Small-scale horizontal distribution patterns of nematodes in deep NW Mediterranean surface sediments (DYFAMED-BENTHOS 2003).

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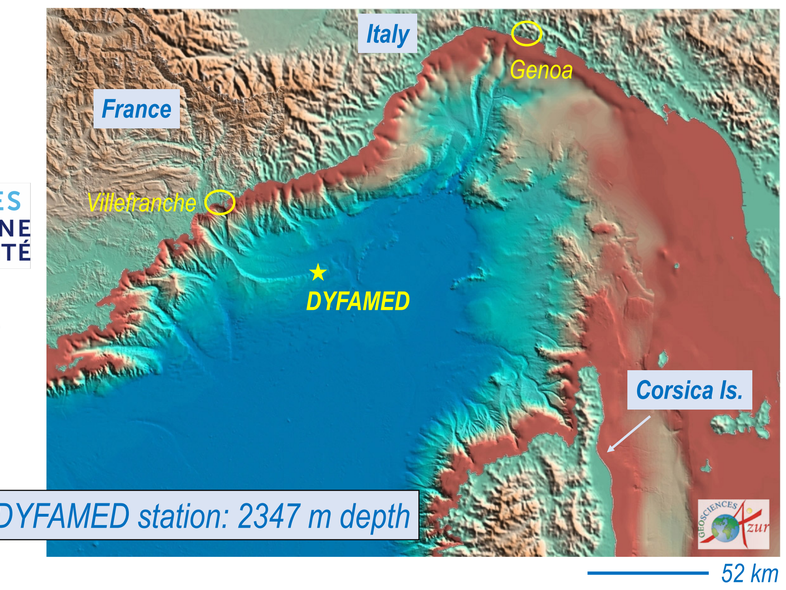


Introduction

The three-year time-series survey of meiofauna conducted from 1993 to 1995 at the DYFAMED-BENTHOS station (2347-m depth) in the Var Canyon (NW Mediterranean) revealed that 58% of the observed variability in nematode abundances was temporal (seasonal and interannual). Moreover, as much as 27% of the variability was spatial, at the centimetre scale (Guidi-Guilvard and Dallot, 2014). To further investigate the small-scale horizontal distribution patterns of nematodes at this station, two additional cruises were performed in spring and summer of 2003.

Material & Method

Spring : 9 April 2003

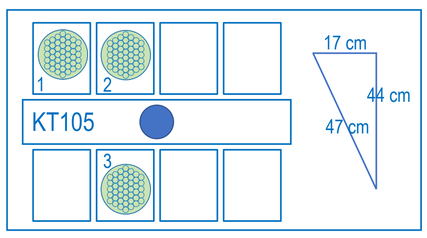
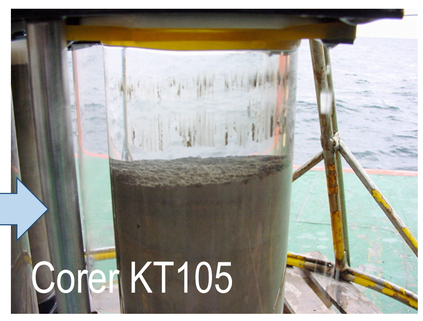
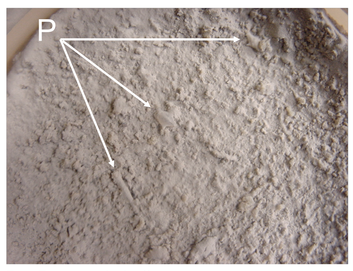


Diagram (top view) showing the position of the subsamples within the Maxicorer tubes.

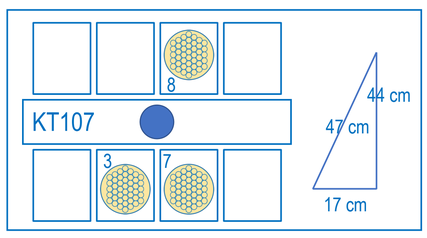


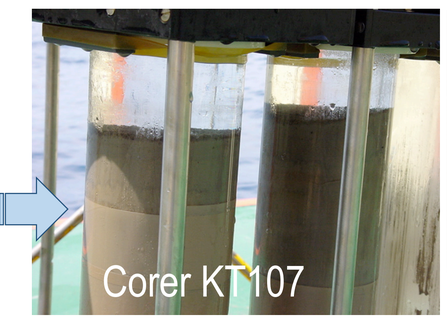
Sediment surface

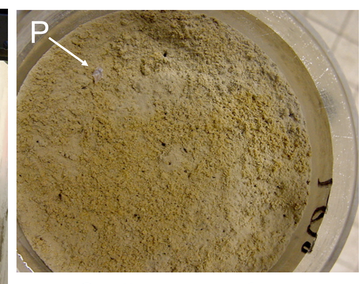


P = Pteropod shell

Summer : 11 July 2003







Sediment surface

Subsampling

Sample processing

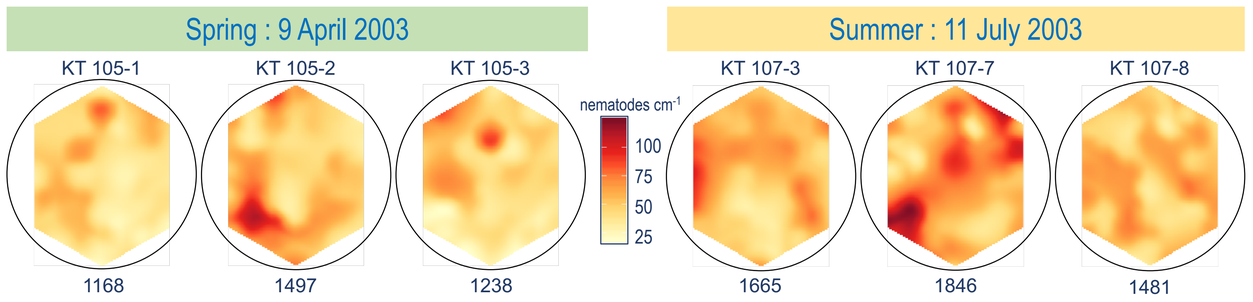
- 6 x 44 = 264 minicore samples washed through a 32 µm-sieve
- Extraction of organisms (Ludox TM-40)
- Enumeration (dissecting microscope)

Nematodes per 0.6 cm² (top 3 cm of sediment)

During each cruise (9 April and 7 July 2003), the Maxicorer was deployed at the DYFAMED-BENTHOS station (43°24,61'N - 7°51,68'E ; 2347-m depth). Three cores (9.8-cm inner diameter) from the same corer were each subsampled on board with 44 contiguous minicores (0.9-cm inner diameter, 1.1-cm outer diameter) arranged in a honeycomb pattern. All 44 minicores were gently pushed into the sediment prior to their removal. They were preserved with 4% Borax-buffered formalin in filtered seawater and later, organisms larger than 32 µm were extracted from the sediment by density gradient separation (McIntyre & Warwick, 1984) and enumerated in the laboratory.

Outcome

1 Densities



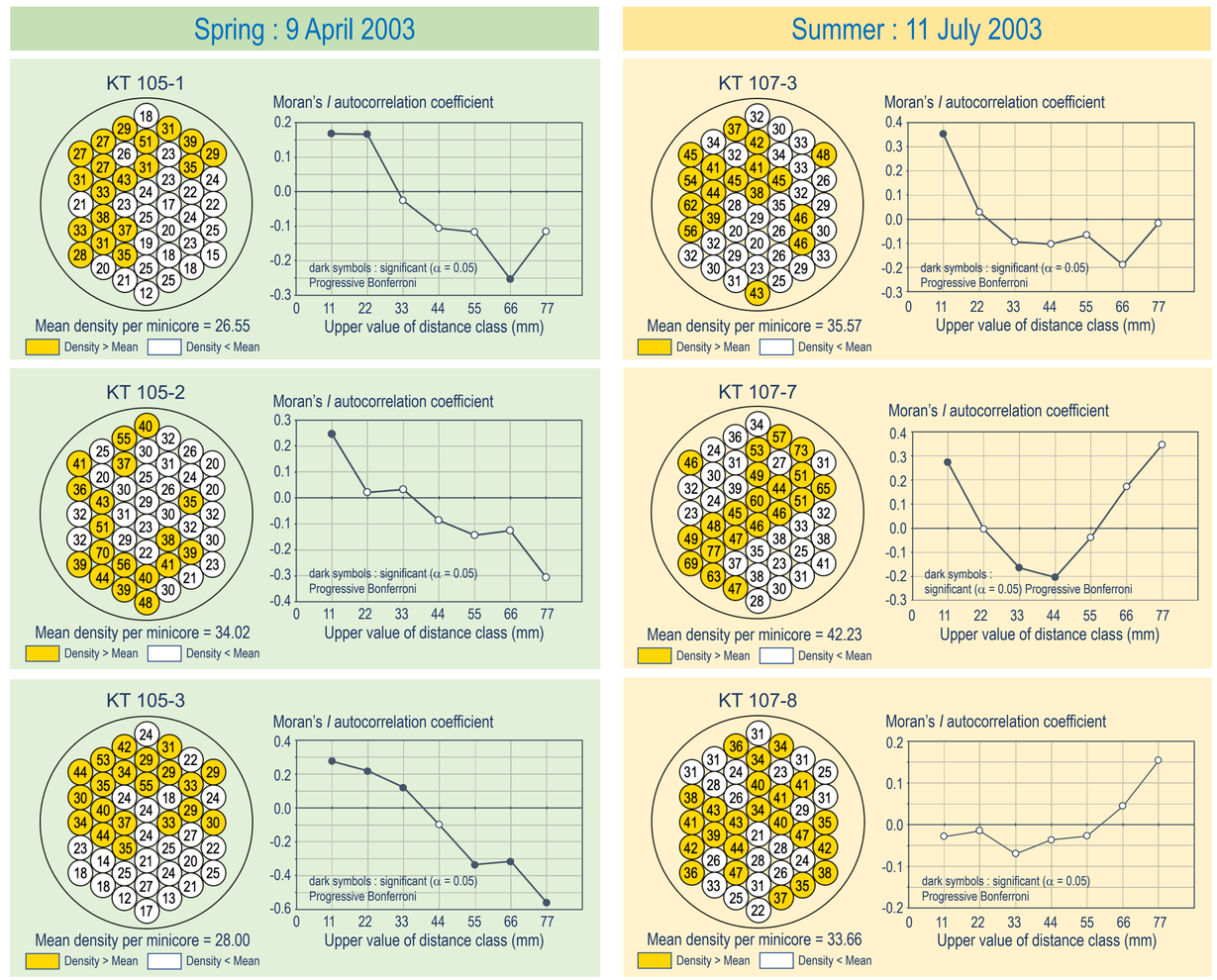
Nematode surface density maps (densities interpolated). Total number of nematodes counted in each honeycomb array (total surface sampled per tube = 28 cm²), and mean (± SD) nematode density per date are indicated under the diagrams.

A total of 8781 nematodes were counted in the 6 x 44 (= 264) minicores. Total density per honeycomb array varied from 1168 to 1848 individuals. For each season, densities between cores within corer did not differ significantly (α = 0.05, modified Student *t* test to take autocorrelation into account, Dutilleul et al., 1993). Although mean densities seemed to be higher in July than in April, differences between seasons were not significant (α = 0.05, Student *t* test).

Surface density maps showed that nematodes were unevenly distributed within the arrays. Techniques of spatial autocorrelation (Legendre & Legendre, 1998) were used to study spatial patterns. In 5 out of the 6 cores, Moran's *I* correlograms showed significant positive autocorrelation at the first distance class, suggesting aggregation at the first inter-minicore distance (11 mm). This distance occurred within groups of 2 and 3 minicores which correspond to patches ~ 2 to 3 cm² in size. In April, significant positive autocorrelation extended to the 22-mm midpoint distance in KT105-1 and KT105-3, and even to 33 mm in this latter core. This corresponds to groups of 6 minicores (~ 6-cm² patches), and in KT105-3, to up to 10 minicores (~10-cm² patches). In July, significant positive autocorrelation was restricted to 11 mm in 2 out of the 3 cores, and in KT107-8, nematode abundances were not autocorrelated at any scale. Higher-order negative significant autocorrelation, indicating the alternation of high and low values (as in the boundary of larger patches), was notable in KT105-3 (April) and KT107-7 (July).

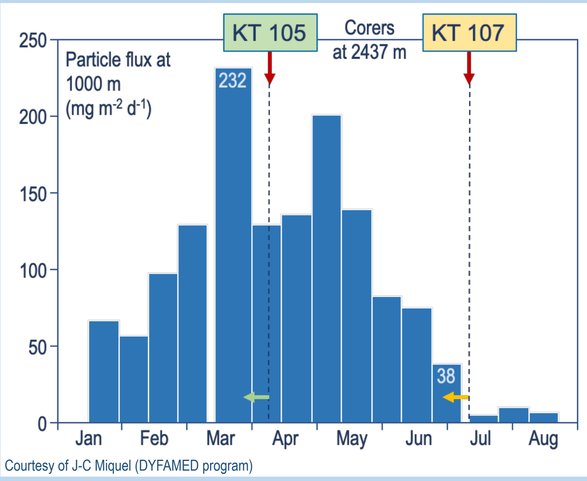
To conclude, nematodes generally exhibited a patchy distribution in the surface sediment of the DYFAMED station. However, both aggregation intensity and patch size were more pronounced in spring than in summer. This could relate to the local patchiness of deposited food. Particulate matter fluxes (i.e. food for the deep-sea benthos) measured in the water column were indeed 6 times larger in spring than in summer, and could have led to different aggregation patterns in the surface-sediment nematodes.

2 Spatial patterns



Small-scale horizontal spatial patterns of nematode densities and results of autocorrelation analyses for each honeycomb array. Minicores with counts greater than the corresponding mean density were coloured in yellow to display aggregation (left). Correlograms of Moran's *I* correlation statistics based on 7 distance classes ranging from 11 mm (smallest midpoint distance between minicores) to 77 mm (largest midpoint distance) are on the right. Dark symbols indicate autocorrelation statistics that remained significant after progressive Bonferroni correction (α = 0.05); white symbols are non significant values.

3 Particle fluxes



Particle flux measured with sediment traps set 1000 m below the sea surface (i.e. 1347 m above the bottom) between January and August 2003. Given that it takes from 7 to 17 more days (mean 12 days) for the particles to reach the bottom, on April 9th (KT 105), the input to the sediment surface was 232 mg of dry particles m⁻² d⁻¹, whereas on July 11th the flux reaching the bottom was 6 times lower (i.e. 38 mg m⁻² d⁻¹). This is indicated by horizontal arrows.