Actor-oriented societal indicators of man-made eutrophication of marine environments

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Summary: Large-scale eutrophication of marine environments is a severe problem that is strongly linked to general trends in the society and the behaviour of a multitude of actors. Producers and consumers of goods, supply chain managers, importers and retailers, public procurers and environmental managers in different types of organisations all make decisions that can lead to increased or decreased inputs of nutrients to the sea. This calls for programmes of measures based on reliable knowledge of how a great variety of societal behaviours and actions are linked to the pressure on marine environment. Here, we present a systematic procedure to identify relevant actors and behaviours and synthesize them into indicators that we refer to as societal indicators. First, we examine how material flows caused by production, transportation, distribution, consumption and the end-of-life of goods result in nutrient inputs to marine environments. Then we identify actors and behaviours that directly or indirectly influence such flows. Based on such knowledge about actors and their behaviour and the results of case studies in Sweden, we propose different groups of potentially useful societal indicators. Further work is needed to address the salience, credibility and legitimacy of the indicators to underpin future use.

Introduction: The Water Framework Directive and the Marine Strategy Framework Directive aims at achieving good environmental status, the Habitat Directive to maintain or restore a favourable conservation status. Obviously, policy actions taken to obtain and maintain such status objectives need to address humans and their organisations. In order to design effective instruments promoting a change in the human pressure on the marine environment, it is necessary to understand how human behaviour influences this status. Although the Marine Strategy Framework Directive demands the initial analysis to include a social analysis, so far the methods for these analyses are underdeveloped and the different member states analysis cannot be compared. There is thus a need to develop methods for visualising actors and their behaviours and to develop societal indicators. Societal indicators is not only useful in finding phenomena in society that have an impact on the marine environment – but also to sort the phenomena in small and large factors, to monitor the extent policy measures actually cause changes in society, and to analyse correlation between changes in society with changes in the marine environment. Hence, societal indicators give marine indicators an extra value.

Materials and methods: In this paper we present a structured method to develop societal indicators that can help identify and follow up measures taken to reduce the pressure of nutrients on marine environment. This method, which integrates analyses of physical flows with a thorough identification of actors, has the following main components:

1. The BPSIR (Behaviour-Pressure-State-Impact-Response) framework that was recently developed to support the implementation of the Marine Strategic Framework Directive, emphasize the importance of acknowledging both direct and indirect actors, drawing attention to important actors along the entire supply chain from raw materials or producer goods to production, distribution, consumption and waste management (Sundblad et al, 2014a).
2. A generic model of the flow of substances and goods, which presents physical flows in a standardized way on any scale from flows of specific products to flows aggregated over whole sectors or societies.
3. Analyses of influence that describe how actors influence other actors.

Results and discussion: In case studies we used the method to get information about key actors and behaviour with the potential to be used as societal indicators (Sundblad et al, 2014b). First, we modelled the flow of nitrogen and phosphorus for food produced or consumed in Sweden. The model ends with the runoff to the sea and goes backwards to waste management, consumption, distribution, production as well as import. Second, for each stage of this flow the actors and their behaviour were linked. Thirdly, we modelled the flow of a specific product (red meat), counting the number of actors in the stages of the flow. By further analysing by whom and by what the identified actors were influenced, we got an even broader picture of other actors that had not been identified through the modelling of substance and product flows. For example, there are major trade organisations, branch organisations and NGOs, having important influence on the behaviour and development. The case studies demonstrated that analysing aggregated substance flows could identify important groups of actors and their behaviour, whereas analysing product chains more efficiently identified specific actors. The influence analysis revealed actors having influence but without direct contact with the substance or the product.

When strong links between actors and physical flows of nitrogen and phosphorus have been established, the magnitude of the physical flow can serve as a societal indicator. Other societal indicators can be based on surveys of the behaviour of key actors. Regardless of the type of societal indicators emanating from our method, further work is needed to ensure feasibility of data collection and acceptance of proposed indicators.

In order to get a better knowledge of all actors directly or indirectly influencing the marine environment, to design efficient measures and to monitor their implementation and effect, we propose member states in cooperation, to develop societal indicators.

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Report:

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