

Editorials

Managing European Sediments: Can We Expand Our Ecological Risk Assessment Paradigms?

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Whilst European ecosystem-based directives and policies span different environments, water, particles the contaminants associated with them move between and link these environments. Effective management of aquatic ecosystems to achieve the European goal of Good Ecological Quality (GEQ) must include an understanding of how natural and anthropogenic disturbances affect the health and functioning of these critical media and associated communities. In support of these goals, one paper in this issue (Chapman & Hollert 2006) represents an explicit discussion of what has been implicit in the field of contaminated sediment management for a long time – that the sediment quality triad is not necessarily always a triad, and that, in particular, the third leg of the 'triad' is interchangeable, depending upon the study. The important feature of the triad is that it is necessary to show the presence of stressors, the evidence that these can present a hazard and evidence that there is also impact on the community. Further LOEs can then be used to confirm links between these (e.g., TIEs, eliminating other stressors, etc) or may be used to better understand the links. LOEs fall into 'classes' which should be filled such that LOEs are complimentary rather than duplicative. In parallel to this, the authors also point out that toxicity alone does not drive risk in sediments. Rather, a broad range of stressors can impact benthic, pelagic and other communities, impacting the WFD objective of 'good ecological status'. The sediment Ecological Risk Assessment paradigm must be expanded to address this. Sediment benthic communities play critical roles in aquatic and global ecosystem function. Many human activities have both intended and unintended impacts on soil and sediment dynamics, as well as on the many systems with which they interact. Indicators of benthic ecosystem health being used in Europe are currently based on structure, but benthic community structure is dynamic and sensitive to a variety of natural and anthropogenic factors, and thus provides little insight into causality. Even if measures are carried out to 'remediate' systems, structures may never return to their 'original' status. A more meaningful measure of benthic health is community function. However, while methods for evaluating and/or managing the effects of hazardous substances are well established, the way in which the impacts to GEQ from non-conventional pressures are assessed and managed is far from clear, as the science to establish links between, for example, morphological change and ecological function is weak. If we are to successfully address the role of sediments in the evaluation and maintenance of GEQ, it is important that we expand our current tools for evaluating ecological risk (primarily focused on contaminants) to these broader risk factors. Thus, there is clearly a need for the development of ecological measures and technology that can evaluate the environmental status of sediments and benthic (and pelagic) ecosystems, and the potential impacts of both proposed developments and measures carried out to mitigate the impacts of past and projected activities. European management is starting to concentrate less on pollution per se and more on the combined effects of multiple stressors at the ecosystem level with a view to ensuring their protection, restoration, and long-term viability. As sediments

provide the substrate for benthic and plant communities critical to aquatic food webs, and as suspended sediment can affect the functional health of pelagic and shore ecosystems, sediment status, dynamics, stability and type are all critical factors of ecosystem health, whether or not contaminants are part of the picture. There is a need for research in various aquatic habitats to provide better scientific understanding of mechanisms linking anthropogenic activities and the biological community function that may be the focus of protection, at various spatial, temporal, trophic, and organizational scales. One FP-6 funded research programme, Coastal Ocean Benthic Observatories (COBO; www.cobo.org.uk) is developing the tools for multidisciplinary *in situ* experimentation and biogeochemical observation and measurement to simulate anthropogenic disturbances and measure their effects on benthic community function. This work should help improve ecosystem models and inform management decisions. European ocean observatories being considered under ESONET should have coastal nodes and inland analogues to evaluate baseline and evolving aquatic ecosystem function.

The SedNet/SETAC advisory group has organized a series of sediment-focused sessions at the SETAC Europe Meeting in The Hague in May 2006 that will address many aspects of sediment assessment and management. A session on sediment ecotoxicology will explore sediment toxicity testing, covering biological, chemical and effects based approaches assessing toxicity of sediments and focussing on some specific biological endpoints in sediment toxicology. Biodiversity, functional diversity and redundancy of functions in sediments will be addressed in another session. Different methods used to address ecological quality (with some focus on the WFD) will be addressed along with the diversity of metabolic functions and their ecological significance, as well as their redundancy in the role of ecological impact assessment. Then, a session will highlight the development and application of Sediment Quality Standards, sediment assessment and management case studies and regulatory needs. A session on Chemical Processes and Interactions will complement these effects-focused sessions by providing insight into the mechanisms driving sediment and contaminant behaviour and fate. All the sediment platform sessions will have time slots left open for focused discussions on the path forward, and will be complemented by poster spotlights and poster corners, one (Potential extensions of the Triad approach) highlighting the topic of the Chapman & Hollert paper described above.

It is clear that we cannot meet WFD ecological objectives if we only address contaminants in aquatic systems. It is hoped that discussions in these sessions, and the continuing dialogue between SedNet members and the broader community will help provide a path forward for managing sediments in support of Europe's ecological goals.

References

- Chapman PM, Hollert H (2006): Should the Sediment Quality Triad Become a Tetrad, a Pentad, or Possibly even a Hexad? *JSS – J Soils & Sediments* 6, 4–8