Methods and Techniques of Decision-making for the Estimate of Venturousness of Marine Sediments

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SUMMARY

Aim of this of work is the report and the information, to the extend it is possible, techniques and methods what they are involved for the estimate and evaluation of polluted marine sediments. The decision-making for the management of sediments is influenced, beyond the various environmental factors, from the political will, the legislative frame but mainly from the economic background which will cover the needs of program of conflict of research of line of factors. Nevertheless each such decision-making requires the existence of solutions what is capable to minimise the repercussions in the ecosystems, to restore the damage and to constitute in future methodology of confrontation of problems that results in the marine sediments mainly because human activities.

In this work is presented the importance of valid and methodical sampling and handling of samples. The first stage of estimate of situation of marine sediments, beyond the already existing data of past, is the collection of samples which, after a line of trials, aims at to locate quantitatively the pollutants and to attribute the relative gravity in them with regard to their repercussion in the situation of sediments. There are reported two types of sampling, the *random and targeted* drawings of sampling and then ways of collection as well as a number of sampling appliances categorized depending on the origin of sample (from the surface or in some depth). There are reported general directives on the recording, treatment, transport and storage of samples as they have been reported in the *Handbook for Sediment Quality Assessment (2005).*

In the next part it follows a description of most categories of trials and experiments. Three are the sectors of examination and research of sediments, chemistry, toxicology and benthos. With regard to the chemistry becomes a small description for each physicochemical parameter that is usually searched as the heterogeneity of sediments, the pH and redox potential of Sediment, the water content, the size of molecules, the Total Organic Carbon(TOC), Acetic-volatile Sulphides (AVS), with the last ones they require particular attention due to the determination of availability of metals in the organisms via these. The toxicity tests are important component for the estimate of repercussions of chemists in the aquatic ecosystems because indicate toxic influences of clashes of chemical mixtures and the methods of marine toxicity tests are summarised in the Marine Water Column Toxicity Tests, Marine Water Column Bioconcentration Tests, Marine Whole Sediment Toxicity Tests, Marine Sediment Porewater Tests, Marine Sediment-Water

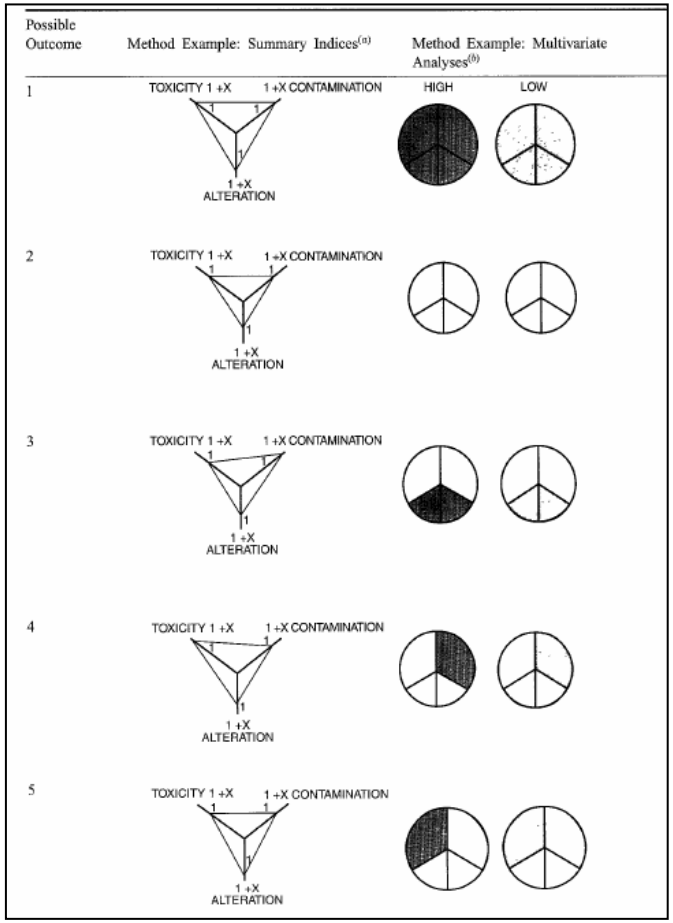
Interface Toxicity Tests, Marine Sediment Bioaccumulation Tests. It is a line of methods of toxicological examination of so much marine sediment in and above this (sediment, porosity and surface water).

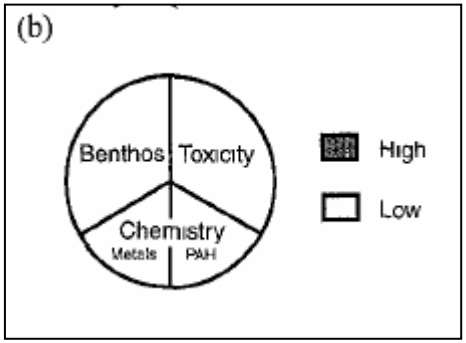
The estimate of structure of benthic community is connected formally with a recording of field so that they are determined the two being first structural characteristics of any community that are the distribution of types and individuals in three dimension environment and the distribution of individuals between the types and higher orders. The comprehension of these two characteristics serves the comprehension of functional characteristics of benthic community, including the trophic relations, capital and secondary productivity and interactions between the biotic and abiotic dwellings.

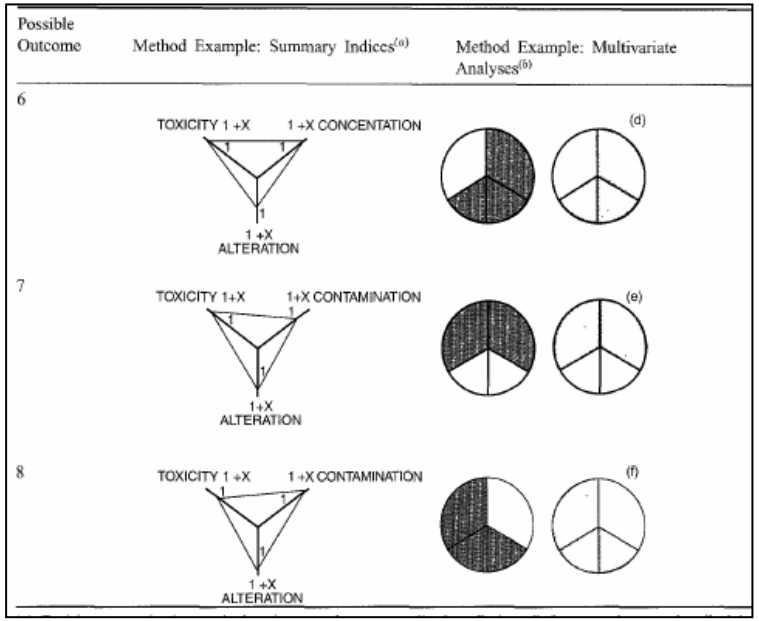
Then the Triad Method Approach is reported, initially adopted from the Chapman, method which includes the three mentioned before basic categories of parameters that elect the characteristics of sediments, considering thus that the estimate and the evaluation of quality of marine ecosystems will be more complete, after separately each one of them they present voids in the effort of interpretation results of trials and experiments.

Table : Information that is provided by different levels of Triad Approach *(Chapman M. Peter, 1996,1997)*

Information that is provided by different levels of Triad Approach				
Case	**Contamination**	**Toxicity**	**Alteration**	**Possible Conclusions**
1	+	+	+	Strong evidence for pollution-induced degradation
2	-	-	-	Strong evidence for pollution-induced degradation
3	+	-	-	Contaminants are not bioavailable
4	-	+	-	Unmeasured contaminants or conditions have he potential to cause degradation
5	-	-	+	Alteration is not due to toxic contamination
6	+	+	-	Toxic contaminants are bioavailable but in situ effects are not demonstrable
7	-	+	+	Unmeasured contaminants are causing degradation
8	+	-	+	Chemical are not bioavailable or Alteration not due to toxic chemical







(a) Toxicity, contamination, and alteration are shown normalized to Ratio-to-Reference values as described by Chapman (1990), 1.0=reference conditions. Note that the exact symmetry in these examples would not be routinely expected in actual studies.
(b) Example data presentation following mulhvariate analyses based on Chapman *et al* (1996). Toxicity (based on a representative toxicity test), sigmficantly different or not than control; Benthos (benthic community structure), Eucledian distance matrices, all taxon abundances relative to reference stations; Metals (based on copper), relative concentrations; Polyaromatic Hydrocarbons (PAH, based on fluoranthene), relative concentrations. If more possxblhties than "high" or "low'" are included, the number of possible combinations increases accordingly.
(c) Plus two intermediate posslbihties (metals and PAIl show different patterns)
(d) Plus six intermediate possibilities (mixtures of high and low).
(e) Plus two intermediate possibilities (maxtures of high and low).
(f) Plus six intermediate possibilities (mixtures of high and low).

Figure: Graphic Presentation for the different levels of Triad Approach *(Chapman M. Peter, Presentation and interpretation of Sediment Quality Triad data)*

Finally becomes report the technical and various directives that are used from various European countries (Belgium, France, Germany, United Kingdom, Spain, Italy, Holland) with regard to the decision-making and investigation of quality of sediments, in which the Triad Approach Method is incorporated identically, in certain cases, or modified depending on the possibilities and the particularities of each country. Two main goals for sediment quality assessment in Europe are distinguished:

- Biological Effects-Based Assessment of *in situ* risks (in situ BEBA) at sites where sediment quality and potentially sediment management is to be considered
- Biological Effects-Based Assessment of the *ex situ* quality of dredged sediments (ex situ BEBA) in order to select sediment management options (e.g., free and confined disposal or treatment options).

In situ BEBA

It particularly focuses in the conditions of field of examination with regard to the biological availability of contaminants and the evaluation of damage in the ecosystem. The BEBA can combine itself with the studies that they focus in the dangers relative with the transport of contaminants to surface water and to biota, or in the deeper layers of sediments, and then in underground water.

In general, three main purposes can be identified for which in situ BEBA frameworks have been developed:

- Integration of information from large numbers of parameters that use different lines of evidence (e.g., sediment chemical concentrations, sediment toxicity, benthic community measures, tissue concentrations, etc.)
- Proof of causality between environmental effects and sediment contamination
- Tiered approach for increasing confidence in a cost-effective manner.

Ex situ BEBA

BEBA is an hazard assessment, in which biological/toxicological endpoints are used as predictors of possible effects that may occur when the sediment is disposed of in the environment. In this BEBA, bioassays are often included in the sediment quality assessment or added as a second Tier. The approach is more prognostic, i.e. based on the outcome of the assessment, predictions are made of the consequences of free disposal of dredged sediments in the environment. In that respect this approach, using sediment toxicity assessment bears resemblance with total effluent risk assessments.

Comparing in situ and ex situ BEBA, it is likely that the assessments lie at very different levels in a decision making process. In situ BEBA is usually a front-end investigation necessary to evaluate whether sediments are a risk, before any decision about some action would be needed. Ex situ BEBA is something that is carried out after it has already been proposed to dredge (e.g. dredging for nautical reasons), but when disposal options have to be considered. Apart from the ecological risk assessment approaches explained above, there may be different concepts that use risk information for other questions, such as prioritizing. **Biological effects-based sediment quality in ecological risk assessment for European waters (BEBA,** 21 April 2003**)**

Mainer sources of information emanated from the *Handbook for Sediment Quality Assessment* with regard to the information on the sampling methods and the handling of samples. Also the chemical measurements that take part at the estimate and evaluation of quality of sediments emanate from this. All the categories of toxicity measurements emanate mainly from the *Overview of Freshwater and Marine Toxicity Tests: A Technical Tool for Ecological Risk Assessment.* The information on the structure of benthic community and measurements that him concern emanates from the *Sediment Classification Methods Compendium.* The *General Guidelines for using the Sediment Quality Triad* and the *Presentation and interpretation of Sediment Quality Triad data* constitute the mainer sources with regard to the description of the Triad Method Approach. With regard to the practical, technical methods of decision-making, directives that various European countries came from *Biological effects-based sediment quality in ecological risk assessment for European waters.*