Microdistribution of macroinvertebrates in a temporary pond in Central Italy

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AIMS

The association between macroinvertebrates and microhabitats in ponds is little known and is limited only to few taxonomic groups.

The main aims of this study were:

- to individuate the physico-chemical differences of the available microhabitats within the pond;
- to determine the spatial microdistribution of macroinvertebrates and which parameters can act as its driving factors.

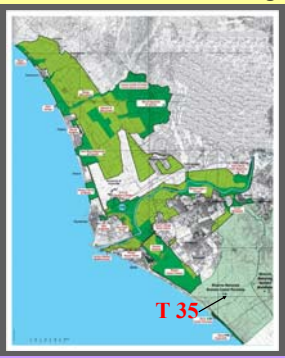

Fig. 1. Map of Presidential Estate of Castelporziano.

Figure 2. The temporary pond T 35.

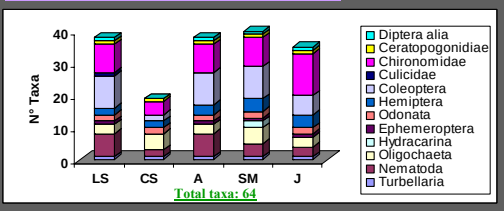

Figure 3. Taxonomic richness in the 5 microhabitats, showing lower walues in CS than in other microhabitats (ANOVA; $p < 0.001$).

N-MDS LEGEND

- LS = littoral sediments
- CS = central sediments
- A = *Spirogyra* spp.
- SM = *Ranunculus* spp.
- J = *Juncus effusus*

STUDY AREA AND METHODS

The study temporary pond is located in the Presidential Nature Reserve of Castelporziano near Rome (Figs 1-2). At the end of April 2004 we sampled macroinvertebrates by a pond net (mesh opening: 0.280 mm) trained for 1 m and dragged for about 5 cm depth into the sediments on five microhabitats [littoral sediments, central sediments, submerged macrophytes (*Ranunculus* spp.), algae (*Spirogyra* sp.), emergent macrophytes (*Juncus effusus)*]. Ten replicates were collected at each microhabitat. At each sampling point, we also recorded some water characteristics (pH, conductivity, dissolved oxygen) and sediment parameters (Total P, Total N. organic C and matter, granulometric elements). Differences between microhabitats were tested by ANOVA and Tukey test and reported with a significance at least of $p < 0.05$.

RESULTS

Non-Metric Multidimensional Scaling (*N-MDS*) performed on physicochemical data (Fig. 4) showed higher contents of total P and N, organic matter and C, silt and clay and lower contents of sand, dissolved oxygen and pH in central sediments with respect to other substrates.

A total of 11,554 individuals belonging to 9 high zoological groups (64 lower taxa, mostly genera or species) of macroinvertebrates was collected during the study. *N-MDS* performed on all taxonomic groups considered together or lower taxa of the most abundant groups separately (Figs 5 -9) showed a clear dissimilarity between the assemblages living in submerged and/or emergent macrophyte species and those in other substrates. The more stable, well oxygenated substrate, which also acts as refuge from predation and offers a three-dimensional space and more types of food tends to favour the presence of more species.

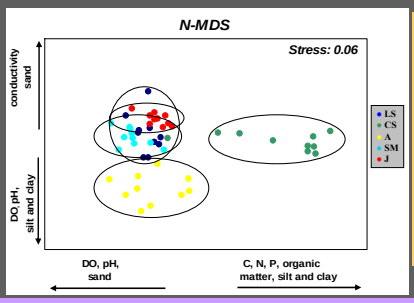

Figure 4. *N-MDS* plot of microhabitats according to their physico-chemical characteristics.

CS showed higher contents of C, N, P, organic matter, silt and clay, and lower pH, DO and sand contents than the other microhabitats.

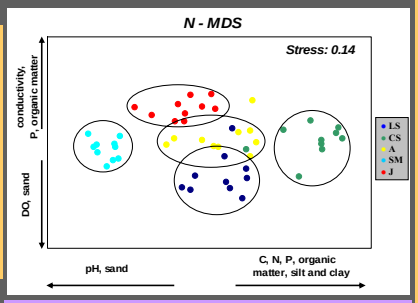

Figure 5. *N-MDS* plot of microhabitats according to the high taxonomic group distribution.

LS and CS were mainly characterized by non-insect taxa, such as Nematoda, Oligochaeta and Turbellaria. In MS the most abundant taxa were Ephemeroptera, Odonata and Coleoptera Dytiscidae. Finally, J was colonized especially by Chironomidae.

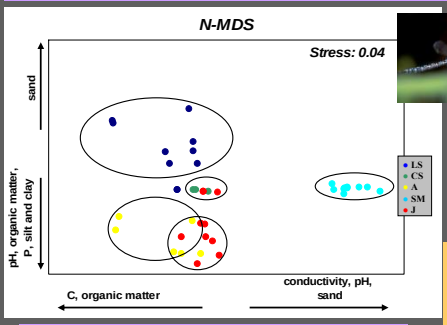

Figure 6. *N-MDS* plot of microhabitats according to Odonata species distribution.

As regards the Odonata, *Lestes barbarus* densities were higher in SM and J with respect to the other substrates. *Sympetrum fonscolombei* was exclusive of SM. Finally, Aeshnidae were exclusively found in CS.

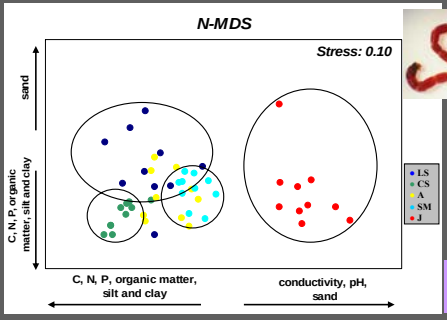

Figure 7. *N-MDS* plot of microhabitats according to Chironomidae taxa distribution.

Among chironomids, LS and CS were characterized by higher abundances of *Procladius* and *Psectrotanypus varius*, and by the exclusive presence of *Chironomus plumosus* gr., whereas *Psectrocladius sordidellus* gr., *Corynoneura scutellata, Isocladius sylvestris* and *Paratanytarsus* were more abundant in J.

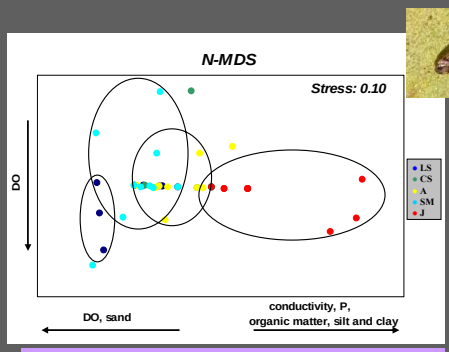

Figure 8. *N-MDS* plot of microhabitats according to Hemiptera species distribution.

Corixa puntata (the most abundant and frequent species in the pond) preferred LS, SM and A, whereas *Plea minutissima* preferred J. Finally, *Notonecta* sp. and *Anisops sardeus* were exclusively found in J.

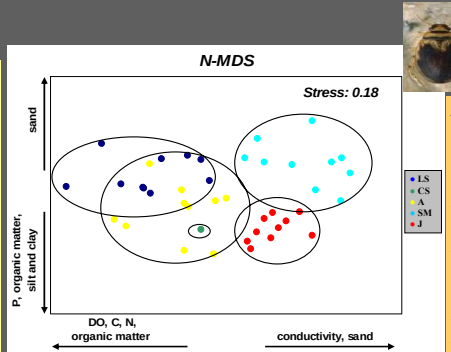

Figure 9. *N-MDS* plot of microhabitats according to Coleoptera species distribution.

Agabus nebulosus characterized LS and SM, whereas *Coelambus confluens* and *Hydroglyphus pusillus* were exclusively found in LS. *Hydroporus pubescens* and *Coelostoma* sp. were more abundant in LS, whereas *Laccophilus minutus* and *Hyphidrus aubei* colouized mostly SM and J. Finally *Hygrobia hermanni* was more abundant in A.

CONCLUDING REMARKS

- The physicochemical features of the five microhabitats showed some differences related to the presence of vegetation (pH and dissolved oxygen) and different accumulation and decomposition of organic matter (contents of P, N and organic C, sand and silt+clay) within the pond;
- the presence of some macroinvertebrate taxa appeared to be exclusive or significantly more abundant in some microhabitats than in others, suggesting that all microhabitats in a pond should be sampled for an esaustive collection of species.
- the highest number of macroinvertebrate taxa and their densities occurring in the macrophyte beds confirm the role of submerged and/or emergent vegetation to mantain high biodiversity in ponds;
- the knowledge of species microdistribution and diversity is of fundamental importance in pond management and conservation, because ponds can be considered as "reservoirs" of species which favour the (re-)colonization of neirorbourg water bodies more or less affected by anthopogenic pressure.