# THE SEASONAL POPULATION STRUCTURE AND VERTICAL DISTRIBUTION OF *SAGITTA DECIPIENS* FOWLER AND *SAGITTA LYRA* KROHN IN THE SOUTH ADRIATIC PIT

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**Abstract**

On the basis of samples collected in South Adriatic Pit during five cruises, abundance and vertical distribution of *Sagitta decipiens* and *Sagitta lyra* and their developmental stages were investigated. A wide vertical distribution (from surface to 1000 m) was noted for both species. Moreover, in the layers below 100 m depth, these species made more than 90% of total chaetognaths. The bulk of the *S. lyra* population (mostly juveniles) was located in the upper 200 m, whereas S. decipiens was most numerous in the 100 to 300 m depth. Both species displayed an ontogenetic vertical distribution with the older stages occuring at greather depth.

*Key words: Zooplankton, Chaetognatha, Adriatic Sea*

## Introduction

In the Adriatic Sea available literature on chaetognaths regards mostly species composition, their frequency and seasonal variation (1-5). Most of the literature data mainly refers to neritic areas of the Adriatic, devoid of oceanic species. Only sporadic specimens of *S. decipiens* and *S. lyra* may be found northward from the southern deep Adriatic in some seasons where they have been carried by the eastern Adriatic incoming current (3, 5). The vertical distribution of chaetognath species has not been well documented for the Adriatic Sea. Hure (6) has provided some general data for the south Adriatic in the upper 300 m. Detailed information on the vertical distribution of the different developmental stages of chaetognaths is completely lacking. The purpose of this study is to present the first data on seasonal abundance and vertical distribution of *S. decipiens* and *S. lyra* and their developmental stages in the open waters of the Southern Adriatic.

## Materials and methods

Planctonic samples were collected at station P-1000 in South Adriatic Pit (Fig. 1) during five cruises: 20 April 1993; 16 September 1993; 25 November 1993; 26 February 1994 and 17 June 1994. The first and the last sampling dates samples were collected during night-time while on the other dates samples were taken in day light.

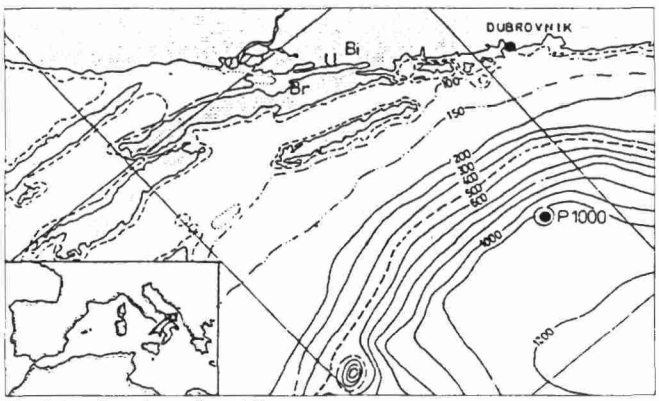


Fig. 1. Location of sampling station.

A total of 35 samples were collected with a Nansen opening-closing net (114 cm diameter, 380 cm length and mesh size of 250 (m) by vertical hauls in the following layers: 0-50, 50-100, 100-200, 200-300, 300-400, 400-600 and 600-1000 m. Salinity and temperature were determined using a CTD multisond (SEA Bird Electronics Inc., USA) at 0, 5, 10, 20, 50, 75, 100, 200 and 300 m.

Maturity stages of chaetognath species were classified using Thomson's (7) criteria as follows: the primitive germ cell of the gonads have not started to develop in Juvenile; the gonads are formed in Stage I; small ova are present in Stage II; some large ova appear in Stage III. Developmental stages in *S. decipiens* specimens with male characteristic were determined as follows: testes visible in Stage I; seminal vesicles present in Stage II, seminal vesicles fill in Stage III. The mean vertical position (weighted mean depth, WMD) of *S. decipiens* and *S. lyra* in the water column was determined using the method of Pearre

(8): $WMD = ((n_i \times d_i)/N$

where d*i* is the depth of sample i, n*i* is the number of individuals collected in sample i and N is the sum of all individuals collected in all samples at all depths. To determine differences in mean vertical position of the different developmental stages of each species, Kruskal-Wallis test was used.

## Results and discussion

*S. decipiens* and *S. lyra* had a wide vertical distribution, from the surface down to 1000 m depth. Moreover, in the layers below 100 m depth, these species made more than 90% of total chaetognaths.

There exist a problem in terminology regarding *Sagitta decipiens* in the pertinent literatury hence the incongruity in terms of its distribution. Most authors treat *S. decipiens* and *S. sibogae* as one species. Tokioka (9) described a new species from the North Pacific, *S. neodecipiens*, closely related to *S. decipiens*. According to Pierrot-Bults (10) *S. neodecipiens* Tokioka 1959, is a junior synonym of *S. decipiens* Fowler 1905. *S. sibogae* Fowler 1906 is the valid name for the species usually incorrectly named *S. decipiens*.

*S. decipiens* was recorded below 50 m depth where temperature variations are small during all seasons (Fig.2, Table 1). Species was most abundant in the layers from 100 to 300 m which is in accordance with data provided by Hure (6). In the Eastern Mediterranean *S. decipiens* was found from 50 m to the deepest extent of sampling (500 m), mainly deeper than 100 m and caracterized as mesopelagic (11). Data from other parts of Mediterranean Sea are similar (12, 13, 14, 15). In the North Atlantic *S. decipiens* was most abundant in the layers from 500 to 800 m, while a single specimens are recorded down to 2000 m depth (16).

Table 1. Ranges of water temperature and salinity in the 0-300 m layer for the cruise dates.

| Depth layers | April 93 | | Sept. 93 | | Nov. 93 | | Feb. 94 | | June 94 | |
|---|---|---|---|---|---|---|---|---|---|---|
| (m) | T (°C) | S(‰) | T (°C) | S(‰) | T (°C) | S(‰) | T (°C) | S(‰)) | T (°C) | S(‰) |
| 0 - 50 | 13.2-14.9 | 38.45-38.60 | 14.4-22.5 | 38.55-38.67 | 14.4-16.4 | 37.87-38.60 | 12.7-13.0 | 37.95-38.24 | 13.6-20.3 | 38.00-38.52 |
| 50 -100 | 13.0-13.2 | 38.56-38.57 | 13.6-14.4 | 38.59-38.65 | 13.9-14.4 | 38.60-38.66 | 13.0-13.8 | 38.24-38.58 | 13.3-13.6 | 38.52-38.59 |
| 100 - 300 | 13.0-13.1 | 38.56-38.59 | 13.4-13.6 | 38.63-38.65 | 13.5-13.8 | 38.61-38.66 | 13.6 | 38.58-38.63 | 13.3-13.4 | 38.61-38.62 |

*S. decipiens* was absent from the upper 100 m layer in April and September. In the 100 - 200 layer, juveniles and Stage I individuals represented more than 95% of the total population. Adult specimens occurred in the 200 - 300 m layer, and dominated the population in the deeper layers (Fig. 2). In the layers where this species was most numerous (100 - 300 m), maximum values did not exceed 7.5 and 12 ind.10m-3 in April and September, respectively.

In November and February *S. decipiens* inhabited the 50 - 100 m layer (Fig. 2). The specimens may have been transported to the surface by upwelling since according to Vilicic *et al.* (17) the Southern Adriatic cyclonic gyre is strongest in winter and early spring. In addition to juveniles and Stage I individuals that dominated the layers down to 200 m, adult specimens (Stage III) participated by about 25% to total numbers. The abundance of adult specimens increased with depth (Fig. 2). During these periods, maximum numbers did not exceed 12 ind.$10m^{-3}$ in the 100 - 300 m layer. Vucetic (18) associates the abundance and vertical position of the *S. decipiens* in the Southern Adriatic with the inflow of the Mediterranean water, especially in winter. However, our results indicated that *S. decipiens* does not enter periodically in the Adriatic. On the contrary, individuals in all developmental stages were present permamently throughout the water column in the Southern Adriatic.

In June, *S. decipiens* was also not recorded in the 0 -100 m layer. A maximum of 14.3 ind.10m-3 was recorded in the 100 - 200 m layer where an important decrease in juveniles contribution (5% of the total)