Università degli
Studi di Genova
DIP.TE.RIS.

MEDCORE Project
International Conference
Florence, 2005

"MICROBIAL AND MEIOFAUNAL COMMUNITIES OF BEACH ECOSYSTEM IN THE MAREMMA REGIONAL PARK (ITALY)"

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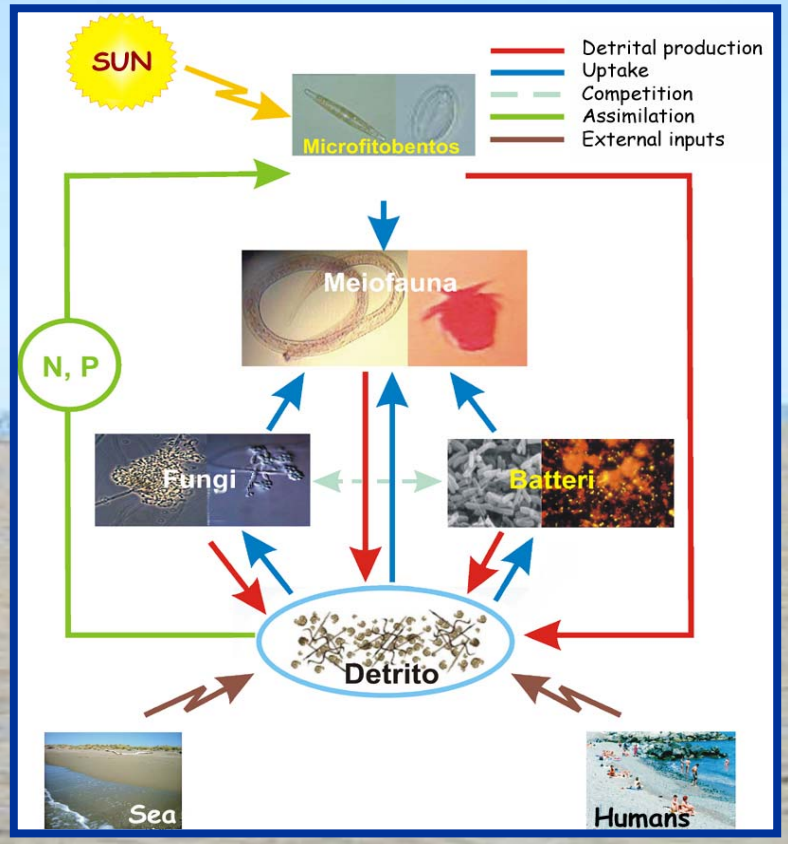
The small food web (micro and meiobenthic organisms) plays an important ecological role in sandy beach ecosystems, generally characterised by oligotrophy and a predominance of heterotrophic organisms.



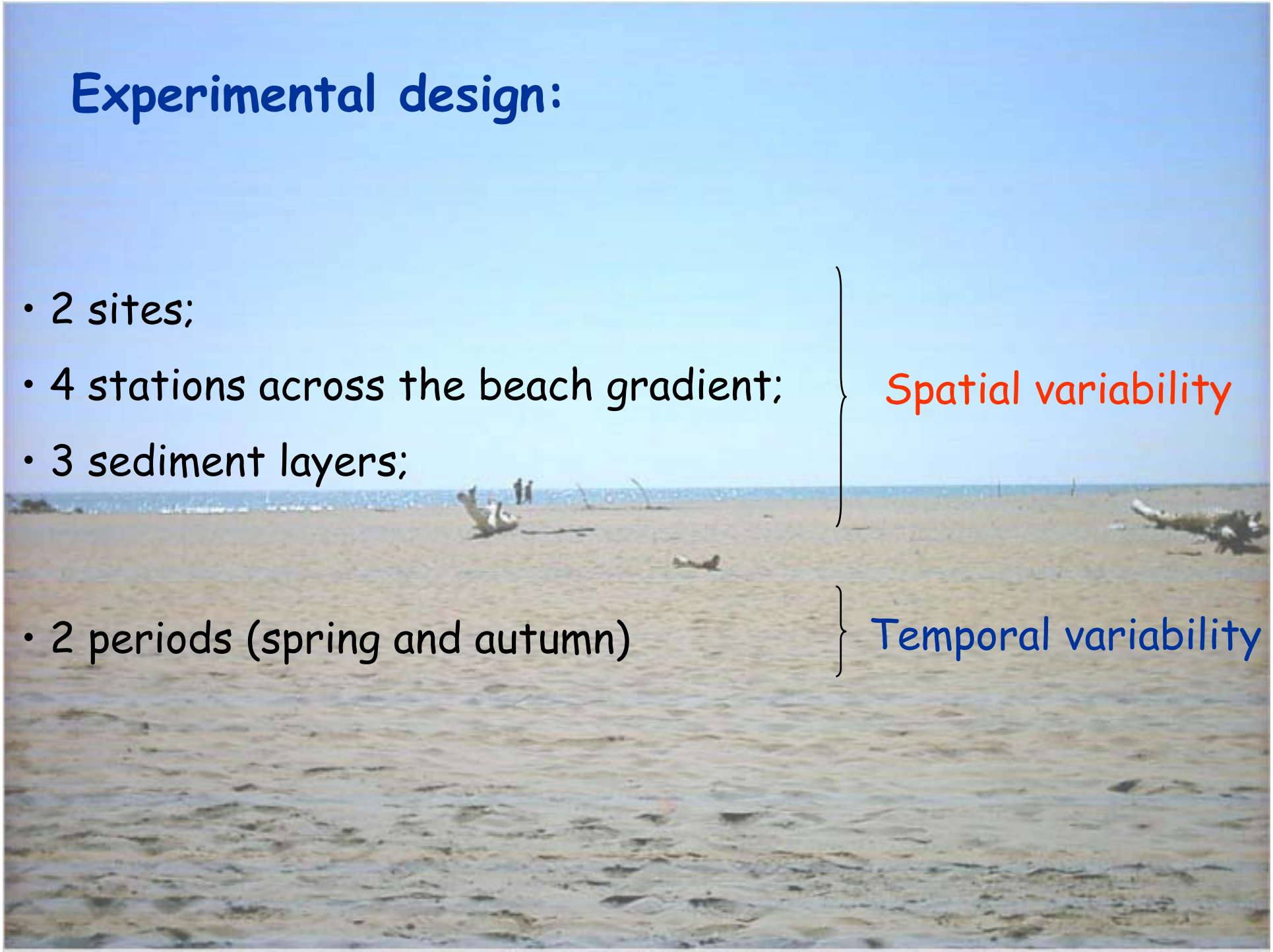
Base Ecological Research: mainly dealing with trophodynamics features, activity and contribution to overall biogeochemical cycles.

Applied Ecological Research: mainly dealing with ecological indicators for the assesment of environmental impact.

Aims of the study:

- The assesment of the abundance, distribution and diversity of micro and meiobenthic communities in the Maremma sandy beach ecosystem
- The investigation of the trophodynamic features and the main environmental variables affecting abundance, distribution and diversity of these communities.

Experimental design:



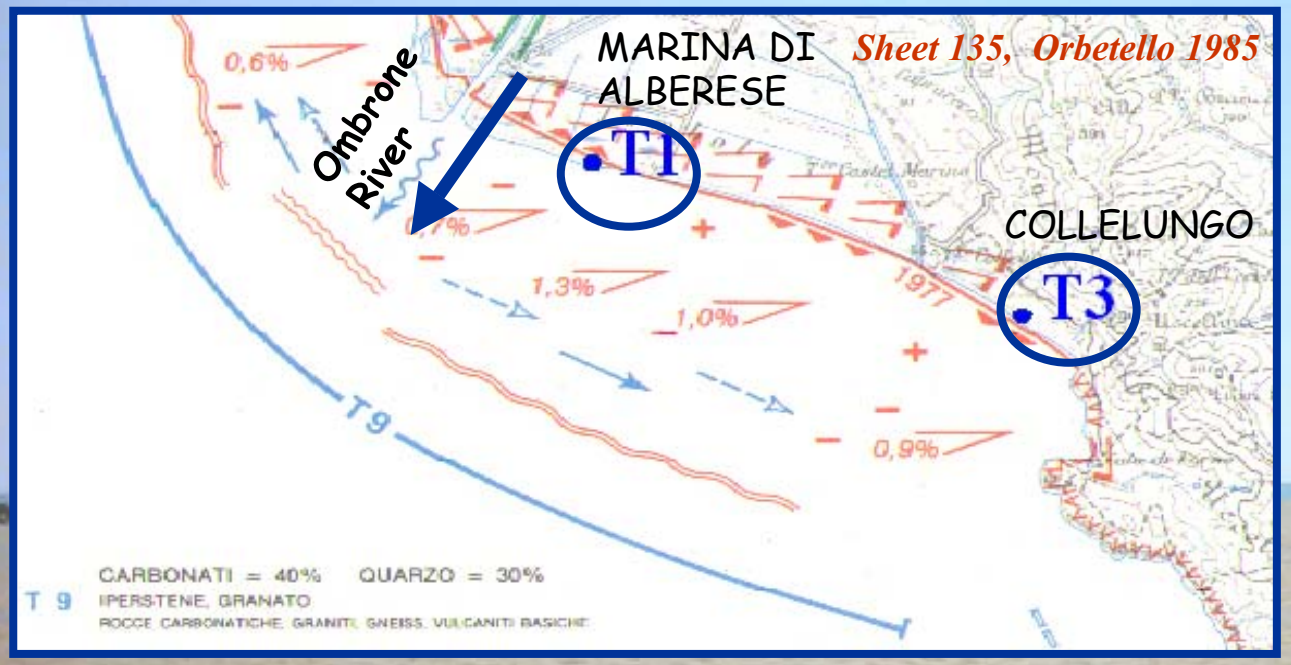
- 2 sites;
- 4 stations across the beach gradient;
- 3 sediment layers;

Spatial variability

- 2 periods (spring and autumn)

Temporal variability

Investigated sites



Maremma Regional Park

Geomorphological characteristics: shore slope 1%, length 7 Km

Microtidal beaches: mean tidal excursions from 20 to 30 cm

Marques *et al.*, (2003)

EXPOSED beaches (exposure rate=12)

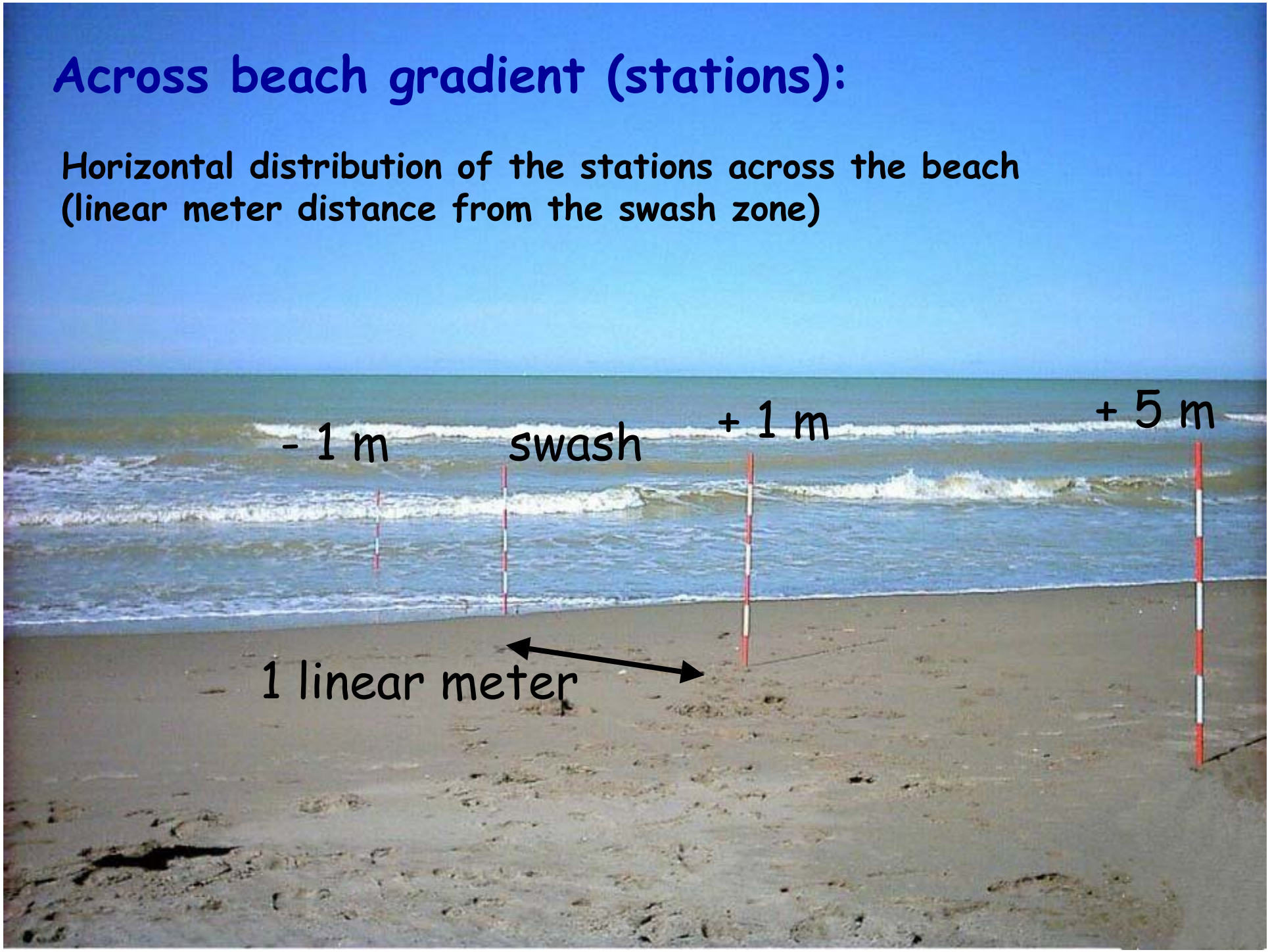
Marina di Alberese (T1) → erosion

Collelungo (T3) → accretion

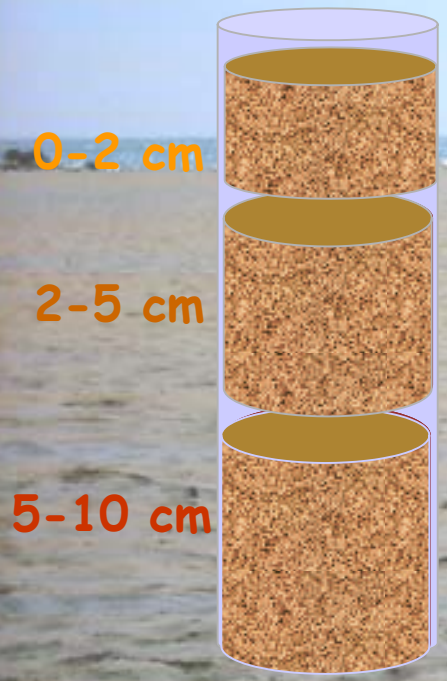
Atlas of the Italian Beaches (AA.VV., 1999)

Across beach gradient (stations):

Horizontal distribution of the stations across the beach (linear meter distance from the swash zone)



Sampling:



Physical and biochemical variables

- Eh
- Grain size
- Organic matter (Prt and Cho)

Biological Communities

- Bacteria (density and biomass)
- Meiofauna (density and diversity)
- Microphytobenthos (density and diversity)
- Fungi (density and diversity)

} 0-2 cm

Sediment characteristics:

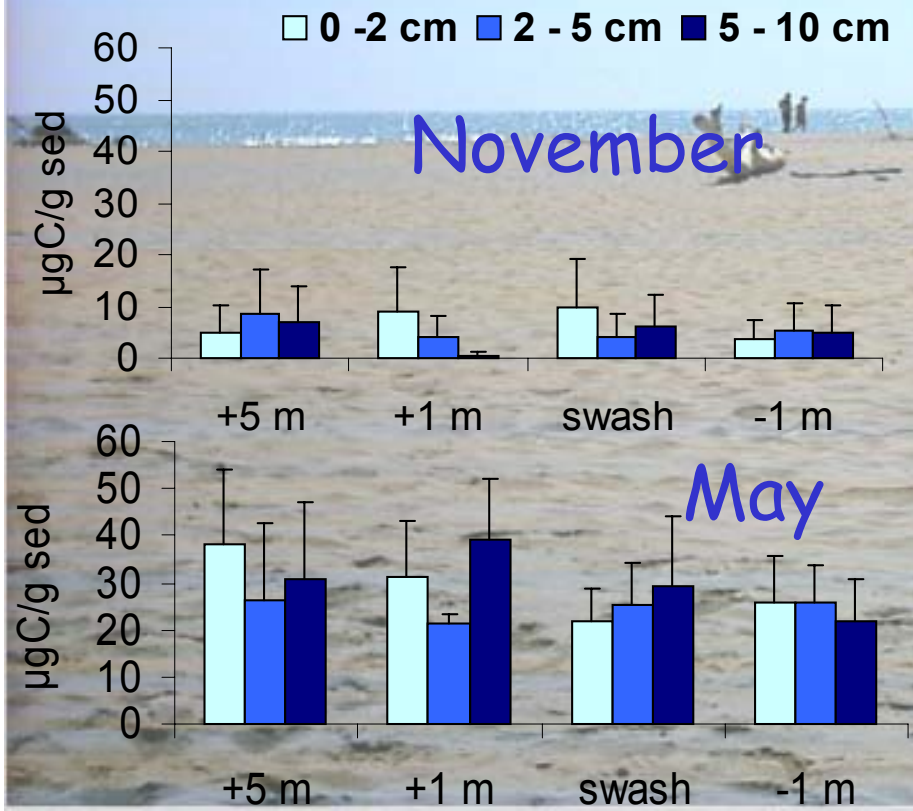
Eh: 385-443 mV

Homogeneus vertical distribution

Grain size: Ø 0.3-0.5 mm

Medium sand
(Udden & Wentworth scale)
Finer grain size in the swash zone

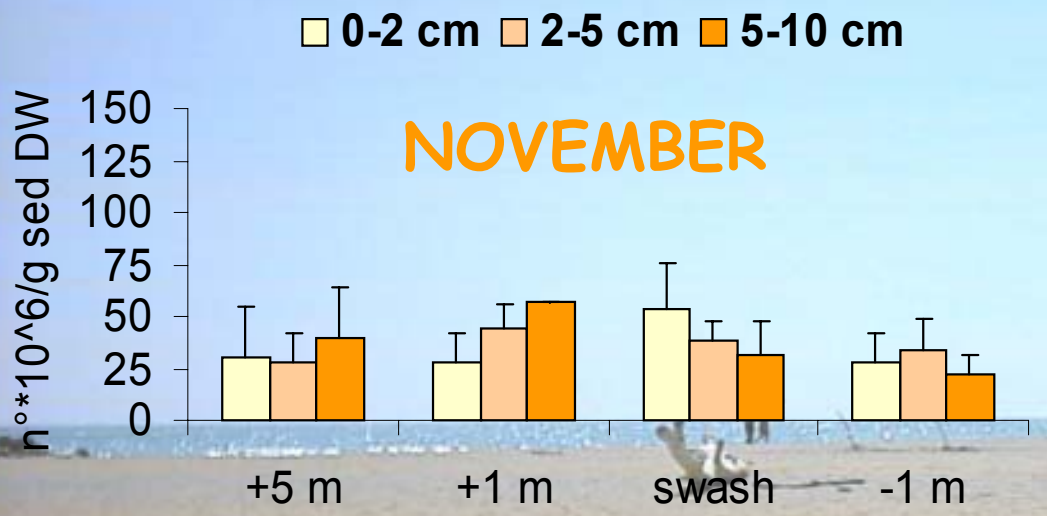
Organic matter (CPrt+CCho µgC/g sed DW):

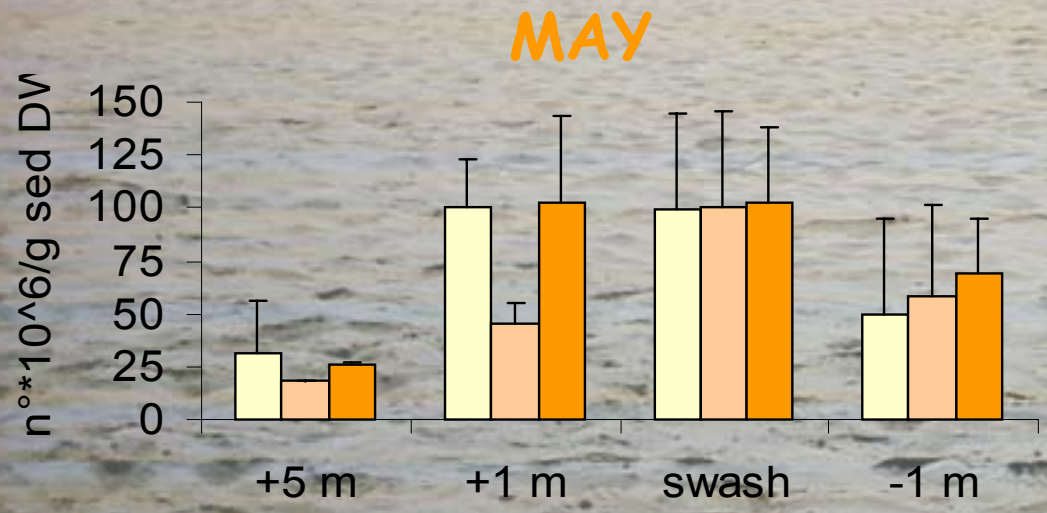


- low concentrations (meditarranean shallow sediments: 100-3000 µgC/g)
- no significative spatial variation (Anova, ns)
- significative temporal variation (Anova, $p<0.05$)

BACTERIAL DENSITY

TBN cellx10^6/g sed DW

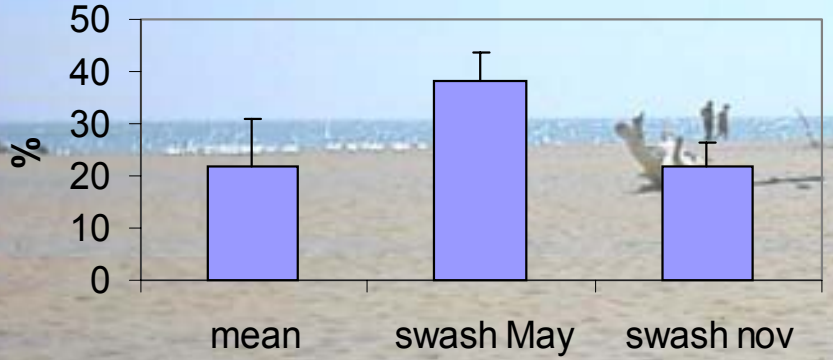




- low densities (meditarranean shallow sediments: 0.75-200*10^8 cells/g sed DW)
- significative spatial variation (Anova, $p<0.05$) → max in the swash zone
- increasing in May

Trophodynamic features:

% of Bacterial N to total protein N



% of Bacterial *C* to total prt and cho *C*

Chl-a concentrations and microphytobenthos densities were very low.

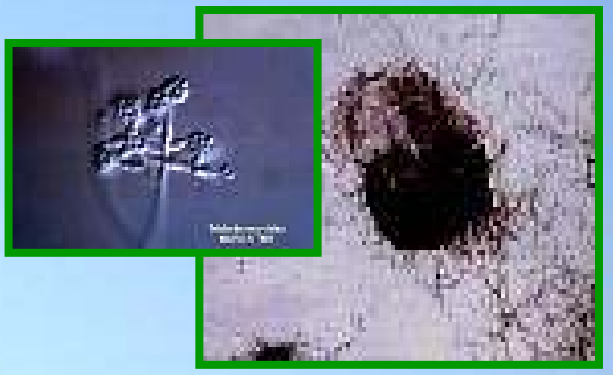
Heterotrophic system

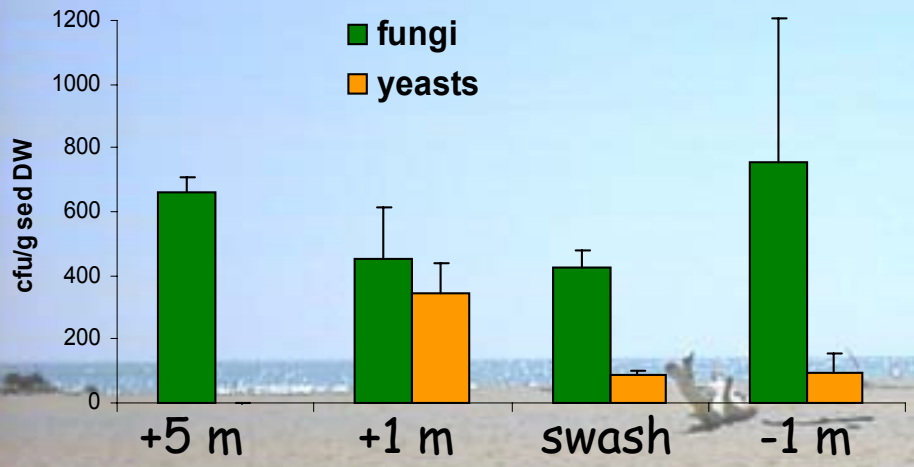
FUNGAL DENSITY

CFU/g sed DW

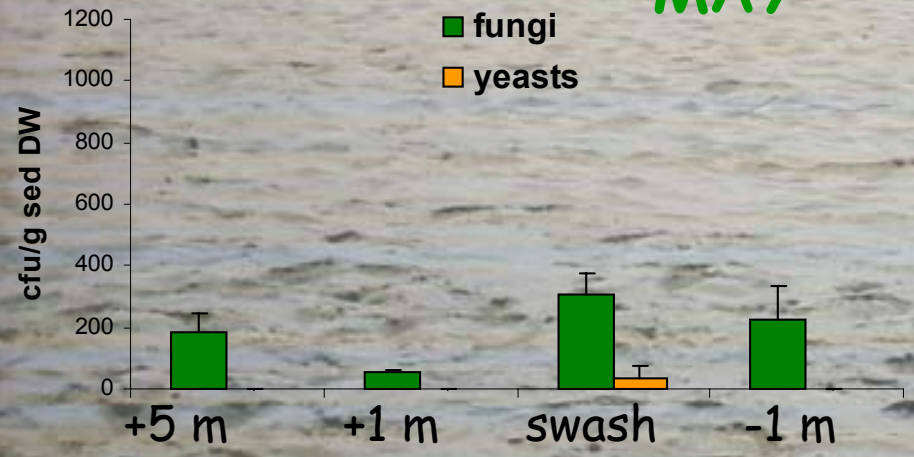
Marina di Alberese

NOVEMBER





MAY

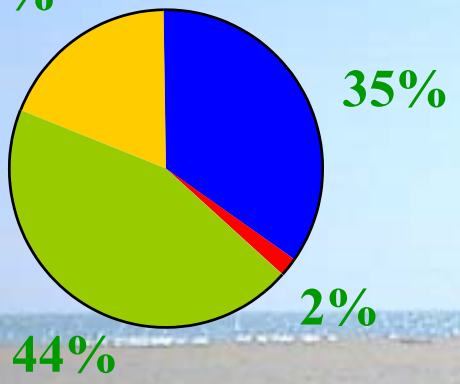


- Not significative spatial differences in density (ANOVA, ns)
- Significative Temporal differences (ANOVA, $p<0.05$)

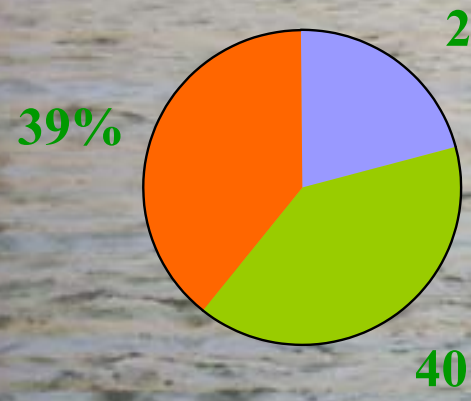
FUNGAL DIVERSITY

Marina di Alberese

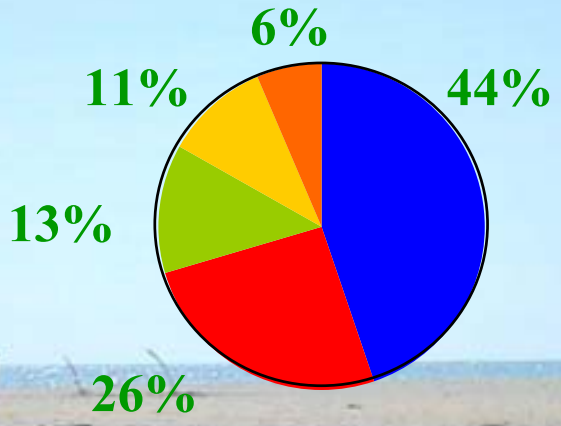
November

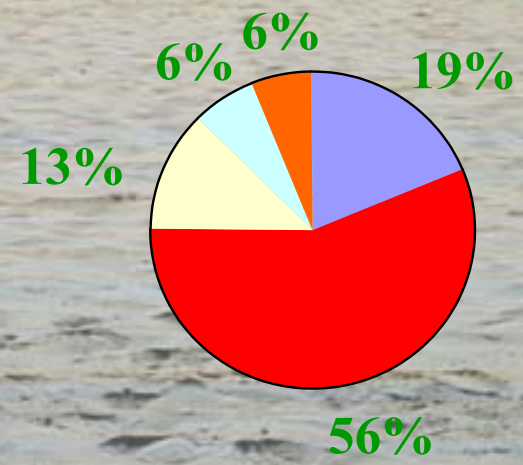


May



Collelungo



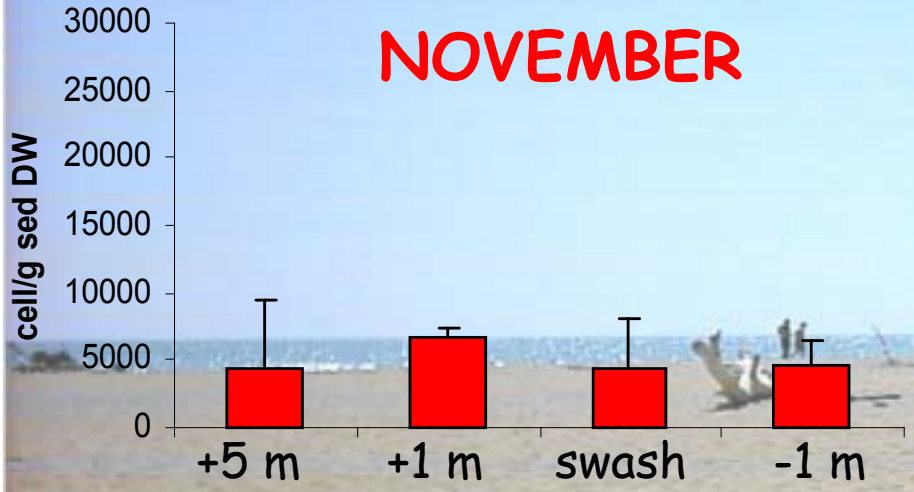


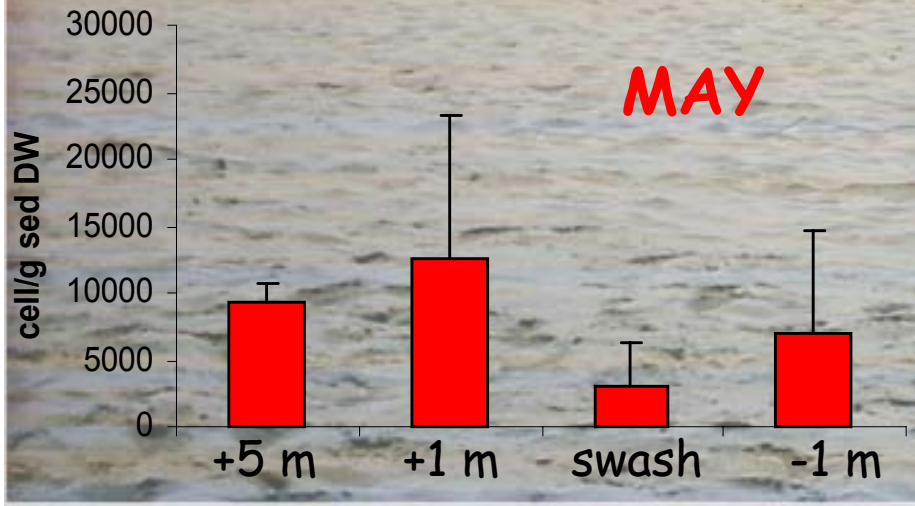
- *Penicillium spp.*
- *Cladosporium spp.*
- *Trichoderma spp*
- *Chaetomium spp.*
- *Papulaspora halima*

- ***Trichoderma spp.***
- ***Phoma spp.***
- ***Cladosporium spp.***
- ***Pericornia spp***
- ***Zopfiella spp***
- ***Papulaspora halima***

MICROPHYTOBENTHOS DENSITY

cell of diatoms/g sed DW





Chl-a concentrations → 0 - 0.1 µg/g

- Low Chl-a concentrations and microphytobenthos densities (Ligurian beaches and 0.04 µg/g; mediterranean shallow sediments 3.27 µg/g)

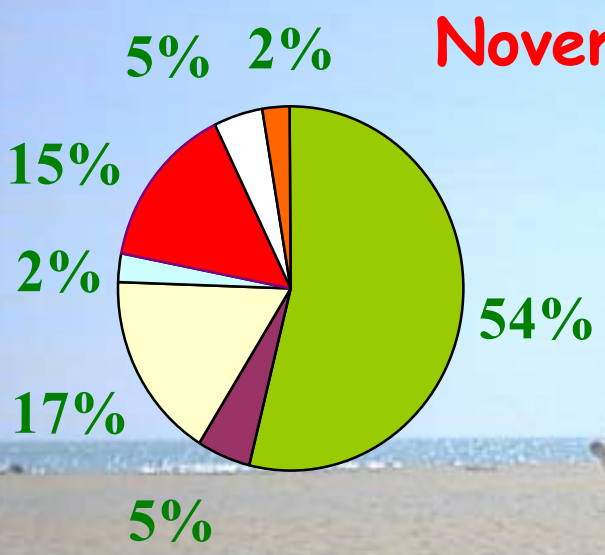
- Not significative Spatial and Temporal differences in density (ANOVA, ns)

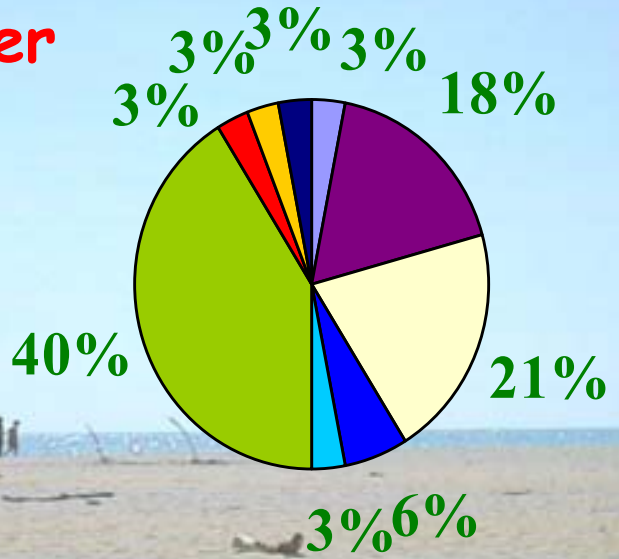
MICROPHYTOBENTHOS DIVERSITY

Marina di Alberese

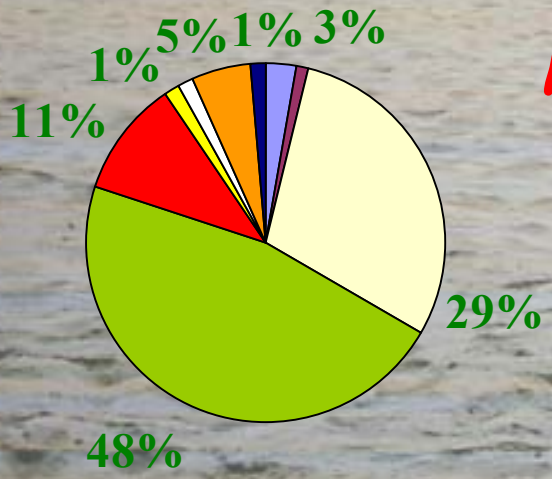
Collelungo

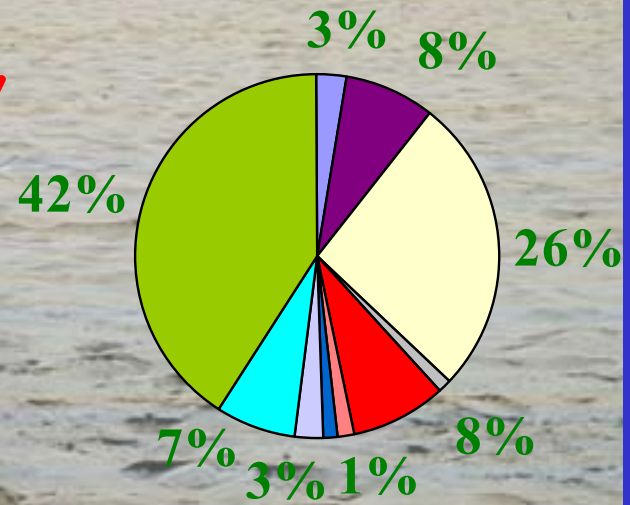
November





May

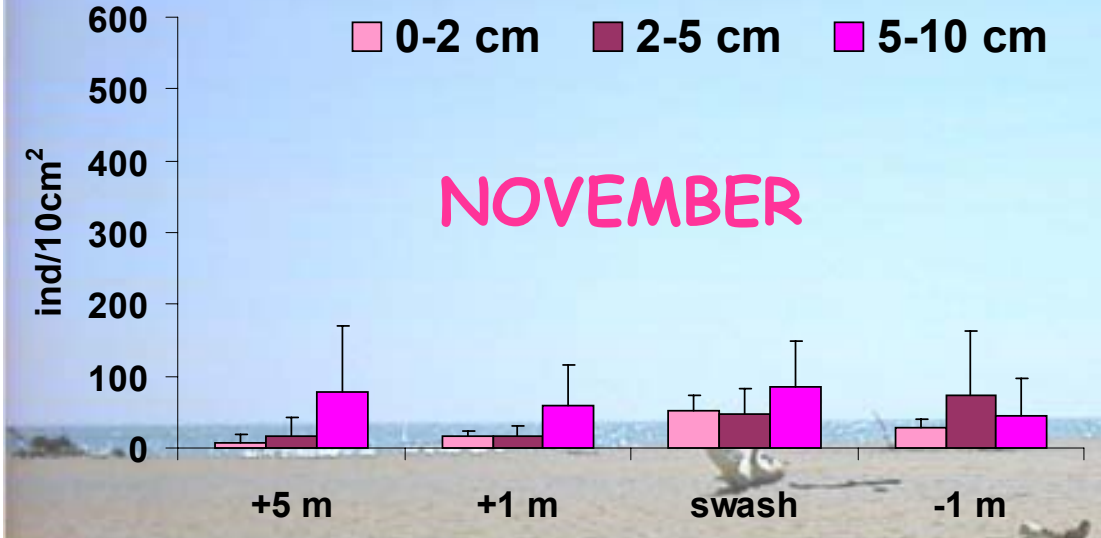


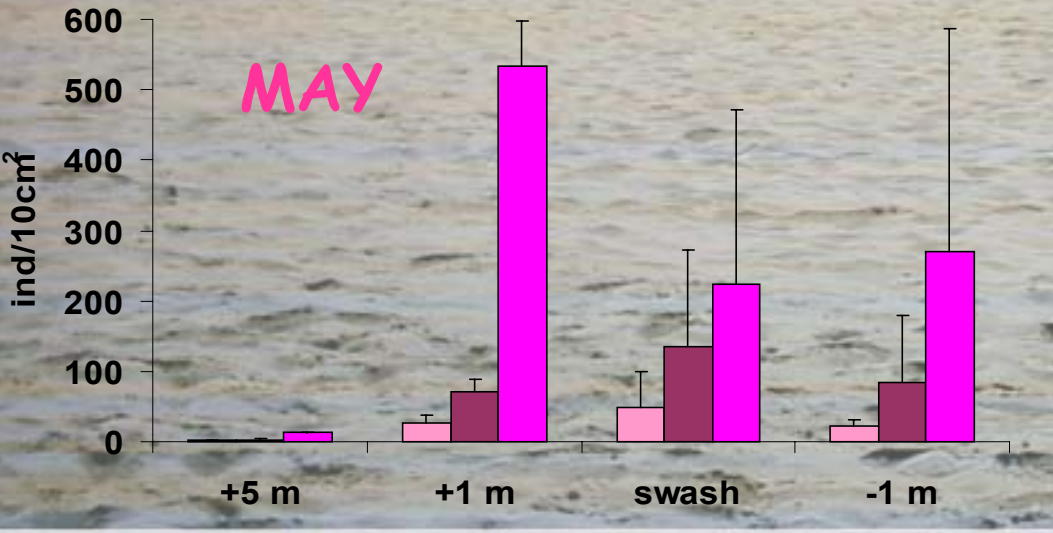


- *Rhabdonema spp*
- *Pleurosigma spp*
- *Amphora spp*
- *Navicula spp,*
- *Cocconeis spp*
- *Nitzschia spp*
- *Staurosira spp.*
- *Coscinodiscus spp,*
- *Licmophora spp*
- *Biddulphia spp*
- *Amphiprora spp*
- *Mastogloia spp*
- *Thalassionema spp.*
- *Fragilaria spp*
- *Gramatophora spp*
- *Synedra spp*
- *Thalassiosira spp*

MEIOFAUNA DENSITY

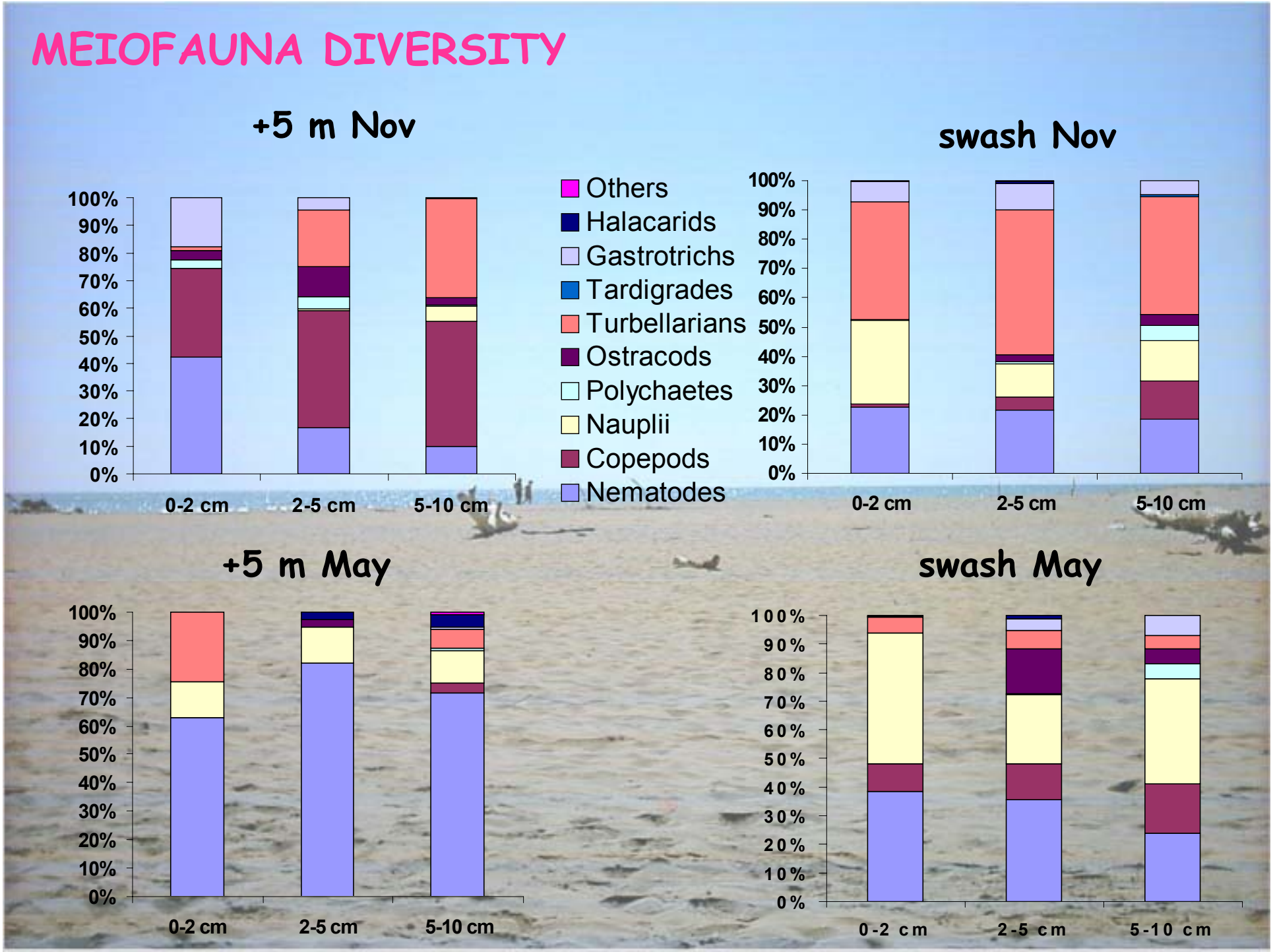
ind/10 cm²



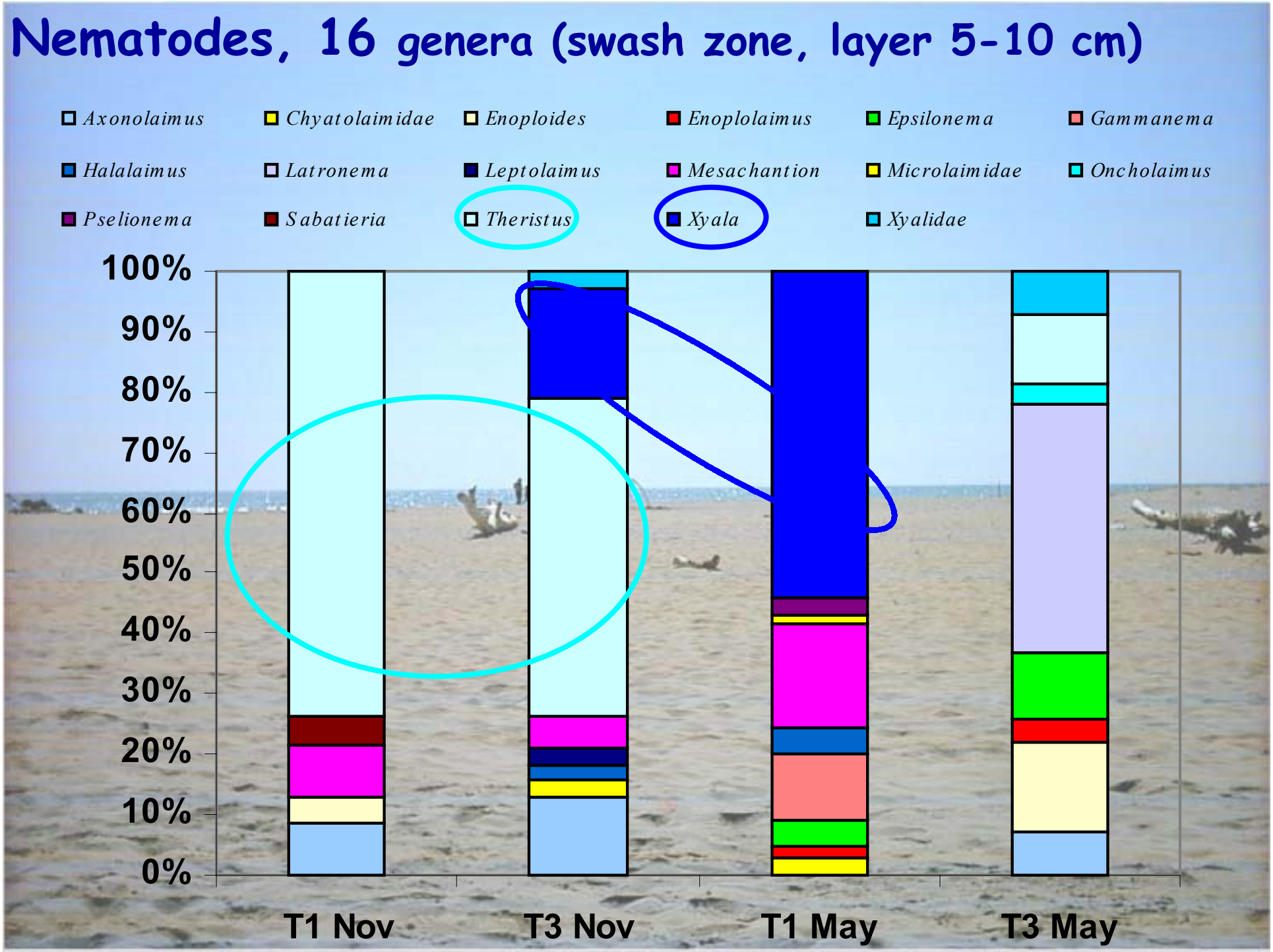


- low densities (meditarranean shallow sediments: 200-3000 ind/10cm²)
- similar densities of other sandy beach : 50-1500 ind/10cm² (McIntyre, 1969)
- vertical distribution with maximum in the deep layer
- increasing in May

MEIOFAUNA DIVERSITY



Nematodes, 16 genera (swash zone, layer 5-10 cm)

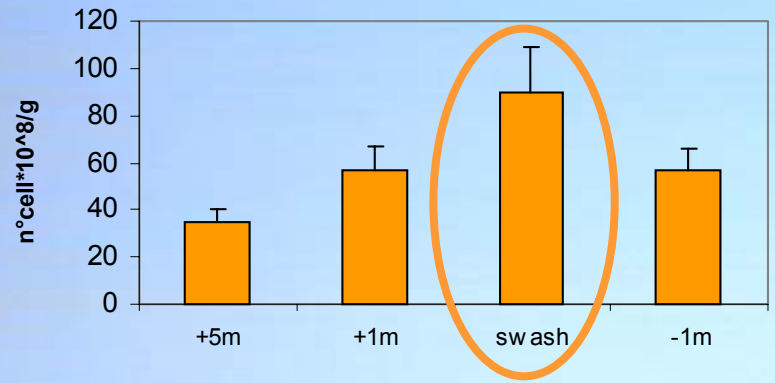


Relationships MEIOFAUNA-ENVIRONMENTAL VARIABLES (Moreno et al., 2005, Estuar Coast Shelf S, in press)

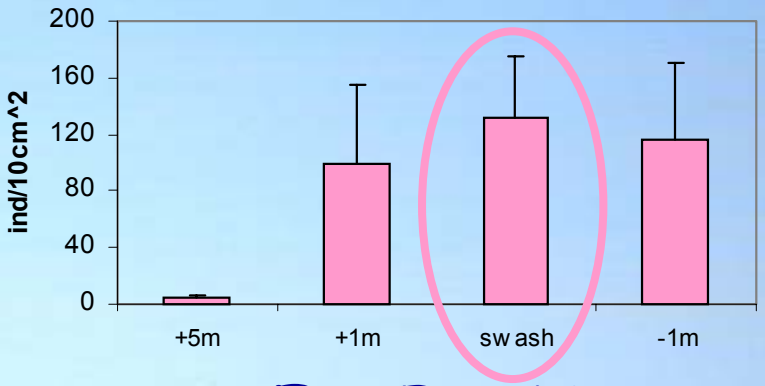
No. Vars	Corr.	Selections
3	0,455	Dryness, Grain Size, BBM
2	0,432	Dryness, BBM
2	0,393	Grain Size, BBM
1	0,388	BBM
4	0,318	Dryness, Grain Size, Cho, BBM
3	0,311	Dryness, Cho, BBM
3	0,288	Grain Size, Cho, BBM
2	0,284	Cho, BBM
2	0,218	Dryness, Grain Size
1	0,196	Dryness

On the surface layer positive correlations were found between meiofauna and fungi, while negative correlations were found between meiofauna and microphytobenthos.

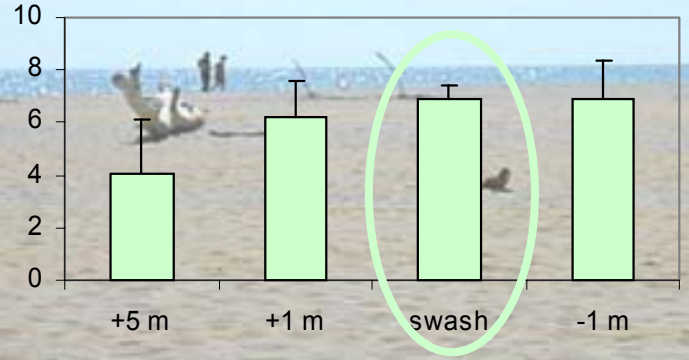
SPATIAL DISTRIBUTION:
The role of the swash zone



TBN



MEIOFAUNA



Number of Taxa

- swash hydrodynamics determine interactions between marine and terrestrial processes
- high oxygenation and moisture content

CONCLUSIONS:

- Maremma beaches are strongly oligotrophic and heterotrophic system, (low microphytobenthos abundance, while bacteria made up to 30% of total biopolymeric C and N).
- Microbial and meiofauna organisms showed low abundances and their distribution showed great variability across the beach gradient and periods.
- Higher values of diversity were always found in Collelungo site for all communities, probably related to the reduce physical stress (accretion) and more pristine environmental conditions (more distance from the river input).

4. Preliminary results highlighted physical factors as the main variables explaining abundance distribution and biodiversity of micro and meiobenthic communities and the swash zone resulted a key area where optimal values of these variable were found.