nigmatullin (1989).

All oocytes in a sample were measured to within 0.1 mm and counted to estimate the potential fecundity (PF), which was calculated as the sum of the total oocyte number in the ovary and egg number in the oviduct. Hence, the relative fecundity (RF) was estimated as the ratio of PF to body weight.

RESULTS

First sexual maturity in females was observed at 42 mm ML. The distribution of gonadal stages according to size were: stage 1, 26–33 mm; stage 2, 35–37 mm; stage 3, 37–43 mm and stage 5, 42–47 mm. No individual was found at stage 4 (Table 1).

The GSI increased with maturation, and in stage 1 it was 0.17–0.44; stage 2, 0.25–0.43; stage 3, 0.78–1.0; and stage 5, 6.4–12.7 (Fig 2). In mature females ovary weight was 6.4–12.7% and oviducal gland

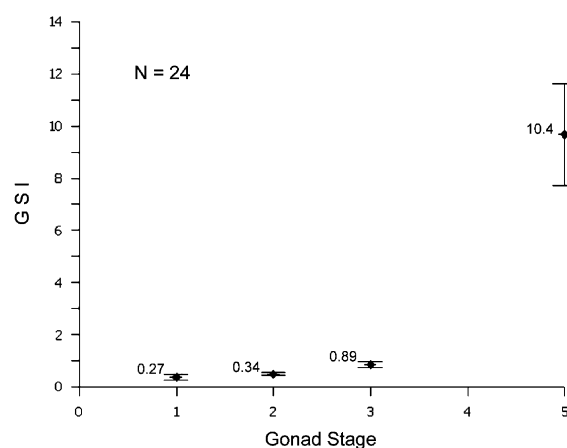


FIG. 2. – Gonado-Somatic index (GSI) for female *Abralia verany* from the Aegean Sea.

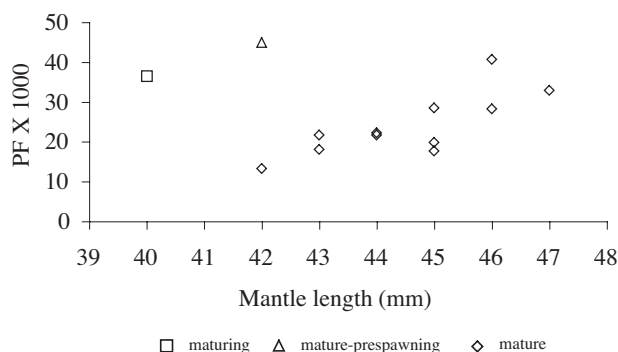


FIG. 3. – Potential fecundity (PF) in *Abralia verany*

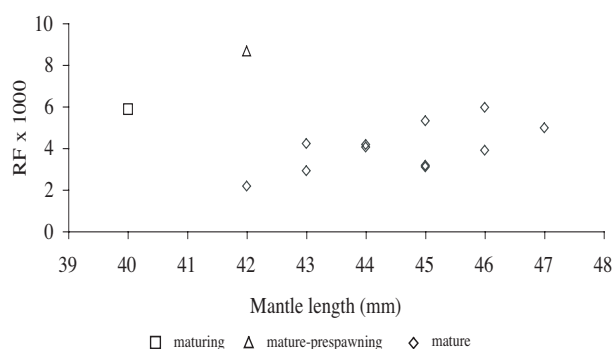


FIG. 4. – Relative fecundity (RF) in *Abralia verany*

weight was 3.5-4.5% of the body weight. Among the oviducts of 13 examined individuals, ripe eggs were detected and the oviduct weight was 1.6-5.2% of the body weight. The number of eggs counted in the oviduct was between 93 and 597. The diameter of ripe eggs in the oviduct ranged from 0.95 to 1.05.

Yolk oocytes in the individuals examined were observed from the third stage on. The total number of yolk oocytes was 3279-9463. The potential fecundity (PF) varied from 13195 to 44846 oocytes (Fig 3), and relative fecundity (RF) was 2170-5310 eggs g⁻¹ (Fig 4).

In the fifth stage 11 out of 13 individuals of the mature females were mated, with an average of 72 spermatangia (10-182) attached to the nuchal cartilage.

DISCUSSION

The length range of the *A. verany* individuals examined, which attained a ML of up to 46 mm (Salman, unpublished data), was larger than the previously reported specimens in the Mediterranean (Jereb and Ragonese, 1986; Mangold and

Boletzky, 1987; Guerra, 1992), and off northwest Africa (Laptikhovsky, 1999b). Although it is a common fact that Atlantic animals are larger than the Mediterranean ones, this difference may be due to the comparatively few specimens involved and reported in the literature.

The potential fecundity (13,195 to 44,846) was much higher than that off northwest Africa (10,000 to 26,000) (Laptikhovsky, 1999b). This is a common case for cephalopods in that females spawning in warmer waters are smaller in size, produce smaller eggs and have a lower fecundity than females that spawn in relatively colder waters (Laptikhovsky and Nigmatullin, 1993). The numbers of oocytes decrease with increasing maturity stages (Fig. 3), which is similar to the findings of Young and Mangold (1994) for *A. trigonura*.

The surface water temperature taken at the sampling stations ranged between 12-23°C, these values were colder than the ones (20-24°C) taken by Laptikhovsky (1999b). This result supports the thesis of Laptikhovsky and Nigmatullin (1993). The importance of surface water temperature during spawning activities of *A. trigonura* has been previously discussed by Young and Mangold (1994).

The estimated RF of the Aegean Sea population was very similar to that of the population off northwest Africa, which was 2400-5800, with a mean of 4300 (Laptikhovsky, 1999b), which shows that an increase in fecundity was achieved by a simple increase in the size of the female. Egg size was also found to be larger (mean 1.01 mm vs. mean 0.8 mm), but this may be due (at least partly) to differences in fixation and preservation.

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