

Temporal variation of the different developmental stages of Chaetognaths in the Gulf of Kisos (Cretan Sea)

G. KEHAYIAS, J. LYKAKIS and N. FRAGOPOULU

Section of Animal Biology, Department of Biology, University of Patras, PATRA (Greece)

There is little information available on the temporal variation of the different developmental stages of chaetognaths in Eastern Mediterranean. FURNESTIN (1958) studied the phases of maturity of specimens found in the sector Libyan-Cretan Sea and the Aegean Sea and GHIRARDELLI (1951) studied the phases of sexual maturity in the gonads of *Sagitta enflata* Grassi in the Gulf of Napoli. MASSUTI-OLIVER (1954) has also reported data on the reproductive cycles of some chaetognath species in the Western Mediterranean.

Samples were collected from four stations during six sampling periods, i.e. 9 September and 20 November 1988, 23 February, 8 April, 23 May and 29 July 1989. Two stations were located on the continental shelf and the remainder at the edge of the continental slope, according to the hydrography of the area. A Bongo net with 500µm mesh size was used for the collection of the samples. Oblique hauls were taken from 50m to the surface. About 80m³ of water were filtered in each haul. We classified the species into stages of maturity based primarily on the development of the ovary and the seminal vesicles using a modification of GHIRARDELLI's (1961) system. Stage I: young without visible ovaries. Stage II: immature with visible ovaries but no visible seminal vesicles. Stage III: seminal vesicles present, ova visible, a few large. Stage IV: filled seminal vesicles and ova large.

The total chaetognaths showed a maximum of abundance in November (322.5 n/100m³) and a minimum in May (82.5 n/m³). There was no statistical difference between the samples collected from the four stations (one-way Anova, p<0.05). Seven chaetognath species were identified. The neritic species *Sagitta enflata* was dominant (d=139.2 n/100m³, 70.9%) and with two pelagic species: *Sagitta serratodentata* (d=27.7 n/100m³, 14.1%) and *Sagitta bipunctata* (d=17.4 n/100m³, 8.8%), accounted for more than 90% of the total chaetognaths in the samples. Four other species, the epipelagic *Sagitta minima* and the deeper living species *Sagitta lyra*, *Sagitta hexaptera* and *Krohnitta subtilis*, were collected in lower numbers. The presence of the pelagic species proved exchange of pelagic and neritic waters in the Gulf.

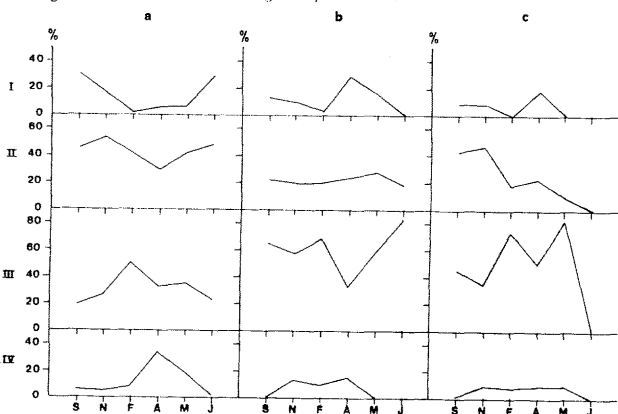
Sagitta enflata: The total population showed a peak of abundance in November (260.3 n/100m³). Stage I was present in the samples during all sampling periods and showed higher relative density in July and September. Stage II was more numerous among all stages of development (mean relative density 42.7%) and showed a peak of abundance in November (136.8 n/100m³, 52.5%). Stage III (mean relative density 30.7%) did not show significant temporal variability. Adults were found all year round and showed a peak in April (Fig.1).

Sagitta serratodentata and *Sagitta bipunctata*: Both two species showed higher abundance in February (90.6 n/100m³ and 51.3 n/100m³ respectively). *S. serratodentata* stage I was absent from our samples in July and showed higher relative density in April. The relative density of stage II specimens remained almost constant during the six sampling periods. Stage III specimens were the most numerous (mean relative density 60.7%) with a peak in July (81.8%). Stage IV was found from November till April. No specimen of *S. bipunctata* was found in July. Stage I was present in the samples only in September, November and April. Stage II and III showed a progressive decrease and increase respectively from September till May. Adults were found from November till May in percentages within the range of 8.0 - 9.1% (Fig.1).

Our results on the breeding of the abundant chaetognaths of Kisos Gulf showed that: *S. enflata* might reproduce all year round with a major summer breeding period, while *S. serratodentata* and *S. bipunctata* might have two breeding periods, a major one in the spring and another one in autumn.

According to earlier publications *S. enflata* reproduces in February and October in W. Mediterranean (MASSUTI-OLIVER, 1954) while all year round in Miami (OWRE, 1960). *S. bipunctata* reproduces in May and September in the former region (MASSUTI-OLIVER, 1954) and is capable of spawning more than once in the latter. Two major breeding periods were also reported for *S. serratodentata* in fall and in winter (OWRE, 1960).

Fig.1 Seasonal distribution of the developmental stages (I,II,III,IV) of *Sagitta enflata* (a), *Sagitta serratodentata* (b) and *Sagitta bipunctata* (c).



REFERENCES

- FURNESTIN M.-L., 1958.- Chaetognathes récoltés en Méditerranée orientale et en Mer Noire par la "Calypso" (campagne 1955). *Rapp. et P.V. Comm. int. Explor. sci. Mer Médit.*, 14 (n.s.): 202-209.
- MASSUTI-OLIVER M., 1954.- Sobre la biología de las Sagitta del plancton del Levante español. *Publ. del Inst. de Biol. Apl. Barc.*, 16 : 137-148.
- GHIRARDELLI E., 1951.- Cicli di maturita sessuale nelle gonadi di *Sagitta inflata* Grassi del Golfo di Napoli. *Boll. Zool.*, 18 : 149-162.
- GHIRARDELLI E., 1961.- Histologie et cytologie des stades de maturité chez les Chaetognathes. *Rapp. Comm. int. Mer Méd.*, 24 (10): 137-138.
- OWRE H. B., 1960.- Plankton of the Florida current. Part VI. The Chaetognatha. *Bull. mar. Sci. Gulf Carrih.*, 10 : 255-322.

Rapp. Comm. int. Mer Médit., 33, (1992).