EMECS 7
Caen 9-12 May 2006

Spatio-temporal scales in estuarine conservation and restoration

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The design of effective habitat management strategies requires attention to the scale related problems, particularly in large systems such as mega-tidal estuaries. The ecosystem conceived as a network of its biotopes is easier to circumscribe because the individual biotopes provide an *ad equate* scale for the study of the ecosystem properties, in space and time. Estuarine ecosystems are, of course, self-controlling and cybernetic but stochastic fluctuations at biotope level are reduced in scale. Both changes in numbers of populations and processes linking the physical and the biotic components remain aprehendable through the use of pilot-stations at biotope level. Biotopes help reconcile the divisive controversy between the population-community view (networks of interacting populations) and the process-function approach (biotic and abiotic components).

Mega-tidal estuaries such as the Seine and the Somme (North-Western France) are rather well delimited and human impacts are well understood. However, conservation and restoration strategies tend to freeze habitats in a particular state, their status being defined, most often, through a patrimonial approach. Connectedness between biotopes has a tendency to be neglected, especially with regard to the main ecological gradients, i.e. salinity. Evaluation methodologies are proposed with a view to assess changes to ecosystem functions, human disturbances under control or otherwise. This paper compares the quality status of the Seine (a heavily industrialised ecosystem) and the Somme (considered here for its natural features) in order to discriminate between oceanic processes (siltation and plugging of estuaries) from anthropogenic influences.

Preservation and restoration of habitats relies on a robust scientific methodology. The multi-scale slant adopted in the programme relies on sensitive socio-ecological assessment procedures, tools for evaluating ecological quality, well-built monitoring programmes based upon pertinent indicators. Such managerial tools are used to refine strategies and make them compatible with the sustainable co-development of resources in a European context.