

Evaluation of coastal perturbations: A new mathematical procedure to detect changes in the reference state of coastal ecosystems.

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The pressure exerted by human activities on living systems has become so intense that it is inspiring the inception of a global network of monitoring of the biosphere and the use of robust statistical procedures to detect potential changes. Here, we propose a new multivariate non-parametric procedure, based on the Mahalanobis generalised distance and a simplification of the multiple response permutation procedure to identify rapidly changes in any natural systems. The procedure can be virtually coupled on all monitoring programmes and is not influenced by missing data, a common feature found in many ecological databases. In France, physical, chemical and biological variability of coastal waters have been monitored since 1997 by the SOMLIT Network. Applied to this data set, this technique enabled a first quantification of the impacts of human disturbance through changes in the concentration of nutrients. Our results revealed how climate may interact with anthropogenic pressure to alter coastal marine systems and suggest a synergism between nutrient enrichment, human activities and local climatic conditions. Indeed some effects of climate (e.g. insolation duration – increase in duration of daylight) may attenuate the fertility of coastal systems, while some others (e.g. precipitation) amplify the human signals.