**Editorial**

# Challenges Faced in the Career and Topics of Scientific Interest by Marcello Bazzanti

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## EDITORIAL

Until now, Marcello Bazzanti published about 100 papers (in extenso) and more than 80 abstracts of congress dealing with three main topics of freshwater sciences which is summarized as follows:

A) Evaluation of the influence of natural and induced (human) pressures on the macroinvertebrate community parameters of lakes. The relationships between these community descriptors and eutrophication, hydrological and morphological pressures allowed to identify potential bio indicators and to test mono- and multi metric indices as tools to assess the ecological integrity of Italian lakes (three case studies are reported).

1) The response of macroinvertebrates and several metrics based on their taxonomic presence/absence to eutrophication was investigated in some Mediterranean lakes of the volcanic district of Italy. The analysis involved a large dataset from 185 sites located in three different depth zones (sandy eulittoral, vegetated infralittoral and sublittoral /profundal zone) of five lakes. For each depth zone, species composition and richness-based metrics were compared between the different lake trophic categories. Results showed that species composition differed among lake zones and, in each depth zone, among sites belonging to lakes of different trophic state. A total of 23 taxa in the eulittoral, 31 in the infralittoral and 14 in the sublittoral/profundal were selected as indicators of different trophic categories. The metric based on molluscan and large crustacean taxa was significantly higher in oligotrophic sites compared to eutrophic ones in all the three benthic zones, whereas the Biological Monitoring Working Party (BMWP) and the Average Score Per Taxon (ASPT) and total taxa richness correctly differentiated between sites of different lake trophic category only in the sublittoral/profundal zone. We conclude that eutrophication pressures could be assessed by the use of certain richness-based metrics not only in the sublittoral/ profundal but also in the sandy eulittoral and vegetated infralittoral zones.

2) The effects of the improvement of environmental conditions (i.e. reversal of eutrophication) on macro invertebrate communities of Lake Nemi (Central Italy) were analyzed by means of a comparison of the communities living in the eulittoral, infralittoral and sublittoral/profundal zones before and after the natural recovery of the lake from eutrophication following the deviation of domestic wastewater. The infralittoral vegetated zone responded more rapidly than the other two depth-zones to the improved ecological conditions, as shown by larger differences in community composition between the two periods. In the eulittoral sand, the combined effects of hydro morphological pressures and reversal of eutrophication hindered the biotic response. In the eulittoral and infralittoral zones, typical taxa of mesotrophic waters appeared or increased their abundances after the eutrophication reversal. Benthic invertebrate response was slower in the sublittoral/profundal zone due to de oxygenation that continued to prevail in the deepest area of the lake during summer. However, both tolerant and more sensitive taxa were collected there for the first time. After the reversal of eutrophication, the percentage of molluscan + large crustaceans increased in the infralittoral zone, whereas the oligochaete/chironomid ratio decreased in both sublittoral/ profundal and infralittoral zones. Functional feeding metrics (percentages of filter-feeders, collector-gatherers, miners and scrapers/grazers) differently tracked the reversal of eutrophication in the three depth-zones probably according to the effects of the reduction of nutrients on food-web structure influencing macroinvertebrates. Biological Monitoring Working Party (BMWP) and the Average Score per Taxon (ASPT) seemed to respond to eutrophication reversal only in the sublittoral/ profundal zone, where de oxygenation plays a major role as a structuring agent of the community. Our results suggest that the effects of reversal of eutrophication can be better assessed by examining the response of the communities belonging to each zone individually.

3) We were also interested in the development of effective methods for assessing the ecological status of some Italian lakes based on littoral benthic fauna has been hampered by the lack of

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quantitative data on the relative impacts of key pressures on the benthic community. We used variance partitioning at 126 sites belonging to 14 natural Mediterranean lakes to analyze the pure and shared effects of eutrophication, morphological alterations, microhabitat type, lake morphometry and geographic position on the littoral macroinvertebrate community. Communities appeared to be affected primarily by morphological alterations to lake shorelines, and their impact was 2.5 times as important as that of eutrophication. The structure of littoral benthic communities was governed by processes acting at several spatial scales from region to lake scale. Thus, several pressures and the various spatial scales at which these act should be taken into account when implementing methods of assessing lake ecological condition based on littoral benthic invertebrates. Region-specific methods for subalpine and volcanic lakes might enhance the validity of assessment of results of morphological alterations and improve management of those water resources.

B) Knowledge on diversity, abundances and functional parameters (feeding groups, habits and resistance to desiccation) of macroinvertebrates of ponds in Central Italy and their relationships with environmental variables (nutrient enrichment, wet phase duration, substrate types, etc.). Biodiversity and conservation approaches of these biotopes are also applied (one case study is reported).

1) Macroinvertebrates of 49 (27 temporary and 22 permanent) ponds located in the Presidential Estate of Castelporziano (Rome) were studied from 1989 to 2004 to investigate their community ecology and to provide a first estimation of their conservation value. More than 300 taxa (about 70 % identified to species) were collected. The main environmental factors influencing the number of species in the study ponds were hydro period length, depth, surface area, dissolved oxygen concentration and macrophyte species richness and abundances. Permanent biotopes generally hosted higher number of taxa than temporary ones. Some taxa were exclusive or more abundant in a pond type. Functional organization (functional feeding groups, habits and resistance to desiccation) of the community appeared similar in the two pond types but differed among mesohabitats. Up to date, about 62 % of the taxa collected have an unknown status with respect to their distribution in Italy (common, rare, threatened and vulnerable). We identified 50 target species with peculiar ecological requirements and/or geographical distribution to promote effective practical basis for pond conservation in Italy. The distribution of rare, vulnerable or threatened species within the ponds studied suggests that the two pond types and all mesohabitats therein should be considered for the sampling procedure to obtain a correct evaluation of pond conservation.

C) Macro invertebrates and bioindices for river ecological quality assessment and ecological requirements of some freshwater taxa (three case studies are reported).

1) Sandy bottom macroinvertebrates in two moderately polluted stations of the River Treia (Central Italy) was studied in order to analyze their structural and functional feeding organization. A total of 60 taxa were collected during the study. Most of the taxa were typical of sandy bottom habitats and moderate current flow. Collectors and shredders were the dominant feeding groups in both stations. Moreover, the direct relationships found between taxonomic and trophic diversities or between taxonomic and trophic evenness suggest a relatively good partitioning of food resources among the taxa. The most common organisms found in both stations were typical of mesosaprobic environments, indicating that the macrofauna of fine sediments seems to be suitable for detecting moderate organic pollution in rivers.

2) We investigate the distribution and abundance of soft bottom chironomids in an organically polluted lowland river of Central Italy. *Chironomus riparius* showed the highest annual mean densities at the very highly polluted station, where it was the dominant species in late spring and summer. At the same station, *Micropsectra* sp., *Polypedilum breviantennatum, Cryptochironomus* sp., *Harnischia* sp. and *Cricotopus bicinctus* replaced *C. riparius* in winter, when the environmental conditions improved slightly. Densities of all the above mentioned taxa generally showed a positive correlation with the orthophosphate and $BOD_5$ contents and a negative correlation with the oxygen content. *C. riparius, Micropsectra* sp. and *Harnischia* sp. preferred fine sediments (silt/clay and very fine sand) with high organic matter content, whereas *P. breviantennatum* was mostly confined to sandy stations. *Robackia demejerei, Acalcarella* sp., *Rheosmittia spinicornis* and *Paracladopelma cloris* group were present and/or abundant exclusively at unstable sandy stations with summer regulation of the water. Principal Component Analyses based on chironomid densities seems to provide an integrated response to the effects of both physical (hydraulic stress and granulometric composition of the sediment) and chemical characteristics (organic pollution) of the river.

3) The effectiveness of macro benthic nematodes as biological indicators along the River Arrone (Central Italy) was tested in soft-bottomed sites variously affected by organic pollution. Significant positive relationships were found between environmental parameters (orthophosphate, ammonium, BODs in the water, and silt/clay and organic matter in the sediments) and densities of both total nematodes and the most abundant species (*Tobrilus diversipapillatus*, *Dorylaimus asymphydorus* and *Tobrilus gracilis*). Relationships were also found between taxa and some common biotic indices (Extended Biotic Index and Biological Monitoring Working Party), in which nematodes are not considered. Principal Component Analysis performed on taxa densities identified a chemical and biotic gradient along the first component and a granulometric and a organic matter content gradient along the second axis. All the data suggest that the analysis of the nematode communities can be a promising tool in water quality assessment studies of lowland rivers, because of the good relations between this zoological group and physico-chemical parameters and biotic indices.