EROCIPS
Emergency Response to coastal Oil, Chemical and Inert Pollution from Shipping

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WP 7: Environmental Monitoring

Task 7.2.1: Protocol for Selection of Sentinel Species and Collection of Specimens

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1. Introduction

The objectives of the monitoring study have to be defined thoroughly in order to select suitable sentinel species. Biological monitoring may provide the basis for estimating an internal chemical dose, to measure effects in the organisms in environmental quality assessment, to measure ecological effects at higher levels of organisation, bioaccumulation, biomagnification, etc. In the case of a monitoring study based on biomarkers, the parameters (biomarkers) to be used should indicate that the organism has been exposed to the pollutants (exposure biomarkers) and/or the magnitude of the organisms' response to pollutant (effects biomarkers or biomarkers of stress). In this type of study, the selection of the species to be used as the sentinel is a key issue and should be carefully considered.

2. Criteria regarding the selection of sentinel species for monitoring studies based on biomarkers

- Sentinel species should be easy to identify through stable and easy observable taxonomic characteristics. In some geographical areas very similar species co-habit in the same area (e.g. *Mugil* spp., *Patella* spp.) and it is difficult and time consuming to make sure that all the specimens collected belong to the same species.
- Species should have a broad geographical distribution in the studied area(s). When the studied area is very large, as in the case of transnational programs, maybe two or more species with similar characteristics and a homologous function in the community have to be selected in order to cover the whole area. It may be true that that even closely related species react very differently to pollution; however, several taxonomic groups have closely related species with similar ecological functions, covering a wide area of distribution if jointly considered.
- A good knowledge of the biology, ecology, physiology and other relevant aspects of the species should be available in the literature. Background information is a determinant for choosing the methodology to be used and for data interpretation.
- Species should be abundant and accessible. In spite of being abundant some species are difficult to capture. It is important that sampling does not cause detrimental effects in population evolution for obvious ecological reasons. In addition, it is not feasible to spend a considerable period of time searching and collecting low numbers of rare species. Collection or purchasing should be cost-effective. In general, species of economical importance are preferable.
- For the most part of the studies, sentinel species should be of reasonable size to allow the individual analysis of specimens and of specific organs, body compartments or fluids (e.g. bile, haemolymph, blood). In small species, pooled samples of individuals or organs must be used, and this may be inconvenient in some situations. Handling, dissection and sampling of target tissue(s) and organ(s) should be easy to perform.
- Species should be responsive to contamination but robust enough to be present in polluted environments.
- Species should have a simple and known feeding habit and a defined position in the food chain to track the contaminant source and to infer about magnification and accumulation if adequate for the study.
- Species should be able to "reflect" local conditions. Therefore, their lifecycle should be restricted to the studied area (or at least a considerable part of it) and they should have a reduced mobility (this also applies to the larval phases). Behaviour patterns should also be considered since some species may elicit avoidance responses.
- The maintenance of the species in the laboratory should be possible and easy. This is important because laboratory studies (e.g. toxicity bioassays) may be necessary to complement field information.

3. Criteria regarding the collection of specimens

- Appropriate and standardised capture techniques should be used to provide animals in good condition and to allow data comparisons. Organisms should be maintained alive and in good condition until collection of the biological material to be analysed.
- Sampling should be performed at least seasonally to take into consideration both abiotic factors and physiological variation.
- Either males or females can be used. However, it should be noted that, in a considerable number of the species, females have a higher physiological variability than males. If both sexes are used, data should be separately analysed and a statistically adequate number of animals of both sexes should be collected in each sampling site.
- Organisms of a well-defined size interval should be collected to minimise age-related differences (e.g. physiological, pathological, ecological factors).
- Only apparently healthy organisms should be included in the study. Dead or organisms damaged during the capture should not be included in the study.
- Specimens should be of sufficient size to perform all the analyses planned. Some analyses require large amounts of tissue; therefore, specimens should be large enough to provide the amount of specific tissue needed for the analyses. Otherwise, pooled samples will be required.

4. Bibliography

Cajaraville, M., Bebianno, M.J., Blásco, J., Porte, C., Sarrasquete, C. and Viarengo, A. (2000). The use of biomarkers to assess impact of pollution in coastal environments in Iberian Peninsula: a practical approach. *Sci. Total Environ.* **247**, 295–311.

Lam, P. and Wu, R. (2003). Use of biomarkers in environmental monitoring. *STAP/GEF Workshop on The Use of Bioindicators, Biomarkers and Analytical Methods for the Analysis of POPs in Developing Countrie*s. UNEP.

Manual for Marine Monitoring in the COMBINE Programme of HELCOM. Available from HELCOM (Helsinki Commission - Baltic Marine Environment Protection Commission) website: http://www.helcom.fi/groups/monas/CombineManual/en_GB/main/. Last updated October 2006 according to the decisions by HELCOM MONAS 8/2006.

OSPAR (1997a). *JAMP Guidelines for General Biological Effects Monitoring*. Oslo and Paris Commissions, Joint Assessment and Monitoring Programme (JAMP).

OSPAR (1997b). *JAMP Guidelines for Monitoring Contaminants in Biota*. Oslo and Paris Commissions, Joint Assessment and Monitoring Programme (JAMP).

Tanabe, S. and Subramanian, A. (2003). Bioindicator(s) suitable for developing countries for measuring POPs. *STAP/GEF Workshop on the Use of Bioindicators, Biomarkers and Analytical Methods for the Analysis of POPs in Developing Countries*. UNEP.