

The Use of Benthic Elements in the European Water Framework Directive for Coastal Waters

C. Silvestri*, C. Lopez y Royo and G. Casazza

APAT – Agency for Environmental Protection and Technical Services, Via V. Brancati, 48 - 00144 Roma, Italy
*E-mail: csilvestri@apat.it

Key words: water framework directive, ecological status, biological elements, intercalibration.

The new EC Water Framework Directive (Directive 2000/60/EC), which came into force in December 2000, requires the Member States of the European Union to establish ecological quality objectives and environmental quality standards for all surface waters including coastal waters. The overall purpose of the Directive is to achieve a “good water status” for all water body types by the year 2015, through a series of key actions that have to be undertaken by Member States to support the implementation of the Directive. This implies the identification of typologies, the description of reference conditions and the development of classification schemes through the knowledge of geomorphological, hydromorphological, physico-chemical and biological characteristics of water bodies. For this purpose, the European Commission agreed a “Common Implementation Strategy” (CIS), with the aim of developing common methodologies and approaches in the different countries, for a shared, uniform and coherent application of the Directive. A series of working groups (WGs) and joint activities, where technical experts and regulators from European Union Member States, Norway and some Accession States participated, were launched in summer 2001 to develop and test non-legally binding guidances. By the end of 2002 the “non-legally binding” guidance documents were approved by the EU Water Directors, for circulation and testing within the Member States, as the basis for carrying forward ongoing implementation work (Vincent *et al.*, 2002; Casazza *et al.*, 2003a, b; Silvestri *et al.*, 2003).

An important point resulting from the overall work of WGs was to consider some aspects and specifications of the Directive application, at the ecoregional level. Maritime areas were divided into three basic Ecoregions: Atlantic/North Sea; Baltic Sea; Mediterranean Sea.

The initial steps for the application of the Directive need to be developed using coherent and uniform technical bases, for all the different Member States and all water categories: definition of Typologies; identification of Reference Conditions; and development of Classification Systems.

The definition of typology lies in characterizing water bodies, based on the description of their geomorphological and hydrodynamic characteristics, and dividing them into specific and significant types. The aim is to produce as simple a physical typology as possible that is both ecologically relevant and practical to implement. The purpose of typology is to enable type specific reference conditions to be established. These then become the anchor for classification systems.

Reference conditions must represent the biological conditions (through the description of quality elements) of the system in its “best” ecological status, that is with the minor disturbance from human activities, to which assign the “high status”.

Such a reference is essential for the subsequent classification of the water body. The main problem in defining the reference conditions, in most of the European coastal regions, arises from the absence of areas without any anthropogenic impact. Nevertheless Member States agreed to base the choice of reference conditions on existing situations in each ecoregion, on the “best” available

ecological conditions. Moreover another problem, shared at EU level, is the lack of biological and chemical data in areas in a high environmental status, since historically marine monitoring programs have mainly concentrated on environmentally critical areas. In the case of the Mediterranean ecoregion, possible reference areas could be marine reserves and/or Marine Protected Areas (Silvestri *et al.*, 2003).

Classification must be accomplished through the analysis of different quality elements: biological, hydromorphological, chemical and physico-chemical. The Directive states clearly a hierarchy in the use of the different quality elements: biological elements (phytoplankton, aquatic flora, benthic invertebrate fauna) are fundamental while hydromorphological and physico-chemical elements are supportive parameters in the definition of the ecological status. Definitions of 5 ecological status classes (high, good, moderate, poor, bad) are reported in the Directive under "Normative definitions" (WFD Directive, Annex 5, 1.2); they are general indications on the different level of "alteration" from the reference conditions for each quality element. The Directive does not provide further specifications for classification: Member States have to establish their own appropriate classification systems. Common agreement on the conditions for the different status classes and above all the identification of the border between the "high" and "good" status and "good" and "moderate" status will have to be defined by intercalibration. The intercalibration exercise, that is the comparison at ecoregion level, of quality elements data available in Member States, in the selected sites (intercalibration network), is one of the normative requirements of the Water Framework Directive in its initial application. The intention here is to emphasise the role of such an exercise in the application of the Directive: the intercalibration must be used as a tool of adjustment, in the first phases of the implementation process, at EU level. The expected results concern: a) acquiring information on biological (and physico-chemical) quality elements data availability in the different Member States; b) verifying the coastal typology definitions and adequate assignment of the different sites to these; c) testing, where applied, the classification systems used by Member States.

The relevance of the biological elements for the assessment of coastal water quality represents one of the main innovative concepts introduced by the Directive. This legal requirement has highlighted serious gaps in the knowledge of biological communities structure and their ecosystems, in coastal waters of most EU countries: in fact monitoring programmes have historically been focused mostly on the analysis of chemico-physical parameters. As previously described (Vincent *et al.*, 2002), at the moment there are few suggested classification systems for coastal waters in the different European countries and anyhow none of these comply with the requirements of the Directive, both for the quality elements used and for the classification. For the Mediterranean ecoregion few systems have been proposed so far and, at the moment, they are being tested.

For the first biological quality element requested: phytoplankton, no classification schemes have been developed, the only proposed evaluation system (Vincent *et al.*, 2002) is the one used by IFREMER in the national monitoring programme REPHY (www.ifremer.fr/envlit/surveillance/rephy.htm), based on the presence of toxic phytoplankton species and algal blooms. This system is used on the French coastline, both on the north Atlantic and on the Mediterranean. Recently it has also been applied experimentally to the Basque coast (Borja *et al.*, 2004).

In regard to phytobenthos, an ecological evaluation approach based on different macrophyte species (both macroalgae and angiosperms) assigned to functional groups has been proposed by Orfanidis *et al.* (2001). Benthic plant communities of rocky substrates have been analysed for environmental quality evaluation along the Catalan coastline (Agencia Catalana de l'Aigua and CSIC 2002a, b).

For angiosperms on the basis of widely distributed, both spatially and temporally, research, studies and monitoring on *Posidonia oceanica*, some scientists from Euro-Mediterranean countries have recently formed (on a voluntary basis) a “Posidonia group” with the intention of evaluating the use of existing data and information to develop a possible quality classification of Posidonia meadows.

For benthic macroinvertebrates two possible classification methods have been proposed: the Biotic Index by Borja *et al.* (2000) and the Bentix by Simboura & Zenetos (2002).

The most relevant conclusions for the application of the WFD to coastal waters can be summarized as follows:

- 1) at present no reference networks of high status sites for coastal waters are known to exist within all Europe. To date most of monitoring programmes were focused on polluted areas rather than areas that would meet the Directive definition of high status. Data are not always available for all quality elements. Therefore, there is a need to start collecting data as soon as possible for the purposes of deriving biological reference conditions.
- 2) There is a lack of appropriate classification tools, to accomplish the requirements of the Directive but the existing classification tools may be suitable for testing by Member States. It is particularly important that information and knowledge, gained in some countries, are diffused and available tools need to be tested in other Member States, firstly within the same Ecoregion.
- 3) The intercalibration exercise is an important tool that should help to develop and test the correct application of the initial steps of the Directive, in particular for the interpretation of the normative definitions of the quality classes.

References

- Agencia Catalana De L'Aigua, CSIC, 2002a. *Development of a new method of monitoring and assessment of the environmental quality of rocky coasts based in the cartography of littoral communities*. www.gencat.es/aca; www.ceab.csic.es.
- Agencia Catalana De L'Aigua, CSIC, 2002b. *Method for monitoring littoral benthic communities. Explanation of the methodology*. www.gencat.es/aca; www.ceab.csic.es.
- Borja, A., Franco, J., Pèrez, V., 2000. A marine biotic index to establish the ecological quality of soft bottom benthos within European estuarine and coastal environments. *Marine Pollution Bulletin*, **40(12)**: 1100-1114.
- Borja, A., Franco, J., Valencia, V., Bald, J., Muxika, I., Belzunce, M.J., Solaun, O., 2004. Implementation of the European Framework Directive from the Basque country (northern Spain): a methodological approach. *Marine Pollution Bulletin*, **48**: 209-218.
- Casazza, G., Silvestri, C., Spada, E., 2003a. Classification of coastal waters according to the new Italian Water legislation and comparison with the European Water Directive. *Journal of Coastal Conservation*, **9**: 65-72.
- Casazza, G., Silvestri, C., Spada, E., 2003b. Implementation of the Water Framework Directive for coastal waters in the Mediterranean ecoregion. In: E. Ozhan (Editor), *Proceedings of the 6th Int. Conference on Mediterranean Coastal Environment (MEDCOAST 03)*, vol. II, 1157-1168.

- Orfanidis, S., Panayotidis, P., Stamatis, N., 2001. Ecological evaluation of transitional and coastal waters: a marine benthic macrophytes-based model. *Mediterranean Marine Science*, **2/2**: 45-65.
- Silvestri, C., Maialetti, E., Cicero, A.M., Giovanardi, F., Scarpato, A., Brondi, A., Spada, E., Casazza, G., 2003. Towards the application of the EU Water Framework Directive in Italian coastal waters: present available data and future needs. In: E. Ozhan (Editor), Proceedings of the 6th Int. Conference on Mediterranean Coastal Environment (MEDCOAST 03), vol. II, 1169-1178.
- Simboura, N., Zenetos, A., 2002. Benthic indicators to use in Ecological Quality classification of Mediterranean soft bottom marine ecosystem, including a new biotic index. *Mediterranean Marine Science*, **3/2**: 77-112.
- Vincent, C., Heinrich H., Edwards, A., Nygaard, K., Haythorn, T.H., Waite, J., 2002. Guidance on typology, reference conditions and classification system for transitional and coastal waters. Produced by: CIS Working Group 2.4 (COAST), Common Implementation Strategy of the Water Framework Directive, European Commission: 119 pp. <http://forum.europa.eu.int/Public/irc/env/wfd/library>.