Spatial heterogeneity at small scale in the microbenthic loop of *Posidonia oceanica* meadows

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Introduction

- *Posidonia oceanica* = endemic seagrass of the Mediterranean Sea
- *Posidonia oceanica* = used as a descriptor of environmental quality
Characteristics of the sediment compartment

- Sediment compartment = "matte"
- $O_2$ produced by roots
  - Oxic conditions
- Important biodiversity

From Boudouresque, 1982 (modif)

http://www.naturamediterranee.com
Interests of the sediment compartment in environmental studies

- Sediment = receptacle for organic and inorganic pollutants
  - modification of its physicochemical properties (redox potential, nutrients content, granulometry, ...)
  - modification of trophic webs

- Organisms with a rapid turnover and which spend all their life cycle in this compartment
  - inevitably affected
  - good indicators of environmental perturbations????

**BUT** in *P. oceanica* meadows: not well known...
Our aims

- Using the microbenthic loop of *P. oceanica* to find an early holistic indicator of anthropogenic perturbations.

**BUT** problems of sampling strategies (important variability between samples)...

- Understand small scales variations in this microbenthic loop

**Organic matter**

- Microphytobenthos
- Bacteria
- Meiofauna
Sampling strategy

- Healthy meadow
- No anthropogenic pollution
- Low hydrodynamism
Sampling strategy

- 3 grids
- March, June, November 08
- 12 nodes/grid (uniform random)
- 3 cores/node
- 1 pore water sample/node (nutrients)
Measured parameters

- Slices: 0-1, 1-2, 2-5, 5-10, 10-15 cm
- Bacterial biomass, abundance (Vienna, Austria, B. Velimirov): epifluorescence
- Organic matter biomass (AFDW)
- Microphytobenthos biomass: spectrophotometer
- Meiofauna
- Granulometry
Results: DIVA analysis

Density of the meadow

Important heterogeneity at such small scale!
Results: DIVA analysis

Biomass of bacteria (0-1 cm)

Important heterogeneity too!
## Results: DIVA analysis

**Biomass of bacteria (µgC.g⁻¹ sediment DW)**

<table>
<thead>
<tr>
<th>Depth</th>
<th>0-1 cm</th>
<th>1-2 cm</th>
<th>5-10 cm</th>
</tr>
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<tr>
<td></td>
<td>40</td>
<td>120</td>
<td>50</td>
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<tr>
<td></td>
<td>314</td>
<td>339</td>
<td>382</td>
</tr>
</tbody>
</table>

*More bacteria at low sediment depth (organic matter, less predators)*

*But hot spots who generate gradients of biomass*

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[Images of color gradients showing biomass distribution at different depths.]
Results: DIVA analysis

Biomass of OM (µgC.g\(^{-1}\) sediment DW)

Small spatial heterogeneity
BUT hot spots at some sediment depths
Results: Correlation between OM and biomass of bacteria

Biomass of bacteria

Biomass of OM

2-5 cm
Results: Correlation between OM and biomass of bacteria

Correlation: $r = 0.81722$

- Total biomass bacteria ($\mu$gC.g$^{-1}$ sediment DW)
- OM (mg.g$^{-1}$ sediment DW)

2-5 cm
Results: Correlation between OM and biomass of bacteria

Biomass of bacteria

Biomass of OM

5-10 cm
Results: Correlation between OM and biomass of bacteria

-bacteria at lower sediment depth because of OM concentration

More food = more bacteria

Less predators = more bacteria
Results: DIVA analysis

Biomass of the microphytobenthos

![Graph showing biomass distribution](image)
Results: DIVA analysis

Biomass of the microphytobenthos (µgC·g⁻¹ sediment DW)

No important variations at small scale
BUT hot spots
Results: DIVA analysis

Phosphates ($\text{HPO}_4^{2-}$) in pore water

Spatial heterogeneity for nutrients concentration too.
Results: Correlation between phosphates and biomass of the microphytobenthos (mean)

Correlation: $r = 0.66824$

Growth limitation of the microphytobenthos by phosphates??
Conclusions

- Spatial heterogeneity is very important at small scale in the sediment of *P. oceanica* meadows

- Presence of biomass hot spots for all the measured parameters

> May introduce bias in statistical analysis

> Must be taken into account in sampling strategies and discussion of results
Thank you very much!!!