Can we use exergy index and the microbenthic loop as indicators of perturbations in *Posidonia oceanica* (L.) Delile meadows?

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Introduction:

Nowadays, many anthropogenic perturbations threaten the Mediterranean Sea. *Posidonia oceanica* , its endemic phanerogam, is often used as a pollution descriptor but does not react very fast because of its low turnover rate. This research project proposes to use the microbenthic loop (bacteria, organic matter, meiofauna and microphytobenthos) present in this ecosystem to detect perturbations earlier and enter those results in the calculation of the exergy index (Fig.1). This index expresses the distance of an ecosystem, at a given state, from its equilibrium. The higher it is, the closer from its optimum state (climax) the ecosystem is.

Exergy index

Weighting factor. It gives a specific weight to each ith group of organisms of the ecosystem (e.g.: detritus = 1, bacteria = 8.5, nematods = 33)

$$Ex = \sum_i^n \beta_i \times C_i$$

Biomass of each ith group of organisms.

Fig. 1: Formula for the exergy index.

Material and methods:

Sampling sites are situated in Calvi Bay (Fig. 1), Corsica, France, where sediment cores (Fig. 2A, B, C) were taken to determine biomasses of every parts of the microbenthic loop and to measure environmental parameters. The reference site is STARESO (STAtion de Recherches Sous-marines et Océanographiques).
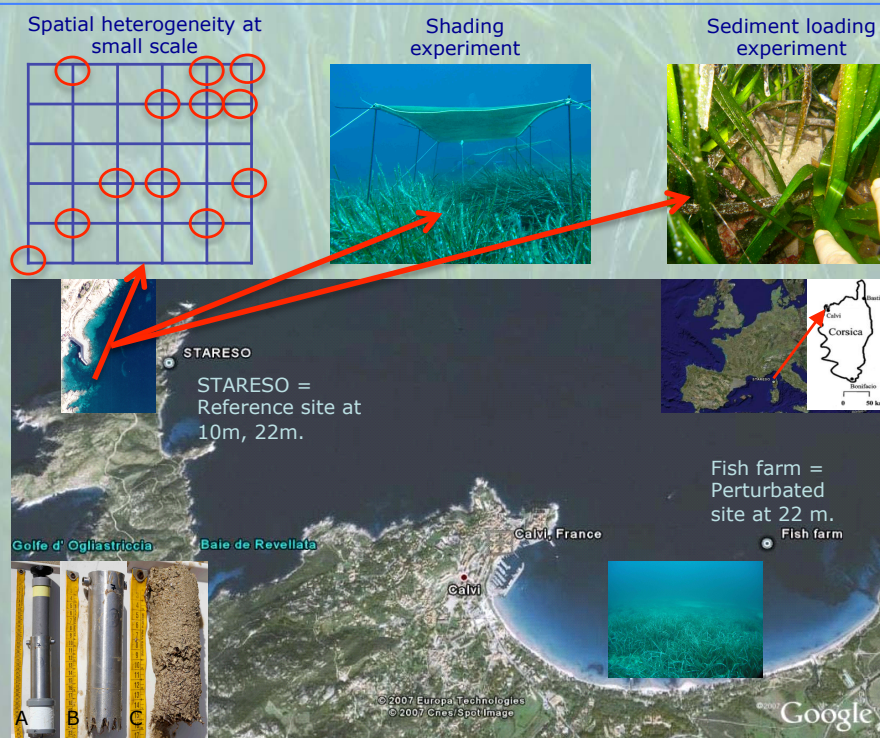
Spatial heterogeneity at small scale

Shading experiment

Sediment loading experiment

STARESO = Reference site at 10m, 22m.

STARESO

Calvi, France

Fish farm = Perturbated site at 22 m.

Fish farm

Golfe d' Ogliastriccia

Baie de Revellata

Calvi

Corsica

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Fig. 2: Sampling sites in the Bay of Calvi: STARESO and the fish farm. A: Sampled corer. B: Corer. C: Sediment sampled.

Some results:

In March 2008, the spatial heterogeneity experiment (Fig. 2) has shown an important variability at small scale for every studied parameters. Here are presented results obtained by DIVA (Data Interpolating Variational Analysis), a method adapted by the GHER (MARE Centre, ULg), for bacterial biomass, in the first centimeter of the cores (Fig 3A).
There is also a difference between STARESO and the fish farm, taking into account biomasses of bacteria, organic matter and microphytobenthos (Fig. 3B). Those results are promising to prove the utility of the exergy index.
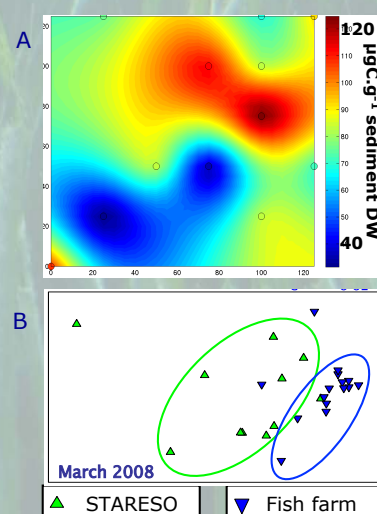
A

$\mu gC.g^{-1}$ sediment DW

B

March 2008

▲ STARESO   ▼ Fish farm

Fig.3: A: Biomass of bacteria in the first centimeter of the core (DIVA analysis). B: MDS based on a similarity analysis realised taking biomasses together

Concluding remarks:

Up to now, that study has led to a better understanding of seasonal and bathymetric patterns in the microbenthic loop of *P. oceanica*. The most important result obtained is the existence of an important spatial heterogeneity at small scale in that ecosystem. It must absolutely be taken into account in studies based on the sediment of *P. oceanica* meadows. Next steps will be the processing of meiofauna samples and a complete chracterization of sediment parameters.