

Selection of metrics based on the seagrass *Cymodocea nodosa* and development of a biotic index (CYMOX) for assessing ecological status of coastal and transitional waters



"Bioindicators, based on a large variety of organisms, have been increasingly used in the assessment of the status of aquatic systems. In marine coastal waters, seagrasses have shown a great potential as bioindicator organisms, probably due to both their environmental sensitivity and the large amount of knowledge available. However, and as far as we are aware, only little attention has been paid to euryhaline species suitable for biomonitoring both transitional and marine waters. With the aim to contribute to this expanding field, and provide new and useful tools for managers, we develop here a multibioindicator index based on the seagrass *Cymodocea nodosa*. We first compiled from the literature a suite of 54 candidate metrics, i. e. measurable attribute of the concerned organism or community that adequately reflects properties of the environment, obtained from *C. nodosa* and its associated ecosystem, putatively responding to environmental deterioration. We then evaluated them empirically, obtaining a complete dataset on these metrics along a gradient of anthropogenic disturbance. Using this dataset, we selected the metrics to construct the index, using, successively: (i) ANOVA, to assess their capacity to discriminate among sites of different environmental conditions; (ii) PCA, to check the existence of a common pattern among the metrics reflecting the environmental gradient; and (iii) feasibility and cost-effectiveness criteria. Finally, 10 metrics (out of the 54 tested) encompassing from the physiological (d15N, d34S, % N, % P content of rhizomes), through the individual (shoot size) and the population (root weight ratio), to the community (epiphytes load) organisation levels, and some metallic pollution descriptors (Cd, Cu and Zn content of rhizomes) were retained and integrated into a single index (CYMOX) using the scores of the sites on the first axis of a PCA. These scores were reduced to a 0e1 (Ecological Quality Ratio) scale by referring the values to the optimal (reference) and worst (most degraded) conditions. The ecological status of sites obtained applying CYMOX correlated significantly with the environmental gradient, validating its adequacy to reflect ecosystem health.

In conclusion, the results presented here suggest that this index can be an adequate alternative for ecological status assessment in water bodies where other species are absent and, specifically, in transitional waters."

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Mots clés : INDICATEUR BIOLOGIQUE, ALGUE, QUALITE DE L'EAU

Thème (issu du Text Mining) : MILIEU NATUREL

Date : 2011

Type de ressource : Article scientifique

Format : text/xml

Identifiant Documentaire : PRLM5951

Langue : Anglais

Accéder à la notice source : <http://85.31.222.100/alexandrie-7/dyn/portal/index.seam?page=alo&aloid=5951>

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