Indicator Fact Sheet — Demonstration indicator

(WEC2d) Classification of coastal waters

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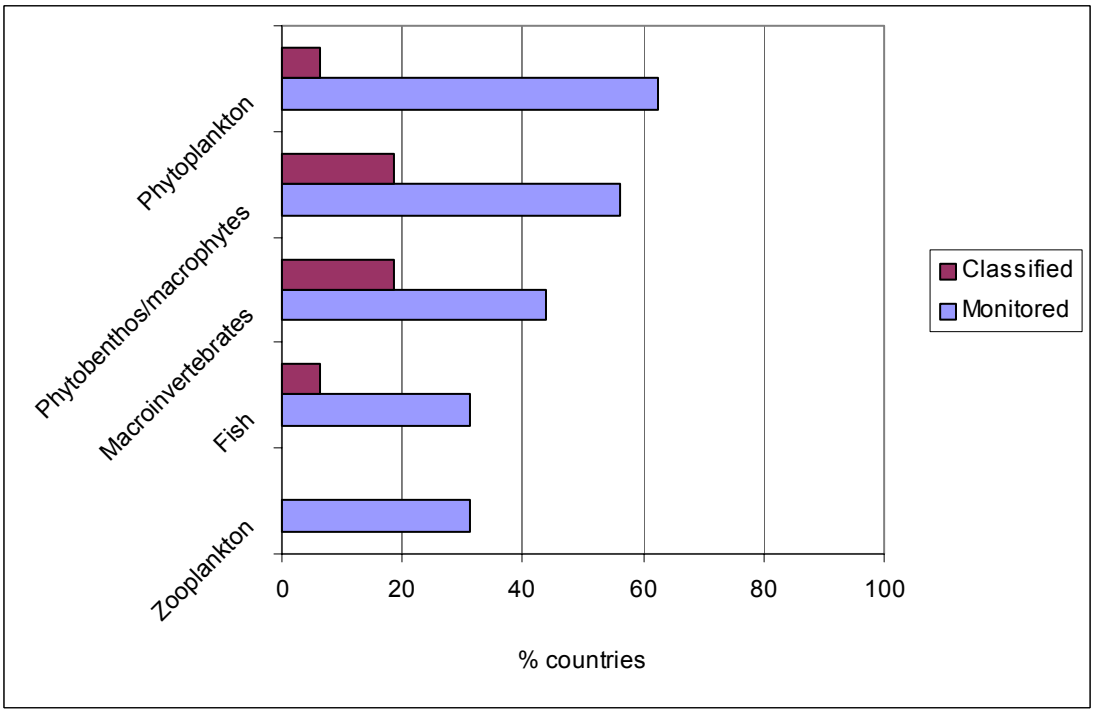
Key message

☹ Only a few countries in Europe have at present classified their coastlines.
☺ Many countries have started to develop classification tools or started testing existing tools as a part of the implementation of the WFD.

Figure 1: Biological quality elements monitored and classified in transitional and coastal waters in the EU and Norway



NB: Monitoring of zooplankton is not required by the Water Framework Directive

Source: Compiled by ETC/WTR from contributions to the Common Implementation Strategy Working Groups 2.4 (COAST) and 2.7 Monitoring. Information from 14 countries with a coastline.

Policy context and relevance:

The Water Framework Directive (WFD) (2000/60/EC) states that the most important task is the protection of Europe's waters (inland, transitional, coastal and marine waters). Protection of water related ecosystems have high priority in the directive; therefore, biological monitoring of surface and groundwater are obligatory in the EU Member States. The WFD sets up only the common aim and the deadline of the subtasks, but each Member State itself regulates methodologies of the water quality monitoring and analyses. The classification of ecological status differentiates high (the taxonomic condition corresponds totally or nearly totally to undisturbed conditions), good (there are slight changes in the composition and abundance of any taxa compared to the type-specific communities) and moderate ecological quality statuses (the composition of any taxa differ moderately from the type-specific communities and are significantly more distorted than those observed at good quality). Water

bodies having high-quality status are also classified as reference water bodies and will form the reference list of each country indicating the natural, undisturbed communities. All other water bodies will be compared to these during the classification of their biological state. The WFD requires that all water bodies of each Member State should have at least good-quality status by 2015.

Organic pollution often originates from municipal treatment works and the Urban Waste Water Treatment Directive (UWWTD) (91/71/EEC) aims to reduce this pollution as it requires secondary level treatment of waste water for population equivalents (p.e.) exceeding 10 000 discharging to coastal waters. With the implementation of this directive, an improvement of the status of coastal waters could be expected.

The Nitrate Directive (19/676/EEC) aims to reduce water pollution caused by nitrates by reducing the nitrogen input to agricultural land. The implementation of this directive should give an environmental effect in coastal areas downstream, large rivers running through agricultural land.

The communication on a European marine strategy aims to protect the marine ecosystem: one of the actions foreseen in the 6EAP is the development of a thematic strategy for the protection and conservation of the marine environment (marine strategy). One of the overarching objectives is *sustainable and healthy European seas and their ecosystems.* The benthic ecosystem (macrozoobenthos included) is of key importance and should be monitored.

The Green Paper on Common Fisheries Policy (Ecosystem approach) demands a reform of the *common fisheries policy so as to ensure sustainable fisheries and healthy marine ecosystems, both in the EU and globally.* The impact of trawling on the benthic ecosystems has been recognised and habitat changes caused by fishing are to be taken into account as a tool to measure the effectiveness of policies.

The Biodiversity Convention aims *to protect and restore habitats and natural systems and halt the loss of biodiversity by 2010*.([1])

Environmental context:

Many people depend on the resources of the sea for food, income and employment. However, with growing numbers converging on the world's coasts and exploiting its seas, profound changes are taking place in the marine environment and in its biodiversity and productivity. The coasts of Europe are heavily populated leading to conflicts of interests e.g. tourism, traditional industry and recreational activities. The high pressure on the coastal zone is a potential threat to the coastal ecosystems and most European countries have some kind of monitoring activities in the coastal zone. However, only few countries have as yet classified their coastlines.

Assessment:

Coast and ocean monitoring is fairly well developed for most of the European countries implementing the WFD. However, most of the monitoring is based on chemical parameters, even though monitoring of biological parameters are increasing (OSPAR, Helcom, Medpol). Only a few countries in Europe have developed classification schemes that have been in use for five years or more. However, all European countries that will implement the Water Framework Directive are developing classification schemes and many of the countries will be testing existing tools and systems in 2003–04 (Common Implementation Strategy WG 2.4. COAST). An indicator, based on the same principles as the river classification indicator is most likely to be available late 2003 or early 2004.

Examples from some countries based on the CIS WG 2.4 working document are given below. These classification schemes include a combination of biological indicators and, mostly, chemical indicators.

Estuarine water quality in **England and Wales** has historically been assessed every five years. This is based on an assessment and classification scheme prepared by the Classification of Estuaries Working Party (CEWP) in the 1970s. Estuaries are classified as good, fair, poor or bad based on three quality elements, biological quality (presence of certain species of fish, aesthetic quality), evidence of aesthetic pollution (sewage-derived litter) and chemical quality (in terms of dissolved oxygen concentrations). A score is allocated for each of these categories according to set criteria and the scores are added to

([1]) SDS p. 12.

determine the overall class. Assessments were last made in 2000 using a combination of data from statutory monitoring programmes and local knowledge. A new scheme has been under development, based on the Scottish Classification scheme, which should replace the CEWP scheme by 2005. However this has now been abandoned pending the development of the scheme that will be needed to meet the requirements of the EC Water Framework Directive. The existing classification scheme is largely an expert-judgment type system, based on several different and independent aspects of water / environment quality. A simple index for benthos is being developed; nothing further has been established to date, but expert groups on all quality elements are progressing these topics in conjunction with Ireland.

The general classification applied in **Finland** (National Board of Waters and the Environment 1988, Heinonen and Gerve 1987, Vuoristo 1998) divides waters into five classes. Two approaches are in use to produce the general classification. First, the classes are determined by a counting procedure based on three separate classification criteria describing the suitability of water for water supply, fishing and recreational activities. Second, the concentrations of relevant water quality variables are compared with boundary values, which reflect the overall suitability of waters for the above modes of use. These variables include oxygen, turbidity, chlorophyll a, total phosphorous, colour, transparency, toxic compounds and algal blooms. In uncertain situations, extra support can be found by examining the criteria of the three more specific classifications. The five classes of the general index also have a verbal description to help in separating them from each other. For brackish coastal waters and sea areas the second approach is used.

France is currently developing a water classification system and is planned finalised in 2003.

New legislation was enforced in **Italy** in 1999 (D.L. 11 May 99, No 152), related to the water protection by pollution in agreement to EC Directives 91/271/CEE and 91/676/CEE. The criteria for classification of the state of marine and coastal environment are given. Particularly, the trophic state of marine and coastal waters is characterised through a trophic index (TRIX) based on chlorophyll a, oxygen saturation, mineral nitrogen and total phosphorus. Numerically, the TRIX index is scaled from 2 to 8, covering a range of four trophic states. The parameters, to be included in this trophic index, were selected as directly related to eutrophication phenomena. Italy has instituted a new monitoring programme for phytoplankton (qualitative and quantitative), zooplankton (qualitative and quantitative), macroalgae/seagrasses and biocoenoses. Italy is now expanding the application of TRIX from northern to southern Italy.

The **Northern Ireland** Estuarine and Coastal Waters Classification Schemes (NIECWCS) were introduced in 1996 and are based upon the Scottish schemes used by the Scottish Environment Protection Agency. These two classification schemes have four class categories; excellent, good, unsatisfactory and seriously polluted. The criteria used to classify coastal waters cover aesthetic condition, biological condition, bacteriological condition and chemical condition. Estuary classification is based upon criteria for the following factors: aesthetic condition, biological condition (fish migration, resident biota and/or bioassay, resident fish) and chemical condition (persistent substances based upon the Northern Ireland shellfish water standards, dissolved oxygen (DO) and the UK Red List and EC dangerous substances). The biological classification element is based entirely on expert judgment and looks at a variety of parameters such as diversity, composition, abundance and evenness of species. Both schemes are default based i.e. the overall class defaults to the worst of the biological/chemical or aesthetic condition for a water body. This approach focuses management attention to the relevant environmental protection issues. A recognised weakness of the scheme is that it does not address eutrophication issues as the biological assessment is based on benthic infauna only. The boundary between coastal waters and estuaries is based upon the limits agreed for the Urban Waste Water Treatment Directive and the scheme extends 12 miles seawards of the territorial waters baseline.

Until the late 1980s, evaluations of environmental conditions in **Norwegian** fjords and coastal waters were mainly based on comparisons with assumed unpolluted areas. In 1993–94 a system for classification of environmental quality, degree of pollution and suitability for various uses was developed by Norwegian Institute for Water Research (NIVA), and published by the Norwegian State Pollution Control Authority (SPCA) through a series of booklets. The system comprised water quality, metals and organic micropollutants in sediments and biota, soft bottom fauna and suitability for various uses of marine water. The system is developed based on long time monitoring data. Reference values are preferably set at the 90–95 percentiles of results from sites beyond traceable influence from point

sources. The final classification of an area is determined based on the parameter that gives the worst score. In 1997 a revised version was presented, using newer data and containing more advice on sampling and calculation of relevant statistical parameters. Norway has started work on classification scheme suitable for WFD based on existing systems and has selected trial 'reference condition' sites. Norway has carried out a typology exercise and has a monitoring program (>10 years) containing all parameters mandatory in the WFD for southern part of the North Sea, mainly the Skagerrak.

Swedish coasts and oceans are characterised by two very different systems: the brackish Baltic Sea and the northern part of the West Coast, which is a more typical marine system. The system comprises water quality, metals and organic micropollutants in sediments and biota, soft- and hard-bottom flora and fauna. Sweden has established criteria for assessing the environmental status for water and sediments divided into two main areas: the Baltic Sea and the Skagerrak. Sweden has an Environmental Quality Classification System, though this is geared mainly towards eutrophication and does not fulfil WFD requirements at present.

Existing schemes will need expansion to meet WFD requirements in the **Netherlands**. No formal classification scheme in place, though trend assessment procedure is in use, which uses the concept of 'reference level/state'. A national 'classification' of waterbodies commenced in 1996.

Intensive monitoring and quality assurance schemes are in place in **Germany**, but there is no formal classification scheme which would meet requirements of WFD. Projects have commenced which will deliver typology and classification.

No formal classification scheme for any of the biological elements is in place in Ireland. **Ireland** has a chlorophyll/nutrients monitoring programme which provides data for a eutrophication assessment scheme focused on UTTW and nitrates directives. Only two main categories are provided for: eutrophic or non-eutrophic. A further category of potentially eutrophic is largely used where data are insufficient for definitive judgement, and does not correspond to an intermediate status. Similar classification schemes are in place for shellfish and shellfish water quality, but none of these conforms to requirements of WFD. Expert groups on all quality elements are progressing these topics in conjunction with Northern Ireland/UK.

Portugal has no formal classification scheme. They have a chlorophyll/nutrients monitoring programme and are applying NOAA/NOS scheme. There is also a monitoring programme for toxic algae in shellfish and they have commenced the process of creating a typology, with a basic division into North (similar to north-east Atlantic) and south (torrential estuaries). The means for further discrimination being progressed.

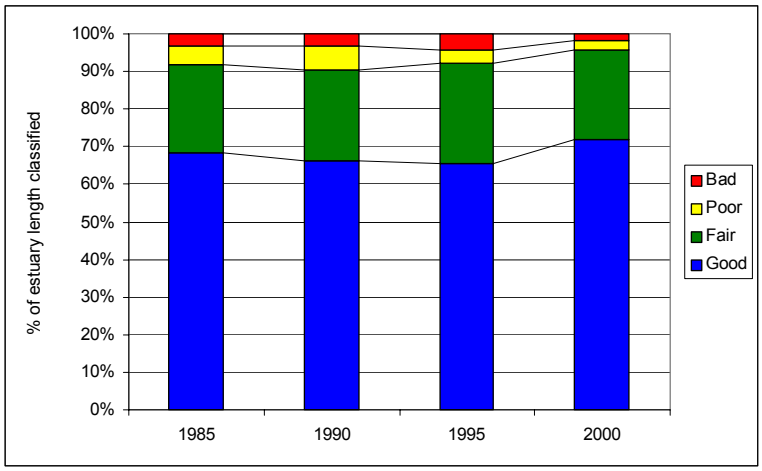
The existing **Slovenian** monitoring scheme covers most parameters, including toxic algae in relation to shellfish quality. Slovenia applies a TRIX scheme, see under Italy.

Sub-indicator: Existing national classifications

Key message

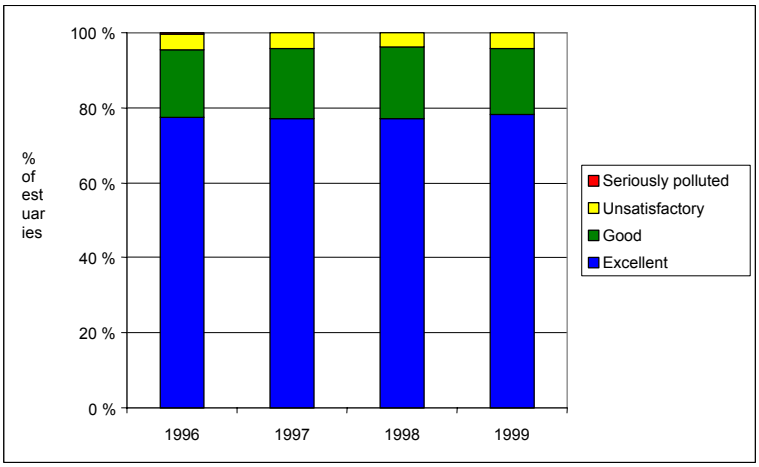
☺ Based on data from England and Wales, Scotland and Finland, the majority of transitional and coastal waters are of good quality.

Figure 1: Classification of estuaries in England and Wales



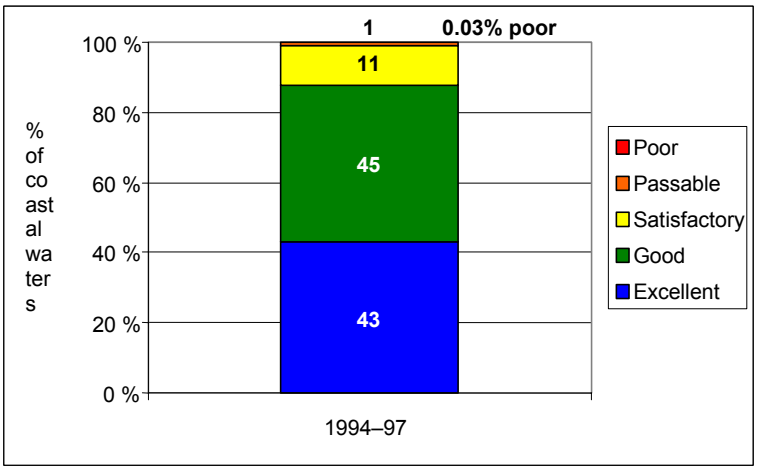
Source: Environment Agency of England and Wales.

Figure 2: Classification of estuaries in Scotland



Source: Scottish Environment Protection Agency.

Figure 3: General classification of Finnish coastal waters based on water quality data (1994–97)



Source: Finnish Environment Institute.

Assessment of the sub-indicator

There are far fewer national classification schemes for transitional and coastal waters than there are for rivers. Those that are used are often based on a combination of chemical, biological and aesthetic measures.

The quality of estuaries in England and Wales showed little improvement between 1985 and 1995 (Figure 1). However between 1995 and 2000, the proportion of good quality estuaries increased and the proportion of poor and bad decreased reflecting the improvement measures introduced under the Urban Waste Water Treatment and Bathing Waters Directives.

The quality of estuaries in Scotland remained relatively constant between 1996 and 1999 (Figure 2).

Figure 3 shows the general classification of Finnish coastal waters based on water quality data from 1994 to 1997. The results indicate that only 12 % of Finnish waters are considered to be of less than good quality. The poorer quality waters are generally due to eutrophication or the presence of hazardous substances or hygienic bacteria. Thus, for example, coastal waters close to large municipalities such as Helsinki are often classified as 'poor' or 'passable'.

References

Environment Agency of England and Wales:
http://www.environment-agency.gov.uk

Scottish Environment Protection Agency:
http://www.sepa.org.uk

Finnish Environment Institute.
http://www.vyh.fi/eng/environ/

CIS WG 2.4 — COAST, Guidance document 'Transitional and Coastal Waters — Typology, Reference Conditions and Classification Systems' (2003)

Data

Spreadsheet files: 38_Classifications.xls

Metadata

Technical information

1. Data source: National reference centres and working documents from the CIS WG 2.4 COAST.
2. Description of data: only the results of the studies are presented in this demonstrator, more detailed information should be requested from the organisations or from the countries when a full indicator is to be produced.
3. Geographical coverage: Examples selected based on available information.
4. Temporal coverage: Some example covers all coast, some only smaller areas.
5. Methodology and frequency of data collection. Most of the countries presented have or are developing regular monitoring and reporting that can be used for classification purposes when tools are available.
6. Methodology of data manipulation. Member states used different numbers of classes and the classes used can not be directly translated to fit the requirements in the WFD. Very few of the existing systems use deviation from reference conditions.

Qualitative information

7. Strength and weakness (at data level). Few countries have yet started using classification tool in accordance to the WFD, but most of them are developing or testing tools that can be included in a future system.
8. Reliability, accuracy, robustness, uncertainty (at data level). As stated above available information were limited, but will be improved over time, when all countries start to prepare for the Water Framework Directive reporting.
9. Overall scoring (give 1 to 3 points: 1 = no major problems, 3 = major reservations):

Relevancy: 1
Accuracy: 2
Comparability over time: 3
Comparability over space: 3

Table 1: Countries that have developed classification systems or are developing such systems.

Country	Established	Number of classes	Nutrients	Eutrophication related biology indicators	Chlorophyl and oxygen	Harmfull substances in Sedediment and water	Harmfull substances in Biota	Aesthetic conditions	Bacteriology	Species composition - some groups	Species composition - wide range	Redlist species
Denmark	1984	(3)	X	X	X	X	X	No	No	X	X	No
England /Wales	Draft	4	No	No	X	X	X	X	No	X	X	X
Finland	1990	5	X[1]	X[2]	X	X	X	No	X	No	No	No
France	Dev.	5	X	X	X	X	X	?	X	X	No	X
Italy	2000	4	X	No	X	No	No	No	No	No	No	No
Norway	1993	5	X	X	X	X	X	No	X	X	No	No
Sweden	1999	5	X	X	X	X	X	no	No	X	No	No
the Netherlands	1996	5	X	X	X	X	No	No	X	No	No	No
Northern Ireland	1996	4	X	X	X	X	X	X	X	X	X	X
Scotland	1980	4	X	X	X	X	X	X	X	X	X	X
Slovenia	1985	4	X	X	X	Water	X	No	X	X	X	?

([1]) Total phosphorous.
([2]) Algae blooms frequency.

Source: CIS WG 2.4 working documents for developing guidelines.

<u>Examples of classification of coastlines in Europe</u>

England and Wales

Information about the quality of estuaries in the UK is given in the table below. The estuaries are categorised into four quality classes, 'good', 'fair', 'poor' and 'bad', based on the biological, aesthetic and chemical quality of the water. A points system is used to classify waters, where points are awarded if certain criteria are met and the total points count for the estuary determines its quality class. In Scotland a new classification system was introduced in 1995, called the Association of Directors and River Inspectors for Scotland (ADRIS) estuary scheme. As with the previous scheme, ADRIS is based on the biological, aesthetic and chemical quality of water, but the criteria are more comprehensive and more precisely defined. In order to achieve a particular classification under the ADRIS scheme waters must satisfy all the quality criteria appropriate to the class. In this scheme, estuaries are also divided into four quality classes; categorised as 'excellent', 'good', 'fair/poor' and 'seriously polluted'. Northern Ireland is changing over to the ADRIS scheme and will present results in future years based on this new classification. The Environment Agency is also considering changing the classification system in England and Wales to a more objective and comprehensive general quality assessment.
Between 1980 and 1995 estuarial quality remained fairly consistent. The latest information for 2000 shows an improvement in England and Wales, with an increase in the proportion of estuaries classified as good or fair:

Class	1980 km	1980 %	1990 km	1990 %	2000 km	2000 %
Good	1.870	68	1.805	66	1.997	72
Fair	620	23	655	24	663	24
Poor	140	5	178	7	67	2
Bad	110	4	85	3	48	2
All classes[1]	2.740	100	2.722	100	2.775	100

([1]) Total estuarial length changed in 1995 as a result of re-classification and revised measurements.
Source: Environment Agency; SEPA; DoE(NI). (http://www.defra.gov.uk/environment/statistics/des/coastwaters/)

Scotland

The SEPA (Scottish Environment Protection Agency) estuary classification scheme is used to classify Scottish estuarine waters. There are four quality classes, 'A' (excellent) through 'D' (seriously polluted). A given area is classified by allocating it to the highest class to which all of its condition criteria conform.

Coastal classification — 1996 to 2000:

	Year	A Excellent km	B Good km	C Unsatis. Km	D Seriously Polluted km	Total km
Length	1996	6210	477	210	50	6947
	1997	6205	496	193	50	6944
	1998	6207	494	199	50	6950
	1999	6152	527	226	45	6950
	2000	6203	509	201	37	6950
%	2000	89	7	3	1	
Change (%)	1996 to 2000	0	+7	-4	-26	

Estuarine classification - 1996 to 2000:

	Year	A Excellent km^2	B Fair km^2	B Unsatis. km^2	D Seriously Polluted km^2	Total km^2
Area	1996	627	147	34	2	810
	1997	625	150	34	1	809
	1998	624	155	29	1	809
	1999	633	144	32	1	809
	2000	637	133	38	0	809
%	2000	1	17.7	3.9	0.1	100
Change (%)	1996 to 2000	+2	-9	+12	-20	

Source: Scottish Environment Protection Agency, SEPA
(http://www.sepa.org.uk/data/classification/coastal.htm)

From both tables it can be seen that the part of the coast or estuarine systems that is seriously polluted (class D) show a positive trend of improvement in the period 1996 to 2000.

Finland

Water quality classifications describe the average quality and domestic, commercial, fishing, and recreational potential of Finnish waterways. The quality category is determined by the sum of the waterway's natural water quality and that of the anthropogenic impact. There are five categories: 'excellent', 'good', 'satisfactory', 'passable' and 'poor'. 79 % of Finnish lakes are classified over 1 km^2 in size, 14 % of total river length (stretches over 2 m wide), and virtually 100 % of Finnish territorial waters in the Baltic Sea. Water quality data from 1994–97 classified 80 % of lakes and 88 % of the sea as either 'excellent' or 'good'. River water quality was lower because it is burdened by greater nutrient and pollution loads; 39 % of river water was of excellent or good quality. 67 km^2 of lakes, 17 km^2 of coastal waters and 290 km of river were classified as 'poor', i.e. in the lowest quality category.

Water quality, general classification 1994–97:

Area type	Excellent	Good	Satisfactory	Passable	Poor
			%		
Coast	43	45	11	1	0.03

Source: Finnish Environment Institute

Greece

Greece supplied a case study covering the bays of Elefsis, Saronikos, N. Evoikos and Thessaloniki. The case study presents classification according to benthos and heavy metals in mussels. Classification from the results from Medpol national monitoring considering concentrations of Cu, Cr, Cd, Ni, Zn, Fe, Mn and Pb, measured between 1990 and 2000, are shown below. Results are presented per stations and are aggregated per area:

Area	Number of stations	High	Good	Moderate	Poor	Bad	Year	Main pressure
				%				
Elefsis bay	2	0	0	50	50	0	2000	Sewage
Saronikos	9	0	0	100	0	0	2000	Sewage
N. Evoikos	4			25	75	0	2001	Trawling(?) and dumping of metalliferous waste
Thessaloniki Bay	6			17	0	83	1995	Sewage
EQS study from Saronikos gulf (ecological quality status as defined by the WFD)								
SE Salamina	1	0	0	100	0	0		Sewage
NE Aegina	1	100	0	0	0	0		
Elefsis	1	0	0	100	0	0		Sewage
Agios Kosmas			Unstable from Good to Poor					Sewage

Source: NCMR, Greece

Norway

Based on the eutrophication related part of the classification system, an overview of the coast (83 000 km) was made in 1997. This overview combines the results of several elements, including

oxygen, nutrients and zoobenthos fauna. A revision of the system was made in 1997 and a new overview was due to be completed by the end of 2002.

Result from the classification in 1997:

Open coast, not including fjords: More than 95 % of the coastline class 1 (very good) based on eutrophication parameters.

Further work required

The indicator should be developed and updated annually following the implementation of the Water Framework Directive.