BIOLOGICAL MONITORING OF WATERS

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Abstract
The management of natural environments passes from the possibility to know environmental features and their evolution in time. Generally quality assessment is based on chemistry or microbiology, and physical values, to justify laws and sanctions. The big problem of these precise measures, however, is in the necessity they have to be recorded in a more or less continuous monitoring. Punctual measures are not good to assess the consequences of acute stress episodes, but simply they measure them. The biological monitoring is the solution for such a kind of necessity. The presence of long living organisms (eucaryotes, generally multicellular) ensures the existence of an average good condition for the species to which they belong. Biological indicators (chemicals inside an organism, the whole organism as well, or community structures) can describe the environmental status. Nowadays, the use of community characteristics, although complex, is considered useful for the quality assessment. This requires a deeper biological study of environments and a growth of interest towards nature in general. A series of studies carried out on Albanian water bodies allowed to discuss the proposed trend.

Introduction

The assessment of the water quality has a fundamental importance in any management activity of the environment, being not excluded even the human health.
The most prompt method, and perhaps the more traditional, is based on the measure of some physical aspect of the environment or of the concentration of some chemicals.
A long literature list exists to address such a kind of measurements, and their accuracy; and continuous is the upgrading of numerical limits with the changing perception of the environment. However they stay the things, each punctuated measure suffers the weakness of to be not sufficient, by alone, to describe a complex system as an environment. In addition, the parameter measured is generally subjected to continuous change, and more than episodic measures, the assessment of environmental quality requires continuous monitoring, thus conflicting with the costs of such measures.
The DIRECTIVE 2000/60/EC, of 23 October 2000, institutes a frame for the actions addressed to the protection of the EU waters (Surface, Underground, Transitional, Coastal) specifying in the premises a long series of facts to be considered (53 points).
The aims of the DIR 2000/60/EC (art.1) are in the frame of a protection of the environment due to all the possible use of water. Definitions (art. 2) consider and specify 41 different terms. This complex document asks for a monitoring (art. 8), for the performance of programs of measurements (art. 11), for the production of management plans (art. 13), to adopt recovering (art. 17) and/or prevention strategies (art. 18).
The considered parameters are grouped as indicators of different environmental risks: distrophy, chemical contamination, human health (see for example, the work of Regione Liguria, 2006). The indicators for each risk can be measured in the water column, or into the sediments on the bottom of a water body:

risk: DISTROPHY

water column	**sediments**
D.O.	Fecal
Contamination	
B.O.D.	Pathogen microbes
O.M. & B.P.C.	Eh
nutrients	A.V.S. & C.V.S.
Chl *a* & pheopigments	Chl *a* &
	pheopigments
TRIX	

risk: CHEMICAL CONTAMINATION

water column	**sediments**
Tensioactive	P.C.B. & P.C.T.
Pesticides	Pesticides

I.P.A.	I.P.A.
Metals	Metals
Mineral Oils	

All the above indicated products are considered as risks also for human health.

Notwithstanding their participation to all environments, living organisms are practically excluded by the indicators for the water column, and only partially considered for the sediments (and only for the trophic status) .

In marine environments, the enormous water masses impede to punctuated measures to be considered as reliable. Here the use of living organisms as indicators is suggested, due to their accumulation capacity for a relatively long life (1-3 months, this avoids the necessity of a continuous monitoring), although not extremely long (due to the month duration of their cycles they allow us to know the end of any stressing episode).

One biological community commonly used for assessment studies is the Meiobenthos:

Indicator (generally for organic pollution):

Abundance and diversification; with identification of Nematodes at level of genus.

proposed limits for quality degrees:

optimal: n° *taxa* > 16

intermediate: 16 < n° *taxa* < 8

worst: n° *taxa* < 8

Another biological community commonly used for assessment studies is the Macrobenthos

Indicator:

Abundance and diversification of macrobenthos

limits:

Biodiversity indicators (n° taxa, Shannon-Wiener, H' index, etc.), are useful, but not as absolute numbers (only for comparisons). As a rule, higher the biodiversity and better the environmental conditions.

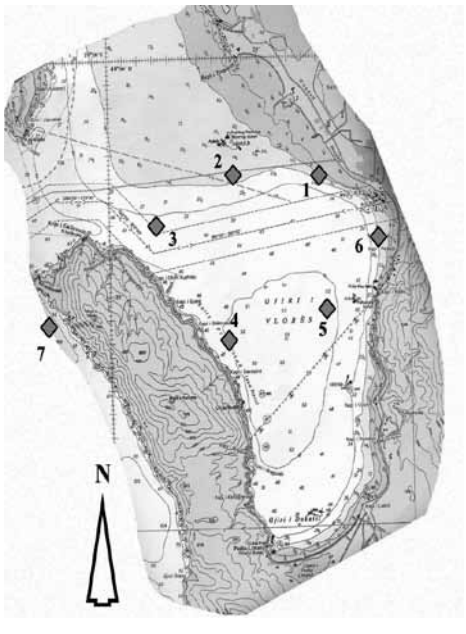
Also in the case of marine environment it is clear as the biota of the water column is not considered. This is probably due to problems of collection and analysis of samples. In fact water columns (either marine or freshwaters) content the plankton, a well known and rich community of living organisms. These organisms have life lengths long enough to amplify chemicals or contaminants of the water where they stay, and contemporaneously their life is short to allow the seasonal renewal.

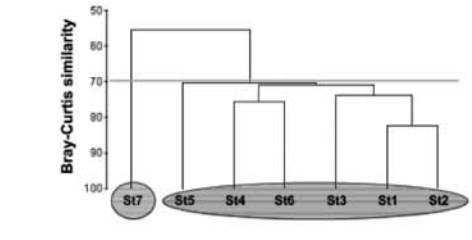
Albanian Examples

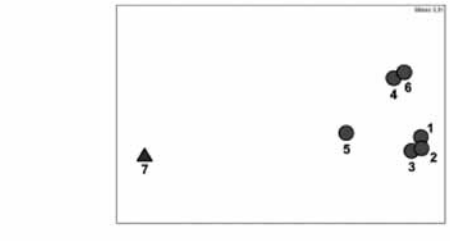
As an example of the presence of plankton we can consider the alpine lake Gjistova, at 2365 m asl on mount Gramoz (South Albania). It is frozen and covered by snow from November to June. This notwithstanding this water body (extreme, for some aspects) hosts a rich plankton community: 12 species of crustaceans and rotifers (excluding Ostracoda, Trichoptera, Rhincota, Chironomida, Protista, Nematoda, Bivalvia, and 12 cyst types, which were not identified at the specie level) (Shehu et al., 2008).

As an example of the characterization of water areas we can consider the plankton of the Vlora bay (Moscatello and Belmonte, 2006) which well described geographic differences.

The plankton of the whole bay is very diversified, being composed by more than 300 different taxa. In the Figure, it is easy to observe that the sampling stations of the Gulf, group allowing to distinguish different areas. For example, stations 1, 2, and 3 group together, and 4, and 6 apart. The station 5 is evidently different from both the groups. But whatever is the difference among the plankton community of the Gulf, it is very evident that the plankton community of the only station (7) outside the gulf is even more different form all the others.







To continue with examples, the study of zooplankton allowed also the discovery of unsuspected problems for lakes in the Dumre area (El Basan). In fact here is well known that the Bellsh lake has problems due to the presence of the city on its coastline, and the absence of any exit way for the waters which became more and more polluted every day.

A program which studied 14 of the Dumre lakes, showed that the Bellsh lake has a plankton community richer than other 6 lakes, and equal to other two (Alfonso et al., 2011). This simply datum allows us to search for problems existing in other Dumre lakes. These are not, however, in a good general condition, due to their carstic origin and the absence of any exit way for the water (all the lakes are collectors of any wastes coming from the surrounding land). The lake Deges, on the contrary, is a Nature Monument for Albania, and it hosts a rich plankton community.

In general, the lakes of the Dumre area are not known from the biological point of view. They all, however, are under risk of existence due to their particular status of carstic lakes without any possibility of water renewal.

Just to finish with a well known example, here I propose just to think about the status of Ohrid lake. This lake is the most ancient of Europe, and a true Nature monument (it has been declared Monument of Nature Heritage by UNESCO). Many topics could be chosen to give value to the Ohrid lake. But the story, the landscape, the economy, or the chemical composition of the waters were not the true responsible of this election.

Ohrid hosts more than 1200 different species of living beings, and this makes it the lake with the most abundant biodiversity (if reported to surface unit) of all the world. This result gives it visibility and fame, and all the world knows that it is important. This fact, from a publicity point of view, promotes its images and its value, in terms of economy (tourism) and gives a good lesson of how the environmental wellness correspond to an economic one.

Conclusions

The use of the plankton community in assessment of environmental quality is not usual. This is probably due to its extreme complexity (hundreds of species which must to be identified). The taxonomic sufficiency TS, however, allows us the analysis of community samples without arriving to the species level (impossible for all the phyla, for any scientist). TS says that also the family (easier to be recognized) are enough for assessment purposes (Terlizzi et al., 2003). Even the specialization on one single taxon (of high level) can, however, allow the scientists to describe the environmental status due to the fractal aspect of evolution which covers all the niches also with extreme diversification of one single taxon (the identification of species of one single taxon should give the same indication of the study of all the existing species in each environment).

Acknowledgements

The present paper is dedicated to the memory of Muharrem Shehu, who first brought us to the Gjistova lake, on mount Gramoz.

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