



Aggregating multiple indicators for an integrated approach, in assessing the environmental status of European regional seas, using open access databases

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According to the Marine Strategy Framework Directive (MSFD), the ecosystem assessment of marine systems requires the use of multiple indicators from different ecosystem components. However, there are still some barriers in undertaking such assessments, mainly due to: (i) lack of indicators; (ii) absence of targets; (iii) difficulty of aggregating indicators from different ecosystem components, habitats, and areas; (iv) absence of criteria on the number of indicators to be used; (v) discussion on the use of 'one-out, all-out' (OOAO) principle in aggregating; and (vi) lack of traceability when integrating data.

The objective of this study was, using open access databases with indicators across all the European seas with agreed targets, to demonstrate if the Nested Environmental status Assessment Tool (NEAT), can be used at the European scale, serving to managers and policy-makers as a tool to assess the environmental status under the MSFD.

For this purpose, the following MSFD Descriptor (D) were used: D3 (commercial fish) from 341 stocks, 119 species and two indicators from each of them (years 2013-2015); D5 (eutrophication) with 90th percentile of Chlorophyll a (years 2009-2014); and D8 (contaminants), with Anthracene, Fluoranthene, Naphthalene, Cadmium, Nickel and Lead as indicators (years 2009-2013). The environmental status for each European subdivision, subregion and regional sea, and nested at different levels, were calculated. The analyses included weighting and no-weighting by each division surface; for ecosystem component (water column, phytoplankton, fish, crustaceans and molluscs); by descriptor (D3, D5, D8), and by habitat (pelagic, demersal/benthic), with the confidence value of the status obtained. The sensitivity of the aggregation was undertaken to determine a minimum number of indicators to be certain in the final status.

This study demonstrates that the use of NEAT is an adequate and efficient tool to aggregate multiple indicators from different ecosystem components to assess the health status of marine waters, inspiring managers and policy-makers when undertaking such assessments, removing the six barriers above mentioned.