# 2.4HOL5 FINAL DRAFT

# GUIDANCE ON TYPOLOGY, REFERENCE CONDITIONS AND CLASSIFICATION SYSTEMS FOR TRANSITIONAL AND COASTAL WATERS

## PRODUCED BY CIS WORKING GROUP 2.4 (COAST)

**Status Box**

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**Changes from Version 4**

Open issues raised by Finland and Sweden have been discussed and efforts have been made to resolve this.

Specific publisher/library/editor information

## Executive Summary


In May 2001 the Common Implementation Strategy was established. The objective of the Strategy has been to provide support to the implementation of the Water Framework Directive by developing coherent and common understanding and guidance on key elements of the Directive.

The COAST working group was one of the working groups established within the Strategy. The remit of the group has been to develop a non-legally binding document providing guidance on the implementation of Annexes II and V in relation to transitional and coastal waters.

This guidance document has been written over a relatively short period of time. A series of working group meetings were held and attended by technical experts and regulators from European Union Member States, Norway and some Accession States as well as experts representing NGOs and Stakeholder organisations associated with water and environmental policy.

The guidance is not prescriptive and will need to be adapted to fit local circumstances. It is also recognised that further work is required on the development of classification schemes as classification tools are tested and class boundaries are set.

The importance of continued communication between experts from different Member States is emphasised throughout the guidance especially with respect to typology, reference conditions and classification.

## Foreword

The EU Member States, Norway and the European Commission have jointly developed a common strategy for supporting the implementation of the Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive). The main aim of this strategy is to allow a coherent and harmonious implementation of this Directive. Focus is on methodological questions related to a common understanding of the technical and scientific implications of the Water Framework Directive.

One of the main short-term objectives of the strategy is the development of non-legally binding and practical guidance documents on various technical issues of the Directive. These guidance documents are targeted to those experts who are directly or indirectly implementing the Water Framework Directive in river basins. The structure, presentation and terminology are therefore adapted to the needs of these experts and formal, legalistic language is avoided wherever possible.

A working group referred to as COAST was established to produce a practical guidance document for the implementation of the Directive for transitional and coastal waters. The working group was established in summer 2001 and was led by the UK with France, Germany, Sweden and the EEA forming the steering group. The working group included representatives from each Member State as well as some candidate countries and non-governmental organisations (NGOs) and stakeholder organisations.

This guidance is the outcome of COAST. It synthesises COAST activities and discussions since summer 2001. It builds on the input and feedback from a wide range of experts and stakeholders in EU Member States and candidate countries who were involved in the development of the guidance through meetings, workshops, conferences and electronic communication, without binding them in any way to its content.

Conclusions of Water Directors meetings are introduced here e.g.

We, the water directors of the European Union, have endorsed this guidance during our informal meeting under the Danish Presidency in Copenhagen, November 2002). We strongly believe this and other guidance documents developed under the common implementation strategy will play a key role in implementing the Water Framework Directive. For all experts involved in its implementation, this guidance document is a *living document* that will need continuous input and improvements as application and experience build up in all countries of the European Union.

**The water directors**

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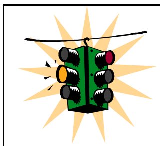
## Introduction - A Guidance Document: What For?

This document aims to guide experts and stakeholders in the implementation of the Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive – "the Directive"). It focuses on the key requirements for implementation of the Directive in relation to coastal and transitional waters.

### TO WHOM IS THIS GUIDANCE DOCUMENT ADDRESSED?

If this is your task, we believe the guidance will help you in *doing the job,* if you or your team are:

- **Developing typology, producing descriptions of reference conditions or developing classification schemes for coastal and transitional waters;**
- **Reporting the status of coastal and transitional waters to the European Union as required by the Directive;**
- **Using the results of the classification of coastal and transitional waters to develop policy**;
- **Implementing related parts of the Directive such as the Intercalibration or Pilot River Basin Studies exercises.**

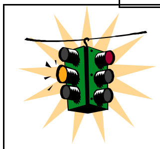


**Look out!** The methodology from this Guidance Document can be adapted to regional and national circumstances

The Guidance Document proposes a European approach. Because of the diversity of coastal and transitional waters across Europe the document has been kept as general as possible whilst still trying to provide a practical level of guidance.

**WHAT CAN YOU FIND IN THIS GUIDANCE DOCUMENT?**

6. Are there any existing classification schemes and tools that could be used for the purposes of the WFD?



**Look out!** What you will <u>not</u> find in this guidance document

- Guidance for coastal and transitional waters that are designated as Heavily Modified water bodies.
- A definitive typology for coastal and transitional waters
- A set of reference conditions
- A definitive classification tool or scheme
- Guidance relating to lakes, rivers (WG 2.3) groundwaters and heavily modified water bodies (WG 2.2).

Historically there has been only limited classification in the transitional and coastal waters of Europe. Existing classification tools have relied heavily on expert judgement. Therefore this guidance document makes suggestions of schemes, tools and best practice which will have to be tested and developed over the next few years.

# Section 1 – Introduction – Implementing the Directive.

**This Section introduces you to the overall context for the implementation of the Water Framework Directive (WFD) and informs you of the initiatives that led to the production of this Guidance Document.**

## 1.1. DECEMBER 2000: A MILESTONE FOR WATER POLICY

*A long negotiation process*

December 22, 2000, will remain a milestone in the history of water policies in Europe: on that date, the WFD (or the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) was published in the Official Journal of the European Communities and thereby entered into force!

This Directive is the result of a process of more than five years of discussions and negotiations between a wide range of experts, stakeholders and policy makers. This process has stressed the widespread agreement on key principles of modern water management that form today the foundation of the WFD.

## 1.2. THE WATER FRAMEWORK DIRECTIVE: NEW CHALLENGES IN EU WATER POLICY

*What is the purpose of the Directive?*

The Directive establishes a framework for the protection of all waters (including inland surface waters, transitional waters, coastal waters and groundwater) which:

- Prevents further deterioration of, protects and enhances the status of water resources;
- Promotes sustainable water use based on long-term protection of water resources;
- Aims at enhancing protection and improvement of the aquatic environment through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution;
- Contributes to mitigating the effects of floods and droughts.

*…and what is the key objective?*

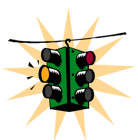
**Overall, the Directive aims at achieving *good water status* for all waters by 2015.**

## 1.3. WHAT ARE THE KEY ACTIONS THAT MEMBER STATES NEED TO TAKE?

- To identify the individual river basins lying within their national territory and assign them to River Basin Districts (RBDs) and identify competent authorities by 2003 (*Article 3, Article 24*);
- To characterise river basin districts in terms of pressures, impacts and economics of water uses, including a register of protected areas lying within the river basin district, by 2004 (*Article 5, Article 6, Annex II, Annex III*);
- To carry out, jointly and together with the European Commission, the intercalibration of the ecological status classification systems by 2006 (*Article 2 (22), Annex V*);
- To make operational the monitoring networks by 2006 (*Article 8*)
- Based on sound monitoring and the analysis of the characteristics of the river basin, to identify by 2009 a programme of measures for achieving cost-effectively the environmental objectives of the WFD (*Article 11, Annex III*);
- To produce and publish River Basin Management Plans (RBMPs) for each RBD including the designation of heavily modified water bodies, by 2009 (*Article 13, Article 4.3*);
- To implement water pricing policies that enhance the sustainability of water resources by 2010 (*Article 9*);
- To make the measures of the programme operational by 2012 (*Article 11*);
- To implement the programmes of measures and achieve the environmental objectives by 2015 (*Article 4*)

Table 1.1. Timetable of Implementation of the Water Framework Directive.

| Year | Requirements |
|---|---|
| **2000** | Directive Adopted |
| **2003** | Transpose into National law<br>Identify River Basin Districts and Competent Authorities<br>Identify draft register of intercalibration sites |
| **2004** | Characterisation of water bodies, including Heavily Modified water bodies<br>Review pressures and impacts and identify sites at risk of not meeting the environmental objective of 'good status.'<br>Establish register of Protected Areas<br>Undertake economic analysis of water use<br>Final register of intercalibration sites |
| **2006** | Comprehensive monitoring programmes operational |
| **2007** | Repeal some Directives |
| **2008** | Publish Draft River Basin Management Plans which will include a first draft of the classification of water bodies |
| **2009** | River Basin Management Plans produced to include final classification of the ecological status of water bodies<br>Programme of measures for each RBD |
| **2010** | Water pricing policies contribute to environmental objectives |
| **2013** | Repeal some Directives |
| **2015** | "Good" Status to be achieved |



**Look Out!**

Member States may not always reach good water status for all water bodies of a river basin district by 2015, for reasons of technical feasibility, disproportionate costs or natural conditions. Under such circumstances that will be specifically explained in the RBMPs, the WFD offers the opportunity to Member States to engage in two further six- year cycles of planning and implementation of measures.

## 1.4. CHANGING THE MANAGEMENT PROCESS – INFORMATION, CONSULTATION AND PARTICIPATION

*Article 14* of the Directive specifies that Member States shall encourage the active involvement of all interested parties in the implementation of the Directive and development of river basin management plans. Also, Member States will inform and consult the public, including users, in particular for:

- The timetable and work programme for the production of river basin management plans and the role of consultation at the latest by 2006;
- The overview of the significant water management issues in the river basin at the latest by 2007;
- The draft river basin management plan, at the latest by 2008.

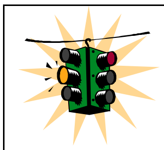
## 1.5. INTEGRATION: A KEY CONCEPT UNDERLYING THE WATER FRAMEWORK DIRECTIVE

The concept central to the WFD is *integration* which is seen as key to the management of water protection within the river basin district:

- **Integration of environmental objectives**, combining quality, ecological and quantity objectives for protecting highly valuable aquatic ecosystems and ensuring a general good status of other waters;
- **Integration of all water resources**, combining fresh surface water and groundwater bodies, wetlands, coastal water resources **at the river basin scale**;
- **Integration of all water uses, functions and values** into a common policy framework, i.e. investigating water for the environment, water for health and human consumption, water for economic sectors, transport, leisure, water as a social good;
- **Integration of disciplines, analyses and expertise,** combining hydrology, hydraulics, ecology, chemistry, soil sciences, technology engineering and economics to assess current pressures and impacts on water resources and identify measures for achieving the environmental objectives of the Directive in the most cost-effective manner;
- **Integration of water legislation into a common and coherent framework.** The requirements of some old water legislation (e.g. the Freshwater Fish Directive) have been reformulated in the WFD to meet modern ecological thinking. After a transitional period, these old Directives will be repealed. Other pieces of legislation (e.g. the Nitrates Directive and the Urban Wastewater Treatment Directive) must be co-ordinated in river basin management plans where they form the basis of the programmes of measures;
- **Integration of a wide range of measures, including pricing and economic and financial instruments, in a common management approach** for achieving the

environmental objectives of the Directive. Programmes of measures are defined in **River Basin Management Plans** developed for each river basin district;

- **Integration of stakeholders and the civil society in decision making,** by promoting transparency and information to the public, and by offering an unique opportunity for involving stakeholders in the development of river basin management plans;
- **Integration of different decision-making levels that influence water resources and water status,** whether local, regional or national, for effective management of all waters;
- **Integration of water management from different Member States,** for river basins shared by several countries, existing and/or future Member States of the European Union.



**Look out!** A number of international marine conventions which deal with the protection of large maritime areas such as the North East Atlantic (OSPAR), the Baltic (HELCOM) and the Mediterranean (BARCOM). These Conventions deal with many marine environmental protection issues including the issue of transboundary pollution. Throughout the drafting of this guidance the COAST working group has tried to ensure good linkages with these Conventions and to build on the sound science that has already been developed. It is the intention to continue to improve the linkages between the Marine Conventions and the EU under the imminent EU Marine Strategy

## 1.6. WHAT IS BEING DONE TO SUPPORT IMPLEMENTATION?

Activities to support the implementation of the WFD are under way in both Member States and in countries candidate for accession to the European Union. Examples of activities include consultation of the public, development of national guidance, pilots for testing specific elements of the Directive or the overall planning process, discussions on the institutional framework or launching of research programmes dedicated to the WFD.

***May 2001 – Sweden: Member States, Norway and the European Commission agreed a Common Implementation Strategy***

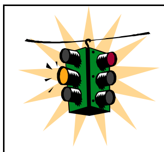
The main objective of this strategy is to provide support to the implementation of the WFD by developing coherent and common understanding and guidance on key elements of this Directive. Key principles in this common strategy include sharing information and experiences, developing common methodologies and approaches, involving experts from candidate countries and involving stakeholders from the water community.

In the context of this common implementation strategy, a series of working groups and joint activities has been launched to develop and test non-legally binding guidance (see *Annex A of this guidance document*). A strategic co-ordination group oversees these working groups and reports directly to the water directors of the European Union and

Commission that play the role of overall decision body for the Common Implementation Strategy.

## 1.7. THE COAST WORKING GROUP (CIS WG 2.4)

The COAST working group was created specifically to deal with the issues relating to transitional and coastal waters and to produce a non-legally binding document of practical advice for implementing the WFD, specifically Annexes II and V, in relation to these waters. The members of the working group included technical experts and regulators from European Union Member States, Norway and some Accession States as well as experts representing NGOs and Stakeholders organisations associated with water and environmental policy.



**Look out! You can contact the experts involved in the *COAST* activities**

**A complete list of *COAST* members with full contact details is in *Annex B* of this guidance document. If you need input into your own activities, please contact a member from *COAST* in your country. If you want more information on specific pilot studies (Annex C), you may also contact directly the people in charge.**

To ensure adequate input and feedback from a wide audience during the drafting, the COAST group organised a series of working group meetings and workshops as well as circulating widely draft documents for comments.

Development of this guidance document was an interactive process. Between September 2001 and September 2002 a large number of experts and stakeholders have been involved in the development of this Guidance. The process has included the following activities:

- **Regular meetings** of the 40 or more experts and stakeholder members of COAST;
- A series of **meetings of the Steering Group** (representatives from UK (lead), France, Germany, Sweden and EEA). These meetings guided the project and agreed on the final structure and format;
- Organisation of **three eco-region workshops** (Baltic, Mediterranean and North-East Atlantic) on typology;
- The **collation of draft coastal and transitional types** from Member States. The purpose of this exercise was four-fold:
  - to determine the approximate number of coastal and transitional types;
  - to prevent Member States assigning different names to the same types and *vice versa*;
  - to identify where Member States have the same type and may therefore be able to share reference conditions;
  - to assist in the identification of suitable types for intercalibration.
- A series of **reference condition pilot studies** were carried out by several Member States and the lessons learnt from these have contributed to the guidance document.
- Invitation of **experts from other working groups to attend *COAST* meetings**.

- **Experts from COAST attending the meetings of other working groups**.
- Regular **interactions with experts from other working groups of the Common Implementation Strategy**,:
  - WG 2.1 (Assessment of pressures and impacts);
  - WG 2.2 (Designation of heavily modified water bodies);
  - WG 2.3 (Reference conditions and classification for freshwater).
  - WG 2.5 (Intercalibration);
  - WG 2.7 (Monitoring).

  The links established with these working groups have resolved some of the issues encountered by COAST and also highlighted areas that needed consideration and discussion (figure 1).
- The **working group leader Claire Vincent, attended regular meetings of the Strategic Co-ordination Group and Working Group Leaders** in Brussels throughout the development of the guidance.

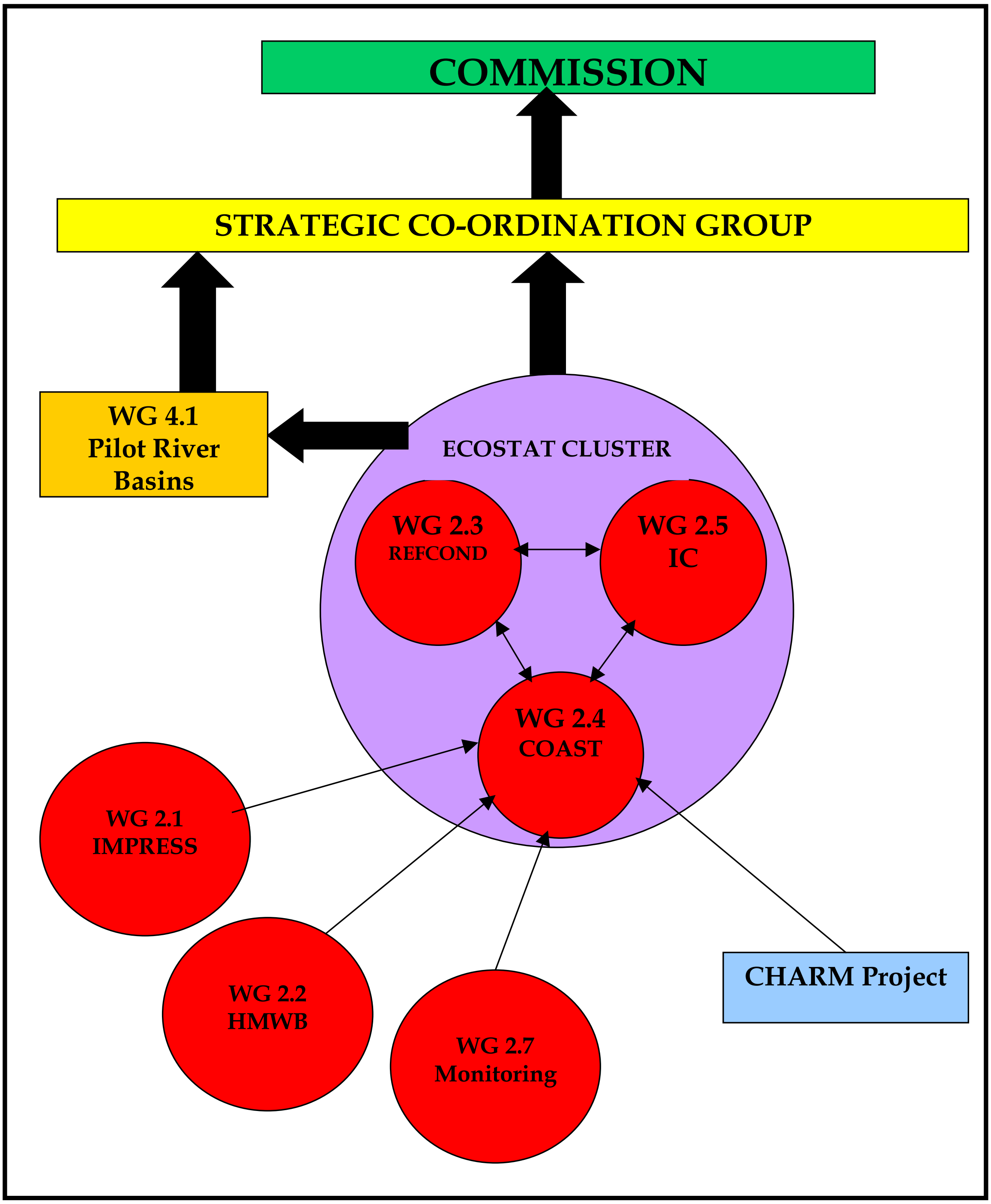



Figure 1.1. Links between COAST, the Commission, other CIS working groups and European funded projects.

# Section 2 – The Common Understanding of Terms related to Transitional and Coastal Waters.

**This section provides guidance on the language used in the Directive for transitional and coastal waters.**

## 2.1. DEFINITIONS OF TRANSITIONAL AND COASTAL WATERS

2.1.1. The Directive defines **transitional waters** as:

> **Article 2 (6)**
> *"'Transitional waters' are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows."*

2.1.2. Further guidance is given in section 2.3 on defining transitional waters.

2.1.3. The Directive defines **coastal waters** as:

> **Article 2 (7)**
> *"'Coastal water' means surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters."*

2.1.4. The ecological status of coastal waters should be classified from the landward extent of either the coastal or transitional waters out to one nautical mile from the baseline. According to the United Nations Convention on the Law of the Sea (UNCLOS) the baseline is measured as the low-water line except along the mouths of estuaries and heads of bays where it cuts across open water. Along highly indented coastlines, bays, mouths of estuaries or coastlines with islands, the baseline can be drawn as a straight line. Each Member State has a legislative baseline associated with this definition.

2.1.5. The Directive gives no indication of the landward extent of either transitional or coastal waters. One of the hydromorphological quality elements for both transitional and coastal waters is the structure of the intertidal zone and since it is likely that some of the quality elements may be monitored within the intertidal area, it is recommended that transitional and coastal water bodies include the intertidal area from the highest to the lowest astronomical tide.

## 2.2. DEFINING SURFACE WATER BODIES WITHIN TRANSITIONAL AND COASTAL WATERS

**Annex II 1.1**
*"Member States shall identify the location and boundaries of bodies of surface water and shall carry out an initial characterisation of all such bodies".*

2.2.1. The Directive requires surface waters within the River Basin District to be split into water bodies (figure 2.1). Water bodies represent the classification and management unit of the Directive. This section gives guidance on defining surface water bodies for coastal and transitional waters. A range of factors will determine the identification of water bodies. Some of these will be determined by the requirements of the Directive and others by practical water management considerations.

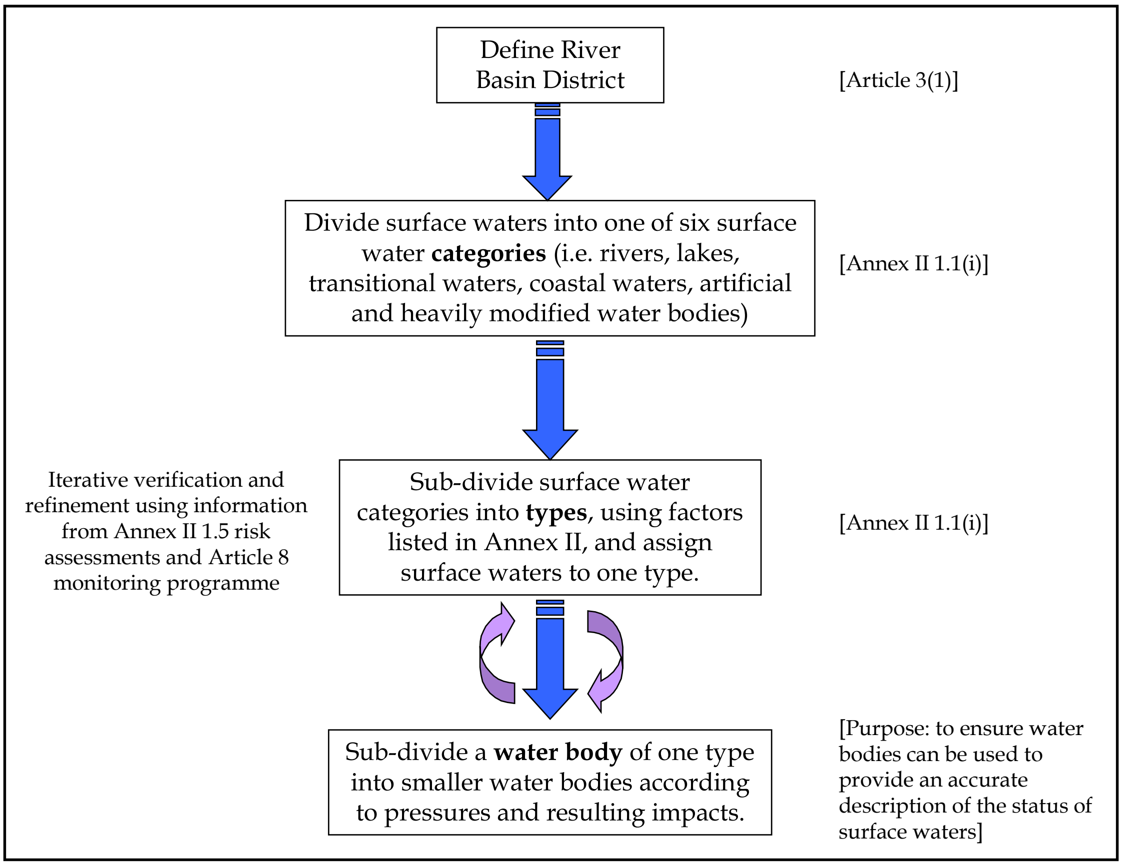



Figure 2.1. Summary of suggested hierarchical approach to the identification of surface water bodies.

2.2.2. This paper provides guidance on defining water bodies specific to coastal and transitional waters. A separate horizontal guidance document is available which specifically gives guidance on the term 'water body' and the identification of water bodies.

**<u>Surface Water Categories</u>**

**Annex II 1.1(i)**
***"The surface water bodies within the river basin district shall be identified as falling within either one of the following surface water categories – rivers, lakes, transitional waters or coastal waters – or as artificial surface water bodies or heavily modified surface water bodies."***

2.2.3. The first stage in describing surface water bodies is to assign all surface waters to a surface water category – rivers, lakes, transitional waters or coastal waters – or to artificial surface water bodies or heavily modified surface water bodies (figure 2.2).

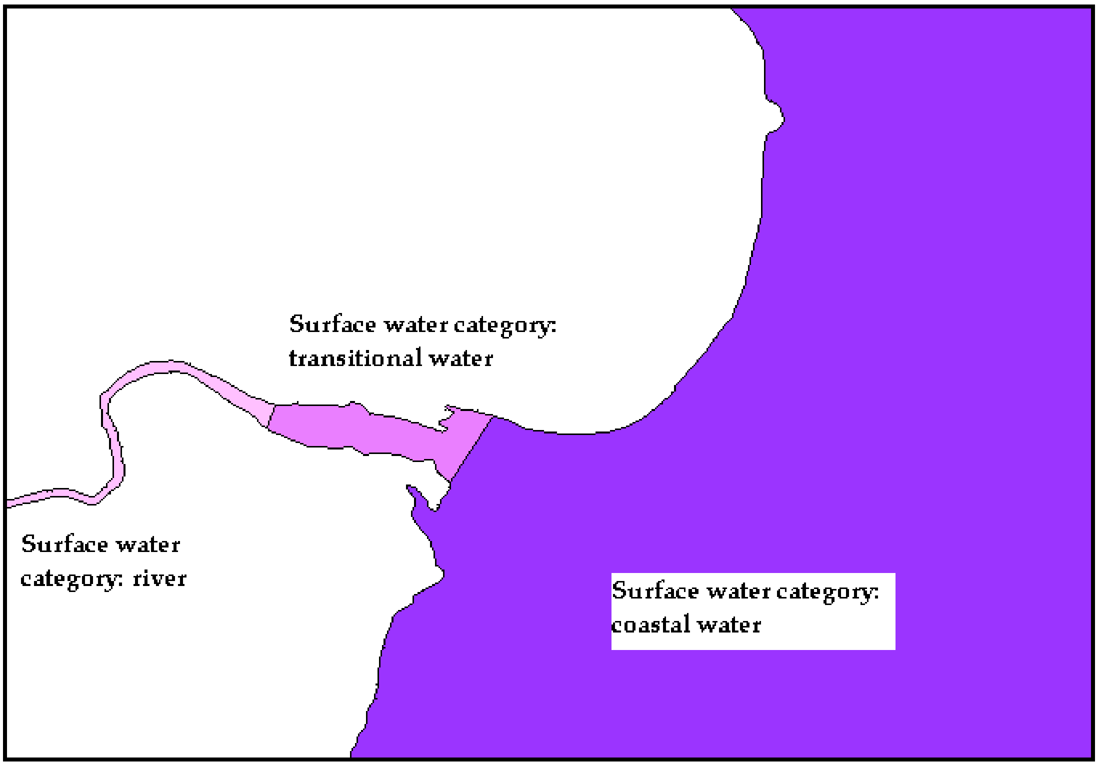



Figure 2.2. Surface Water Categories.

**Surface Water Types**

> **Annex II 1.1(ii)**
> *"For each surface water category, the relevant surface water bodies within the river basin district shall be differentiated according to type. These types are those defined using either 'system A' or 'system B'."*

2.2.4. The Directive recognises that the ecological character of surface waters will vary according to their different physical regimes. For example, a marine scientist expects to find different biological communities on an exposed Atlantic rocky shore compared to a fjord, a bay in the Baltic or a Mediterranean coastal lagoon Examples of surface water types are shown in figure 2.3. The purpose of assigning water bodies to a physical type is to ensure that valid comparisons of its ecological status can be made. For each type, reference conditions must also be described as these form the 'anchor' for classification of the water bodies status or quality. Guidance on how to type surface water bodies is given in section 3.

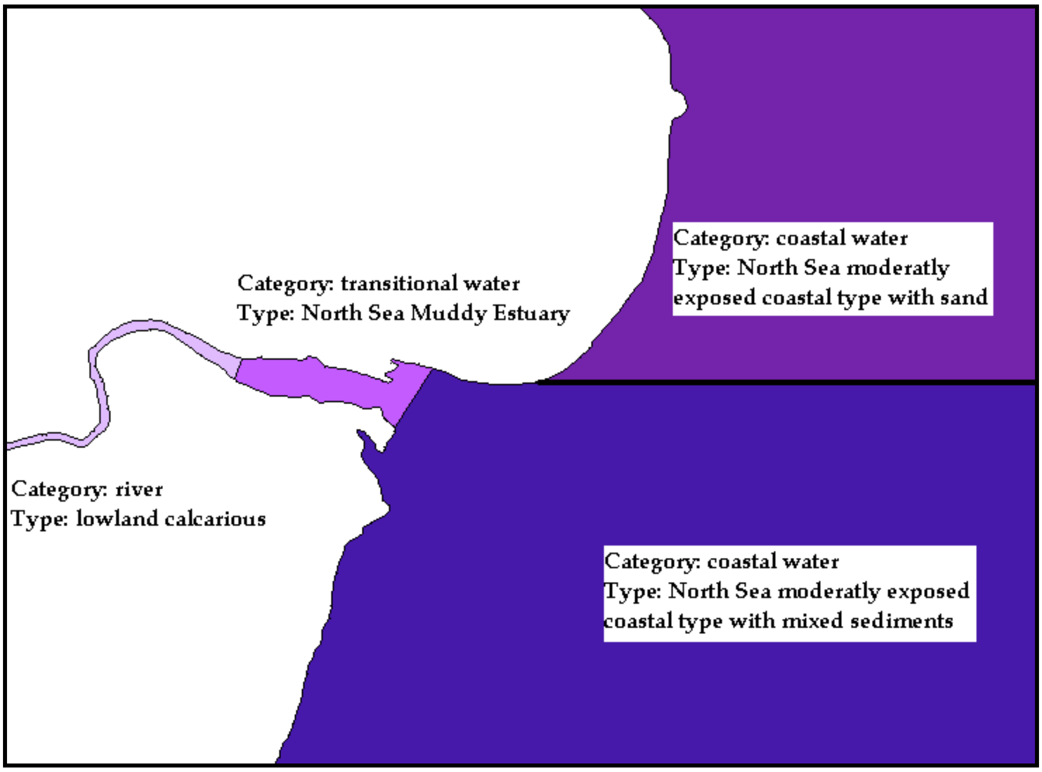



Figure 2.3. Types of surface water.

**Surface Water Bodies**

**Article 2(10)**
*"Body of surface water" means a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.*

2.2.5. The water body is the management unit of the Directive.

2.2.6. Water bodies may be identified for all surface waters (natural, heavily modified and artificial waters). This step is of major importance for the implementation process because water bodies represent the units that will be used for reporting and assessing compliance with the Directive's principal environmental objectives.

2.2.7. To assign a single classification and effective environmental objectives to a water body it may be necessary to divide an area which is of one type further into two or more separate water bodies (figure 2.4.). Water bodies may not spread over two types because reference conditions and hence environmental objectives are type specific.

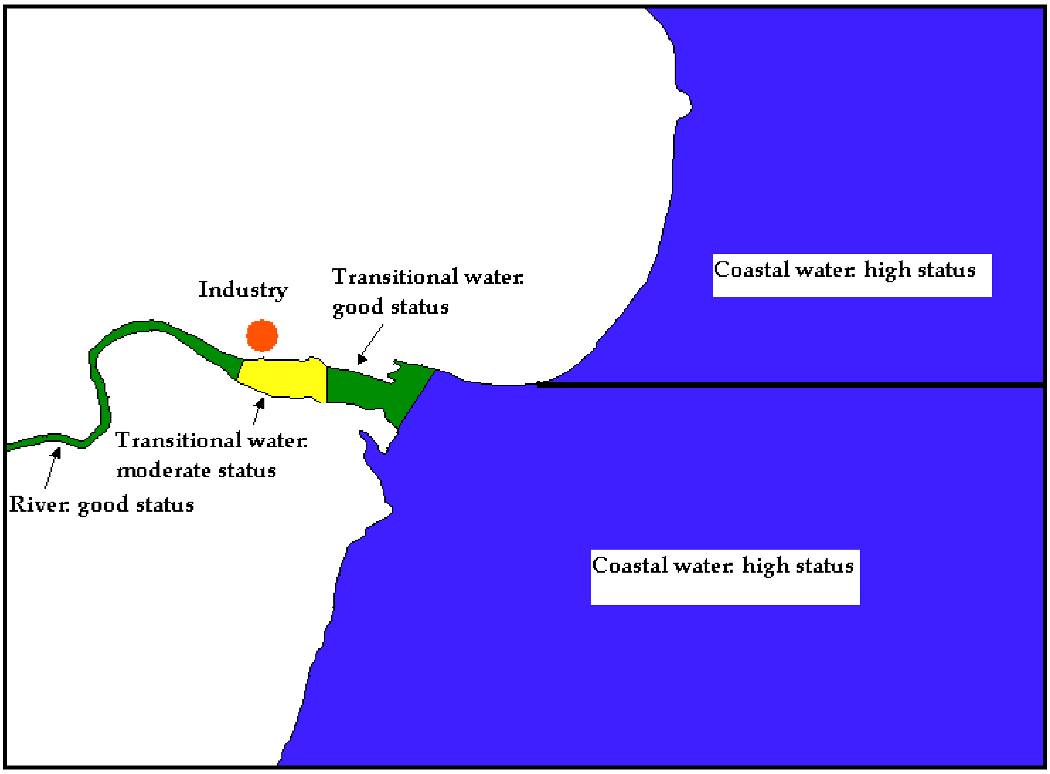



Figure 2.4. Surface water bodies. The colours used relate to those stated in Annex V 1.4.2 for reporting.

2.2.8. According to the definition in the Directive, water bodies must be "discrete and significant". This means that they must not be arbitrary sub-divisions of river basin districts, that they must not overlap with each other, nor be composed of elements of surface water that are not contiguous.

2.2.9. The Directive specifies that rivers and coastal waters may be sub-divided. It is assumed that transitional waters may also be sub-divided as long as the resulting water bodies are discrete and significant (figure 2.5). In the case of coastal waters, stretches of open coast are often continuous (unless divided by transitional waters); here subdivisions may follow significant changes in substratum, topographies or aspect.

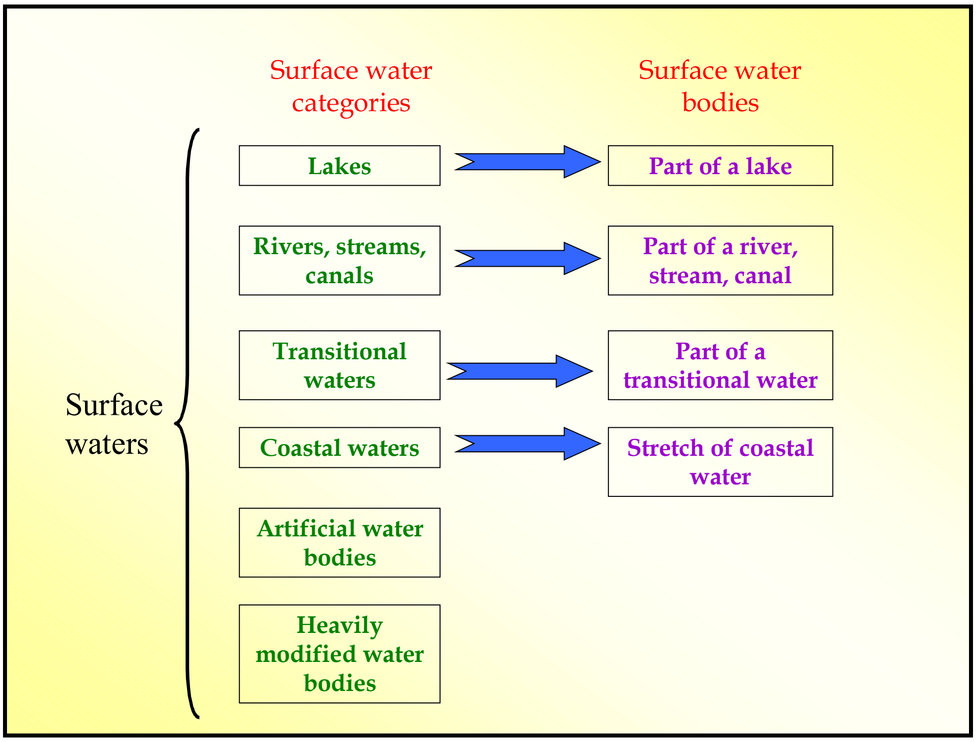
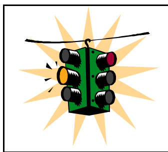



Figure 2.5. The splitting of surface water categories into surface water bodies.

2.2.10. The need to keep separate two or more contiguous water bodies of the same type depends upon the pressures and resulting impacts. For example, a discharge may cause organic enrichment in one water body but not in the other. Such an area of one type could therefore be divided into two separate water bodies with different classifications. If there were no impact from the discharge it would not be necessary to divide the area into two water bodies as it would have the same classification and should be managed as one entity.



**Look out!** The Directive only requires sub-divisions of surface water that are necessary for the clear, consistent and effective application of its objectives. Sub-divisions of coastal and transitional waters into smaller and smaller water bodies that do not support this purpose should be avoided.

2.2.11. Every six years from 2013, Member States must review the characterisation of water bodies, including the type-specific reference conditions, so as to reflect greater understanding and knowledge of the systems and natural variability including climate change. In this review, water bodies whose status changes may be merged with adjacent water bodies of the same status **and** the same type.

> **Article 5(2)**
> *"The analyses and reviews mentioned under"* [Article 5] *"paragraph 1 shall be reviewed, and if necessary updated at the latest 13 years after the date of entry into force of this Directive and every six years thereafter."*

## 2.3. DEFINING TRANSITIONAL WATERS

2.3.1. The Directive defines transitional waters as:

> **Article 2 (6)**
> *"'Transitional waters' are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows."*

2.3.2. When defining transitional waters for the purposes of the WFD, it is clear that the setting of boundaries between transitional waters, freshwaters and coastal waters must be ecologically relevant.

2.3.3. Transitional waters are:
(1) "...in the vicinity of a river mouth" meaning close to the end of a river where it mixes with coastal waters;
(2)"...partly saline in character" meaning that the salinity is generally lower than in the adjacent coastal water;
(3)"...substantially influenced by freshwater flow" meaning that there is a change to salinity or flow.

2.3.4. If riverine dynamics occur in a plume outside the coastline because of high and strong freshwater discharge, the transitional water may extend into the sea area (allowed in definition 1).

2.3.5. For the purposes of the Directive, the main difference between transitional and coastal waters is the inclusion of the abundance and composition of fish fauna in the list of biological quality elements for the classification assessment of transitional waters.

2.3.6. Transitional waters are usually characterised by their morphological and chemical features in relation to the size and nature of the inflowing rivers. Many different methods might be used to define them but the method should be relevant ecologically. This will ensure reliable derivation of type-specific biological reference conditions.

2.3.7. In certain areas of the Baltic Sea, such as the Bothnian Bay, the salinity of coastal water is similar to that of fresh water. As a result riverine fresh water life may extend into the adjacent coastal water. However, because of the different physical characteristics (flow dynamics) of a river and coastal water Article 2(6)) the same biological community falls into two different categories of surface waters (river - coastal) and hence, must be separated into two different water bodies, as required by the Directive. In such cases the delimitation of a transitional water might be superfluous.

**Defining the seaward boundary of transitional waters**

2.3.8. To assist Member States in defining the seaward boundary of transitional waters, four methods are proposed.

1. The use of boundaries defined under other European and national legislation such as the Urban Waste Water Treatment Directive;
2. Salinity gradient;
3. Physiographic features;
4. Modelling.

2.3.9. Member States should select the most ecologically relevant method for their own situation: The use of one or more of these approaches will allow comparisons across all Member States.

**The use of boundaries defined under other European and National legislation**

2.3.10. Where boundaries of transitional waters were defined for the purposes of existing legislation, they may be used to define transitional waters under the WFD as long as they are consistent with the WFD categories.

2.3.11. Article 17(1) and (2) of the Urban Waste Water Treatment Directive (91/271/EC) gave Member States the task to establish an implementation programme which should include information on discharges into different types of water bodies, which might have implicated defining the outer (seaward) limit of estuaries. Each Member State used its own individual method. These boundaries are likely to have been drawn for most sizeable estuaries and could be used to define transitional waters for the purposes of the WFD.

**Salinity gradient**

2.3.12. If salinity measurements exist, the outer boundary should be drawn where the salinity of the transitional water is usually substantially lower than the salinity of the adjacent coastal water. By definition, the transitional water must also be substantially influenced by freshwater flows.

2.3.13. For larger rivers the influence of freshwater is likely to extend into coastal waters (figure 2.5).

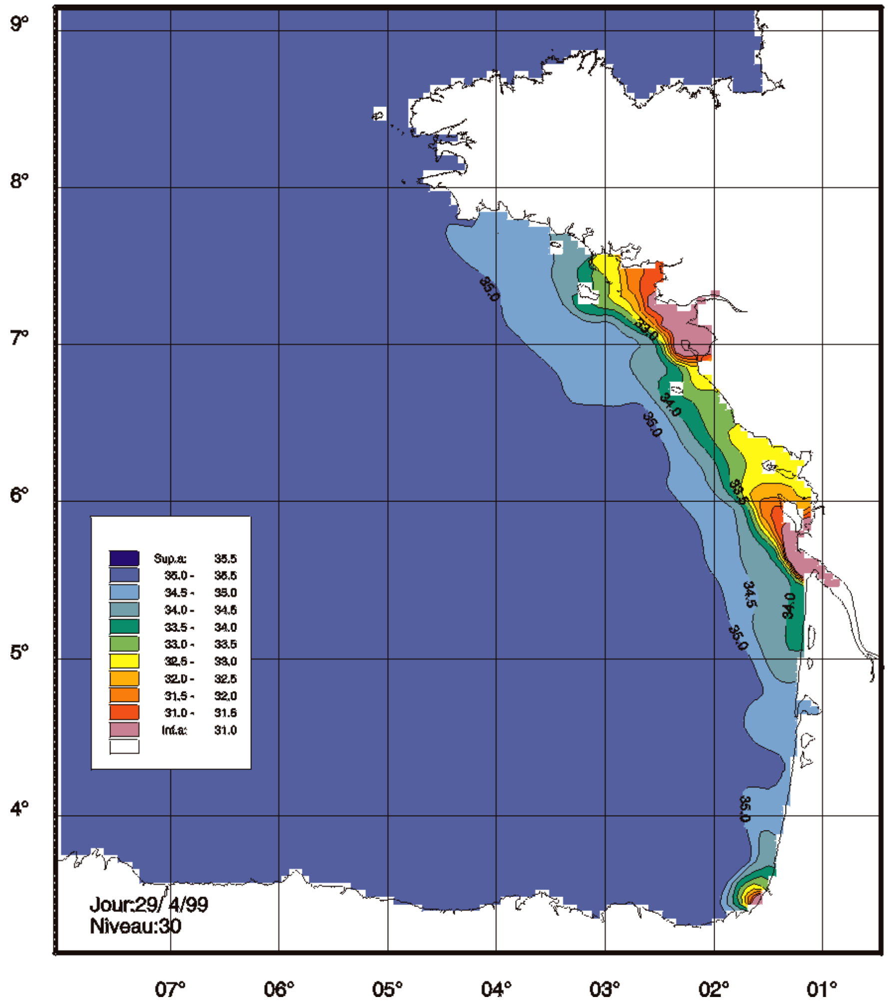



Figure 2.5. Examples of the plumes of the Loire and Gironde estuaries on the French Atlantic coast. The extension of the plume (salinity gradient) varies according to freshwater flow and tide conditions.

**Physiographic features**

2.3.14. Where morphological boundaries lie close to enclosing geographic features such as headlands and islands, such features may be used to define it. This is acceptable in some cases such as bar-built estuaries (Figure 2.6) whose morphological features may also coincide with biological boundaries.

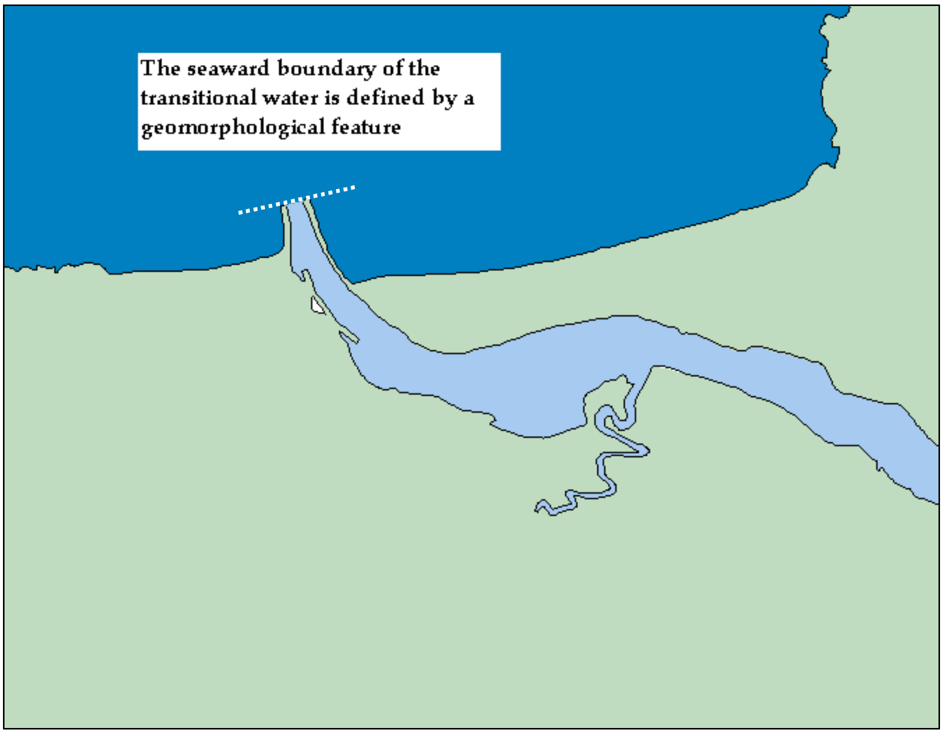



Figure 2.6. Bar-built estuary showing that geomorphological and biological limits of transitional waters can coincide.

**Modelling**

2.3.15. Models may be designed to predict the size of transitional waters. This method may be applicable where no estuary boundary has been defined for the purpose of existing legislation and where no suitable salinity data are available. Models may be used to estimate the area of water of a salinity substantially less than the salinity of the adjacent coastal water.

### Defining the freshwater boundary of transitional waters

2.3.16. Annex II 1.2.3. and 1.2.4 of the Directive defines freshwater as less than 0.5 salinity.

2.3.17. There are two main methods for defining the freshwater boundary of transitional waters: the fresh/salt water boundary or the tidal limit (figure 2.7). In some large estuaries, the tidal limit can be several tens of kilometers further inland than the freshwater/salt water boundary.

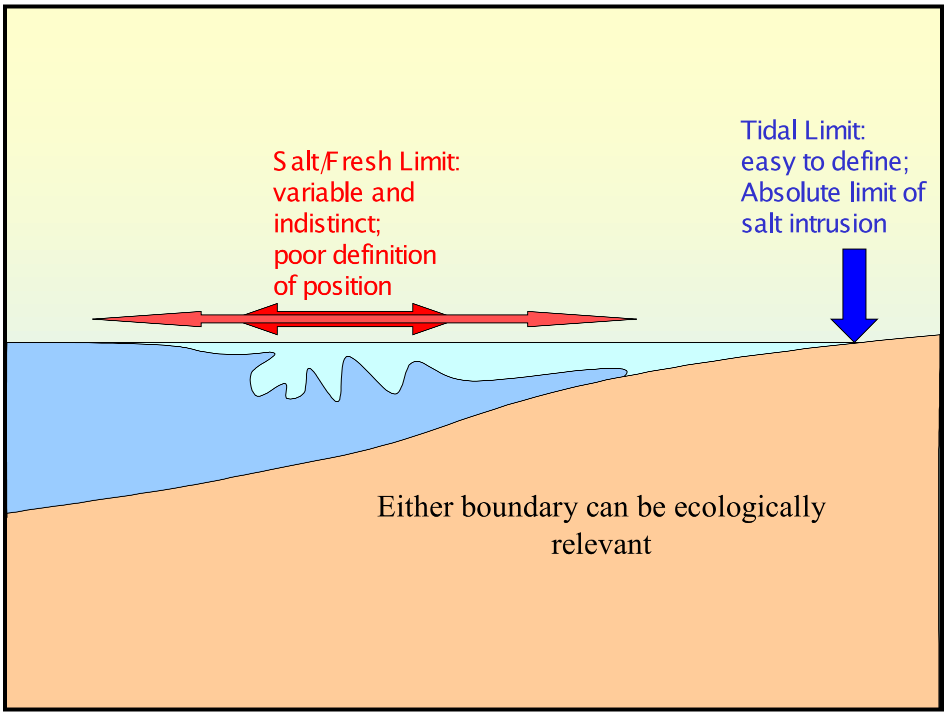



Figure 2.7. Methods for defining the freshwater boundary of transitional waters.

2.3.18. It is suggested that either the fresh /salt boundary or the tidal limit be used to define the freshwater boundary of transitional waters depending upon which method is most suitable to local circumstances. Whichever method is used, it is clear that all transitional waters must abut freshwater, leaving no section of the system unassigned to a surface water category.

### The Minimum Size of Transitional Waters

2.3.19. The Directive gives no indication of the minimum size of transitional waters to be identified as separate water bodies Although catchment size may be used as a guideline for the size of identified transitional waters, it should be considered with other factors such as the size, length, volume, river, discharge and the nature of the mixing zone. Most importantly it must meet the water body definition (Article 2.10) of being a 'discrete and significant' element of surface water. Significant could mean in terms of size or a risk of failing to meet good ecological status.

2.3.20. The horizontal guidance on water bodies gives no guidance on the minimum size for transitional or coastal water bodies. It does however state that Member States have the flexibility to decide whether the purposes of the Directive, which apply to all surface waters, can be achieved without the identification of every minor but discrete element of surface water as a water body**.** .

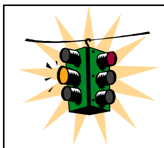
## 2.4. ASSIGNING COASTAL WATERS WITHIN THE RIVER BASIN DISTRICT

**Article 3.1**
*"Coastal waters shall be identified and assigned to the nearest or most appropriate river basin district or districts."*

3.4.1. The free exchange of substances from river basin districts to the open sea takes place in coastal waters. Coastal waters must be assigned to a River Basin District. This may involve the splitting of stretches of coastal water that might otherwise be considered as single water bodies.

2.4.2. When assigning a stretch of coastal water to a River Basin District the objective is to ensure that coastal waters are assigned to the closest possible or the most appropriate natural management unit and to minimise any unnecessary splitting of coastal stretches. To ensure consistency in the approach, the following principles should be applied:

- Where possible, existing administrative boundaries could be used. Examples are, ecoregions defined within the Directive and regions defined in the Marine Conventions;
- The boundaries between two adjacent types should be used wherever possible to minimise unnecessary splitting of the coastline;
- In the general case, the coastline should be split at open coast areas rather than through natural management units such as bays or inlets. However, specific situations may exist where the splitting of natural units for management purposes can not be avoided.



**Look out!** Further details on assigning coastal stretches to River Basin Districts are given in the guidance document "Identification of River Basin Districts in Member States. Overview, criteria and current state of play" produced by working group 2.9.

2.4.3. When managing coastal water bodies it must be recognized that water bodies in different river basin districts may interact to affect water quality in adjacent water bodies or even further away. In this case, the management plans of both river basins should acknowledge the problem and work together to resolve any issues. Where possible the coastal water body should be assigned to the River Basin District most likely to influence its quality, particularly taking into account long-shore influences of any contaminants.

## 2.5. TERRITORIAL WATERS

> ***Article 2. 1***
> *'Surface water' means inland waters, except groundwater; transitional and coastal waters, except in respect of chemical status for which it shall also include territorial waters.*

2.5.1. The definition of surface waters includes territorial waters. The Directive requires the achievement of good surface water chemical status for all surface water up to 12 nautical miles seaward from the baseline from which territorial waters are measured (i.e. territorial waters).

2.5.2. However, Member States are only required to identify water bodies in coastal waters, not in territorial waters.

> ***Article 2. 10***
> *'Body of surface water' means a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.'*

2.5.3. By protecting these inland surface waters, transitional waters, coastal waters and groundwaters, the Directive *contributes* to the protection of territorial and marine waters.

2.5.4. It is intended that the daughter directives that must be proposed by the Commission for substances on the Priority List by 20 November 2003 will clarify the compliance, assessment and reporting requirements relevant to the classification of good surface water chemical status.

2.5.5. One option for reporting any failures to achieve good surface water chemical status in territorial waters would be to identify territorial water bodies only where needed to delineate contiguous stretches of water in which the required environmental quality standards for good chemical status are not being met.

## 2.6. MARINE LAGOONS

2.6.1. Coastal lagoons may be either coastal waters or transitional waters, depending on whether the lagoon fits the definition of transitional waters in the Directive "*substantially influenced by freshwater flows and in the vicinity of river mouths*."

2.6.2. All surface waters are covered by the Directive. The minimum size of lagoons to be covered by the Directive is here suggested to be the same as the minimum size of lakes. Within Annex II of the Directive, the smallest size of lakes included in System A is a surface area of 0.5 to 1 km$^2$. This must not be considered as an absolute value and Member States may wish to include lagoons smaller than 0.5 km$^2$, particularly if they are at risk of failing to meet good status or are at high status and require a high level of protection. Further information on significant water bodies is given in the horizontal guidance on water bodies.

## 2.7. WETLANDS

**Look out!** A horizontal guidance paper has been written by the EEB/WWF which deals with the role of wetlands in the WFD and should be referred to for more detailed discussion.

**Article 1**
*The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:*
*(a) prevents further deterioration and protects and enhances the status of aquatic ecosystems, and with regard to their water needs, terrestrial ecosystems and wetlands directly dependent on aquatic ecosystems.*

2.7.1. It is clear from Article 1 of the Directive that one of the primary objectives of the WFD is to protect and enhance aquatic ecosystems including wetlands directly dependent on aquatic ecosystems. The major strength of the WFD as a management tool is that these interdependencies are recognised, in contrast to previous water pollution control or nature conservation directives.

**Look out!** Although specific guidance on marine wetlands is not covered within this guidance document, the importance of wetlands associated with coastal and transitional waters, in particular salt marshes, is recognised.

2.7.2. Wetlands play an important role in the water cycle and can act as sources and sinks of nutrients and contaminants and also as a buffer zone for water.

Wetlands also have important linkages with groundwaters. It is clear that the water environment cannot be managed without considering wetlands. In order to achieve 'good status' for parts of the water cycle, it must be achieved for the whole of the cycle. Failure to recognise these interdependencies will undermine the real purpose of the Directive as outlined in Article 1. In addition, the natural hydrological and ecological functioning of wetlands may also contribute to achieving the objective of 'good status' *via*, for example, the uptake of excessive nutrients through reed beds within associated transitional and coastal water bodies.

2.7.3. Water bodies have to be defined for rivers, lakes, transitional and coastal waters and groundwater. A water body is described as a discrete and significant element of surface water. A wetland can only be described as part of a water body where it fits this definition, for example, the intertidal area may be included in a water body as this is the discrete area between the highest and lowest astronomical tides. Wetlands are not included in the definition of surface water categories (rivers, lakes, transitional and coastal waters, artificial water bodies or heavily modified water bodies). However, as wetlands are often dependent on the quality and quantity of surface waters and groundwater, the achievement of good ecological and chemical status and good groundwater status will benefit wetlands. In addition, some wetlands may be included in the register of Protected Areas (Annex IV) which have ecological quality objectives set under other legislation, for instance, the Habitats Directive (92/43/EEC) the Birds Directive (79/409/EEC), the RAMSAR Convention and national designations.

# Section 3 – Guidance for Typology in Transitional and Coastal Waters.

**This section interprets the requirements of the WFD to define typology as one of the supporting factors in determining ecological status.**

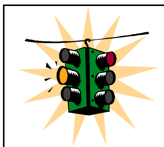
## 3.1. INTRODUCTION TO TYPOLOGY

**Article 5(1).**
*"Each Member State shall ensure that for each river basin district or for the portion of an international river basin district falling within its territory:*
*- an analysis of its characteristics"…*
*…"is undertaken according to the technical specifications set out in Annexes II and III and that it is completed at the latest four years after the date of entry into force of this Directive."*

3.1.1. Article 5 of the Directive requires Member States to carry out a characterisation of all water bodies. This exercise is referred to as typology. It is one of the first stages in the implementation of the WFD.

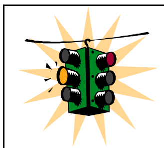
3.1.2. Annex II of the Directive gives instructions on how typology should be carried out and the obligatory and optional factors that can be used.

3.1.3. The purpose of typology is to enable type specific reference conditions to be established. These then become the anchor for classification systems. Typology has consequences for all subsequent operational aspects of the implementation of the Directive including monitoring, assessment and reporting.



**Look out!** Typology should be completed as soon as possible because all successive steps of Annexes II and V build on typology. In addition, the selection of types and sites for the draft register to form the intercalibration network is needed in 2003.

3.1.4. When carrying out typology Member States should focus on the overall purpose of the Directive outlined in Article 1; to establish a framework for the protection of both water quality and water resources preventing further deterioration and protecting and enhancing ecosystems. Typology is simply a tool to assist this process by comparing like with like.



**Look out!** The aim of typology is to produce as simple a physical typology as possible that is both ecologically relevant and practical to implement. It is recognised that a simple typology system needs to be complemented by more complex reference conditions that cover ranges of biological conditions.

3.1.5. The final typology should be submitted to the Commission in the form of GIS map(s) by 2004.

**Annex II 1.1(vi)**
*"Member States shall submit to the Commission a map or maps (in a GIS format) of the geographical location of the types".*

## 3.2. THE PROCESS OF TYPING

3.2.1. According to Annex II, Member States shall assign surface water bodies to one of the following categories: rivers, lakes, transitional, coastal, artificial or heavily modified surface water bodies. These categories must then be further divided into types.

**Annex II 1.1(ii)**
*"For each surface water category, the relevant surface water bodies within the river basin district shall be differentiated according to type. These types are those defined using either 'system A' or 'system B'"*

3.2.2. Water bodies within each surface water category are differentiated according to type using a system of typology as defined in Annex II of the Directive. Member States may choose to use either System A or System B.

3.2.3. If system A is used the type must first be assigned to an Ecoregion as shown in Map B of the Directive (figure 3.1). In transitional waters the surface water type is then described according to mean annual salinity and mean tidal range. In coastal waters mean annual salinity and mean depth are used to describe the type. The COAST working group held the opinion that the class limits defined for the various descriptors by system A are not always ecologically relevant for the local environmental conditions.

**Annex II 1.1(iv)**
*"If system B is used, Member States must achieve at least the same degree of differentiation as would be achieved using System A. Accordinly, the surface water bodies within the river basin district shall be differentiated into types using the values for the obligatory descriptors and such optional descriptors, or combinations of descriptors, as are required to ensure that type specific biological reference conditions can be reliably derived."*

3.2.4. The Directive states that if Member States choose to use system B at least the same degree of differentiation must be achieved as if system A were used. System B uses a series of obligatory (e.g. tidal range and salinity) and optional factors (e.g. mean substratum composition, current velocity) in order to classify surface waters into types.

3.2.5. Most Member States have expressed the opinion that system B will be applied. This is because the differences in biological compositions and community structures normally depend on more descriptors than those in system A.

## 3.3. THE DEVELOPMENT OF TYPOLOGY GUIDANCE

3.3.1. The Directive does not prescribe a scientific methodology as to how Member States should type their surface waters.

3.3.2. The ecological approach to assessing the quality of Europe's transitional and coastal waters takes into account biological differences caused by land-ocean interactions and climatic zones. Therefore, the starting point for managing the scientific development of types of water bodies is a separation into broad ecoregions based on accepted marine biological provinces.

3.3.3. On the basis of the 'Obligatory Factors' in system B (latitude, longitude, tidal range and salinity), it is possible to split the maritime area into three basic Ecoregions/Ecoregion Complexes:

- **Atlantic/North Sea Ecoregion Complex** comprises North Atlantic Ocean, North Sea, Norwegian Sea and the Barents Sea Ecoregions. A general physical description shows mostly full salinity regimes and moderate to higher hydrodynamic properties;

- **Baltic Sea Ecoregion** with brackish waters and mostly low hydrodynamic properties;

- **Mediterranean Sea Ecoregion** with euhaline waters and moderate hydrodynamic properties.

3.3.4. These Ecoregions are shown on Map B in the Directive (figure 3.1).

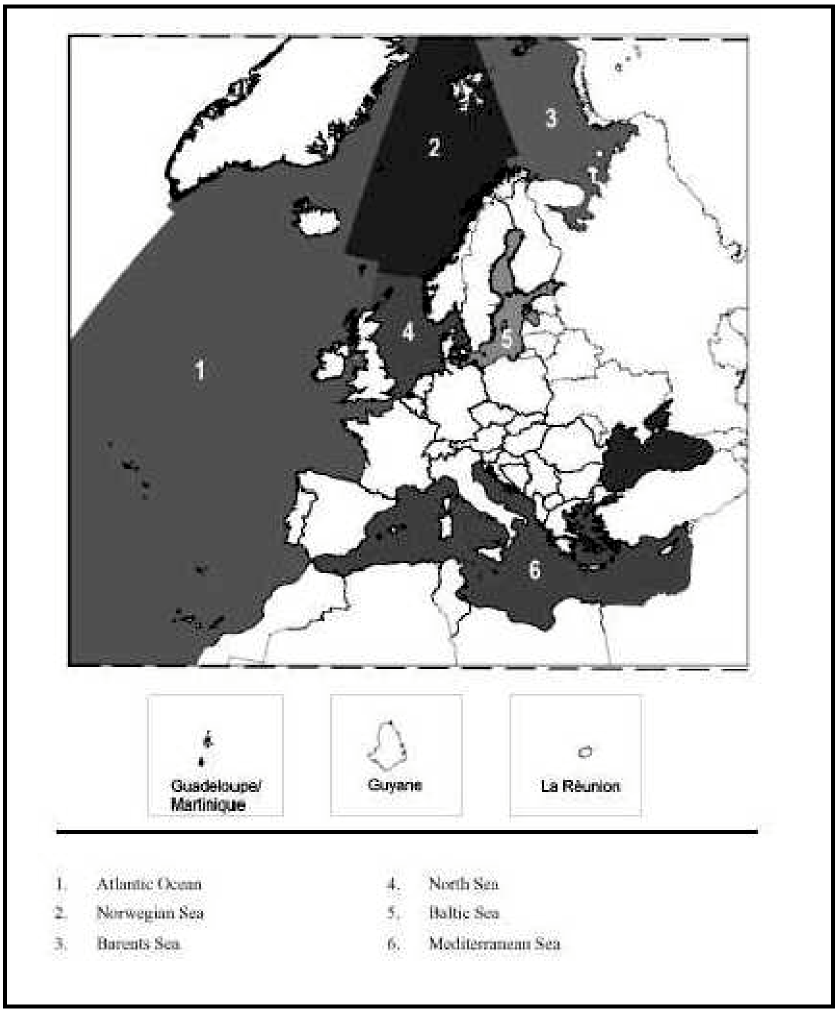



Figure 3.1. Map B from the Directive. System A: Ecoregions for transitional and coastal waters. The North-East Atlantic eco-region complex referred to in this guidance document includes the Atlantic Ocean, Norwegian Sea, Barents Sea and North Sea.

3.3.5. The guidance was developed at three Ecoregion workshops by investigating

- the common key optional factors within each Ecoregion;
- the order in which optional factors could be used to achieve the appropriate level of differentiation;
- the way in which the optional factors could be used.

## 3.4. COMMON FRAMEWORK FOR THE USE OF FACTORS FOR SYSTEM B

3.4.1. The factors listed in Annex II for coastal and transitional waters under System B are as follows:

**Annex II 1.2.3. Transitional Waters**

System B

| Alternative Characterisation | Physical and chemical factors that determine the characteristics of the transitional water and hence the biological population structure and composition |
|---|---|
| **Obligatory factors** | latitude<br>longitude<br>tidal range<br>salinity |
| **Optional factors** | depth<br>current velocity<br>wave exposure<br>residence time<br>mean water temperature<br>mixing characteristics<br>turbidity<br>mean substratum composition<br>shape<br>water temperature range |

**Annex II 1.2.4. Coastal Waters**

System B

| Alternative Characterisation | Physical and chemical factors that determine the characteristics of the coastal water and hence the biological population structure and composition |
|---|---|
| **Obligatory factors** | latitude<br>longitude<br>tidal range<br>salinity |
| **Optional factors** | current velocity<br>wave exposure<br>mean water temperature<br>mixing characteristics<br>turbidity<br>retention time (of enclosed bays)<br>mean substratum composition<br>water temperature range |

3.4.2. From the set of factors listed in Annex II of the Directive, Member States should use the obligatory factors followed by the optional factors that are most applicable to their own ecological situation.

3.4.3. It is suggested that a hierarchical approach is used for use of the optional factors when using System B.

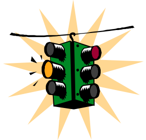
- First use obligatory factors
  - Latitude/Longitude - Ecoregion (c.f. Annex 11 of the Directive, Map B) (figure 7 above);
  - Tidal Range;
  - Salinity.

3.4.4. If ecological separation to define the type specific reference conditions can be achieved by using only the obligatory factors, the use of optional factors is unnecessary;

3.4.5. If ecological separation to define the type specific reference conditions according to types can not be achieved by using only the obligatory factors, then optional factors should also be used.

3.4.6. In **transitional waters**, the optional factors may be used in the following order if possible:
- Mixing;
- Intertidal Area (as an integrator of depth, tidal range and shape);
- Residence time;
- Other factors until an ecologically relevant type of water body is achieved.

3.4.7. In **coastal waters**, the optional factors may be used in the following order if possible:
- Wave exposure;
- Depth (*not in Annex II list);*
- Other factors until an ecologically relevant type of water body is achieved.



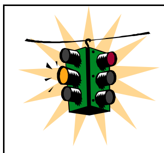
**Look out!** Even if only several factors are used to describe a type, it is suggested that Member States describe each water body using all factors in order to allow comparison of types between Member States. This will also aid the intercalibration exercise.

## 3.5. HOW COULD THE FACTORS BE USED?

3.5.1. Each factor has been split into several ranges on the basis of the ecological relevance across the three ecoregions.

3.5.2. Working within the agreed ranges will

- ensure true comparability between Member States on types;
- enable the identification of common types which could be used for intercalibration.



**Look out!** The guidance was agreed on the understanding that:

- Member States may further split descriptors within these ranges if this is necessary to achieve an ecologically relevant type;
- Member States may aggregate descriptors within these ranges if there is no biological difference.

3.5.3. **Salinity**
In defining types the ranges of the broadly in line with system A of the Directive should be used.

| | |
|---|---|
| freshwater | < 0.5 |
| oligohaline | 0.5 to 5 - 6 |
| mesohaline | 5 - 6 to 18 - 20 |
| polyhaline | 18 – 20 to 30 |
| euhaline | >higher than 30 |

3.5.4. **Mean Spring Tidal Range** (astronomical)

| | |
|---|---|
| micro tidal | < 1m |
| meso tidal | 1m to 5 m |
| macro tidal | > 5 m |

Tidal Range is irrelevant for the Baltic Sea and the Mediterranean Sea because they have negligible tides. These whole areas are therefore defined as microtidal.

3.5.5. **Exposure (wave)**
It has been agreed that a pan-European scale should be used.

| | |
|---|---|
| **Extremely exposed** | open coastlines which face into prevailing wind and receive oceanic swell without any offshore breaks (such as islands or shallows) for more than 1000km and where deep water is close to the shore (50 m depth contour within about 300 m). |
| **Very exposed** | open coasts which face into prevailing winds and receive oceanic swell without any offshore breaks such as islands, or shallows for at least several hundred kilometres. Shallow water less than 50m is not within about 300m of the shore. In some areas exposed sites may also be found |

along open coasts facing away from prevailing winds but where strong winds with a long fetch are frequent.

**Exposed** the prevailing wind is onshore although there is a degree of shelter because of extensive shallow areas offshore, offshore obstructions, or a restricted (<90°) window to open water. These stretches of coast are not generally exposed to strong or regular swell. Coasts may also face away from prevailing winds if strong winds with a long fetch are frequent.

**Moderately exposed** these sites generally include open coasts facing away from prevailing winds and without a long fetch but where strong winds can be frequent.

**Sheltered** at these sites there is a restricted fetch and/or open water window. Coasts can face prevailing winds but with a short fetch e.g. 20km or extensive shallow areas offshore or may face away from the prevailing winds.

**Very sheltered** these sites are unlikely to have a fetch greater than 20km (the exception being through a narrow) and may face away from prevailing winds or have obstructions such as reefs offshore or be fully enclosed.

3.5.6. **Depth**

| | |
|---|---|
| shallow | < 30 m |
| intermediate | 30m to 50 m |
| deep | > 50 m |

3.5.7. **Mixing**

permanently fully mixed
partially stratified
permanently stratified

3.5.8. **Proportion of Intertidal Area**

| | |
|---|---|
| small | < 50 % |
| large | > 50 % |

The intertidal area integrates other Annex II factors such as depth, tidal range, residence time and shape.

3.5.9. **Residence Time**

| | |
|---|---|
| short | days |
| moderate | weeks |
| long | months to years |

3.5.10. **Substratum**

hard (rock, boulders, cobble)
sand-gravel
mud
mixed sediments

In many cases different seabed substrata will occur within one water body type. The dominant substratum should be selected.

3.5.11. **Current Velocity**

| | |
|---|---|
| weak | <1 knot |
| moderate | 1knot to 3 knots |
| strong | > 3 knots |

Average current velocities should be used from measurements, tidal atlases or modelling. Current velocities throughout the Mediterranean Sea are expected to be < 1 knot. Member States may further divide this class into < 0.5 knots and 0.5 – 1 knot.

3.5.12. **Duration of Ice Coverage**

| | |
|---|---|
| irregular | |
| short | < 90 days |
| medium | 90 to 150 days |
| long | > 150 days |

In parts of the Baltic Sea ice coverage has an important influence on the ecosystem. It was the expert's advice to include this factor in the set of optional descriptors.

# Section 4 – Guidance on the Development of Biological Reference Conditions for Coastal and Transitional Waters.

**This section of the guidance explains the concepts of biological reference conditions and presents a way to use these concepts in practice.**

## 4.1. INTRODUCTION

4.1.1. The reference condition is a description of the biological quality elements that exist, or would exist, at high status, that is, with no, or very minor, disturbance from human activities. The objective of setting reference condition standards is to enable the assessment of ecological quality against these standards.

4.1.2. Within the Directive, reference conditions are described as follows:

> **Annex II 1.3 (i)**
> *"Type specific biological reference conditions shall be established, representing the values of the biological quality elements" … "for that surface water body type at high ecological status".*

4.1.3. In defining biological reference conditions, criteria for the physico-chemical and hydromorphological quality elements at high status must also be established. The reference condition is a description of the **biological** quality elements only. High **ecological status** incorporates the biological, physico-chemical and hydromorphological elements.

> **Annex II 1.3 (i)**
> *"For each surface water body type"….."type-specific hydromorphological and physicochemical conditions shall be established representing the values of the hydromorphological and physico chemical elements"….."for that surface water body type at high ecological status".*

4.1.4. 'Type specific' means that reference conditions are specific to a type as described under Annex II, System A or B (section 3.2.).

4.1.5. It is recognised that some Member States may have few or no water bodies at high status and may need to use reference conditions established in another Member State for the same type.

4.1.6. Pressures such as diffuse pollution and land-use patterns are indirect pressures that Member States are required to control under the WFD. However, it is unrealistic to base reference conditions upon historic landscapes that no longer exist in modern Europe.

4.1.7. High status provides the direction, not the target, for restoration.

> **Article 4.1 a (ii)**
> *"Member States shall protect, enhance and restore all bodies of surface water" with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of this Directive."*

4.1.8. Qualitative and quantitative aspects of reference conditions should be published as part of the River Basin Management Plan and be available to the public.

> **Annex VII, A 1.1.**
> *"River basin management plans shall cover the following elements:*
>
> *1.1. …for surface waters….identification of reference conditions for the surface water body types;"*

4.1.9. Member States may wish to engage in a consultation process on any reference network of high status sites in the spirit of Article 14. Further guidance on the Public Participation Process is given in the CIS 2.9 Guidance on Best Practice in River Basin Planning.

## 4.2. REFERENCE CONDITIONS AND THE RANGE OF NATURAL VARIATION

4.2.1. Reference conditions must summarise the range of possibilities and values for the biological quality elements over periods of time and across the geographical extent of the type. The reference conditions represent part of nature's continuum and must reflect natural variability (figure 4.1).

> **Look out!**
> Reference conditions are type specific, and therefore the typology must lead to the reliable derivation of biological reference conditions.

4.2.2. Because reference conditions must incorporate natural variability, in most instances they will be expressed as ranges. Reference conditions should be derived with a view to distinguishing between very minor, slight, and moderate disturbance. 'Very minor' disturbance could be defined as just detectable in the sense that the disturbance is more likely to be anthropogenic than not. Slight disturbance could be defined as anthropogenic at a prescribed level of confidence.

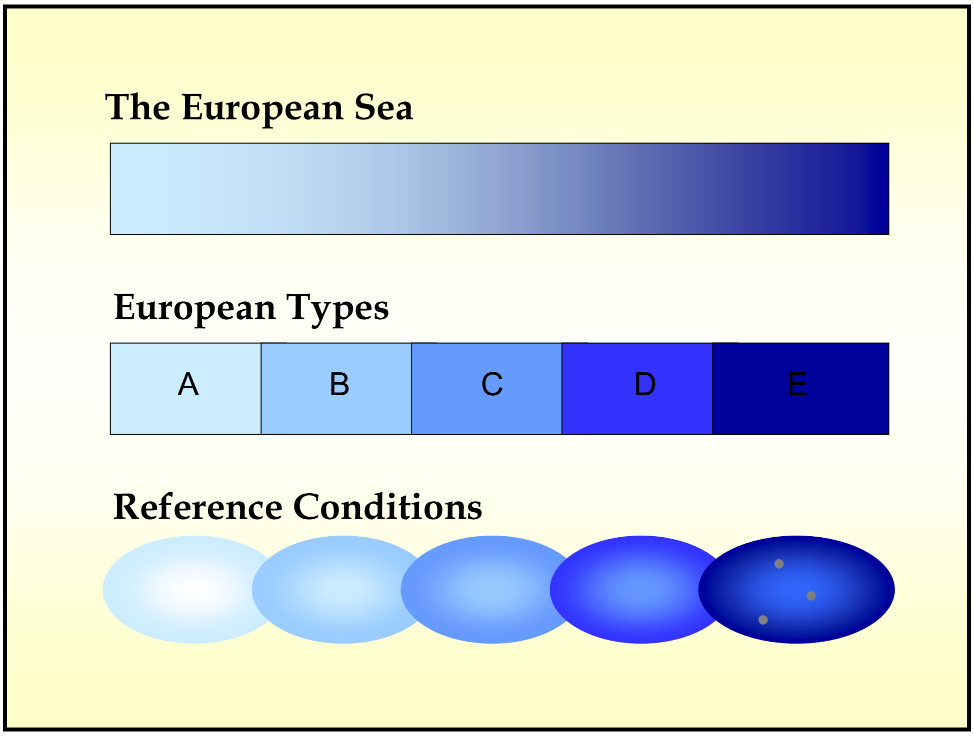



Figure 4.1. The relationship between all the seas in Europe (the European Sea), typology and type-specific reference conditions. The European sea is a continuum. Typology falsely compartmentalises this continuum into a number of physical types. The reference conditions for a specific water body type must then describe all possible natural variation within that type. In type E, sites are shown. This shows how sites within a type may be used to establish the natural variability within the type.

4.2.3. It is likely that the natural variability of a quality element within a type may be as large as the natural variability between types. Member States should adopt the spirit of the Directive and attempt to minimise variability by making valid comparisons between biological communities (i.e. compare 'like with like' by selecting comparable parts of the biological communities with the comparable part of the reference condition).

## 4.3. THE RELATIONSHIP BETWEEN REFERENCE CONDITIONS, HIGH STATUS AND THE ECOLOGICAL QUALITY RATIO

4.3.1. Type specific reference conditions are to be established for the **biological** quality elements for that type of surface water at high status. Reference conditions are a description of the biological quality elements at high status.

> **Annex V 1.4.1. (ii)**
> *"the results of the (classification) systems"…"shall be expressed as ecological quality ratios for the purposes of classification of ecological status. These ratios shall represent the relationship between the values of the biological parameters observed for a given body of surface water and the values for these parameters in the reference conditions applicable to that body. The ratio shall be expressed as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero."*

4.3.2. The description of the biological reference conditions must permit the comparison of monitoring results with the reference conditions in order to derive an Ecological Quality Ratio (EQR). The values of the EQR set for each status class must mean that the water body meets the normative definition for that status class given in Annex V table 1.2. and each biological quality element meets the relevant definition in Annex V tables 1.2.3. or 1.2.4. The EQRs must be defined in such a way that allows the comparison of high status sites between Member States.

4.3.3. The EQR is not necessarily a simple ratio of two numbers but 'represents the relationship between the values of the biological parameters' in a given water body.

4.3.4. The EQR expresses the relationship between observed values and reference condition values. Its numerical value lies between 0 and 1. At high status, the reference condition may be regarded as an optimum where the EQR is close to, and including one.. Above and below the optimum, the EQR is less than 1.

4.3.5. Outside the reference condition range, the method of conversion of measurements to a numerical EQR will depend on the quality element and on classification schemes within individual Member States.

## 4.4. BIOLOGICAL QUALITY ELEMENTS REQUIRING REFERENCE CONDITIONS

4.4.1. Reference conditions should be described according to the definitions of the biological quality elements at high status in Annex V table 1.2.3 and table 1.2.4.

Definitions of the biological elements at high status in transitional waters taken from Annex V table 1.2.3.

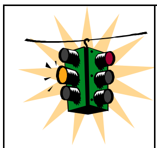
| **Element** | **High Status** |
|---|---|
| ***Biological Quality Elements*** | |
| ***Phytoplankton*** | *The composition and abundance of the phytoplanktonic taxa are consistent with undisturbed conditions.*<br>*The average phytoplankton biomass is consistent with the type-specific physico-chemical conditions and is not such as to significantly alter the type-specific transparency conditions.*<br>*Planktonic blooms occur at a frequency and intensity which is consistent with the type specific physico-chemical conditions.* |
| ***Macroalgae*** | *The composition of macroalgal taxa is consistent with undisturbed conditions.*<br>*There are no detectable changes in macroalgal cover due to anthropogenic activities.* |
| ***Angiosperms*** | *The taxonomic composition corresponds totally or nearly totally to undisturbed conditions.*<br>*There are no detectable changes in angiosperm abundance due to anthropogenic activities* |
| ***Benthic Invertebrate Fauna*** | *The level of diversity and abundance of invertebrate taxa is within the range normally associated with undisturbed conditions.*<br>*All the disturbance-sensitive taxa associated with undisturbed conditions are present.* |
| ***Fish Fauna*** | *Species composition and abundance is consistent with undisturbed conditions.* |

Definitions of the biological elements at high status in coastal waters taken from Annex V table 1.2.4.

| **Element** | **High Status** |
|---|---|
| ***Biological Quality Elements*** | |
| ***Phytoplankton*** | *The composition and abundance of the phytoplanktonic taxa are consistent with undisturbed conditions.*<br>*The average phytoplankton biomass is consistent with the type-specific physico-chemical conditions and is not such as to significantly alter the type-specific transparency conditions.*<br>*Planktonic blooms occur at a frequency and intensity which is consistent with the type specific physico-chemical conditions.* |
| ***Macroalgae and Angiosperms*** | *All disturbance-sensitive macroalgal and angiosperm taxa associated with undisturbed conditions are present.*<br>*The levels of macroalgal cover and angiosperm abundance are consistent with undisturbed conditions.* |
| ***Benthic Invertebrate Fauna*** | *The level of diversity and abundance of invertebrate taxa is within the range normally associated with undisturbed conditions.*<br>*All the disturbance-sensitive taxa associated with undisturbed conditions are present.* |

4.4.2. There is an urgent need to collect new data to ensure that reference conditions which incorporate natural variability can be derived. The development of reference conditions is likely to be an iterative process until adequate data sets are available. This urgent need is reflected in Annex V 1.3.1. The impact assessment has to be completed by 2004 and reference conditions will be required in order to undertake the intercalibration exercise.

**Annex V 1.3.1**
*"Member States shall establish surveillance monitoring programmes to provide information for:*
*- supplementing and validating the impact assessment procedure detailed in Annex II."*

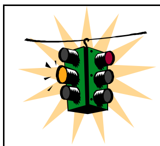


**Look out!** It is likely that the complete descriptions of reference conditions for transitional and coastal waters will not be possible at this stage as there are few or no data for some of the biological quality elements.

## 4.5. METHODS FOR DETERMINING REFERENCE CONDITIONS

4.5.1 The WFD identifies four options for deriving reference conditions.

**Annex II, 1.3 (iii)**
Reference conditions may be *"either spatially based or based on modelling, or may be derived using a combination of these methods. Where it is not possible to use these methods, Member States may use expert judgement to establish such conditions."*



**Look out!** A hierarchical approach for defining reference conditions is suggested using the various methods in the following order:

1. An existing undisturbed site or a site with only very minor disturbance; or
2. historical data and information; or
3. models; or
4. expert judgement.

4.5.2. Models are generally not well developed or validated for the marine environment and given the problems with using historical data, the reference network of high status sites is the preferred approach for deriving reference conditions for transitional and coastal waters.

Spatial Data

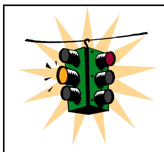
4.5.3. With regard to spatial data, Annex II, 1.3 (iv) states that:

> **Annex II 1.3 (iv)**
> *"Member States shall develop a reference network for each surface water body type. The network shall contain a sufficient number of sites of high status to provide a sufficient level of confidence about the values for the reference conditions, given the variability in the values of the quality elements corresponding to high ecological status for that surface water body type".*

4.5.4. Where a site with 'very minor disturbance' is used to derive reference conditions it should be validated to ensure that it meets the definitions of high status given in Annex V.

4.5.5. It may be possible to use a site to derive biological reference conditions for a biological quality element, even though not all other quality elements at the site are at high status. In this case it must be demonstrated that this biological quality element is not disturbed.

4.5.6. A site with hydromorphological modification may be used to derive biological reference conditions for the quality elements which are not disturbed by the modification (e.g. a slipway or a small jetty will not disturb the phytoplankton community). Although this water body as a whole may not qualify for high status, given the hydromorphological modification, it may be possible to derive biological reference conditions from this site.



**Look out!** At present there are no reference networks of high status sites for coastal and transitional waters. In addition, there are few reliable models for predicting marine biological communities. The few existing tools which are in existence have generally not been tested outside individual Member States.

Historical data and information

4.5.7. It may be possible to use historical information to derive reference conditions if the historical data are of assured quality. If reference conditions are derived from historical conditions, these should be based upon the condition of water bodies at times of no or very minor anthropogenic influence. No single date can be used to determine the reference conditions, for example, in urbanised estuaries a historical period of low nutrient inputs from agriculture may have corresponded to high industrial discharges and the release of untreated sewage.

4.5.8. A site at which there are historic pressures may still be used to derive biological reference conditions if the pressures are not causing current ecological disturbance to that quality element.

Modelling

4.5.9. A number of different modelling techniques may be used to derive reference conditions.

> **Annex V 1.3 (v)**
> *"Type-specific biological reference conditions based on modelling may be derived using either predictive models or hindcasting methods. The methods shall use historical, palaeological and other available data and shall provide a sufficient level of confidence about the values for the reference conditions to ensure that the conditions so derived are consistent and valid for each surface water body type."*

Expert Judgement

4.5.10. It is emphasised that expert judgement is required with all the above techniques: for example, use of historical data will require expert judgement in deciding which data are appropriate. In addition, robust predictive models can only be developed using data plus expert judgement. In the early stages of implementation of the Directive, expert judgement will be used alongside the developing classification tools outlined in section 6 to derive reference conditions consistent with the normative definitions.

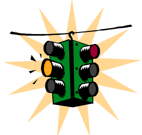
## 4.6. THE SELECTION OF A REFERENCE NETWORK OF HIGH STATUS SITES

4.6.1. The Directive requires Member States to establish a reference network of high status sites.

4.6.2. A possible starting point for this process is to screen for unimpacted areas using pressure criteria. It is clear that pressure criteria alone cannot be used to define high status areas because something which would be a minor pressure in one water body (e.g. a sewage works of 250 population equivalent discharging to the Atlantic Ocean) may have a significant impact if discharged to a small lagoon with poor water exchange. However, screening for areas with a lack of pressures is a useful starting point in identifying a reference network of high status sites.

4.6.3. The screening process starts with the identification of areas with no or very minor morphological changes. These areas can be identified from examining sea charts and from obtaining licensing information on the disposal of dredged material, extraction of oil, gas, aggregates or other marine resources. More information would be required to ensure that these areas are not subject to a fishing pressure which would constitute more than a 'very minor disturbance'.

4.6.4. The next step is to identify areas of no or very minor pressures from land based activity (i.e. areas which have no or low intensity agricultural practises and no or few point sources of pollution).



**Look out!** A German screening tool for identifying significant pressures and evaluating their impacts is included in the IMPRESS guidance (section 4.2)

4.6.5. A detailed examination of the biological status of these areas is required alongside expert judgement to establish if these sites are at high status. In many cases it may be unacceptable to base reference conditions on current land management practice.

## 4.7. EXCLUSION OF QUALITY ELEMENTS WITH HIGH NATURAL VARIABILITY

**Annex II 1.3 (vi)**
*"Where it is not possible to establish reliable type-specific reference conditions for a quality element in a surface water body type due to high degrees of natural variability in that element, not just as a result of seasonal variations, then that element may be excluded from the assessment of ecological status for that surface water type. In such circumstances Member States shall state the reasons for this exclusion in the river basin management plan".*

4.7.1. The WFD allows Member States to exclude a quality element from the assessment of ecological status if its natural variability, other than seasonal, is too high to allow the derivation of reliable reference conditions. In this case reference conditions need not be formulated but the reason for the exclusion along with supporting evidence must be stated in the river basin management plan.

4.7.2. No specific guidance is given within the Directive on the level of natural variability that justifies such exclusion. It is recommended that sufficient reason for exclusion may exist if the range of natural variability within a type overlaps with the range expected in disturbed conditions resulting in a high risk of mis-classification.

4.7.3. When formulating reference conditions it is important to express natural variability as explicitly as possible (e.g. the specific seasonal (spring or summer) range of phytoplankton biomass.

## 4.8. Reference Conditions and Other Significant Anthropogenic Impacts

Non-indigenous species

4.8.1. The biological quality of water bodies may be impacted by pressures such as the introduction of non-indigenous species or disease-causing organisms. The WFD does not identify them explicitly as pressures but includes them as "*other significant anthropogenic impacts*" (Annex II 1.4.). Such pressures may affect some biological quality elements and must be taken into account when deriving reference conditions.

4.8.2. The mere presence of a non-indigenous species in a water body of high status is acceptable if it does not unduly influence the overall structure and function of the ecosystem and if the normative definitions of high status are not compromised.

Fishing

4.8.3. Where a fishing operation constitutes more than 'a very minor disturbance' on one or more of the biological quality elements, that water body cannot be considered to be at high status (e.g. benthic trawling has a direct impact on the benthic invertebrate fauna). In addition, fishing activities may compromise high hydromorphological status in transitional or coastal waters.

Definitions of the hydromorphological elements at high status in transitional waters taken from Annex V table 1.2.3.

| *Element* | *High Status* |
|---|---|
| *Hydromorphological Quality Elements* | |
| *Morphological* | *Depth variation, substrate conditions and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.* |

Definitions of the hydromorphological elements at high status in coastal waters taken from Annex V table 1.2.4.

| *Element* | *High Status* |
|---|---|
| *Hydromorphological Quality Elements* | |
| *Morphological* | *Depth variation, structure and substrate of the coastal bed conditions and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.* |

4.8.4. The specification for fish fauna in transitional waters at good status includes impacts due to the physico-chemical or hydromorphological quality elements but does not explicitly include the effects of fishing. Therefore a water body within which fishing takes place can be considered to be at good status if the effects of, for example benthic trawling, lead only to slight disturbance of the quality elements from high status.

**Annex V 1.2.3.**
**Description of fish fauna at high status**
*"Species composition and abundance is consistent with undisturbed conditions".*
**Description of fish fauna at good status**
*"The abundance of the disturbance-sensitive (fish) species shows slight signs of distortion from type specific conditions attributable to anthropogenic impacts on physico-chemical or hydromorphological quality elements".*

## 4.9. UPDATING REFERENCE CONDITIONS

4.9.1. Reference conditions are not permanent. Climate, land cover and marine ecosystems vary naturally over many periods relevant to the WFD. Every six years from 2013, Member States must review the characterisation of water bodies, including reference conditions.

4.9.2. Reference conditions must therefore be formulated so as to include natural variability over a period of at least six years, and other factors directly out of the control of Member States. It is accepted that many of these variables are not fully understood in the marine environment.

4.9.3. Over the forthcoming years as understanding increases it may be possible to develop sound predictive models, thus reducing the degree of expert judgement in the process.

## 4.10. REFERENCE CONDITIONS / HIGH STATUS STUDIES

4.10.1. Through the COAST working group, a number of Member States completed reference condition pilot studies for areas which may be in high status. It cannot be confirmed that these areas are in high status until classification tools are developed and the intercalibration exercise has been completed. Some Members States with no sites considered to be at high status completed 'best of type' studies for types that may be in good or moderate status.

4.10.2. The papers were discussed by the working group and the main lessons learnt through the exercise are listed below:

- It is likely that there will be very few sites across the whole of Europe at high status because of human pressures and impacts.
- The IMPRESS guidance document gives guidance on what constitutes a specific pollutant. This guidance will need to be tested to see if the strict requirements for specific pollutants discount sites which are **biologically** in high status..
- In the marine environment there is a lack of biological and chemical data for high status sites as the focus for monitoring programmes has historically been centred on polluted areas.
- At present Member States do not have a full set of data for each quality element. This is particularly true for macroalgae, angiosperms and fish. It is clear that additional studies may be required in order to derive reference conditions.
- Where possible reference conditions should be quantitative rather than qualitative. However it is appreciated that this may not be possible initially, if at all, for all quality elements.
- At least in the short term, expert judgement is essential because of the lack of good data sets. Over the forthcoming years as understanding increases it may be possible to develop sound predictive models, thus reducing the degree of expert judgement.

4.10.3. A table can be found in Annex C which lists the pilot studies that were carried out by various Member States.

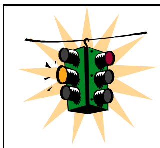
# Section 5 – General Guidance on the Classification of Ecological Status within Transitional and Coastal Waters.

**This section of the guidance introduces the principles underlying classification and the requirements of classification tools and schemes for the purposes of the WFD.**

## 5.1. INTRODUCTION TO CLASSIFICATION

5.1.1. The WFD requires Member States to assess the ecological status of water bodies and then ensure that the appropriate environmental objectives are set for these water bodies through the river basin management process.

5.1.2. At present, there are a limited number of coastal and transitional water classification schemes in Europe. None of the existing schemes meet all the requirements of the WFD. Existing classification schemes do not generally include all of the quality elements given in Annex V 1.2.3 and 1.2.4. Each of the existing schemes has different strengths and weaknesses in relation to WFD implementation.



**Look out!**
A **classification scheme** is what is used for the overall classification and includes a measure of all appropriate quality elements.
**Classification tools** are used for assessing the status of each individual quality element against high status.

5.1.3. WFD classification schemes and tools must assess status against the biological reference conditions.

5.1.4. The classification of ecological status is based upon the status of the biological, hydromorphological and physico-chemical quality elements (figure 5.1). The quality elements to be included in classification are listed in Annex V 1.1.3. and 1.1.4. The hydromorphological and physico-chemical elements are also referred to as the supporting elements.

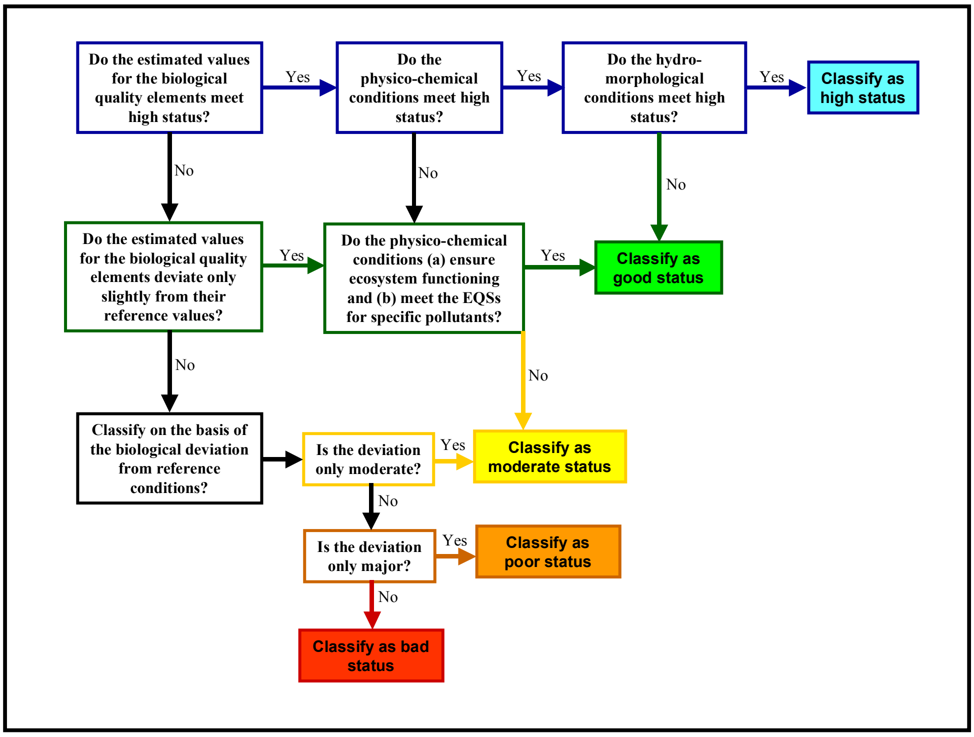



Figure 5.1. The classification of ecological status is represented by the lower of the values for the biological and physico-chemical monitoring results.

| Annex V 1.1.3. Transitional Waters<br>Biological elements | Annex V 1.1.4. Coastal Waters |
|---|---|
| • *Composition, abundance and biomass of phytoplankton*<br>• *Composition and abundance of other aquatic flora*<br>• *Composition and abundance of benthic invertebrate fauna*<br>• *Composition and abundance of fish fauna* | • *Composition, abundance and biomass of phytoplankton*<br>• *Composition and abundance of other aquatic flora*<br>• *Composition and abundance of benthic invertebrate fauna* |

**Hydromorphological elements supporting the biological elements:**

| | |
|---|---|
| *Morphological conditions:*<br>• *depth variation*<br>• *quantity, structure and substrate of the bed*<br>• *structure of the inter-tidal zone*<br>*Tidal regime:*<br>• *freshwater flow*<br>• *wave exposure* | *Morphological conditions:*<br>• *depth variation*<br>• *structure and substrate of the coastal bed*<br>• *structure of the inter-tidal zone*<br>*Tidal regime:*<br>• *direction of dominant currents*<br>• *wave exposure* |

**Chemical and physio-chemical elements supporting the biological elements:**

| | |
|---|---|
| *General:*<br>• *Transparency*<br>• *Thermal conditions*<br>• *Salinity*<br>• *Oxygenation conditions*<br>• *Nutrient conditions*<br>*Specific Pollutants:*<br>• *Pollution by all priority substances identified as being discharged into the body of water*<br>• *Pollution of other substances identified as being discharged in significant quantities into the body of water.* | *General:*<br>• *Transparency*<br>• *Thermal conditions*<br>• *Salinity*<br>• *Oxygenation conditions*<br>• *Nutrient conditions*<br>*Specific Pollutants:*<br>• *Pollution by all priority substances identified as being discharged into the body of water*<br>• *Pollution of other substances identified as being discharged in significant quantities into the body of water.* |

## 5.2. Ecological Status Classes and the Ecological Quality Ratio

5.2.1. Definitions of the five ecological status classes are given in Annex V table 1.2. These are referred to as the **normative definitions**.

**Annex V Table 1.2. General definition for rivers, lakes, transitional waters and coastal waters**

High status

*"There are no, or only very minor, anthropogenic alterations to the values of the physicochemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions.*

*The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion.*

*These are the type specific conditions and communities."*

Good status

*"The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions."*

Moderate status

*"The values of the biological quality elements for the surface water body type deviate moderately from those normally associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status."*

Poor status

*"Water showing evidence of major alterations to the values of the biological quality elements for the surface water body type and in which the relevant biological communities deviate substantially from those normally associated with the surface water body type under undisturbed conditions, shall be classified as poor."*

Bad status

*"Water showing evidence of severe alterations to the values of the biological quality elements for the surface water body type and in which large portions of the relevant biological communities normally associated with the surface water body type under undisturbed conditions are absent, shall be classified as bad."*

5.2.2. The observed results from the monitoring of the biological quality elements should be compared against the reference conditions for that type and expressed as an Ecological Quality Ratio (figure 5.2).

> **Annex V, 1.4.1 (ii)**
> *"In order to ensure comparability of such monitoring systems, the results of the systems operated by each Member State shall be expressed as ecological quality ratios for the purposes of classification of ecological status. These ratios shall represent the relationship between the values of the biological parameters observed for a given body of surface water and the values for these parameters in the reference conditions applicable to that body. The ratio shall be expressed as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero."*

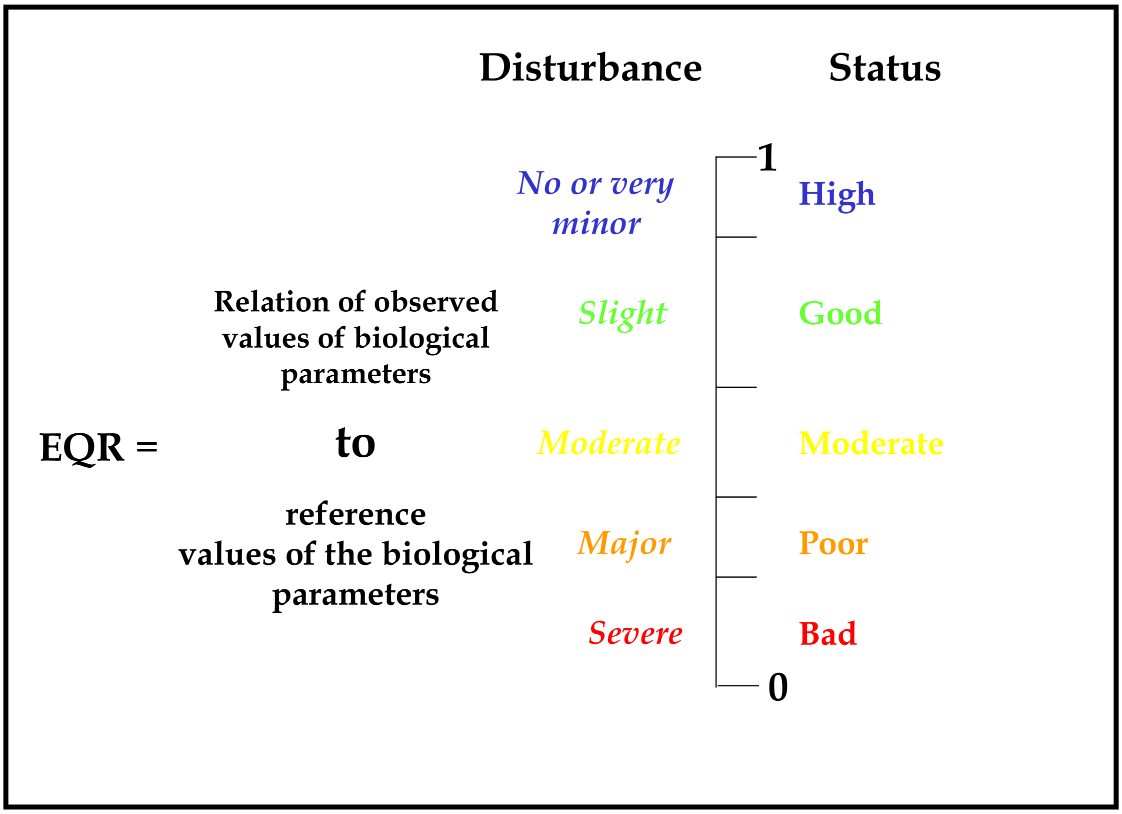
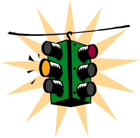



Figure 5.2. Suggested Ecological Quality Ratio according to Annex V, 1.4.1. The size of the bands differ because the boundaries between classes must align with the normative definitions, not a simple percentage. Note that all the deviations are measured from the reference condition.

5.2.3. A most critical issue in implementing the WFD will be setting the borders between the high, good and moderate classes, as this determines whether management action is necessary.

**Annex V 1.4.1.(iii)**
*"The value for the boundary between the classes of high and good status, and the value for the boundary between good and moderate status shall be established through the intercalibration exercise…"*

| | |
|---|---|
|  | **Look out!** The borders between high and good status and good and moderate status will be set as part of the Intercalibration exercise to be carried out by the Member States. The role of the Commission is to facilitate the information exchange between the Member States. More information on intercalibration can be found in the Intercalibration Guidance. |

5.2.4. Definitions are given for each of the quality elements at high, good and moderate status in Annex V tables 1.2.3 and 1.2.4. These definitions can therefore be used to help determine whether a quality element is affected by very minor, slight or moderate anthropogenic influences. The preliminary description of high and good ecological status will, to a large extent, have to rely on existing monitoring data and pressure information in combination with risk assessments. It will be extremely difficult to define the difference between very minor and slight disturbance before the results of monitoring programmes are available.

5.2.5. Environmental objectives are set for water bodies as laid out in Article 4 of the Directive. These are summarised below:

**Article 4(1)(a)(i) No Deterioration**
*"… to prevent deterioration of the status of all bodies of surface water…"*

**Article 4(1)(a)(ii) Good Status – Default Objective**
*"Member States shall protect, enhance and restore all bodies of surface water"…"with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of this Directive…"*

**Article 4(1)(a)(iii) Good Ecological Potential**
*"Member states shall protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status at the latest 15 years from the date of entry into force of this Directive….."*

**Article 4(1)(c) Protected Areas**
*"for protected areas*
*Member States shall achieve compliance with any standards and objectives at the latest 15 years after the date of entry into force of the Directive, unless otherwise specified in the Community legislation under which the individual protected areas have been established."*

**Article 4(4) Good Status with an Extended Deadline Derogation**
*"The deadlines"…"may be extended for the purposes of phased achieved of the objectives for bodies of water, provided that no further deterioration occurs in the status of the affected body of water when all of the following conditions are met…"*

**Article 4(5) Less Stringent Environmental Objectives Derogation**
*"Member States shall 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 of the following objectives are met…"*

5.2.6. The results of classification will be used alongside the requirements of Annex II to evaluate the risk of a water body failing its objectives (figure 5.3).

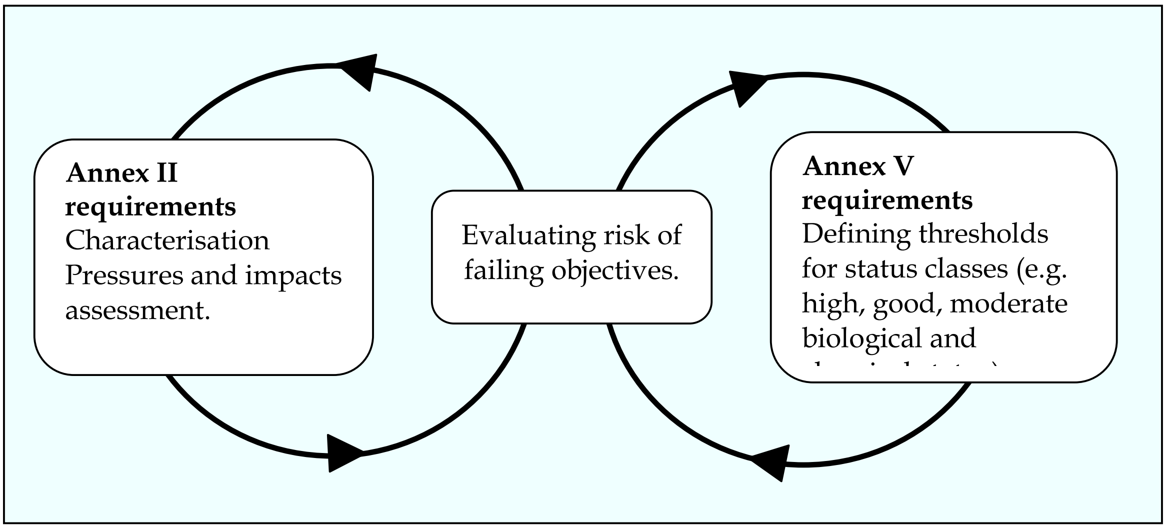



Figure 5.3. The iterative evaluation of the risk of failing objectives.

## 5.3. BASIC PRINCIPLES UNDERPINNING CLASSIFICATION

<u>Precautionary Principle</u>

> **Preamble (11)**
> *As set out in Article 174 of the Treaty, the Community policy on the environment is to contribute to pursuit of the objectives of preserving, protecting and improving the quality of the environment, in prudent and rational utilisation of natural resources, and to be based on the precautionary principle and on the principles that preventive action should be taken, environmental damage should, as a priority, be rectified at source and that the polluter should pay.*

5.3.1. The EC Treaty sets out the general principles of environmental policy including the precautionary principle. The precautionary principle underpins all environmental legislation.

<u>One Out, All Out Principle</u>

5.3.2. The classification scheme must apply the one-out all-out principle. This means that the ecological status of the water body equates to the lower status of either the biological quality elements or the physico- chemical elements

> **Annex V 1.4.2.(i)**
> *"For surface water categories, the ecological status classification for the body of water shall be represented by the lower of the values for the biological and physico-chemical monitoring results for the relevant quality elements classified".*

## 5.4. Quality Assurance and Expert Judgment

5.4.1. The sources of uncertainty in the classification of ecological status fall into the following categories:

- **Natural Spatial Variability** Within each water body there will be spatial heterogeneity in the microhabitats. This means that, for example, taxonomic richness and composition or the concentration of a contaminant within sediments can vary within the sampling location;
- **Natural Temporal Variability** The taxa present or contaminant in biota at a site will vary naturally over time.
- **Biological Sampling and Analytical Errors.** When e.g. sorting the material in a new macro invertebrate sample and identifying the taxa, some taxa may be missed or misidentified.
- **Chemical Sampling and Analytical Errors.** For chemical quality elements the errors associated with different analytical techniques may vary for the same substance;

5.4.2. Any of these errors or variability may lead to misclassification.

5.4.3. Confidence in the overall classification requires confidence in the

- sampling process,
- analysis, and
- classification.

The Directive gives a clear message on the importance of quality assurance at all stages in the classification process.

Sampling and Analysis

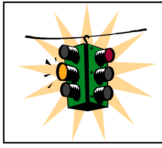
5.4.4. In recognition that different sampling methods and analysis can produce incomparable results, the Directive also specifies the use of ISO/CEN standards, or other national or international standards, where available.

> **Annex V 1.3.6. Standards for the Monitoring of Quality Elements**
> *"Methods used for the monitoring of type parameters shall conform to the international standards listed below or such other national or international standards which will ensure the provision of data of an equivalent scientific quality and comparability."*

5.4.5. To date there are few ISO/CEN standards applicable to the marine environment. However, there is a wealth of international standards, monitoring methods and guidelines available that have been developed by the marine conventions (OSPAR, HELCOM, AMAP, UNEPMAP), or ICES. More information on this is given in the CIS 2.7 Guidance on Monitoring.

5.4.6. Quality assurance systems are well developed for some of the marine chemistry determinands through the QUASIMEME Scheme, though not all of the WFD priority substances are covered at present.

5.4.7. BEQUALM is a Europe wide scheme for quality assurance in marine biological effects measurement. The scope of this scheme is being developed further.

| | |
|---|---|
|  | **Look out!** Given the difficulties and expense involved in sampling the marine environment, Member States need to ensure excellent quality assurance and control throughout the sampling and analysis process. |

Expert Judgement

5.4.8. In addition to good quality assurance in sampling and analysis, expert judgement will be extremely important in the development of classification tools and in the preliminary 2004 assessment (figure 5.4).

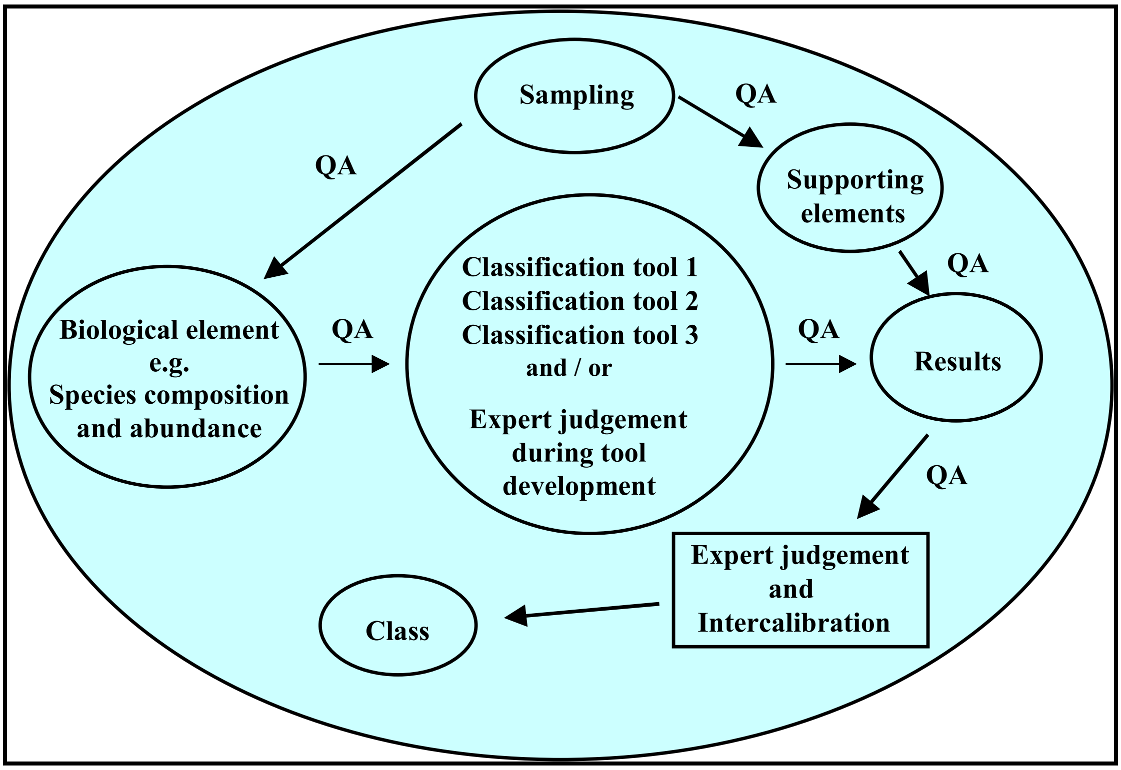



Figure 5.4. The importance of quality assurance and the use of expert judgement through the whole classification process.

**Annex V 1.3.4 Frequency of Monitoring**
*"Frequencies shall be chosen to achieve an acceptable level of confidence and precision. Estimates of confidence and precision attained by the monitoring system shall be stated in the river basin management plan."*

5.4.9. In order to quantify the level of confidence, the errors associated with each classification method must be quantified. For some of the biological quality elements there is no or little information on spatial or temporal variability.

5.4.10. Until there is a better understanding of spatial and temporal variability in the marine environment along with adequate marine biological quality control schemes, expert judgement will play an important role in classification.

## 5.5. CLASSIFICATION OF THE BIOLOGICAL QUALITY ELEMENTS

**Phytoplankton**

5.5.1. The classification of phytoplankton in transitional and coastal waters must be based upon:
- composition
- abundance
- biomass.

The Directive also mentions transparency conditions and frequency and intensity of blooms.

5.5.2. The WFD presents definitions of phytoplankton at high, good and moderate status.

## Transitional Waters Annex V, 1.2.3.

| *High status* | *Good status* | *Moderate Status* |
|---|---|---|
| *The composition and abundance of the phytoplanktonic taxa are consistent with undisturbed conditions.*<br><br>*The average phytoplankton biomass is consistent with the type-specific physico-chemical conditions and is not such as to significantly alter the type specific transparency conditions.*<br><br>*Planktonic blooms occur at a frequency and intensity which is consistent with the type specific physicochemical conditions.* | *There are slight changes in the composition and abundance of phytoplanktonic taxa.*<br><br>*There are slight changes in biomass compared to the type-specific conditions. Such changes do not indicate any accelerated growth of algae resulting in undesirable disturbance to the balance of organisms present in the water body or to the physico-chemical quality of the water.*<br><br>*A slight increase in the frequency and intensity of the type specific planktonic blooms may occur.* | *The composition and abundance of phytoplanktonic taxa differ moderately from type specific conditions.*<br><br>*Biomass is moderately disturbed and may be such as to produce a significant undesirable disturbance in the condition of other biological quality elements.*<br><br>*A moderate increase in the frequency and intensity of planktonic blooms may occur. Persistent blooms may occur during summer months.* |

## Coastal Waters Annex V, 1.2.4.

| *High status* | *Good status* | *Moderate Status* |
|---|---|---|
| *The composition and abundance of the phytoplanktonic taxa are consistent with undisturbed conditions.*<br><br>*The average phytoplankton biomass is consistent with the type-specific physico-chemical conditions and is not such as to significantly alter the type specific transparency conditions.*<br><br>*Planktonic blooms occur at a frequency and intensity which is consistent with the type specific physico-chemical conditions.* | *The composition and abundance of planktonic taxa show slight signs of disturbance.*<br><br>*There are slight changes in biomass compared to the type-specific conditions. Such changes do not indicate any accelerated growth of algae resulting in undesirable disturbance to the balance of organisms present in the water body or to the quality of the water.*<br><br>*A slight increase in the frequency and intensity of the type specific planktonic blooms may occur.* | *The composition and abundance of phytoplanktonic taxa show signs of moderate disturbance.*<br><br>*Algal biomass is substantially outside the range associated with type-specific conditions, and is such as to impact upon other biological quality elements.*<br><br>*A moderate increase in the frequency and intensity of planktonic blooms may occur. Persistent blooms may occur during summer months.* |

**Other aquatic flora:**

5.5.3. The classification of aquatic fauna in transitional and coastal waters must be based upon:
- composition
- abundance.

The Directive also mentions the presence and absence of disturbance sensitive taxa.

5.5.4. The Directive separates transitional and coastal waters for plants.

5.5.5. The WFD presents separate normative definitions for macroalgae and angiosperms at high, good and moderate status in transitional waters.

**Annex V, 1.2.3.**

| ***High status*** | ***Good status*** | ***Moderate status*** |
|---|---|---|
| ***Macroalgae:*** | | |
| *The composition of macroalgal taxa is consistent with undisturbed conditions.*<br><br>*There are no detectable changes in macroalgal cover due to anthropogenic activities.* | *There are slight changes in the composition and abundance of macroalgal taxa compared to the type-specific communities. Such changes do not indicate any accelerated growth of phytobenthos or higher forms of plant life resulting in undesirable disturbance to the balance of organisms present in the water body or to the physico-chemical quality of the water.* | *The composition of macroalgal taxa differs moderately from type-specific conditions and is significantly more distorted than at good quality.*<br><br>*Moderate changes in the average macroalgal abundance are evident and may be such as to result in an undesirable disturbance to the balance of organisms present in the water body.* |
| ***Angiosperms:*** | | |
| *The taxonomic composition corresponds totally or nearly totally to undisturbed conditions.*<br><br>*There are no detectable changes in angiosperm abundance due to anthropogenic activities.* | *There are slight changes in the composition of angiosperm taxa compared to the type-specific communities.*<br><br>*Angiosperm abundance shows slight signs of disturbance.* | *The composition of the angiosperm taxa differs moderately from the type-specific communities and is significantly more distorted than at good quality.*<br><br>*There are moderate distortions in the abundance of angiosperm taxa.* |

5.5.6. The WFD presents joint normative definitions for macroalgae and angiosperms in coastal waters at high, good and moderate status.

**Annex V 1.2.4.**

| *High status* | *Good status* | *Moderate status* |
|---|---|---|
| *All disturbance sensitive macroalgal and angiosperm taxa associated with undisturbed conditions are present.*<br><br>*The levels of macroalgal cover and angiosperm abundance are consistent with undisturbed conditions.* | *Most disturbance sensitive macroalgal and angiosperm taxa associated with undisturbed conditions are present.*<br><br>*The level of macroalgal cover and angiosperm abundance shows slight signs of disturbance.* | *A moderate number of the disturbance sensitive macroalgal and angiosperm taxa associated with undisturbed conditions are absent.*<br><br>*Macroalgal cover and angiosperm abundance is moderately disturbed and may be such as to result in an undesirable disturbance to the balance of organisms present in the water body.* |

**Benthic invertebrate fauna**

5.5.7. The classification of benthic invertebrate fauna in transitional and coastal waters must be based upon:
- composition
- abundance.

It also mentions both disturbance sensitive taxa and taxa indicative of pollution.

5.5.8. The WFD presents normative definitions of benthic invertebrate fauna at high, good and moderate status.

**Annex V 1.2.3. & 1.2.4.**

| *High status* | *Good status* | *Moderate status* |
|---|---|---|
| *The level of diversity and abundance of invertebrate taxa is within the range normally associated with undisturbed conditions.*<br><br>*All the disturbance-sensitive taxa associated with undisturbed conditions are present.* | *The level of diversity and abundance of invertebrate taxa is slightly outside the range associated with the type-specific conditions.*<br><br>*Most of the sensitive taxa of the type-specific communities are present.* | *The level of diversity and abundance of invertebrate taxa is moderately outside the range associated with the type-specific conditions.*<br><br>*Taxa indicative of pollution are present*<br><br>*Many of the sensitive taxa of the type specific communities are absent.* |

**Fish fauna**

5.5.9. The classification of fish fauna is only required in transitional waters and must be based upon:
- composition
- abundance.

It also mentions disturbance sensitive species

5.5.10. The WFD presents normative definitions of the fish fauna at high, good and moderate status for **transitional waters** (Annex V, 1.2.3, 1.2.4).

**Annex V 1.2.3.**

| *High status* | *Good status* | *Moderate status* |
|---|---|---|
| *Species composition and abundance is consistent with undisturbed conditions.* | *The abundance of the disturbance-sensitive species shows slight signs of distortion from type specific conditions attributable to anthropogenic impacts on physico-chemical or hydromorphological quality elements.* | *A moderate proportion of the type-specific disturbance-sensitive species are absent as a result of anthropogenic impacts on physicochemical or hydromorphological quality elements.* |

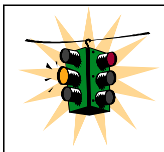
## 5.6. CLASSIFICATION OF THE HYDROMORPHOLOGICAL AND PHYSICO-CHEMICAL SUPPORTING ELEMENTS

5.6.1. The hydromorphological and physico-chemical elements are supporting elements for the classification of ecological status.

**Hydromorphological Elements**

5.6.2. The classification of hydromorphological quality elements in transitional and coastal waters must be based upon:

| **Annex V, 1.1.3.** | **Annex V,1.1.4.** |
|---|---|
| ***Transitional waters (Annex V, 1.1.3)*** | ***Coastal waters (Annex V, 1.1.4)*** |
| *Morphological conditions:*<br>*depth variation*<br>*quantity, structure and substrate of the bed*<br>*structure of the inter-tidal zone*<br>*Tidal regime:*<br>*freshwater flow*<br>*wave exposure* | *Morphological conditions:*<br>*depth variation*<br>*structure and substrate of the coastal bed*<br>*structure of the inter-tidal zone*<br>*Tidal regime:*<br>*direction of dominant currents*<br>*wave exposure* |



**Look out!** Hydromorphological elements are only included in the classification of high ecological status. For a waterbody to be at high status the biological, hydromorphological and physico-chemical quality elements must be at high status (figure 5.1).

5.6.3. The WFD presents definitions of the hydromorphological quality elements at high, good and moderate status for **transitional waters** (Annex V, 1.2.3.):

### Annex V 1.2.3.

| *High status* | *Good status* | *Moderate status* |
|---|---|---|
| *Morphological conditions:* | | |
| *Depth variations, substrate conditions, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to undisturbed conditions.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |
| *Tidal regime:* | | |
| *The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |

5.6.4. The WFD presents definitions of the hydrological quality elements at high, good and moderate status for **coastal waters** (Annex V, 1.2.4):

### Annex V 1.2.4.

| ***High status*** | ***Good status*** | ***Moderate status*** |
|---|---|---|
| ***Morphological conditions:*** | | |
| *The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |
| ***Tidal regime:*** | | |
| *The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |

**Physico-Chemical Elements**

5.6.5. The WFD presents normative definitions of ecological status classifications (Annex V, 1.1.3, 1.1.4). For the purposes of classification of the physico-chemical quality elements in transitional and coastal waters, the following is to be included:

*Annex V 1.1.3. and 1.1.4.*

**General:**

- *Transparency*
- *Thermal conditions*
- *Oxygenation conditions*
- *Salinity*
- *Nutrient conditions*

**Specific Pollutants:**

- *Pollution by all priority substances identified as being discharged into the body of water*
- *Pollution of other substances identified as being discharged in significant quantities into the body of water*

5.6.6. The WFD presents normative definitions of the physico-chemical elements at high, good and moderate status for **transitional** and **coastal waters** (Annex V, 1.2.3, 1.2.4).

### Annex V 1.2.3. and 1.2.4.

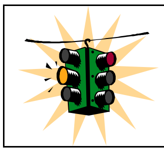
| *High status* | *Good status* | *Moderate status* |
|---|---|---|
| *General conditions:* | | |
| *The physico-chemical elements correspond totally or nearly totally to undisturbed conditions.*<br><br>*Nutrient concentrations remain within the range normally associated with undisturbed conditions.*<br><br>*Temperature, oxygen balance and transparency do not show signs of anthropogenic disturbance and remain within the ranges normally associated with undisturbed conditions.* | *Temperature, oxygenation conditions and transparency do not reach levels outside the ranges established so as to ensure the functioning of the ecosystem and the achievement of the values specified above for the biological quality elements.*<br><br>*Nutrient concentrations do not exceed the levels established so as to ensure the functioning of the ecosystem and the achievement of the values specified above for the biological quality elements.* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |
| ***Specific synthetic pollutants:*** | | |
| *Concentrations close to zero and at least below the limits of detection of the most advanced analytical techniques in general use.* | *Concentrations not in excess of the standards set in accordance with the procedure detailed in section 1.2.6 without prejudice to Directive 91/414/EC and Directive 98/8/EC. (<environmental quality standard).* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |
| ***Specific non synthetic pollutants:*** | | |
| *Concentrations remain within the range normally associated with undisturbed conditions (background levels).* | *Concentrations not in excess of the standards set in accordance with the procedure detailed in section 1.2.6. without prejudice to Directive 91/414/EC and Directive 98/8/EC. (<environmental quality standard).* | *Conditions consistent with the achievement of the values specified above for the biological quality elements.* |

<u>Specific Pollutants</u>

5.6.7. Under 'Chemical and physico-chemical elements supporting the biological elements', the Directive refers to specific pollutants. These are understood to mean substances not included in the chemical status assessment i.e. priority substances for which European EQSs have not yet been agreed or other substance identified as being discharged in significant quantities into the body of water. These may be described as

a) Specific synthetic pollutants
b) Specific non-synthetic pollutants

5.6.8. The word "specific" indicates that not all pollutants listed in Annex VIII, points 1-9. (or any others) must be considered.



**Look out!** The guidance document produced by CIS working group 2.1 (IMPRESS) provides guidance on how specific pollutants are to be identified in the pressures and impacts analysis.

5.6.9. Specific pollutants are included in ecological status and accordingly there are five class categories. The definitions for specific pollutants at high status are stringent (Annex V tables 1.2.3. and 1.2.4.).

5.6.10. This definition has been subject to a long political debate (*cf.* OSPAR) and it is clear that no scientific specification can be given for terms such as "close to zero". These issues are being examined by a sub-group of the Expert Advisory Forum on Priority Substances (EAF PS) dealing with Analysis and Monitoring (AMPS). It is recommended that the approach adopted by the EAF PS, AMPS group, be adopted for substances for which national detection limits and background concentrations are to be set.

## 5.7. The Relationship between Chemical and Ecological Status

5.7.1. Chemical status refers only to those priority substances for which Environmental Quality Standards (EQSs) are set at the European level.

**Annex V, 1.4.3**
*"Where a body of water achieves compliance with all the environmental quality standards established in Annex IX (existing List I substances, Dangerous Substances Directive), Article 16 (Priority Substances, Annex X) and under other relevant Community legislation setting environmental quality standards it shall be recorded as achieving good chemical status. If not, the body shall be recorded as failing to achieve good chemical status."*

5.7.2. Chemical status is only divided into 2 classes; good status and bad status and good status is defined as being less than the EQS.

<u>Relationship between Chemical Status and Ecological Status</u>

5.7.3. Once European EQSs have been established, those substances are **NOT** included in ecological status. There are currently 18 of these from the existing Dangerous Substance Directive. More will be added to this list by the end of 2003 for the Annex X. These EQSs are to be agreed by the Expert Advisory Forum on Priority Substances. Until European EQSs have been agreed, priority substances are part of the ecological status.

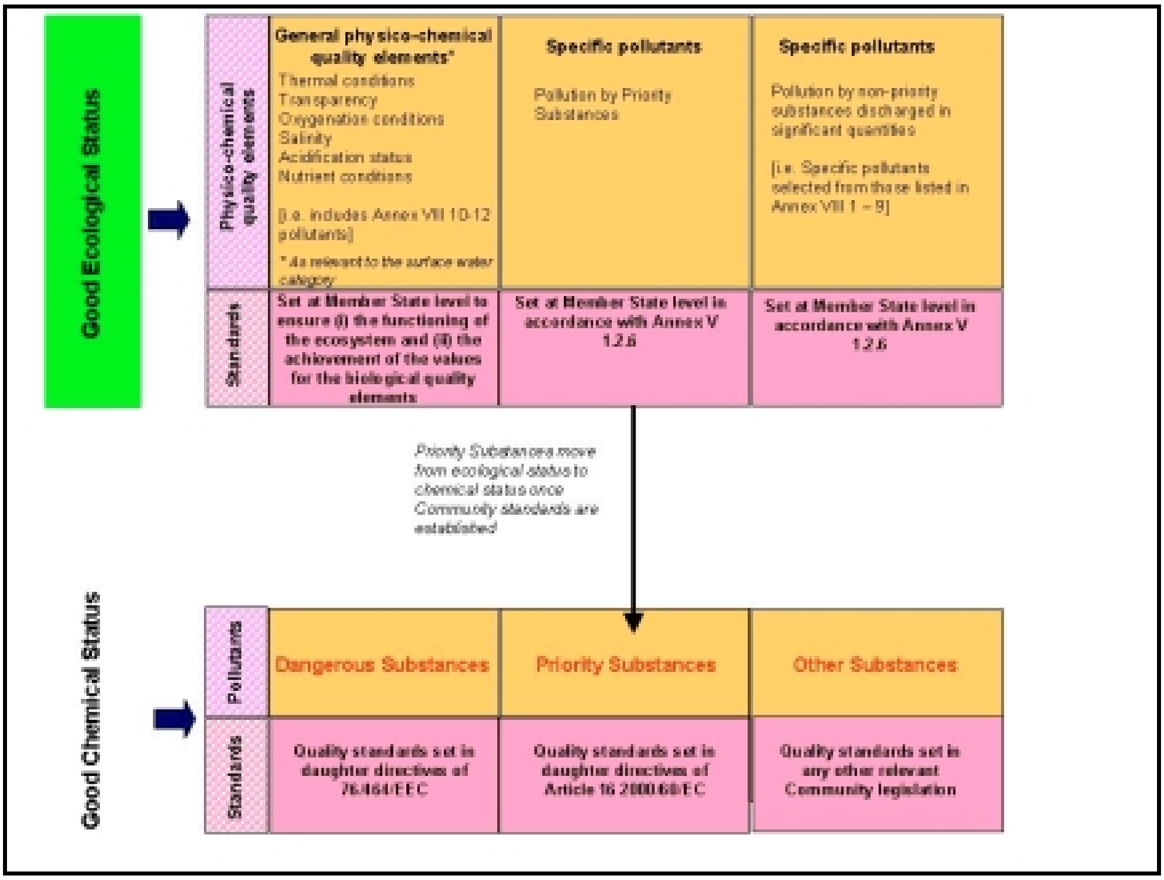



Figure 5.5. The relationship between good ecological status and good chemical status.

# Section 6 - Toolbox

## 6.1. INTRODUCTION

6.1.1. This toolbox contains examples of existing classification schemes and tools for transitional and coastal waters that may be suitable for testing by Member States.

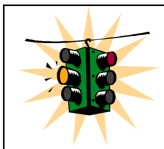
6.1.2. It must be stressed that very little testing of these tools for the purposes of the WFD has been completed yet. Member States are encouraged to test existing classification schemes and tools in their ecoregion and share the results and knowledge gained with experts from other Member States.

## 6.2. PHYTOPLANKTON

**Tools currently available in Member States to assess the ecological status of phytoplankton:**

6.2.1. Several tools for classifying the ecological status of phytoplankton in transitional and coastal waters are presented here although no single suggested tool meets all the requirements of the Directive.

6.2.2. **OSPAR – Comprehensive Procedure**
The OSPAR Comprehensive Procedure provides a framework for classifying the trophic status of marine waters into three classes; non-problem, problem and potential problem areas. The criteria include the maximum and mean chlorophyll *a* concentrations (a surrogate for algal biomass) and the presence / concentration of nuisance / toxic algae species, providing some measure of composition and abundance.



**Look out!** Further information about the OSPAR Comprehensive Procedure can be found in Section 6.6 of the toolbox under classification schemes.

6.2.3. **Tentative classification tool for phytoplankton under development in France by IFREMER.**
As part of a global classification tool for transitional and coastal waters, France is currently developing a classification tool for phytoplankton, building on the work undertaken for the Shellfish Hygiene Directive.

6.2.4. **EC Shellfish Hygiene Directive: (Council Directive 91/492/EEC of 15 July 1991 laying down the health conditions for the production and the placing on the market of live bivalve molluscs.)**

The purpose of this Directive is to protect public health and includes a requirement to monitor the presence of plankton containing marine biotoxins. Periodic sampling is required to detect changes in the composition and distribution of specific plankton that produce biotoxins. When threshold values are reached, more intensive sampling is undertaken.

<u>Do the available tools available fulfill the requirements of the Directive?</u>

6.2.5. **OSPAR Comprehensive Procedure**

The Comprehensive Procedure is not fully compatible with the requirements of the Directive, but there is the potential to develop the criteria further to fit the Directive's requirements. The procedure includes algae composition but focuses on nuisance and toxic algae rather than the whole community. It also includes a measure of biomass in terms of chlorophyll *a*, which may not be sensitive enough in many areas. The Comprehensive Procedure may have to be adapted for region-specific circumstances, but clearly could be used as a framework for further development of classification tools under the WFD.

6.2.6. **Tentative classification scheme for phytoplankton under development in France by IFREMER**

The threshold values for nuisance/toxic algal species are strongly associated with detecting diarrhetic and paralytic shellfish poisoning species, rather than any measure of ecological status. The links between the two have been the subject of debate among marine scientists for many years. It is clear that the links will need to be further explored. This French classification tool which is under development takes into account the abundance of phytoplankton species that are toxic for both human health and flora and fauna as well as those species that are used as a eutrophication indicator. The tool does not include measures of biomass of the population.

6.2.7. Summary of the **tentative classification tool for phytoplankton under development in France by IFREMER**.

**1. Phytoplankton species toxic for human health**

Species: those species producing DSP, PSP and ASP toxins. *Dinophysis* spp., *Alexandrium minutum, Gymnodinium catenatum, Gymnodinium breve, Prorocentrum minimum.*

Thresholds: DSP negative results of biological tests
PSP 80 µg.100g$^{-1}$
ASP 20 g. g$^{-1}$ domoic acid

Indicator: Number of weeks of positive results over a 5-year moving period.

Classification:

Table 6.1. Classification of number of positive results of DSP and PSP over a 5 year moving period.

| High (blue) | Good (green) | Moderate (yellow) | Poor (orange) | Bad (red) |
|---|---|---|---|---|
| 0 | 1-5 | 6-15 | 16-25 | >25 |

Table 6.2. Classification of number of positive results of ASP over a 5 year moving period.

| High (blue) | Good (green) | Moderate (yellow) | Poor (orange) | Bad (red) |
|---|---|---|---|---|
| 0 | 1 | 2-3 | 4-5 | >5 |

**2. Phytoplankton species toxic for the flora or the fauna:**

Species: *Gymnodinium* cf. *nagasakiense (= G. nagasakiense, G. aureolus, G. mikimotoi), G. splendens (=G. sanguineum), G. breve (=Ptychodiscus brevis), Gyrodinium spirale, Prorocentrum micans (= P. arcuatum = P gibbosum)* (main species) + *P. minimum (= P. balticum = P. cordatum)* (high proportion species), *P. gracile, P. lima (=P marinum); P. triestum (=P. redfieldii)* (low proportion species) + *P. compressum, P. mexicanum* (sporadic species), *Dictyocha* sp., *Heterosigma carterae, Fibrocapsa japonica, Chrysochromulina* spp.

Thresholds: A bloom occurrence means >10$^{6}$ cell.l$^{-1}$

Indicator: Total number of bloom occurrences over a 5 years moving period.

Classification:

Table 6.3. Classification of the number of blooms of phytoplankton species toxic for the flora or fauna over a 5 year moving period.

| High (Blue) | Good (Green) | Moderate (yellow) | Poor (Orange) | Bad (red) |
|---|---|---|---|---|
| 0 | 1-2 | 3-5 | 6-10 | >10 |

**3. Phytoplankton species used as a eutrophication indicator**

Species: All species

Thresholds: A bloom occurrence means >10$^{5}$ cell.l$^{-1}$

Indicator: Total number of bloom occurrences over a 5 years moving period.

Classification:

Table 6.4. Classification of the number of blooms of phytoplankton species used as an eutrophication indicator over a five year moving period.

| High (Blue) | Good (Green) | Moderate (yellow) | Poor (Orange) | Bad (red) |
|---|---|---|---|---|
| 0-10 | | 11-20 | 21-40 | >40 |

## 6.3. Other Aquatic Flora

Tools currently available in Member States to classify other aquatic flora:

6.3.1. The **OSPAR Comprehensive Procedure** has criteria for macrophytes which are region specific and include a shift from long-lived to short-lived nuisance species. These regional criteria have still to be developed.

6.3.2. **Sweden** has a classification system covering both chemical elements as well as biota. Below is presented some examples from the Swedish classification scheme (angiosperms and rocky shore communities).

6.3.3. **Greece** is developing a classification tool for seaweed and seagrasses.

6.3.4. **Spain** has developed a classification tool for rocky shore communities using multivariate methods.

Do the tools available fulfill the requirements of the Directive?

6.3.5. The OSPAR Criteria for macrophytes could be developed further on a regional basis to take into account WFD requirements.

6.3.6. The Swedish classification tool does not fulfill all the criteria in the WFD, but the tool is being adjusted at the moment and could be tested for the relevant ecoregions.

6.3.7. The Greek tool compares composition and abundance of sensitive and non-sensitive species and could be tested in more areas.

6.3.8. The Spanish tool fulfils the criteria and could be tested in more areas.

6.3.9. Summary of the **Swedish Classification Tool for Angiosperms and Rocky Shore Communities** (Swedish Environmental Protection Agency 2000). A full presentation can be downloaded at: www.environ.se

The term "macrovegetation" refers to plants that are large enough to be readily visible to the naked eye. The species composition of vegetation is affected by two aspects of eutrophication – an increased supply of nutrients, and increased turbidity (increasing number of particles). In some cases, the distribution and species composition of the vegetation can also be influenced by thick layers of ice, other pollutants, wave actions from heavy boat traffic, etc.

The correct interpretation of macrovegetation characteristics requires knowledge of natural variations in the flora associated with various parts of a coast. These variations depend to a large extent on differences in salinity. Also, there are usually important differences between the vegetation of hard bottoms (rocks, boulders, etc.) and that of soft bottoms (sand, clay, mud, etc.). Furthermore, the vegetation of exposed bottoms in outer archipelagos and along open coasts often has a different character from that of more sheltered areas.

The examples below are from the Skagerrak/Kattegat area. The scheme also covers the Baltic proper and the Bothnian Sea.

No special reference values are provided, but the conditions described in class 1 can in most cases be used as a basis for comparisons. Class 1, which is based on data from historical sources and more-or-less pristine areas, is intended to represent natural conditions.

Assessments of the macrovegetation's current conditions should be based on data gathered during the summer.

For the Skagerrak/Kattegat, there are three classifications, which can be used separately or together. A basic precondition for all three is that the salinity of the water must be greater than five parts per thousand.

Table 6.5. Classification of common eelgrass (*Zostera marina*) beds on soft bottoms in the Skagerrak / Kattegat.

| **Class** | **Level** | **Description** |
|---|---|---|
| **1** | Little or none | Dense growth of common eelgrass *(Zostera marina),* which occurs at depths greater than 6 metres. |
| **2** | Moderate | Abundant growth of common eelgrass down to depths of 3 metres, sparse growth to depths of 6 metres. |
| **3** | Significant | Common eelgrasses present to depths of 3 metres; loose filamentous algae also common. |
| **4** | Serious | Isolated specimens of common eelgrass; loose filamentous algae dominate. |
| **5** | Eradication | "Dead" bottom areas, or absence of stationary vegetation. Possibly masses of loose algae and/or bottom layer of luminous white sulphurous bacteria (thread-like or downy substance). |

Table 6.6. Classification of sheltered to moderately exposed hard bottom communities in the Skagerrak / Kattegat.

| Class | Level | Description |
|---|---|---|
| **1** | Little or none | Dense stands of bladder wrack *(Fucus vesiculosus)* and/or *Ascophyllum nodosum*, (Knobbed or knotted wrack). Epiphytes consist primarily of brown and red algae, and only to a limited extent of green algae or the odd filter feeders. (Green algae may grow more abundantly on cliffs with large quantities of bird droppings.) The undervegetation is varied. In exposed areas, the bladder wrack may lack bladders and may thus be confused with *Fucus evanescens*. |
| **2** | Moderate | Dense stands of *Fucus vesiculosus* and/or *Ascophyllum nodosum*, which are partly covered with epiphytic green algae. Also present are *Fucus evanescens* and the red alga *Porphyra purpurea*. |
| **3** | Significant | Sparse stands of bladder wrack. *Fucus evanescens* often more abundant, together with belts of green algae. *Porphyra purpurea* may also be common. The bladder wrack is covered with thick growths of green algae and/or filtering animal species. |
| **4** | Serious | Sparsely distributed specimens of *Fucus vesiculosus* or *Fucus evanescens*, often covered with thick growths of green algae and/or filtering animal species. Loose drifting algae may also be common. |
| **5** | Eradication | Perennial brown algae such as bladder wrack are lacking entirely. Vegetation is dominated by stands of green algae or drifting carpets of algae, usually of the genera *Enteromorpha* (grass kelp) and *Blidingia*, but also *Cladophora*. Alternatively, no algae larger than 1 cm are present; instead, there are "blue-green algae" (cyanobacteria) and other bacteria. |

This classification applies to the vegetation of rocky bottoms to depths of 0–1 metre. Inventories should be made during the period 1 June–31 August. Areas affected by heavy layers of ice or intensive boat traffic should not be used.

Table 6.7. Classification of exposed hard bottom communities in the Skagerrak / Kattegat.

| Class | Level | Description |
|---|---|---|
| **1** | Little or none | Macroalgae grow at depths greater than 25 metres |
| **2** | Moderate | Macroalgae grow at depths of at least 20 metres. |
| **3** | Significant | Macroalgae grow at depths of up to 10–25 metres |
| **4** | Serious | Macroalgae grow at depths of up to 5 metres. Perennial species are present, but short-lived species dominate. |
| **5** | Eradication | Macroalgae grow at maximum depths of up to 1–2 metres. Perennial species are completely lacking. |

This classification applies to the vegetation of hard bottoms to depths of 0–20 metres. Inventories require diving, and should be taken during the period 1 April–31 October. Class 1 requires sites that are at least 25 metres deep or have well-developed vegetation at 20 metres.

6.3.10. Summary of the **Greek classification tool for seaweed and seagrasses** (Orfanidis *et al.*, 2002)**.**

A model to estimate the ecological status and identify restoration targets of transitional and coastal waters was developed. Marine benthic macrophytic species (seaweeds, seagrasses) were used to indicate shifts in the aquatic ecosystem from the pristine state with late-successional species (Ecological State Group (ESG) I) to the degraded state with opportunistic (ESG II) species. The first group comprises species with a thick or calcareous thallus, low growth rates and long life cycles (perennials) whereas the second group includes sheet-like and filamentous species with high growth rates and short life cycles (annuals). Seagrasses were included in the first group, whereas Cyanophyceae and species with a coarsely branched thallus were included in the second group.

The evaluation of ecological status into five categories from high to bad includes a cross comparison in a matrix of the ESG and a numerical scoring system. The model could allow comparisons, ranking and setting of priorities at regional and national levels fulfilling the requirements of the WFD. A successful application of the model was realised in selected lagoons of the Macedonian & Thrace region (North Greece) and in the Saronikos coastal ecosystems (Central Greece).

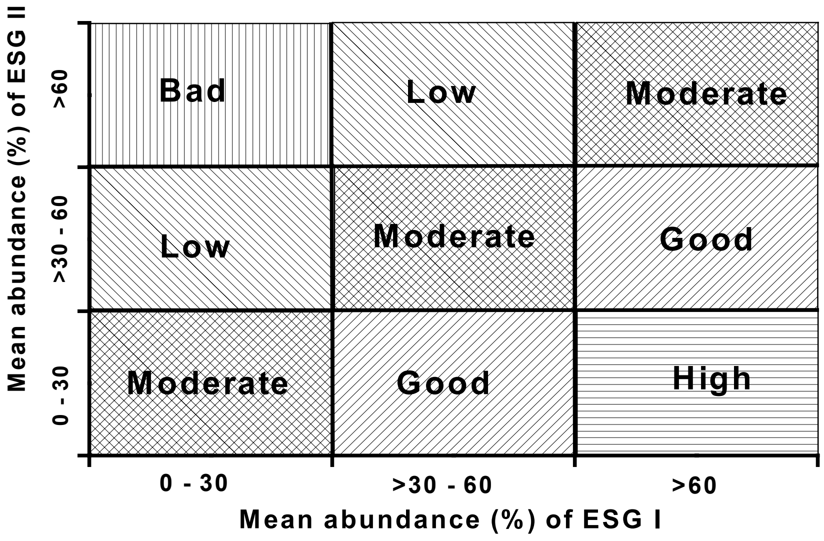



Figure 6.1. A matrix based on the mean abundance (%) of ESGs to determine the ecological status of transitional and coastal waters.

6.3.11. Summary of the **Spanish classification tool for littoral benthic communities using multivariate analysis (**Agència Catalana de l'Aigua and Centre d'Estudis Avançats de Blanes 2002)**.**

A combination of sampling information, the species-coverage and species-biomass data matrices are developed, prior to carrying out the two- or three-dimensional cluster aggregation ordering analyses. Numerous multivariate analyses and hierarchical classification systems can be used. Each of them has advantages and weaknesses and it is up to each researcher to select the method that can best help to interpret the data. One of the multivariate analyses is the PCA (Principal Components Analysis), which uses the Euclidean metric distance, giving too much importance to the abundance/biomass of the species and is useful only if the samples are very similar. The AC (Analysis of Correspondences) uses the $X^2$ distance, which solves the problem since it gives relatively greater importance to the species with little representation. But it has a double weakness. On one side, the species that appear in very few samples but are very abundant distort the representation, and, on the other, if the samples are located along a strong gradient, the second axis is often a function of the first and then the samples are distributed in the factorial space in the form of an arc (Guttman effect). The DCA (Detrended Correspondence Analysis) has the advantages of the AC (uses the $X^2$ distance) but avoids the relationship between the second and the first axes, avoiding the Guttman effect. Hence, we have considered that it is the method that best suits our data. Another of the methods in use is the MDS (Multidimensional Scaling) and, more specifically, the non-parametric MDS, recently applied to biological data. One of the advantages of this method is that it requires very few assumptions about the data and the interrelation among samples to apply it effectively. It is a very flexible method that uses ranges of similarity among samples. This new method has not yet been applied to the environmental quality data on the Catalan coast.

The statistics packages that can be used to apply the various multivariate analyses are the CANOCO (Ter Braak, 1988) and the PRIMER (Clark & Warwick, 1994). The objective of hierarchical classification systems is to group the objects in classes or homogenous groups, so that each group is differentiated from the rest with measurements of similarity or of distance among samples. The process builds up increasingly larger groups that include some classes within others. It is presented in the form of a classification tree or dendrogram. The statistical package that will be used to apply this type of classification system will be the PRIMER (Clark & Warwick, 1994). All the analyses have considered the overall set of species (flora and fauna) and have eliminated all those species that appear in less than 2% of the samples, considering that they are hardly representative of the community.

## 6.4. BENTHIC INVERTEBRATE FAUNA

Tools currently available in Member States to classify benthic invertebrate fauna

6.4.1. **Norway has** a classification tool covering both chemical elements as well as biota.

6.4.2. **Greece** is developing a classification tool for benthic invertebrate fauna.

6.4.3. **Spain** has developed a biotic index to establish the ecological quality of soft bottom benthos. The index has been designed for use with in European estuarine and coastal environments.

6.4.4. The **UK** has started to test the Spanish classification tool within a number of estuaries and this work is to be continued over the forthcoming year.

6.4.5. The **OSPAR Comprehensive Procedure** includes benthic invertebrate fauna as a possible indirect effect of eutrophication in relation to kills in zoobenthos by oxygen depletion and / or long-term changes in zoo-benthos biomass and species composition due to nutrient enrichment (see section 6.6).

Do the tools available fulfill the requirements of the Directive?

6.4.6. All of the existing methods either have limitations to areas they can be used or are not yet widely tested. Methods combining composition, abundance and sensitivity may be the most promising.

### 6.4.7. **Summary of the** Norwegian Classification tool for soft bottom macrofauna and chemical elements (Molvær *et al.*, 1997).

This Norwegian classification tool uses the faunal diversity of soft bottom macrofauna to assess ecological status. The present form of the system has been used since 1997 and a former version was used from 1993. The system also includes chemical elements and harmful substances in biota and will be adjusted to fit the requirements of the WFD.

The faunal diversity is measured by the Shannon-Wiener index (H') (Shannon and Weaver 1963) and the Hurlbert rarefaction method (Hurlbert 1971). Samples must be quantitative, usually taken with a 0.1 $m^2$ grab and the samples are sieved on 1 mm screens. Calculations are carried out using four or five pooled samples representing 0.4-0.5 $m^2$ bottom surface, but is also used for single samples as well.

In addition to fauna the organic content of the sediment is measured in terms of total organic carbon (TOC) using an elemental analyser. The measured values are adjusted for the content of silt and clay (fine fraction) in the sediments. This part of the tool has to be developed further as it does not fit in all areas.

The classification is shown in table 6.8. The class limits have been set using a large number of samples (> 500) from Norwegian waters taken under different environmental conditions as a reference basis. The limit between class II (good conditions) and class III (fair conditions) has been set at the median value for the indices, i.e. such that classes I and II encompass 50 % of the samples and classes III, IV and V the other 50 %. The further separation between classes has been based on the calculation of percentiles. In addition, expert judgement is used to adjust the values according to the environmental conditions.

Table 6.8. The Norwegian system for classification of environmental status with regard to fauna and total organic content (TOC) of soft sediments.

| | | Classes | | | | |
|---|---|---|---|---|---|---|
| | **Parameters** | **I Very Good** | **II Good** | **III Fair** | **IV Bad** | **V Very bad** |
| **Diversity of soft-bottom fauna** | Shannon-Wiener index ($H'_{log2}$) | **>4** | **4-3** | **3-2** | **2-1** | **<1** |
| | Hurlbert's index $ES_{n=100}$ | **>26** | **26-18** | **18-11** | **11-6** | **<6** |
| **Sediments** | TOC (mg/g) | **<20** | **20-27** | **27-34** | **34-41** | **>41** |

6.4.8. Summary of the **Greek classification tool for benthic invertebrate fauna** (Simboura and Zenetos 2002).

The general scheme proposed for the implementation of WFD requirements into Greek coastal waters with the use of macrozoobenthic quality element, comprises of three steps leading to the typological justification of water body types and the classification of ecological quality (Simboura & Zenetos, 2002). These steps are briefly described bellow:

**a) Definition of habitat types.** The outline of the major benthic habitat types occurring in the Mediterranean is essential for linking water body types and benthic habitat types and also for the implementation of classical classification tools as the diversity indices.

**b) Definition of benthic indicator species.** These are species which according to the literature are either sensitive and characterise a given habitat type by their dominance or exclusive presence in the specific habitat, or are tolerant and indicate instability or pollution. Linking sensitive indicator species to a habitat type serves as a biological justification of the typological definition of a given water body.

**c) Development of a new Biotic index (BENTIX).** The new index was developed on the basis of former indices which combine the relative percentages of five ecological groups of species with varying degree of sensitivity to disturbance factors, into a single formula. The innovation of the new index lies in the reduction of the ecological groups from five to three and finally to two as described below. Reducing the number of groups has the advantage of avoiding uncertainty regarding the grouping (two groups instead of five) and also of increasing the simplicity of its calculation.

**Ecological groups:**

**Group 1** (GI). Species belonging to this group are very sensitive to disturbance conditions in general. This group correspond to the k-strategy species, with relatively long life, slow growth and high biomass. Also species indifferent to disturbance always present in low densities with non-significant variations with time are included in this group, as they cannot be considered as tolerant by any degree.

**Group 2** (GII). This group includes species tolerant to disturbance or stress whose populations may respond to enrichment or other sources of pollution by an increase in density (slightly unbalanced situations). This group also includes second-order opportunistic species, or late successional colonisers with r-strategy: species with short life span, fast growth, early sexual maturation and larvae throughout the year.

**Group 3** (GIII). First order opportunistic species (pronounced unbalanced situations), pioneers, colonisers, species tolerant to hypoxia.

The derived formula gives a series of continuous values from 2 to 6, being 0 when the sediment is azoic. By assigning the factor 2 to both groups GII and GIII, the ecological groups are finally reduced to two: the sensitive and the tolerant.

**Bentix Index = {6 X %GI + 2 X (% GII + % GIII)}/100**

A classification system appears as a function of the Bentix Index including five levels of ecological quality. The Bentix Index is independent from the habitat type and the sample size, does not require exhaustive taxonomic effort and is easy in its calculation and use.

Table 6.9. Pollution Classification, Bentix Index and Ecological Status.

| Pollution Classification | BC | Ecological Status |
|---|---|---|
| Normal | $4.5 \leq BC < 6$ | High |
| Slightly polluted, transitional | $3.5 \leq BC < 4.5$ | Good |
| Moderately polluted | $2.5 \leq BC < 3.5$ | Moderate |
| Heavily polluted | $2 \leq BC < 2.5$ | Poor |
| Azoic | 0 | Bad |

6.4.9. Summary of the **Spanish marine Biotic Index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments** (Borja *et al.*, 2000)**.**

The index developed is based on that first used by Glémarec and Hily (1981) and then by Hily (1984), which utilises soft-bottom benthos to construct a biotic index. Hily (1984) and Glémarec (1986) stated that the soft-bottom macrofauna could be ordered in five groups, according to their sensitivity to an increasing stress gradient (i.e. increasing organic matter enrichment). These groups have been summarized by Grall and Glémarec (1997), as outlined below.

**Group I:** Species very sensitive to organic enrichment and present under unpolluted conditions (initial state).
**Group II:** Species indifferent to enrichment, always present in low densities with non-significant variations with time (from initial state, to slight unbalance).
**Group III:** Species tolerant to excess organic matter enrichment. These species may occur under normal conditions, but their populations are stimulated by organic enrichment (slight unbalance situations).
**Group IV:** Second-order opportunistic species (slight to pronounced unbalanced situations). Mainly small sized polychaetes: subsurface deposit-feeders, such as cirratulids.
**Group V:** First-order opportunistic species (pronounced unbalanced situations). These are deposit-feeders, which proliferate in reduced sediments.

The distribution of these ecological groups, according to their sensitivity to pollution stress, provides a biotic index with eight levels, from 0 to 7 (Hily, 1984, Hily *et al*., 1986; Majeed, 1987). Based upon Hily's model (Hily, 1984; Hily *et al*., 1986, Majeed, 1987), and in order to improve the index, a single formula was proposed. This is based upon the percentages of abundance of each ecological group, within each sample, to obtain a continuous index (the Biotic Coefficient, BC), where:

$$\mathbf{BC = \{(0 \times \%GI) + (1.5 \times \%GII) + (3 \times \%GIII) + (4.5 \times \%GIV) + (6 \times \%GV)\}/100}$$

In this way, use of the Biotic Coefficient can derive a series of continuous values, from 0 to 6, being 7 when the sediment is azoic. The result obtained is a "pollution classification" of a site which is a function of the Biotic Coefficient. Consequently, this represents the benthic community "health", represented by the entire numbers of the Biotic Index.

Table 6.10. Site Pollution classes derived from the Biotic Coefficient.

| Site Pollution Classification | Biotic Coefficient | Biotic Index | Dominating Ecological Group | Benthic Community Health |
|---|---|---|---|---|
| Unpolluted | $0.0 < BC \leq 0.2$ | 0 | I | Normal |
| Unpolluted | $0.2 < BC \leq 1.2$ | 1 | | Impoverished |
| Slightly Polluted | $1.2 < BC \leq 3.3$ | 2 | III | Unbalanced |
| Meanly Polluted | $3.3 < BC \leq 4.3$ | 3 | | Transitional to pollution |
| Meanly Polluted | $4.3 < BC \leq 5.0$ | 4 | IV-V | Polluted |
| Heavily Polluted | $5.0 < BC \leq 5.5$ | 5 | | Transitional to heavy pollution |
| Heavily Polluted | $5.5 < BC \leq 6.0$ | 6 | V | Heavy polluted |
| Extremely Polluted | Azoic | 7 | Azoic | Azoic |

The index has been validated and has been shown to be able to detect differences between control and contaminated stations (based on the oxygenation at bottom waters, and organic matter and heavy metal content of the sediments). The results were published in Marine Pollution Bulletin (Borja *et al*., 2000). This index could comply with the requirements of the WFD if combined with measures of abundance and diversity.

## 6.5. FISH

Tools currently available in Member States to classify fish fauna

6.5.1. No tools are commonly used at the moment in Europe.

6.5.2. Within the **UK** a fish classification tool that was developed for assessing the status of fish communities in estuaries within South Africa is currently being tested.

6.5.3. **Belgium** has developed an estuarine fish index for the Scheldt estuary in Flanders.

Do the available tools fulfill the requirements of the Directive?

6.5.4. The **South African tool being tested by the UK**: includes a measure of both the composition and abundance of the fish fauna.

6.5.5. The **Belgium** classification tool considers the composition of the fish community. The tool does not include a direct measure of abundance.

6.5.6. Summary of the **South African Fish Classification System currently being tested within the UK.**

**Introduction**
The UK is currently testing a fish classification system developed in South Africa. It is believed that although this approach was developed to assess the status of fish communities in estuaries in South Africa, it could also be applied to European estuaries. Until adequate datasets are available, full testing and refinement of the categories in Table 6.11 to ensure alignment with the normative definitions in the Directive will not be possible.

The approach described below was developed in order to provide a state of the environment indicator and monitoring tool within South Africa. Research was based on a 7-year intensive field sampling program during which 257 estuaries were visited. Using fisheries data and typological classification, biogeographic regions were identified and characterised in order to form six basic estuary types (Harrison et al., 2000).
The fish community structure within each estuary type was investigated, with each estuary type being found to contain a fairly distinctive fish assemblage. From this an Estuarine Classification Scheme was developed. The fish community structure (species richness, composition & relative abundance) of each estuary type within a biogeographic region is described and used as a reference against which each estuary is assessed.

**Methods**
A multi-method sampling approach was used including seine netting and gill netting. Sampling was generally carried out until no new species were encountered or until all representative habitats within the estuary had been sampled.

The fisheries data was then analysed using the Bray-Curtis similarity co-efficient which was essential for standardisation of sampling effort. The Bray-Curtis coefficient reflects the differences between two samples due to differing community composition and/or differing total abundance. Standardisation removes any effect of the latter.

These results showed that estuarine fish communities within each geomorphological type formed groups which were related to their geographical position & biogeography.

**Classification**
Having determined the biogeographic boundaries along the South African coast the fish community structure was investigated in relation to estuary type. Data analysis used a combination of hierarchical agglomerative clustering and non-metric multi-dimensional scaling (MDS) using PRIMER (Clark and Warwick 1994).

The concept of biological community health (in relation to the ecosystem) was used and termed 'Fish Community Status (Health)'. It uses the 'Community Degradation Index (CDI)' which measures the degree of dissimilarity (degradation) between a potential fish assemblage and the actual measured fish assemblages. This was then modified into the 'Biological Health Index' (BHI) to provide a measure of the similarity between the potential and actual fish assemblages (Cooper *et al.*, 1994). The index ranges from 0 (poor) to 10 (good). Although the BHI is a useful tool in condensing information on estuarine fish assemblages into a single value (the index is based on presence/absence data) it does not take into account the relative proportions of the species present.

Whitfield and Elliott (2002) give examples of indexes which can be used to condense biological community data and suggest how these parameters could be used to determine the degree of human induced change within an estuary (table 6.11).

Table 6.11. Fish-based parameters that could be used in a single or composite scoring system (the higher the score, the more natural the system) for monitoring human induced changes within an estuary. Some of the indicators are subjective and qualitative whereas others are more objective and quantitative.

| Level | Indicator | Value | Score |
|---|---|---|---|
| **1. Fish species** | 1(a). Species abundance/ biomass | Artificially low | 1 |
| | | Medium/high | 3 |
| | 1(b). Keystone/indicator species | Present | 3 |
| | | Absent | 1 |
| | 1(c). Alien/introduced species | Presence of alien/introduced species | 1 |
| | | Absence of alien/introduced species | 3 |
| | 1(d). Fish species health | Toxic accumulations present | 1 |
| | | Toxic accumulations absent | 3 |
| **2. Fish community** | 2(a). Harrison et al. (2000) Species richness index | Similarity with mean number of taxa: | |
| | | >95% upper confidence interval | 5 |
| | | Within 95% confidence intervals | 3 |
| | | <95% lower confidence interval | 1 |
| | 2(b). Harrison et al. (2000) Bray-Curtis presence/absence similarity index | Similarity with reference condition: | |
| | | >50th percentile similarity | 5 |
| | | 10th – 50th percentile similarity | 3 |
| | | <10th percentile similarity | 1 |
| | 2(c). Harrison et al. (2000) Bray-Curtis percentage abundance similarity index | Similarity with reference condition: | |
| | | >50th percentile similarity | 5 |
| | | 10th – 50th percentile similarity | 3 |
| | | <10th percentile similarity | 1 |
| | 2(d). Deegan et al. (1997) Estuarine Biotic Integrity Index (number and/or biomass) | EBI value (eight metrics used): | |
| | | Score 31 – 40 | 5 |
| | | Score 21 – 30 | 3 |
| | | Score 0 – 20 | 1 |

6.5.7. Summary of the **of an estuarine fish index (EFI) for the Scheldt estuary in Flanders (Belgium)** (Goethals *et al.*, 2002, Adriaenssens *et al.*, 2002a, Adriaenssens *et al.*, 2002b).

The Estuarine Fish Index consists of seven metrics, which each aim to assess a different functional aspect of the estuarine fish assemblages and the integrated quality of the ecosystem.

**Description of the score system**

**Application area:** Schelde estuary between Burcht and the Dutch Belgian border, based on salinity measurements

**Description of reference conditions**: a combination of historical data, data from similar European Estuaries (e.g. Eems-Dollard), expert knowledge and recent data collections.

**Data collection**: double fykes (type 120/80). Fykes were emptied every three days. Data were based on averaging data collected during one month, recalculated as average catch per day per fyke for a particular month.

Table 6.12. Metrics, variables and scoring system:

| **Parameter** | **Score** | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| **Total number of species** | >=4 | 5-14 | 15-19 | 20-24 | >24 |
| **Type species*** | | | | | |
| % Flounder | <=5 | >5-10<br>>50-80 | | | >10-50 |
| % Smelt | <=5 | >5-10<br>>50-80 | | | >10-50 |
| **Trophic composition*** | | | | | |
| % omnivores | <=1<br>>80 | >1-2.5<br>>20-80 | | | >2.5-20 |
| % piscivores | <=5<br>>80 | >5-10<br>>50-80 | | | >10-50 |
| ♦**Tolerance** | <1.20 | 1.20-1.59 | 1.60-1.99 | 2-3 | >3 |
| **Estuarine resident species*** | | | | | |
| Number E.R.S. | <2 | 2 | 3 | 4 | >4 |
| % E.R.S. | <5<br>>50 | 5-10<br>40-50 | | | >10-<40 |
| **% diadromous species** | <=5<br>>80 | 5-10<br>>70-80 | | | >10-70 |
| **% marine juvenile migrating species** | <=10<br>>90 | 5-10<br>>80-90 | >20-30<br>>70-80 | | >30-70 |

*adding missing scores 3, 4 (and 5) would be of no ecological relevance, presence of extremely low as well as extreme high number reflect deterioration

♦A tolerance score was attributed to each fish species present.

Overall classification of the estuarine fish index, is the average of the seven metric sores as shown in table 6.13.

Table 6.13. Estuarine Fish Index quality classes.

| colorcode | EFI-value | Classification |
|---|---|---|
| | >4,5 | excellent |
| | 4-<4,5 | good |
| | 3-<4 | moderate |
| | 2-<3 | bad |
| | <2 | very bad |

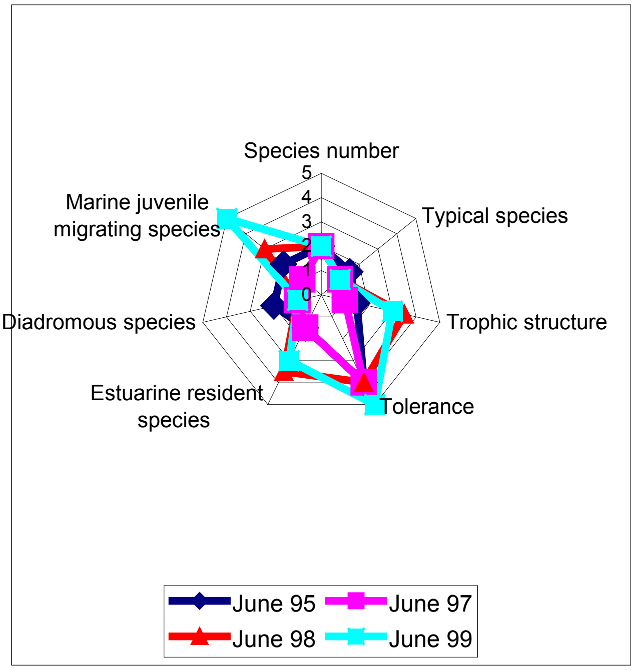



Figure 6.2. Visual presentation of the evolution for the 7 metric scores at Bath.

## 6.6. CLASSIFICATION SCHEMES FOR BIOLOGICAL QUALITY ELEMENTS

**The OSPAR Comprehensive Procedure**.

6.6.1. Marine eutrophication is one of the main issues that has been dealt with for over 10 years in the context of the North Sea Conferences (Declarations of London 1987, den Hague 1990, Esbjerg 1995) and OSPAR. Consequently, PARCOM Recommendation 88/2 recommends that OSPAR Contracting Parties:

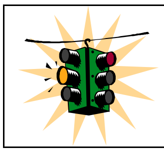
(i) take effective national steps in order to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution;

(ii) aim to achieve a substantial reduction (in the order of 50 %) in the inputs of phosphorus and nitrogen into these areas between 1985 and 1995, or earlier if possible.

6.6.2. The Common Procedure for the Identification of the Eutrophication Status of the Maritime Area is a main element of that strategy. The Strategy has the aim of identifying the eutrophication status of all parts of the maritime area by the year 2002 and asks for every effort to be made to combat eutrophication in order to achieve, by the year 2010, a healthy marine environment where eutrophication does not occur.

6.6.3. The Common Procedure consists of a set of assessment criteria that may be linked to form a holistic and common assessment of the eutrophication status of the maritime area. Through this process the OSPAR maritime area is classified into areas which are considered to be problem, potential problem, or non-problem areas with regard to eutrophication. Repeated application of the Comprehensive Procedure should identify any change in the eutrophication status of a particular area.

6.6.4. The Common Procedure comprises two steps. The first step is the screening procedure which is a broad-brush process to identify obvious non-problem areas with regard to eutrophication. Following that step, all areas not identified as non-problem areas shall be subject to the Comprehensive Procedure.



**The Common Procedure is specifically designed to assess the effects of eutrophication within the North-East Atlantic. This is just one of the pressures that a classification scheme for the WFD should be able to detect.**

6.6.5. The following is a summary of the **Comprehensive Procedure** (OSPAR 1997).

**Assessment criteria and their assessment levels within the Comprehensive Procedure**

In order to enable Contracting Parties to undertake a harmonised assessment of their waters subject to the Comprehensive Procedure it was necessary to develop a number of the qualitative assessment criteria into quantitative criteria that could be applied in a harmonised way. On the basis of common denominators within a wide range of qualitative and quantitative information provided by Contracting Parties on the criteria and assessment levels already used, a set of assessment criteria were selected and further developed into quantitative criteria for use in a harmonised assessment. It should also be noted that, although the levels against which assessment is made may be region-specific, the methodology for applying these assessment criteria is based on a common approach.

The assessment criteria selected for further development fall into the following categories (table 6.14):

***Category I*** ***Degree of nutrient enrichment***
***Category II*** ***Direct effects of nutrient enrichment***
***Category III*** ***Indirect effects of nutrient enrichment***
***Category IV*** ***Other possible effects of nutrient enrichment***

The main interrelationships between the assessment parameters and their categories are shown in Figure 6.3.

**Agreed harmonised assessment criteria and their assessment levels**

For each criterion an assessment level has been derived (based on a level of elevation) with the exception of nutrient inputs for which there should also be an examination of trends. The level of elevation is defined, in general terms, as a certain percentage above a background concentration. The background concentration is, in general terms, defined as a salinity related and/or region specific derived spatial (offshore) and/or historical background concentration.

In order to allow for natural variability in the assessment, the level of elevation is generally defined as the concentration of more than 50 % above the salinity related and/or region specific background level (e.g. DIN and DIP concentrations).

Table 6.14. The agreed Harmonised Assessment Criteria and their respective assessment levels of the Comprehensive Procedure.

| Assessment parameters | | |
|---|---|---|
| **Category I** | **Degree of Nutrient Enrichment** | |
| | **1** | **Riverine total N and total P inputs and direct discharges (RID)**<br>Elevated inputs and/or increased trends<br>(compared with previous years) |
| | **2** | **Winter DIN- and/or DIP concentrations**[1]<br>Elevated level(s) (defined as concentration > 50 % above[2] salinity related and/or region specific natural background concentration) |
| | **3** | **Increased winter N/P ratio (Redfield N/P = 16)**<br>Elevated cf. Redfield (> 25) |
| **Category II** | **Direct Effects of Nutrient Enrichment (during growing season)** | |
| | **1** | **Maximum and mean Chlorophyll <u>a</u> concentration**<br>Elevated level (defined as concentration > 50 % above[2] spatial (offshore) / historical background concentrations) |
| | **2** | **Region/area specific phytoplankton indicator species**<br>Elevated levels (and increased duration) |
| | **3** | **Macrophytes including macroalgae (region specific)**<br>Shift from long-lived to short-lived nuisance species (e.g. *Ulva*) |
| **Category III** | **Indirect Effects of Nutrient Enrichment (during growing season)** | |
| | **1** | **Degree of oxygen deficiency**<br>Decreased levels (< 2 mg/l: acute toxicity; 2 - 6 mg/l: deficiency) |
| | **2** | **Changes/kills in Zoobenthos and fish kills**<br>Kills (in relation to oxygen deficiency and/or toxic algae)<br>Long term changes in zoobenthos biomass and species composition |
| | **3** | **Organic Carbon/Organic Matter**<br>Elevated levels (in relation to III.1) (relevant in sedimentation areas) |
| **Category IV** | **Other Possible Effects of Nutrient Enrichment (during growing season)** | |
| | **1** | **Algal toxins (DSP/PSP mussel infection events)**<br>Incidence (related to II.2) |

[1] Maps, figures and mixing diagrams are available in OSPAR EUC 01/11/1 Annex 5 Appendix 4
[2] Other values less than 50 % can be used if justified

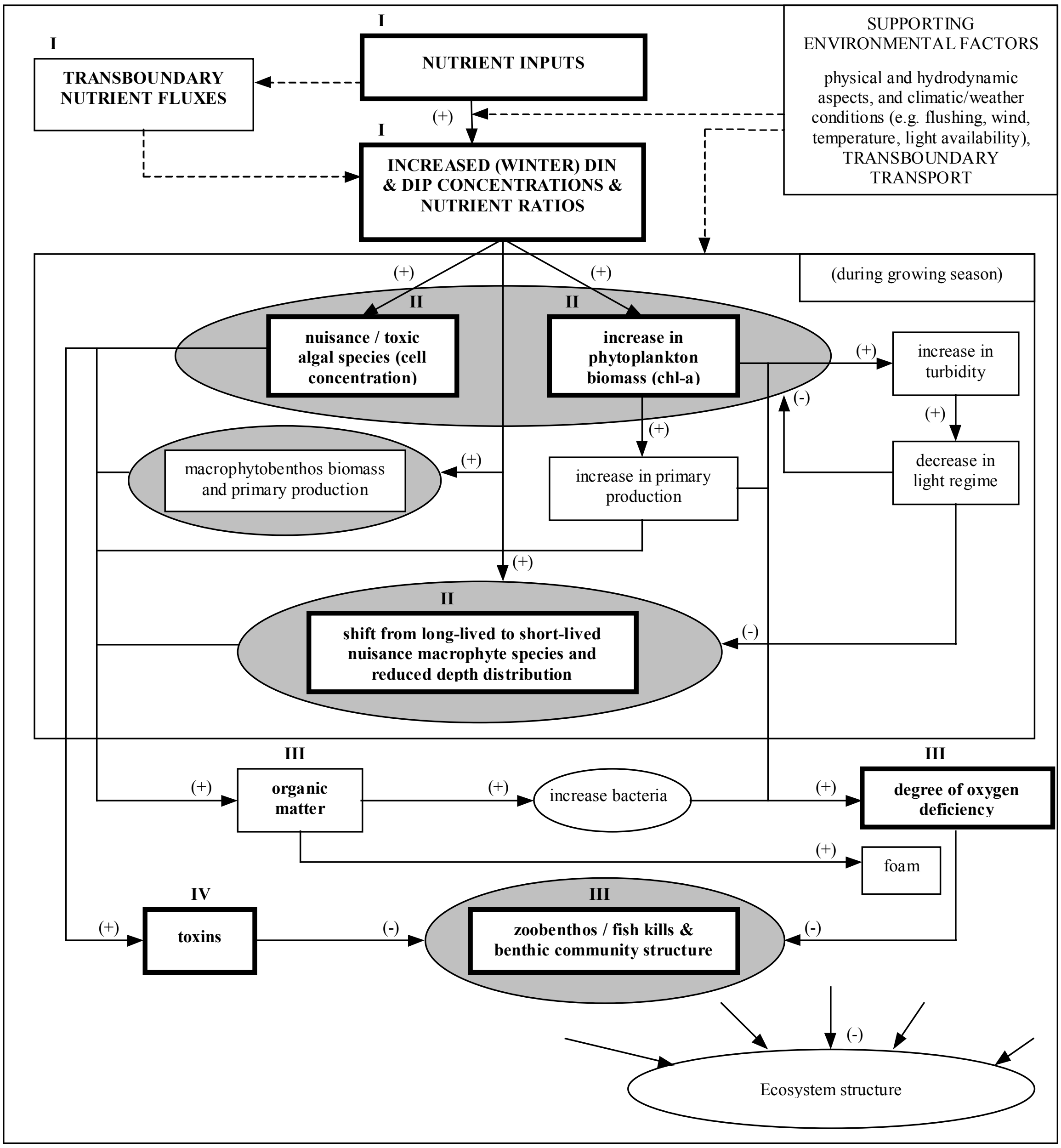



Figure 6.3. Main Interrelationships between the Assessment Parameters (in bold) of the OSPAR Comprehensive Procedure (COMPP).

Parameters for which Assessment Criteria and their assessment levels are identified are shown in boxes with bold lines. Biological elements are shaded. Continuous arrow lines with (+) and (-) indicate 'having stimulating effect upon', and 'having inhibiting effect upon', respectively. Dashed arrow lines indicate 'having influence upon'.

| Key: | | | | |
|---|---|---|---|---|
| | I | = | Category I | Degree of Nutrient Enrichment (Causative factors) |
| | II | = | Category II | Direct Effects of Nutrient Enrichment |
| | III | = | Category III | Indirect Effects of Nutrient Enrichment |
| | IV | = | Category IV | Other Possible Effects of Nutrient Enrichment |

**Classification on the basis of the harmonised assessment criteria and their respective assessment levels**

For a harmonised holistic assessment of eutrophication status of an area one needs at least to address the common assessment parameters listed in the four categories of the assessment procedure.

To carry out the classification of the eutrophication status of areas of the maritime region each Contracting Party should undertake a number of steps, which are outlined below. The first step is to provide a score for each of the harmonised assessment criteria being applied according to Table 6.14. The second step will bring these scores together according to Table 6.15 to provide a classification of the area. The third step is to make an appraisal of all relevant information (concerning the harmonised assessment criteria their respective assessment levels and the supporting environmental factors), to provide a transparent and sound account of the reasons for establishing a particular status for the area.

Finally this process should enable the classification of the maritime area in terms of problem areas, potential problem areas, and non-problem areas.

**Integration of Categorised Assessment Parameters for Classification**

The assessment levels of the agreed harmonised assessment criteria form the basis of the first step of the classification.

The next step is the integration of the categorised assessment parameters mentioned in Table 6.14 to obtain a more coherent classification. For each assessment parameter of Categories I, II, III and IV mentioned in Table 6.14 it can be indicated whether its measured concentration relates to a problem area, a potential problem area or a non-problem area as defined in the OSPAR Strategy to Combat Eutrophication. The results of this step are summarised in Table 6.15 and explained below:

a. Areas showing an increased degree of nutrient enrichment accompanied by direct and/or indirect/other possible effects are regarded as **'problem areas**;
b. Areas may show direct effects and/or indirect or other possible effects when there is no evident increased nutrient enrichment, e.g. as a result of transboundary transport of (toxic) algae and/or organic matter arising from adjacent/remote areas. These areas could be classified as **'problem areas'**;
c. Areas with an increased degree of nutrient enrichment, but without showing direct, indirect/ other possible effects, are initially classified as **'potential problem areas'**;
d. Areas without nutrient enrichment and related (in) direct/other possible effects are considered to be **'non-problem areas'**.

Table 6.15. Integration of Categorised Assessment Parameters for Classification (see also Table 6.14.)

| | **Category I Degree of nutrient enrichment** | **Category II Direct Effects** | | **Category III and IV Indirect effects/ other possible effects** | **Classification** |
|---|---|---|---|---|---|
| **A** | + | + | and/or | + | problem area |
| **B** | - | + | and/or | + | problem area[3] |
| **C** | + | - | | - | potential problem area |
| **D** | - | - | | - | non-problem area |

(+) = Increased trends, elevated levels, shifts or changes in the respective assessment parameters in Table 6.14.
(-) = Neither increased trends nor elevated levels nor shifts nor changes in the respective assessment parameters in Table 6.14.

Note: Categories I, II and/or III/IV are scored '+' in cases where one or more of its respective assessment parameters is showing an increased trend, elevated level, shift or change.

**Supporting Environmental Factors**

3.6 Region specific characteristics should be taken into account, such as physical and hydrodynamical aspects, and weather/climate conditions (see Figure 6.3.). These region specific characteristics may play a role in explaining the results of the classification.

[3] Caused by transport from other parts of the maritime area.

## 6.7. SUPPORTING ELEMENTS (HYDROMORPHOLOGICAL AND PHYSICO-CHEMICAL)

Tools currently available in Member States to classify the general elements:

6.7.1. A number of Member States have or are developing classification tools for all or most of the general supporting elements.

6.7.2. In the context of the Marine Strategy, the Commission will initiate action to prepare in collaboration with the regional marine conventions by 2006 a comprehensive assessment of the extent of marine eutrophication on the basis of a harmonised classification tool.

6.7.3. The OSPAR Common Procedure includes nutrients and could be tested by non-OSPAR Contracting Parties. One challenge is how to handle nutrients, because the Comprehensive Procedure only handles winter values and has been developed for open seas.

# Section 7 – Summary and Conclusions

## 7.1. TYPOLOGY

7.1.1. Many Member States have started to develop a typology for transitional and coastal waters. This guidance document promotes the development of a harmonised European typology for transitional and coastal waters through the use of the factors for system B.

7.1.2. It is important to establish good links between typing experts in Member States with similar types. Collaboration is the most important process in reaching a harmonised elaboration of a pan-European basis for the implementation of the Water Framework Directive with regard to monitoring and assessment. Communication between experts in different Member States at the typology stage could aid with the implementation of the successive stages of the Directive such as the establishment of reference conditions and the intercalibration exercise.

7.1.3. In cases where Member States of an Ecoregion have similar coastlines experts should work together to develop a common set of types of surface water body types where possible. This process should result in a smaller number of water body types than if Member States work independently.

7.1.4. In addition, harmonisation of types between Member States should be encouraged to avoid:

- the same surface water body type having different names or
- different surface water body types having the same name.

Such collaboration should also prevent disharmony in water body types at the borders between neighbouring Member States.

## 7.2. REFERENCE CONDITIONS

7.2.1. At present no reference network of high status sites exist for transitional and coastal waters within Europe that are known to meet the requirements of the WFD.

7.2.2. To date the majority of monitoring within transitional and coastal waters has concentrated upon polluted areas rather than areas that will meet the definition of high status for the WFD. 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.

7.2.3. It should be emphasised that the derivation of reference conditions that encompass the full natural variability found within a water body type is likely to take many years. It will be an iterative process and will be assisted by the collection of monitoring data for the purposes of the Directive over the forthcoming years.

7.2.4. Member States with similar types should work together where possible in order to enable the sharing of reference conditions.

7.2.5. Member States should collaborate as soon as possible to start developing a European reference network of high status sites.

## 7.3. CLASSIFICATION

7.3.1. Section 6 of this guidance is a toolbox which contains existing classification schemes and tools that may be suitable for testing by Member States. Those classification tools which currently exist have generally not been tested against the normative definitions (Annex V tables 1.2.) and descriptions of high, good and moderate status for each of the quality elements in transitional and coastal waters (Annex V tables 1.2.3. and 1.2.4.).

7.3.2. As classification tools are developed within Member States, experts are encouraged to exchange information and knowledge gained from testing. It is likely that Member States with similar types may find that they can use the same classification tools.

7.3.3. Once classification tools have been developed and tested it will be possible to develop further guidance on the setting of EQRs and the boundaries between high/good, and good/moderate.

7.3.4. It is recognised that this guidance does not give specific advice on setting EQR values and on the statistical issues surrounding classification. It is suggested that this work needs to be taken further. The development of classification tools will require the gathering of data from a wide range of sites at different status. It should be noted that robust classification tools require many years of data, for example, the South African Fish Classification tool in section 6.5.6. was developed after seven years of intensive data collection.

## 7.4. THE PROMOTION OF COMMUNICATION

7.4.1. The establishment of the COAST working group has brought together experts from across Europe who are involved in the implementation of the WFD with regard to transitional and coastal waters.

7.4.2. The establishment of the COAST working group has highlighted that communication and collaboration between experts from different Member States is an important and integral part in the implementation of all parts of the Directive. Communication and collaboration between those people who are implementing the Directive both within and between Member States is essential to ensure the effective and integrated implementation of the Directive both within Member States and across Europe and to exchange knowledge and experience.

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## Annex A – Key Activities and the Working Groups of the Common Implementation Strategy.

**Key Activity 1: Information Sharing**

1.1. Tools for Information sharing
1.2. Raising Awareness

**Key Activity 2: Develop Guidance on Technical Issues**

2.1. Guidance on the analysis of pressures and impacts
2.2. Guidance on the designation of heavily modified bodies of water
2.3. Guidance on classification of inland surface water status and identification of reference conditions
2.4. Guidance on the development of typology and classification systems of transitional and coastal waters
2.5. Guidance for establishing the intercalibration network and intercalibration exercise
2.6. Guidance on economic analysis
2.7. Guidance on monitoring
2.8. Guidance on tools on assessment and classification of groundwater
2.9. Guidance on best practices in river basin management planning

**Key Activity 3: Information and Data Management**

3.1. Development of a shared Geographical Information System

**Key Activity 4: Application, testing and validation**

4.1. Integrated testing of guidelines in pilot river basins

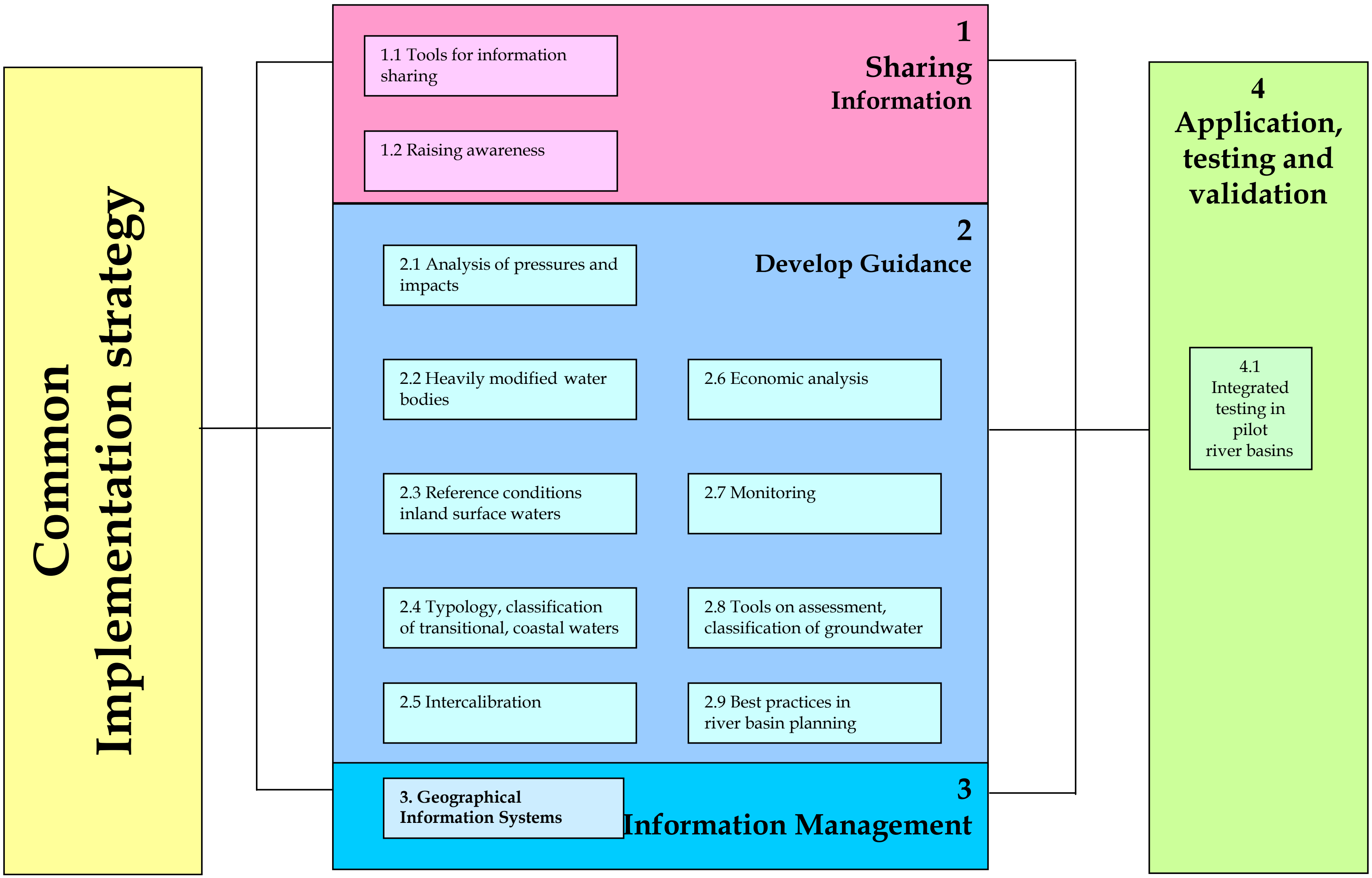


Figure A.1. Overall structure of the Common Implementation Strategy.

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**This list is by no means exhaustive. There were many other people who had an input to the writing of the guidance document.**

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## Annex C – List of Reference Conditions Studies

The following table lists all the pilot studies that were carried out within the COAST working group. It is recognised that not all of these areas are in high status. Some are 'best of type' and may equate to good status.

For further information regarding these pilot studies please contact one of the COAST representatives from the respective Member State.

Table C.1. List of Pilot Studies.

| Site | Member State | Coastal or Transitional |
|---|---|---|
| Randers Fjord | Denmark | Coastal |
| Rio Formosa, (mesotidal shallow ria) | Portugal | Coastal |
| Mira Estuary, (Mesotidal torrential estuary) | Portugal | Transitional |
| Loch Creran and Loch Ardbhair, Scotland | United Kingdom | Coastal |
| Strangford Lough, Northern Ireland | United Kingdom | Coastal |
| Northern part of South Evvoikos Gulf | Greece | Coastal |
| Southern part of South Evvoikos Gulf | Greece | Coastal |
| Tsoukalio, Rhodia and Tsopeli lagoon complex | Greece | Transitional |
| North Sea Skagerrak Open Rocky Coast | Norway | Coastal |

## Annex D - Glossary

| | |
|---|---|
| **AMAP** | Artic Monitoring and Assessment Programme established in 1991 to implement certain components of the Artic Environmental Protection Strategy. |
| **Angiosperm** | Flowering plant. |
| **Anthropogenic** | Caused or produced by human influence. |
| **Artificial Water Body** | A body of surface water created by human activity (Article 2(8)). An artificial water body is a surface water body which has been created in a location where no water body existed before and which has not been created by the direct physical alteration or movement or realignment of an existing water body. |
| **Bar-built estuary** | An estuary characterised by a bar across the mouth. Usually associated with the availability of large volumes of sediment and a restricted tidal range. |
| **Barcelona Convention** | Convention for the Protection of the Mediterranean Sea against Pollution adopted in Barcelona on 16 February 1976. |
| **Baseline for Territorial Waters** | According to the United Nations Convention on the Law of the Sea the baseline is measured as the low-water line except along the mouths of estuaries and heads of bays where it cuts across open water. Along highly indented coastlines, bays, mouths of estuaries or coastlines with islands, the baseline can be drawn as a straight line. Each Member State has a legislative baseline associated with this definition. |
| **Benthic Invertebrates** | Invertebrate organisms that are attached to, living on, or in the seabed. |
| **BEQUALM** | Biological Effects Quality Assurance in Monitoring Programmes. |
| **Birds Directive** | Council Directive 79/409/EECof 2 April 1979 on the conservation of wild birds |

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| **Catchment** | Area from which rainfall flows into a river, lake or reservoir. |
| **Competent Authority** | An authority or authorities identified under Article 3(2) or 3(3) (Article 2 (16)). |
| **Deterioration** | A reduction in quality of one or more of the quality elements. |
| **Diffuse Source Pollution** | Pollution which originates from various activities and which can not be traced to a single source e.g. run off from agriculture. |
| **Discharge** | The release of a liquid substance into the environment. |
| **Disturbance** | Interference with the normal functioning of the ecosystem. |
| **Diurnal tidal cycle** | Tide which has a period or cycle of approximately one tidal day (about 25 hours). Diurnal tides usually have one high and one low tide each day. |
| **Ecological Quality Ratio** | Ratio representing the relationship between the values of the biological parameters observed for a given body of surface water and values for these parameters in the reference conditions applicable to that body. The values shall be represented as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero (Annex V 1.4(ii)). |
| **Ecological Status** | An expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, classified in accordance with Annex V (Article 2(21)). |
| **Eco-region** | The geographical areas illustrated in Annex XI Maps A (rivers and lakes) and B (transitional waters and coastal waters). |
| **Environmental objectives** | The objectives set out in Article 4 (Article 2(34)). |
| **Environmental Quality Standard** | The concentration of a particular pollutant of group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment Article 2(35)). |

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| **EU Marine Strategy** | Part of the 6th Environment Plan in order to develop a strategy for the marine environment in collaboration with all major stakeholders. The aim is for a joint Europe wide assessment to be published by 2010. |
| **Groundwater** | All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil (Article 2(2)). |
| **Habitats Directive** | Council Directive 92/43/EEC of 21 May 1992on the conservation of natural habitats and of wild fauna and flora. |
| **Heavily Modified Water Body** | A body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II (Article 2(9)). |
| **HELCOM Convention** | Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 which entered into force on 17 January 2000 (otherwise known as the Helsinki Convention). |
| **Hydromorphology** | The physical characteristics of the boundaries of a water body. |
| **ICES** | International Council for the Exploration of the Sea which coordinates and promotes marine research in the North Atlantic. |
| **Impact** | The environmental effect of the pressure. |
| **Intercalibration** | An exercise facilitated by the Commission to ensure that the high/good and good/moderate class boundaries are consistent with the normative definitions in Annex V Section 1.2 of the Directive and are comparable between Member States (see guidance produced by WG 2.5) (Annex V 1.4. (iv)). |
| **Isohaline** | A line connecting points of equal salinity (OSPAR QSR 2000 North Sea). |
| **Lagoon** | Isolated saline water. Enclosed bodies of water, separated or partially separated from the sea. |
| **Lake** | Body of standing inland surface water (Article 2(4)). |

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| **Macrophyte** | Attached benthic aquatic flora. |
| **Non-Indigenous Species** | An introduced species that would not naturally occur in that water body. |
| **OSPAR Common Procedure** | The Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area. A checklist of qualitative assessment parameters for use in a holistic assessment to classify the OSPAR Convention Waters (including estuaries) with regard to eutrophication. |
| **OSPAR Convention** | The Convention for the Protection of the Marine Environment of the North-East Atlantic which replaces the former Oslo and Paris Conventions. The Convention entered into force on 25 March 1998. |
| **Phytoplankton** | Photosynthetic organisms that are the main source of primary production in the seas. |
| **Point Source Pollution** | Pollution traceable to a specific source e.g. from a sewage treatment works. |
| **Pollutant** | Any substance liable to cause pollution, in particular those listed in Annex VIII (Article 2(31)). |
| **Pollution** | The direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment (Article 2(33)). |
| **Pressure** | The direct impact of an anthropogenic activity that has an environmental effect. |
| **QUASIMEME** | Quality Assurance in Marine Environmental Monitoring in Europe. |
| **RAMSAR Convention** | The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. |

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| **Register of Protected Areas** | A register of areas lying within the river basin district which have been designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species directly depending on water. This register must be completed by December 2004. |
| **River** | Body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course (Article 2(4)). |
| **River Basin** | The area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta (Article 2(13)). |
| **River Basin District** | The area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, which is identified under Article 3(1) of the Directive as the main unit for management of river basins (Article 2(15)). |
| **River Basin Management Plan** | A plan that must be produced for each River Basin District within a Member State under Article 13. The plan shall include the information detailed in Annex VIII. |
| **Salt marsh** | An area of coastal grassland that is regularly flooded by seawater. |
| **Shellfish Waters Directive** | Council Directive of 30 October 1979 on the quality required of shellfish waters (79/923/EEC). |
| **Specific Non-Synthetic Pollutants** | Naturally occurring priority substances identified as being discharged into the body of water and other substances identified as being discharged in significant quantities into the body of water (Annex V 1.1). Further guidance is given in the guidance document produced by WG 2.1. |
| **Specific Pollutants** | According to SEPA these are listed in Annex VIII of the Directive. Just have this entry and not separate entries for synthetic and non-synthetic. Further guidance is given in the guidance document produced by WG 2.1. |

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| **Specific Synthetic Pollutants** | Man-made priority substances identified as being discharged into the body of water and other substances identified as being discharged in significant quantities into the body of water (Annex V 1.1). Further guidance is given in the guidance document produced by WG 2.1. |
| **Strategic Co-ordination Group** | A group led by the Commission with participants from all Member States which was established to co-ordinate the work of the different working groups of the Common Implementation Strategy. |
| **Taxa** | Taxonomic groups of any rank. |
| **Territorial waters** | The breadth of waters extending out to 12 nautical miles from the baseline defined under the United Nations Convention on the Law of the Sea, 1982. |
| **Toxic Algae** | Species of algae that produce harmful toxins. |
| **Transboundary** | Crossing the boundary between Member States, River Basin Districts etc. |
| **UNEPMAP** | United Nations Environment Programme Mediterranean Action Plan. |
| **Urban Waste Water Treatment Directive** | Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC). |
| **Wetland** | Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (Ramsar Convention). |