



Adriatic Common Indicators
Methodology sheet (October 2004)



Title: WATER

Subject of the measuring:

- 1.1 surface water quality;**
- 1.2 marine and costal quality**
- 1.3 consumption**
- 1.4 wastewater management**

The use of indicators as information tools to characterise the status of the specific environment is fundamental, as it supplies an objective system of information and evaluation, when indicators are properly selected and the methodology of their calculation and use is uniformly specified and agreed. Indicators are key tools for linking to policy objectives and targets, for communicating to countries data priorities and reporting complexity in simple ways that policy makers and public can understand.

To support their specific purpose's use, the number of indicators has to be limited. Their choice and, even more important, the choice of their originating data has to be well defined, framed into the institutional official level, analysing all the available database in national and regional authorities: i.e. ministries, agencies, statistical institutes, that could, above all, guarantee a continuous temporal scale and a territorial covering the most complete way.

This choice should allow everybody managing territory in the next future, with special attention to the environmental aspects and degradation/alteration elements, to use a uniform objective methodological tool, easy to update and compare.

A very common framework for indicators environmental analysis adopts the DPSIR model (Driving forces – Pressure – State – Impact –Response) established by the Organization for Economic Cooperation and Development Agency (EEA).

1.1 Surface water quality

Headline indicator:

I.B.E Indice Biotico Esteso or (EBI Extended Biological Index)

1. Definition

Surface water means inland waters (standing and flowing), except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters.

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.

Surface water status is the general expression of the status of a body of surface water, determined by the poorer of its ecological status and its chemical status.

Good surface water status means the status achieved by a surface water body when both its ecological status and its chemical status are at least "good".

Ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters.

2. Question

Which is the right indicator to apply for the regions involved in the Project Aap2020 in relation to the water category?

3. Context

My main doubt when choosing a surface water quality indicator for ACI is whether to apply a status indicator of a biological type: such as the Extended Biological Index (IBE in Italian) or a more complex but also more comprehensive one (including the biological, chemical and physical aspects)

I attached the document "*Guidance on establishing reference conditions and ecological status class boundaries for inland surface waters*" which gives relevant information on this issue.

I am more bound to use a synthetic indicator I've come across when preparing this document. It is a synthetic indicator used by the Italian Environmental Protection Agency as a surface waters monitoring tool and it is described by Raffaella Canepel and Maurizio Siligardi.

I enclose part of the abstract of the paper describing this indicator: (and a jpg version of the document)

" The monitoring of surface water quality gives the main information about the water resource state of health, also permitting to assess the effectiveness of an implemented environmental policy.

For a correct evaluation of the river water quality, we worked out a synthetic indicator that provides with the overall quality information for every sampling spot, taking into account data from chemical, biological and bacterial analyses.

Seven parameters: five chemical, (NH₄⁺, PO₄³⁻, BOD₅, conductivity, oxygen consumption (Kübel)); one biological I.B.E.(Extended Biological Index of Italy); one bacterial (faecal coliforms merge into three separately indexes, then some relative weights are applied and they combine into a single indicator therefore called synthetic indicator

The use of this simple and efficient tool overcomes any partial statement coming from a single analysis (chemical, biological or bacterial) in a comprehensive assessment of river water quality. This original approach brings together the reliability of a scientific tool with the effectiveness and objectivity as a support for decisions concerning water resources management...

However, it is feasible that the members of the project find easier to follow an easier but also less comprehensive indicator to measure or assess the quality of water, such as the Extended Biological Index (IBE of Italy)."

4. Targets

To develop a reliable and effective method to assess surface water quality. This method should be based on comprehensive indicators, which should be able to be collected and compared throughout the regions involved in the Aap2020 project and extended along the Adriatic Forum countries.

It is to be decided whether this quality is related to biological or to ecological status.

5. Unit of measurement

If the IBE is chosen, the assessment of surface water quality is stated on the basis of the modification in macroinvertebrate community composition. It is based on a comparison between an expected community and an observed community in the river stretch. The IBE values have been grouped in five Quality Classes, each represented by different colour codes, as it can be seen in the attached synthetic indicator paper.

6. Frequency of measurement

For the Synthetic Indicator measures should be taken monthly.

7. Form of reporting / presentation

The results emerged both from the method using only IBE and from the synthetic indicator are presented under quality maps elaborated every year, where different colours are linked to correspondent quality classes.

8. Examples of similar application

The use of these indicators can be checked by Piero Remitti through the Environmental Protection Agency of Italy.

9. Questions to address, future developments

Experience of surface water quality indicators used so far in the Adriatic Regions may help to decide which indicator would meet the Aap2020 members' needs.

The SACA index (a synthetic indicator) has also been identified as a possible indicator for the quality of surface water. SACA means (Stato Ambientale dei Corsi d'Acqua) or Environmental State of a body of water.

Nevertheless, the difficulty on using this indicator derives from the fact that the monitoring of the original data for its construction is not widely carried out along Italy.

10. Keywords

Synthetic Indicator as a surface water monitoring tool.

Extended Biological Indicator I.B.E.

Ecological status. Biological Status.

1.2 Marine and coastal water quality

Relevant information for the methodological approach of this category can be found on the paper:

"Coastal Environment in Italy: Preliminary Approach using the "DPSIR Scheme" of Indicators" by Gianna Casazza , Cecilia Silvestri , Emanuela Spada & Antonio Melley . (document attached)

Headline Indicator: TRIX

1. Definition

Coastal zones are complex environments; they are influenced by a myriad of inter-related forces related to hydrological, geomorphological, socio-economic, institutional and cultural systems. The close links (through both human and physical processes) between the marine and terrestrial components of the coastal zone imply that coastal zone management should always consider both the marine and terrestrial portions of the coastal zone, as well as the river basins draining into it.

Since the extent of the zone over which the land and the sea interact is area specific, it is not appropriate to give a general *a priori* geographic definition of the "coastal zone".

Indeed, frequently important driving forces or areas of impact are located in other administrative units and possibly far from the coastline as many of the systems influencing the coastal zone (transportation networks, demographic flows, changes in terrestrial land use, pollution transport systems, etc) are physically dispersed.

Definitions of "coastal area" or "coastal strip", considering the terrestrial and the marine extensions are still worldwide debated issues, with no final simple solutions.

For the purpose of ACI we could agree on considering the marine part of the coastal zone.

2. Question

Are the original data for the construction of TRIX available at the level of the municipalities participating on the Aap2020 Project?

3. Context

The Adriatic sea, with a length of 800 km and a width ranging from 90 to 220 km, is an enclosed basin linked with the eastern Mediterranean through the Otranto strait (about 75 km). It is a shallow sea: in the North western part maximum depth reaches 70 meters, slowly decreasing northbound, up to depth lower than 30 meters; in the middle Adriatic bathymetry reaches about 150 m, while southern the continental shelf, which is constantly wide along the littoral area, ends into a 1200 m deep trench, offshore the Albanian coast.

Considering the hydrodynamic characteristics, main circulation trends of all Italian seas are typically Mediterranean: counter-clockwise pattern, with relevant seasonal variations; surface currents are more intense during winter and spring periods, while circulation in summer time is weaker and quite variable. Particularly important is circulation in the higher Adriatic basin: most Italian riverine inputs are found here (rivers: Isonzo, Tagliamento, Piave, Brenta, Adige and mainly Po) and their considerable fresh water mass, relatively to the basin total volume, strongly influences general circulation.

This is the only Italian area where a close correlation between coastal waters and hydrographic basins is clearly evident. For the rest of Italian coastal areas influence of riverine inputs is limited to a few areas of limited extension.

New legislation was enforced in Italy in 1999 (D.L. 11 May 99, n.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 4 trophic state. 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.

Trophic index or TRIX: Evaluation of the trophic state of the coastal waters deriving from an elaboration of physicochemical parameters-

$$\text{TROPHIC INDEX} = \text{LOG} [\text{Ch} * \text{D}\% \text{O} * \text{N} * \text{P}] - [1,5] / 1.2$$

Main parameter:

- 1.- Chlorophile a Cha: mg/m^3
- 2.- Oxygen (absolute deviation of saturation) $\text{D}\% \text{O} = \text{[ass}[100 - \% \text{O}_2]]$
- 3.- Total Nitrogen NT: mg/m^3
- 4.- Total phosphorous PT: mg/m^3

Other parameter:

- 5.- Mineral Nitrogen dissolved DIN = $[\text{N} - (\text{NO}_3 + \text{NO}_2 + \text{NH}_4)]$
- 6.- Phosphorous Minerale Dissolved $[\text{P} - \text{PO}_4]$

Additional parameter

- 7.- Transparency Secchi Disc in meters

TRIX can be obtained from different original data.

- TRIX (NT, PT)
- TRIX DIN, PT)
- TRIX (DIN , P/PO₄)

The TRIX ranges from 3.33 to 8.67

4. Targets

To evaluate the quality of costal waters using a synthetic indicator (trophic index).

5. Unit of measurement

Quality classes

6. Frequency of measurement

7. Form of reporting / presentation

8. Examples of similar application

Look at the report "Gli Indicatori trofici per le acque marino costiere"

9. Questions to address, future developments

Quality and state of marine coastal water is being assessed using TRIX, although the new Italian water Directive addresses towards the use of biological indicators too (analysis of structure and communities of main biocenosis), in order to support the first indicator (TRIX).

On the other hand it is important to highlight the non uniform availability of original data for the calculation of TRIX along the Italian costs, and the likely scarcity of data for the other regions involved in the project.

10. Keywords

TRIX Trophic Index, European Water Framework Directive 2000//EC

1.3 Consumption

Headline Indicator: Consumption of water per capita per day (domestic use) (l/pc/d)

1. Definition

Consumption of water per person depends on the availability and price of water, the climate, and the uses to which water are customarily put by individuals (drinking, bathing, washing, gardening).

This is a key pressure indicator when focusing on the sustainability of urban areas.

2. Question

Should Aap2020 discriminate among the different types of consumption (residential, industrial, commercial, total) f.i. Water consumed by Industry sector as a percentage of total consumed?

3. Context

If we choose to measure the consumption of water used on domestic needs, we'll divided the total water used in a city along a year (excepting the industrial use) into the total population and the numbers of days (365).

Should we only consider the amount of water use on domestics needs in relation to the total supplied water?

4. Targets

Improve and make more sustainable the citizenship's performance in the usage of water ??

5. Unit of measurement

Litres Per capita and per day

6. Frequency of measurement

Once a year

7. Form of reporting / presentation

Graphics

8. Examples of similar application

<http://www.iclei.org/cities21/c21ind.htm>

http://www.flanet.org/ricerca/a21l/indicatori_en.pdf

9. Questions to address, future developments

We need to take into account the variability on the number of residents (seasonal) in tourist areas

10. 11. Keywords

Domestic consumption

1.4 Water Management

Headline Indicator: % of treated water

1. Definition

Treated water. Water receiving some kind of treatment in order to reduce its impact on the human health and on the ecosystems.

'urban waste water' means domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water;

'domestic waste water' means waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities;

'industrial waste water' means any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic waste water and run-off rain water;

'agglomeration' means an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point;

'collecting system' means a system of conduits which collects and conducts urban waste water;

'1 p.e. (population equivalent)' means the organic biodegradable load having a five-day biochemical oxygen demand (BOD₅) of 60 g of oxygen per day;

'primary treatment' means treatment of urban waste water by a physical and/or chemical process involving settlement of suspended solids, or other processes in which the BOD₅ of the incoming waste water is reduced by at least 20 % before discharge and the total suspended solids of the incoming waste water are reduced by at least 50 %;

'secondary treatment' means treatment of urban waste water by a process generally involving biological treatment with a secondary settlement

'eutrophication' means the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned;

2. Question

Which level of treatment are we considering? Pre-treatment, primary, secondary or tertiary.

Should we only consider the amount of treated water coming from the sewerage system or should we include the amount treated on site by the industrial sector?

3. Context

The Urban Waste Water Treatment Directive (91/271/EEC) is an important Community Water Policy and its aim is to protect the environment from the adverse effects of urban waste water

discharges. The directive sets minimum standards for the collection, treatment and disposal of waste water dependent upon the size of the agglomeration, and the type and sensitivity of the receiving waters. The directive has some important deadlines. The following assessment of the implementation of the directive is based on the Commission's report 2002 on Member States' implementation of the directive.

By 30 June 1993, the directive had to be transposed into national law. Many Member States were late in transposing the directive, the last being Italy in 1999.

Member States were required to identify sensitive areas at the latest by 31 December 1993. Sensitive areas are surface waters which may become eutrophic if protective action is not taken; drinking waters with nitrate exceeding standards and areas where further treatment is required to comply with other directives (for example, bathing waters or shellfish waters). Six Member States have decided to apply stringent (tertiary) treatment over all their territory (all sensitive areas); nine other Member States have identified certain water bodies in their territory as a sensitive area. These areas were identified, with a greater or lesser degree of delay, between 1994 and 1999.

By 31 December 1998, Member States were required to ensure that waste water treatment facilities with stringent (tertiary) treatment were available for all agglomerations with a population equivalent greater than 10.000 where the effluent was being discharged into a sensitive area. Major delays in implementing have been found in most Member States. Taking the 3.243 agglomerations in which Member States have decided to provide tertiary treatment out of some 20.000 agglomerations affected by the directive, only Denmark and Austria were in a situation very close to conformity on 31 December 1998 and eight countries were far from conformity. However, most Member States had plans to achieve conformity in these agglomerations over the next few years.

The Directive sets out what sort of treatment systems (primary, secondary and tertiary) are required in different situations – for example making secondary treatment systems, which use biological processes to break down organic material, essential wherever discharges flow directly into fresh waters or estuaries.

The Directive is resulting in increased treatment capacity in all EU countries except Sweden, Finland and the Netherlands, where it was already sufficient. The largest increase will be seen in southern Europe and Ireland.

As a result, the EU's collection and treatment systems should be able to cope with all organic discharges from most Member States by 2005, reducing nutrient and organic matter pollution further. The most significant improvements are expected to be seen in levels of phosphorous and biochemical oxygen demand in southern Europe.

The Northern and Western European countries with the longest tradition of purification have a high proportion of treated wastewater, and treatment levels are being continual improved. Southern countries are also improving the level of treatment.

Primary (mechanical) treatment removes some of the suspended solids.

Secondary (biological) treatment uses aerobic or anaerobic micro-organisms to decompose most of the organic matter and retain some (around 20-30 %) of the nutrients.

Tertiary (advanced) treatment generally includes phosphorus removal and in some cases nitrogen removal.

One example of the results of using different treatments is given by the fact that: no ammonium is removed by primary treatment removes, where secondary treatment removes about 75 %.

The data on percentage of population connected to different types of treatment plant provide the only indicator of trends in wastewater treatment. Ideally, the indicator should be changed

to the number of person equivalents connected to the different types of treatment plants, but such data are not available.

The Urban Wastewater Treatment Directive (UWWTD) requires Member States to provide all agglomerations of more than 2000 population equivalents (p.e.) with collecting systems from 1991. Secondary treatment must be provided for all agglomerations of more than 2.000 p.e. discharging into fresh waters and estuaries and for all agglomerations of more than 10.000 p.e. discharging into coastal waters.

Member States have to identify water bodies as sensitive areas in accordance with the criteria of the Directive (relating to eutrophication). In sensitive areas and the catchments of sensitive areas, Member States have to provide more advanced treatment with nutrient removal.

For agglomerations smaller than described above and those equipped with a collecting system, the treatment must be appropriate, meaning that the discharge must allow the receiving waters to meet the relevant quality objectives.

4. Targets

To know the state of water treatment on the municipalities involved in the project.

To improve the water treatment (reaching national and European standards) (and make more sustainable the citizenship 's performance in the usage of water ??

5. Unit of measurement

(Total treated water / Total Water consumed) * 100

6. Frequency of measurement

Once a year/ Semester

7. Form of reporting / presentation

Graphics

8. Examples of similar application

9. Questions to address, future developments

The percentages of the water reused (agriculture and gardening) and water discharged into the sea would add remarkable information in the way to sustainability in the region

Other indicators that could be incorporated are:

The share of collected and treated wastewater by the public sewerage system may give an idea of the level of development for the solution of pollution

The share of industrial wastewater treated on site. This is the proportion of wastewater produced by industry and receiving autonomous treatment that is adequate to allow it to be discharged into the environment without impacting human health or ecosystems.

10. Keywords

Treated water, discharged (disposed) water, reused water