THE CASE FOR A BIOMONITORING PROGRAMME OF POLLUTION IN THE MEDITERRANEAN*

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Monitoring programmes absorb a lot of resources both human and financial in order to secure the reliable assessment of quality of the environment and "health'" of ecosystems. Most of the presently operated projects focusing only on chemical parameters (often only of a limited range of suspected contaminants) are unable to provide adequate information to fulfil the aforementioned objective. Therefore it seems logical that a proper monitoring should include the right mixture of chemical and biological parameters, that is the assessment of the quality of the environment also on the basis of the response of organisms to pollution or other stressors. Any cost-effective environmental monitoring programme must integrate a wide range of chemical and biological monitoring techniques, thereby avoiding replication and providing the sufficient scientific information required to predict the risk of damage to living resources or to man at the earliest possible stage.

The range of biomarkers applicable to the Mediterranean has been recently reviewed by SCOULLOS (1993) and AXIAK (1993). The types of bioassays which are currently available and which have shown a proven potential for field monitoring are included in table 1. A wider range of bioassays are indeed available, but these are either of dubious specificity, sensitivity or ecological relevance or have not been sufficiently tested yet in the field. At this stage of bioassay development, it is possible to develop an effective biomonitoring programme, which would be integrated in the current chemical monitoring programmes, and which would be based on the use of biochemical markers such as MFO, methallothioneins, and cellular changes. A pilot biomonitoring programme has been recently proposed to be introduced within the Mediterranean Action Plan. The success of this pilot project will initially depend on the political will and availability of adequate resources for its implementation.

The limitations and inadequacies of the present chemical monitoring programme include : insufficient data quality control, incomplete geographical coverage and insufficient implementation of the required standardized methodologies. The realization of such limitations will be an essential prerequisite in optimizing the present monitoring strategies and in ensuring the effective integration of a biomonitoring component in such a programme. Ultimately, the success of any region-wide environmental monitoring programme will depend on its compatibility with on-going national monitoring programmes and on its ability to communicate effectively relevant information on the state of the environment to the decision makers and environmental authorities.

Table 1. A comparative review of some bioassays and their potential for use in environmental monitoring programmes in the Mediterranean.

	Mixed Function Oxygenases	Methallo-thioneins	Cellular Changes	Genetic Changes	Scope For Growth	Species Diversity abundance
Organisms used	Mostly fish	Mostly mussels	Various	Various	Mostly bivalves	
Specificity of response	Organics	Heavy metals	General	General	General	General
Sensitivity	Varies	High	Medium	Varies	High	High
Dose-response relationship	Good	Good	Low	Unknown	Good	Low
Ability to monitor recovery	Unknown	Unknown	Unknown	Unknown	High	High
Ecological significance	Low	Medium	Medium	Unknown	High	High
Sampling validity	High	High	Medium	Unknown	High	Varies
Time of response	Hours	Hours - days	Days-months	Days-months	Days-months	Months
Costs	Medium	Medium	Low	Medium	Medium	Low-Medium
Relative ease	Complex	Complex	Medium	Medium-Complex	Medium	Labour intensive
Potential for monitoring	High	High	Medium	Unknown	High	High

Adapted from HOWELL et al. (1990)

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** An introduction to the round table discussion on monitoring.*

HEAVY METALS IN THE SUPERFICIAL SEDIMENTS OF BOUISMAIL BAY

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In order to estimate the contamination degree of the Algerian coasts by heavy metal, Bouismail bay has been the object of a preliminary study during the summer 1991. The studied zone was sampled in eight radials among which six were in direct relation with the rivers (Mazafran and Beni-messous) (fig.1). Surface sediment samples were colleted by using a Van Veen grab, which takes representative samples by 0-10 cm layer. From the dried sediment samples a quantity of 1 g (< 63 µm) was mineralized with mixture of HCL-HNO_3 (3-1 v/v Ridel-de Haën) during two hours at 120° under a flowing-back column. This treatment methods are those suggested by UNEP/IAEA (1985a, 1985b and 1986). Cadmium, Chromium, Copper, Manganese, Lead, Mercury and Zinc were the metals analysed. The inter-stantardization is realized on lyophilised sediment provided by the IAEA (MONACO) and coded SDM2/TM. The analysis is led by a Perkin-Elmer 2380 GFAAS.

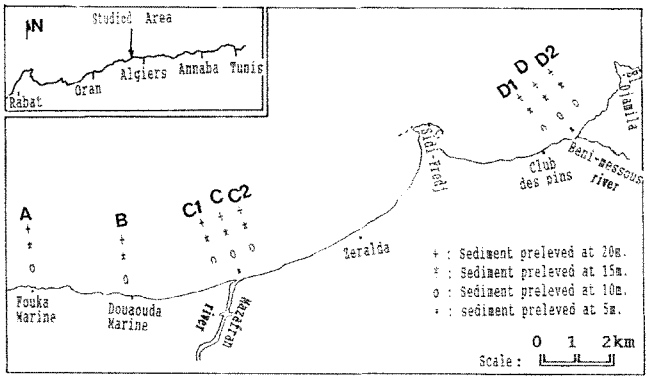

Fig. 1. Bouismail Bay : sampling stations

The high levels of Hg and Pb reflect the existence of pollution sources, essentially in front of the Mazafran river where we found the highest values. The strong variation of these metals is in relation to the important intake of this river which marks out Bouismail bay. Cd variation is due to the diversity of pollution sources, important agricultural activity, urban casting up, etc., on one side and on the other side to the natural variations (DESSAINT, 1987).

Mn and Cr present normal values and their distribution is uniform in the studied zone. However, we may point out that the floculation effect is very important for Mn (rapid precipation of this metal to the interface fresh water/salt water). This has been already shown by CHESTER and STONER (1975) in sediments from the lower Severn Estuary and Bristol Channel. Finally Zn and Cu concentrations are variable and the highest are located at the west of Mazafran river. This augmentation is probably due to an anthropic input principally caused by this river, and may also be due to the fertility of this sector in organic substances.

Radials (Bottoms nature)	Hg	Pb	Cd	Mn	Cr	Cu	Zn
A (fine sand)	00.24	14.84	00.56	449.63	72.49	23.52	107.00
B (fine sand)	00.42	16.16	00.27	495.85	73.70	55.16	125.60
C (muddy sand)	00.44	31.42	00.34	417.15	71.85	22.62	72.62
C1(fine sand)	00.46	25.79	00.95	504.55	73.52	24.82	103.00
C2(fine sand with shells fragments)	00.40	25.16	00.13	507.30	73.94	22.59	103.59
D (fine sand)	00.045	15.17	00.49	468.25	70.39	15.59	65.30
D1 (fine sand)	00.065	15.48	00.15	484.15	72.33	16.23	65.00
D2 (fine sand)	00.055	18.39	00.33	481.00	73.50	20.10	85.87
Mean	00.265	20.30	00.40	475.98	72.71	25.07	91.00
± SD	00.17	05.89	00.25	28.50	01.12	11.79	20.78

Table 1. Average concentration of metalic element in the superficial sediments of Bouismail Bay (µg/g. Dry weight)

The analysis of the heavy metals studied in the superficial sediments of Bouismail bay shows an irregularity in their repartitions. The continental input directly sheded into the bay or indirectly by the slants of the river, the heterogeneity of the bottom sediments and the abundance of biogene particles in this sector are the causes of this variation. However, the metalic pollution at the level of the bay is not alarming and is rather weak in comparison to other sites of the Algerian coast. However, considering the evolution of the agricultural activities in this region and the massive urbanisation along the Bouismail coast, further pollution may be expected for the future.

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