

## SUITABILITY OF AN OBJECTIVE-DIRECTED ECOLOGICAL STATUS ASSESSMENT IN PORT AREAS IN AGREEMENT WITH THE WATER FRAMEWORK DIRECTIVE

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In order to “establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater”, in the year 2000 the European Parliament published Directive 2000/60/EC (henceforth Water Framework Directive or WFD). The management policies established by the WFD define a unique performance framework for watersheds. Furthermore, in this new framework of management, it is possible to identify singular elements, such as ports, whose peculiarities justify the development of control and monitoring programmes specific and adequate to their characteristics (operational monitoring programmes in WFD terms). With these objectives, the paper introduces the first methodological and technical tool for management of seaport water quality, with direct incidence in design, evaluation and environmental monitoring of infrastructure works, activities and port operations. This tool included in the Spanish standardisation programme of ports (ROM PROGRAMME) was published in 2005 under the denomination of “ROM 5.1. Quality of coastal waters in port areas” (Revilla *et al.*, 2005).

### BACKGROUND

With the aim to tackle the water systems quality deterioration, and to order and simplify the diverse and complex European legislation in this matter, at the year 2000 it was published the Water Framework Directive (WFD) 2000/60/EC. This normative establishes a framework for the inland surface waters, transitional waters, coastal waters, and groundwaters protection in order to prevent, protect, and improve their ecological status before the year 2015. The WFD management model is focused on the application of policies, that under the same actuation framework, manage globally the aquatic systems included at the same river basin district. Nevertheless, within this integrated management framework, it is possible to identify singular elements as the ports because of their potentiality of failing to meet the ecological status established by the WFD.

In that sense, the WFD recognize the existence of **specified uses** with high economic and social value, which development imply hydromorphological changes into the water bodies of such magnitude that may cause that the good ecological status could not be reached as long as those uses are active. This recognition is established in the Article 4.5 that enunciates: “Member States may aim to achieve less stringent environmental objectives (...) when they are so affected by human activity, (...), or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive, and all the following conditions are met: the environmental or socioeconomic needs served by such

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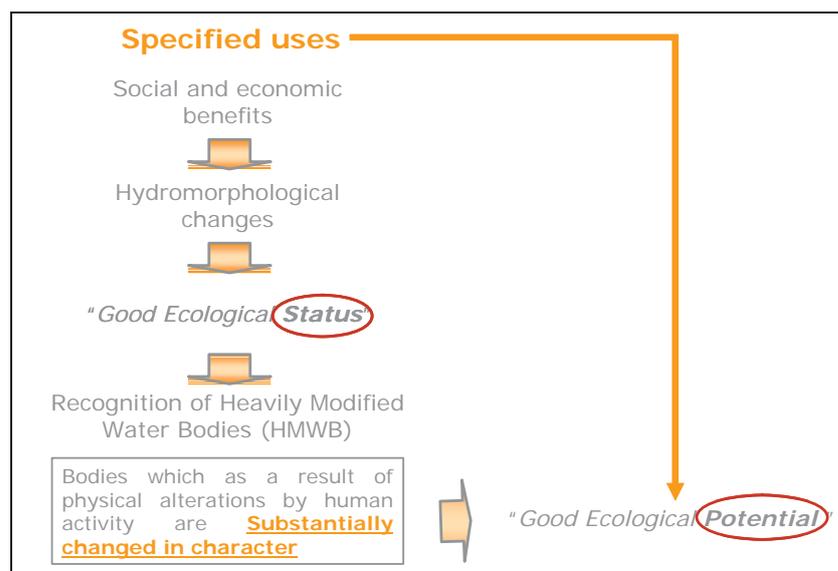
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human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs (...).”

The conflict between the necessity to give priority to the development of specific economic activities and the fulfilment of the environmental objectives of the WFD was solved by the introduction of the figure of the “**heavily modified water bodies**” (HMWB). These water bodies are defined as “bodies of surface water which as a result of physical alterations by human activity are substantially changed in character”. The designation of a water body as heavily modified justifies the reduction of its environmental objectives until the named good **ecological potential**, besides the good ecological status required for the rest of the water bodies.

But, when a water body could be defined as heavily modified? In accordance with the article 4 of the WFD, Member States could qualify a surface water body as heavily modified, when the changes of the hydromorphological characteristics of that water body which will be necessary for achieving good ecological status would have adverse effects on **navigation**, including **port facilities**, among others.



**Figure 1. Scheme of the introduction of the “heavily modified water bodies” and “good ecological potential” concepts.**

The explicit recognition of ports as a relevant economic and social use, and then, as potential heavily modified water bodies, have conferred them the chance to adapt their water bodies environmental objectives to the good ecological potential. Nevertheless, the environmental problems are not always solved reducing the environmental requirements.

In that sense, several studies carried out at the Atlantic Ecoregion confirm ports as **significant pressures** at risk to not fulfil their environmental objectives. For this particular

cases, the WFD, demands the development of an **operational monitoring**. The operational monitoring should be focused on the evaluation of the magnitude and the impact of the pressures that have the potentiality to impede the fulfilment of the environmental objectives of the water bodies at risk. This measure have served to recognize that the diverse and complex environmental problematic of port spaces requires **specific management tools**, that goes further than its recognition as heavily modified water bodies, and the reduction of its environmental objectives.

In this context, nowadays ports are being subjected to a modification of management policies, more orientated towards the utilization of models, in which the economic and the environmental factors can be considered as development variables. Nevertheless, this goal can only be reached using management instruments which conjugate the social, economic, legal, technical and environmental demands along with the requirements of the WFD.

Taking advantage of the new framework offered by the WFD, and with the objective to give port administrations a management tool able to satisfy the operational monitoring basis demanded by that Directive for the water bodies at risk, it was begun the elaboration of **“ROM 5.1. Quality of Coastal Waters in Port Areas”** within the Recommendations for Maritime Works Programme (ROM by its Spanish acronym) of the Spanish National Port Administration.

This Recommendation, published in September 2005, arose with the aim to be a an instrument that could be easily integrated into port management schemes. Any methodological procedure as the one proposed by ROM 5.1 should start from basic management schemes capable to respond questions such as: What should be protected? From what should it be protected? or How should it be protected? This analysis allows to recognize the appropriate criteria through which could be identified the basic management units, to ascertain which actions could affect potentially those management units and to define indicators capable to evaluate and quantify that potentiality.

Nowadays, the indicators and parameters established in this Recommendation have been incorporated in the guidance document for the planning process of WFD elaborated by the Spanish Ministry of Environment.

#### **METHODOLOGICAL PROCEDURE OF ROM 5.1.**

The goal of this methodological procedure was to perform a conceptual model to manage ports water bodies quality, scientifically rigorous, simple in its design and interpretation, easily integrated into port schemes, sensitive to port singularities, and sustained on a public draft procedure. The first step in the development process was to design a scheme to answer three main questions:

What has to be protected?

What does it have to be protected from?

How can it be protected?

As a result, a methodological model structured in four working areas was implemented. These areas are: the Delimitation of Uses and Characterization of Water Bodies Programme, the Environmental Risk Assessment Programme, the Environmental Monitoring Programme, and the Management of Contaminant Events Programme (Figure 2).

#### **Delimitation of Uses and Characterization of Water Bodies Programme**

At first place, management of water quality in a specific port environment requires the

establishment of methods and procedures for delimitation and characterization of its different water bodies. In the application of the ROM 5.1, these objectives are gotten through the development of the following tasks: delimitation of uses of the aquatic environment (port and non port uses), establishment of categories of the water bodies (heavily modified or non modified water bodies), and assignment of types to the water bodies in accordance with different descriptors (salinity, substratum and flushing time).

The consideration of all those elements, allows to establish four specific types of non modified water bodies, and four more specific types of heavily modified water bodies. The importance of these types lays in the fact that the evaluation of the ecological status and ecological potential is made in function of the water body specific type.

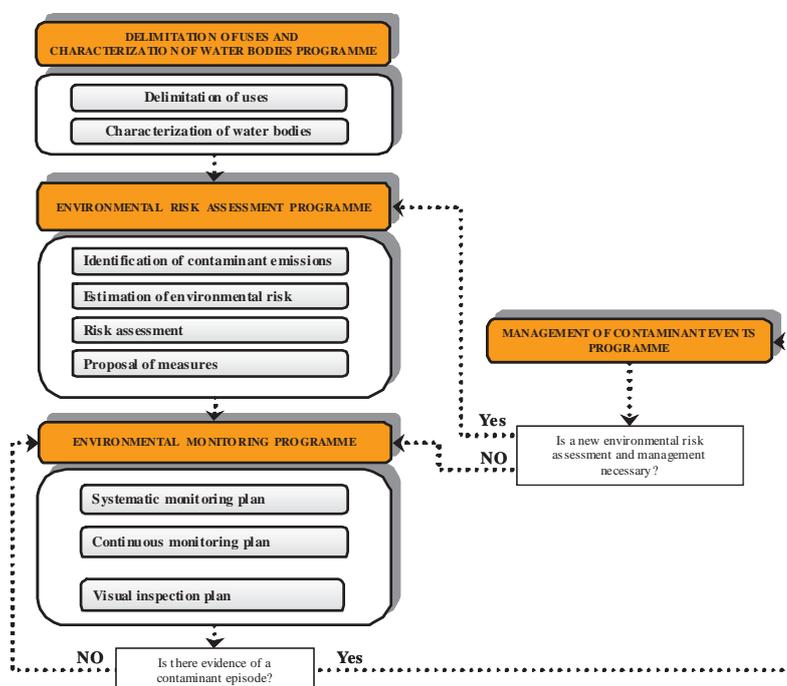


Figure 2. Flowchart for application of the ROM .5.1

### Environmental Risk Assessment Programme

The quality of the waters in port areas will be conditioned by the set of interactions of the existing activities. Taking this fact into consideration, ROM 5.1 establishes procedures to evaluate environmental risks associated with the different contaminant emissions impacting on the port area. To this end, the risk assigned to each emission is evaluated on the basis of the likelihood of its occurring, the ensuing consequences and the vulnerability of potentially affected waters. Depending upon the tolerability of the emission, appropriate preventive and

corrective measures should be applied in order to minimize the environmental risks of these contaminant emissions.

#### **Environmental Monitoring Programme**

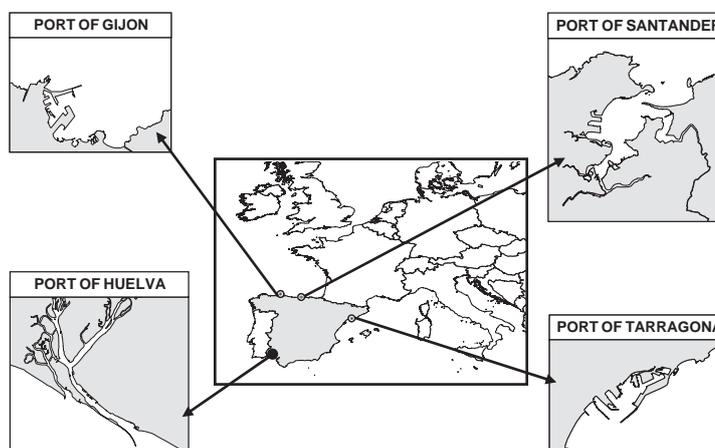
The Environmental Monitoring Programme is the tool through which the evolution of the ecological status of the non modified water bodies or the ecological potential of the heavily modified water bodies, as well as the chemical quality of all of them can be evaluated. This programme remains active continuously in time. Its application enables the proof of reduction in quality of the water bodies, the failure and omissions of the programme of assessment and management of environmental risks and the activation of the programme of management of contaminant events.

#### **Management of Contaminant Events Programme**

Finally, the programme of management of contaminant events is the procedure leading to the mitigation of the quality deficits detected in the water bodies by the programme of environmental monitoring. It looks for the reduction of the adverse effects of contaminant episodes through the application of corrective measures. Its development is based on the following tasks: identification of origin, adoption of corrective measures, and verification of the results.

#### **APPLICATION OF ROM 5.1 IN SPAIN**

Nowadays, the ROM 5.1 is being applied to different harbours in Spain, Port of Gijon and Santander in the Spanish North coast in the Cantabrian Sea, Port of Tarragona located in the North-East coast in the Mediterranean Sea, and Port of Huelva in the South-West coast in the Atlantic Ocean.



**Figure 3. Spanish Ports applying ROM 5.1.**

## DISCUSSION

ROM 5.1 has developed a number of approaches to provide port authorities a unique, standardised and coherent tool to satisfy the operational monitoring demanded by Water Framework Directive to bodies at risk of failing environmental objectives. In a general analysis ports can be considered as significant pressures to water bodies and therefore with potential to fail its environmental objectives. Nevertheless, this is not a simple task to solve. In port areas environmental situation respond to the concurrence of interests and activities which produce a complex environmental challenge (Ondiviela, 2006). Nowadays the absence of legal procedures to regulate environmental quality in port areas (Goulielmos, 2000) is being replaced by initiatives promoted from the port organization directed to achieve the sustainability of its activities. That is the case of ROM 5.1. a methodology promoted by the Spanish National Ports Administration to help port authorities to be objective about environmental management and to explore sustainable development in port areas in terms of protection and improvement of the aquatic environment (Puertos del Estado, 2005). In agreement with WFD operational monitoring shall be undertaken in order to establish the status of those water bodies identified as being at risk of failing to meet their environmental objectives, and assess any changes in the status of such bodies resulting from the programmes of measures (European Parliament and the Council, 2000). Although literature offers numerous methodologies to analyse port environmental problems (Darbra *et al.*, 2004; Darbra *et al.*, 2005; Eide *et al.*, 2007; Jones *et al.*, 2005; Peris-Mora *et al.*, 2005; Ronza *et al.*, 2006; Ronza *et al.*, 2003; Wang *et al.*, 2004) neither of them manage sea port aquatic systems in an integral form. With this objective ROM 5.1 recognises physical singularities in seaport aquatic systems, gives evidences of significant pressures caused or induced by port activities, assesses its effects in water bodies quality but also proposes prevention, protection and control measures for water quality. This knowledge will contribute to identify where are the problems and which are the measures to be applied. In other words to identify the relations between anthropic disturbances and environmental attributes (Pearson & Rosemberg, 1978).

Nevertheless environmental impacts will differ from place to place depending upon the variations of geography, hydrology, geology, ecology types of shipping industrialization and urbanization (Gupta *et al.*, 2005). Hence, ROM 5.1. is currently being tested at different Spanish ports, in the Mediterranean, the Atlantic and the Biscay Gulf in order to create baseline studies able to establish a strong scientific background.

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