Catalogue of marine biodiversity indicators to assess the environmental status – a software and a review of the current indicator set

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Summary

A Catalogue of Biodiversity Indicators useful for the implementation of the Marine Strategy Framework Directive (MSFD) was developed by the DEVOTES FP7 Project with the aim of providing the basis for assessing the environmental status of European seas. It is available online through the DEVOTool 0.64 software application that allows navigating a database of indicators related to the following MSFD descriptors: biological biodiversity, non-indigenous species, food webs, and seafloor integrity.

The catalogue (v.6) contains over 500 indicators used by different initiatives, in national and international contexts. A comprehensive overview of these indicators is given: descriptions, data requirements, developmental status, geographical coverage and applicable habitats, biodiversity components and descriptors targeted, and related human pressures.

The DEVOTool provides a query and analysis function for browsing the metadata (Figure 1), extracting and ranking lists of indicators best fulfilling pre-set criteria; enabling users to search, for example, for indicators suitable to fill in an identified gap or address a particular pressure in a marine area.

The major strengths and gaps of the indicator set (at EU level) allow to focus the development of new indicators where it is most urgently needed, and to foster transfer of know-how across marine regions.

Introduction

Several marine biodiversity assessment and monitoring initiatives are in place worldwide. In such context, numerous indicators have been used and /or developed over the last few decades, driven either by environmental policies or in relation to research. To take advantage of the existing knowledge and past efforts to develop robust assessment tools and also to optimize current approaches in use by European Member States (MS) to fulfil their legal environmental responsibilities, a survey was undertaken to collate existing indicators for addressing marine biodiversity. This work reviews the current capabilities of the existing environmental indicators in the context of the EU Marine Strategy Framework Directive (**MSFD**, 2008/56/EC) focusing on the biodiversity related descriptors.

Materials and Methods

Our survey targeted specifically indicators related to the following MSFD descriptors: biological biodiversity, non-indigenous species, food webs, and seafloor integrity. It compiled indicators used by different initiatives, in national and international contexts: under EU Directives (including MSFD initial assessments of EU Member States), Regional Seas Conventions (RSC), assessments from non-EU seas, and developed under research programmes. Metadata associated to each indicator was gathered, from which we highlight: description, data requirements, developmental status, geographical coverage and applicable habitats, biodiversity components and MSFD descriptors targeted, and related human pressures. The indicator set has been further classified according to four criteria: within the DPSIR framework; in relation to its main attribute or theme; according to the type of underlying variables required to calculate the index; and according to its algorithm or classification type. The catalogue (v.6) is available online through the DEVOTool 0.64 software application that allows navigating the database of indicators (Figure 1).
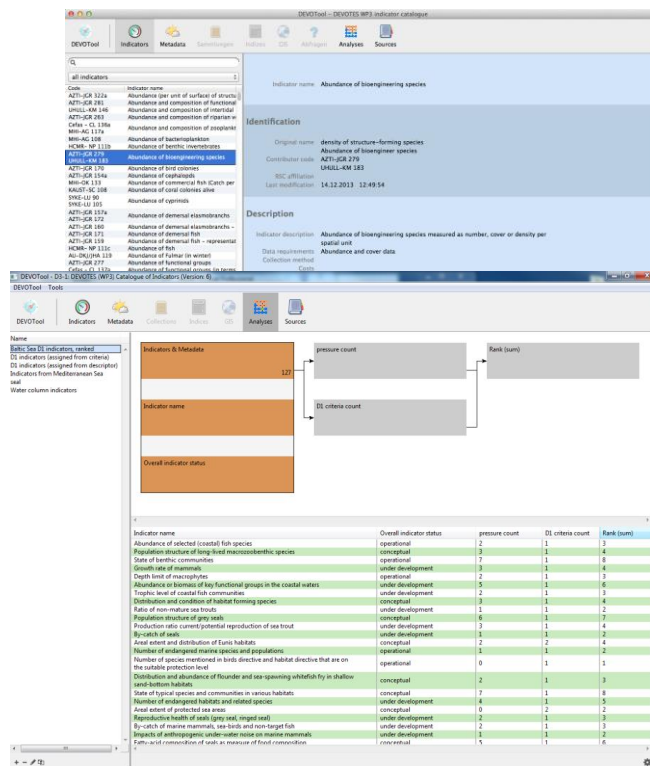

Figure 1. DEVOTool software: *Indicators* and *Analyses* views.

Results and Discussion

The catalogue currently contains 557 indicators, of which approximately half are operational. A significant portion of the indicators (36%) are still under development, i.e. the indicator proposal exists but was not yet validated with real data or in new locations. A small percentage of conceptual indicators was also reported (8%), i.e. an indicator idea supported by theoretical grounds, although no practical measure or metric is yet available. Most of the entries in the catalogue refer to State indicators *sensu* DPSIR that report on very distinct aspects, such as community structure, population ecology, foodwebs, habitat integrity, indicator species or other target groups, species life traits, production, or individuals physiological condition. Only 8% are Pressure indicators, essentially focusing on anthropogenic activities (e.g. the ballast water treatment indicator, species removal and by-catch) and specific target groups (mainly non-indigenous species indicators), but also foodweb, habitat integrity, or pollution related (e.g. light pollution for sea birds).

There is considerable overlap of indicators assigned to various descriptors and criteria of the MSFD, promoting ambiguity and double counting risk within this assessment framework (Berg et al. 2015). The survey also highlighted, for example, the need for the development of biodiversity indicators that work on ecosystem level, or gaps on the indicator set (at EU level) in relation to some biodiversity components (e.g. microbes or pelagic invertebrates) and specific habitats (e.g. higher depth habitats). Potential users of this tool are Member States, RSC, the European Commission, non-governmental organizations, scientists and any person interested in marine environmental assessment.

References: Berg, T., Fürhaupter, K., Teixeira, H., Uusitalo, L., and Zampoukas, N. 2015. The Marine Strategy Framework Directive and the ecosystem-based approach–pitfalls and solutions. Marine Pollution Bulletin, 96:18-28.