CIS WORKSHOP ON SURFACE WATERS MONITORING NETWORKS AND CLASSIFICATION SYSTEMS

Brussels 27-28 April 2006

Draft collection of presentations

This working document has been produced in advance of the Workshop for the participants. Some of the final presentation may differ from the ones included here. Final presentations will be made available after the Workshop through the public library of WFD CIRCA.

CIS Workshop on Surface water monitoring networks and classification systems

Summary of the CIS Guidance Document number 7 on Monitoring

Steve Nixon, WRc

Guidance Document proposes an overall pragmatic approach

- Because of the diversity of circumstances within Europe
- Guidance may be applied in a flexible way in answer to problems that will vary from one river basin to the next
- Guidance should be tailored to specific circumstances
- Any adaptations should be justified and reported in a transparent way

Article 8 – Monitoring

- for surface water status, groundwater status and protected areas
- to establish a coherent and comprehensive overview of water status within each river basin district
- Operational by 22 December 2006, and
- in accordance with the requirements of Annex V

Scope of Directive/monitoring

Covers all waters

- Rivers, lakes and groundwater
- Transitional waters
- Coastal waters up to one sea mile
- For chemical status also territorial waters which may extend to 12 sea miles from the territorial baseline of a Member State

Types of monitoring

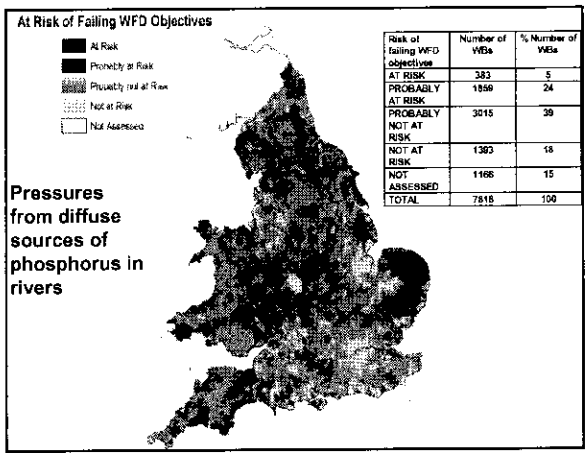
- Surveillance
- Operational
- Investigative
- Protected Areas

Objectives of surveillance monitoring

- Supplementing and validating the impact assessment procedure
- Designing efficient and effective future monitoring programmes
- Assessing long term changes
- Undertaken for at least a period of one year during the period of a RBMP

Objectives of operational monitoring

- Establish status of those water bodies identified as being at risk of failing to meet their environmental objectives
- Assess any changes in the status of such water bodies resulting from the programmes of measures
- Results of operational monitoring used to classify status of water bodies at risk
- Results of surveillance monitoring used to classify status of water bodies not at risk



Objectives of investigative monitoring

- To ascertain the causes of a water body or water bodies failing to achieve the environmental objectives when not known
- To ascertain the magnitude and impacts of accidental pollution

Monitoring information also required for:

- Estimating pollutants loads - transboundary and into seas
- Intercalibration exercise
- Assessing compliance with standards and objectives of Protected Areas
- Quantifying reference conditions where they exist

Where to monitor? Surveillance

- In sufficient water bodies to provide an assessment of the overall surface water status within each catchment and sub-catchment within the river basin district
- Also dependent on amount of existing monitoring data and confidence in Annex II risk assessments

Where to monitor? Surveillance

- Rivers with catchments > 2 500 km^2
- Large lakes and reservoirs,
- Significant international transboundary water bodies
- Sites included under Exchange of Information Decision

Where to monitor? Surveillance

- May initially need to be more extensive in terms of water bodies included, monitoring stations within bodies and the range of quality elements because
  - probable lack of appropriate existing monitoring data
  - different/new range of elements/pressures to be monitored

Where to monitor? Operational

- For all water bodies identified as being at risk of failing EOs
- For all water bodies into which priority substances are discharged
- Not necessarily in ALL such bodies as grouping of water bodies allowed but must be technically or scientifically justifiable

Key Principle Grouping of water bodies

- Surface water bodies may be grouped for monitoring purposes
- As long as the monitoring of sufficient indicative or representative water bodies in the sub-groups of surface water provides for an acceptable level of confidence and precision
  - in the results of monitoring, and
  - in particular the classification of water body status

Where to monitor? Operational

- Number of monitoring stations needs to be sufficient to assess the magnitude and impact of
  - significant point sources,
  - diffuse sources and
  - hydromorphological pressures
- More than one station per water body may be required

What to monitor?

Surveillance

- Parameters indicative of all biological, hydromorphological and general physico-chemical quality elements
- Priority List substances if discharged in River Basin
- Other pollutants if discharged in significant quantities

Operational

- Parameters indicative of those biological and hydromorphological quality elements most sensitive to the pressures to which the body(ies) are subject
- Only priority substances and other pollutants (including nutrients) that might cause failure of EOs

Meaning of 'parameter' and 'quality element'

Elaborated in CIS Guidance No. 13 – Overall approach to the classification of ecological status and ecological potential

Groups of Quality Elements	Examples of Quality Elements	Examples of parameters
General physicochemical elements	Oxygenation conditions	COD, BOD, Dissolved oxygen (see point 12 of Annex VIII)
Non-priority, specific pollutants	Copper discharged in significant quantities	Concentrations of copper in water, sediment or biota
Hydromorphological elements	Hydrological regime	Quantity of flow, dynamics of flow
Biological elements	Composition and abundance of benthic invertebrate fauna	Composition, abundance (for further examples see Table 3)

Meaning of 'parameter' and 'quality element' (2)

Example Biological Quality Element	Examples of indicative parameters (metrics) based on measurements of composition and abundance
Benthic Invertebrate Fauna (rivers)	Presence or absence of particular species or groups of species Overall richness or richness of particular taxonomic Groups Relative number of taxa in particular taxonomic groups Abundance of particular species or groups of species Relative abundance of particular species or groups of species Overall diversity, or diversity within particular taxonomic groups

Biological Quality Elements

	Phyto-plankton	Aquatic flora	Benthic invertebrates	Fish
Rivers	Yes	Yes	Yes	Yes
Lakes	Yes	Yes	Yes	Yes
Transitional waters	Yes	Yes	Yes	Yes
Coastal waters	Yes	Yes	Yes	No

Key principles in the monitoring of biological quality elements

- Use of non-biological indicators for estimating the condition of a biological quality element may complement the use of biological indicators but it cannot replace it.
- Must be at an appropriate taxonomic level to achieve adequate confidence and precision in the classification of the quality elements
- May use particular species or groups of species which are representative of the quality element as a whole

Hydromorphological elements supporting the biological elements

	Rivers	Lakes	Transitional waters	Coastal waters
Hydrological regime	Yes	Yes		
Tidal regime			Yes	Yes
River continuity	Yes			
Morphological conditions	Yes	Yes	Yes	Yes

Chemical and physicochemical elements supporting the biological elements

	Trans-parency	Thermal conditions	DO conditions	Salinity	Acid. status	Nutrient conditions
Rivers		Yes	Yes	Yes	Yes	Yes
Lakes	Yes	Yes	Yes	Yes	Yes	Yes
Transition al waters	Yes	Yes	Yes	Yes		Yes
Coastal waters	Yes	Yes	Yes	Yes		Yes

Specific pollutants — **Pollution by all priority substances identified as being discharged into the body of water**

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

Chemical Monitoring Activity

- Mandate approved by Water Directors in Luxembourg, June 2005
- Surface and groundwaters
- Analytical issues
- Surface/marine water part dealing with monitoring matrices, sampling, sample pre-treatment, frequency, location, areas of impact etc.
- Proposed Commission Decision on minimum performance criteria for chemical monitoring methods and the quality of analytical results

Frequency of monitoring

- Minimum given for all quality elements,
- More frequent may be necessary (e.g. to detect long term changes and/or initially before first RBMP),
- Less frequent if justifiable,
- Seasonally targeted
- Achievement of acceptable levels of confidence and precision in assessing status of water bodies – balanced between costs of monitoring and costs of measures

Key Principle

- The actual precision and confidence levels achieved should enable meaningful assessments of status in time and space to be made
- Member States will have to quote these levels in RBMPs and will thus be open to scrutiny and comment by others. This should serve to highlight any obvious deficiencies or inadequacies in the future

Quality Element	Rivers	Lakes	Transitional	Coastal
Biological				
Phyto-Plankton	6 months	6 months	6 months	6 months
Other aquatic flora	3 years	3 years	3 year	3 year
Macro invertebrates	3 years	3 years	3 years	3 years
Fish	3 years	3 years	3 years	
Hydromorphological				
Continuity	6 years			
Hydrology	continuous	1 month		
Morphology	6 years	6 years	6 years	6 years
Physico-Chemical				
Thermal Conditions	3 months	3 months	3 months	3 months
Oxygenation	3 months	3 months	3 months	3 months
Salinity	3 months	3 months	3 months	
Nutrient Status	3 months	3 months	3 months	3 months
Acidification Status	3 months	3 months		
Other Pollutants	3 months	3 months	3 months	3 months
Priority Substances	1 month	1 month	1 month	1 month

Monitoring for Protected Areas

- Additional monitoring required for drinking water abstraction points and habitat and species protection areas.
- Also includes areas designated as bathing waters, as vulnerable zones and sensitive areas.
- The latter are in Directives that also have monitoring requirements
- CIS Guidance on "Eutrophication assessment in the context of European water policies" includes a chapter on "Monitoring – guidance and integration of requirements stemming from various obligations"

Thank you for your attention!

The Danish Monitoring Strategy for Meeting the Obligations of the Water Framework Directive

Lilian van der Bijl
National Environmental Research Institute

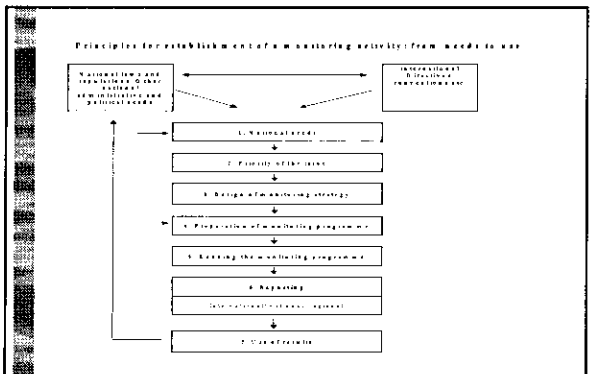
My Presentation Concerns

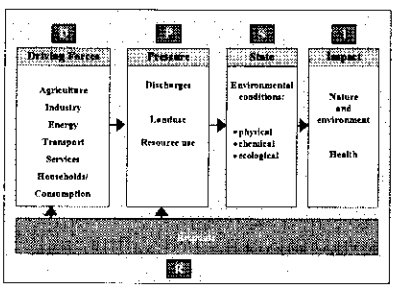
- The WFD challenge
- Overall principles for the monitoring programmes
- The Danish NOVANA programme
- Additional monitoring to meet the WFD
- Issues to discuss

Exciting and Future Monitoring

WFD Monitoring obligation	Surveillance	Operational	Investigative

Current Danish monitoring programmes	NOVANA	Regional monitoring





No monitoring without objectives - No objectives without monitoring

- International objectives
- National objectives
- Regional objectives

Guiding principles for monitoring

- Relevant
- Economically feasible
- Cost/efficient
- Scientific
- Flexible
- Reveal trends

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NOVANA aims at

- Establishing the national and regional status and trends of the environment
- Identifying year to year variation
- Distinguishing between natural variation and variations due to human impacts
- Identifying the gap between observed status and objectives

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NOVANA subprogrammes

- **Lakes**
- **Watercourses**
- **Marine Areas**
- **Groundwater**
- **Agricultural Catchments**
- **Point sources**
- **Air quality and atmospheric deposition**
- **Terrestrial habitats**
- **Species**

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NOVANA strategy

- Integrated monitoring of environment, habitats and species (HD/WFD)
- Few intensively monitored stations
  - every year
  - several parameters
- many extensively monitored stations
  - representative monitoring
  - every 6 years
  - selected parameters

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Parameters investigated in the different subprogrammes within NOVANA

Investigated Parameters	Lakes	Water courses	Agric. catchment monitoring (1 2 3 4 5)	Ground-water	Point sources	Marine waters	Atmo-sphere	Terre-strial habitats	Species
Catchment description	x	x	x	x				x	
Catchment analyses	x	x	x						
Physical parameters:									
- oxygen and temperature	x	x	x	x	x	x			
- water quantity	x	x	x x		x	x	x	x	
- transparency	x					x			
- agr. soil physics					x			x	
Chemical parameters:									
- nutrients	x	x	x x x x	x	x	x	x	x	
- org. matter, other param.	x	x	x x	x	x	x		x	
- acidifying substances							x		
- hazardous substances	x	x	x x	x	x	x			
- heavy metals	x	x	x	x	x	x	x		
- pesticides			x x x x	x	x				
Biological investigations									
- Phytoplankton	x					x			
- Zooplankton	x					x			
- Fish fry	x								
- Fish	x	x							
- Macrophytes	x	x				x			
- Macroinvertebrates		x	x			x			
- Vegetation								x	x
- Birds	x		x						x
- Amphibians	x		x						x
- Mammals			x						x

1 = groundwater; 2 = liquid manure; 3 = watercourses; 4 = ocean; 5 = soil water

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WFD Article 8.2

The programmes shall be operational in 2006 and comprise:

- Surveillance monitoring
- Operational monitoring
- Investigative monitoring

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DEVANO

Extensive monitoring subprograms to

- Establish status of water bodies in 1 year
- Sites not included in NOVANA
- Reduced set of parameters
- Lower frequencies

DEVANO - monitoring network

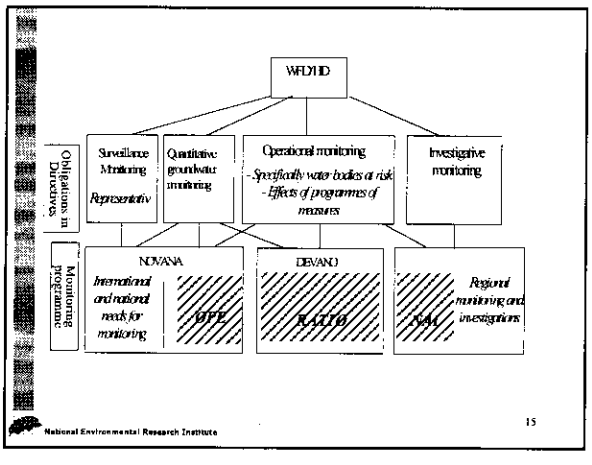
Ia) Water body evidently meeting the objective

Ib) Available data indicate no risk

IIa) Water body may be at risk - Lack of data to confirm

IIb) Probably no objective compliance - supplying monitoring/characteristics necessary to confirm

IIc) Water body obviously not meeting the objective



Issues to discuss

- **What is a "significant water body"?**
- **What is the needed density of the monitoring sites?**
- **What frequencies are needed to establish long-term changes**
- **Is the Danish strategy for operational monitoring acceptable i.e. 1) a limited number of water bodies and 2) awayting effects of programmes of measures**

CIS workshop on

Surface Waters Monitoring Networks

Experiences of designing WFD-monitoring networks in the Netherlands

Wim van Leussen
Ministry of Transport, Public Works and Water Management, NL
Brussels - 27-28 April 2006

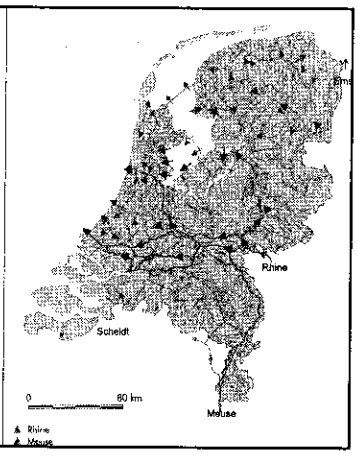
Implementation WFD in the Netherlands

Living in a delta
(more than 50% lower than sea level)

- Rhine
- Meuse
- Scheldt
- Ems



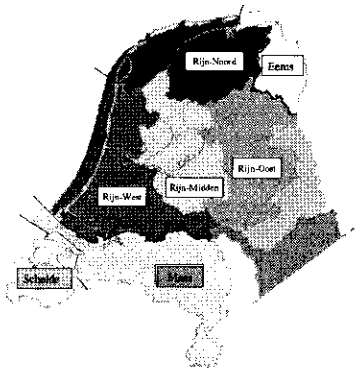
Distribution of the water of the rivers **Rhine** & **Meuse** in the Netherlands



Implementation WFD in the Netherlands

↓

seven (sub)catchments



Working Programme Design WFD-monitoring network

WFD Monitoring network	2005	2006
NL-guidelines		
regional design		
compliance checking		
improvements of the network		
uploading data to WFD-portal		
regional decision-making		
national decision-making		
final monitoring nertwork		

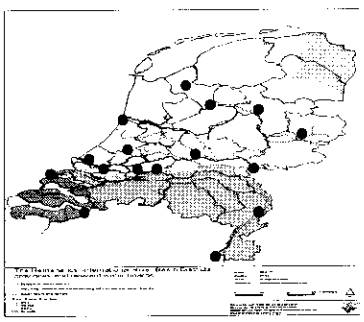
Surveillance monitoring

Objectives:

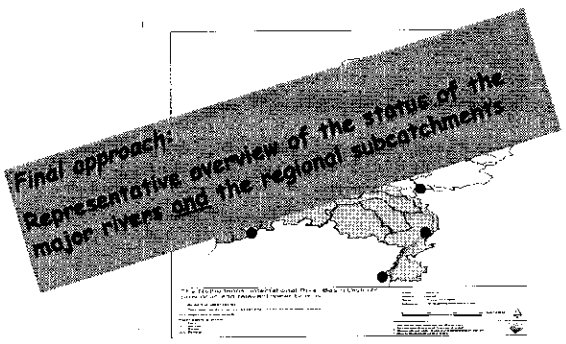
- Assessment of long term changes in natural conditions and effects of anthropogenic activities
- Supplementing "risk analysis"
- Efficient and effective design of future monitoring programmes

➔ **How to obtain a representative overview?**

First approach for the surveillance network:
mainly in the major rivers



First approach for the surveillance network:
mainly in the major rivers



Selection of measuring locations

- representative cluster of water bodies
- the same type and status (biology and hydromorphology)
- measuring location
  - chemistry: *1 measuring point*
  - biology and hydromorphology: *generally more measuring points or the whole area*

Selection of measuring locations

BIOLOGY

major questions:

- **water body with a significant size and functions in the catchment?**
- **border crossing water body of significant size?**
- **belongs to one of the dominant or important types of water bodies in the catchment?**

Selection of measuring locations

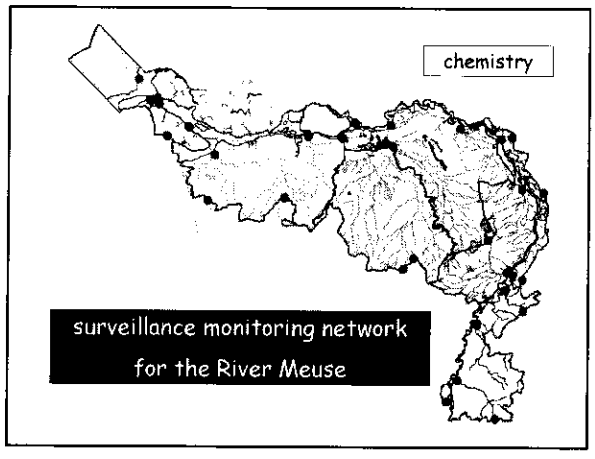
CHEMICAL SUBSTANCES

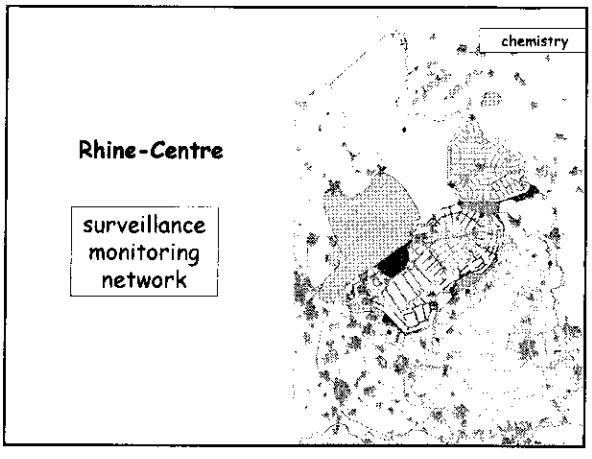
- **all WFD priority substances** → in the major rivers and at the downstream end of relevant subcatchments; at relevant border crossing waters
- **other chemical substances, giving essential pressure to the catchment** → in the major rivers and at the downstream end of relevant subcatchments; at relevant border crossing waters
- **physico-chemical parameters, supporting the biological quality elements** → at the biological monitoring locations

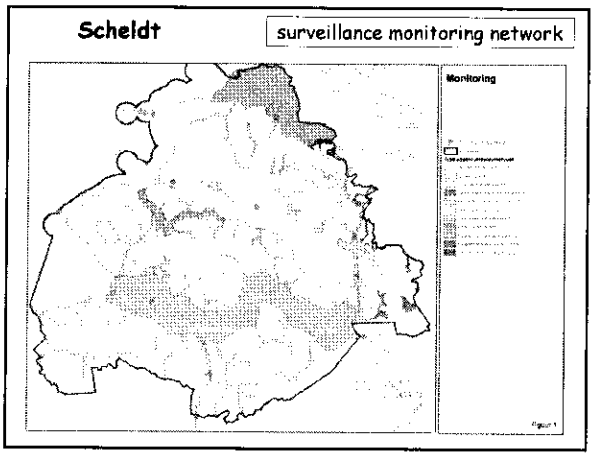
Selection of measuring locations

HYDROMORPHOLOGY

- **hydromorphological quality elements, supporting the biological quality elements** → at the biological monitoring locations; over the whole area of the water body



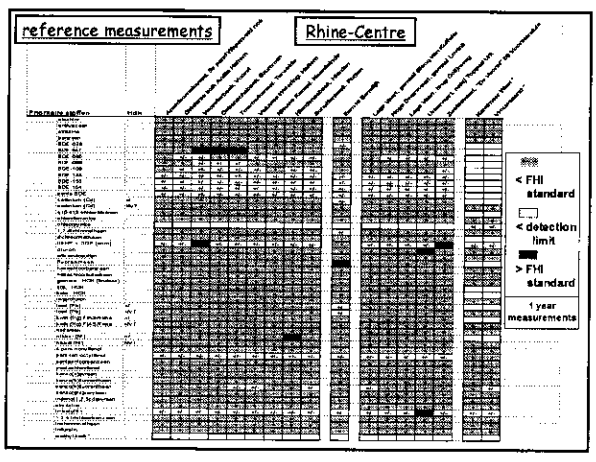




Quality elements and measuring frequencies

Discipline	Quality element	measuring frequencies (yr⁻¹) R rivers	L lakes	TW transit waters	CW coastal waters
Biology	phytoplankton		6	6	6
	phytobenthos	1	1		
	macrophyten	1	1		
	marcoalgae			1	1
	angiosperms			1	1
	macrofauna	1	1	2	1
	fish	1	1	2	
Chemistry	priority substances	12	12	12	12
	other substances	4	4	4	4
	physico-chemical parameters	4	4	4	4
Hydro-morphology	hydrologic regime	conti-nuously	high frequent	high frequent	high frequent
	river continuity	1			
	morphology	1	1	1	1

frequencies in accordance witrh WFD,
sometimes higher due to requirements of the status classification



Hydromorphological quality elements

RIVERS

1. Continuity in the river (inventary of obstacles) (biota and sediment)
2. Obstacles for fish migration?
3. Water levels
4. Discharge, flow velocity
5. Any effects on free (natural) discharge?
6. Natural dynamics of the flow? Any effects?
7. Tidal charateristics, incl. tidal range
8. Groundwater levels in surrounding area
9. Course of the river (sinuosity, etc.)
10. Cross section and natural condition
11. Occurrences of artificial bottom areas
12. Percentage of natural substrate
13. Erosion / sedimentation patterns
14. Occurrences of bank protection structures
15. Land use in the riparian zones
16. Land use in the flood plains
17. Possibilities for natural inundation
18. Possibilities for natural meandering

Hydromorphological quality elements

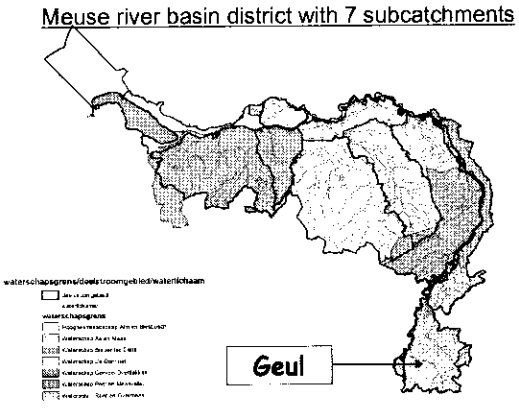
Meuse river basin district

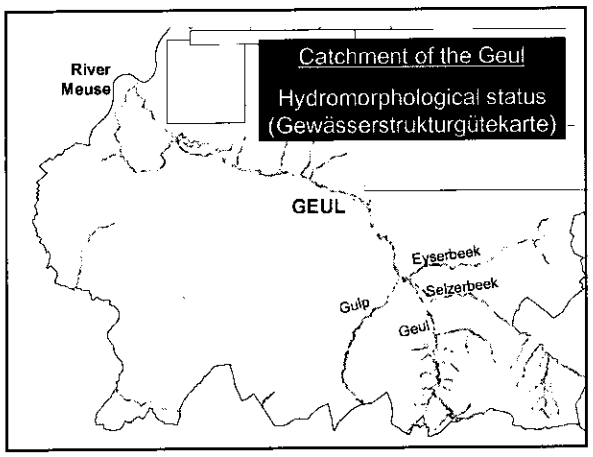
→ Overall description of the hydromorphological status

Deutsche Strukturgütekartierung

For the whole Meuse river basin district →

Meuse river basin district with 7 subcatchments





Operational monitoring

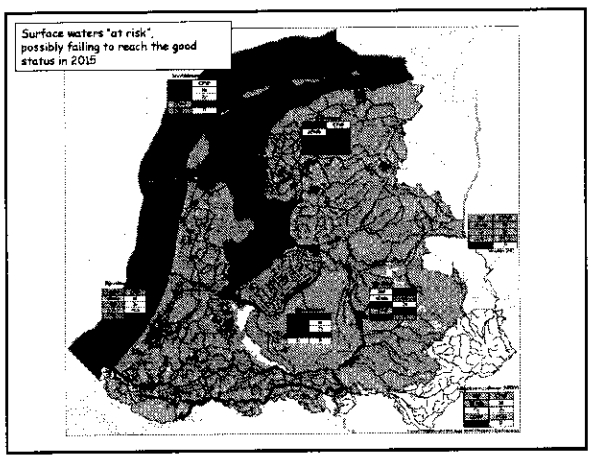
Objectives:

- Establish the status of the "at risk" water bodies (failing to meet the environmental objectives)
- Assess any changes in this status as a result of the implementation of programmes of measures

→ determination in 6 steps

→ "at risk" assessment of 2004

→ **How to obtain a representative overview?**



Where to measure?

- All water bodies, which are "at risk" and the HMWBs
- All water bodies, where priority substances are discharged

→ water bodies can be clustered, but measuring points should be *representative*

6 steps

step 1: operational monitoring needed?
(water bodies "at risk", and/or HMWBs)

step 2: clustering of water bodies
(same type, status, comparable pressures, belonging to the same (sub)catchment)

step 3: what must be monitored?
- selection of dominant pressures;
- selection representative (most sensitive) biological quality element;
- selection significant supporting abiotic quality elements

step 4: where to monitor?
- selection of representative measuring points

step 5: frequencies of monotoring measurements

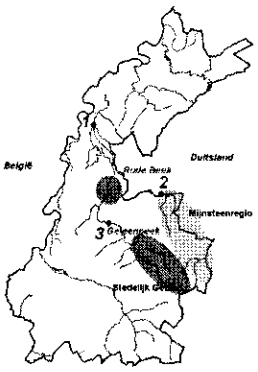
step 6: monitoring methods (determination of the parameters)

Geleenbeek

tributary of the river Meuse

Some typical characteristics:

- area with previous mining industry
- densely populated area in Eastern part
- 3 sewage treatment plants
- important functions: agriculture and nature
- high potentials for ecological zone along the river



Geleenbeek

tributary of the river Meuse

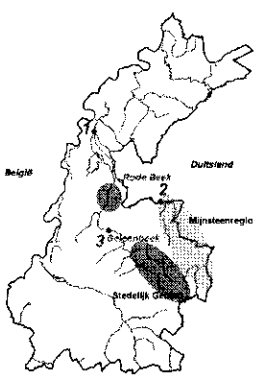
Pressures:

chemical:

- sulphate and heavy metals from previous mining area
- heavy metals and pesticides from agriculture
- inputs from sewage treatment plants (point sources) and agriculture (diffuse sources)

hydromorphological:

- normalisation, obstacles for continuity



Geleenbeek

3 clusters of water bodies

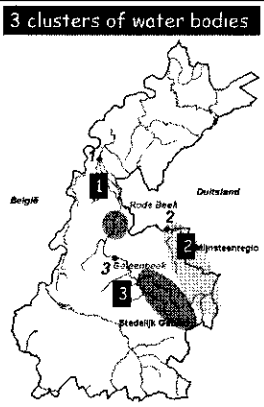
tributary of the river Meuse

Three operational monitoring locations:

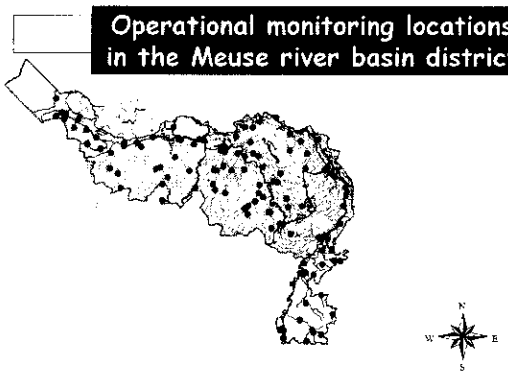
1. - heavy metals
   - pesticides
   - priority substances
   (1. = surveillance MP)

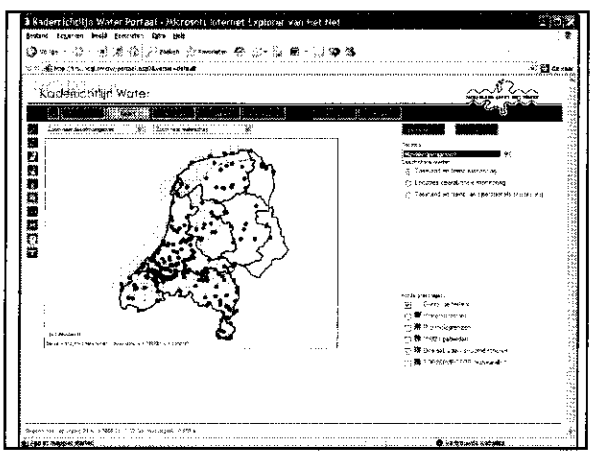
2. - sulphate
   - heavy metals

2. & 3.
   - benthic diatoms
   - macrofauna

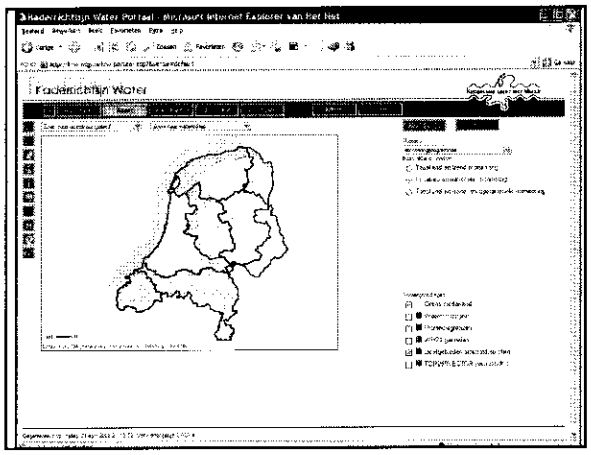


Operational monitoring locations in the Meuse river basin district





Session 1.2 - Netherlands - van Leussen



Design of UK monitoring networks (rivers & lakes)

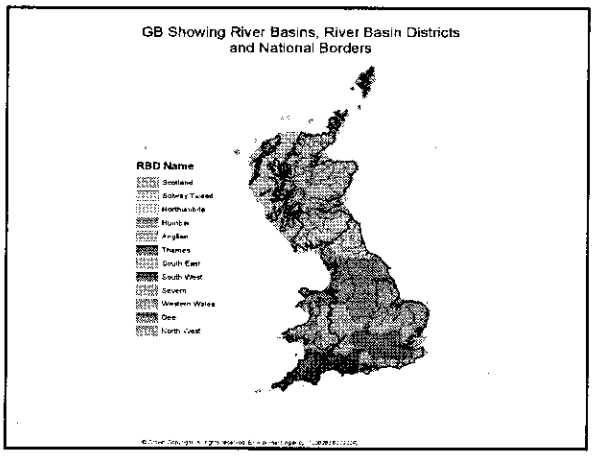
Ingrid Baber, UK

Introduction

- How have we derived surveillance and operational networks
- Examples of proposed networks in Scotland RBD
- What quality elements will be monitored at operational sites
- Investigative monitoring

Surveillance monitoring

- Based on current networks designed on a national basis, e.g.:
  - Freshwater Fish Directive
  - Nitrates Directive
  - OSPAR
  - National long term sites used for quality trends
- Generally one site per water body
- Priority substances will generally only be monitored at surveillance sites where they are present (deviation from WFD?)

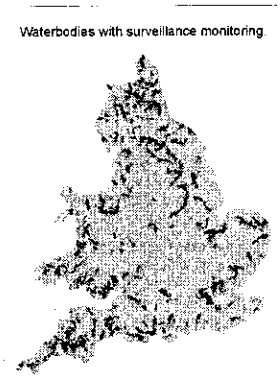


Example for Scotland RBD

	Rivers	Lakes
Number of water bodies (length/area)	~2000 (21,000 km)	~300 (960 km2)
Number at risk (length/area)	~900 (10,000 km)	~170 (590 km2)
Number of surveillance sites	~240 (in ~240 water bodies)	~35 (in ~35 water bodies)



Distribution of river surveillance sites across Scotland RBD

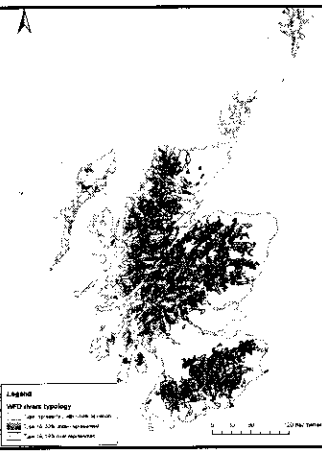


England & Wales

Rivers	Lakes
~5870 water bodies	~430 water bodies
~450 surveillance sites	~45 surveillance sites

Representativeness of sites (rivers)

- Art 5 risk categories:
  - 60% of surveillance sites in 'at risk' water bodies
  - 40% of surveillance sites in 'not at risk' water bodies
- Typology: sites generally distributed in proportion to types found (one type under, one type over represented)
- Art 5 pressures: generally pressure profiles in surveillance sites similar to profiles for 'at risk' water bodies across RBD (slightly higher point source organic pressures in surveillance sites)



Type 16 – 30% under represented (most common type in RBD)

Type 19 – 19% over represented (second most common type)

All other types - <10% deviation

Operational monitoring

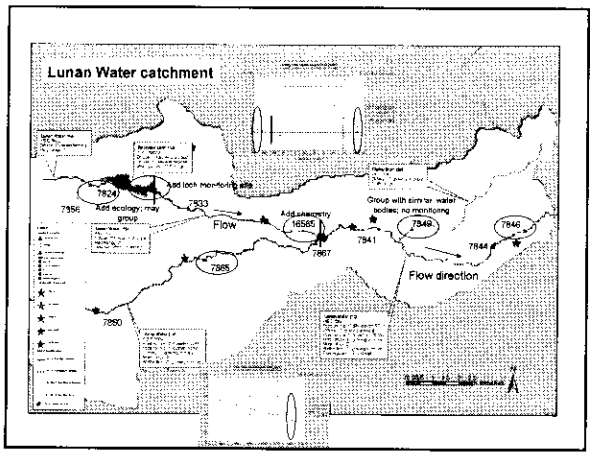
- Using Art 5 risk categories and pressure information to determine monitoring
- 'At risk' – monitoring for most sensitive pressure (generally 1 site per WB)
- 'Not at risk' – grouping of water bodies
- Large change from existing monitoring network: reduction in sites in order to accommodate greater number of QEs, more investigative/targeted monitoring

Proposed quality elements to monitor (still under discussion)

Pressure	Rivers							Lochs							
	Macroinvertebrates	Phytobenthos	Fish	Macrophytes	Habitat survey	Physico-chemical	Specific pollutants	Macroinvertebrates	Phytobenthos	Fish	Macrophytes	Phytoplankton	Habitat survey	Physico-chemical	Specific pollutants
Organic	X					X		X						X	
Acidification	X	X	X			X		X	X	X				X	
Nutrients		X				X			X			X		X	
Physico-chemical pressures	X					X	X	X							X
Hydromorphological	X		X	X	X			X			X		X		

Assumptions for grouping water bodies

- Grouping can be carried out for some pressure types (mainly envisaged for diffuse and hydromorphological pressures)
- Grouping can be carried out for all risk assessment groups (but especially for 'not at risk' water bodies)
- To be grouped water bodies must:
  - Be in same risk assessment category
  - Share similar pressure profile
  - Be considered spatially (within catchment first then neighbouring catchment)
  - Be of same or similar typology
- Working assumption is to sample ~20% of water bodies in a group (to be reviewed once costs are known)

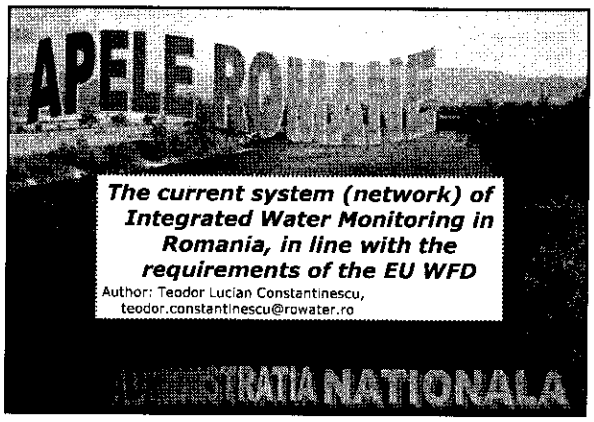


Investigative monitoring – some examples

- To be planned at local level with input from RBMP stakeholder groups
- Pollution incidents
- Programme to investigative potential effects from e.g. sheep dip use
- Selected catchments to determine source apportionment between point/diffuse pollution
- Surface/groundwater interactions
- Assist with licence determinations

Conclusions

- Surveillance sites based on existing networks
- Operational monitoring reduced from current network
- Larger proportion of network more flexible/targeted
- Still developing monitoring tools
- Still considering monitoring frequencies and length of data series to use (→classification)



The current system (network) of Integrated Water Monitoring in Romania, in line with the requirements of the EU WFD

Author: Teodor Lucian Constantinescu,
teodor.constantinescu@rowater.ro

Generalities

- The national water monitoring network is in revision, in line with the requirements of the EU WFD. The existing (mostly surveillance) monitoring of surface waters (rivers, lakes, coastal), groundwater and wastewater was planned to be extended on transitional waters and protected areas and operational and investigative monitoring it will be included.
- It will be developed the biological monitoring, based on the existing biological monitored elements (macrozoobenthos, phytobentos and plankton) and new monitored elements like fish and macrophytes.

Requirements for development of national monitoring system

- The accession of Romania in European Union needs to the implementation of 18 Directives and 2 Decisions in the field of water management. This means the integration of three important elements:
- Water systems: rivers, lakes, coastal waters, transitional waters, groundwater, wastewaters, protected areas;
- Investigative matrices: water samples, sediments/ suspended solids, biota;
- Investigative elements:biological,hydromorphological, physico-chemical.

The new monitoring system is based on the following European Directives in the field of water:

- Water Framework Directive (WFD) - 2000/60 EEC;
- Dangerous substances Directive – 76/464/EEC;
- Groundwater Directive – 80/68/EEC;
- Nitrate Directive – 91/676/EEC;
- Urban Wastewater Treatment Directive – 91/271/EEC;
- Surface water abstraction Directive – 75/440/EEC;
- Methods of measurements and frequencies of sampling and analysis intended for abstraction of drinking water Directive - 79/869/EEC;

European Directives in the field of water (continuation):

- Fish life Directive – 78/659/EEC;
- Shellfish waters Directive – 79/923/EEC;
- Bathing water Directive – 76/160/EEC;
- Drinking water Directive – 80/778/EEC and 98/83/EEC;
- Exchange of information Decision – 77/795/EEC;
- Habitats Directive – 92/43/EEC;
- Birds Directive – 79/409/EEC.

Implications of the development of national integrated monitoring system

- In Romania until now surface waters physico-chemical parameters were routinely monitored up to 12 times a year, which is more often than the WFD requires. This higher frequency results in greater precision and was justified at this stage.
- Monitoring should be carried out for a purpose and not simply to collect data to fulfil a programme.
- Only relevant parameters need to be measured with the frequency necessary to meet the purpose.
- The emphasis should be on producing high quality, reliable and relevant data rather than on simply completing a programme.

Development stages of the national monitoring system

Stage I : 2002-2004

- During December 2004 – March 2005, in Romania was ended the process of delineation of water bodies and were preliminarily identified the water bodies at risk;

The preliminary identification of the water bodies means also:

- Preliminary definition of the reference conditions and respectively the definition of the reference sites (December 2003);
- Establishing of the inter-calibration network for the reference sites (December 2004);

Stages I & II of Monitoring Activities

Table 1 – Development stages of the monitoring activities

No.	Stage	EU WFD requirements	Monitoring	Period
1	I	Preliminary identification and delineation of water bodies	Network and existing data	2003 - 2004
2		Preliminary characterisation of water bodies	Network and existing data	2003 - 2004
3		Definition of the monitoring strategy based on the preliminary characterisation of water bodies	Definition of the necessary information	2004 - 2006
4	II	Design and setting up of the monitoring network	Implementation of the monitoring strategy	2004 - 2005
			Extension of the current monitoring network to be in line with the requirements of the EU WFD	2004 - 2005
			Installing of the new monitoring stations and/or updating of the existing ones	2005 - 2006
			Setting up of the new monitoring system	→ 2006

Stage III of Monitoring Activities

5	III	Functioning of the water monitoring system	surveillance monitoring operational monitoring investigative monitoring	2006 - 2007
6		Final characterisation of the water bodies	Quality data assurance	2006 - 2008
7		Identification of the significant issues of water management – plans of measures	If they are available it will be used the data obtained as the result of the new water monitoring system	2006 - 2008
8		Publishing and consultation of the Draft of the River Basin Management Plan (RBMP) by the public	It's based on data (if then are available) supplied by the new monitoring system	2007 - 2008
9		Publishing of the RBMP	It's based on data supplied by the new monitoring system	2008 - 2009
10		Implementation of the RBMP		2009 - 2015
11		Continuation of the water monitoring and updating of the system – the first cycle		2009 - 2015
12		Updating of the RBMP	Data obtained by the new system	2013 - 2015
13		Continuation of the water monitoring and updating of the system – the second cycle	Validation of the programme of measures	2016 - 2021

Stages of development of the new monitoring system

- Setting up the water monitoring subsystems;
- Setting up the investigative matrices;
- Establishing the spatial structure;
- Definition of types of monitoring programmes;
- Setting up the monitoring parameters;
- Setting up the monitoring frequencies;
- specialisation of laboratories.

Stage 2006-2008

- In Romania, in the period 2006-2008, during the first RBMP, the surveillance monitoring have to be performed yearly, over a three year period, for obtaining good quality data for the characterisation of the water bodies.
- It will be performed the monitoring of the WFD priority substances for the water bodies where were detected these substances.

Spatial and time structure of water monitoring

The designed criteria for quantitative monitoring were until now the following:

- physico-geographical representativeness for the basins with surface 100<F<500 km2;
- significant changes of the hydrological regime;
- linear interpolation for the middle and inferior sector of the river of F>3000 km2.

Old criteria of positioning *river* quality control stations

- the homogeneity degree of water;
- the importance of the water stream at national level, depending on the size (discharge, length) and on the important water users and water intakes;
- the possibility of measurement of the discharge associated with quality determinations.

Old criteria of positioning *river* quality control stations (cont.)

- The old monitoring sites were originally selected according to pressures on the river systems, for example, close to abstractions or discharges of water and downstream of confluences.
- Biological sampling points monitored coincide with chemical sampling points for rivers, lakes and drinking water abstraction points.

Old criteria of positioning *river* quality control stations (cont.)

- The physico-chemical monitoring were carried out 12 times per year (for first order rivers) and 2, 4 or 6 times per year (for second order rivers).
- Drinking water abstraction points and wastewater discharges were monitored at a frequency dependant on community served and the load discharged.
- sampling programme for phytoplankton and zooplankton was monitored at each river site 4 times per year, while phytobenthos and zoobenthos was monitored at each river site 2 times per year (spring and autumn).

Criteria for the new monitoring system

- water bodies representativeness ;
- reference site representativeness ;
- transboundary representativeness;
- anthropogenic pressures (point pollution, diffuse polution sources);
- protected areas (*water abstraction, bathing waters, nutrient sensitive areas under Directive 91/271/EEC, vulnerable zones under Nitrate Directive, areas designated for protection of habitats, areas designated for protection of economically significant aquatic species*);
- international conventions;
- EUROWATERNET network.

Criteria for the new monitoring system (cont.)

- Sampling sites should be selected at locations which are characteristic of the river, but which also provide information so that decisions on developments that may affect water quality -discharges, abstractions and changes in land use – can be made.
- Water quality sampling close to water treatment works intakes and wastewater treatment works, as well as upstream of confluences and at locations where the river changes its nature (i.e. dams, reservoirs, etc) are particularly important.

Criteria for the new monitoring system (cont.)

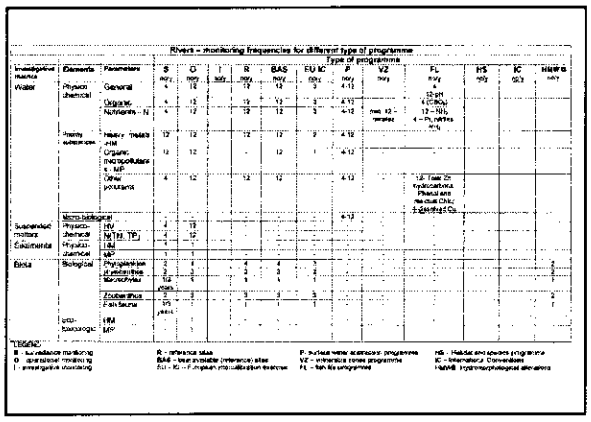
- Sampling a minimum of 12 times a year and using data collected over a three year period, in general, provides results of sufficient precision and confidence to establish the class of the water body.
- Ideally the number of monitoring points within a river type should depend on how many water bodies fall into the river type (i.e. a larger number of water bodies should have more monitoring points).

Criteria for the new monitoring system (cont.)

- As you can see in table 2 the WFD minimum recommendations for sampling are 6 monthly for phytoplankton and phytobenthos and 3 yearly for zoobenthos, macrophytes and fish.
- However, in order to identify any water quality problems at an early stage and enable remedial measures to be effectively implemented, it is usually recommended that samples are taken 2 times per year for zoobenthos and phytobenthos (spring and autumn) and 4 times per year for phytoplankton.

Criteria for the new monitoring system (cont.)

- The general physico-chemical parameters must be monitored in the same water body as where biological monitoring takes place.
- A recommended strategy is to monitor physico-chemical parameters at the same monitoring points and at the same time as the phytoplankton or phytobenthos (in the case of rivers) parameters.



THANK YOU FOR YOUR INTEREST!

Monitoring networks under the WFD for EEA state of the Environment reporting

Beate Werner
EEA

Monitoring networks under the WFD for EEA state of the Environment reporting

- Why SOE reporting by EEA?
- Indicator based assessments
- Which data are needed for EEA assessments, and from where?
- Representativity and data aggregation
- Institutional framework and WISE
- How to ensure transparancy?

SoE reporting by EEA

- The European Environment Agency is the EU body dedicated to providing timely, targeted, reliable and independent information on the environment

To this end EEA is mandated:

- to provide the Community and the Member States with the objective, comparable information necessary for framing and implementing sound and effective environmental policies;
- to record, collate and assess data on the state of the environment and to draw up regular expert reports on the state, quality, sensitivity and pressures on the environment

Information needs on the European level

- State of Europe's waters
  - How is it? (Nutrients, pesticides, heavy metals, ecological quality.....)
  - How much is there? (Runoff, availability, demands, water stress.....)
- Time trends
  - Getting better or worse?
  - Within or outside agreed limits?

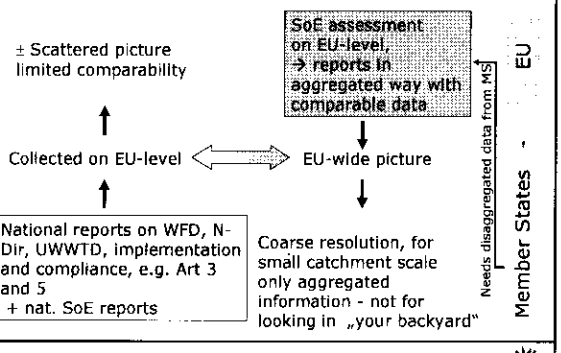
Information needs on the European level

- Pressures on the environment
  - Human
  - Industrial
  - Agricultural

  "What is causing the problems?"
- State of Action on policies

  "Are they working towards targets?"

Purpose of EU-level SoE assessments



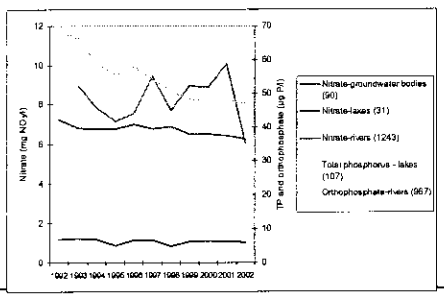
EEA assessments

- Core Set of Indicators
  - Nutrients in inland and marine; chlorophyll
  - Oxygen consuming substances in rivers
  - Urban waste water treatment
  - Use of freshwater resources
  - Marine fish stocks, fishing fleet and aquaculture
- Other indictors, see Water Indicator Report
  - Hazardous substances in inland and marine water
  - Hazardous substances in biota
  - Pesticides in groundwater
  - Water quantity

EEA Indicator based reporting

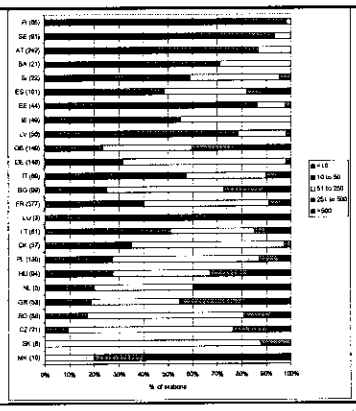
- Indicators as building blocks for SOE-reporting
- Broader integrated assessments e.g.:
  - Agriculture/water linkages, and effectiveness of UWWTD; → Linking water quality to pressures from agriculture and point sources
  - Impacts from climate change – water quantity on EU-scale

Disaggregation for trends – Nutrients in freshwater



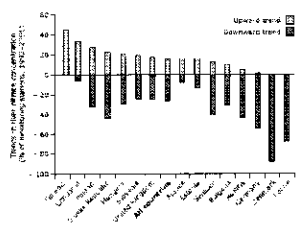
Dissagregation on station level

Present concentration of orthophosphate (µg P/l) in rivers in European countries



Are measures effective?

Many national monitoring programmes have been running for 20-40 years – good basis for evaluating trends



25 % of monitoring stations on Europe's rivers recorded a decrease between 1992 and 2001. However, around 15 % of river monitoring stations showed an increasing trend in nitrate concentrations over the same period. Source: EEA Signals 2004

- Dissagregated data needed to make the overall EU-level statistic

Network and data to support assessments

- Data exchange developed and coordinate in the Eionet (European Environmental Information and Observation Network)
- Data flows for formulation of indicators → Eionet-Water
- Data flows on water have become established across Europe for physicochemical quality elements and hazardous substances
- Longer term aim is to develop also hydromorphological and biological data flows and indicators for all water categories

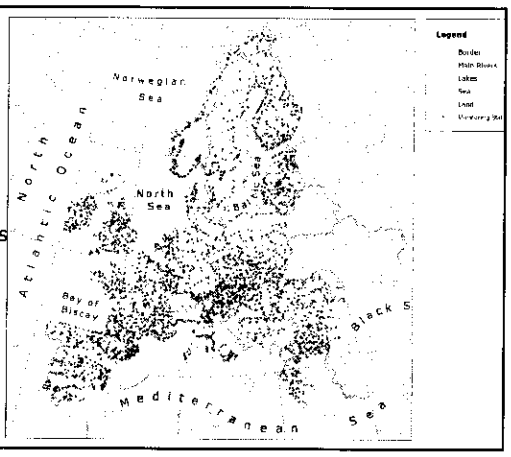
EEA and Monitoring?

- EEA is not directly involved in the practical aspects of monitoring
- Monitoring is a national responsibility
- Countries must ensure they meet requirements of national and European legislation

EEA is a USER of monitoring

- EEA requires data from
  - Monitoring from in-situ networks
  - Data from Earth Observation platforms (e.g. services from GMES initiative)
  - Data from major research projects (e.g. FP5 and 6)
  - Data from the results of modelling (especially relating to diffuse pollution from agriculture)

Eionet-Water River Stations



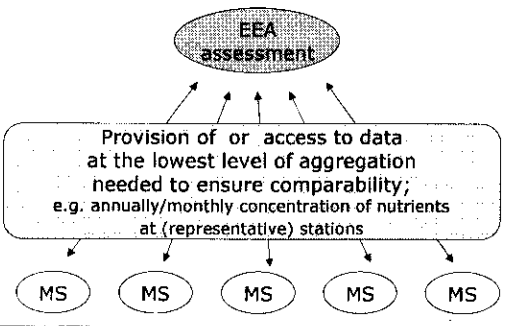
Eionet-Water

- EEA Priority Data flow for:
  - rivers,
  - lakes,
  - groundwater,
  - transitional,
  - coastal and marine waters
- Water quantity
- Updated annually
- Moral rather than mandatory reporting obligation

New data flows are needed and being developed

- Need more and different data to improve assessments
- Emissions to water
  - Working closely with Pilot River Basins, WFD Article 5 reports,
  - Data from national sources, river and marine conventions
- Biological and hydromorphological quality elements

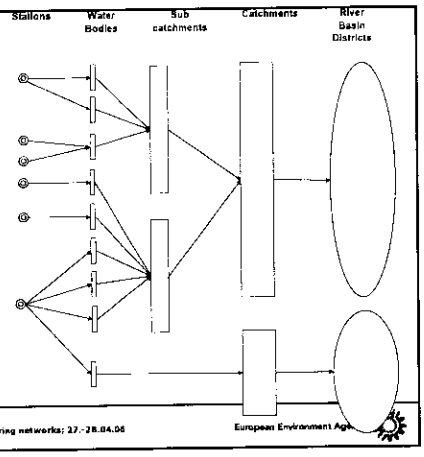
Data from Member states



Aggregation of requested data

- Aggregated data:
  - more work for NRCs, less for EEA/ETC
  - data should be aggregated in a common way
  - summary statistics also required
  - less useful for detailed analysis
- Disaggregated data:
  - more work for EEA/ETC, less for NRCs
  - guarantees the same treatment/aggregation of data
  - more possibilities for statistical testing
  - More useful for detailed analysis (and for compliance)

Schematic diagram illustrating relationships between monitoring stations, water bodies and RBDs



Options for selection of monitoring stations/water bodies

1: Criteria for the selection of representative monitoring stations or water bodies (representative, reference, pressure and flux stations
2: Selection of stations using statistical criteria
3: Request all stations included in national monitoring networks

Types of monitoring station

- Representative
- Reference
- Pressure
- Flux

Representative monitoring stations

- Number of stations that provides a representative overview of the range of statuses and types of river water bodies within each catchment of the country
- All?
- Covering all sizes of water body – small to the largest
- Range of altitudes
- Monitoring undertaken every year
- Stations included in surveillance monitoring if surveillance monitoring covers the whole range of statuses present
- If just high and good status then stations required from operational monitoring

Reference monitoring stations

- A selection of stations that are in water bodies of high water status
- likely to be included in surveillance monitoring
- may not exist in many EEA countries
- must meet the definition of high ecological status given in the WFD.

Pressure monitoring stations

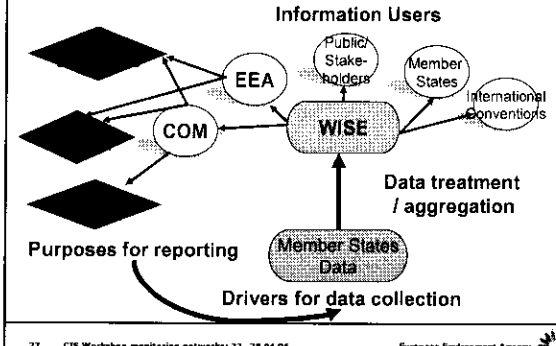
- Representative of the significant pressures within each catchment
- Probably included in operational monitoring
- Maybe monitored annually for the determinands indicative of the significant pressure (e.g. nitrate concentrations indicative of diffuse agricultural pressures)
- Maybe monitored over the duration of a RBMP or until the water body has reached its environmental objective
- Then may no longer be included in operational monitoring

Flux monitoring stations

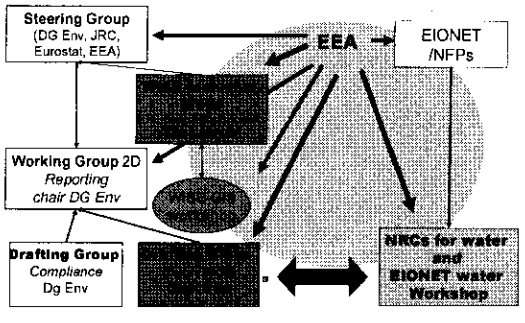
- All stations being used for the assessment of loads entering Europe's Seas
- These stations would be included in surveillance monitoring

Stations maybe of more than one type!!

Institutional framework and WISE

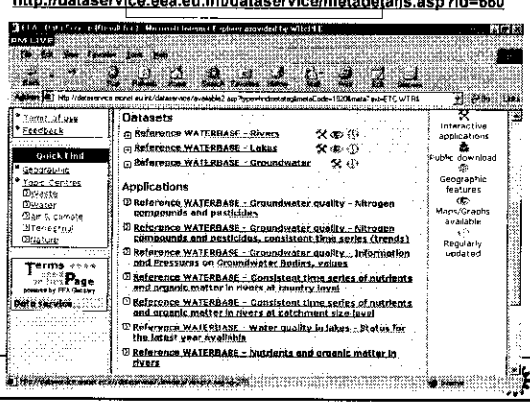


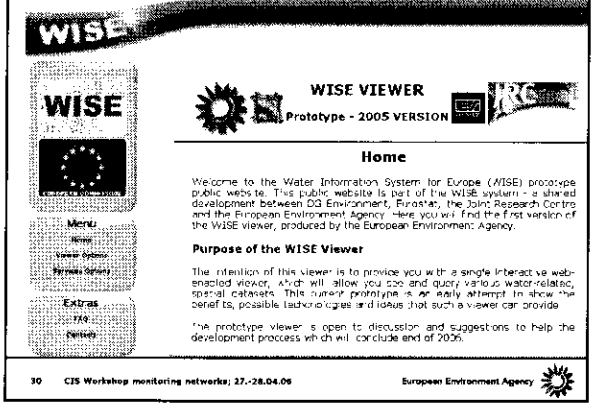
EEA contribution and chairing

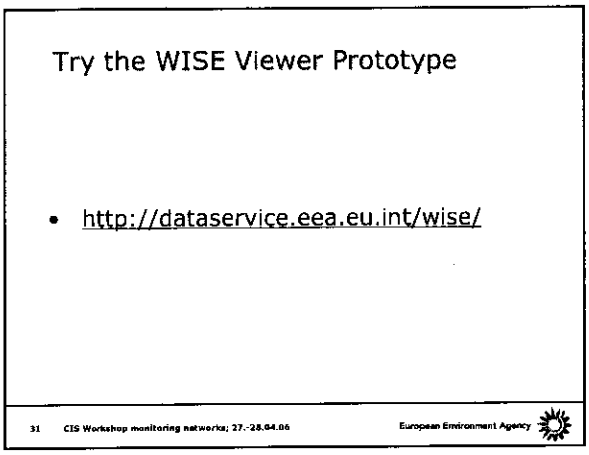


Reference Waterbase -

http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=660

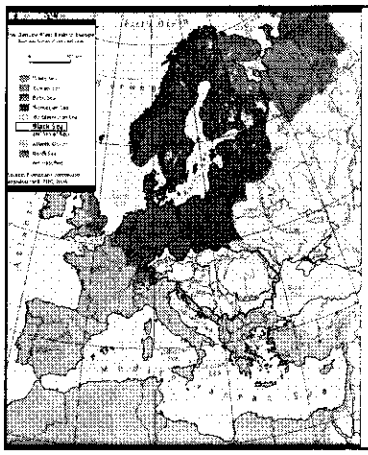





Try the WISE Viewer Prototype
• http://dataservice.eea.eu.int/wise/
31 CIS Workshop monitoring networks; 27.-28.04.06
European Environment Agency

Development of WFD compliant Transnational Monitoring Network in the Danube River Basin





- 10% of Europe
- 83 mil inhabitants
- 18 countries

Most international river basin in the world

icpdr

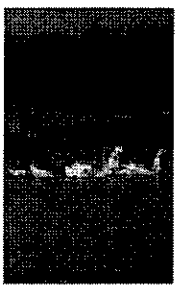
The Danube River Protection Convention

- Signed 29. June 1994
- Entry into force 22. October 1998
- Permanent Secretariat since 1 October 1999

A legal frame for co-operation to assure the protection of water and ecological resources and their sustainable use in the Danube River Basin

icpdr

The International Commission for the Protection of the Danube River (ICPDR)

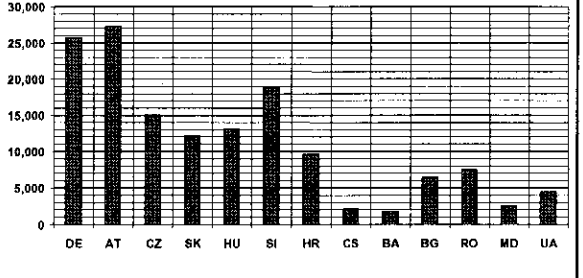


has been established to implement the objectives and provisions and to achieve the goals of the Danube River Protection Convention

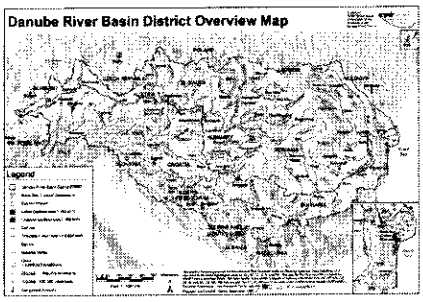
COUNTRY				POPULATION*			TOTAL AREA			DRB
				of the state	in DRB		of the state	in DRB		in state
flag	name	status		capita	million	%	km²	km²	%	%
	GERMANY	EU	CP	82,398,326	9.300	11.49	357,021	56,184	7.01	15.74
	AUSTRIA	EU	CP	8,188,207	7.700	9.51	83,858	80,423	10.03	95.90
	CZECH REPUBLIC	EU	CP	10,249,216	2.800	3.46	78,868	22,670	2.83	29.00
	SLOVAKIA	EU	CP	5,430,033	5.200	6.42	48,845	47,084	5.87	96.39
	HUNGARY	EU	CP	10,045,407	10.045	12.60	93,030	93,030	11.61	100.00
	SLOVENIA	EU	CP	1,935,677	1.700	2.10	20,273	16,422	2.05	81.00
	CROATIA	Apl	CP	4,422,248	3.000	3.71	56,542	34,965	4.36	61.84
	SERBIA AND MONTENEGRO	-	CP	10,655,774	9.800	12.11	102,350	88,635	11.06	86.60
	BOSNIA AND HERZEGOVINA	-	CP	3,989,018	2.900	3.58	51,129	36,636	4.57	71.65
	BULGARIA	Acs	CP	7,537,929	3.500	4.32	110,910	47,413	5.92	42.75
	ROMANIA	Acs	CP	22,271,839	21.000	25.94	237,500	232,193	28.97	97.77
	MOLDOVA	-	CP	4,439,502	1.100	1.36	33,843	12,034	1.60	37.91
	UKRAINE	-	CP	48,055,439	2.650	3.27	603,700	30,520	3.81	5.06
ICPDR TOTAL				219,618,615	80.850	99.88	1,877,867	799,209	99.72	
	ALBANIA	-	-	3,582,206	0.010	0.01	28,748	126	0.01	0.44
	ITALY	EU	-	57,998,353	0.020	0.02	301,230	565	0.07	0.19
	MACEDONIA	-	-	2,063,122	0.010	0.01	25,333	109	0.01	0.43
	POLAND	EU	-	38,622,660	0.040	0.05	312,685	430	0.05	0.14
	SWITZERLAND	-	-	7,318,638	0.020	0.03	41,290	1,809	0.23	4.38
BASIN TOTAL				329,203,593	80.950	100.00	2,587,153	802,248	100.00	

Economic indicators (estd. in 2002)

GDP on PPP [Euro / capita]



EU Water Framework Directive



ICPDR – common platform for the implementation of EU WFD in the Danube River Basin

8

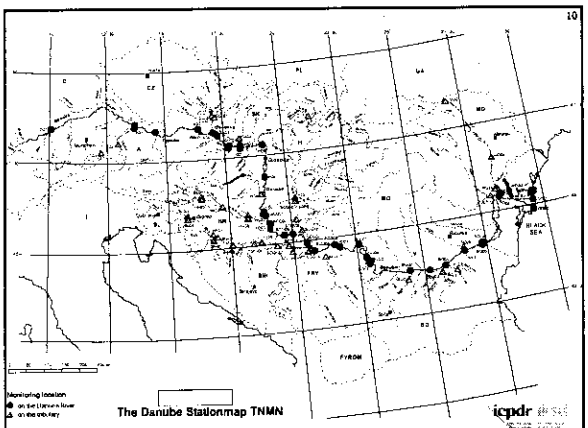
According to the Article 9 of the DRPC the Contracting Parties to DRPC have agreed to co-operate in the field of monitoring and assessment of the water resources.

9

TNMN

- **Based on national monitoring networks**
- **78 sampling stations (76 provided data in 2003)**
- **52 determinands in water**
- **Minimum sampling frequency 12/year (chem) 2/year (biol)**

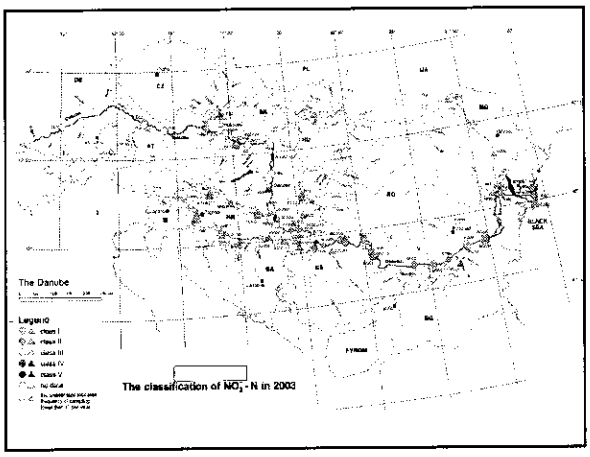
10



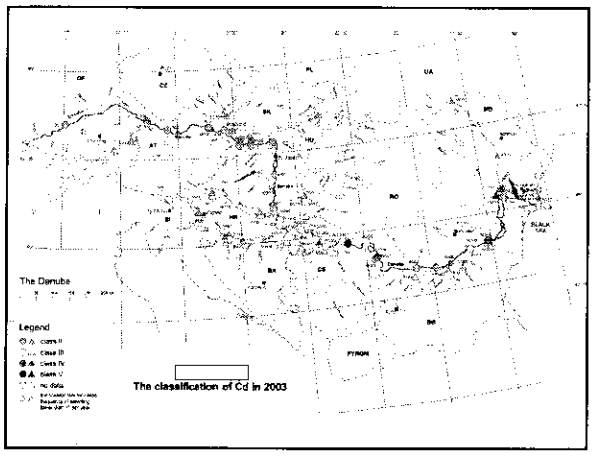
The Danube Stationmap TNMN

11

Determinand	Unit	Class				
		I	II - TV	III	IV	V
		Class limit values				
Oxygen/Nutrient regime						
Dissolved oxygen	mg l^{-1}	7	6	5	4	< 4
BOD_5	mg l^{-1}	3	6	10	25	> 25
COD_{Mn}	mg l^{-1}	5	10	20	50	> 50
COD_{Cr}	mg l^{-1}	10	25	50	125	> 125
pH	-		> 6.5 and < 8.5			
Ammonium-N	mg l^{-1}	0.2	0.3	0.6	1.5	> 1.5
Nitrite-N	mg l^{-1}	0.01	0.06	0.12	0.3	> 0.3
Nitrate-N	mg l^{-1}	1	3	6	15	> 15
Total-N	mg l^{-1}	1.5	4	8	20	> 20
Ortho-phosphate-P	mg l^{-1}	0.05	0.1	0.2	0.5	> 0.5
Total-P	mg l^{-1}	0.1	0.2	0.4	1	> 1
Chlorophyll-a	µg l^{-1}	25	50	100	250	> 250
Metals (total)						
Zinc	µg l^{-1}	bg	100	200	500	> 500
Copper	µg l^{-1}	bg	20	40	100	> 100
Chromium (Cr-III-VI)	µg l^{-1}	bg	50	100	250	> 250
Lead	µg l^{-1}	bg	5	10	25	> 25
Cadmium	µg l^{-1}	bg	1	2	5	> 5
Mercury	µg l^{-1}	bg	0.1	0.2	0.5	> 0.5
Nickel	µg l^{-1}	bg	50	100	250	> 250
Arsenic	µg l^{-1}	bg	5	10	25	> 25
Toxic substances						
AOX	µg l^{-1}	10	50	100	250	> 250
Lindane	µg l^{-1}	0.05	0.1	0.2	0.5	> 0.5
p,p'-DDT	µg l^{-1}	0.001	0.01	0.02	0.05	> 0.05
Atrazine	µg l^{-1}	0.02	0.1	0.2	0.5	> 0.5
Trichloromethane	µg l^{-1}	0.02	0.6	1.2	1.8	> 1.8
Tetrachloromethane	µg l^{-1}	0.02	1	2	5	> 5
Trichloroethene	µg l^{-1}	0.02	1	2	5	> 5
Tetrachloroethene	µg l^{-1}	0.02	1	2	5	> 5

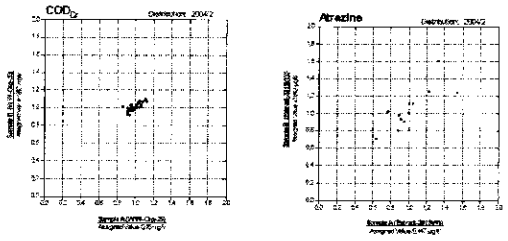


The classification of NO_3 - N in 2003



14

Analytical Quality Control



Variation in the reported values of COD-Cr and Atrazine in AQC samples

icpdr

15

Load assessment programme

- Integrated with the TNMN
- Loads are calculated for BOD_5, inorganic nitrogen, ortho-phosphate-phosphorus, dissolved phosphorus, total phosphorus, suspended solids and chlorides *(voluntary)*
- Minimum sampling frequency - at least 24 per year

icpdr

Joint Danube Survey - Objectives

- **To produce a homogenous data set for the Danube River;**
- **To screen the EU WFD priority substances and biological quality elements not covered by regular monitoring;**



Upgrade of TNMN according to WFD Major objectives

- **Future TNMN should focus on monitoring needs on the basin-wide level in rivers, groundwaters, protected areas and coastal waters.**
- **Surveillance monitoring - to provide an overview of the overall status and long-term changes of surface water and – where necessary – groundwater status in a basin-wide context with a particular attention paid to the transboundary pollution load**
- **Operational monitoring - for those bodies of water reported in the Article 5 Roof report, which have been identified as being at risk of failing to meet their environmental objectives**
- **Investigative monitoring – primarily national task; basin-wide via JDS, possible also triggering by AEWS**

Surveillance monitoring – surface waters

- "Flagship" monitoring of the ICPDR at the basin-wide level
  - Focus on status as required by Annex V, 1.3
  - Info needed on trends and loads,
- Should fulfil both WFD and DRPC requirements
- The agreements made with the Black Sea Commission should be reflected as well
- It has to be a part of national monitoring networks

Surveillance monitoring – surface waters

- **WFD requirements**:
  - Supplementing and validating the risk assessment detailed in the Danube Basin Analysis - WFD Roof Report 2004 according to Annex II WFD;
  - The efficient and effective design of future monitoring programmes;
  - The assessment of long term changes in natural conditions (*under consideration – proposal to monitor the reference sites on the national level only and report on changes*);
  - The assessment of long term changes resulting from widespread anthropogenic activity and
  - Estimating pollutants loads transferred across international boundaries and their discharging into the Black Sea.
- **DRPC:**
  - Compatibility maintained with the TNMN data from years 1996-2005 - would require increase of monitoring frequency as required by WFD

Surveillance monitoring – surface waters

How to put in coherence WFD requirements with a demand for continuity with the current TNMN?
Draft proposal:

- Surveillance monitoring of ecological and chemical status (complying with requirements as stated in Annex V, 1.3)
- Surveillance monitoring of specific pressures (basin-wide scale, selected determinands, higher frequencies) – more character of an operational monitoring but sites are not dropped after reaching compliance (**based on the old TNMN**)
  - Annual monitoring for selected physico-chemical parameters (organic pollution, nutrients) and relevant PHS, PS and/or other substances. Hydromorphological parameters under consideration – site-specific only

Surveillance monitoring – sampling sites

- Surveillance monitoring of ecological and chemical status: sites selected on criteria given in Annex V. 1.3.1
  - The rate of water flow is significant within the river basin district as a whole including point on large rivers where the catchment is greater than 8,000 (?) km²
  - Sites on the Danube River and its major tributaries
  - Black Sea coast included (although catchments smaller than 8,000 (?) km²)
- Surveillance monitoring of specific pressures
  - Sites required to estimate the pollutant load (e.g. of nutrients or hazardous substances)
  - Sites for a long-term trend analysis - review of the existing TNMN sites
  - Coastal sites included

Surveillance monitoring – quality elements

- Biology
  - Phytoplankton
  - Phytobenthos
  - Macrophytes
  - Benthic invertebrates
  - Fish
- Chemistry
  - PS and *other* PS – as surveillance strategy/ 1 per WB
  - General physico-chemical parameters – supportive to biology
- Hydromorphology
  - Supportive to biology

Quality elements – microbiology ???

- Intestinal Enterococci (I.E.) in cfu/100 ml (ISO 7899-)
- Escherichia coli (E.C.) in cfu/100 ml (ISO 9308-1)

- Are the large rivers selected for bathing water purposes?
- Should these determinands be voluntary or obligatory for the TNMN?
- Is there national sampling and analysis for microbiology?

- In order to assess bathing water quality more determinands may be needed and a rather dense frequency (especially in summer periods).

Monitoring frequency I

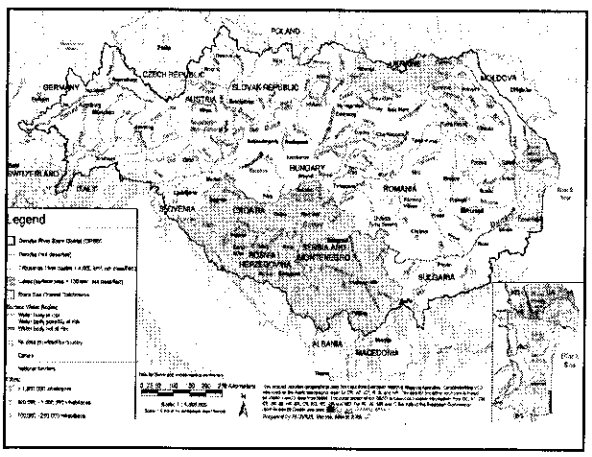
Sector	Quality element	Rivers	Coastal waters
Biology	Phytoplankton	3 years (6x)	3 years (6x)
	Phytobenthos	3 years	3 years
	Macrophytes	3 years	3 years
	Benthic invertebrates	1 year (?)	1 year (?)
	Fish	6 years	
Hydromorphology	Hydrological regime /Tidal regime	Continuous	6 years (high frequency)
	River continuity	6 years	
	Morphology	6 years	6 years

Monitoring frequency II

Sector	Quality element	Rivers	Coastal waters
Chemistry	Priority substances regularly occurring in-stream: **Lindane, Atrazine, Cadmium, Lead, Mercury**	1 year (12x)	1 year (12x)
	Other polluting substances occurring in-stream: **DDT, Bisphenol A**	1 year (12x)	1 year (12x)
	Danube Priority substances and other substances on the EC list	6 years (12x)	6 years (12x)
	General physico-chemical parameters	1 year (12x)	1 year (12x)

Operational monitoring – surface waters

- Selection of monitoring sites, determinands and frequencies to be done at the national level in line with the information requirements for a particular water body (depending on relevant pressures)
  - Includes monitoring of protected areas (habitat protection – those listed in Roof Report)
- Used for preparation of a basin-wide report focused on fulfilling the WFD environmental objectives for water bodies listed in the basin-wide Article 5 report
  - The information from the relevant national operational monitoring sites to be presented in a graphical form at the basin-wide scale
  - For each pressure a separate map should be prepared using the format similar to that applied in the Roof Report 2004



Surface water

	Part A	Part B
Surveillance monitoring	**TNMN sites**	**national sites**
Operational monitoring	**All WB from RR 2004 at risk**	**national sites (WB at risk)**
Investigative monitoring	**JDS once in 6 years**	**As appropriate**

Monitoring in protected areas

	Part A	Part B
Surveillance monitoring		**national sites**
Operational monitoring	**All WB at risk in protected areas shown in RR 2004**	**All WB at risk in protected areas**
Investigative monitoring	**As appropriate**	**As appropriate**

Ground water

	Part A	Part B
Surveillance monitoring	**11 GW bodies in RR 2004**	**national sites**
Operational monitoring	**All GW bodies at risk out of 11 GW bodies in RR 2004**	**All GW bodies at risk**

Role of hydrological monitoring and assessment in WFD implementation

Markku Puupponen* and Tommaso Abrate**

CIS Workshop on Surface Waters Monitoring Networks and Classification Systems, Brussels 27 - 28 April 2006

* Finnish Hydrological Service, Coordinator of WMO Region Europe / Working Group on Hydrology Network for Contributions to Regional Initiatives Related to Water

** World Meteorological Organization, Hydrology and Water Resources Department

World Meteorological Organization (WMO)

- A Specialized Agency of the United Nations
- Dealing with weather, climate and water related issues
- Some 190 member countries, represented by their national meteorological, hydrological and hydrometeorological institutes
- Headquarters (Secretariat) in Geneva
- Regional Office for Europe in Geneva
- Thematic commissions – Commission for Hydrology
- Regional Associations – Europe (RA VI)
- European Hydrological Services participate in the Regional Working Group on Hydrology

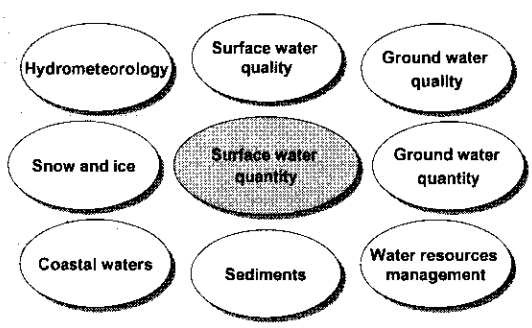
Main concerns of hydrological community as to WFD

- We should be one of the key players in the WFD CIS process, but we feel that we have been too far from the core
  - is WFD overlooking the importance of water quantity aspect?
  - hydrological information should be essential for ecological and water quality assessment
- We have to improve our participation to:
  - guarantee strong hydrological contribution
  - be better prepared for future requirements

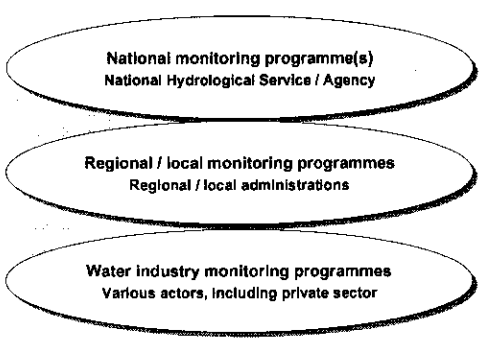
Hydrological Services expertise profile

- Well developed monitoring infrastructures
- Database management and development
- Production processes (monitoring – data – information)
- Tools for water resources assessment
- Geo-informatics (GIS, mapping) for water resources
- Close links with meteorological and climatological communities – forecasting, climate change and variability
- Flood and draught research
- Hydraulics applications – links with aquatic ecology
- Interactions and integration between data, products and research

Institutional aspect I Activities within Hydrological Services



Institutional aspect II Monitoring actors



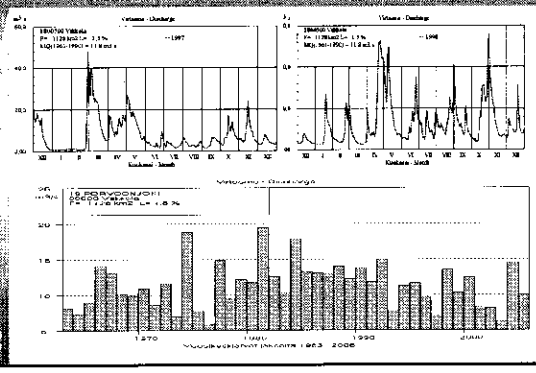
Institutional aspects III Summary

- Weakness:
  - many different institutional settings (centralised vs regionalised) – multiplicity of other actors
  - weak coordination in some countries
  - not easy to identify best partners and data producers
- Strengths:
  - national/basic monitoring programmes often provide good areal coverage
  - basic data are quality controlled
  - databases may also be integrated, including material from various data producers

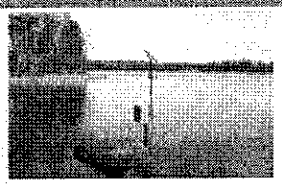
Surface water level and river discharge The basic variables

- Water level and river discharge are the basic variables of hydrological surface water monitoring programmes – also most relevant and usable for the WFD monitoring, e.g. to:
  - define the principal hydromorphological Quality Elements
  - calculate mass transport/fluxes
  - support assessment of ecological status and water quality
  - define criteria for heavily modified water bodies
  - analyse hydrological extremes
- Basically, a monitoring station can produce both water level and river discharge data, or water level data only – various methodologies and technologies are being used
- Are the WFD QE "quantity and dynamics of water flow" and the hydrological term "river discharge" equal?

Variability and trends of the hydrological cycle



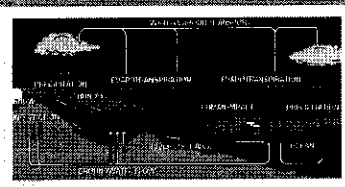
Towards more integrated monitoring?



New monitoring technologies introduce:

- continuous or high frequency measurement and near real-time data transmission
- low energy demand, offering more flexible site selection
- options for multi-variable measurement: possibilities for integrated monitoring, including quantity-quality monitoring

Hydrological modelling builds up better tools for assessment



- Use of large (river basin) scale, operational models will continuously increase
- Models allow spatial and temporal assessment – which can further be used widely for water resources assessment
- Strong bases for developing also impact assessment (hydrological cycle – chemical and ecological status of waters) and integrated modelling

Conclusions

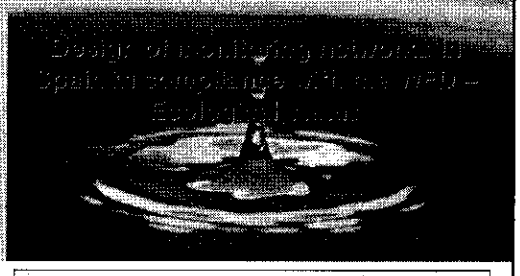
The hydrological community can contribute in many ways to the implementation of WFD and its monitoring programmes:

- monitoring should be based on best possible hydrological data – development of the WISE system should be taken into account
- information on hydrological variability and trends is essential for understanding ecological processes and assessing quality of water
- integration of monitoring programmes and data systems can bring additional benefits
- water resources assessment, based on modelling and model simulations, can be developed substantially
- strong links should be created with climate change research
- hydrological input will strenghten the multidisciplinary aspect
- the concepts of Integrated Water Resources Management and River Basin Management Planning can be developed in an interactive manner

MINISTERIO DE MEDIO AMBIENTE

DIRECCIÓN GENERAL DEL AGUA

SUBDIRECCIÓN GENERAL DE GESTIÓN INTEGRADA DEL DOMINIO PUBLICO HIDRAULICO



Alfredo Corrochano Codorniu

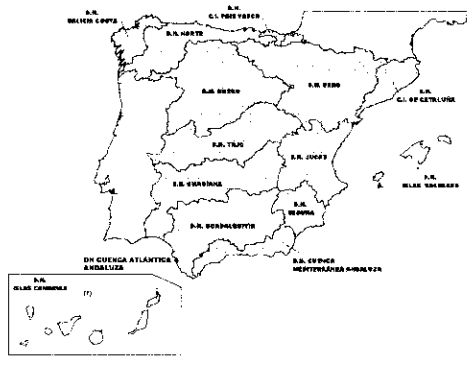
Route Map

- Constraints – Coordination needs
- Spanish Water Quality Monitoring Network
- Biological Monitoring Network
- WFD Monitoring networks design - Integration

Constraints

- WFD Complex legislative text + 14 Guidance documents
- More than 3000 water bodies, 32 (rivers) and 19 (lakes) types
- Different methods to establish RC due to lack of natural waters
- Lakes and rivers managed by 14 River Basin Districts
- Biological control relatively new in Spain

River Basin District Authorities



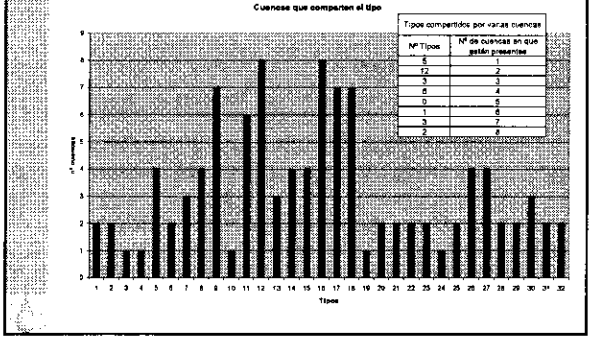
Water Body Types (1)

1	Ríos de llanuras aluviales del Tajo y Guadiana
2	Ríos de la Depresión del Guadalquivir
3	Ríos de las penillanuras silíceas de la Meseta Norte
4	Ríos mineralizados de la Meseta Norte
5	Ríos manchegos
6	Ríos silíceos del piedemonte de Sierra Morena
7	Ríos mineralizados mediterráneos de baja altitud
8	Ríos de la baja montaña mediterránea silícea
9	Ríos mineralizados de baja montaña mediterránea
10	Ríos mediterráneos con influencia cárstica
11	Ríos de montaña mediterránea silícea
12	Ríos de montaña mediterránea calcárea
13	Ríos mediterráneos muy mineralizados
14	Ejes mediterráneos de baja altitud
15	Ejes mediterráneos continentales poco mineralizados
16	Ejes mediterráneo-continentales mineralizados
17	Grandes ejes en ambiente mediterráneo
18	Ríos costeros mediterráneos
19	Ríos Tinto y Odiel
20	Ríos de llanuras bálticas húmedas
21	Ríos cántabro-atlánticos silíceos
22	Ríos cántabro-atlánticos calcáreos
23	Ríos ibero-pirenaicos
24	Gargantas de Gredos-Béjar
25	Ríos de montaña húmeda silícea
26	Ríos de montaña húmeda calcárea
27	Ríos de alta montaña
28	Ejes fluviales principales cántabro-atlánticos silíceos
29	Ejes fluviales principales cántabro-atlánticos calcáreos
30	Ríos costeros cántabro-atlánticos
31	Pequeños ejes cántabro-atlánticos silíceos
32	Pequeños ejes cántabro-atlánticos calcáreos

1	Alta montaña septentrional, húmedos, aguas ácidas
2	Alta montaña septentrional Húmedos, aguas alcalinas
3	Alta montaña septentrional, monomíctico frío, aguas ácidas
4	Media montaña septentrional, monomíctico cálido, aguas ácidas
5	Media montaña septentrional, monomíctico cálido, aguas alcalinas
6	Media montaña septentrional, monomíctico frío, aguas alcalinas
7	Alta montaña mediterránea, monomíctico, frío, aguas ácidas
8	Interior en cuenca de sedimentación, cárstico, hiogénico, grande
9	Interior en cuenca de sedimentación, cárstico, hiogénico, pequeño
10	Interior en cuenca de sedimentación, cárstico, hipogénico, pequeño tipo Torca
11	Interior en cuenca de sedimentación, cárstico aportación media
12	Interior en cuenca de sedimentación, no cárstico, permanente, profunda, salina
13	Interior en cuenca de sedimentación, no cárstico, permanente, profunda, no salina
14	Interior en cuenca de sedimentación, no cárstico, permanente, somera, salina
15	Interior en cuenca de sedimentación no cárstico, permanente, somera, no salina
16	Interior en cuenca de sedimentación, no cárstico, temporal, salina
17	Interior en cuenca de sedimentación, no cárstico, temporal, no salina, aguas ácidas
18	Interior en cuenca de sedimentación, no cárstico temporal, no salina, aguas alcalinas
19	Litoral en complejos dunares

Water Body Types (2)

RIVER BASIN DISTRICTS SHARING TYPES



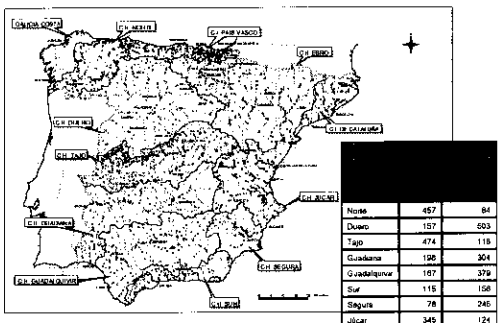
Spanish Water Quality Network

SURFACE WATERS

INTEGRATED WATER QUALITY MONITORING NETWORK (ICA)

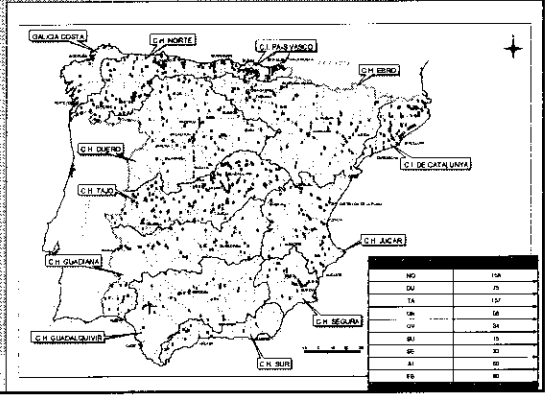
- functioning since 1993
- more than 2000 sampling points
- integrates different control requirements
  - *General water quality control (COCA) ICG Index*
  - *Quality of water intended for the abstraction of drinking water (COAS) 75/440/EEC Directive*
  - *The Freshwater Fish Directive (COPI) 78/659/EEC Directive*
  - *Dangerous substances control (RCSP) 76/464/EEC*
  - *Other control needs: OSPAR, ALBUFEIRA, EEA*

ICA NETWORK SAMPLING POINTS



Norte	457	84
Duero	157	503
Tajo	474	118
Guadiana	196	304
Guadalquivir	167	379
Sur	115	158
Segura	78	246
Júcar	345	124
Ebro	316	271
TOTAL	2307	269

General Water Quality Monitoring Control



Biological monitoring networks



Existing biological monitoring networks (1)

- Lack of systematic biological studies for surface waters in Spain
- Relative tradition at academic level (University)
- Heterogenity between the applied field methods producing not comparable datasets
- Recent developments in the last five years according to WFD requirements (all water managers involved)
- Provisional networks in order to obtain information for the final design and improvement of monitoring programs by December 2006
- Testing quality elements and metrics against different pressures
- Development of metrics (IBI, Phytoplankton, Macrophytes)
- Quantify temporal and spatial variability

Existing biological monitoring networks (2)

2003	436	EPT, N° taxa, diversity, other multimetric	Barbour et al., 1998 EPA (Multihabitat, 100m long, 2.5 m 2 (20 kicks, 500µm net)
2003	90	IBMWP, n° taxa and relative abundance	Guadalmed
2006	90	IBMWP, Shannon-Weaver, IASPT	Guadalmed
2001	220	IBMWP, IASPT, n° taxa	UNE-EN-ISO 5667:1996 UNE-EN 27828:1993 UNE-EN 28265 : 1995 UNE-EN-ISO-9391:1993
2006	90	IBMWP, IASPT, N° Taxa	Guadalmed
2006	90	IBMWP, IASPT, N° Taxa	Guadalmed
1999	272 - 90	IBMWP	Guadalmed
1993	200-500	IBMWP, IASPT	UNE-EN 27828:1995
1993	100-107	IBMWP, IASPT, Shannon Weaver, Berger-Parker, Simpson-Gini, Margalef, EPT and others	Barbour et al., 1998 EPA
1993-1997	118	IBMWP, IASPT, IBMWPC, FBILL	Guadalmed
2006			

Existing biological monitoring networks (3)

2003	400	IPS, IBD, CEE IDG, IDAP, SMS, IDI	AFNOR, 2006; EN 13946
2003 - 2004	90	IPS, IBD, CEE (in study) IM	LUC SECTOR PROTOCOL IM
2006	90	IPS, IBD	Sampling Protocol Guidance
2004	220	IPS, IBD, CEE IM	EN 13843 (CEN - TC 230) 2003 EN 13946:2002 EN1440":2004
2006	90	IPS, IBD, CEE IM	Sampling Protocol Guidance
2006	90	IPS, IBD, SPECIES DIVERSITY	AFNOR 1990 354 IM
2000	60-90	ID IM	Standard methods (10.300 periFiton) Guadalmed 2 (macrophytes)
2002	200	IPS, IBD, CEE Others: OMNIDEA	EN 13943 (CEN TC 230) 2003
1996 -2002	62-66 71-107	IPS, IBD, IC	EN 13943 (CEN TC 230) 2003 STAR Adaptation for Macrophytes
2002	90	IPS, IBD, CEE SAP, ILFI, SLA	EN 13943 (CEN TC 230) 2003 IFPA (Macrophytes)
2006			

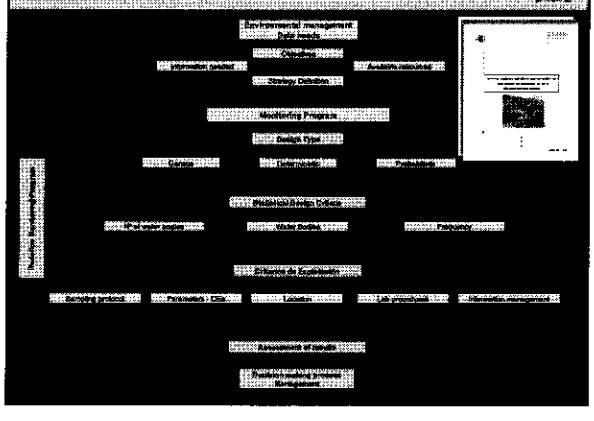
Existing biological monitoring networks (4)

2005	90	Relative abundance per effort unit and size	FAME
2004	90	IBFI, diversity, biomass and N° of taxa	EFI (for 2004 quantitative fishing)
2006	90	BII development	FAME
2001	220	BII development CPUE	Electric fishing 50- 100m 30 60 min
2006	90		Sampling Protocol Guidance
2006	90	Composition, introduced species and age structure	Sampling Protocol Guidance
2006	60	Community structure, aspect, introduced species	Standard methods
2005	300	CPUE, BII	FAME
1993	97-107	FCP, diversity indexes, density, biomass, sensible taxa,	CEN TC 230
2002-2003	130	IBMAT (multimetric) 5 different metric for different types	FAME
2006			

WFD Monitoring networks design



WFD Monitoring networks design



Objectives – Design type

- Surveillance

  Overall surface water status – Must be representative

  "Representativeness is the correspondence between the analytical result and the actual environmental quality or condition experienced by a contaminant receptor" (Barcelona, 1988)

  Probabilistic sampling design: stratified random sampling according to types or pressures

- Operational

  Establish status of water bodies identified at risk of failing to meet their environmental objectives and assess any changes resulting from programmes of measures

  Deterministic sampling design

N° of Water bodies

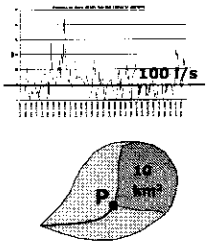
Surveillance Monitoring

WFD - sufficient water bodies should be included in the surveillance monitoring programme to provide an assessment of the overall surface water status within each catchment and sub-catchment within the river basin district. (….)

- *N° of water bodies*
- *Statistical assessment of datasets from existing monitoring networks (Biological and ICA)*
- *Precision and confidence*

Water bodies identification criteria - Rivers

- **Hydrological criteria (a):** (average flow > 100 l/s)
- **Geographical criteria:** (catchment area > 10 Km²)
- **Hydrological criteria (b):** (>75% months with flow ≠ 0)



Water bodies identification criteria - Lakes

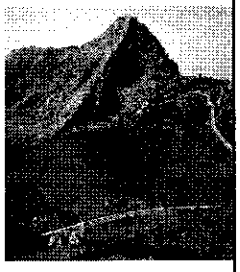
- **Initial criteria:** size > 50 ha

  But some high ecological quality ecosystems were excluded so…

Additional criteria: size > 8 ha and depth > 3 m

New water bodies considered: i.e. La Caldera

- Other water bodies with special interest included



Spanish Surface Water Bodies

469	5
297	6
183	1
279	34
321	6
64	1
269	9
697	91
48	0
436	0
82	4
225	66
--	3
0	0
3.378	226

Nº of Water bodies at risk

Operational Monitoring All water bodies which on the basis of either the impact assessment or surveillance monitoring are identified at risk of failing

1,1	6	74	405	24,9	136
3,4	12	82,7	292	13,9	49
1,4	10	94,9	282	1,7	5
13,6	44	79	256	7,4	24
12,1	46	64,7	246	23,2	88
9,8	9	89,1	82	1,1	1
40	108	59,6	161	0,4	1
4,9	34	51,8	361	43,3	302
27,1	13	37,5	18	35,4	17
5	22	72,5	316	22,5	98
26,8	23	65,1	56	8,1	7
30	127	28	92	33	108
--	-	--	--	--	
--	--	--	--	--	--
11,8	454	66,5	2.567	21,7	836

Location of sampling points inside the water body (1)

Depending on the monitoring objectives different criteria should be considered for the location of sampling points inside the water body:

General assessment:

Average value of a given parameter inside the water body

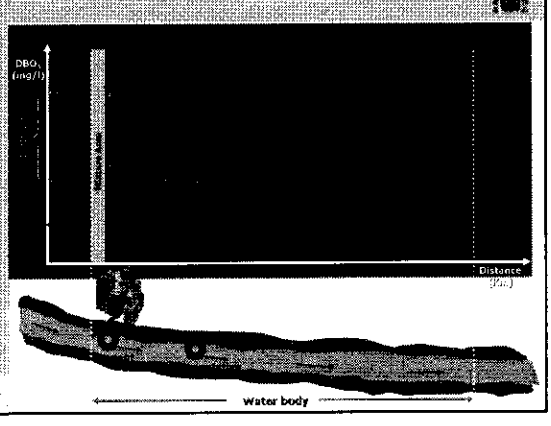
Pressures assessment:

Worst situation inside the water body affected by a given pressure

Particular circumstances related with the different QEs and types of water bodies should also be considered (i.e. phytobenthos sampling points must have an adequate substrate)

Accessibility to the sampling point

Location of sampling points inside the water body (2)



Frequency

Higher frequency than required by WFD has been defined for the initial the first River Basin District Management Plan in order to satisfy information needs – every year for surveillance monitoring

- Biological Quality Elements
  - Phytoplankton - 2 / year considering higher
  - Macrophytes - 2 / year
  - Benthic Invertebrates – 2 / year
  - Phytobenthos - 2 / year
  - Fish - 2 / year
- Physicochemical: monthly (ICA)
- Hydromorfological: continuous and 2 / year (QBR and IHF)

Sampling period

Considering the establishment of different sampling periods for different types of water bodies

- Macrophytes: Spring – Autumn optimal sampling period adjustable to climatic conditions for each water body type
- Benthic Invertebrates: spring and summer
- Phytobetnhos: Spring and Autumn – avoid sampling after hard rain periods
- Phytoplankton: Seasonal (4/year)
- Fish: Spring – Autumn better for electric fishing. Optimal sampling period middle summer beginning of fall

Sampling Protocol (1)

Experts Seminar for the establishment of biological sampling protocols and analysis in accordance with WFD

(October – December 2005 - Ebro River Basin District Authority)

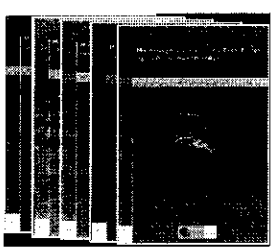
SPECIFIC MEETINGS FOR EACH BIOLOGICAL QUALITY ELEMENT

OBJECTIVE: Share experiences and knowledge between a group of experts identified for each biological quality element and water managers in order to establish a suitable sampling protocol for the WFD monitoring requirements

Sampling Protocol (2)

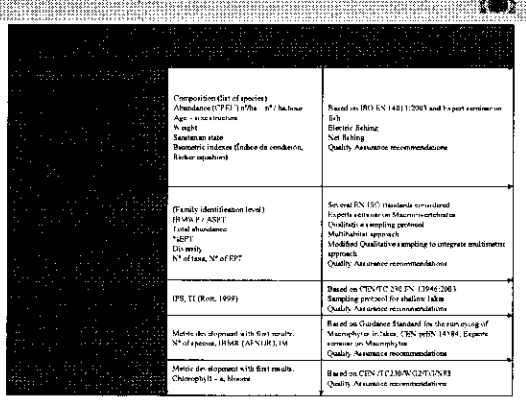
Guidance including:

- procedures for collecting the sample
- handling and preparing the physical sample
- analytical method to obtain a result
- Metrics



http://oph.chebro.es/DOCUMENTACION/Calidad/dma/manuales/

Sampling Protocol (3)



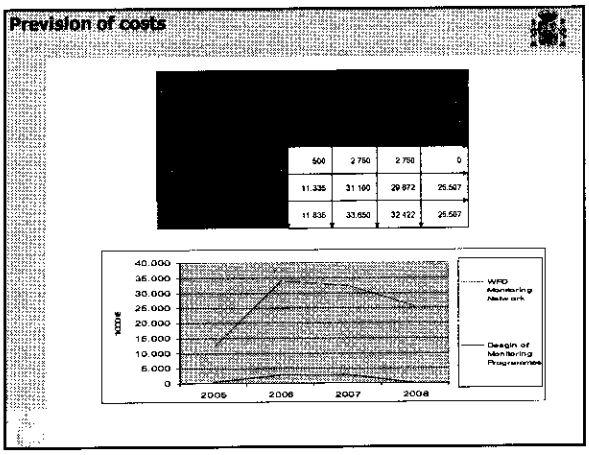
Integration

PILOT STUDY FOR THE INTEGRATION OF MONITORING NETWORKS TO COMPLY WFD

(Guidance Document for the design of Monitoring networks in compliance with the WFD)

ECOLOGICAL STATUS

- WFD Monitoring Network design
  - ICA Network adaptations
  - Biological Control Network results – Statistical analysis, spatial and temporal variability, metrics against pressures. Final design
- Sampling Protocol and Lab procedures Guidance (Ebro River Basin District Experts Seminar)
- Quality Assurance and Quality Control Plan
- Taxonomy - Atlas for the identification of biological quality elements
- (SAICA) Data base configuration for ecological data storage
- Training program for water managers
- Typology
- Water Bodies
- Reference Conditions
- Classification System

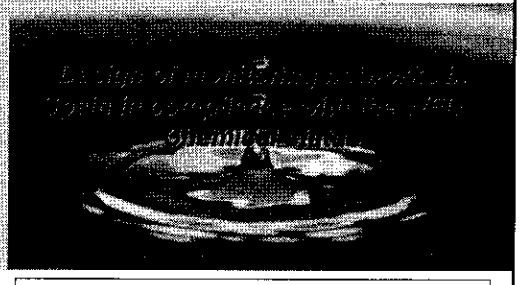

Prevision of costs
500
2 750
2 750
0
11.335
31 160
29 872
25.587
11 835
33.650
32 422
25.587
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0
2005
2006
2007
2008
WFD Monitoring Netw ork
Design of Monitoring Programmes



MINISTERIO DE MEDIO AMBIENTE

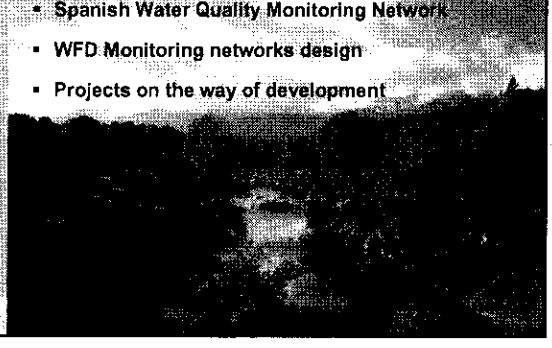
DIRECCIÓN GENERAL DEL AGUA

SUBDIRECCIÓN GENERAL DE GESTIÓN INTEGRADA DEL DOMINIO PÚBLICO HIDRÁULICO

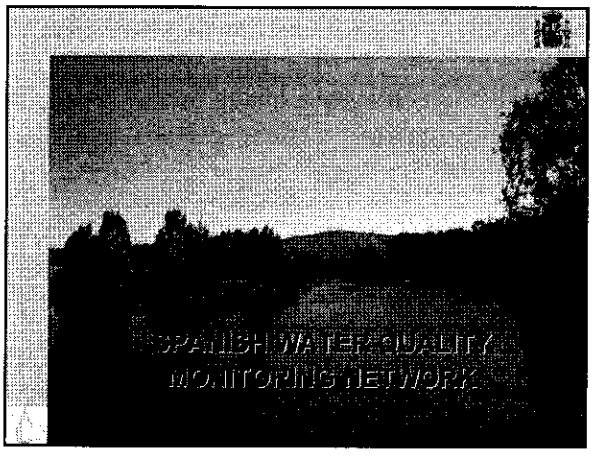


Elena Pérez Gallego

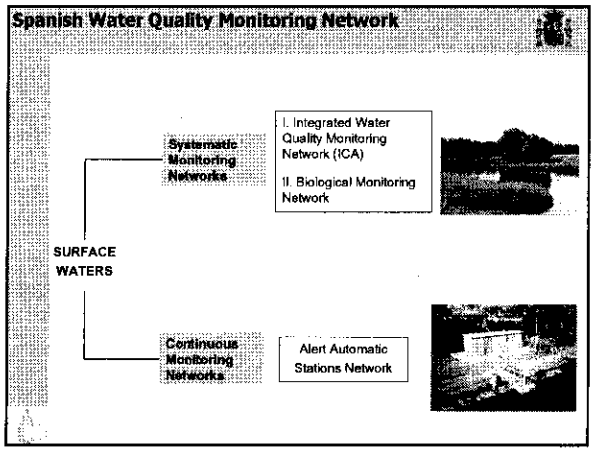
Route Map



- Spanish Water Quality Monitoring Network
- WFD Monitoring networks design
- Projects on the way of development



Spanish Water Quality Monitoring Network



Spanish Water Quality Monitoring Network

SURFACE WATERS

INTEGRATED WATER QUALITY MONITORING NETWORK (ICA)

- functioning since 1993
- more than 2000 sampling points
- integrates different control requirements
  - *General water quality control (COCA) ICG Index*
  - *Quality of water intended for the abstraction of drinking water (COAS)*
  - *The Freshwater Fish Directive (COPI)*
  - *Dangerous substances control (RCSP)*
  - *Other control needs*

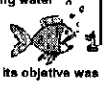
Spanish Water Quality Monitoring Network

INTEGRATED WATER QUALITY MONITORING NETWORK (ICA)

QUALITY OF WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER (COAS)

- **Its objective is the protection of the drinking water catchment areas**
- **The reference law comes from the Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water**
- **842 sampling points**

THE FRESHWATER FISH DIRECTIVE (COPI)



- **Its objective is the protection of the fish life, although in origin its objetive was the protection of human health**
- **The reference law comes from the Directive 78/659/EEC on the quality of freshwaters needing protection or improvement in order to support fish life**
- **406 sampling points**

GENERAL WATER QUALITY CONTROL (COCA)

- **Functioning since 1962**

DANGEROUS SUBSTANCES CONTROL (RCSP)

- **Preferential Substances and pesticides**

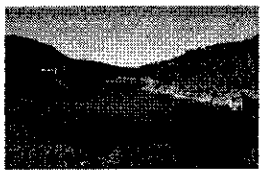
OTHER CONTROL NEEDS

Spanish Water Quality Monitoring Network

INTEGRATED WATER QUALITY MONITORING NETWORK (ICA)

OTHER CONTROL NEEDS:

- Bathing network
- Nitrates network
- Information Exchange network
- EUROWATERNET network (European Agency of Environment)
- International Agreements:
  - Ospar (RID)
  - Barcelona
  - Albufeira



General water quality control (COCA)

OBJECTIVE: The control of the general quality and the surveillance of the quality of the potentially contaminated sections

PARAMETERS: 40 P-C divided into 4 groups

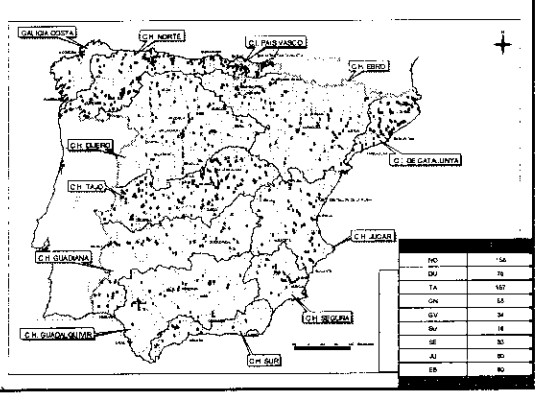
GROUP A	GROUP B	GROUP C	GROUP D
Flow	Dissolved solids	Silica	Arsenic
Temperature	Chlorides	Fe and general	Copper
Dissolved oxygen	Sulfates	Cyanides	Iron
pH	Calcium	Phenols	Manganese
Conductivity	Magnesium	Fluorides	Lead
BOD	Sodium	Sulphides	Zinc
Color	Potassium	Chromium VI	Antimony
Turbidity	Phosphates	Mercury	Nickel
Total coliforms	Nitrates		Selenium
	Nitrites		
	Ammonium		
	Carbonates		
	Bicarbonates		
	Surfactants		

FREQUENCY: It depends on the kind of station and the parameter to analyze

Kind of station	Group A	Group B	Group C	Group D
Normal	Monthly	Bi-monthly		
Preferential	Monthly			
Special	Monthly	Monthly	Monthly	Monthly

DIAGNOSTIC: There isn't any official method although it usually uses the ICG Index

General water quality control (COCA)



Dangerous substances control (RCSP)

- **OBJECTIVE:** The surveillance of the contamination caused by the discharged of dangerous substances
- The reference law comes from the Directive 76/464/EEC
- It is composed by 2 subnetworks:
  - **Preferential substances subnetwork** (115 sampling points)

    The Royal Decree 995/2000 sets out Environmental Quality Standards for certain pollutant substances (28) which have been selected taking into account their toxicity, persistence and bioaccumulation in the Spanish aquatic environment
  - **Pesticides subnetwork** (45 sampling points)
    - ✓ Routine analysis
    - ✓ Intensive analysis

Preferential Substances of the RD 995/2000 (28)

1912-24-9	ATRAZINE	1	71-55-6	1,1,1-TRICHLOROMETHANE	100
71-43-2	BENZENE	30	1330-20-7	XILENE (3 isomers orto, meta y para)	30
108-90-7	CHLOROBENZENE	30	74-90-8	CYANIDES	40
25321-22-6	DICHLOROBENZENE (3 isomers orto, meta y para)	20	16984-48-8	FLUORIDES	1700
100-41-4	ETHYLBENZENE	30	7440-38-2	TOTAL ARSENIC	50
51218-45-2	METALOCHLOR	1	7440-50-8	DISSOLVED COPPER	$CaCO_3 \leq 10$: 5; $10 < CaCO_3 \leq 50$: 22; $50 < CaCO_3 \leq 100$: 40; $CaCO_3 \geq 100$: 125
91-20-3	NAPHTHALENE	5	7440-47-3	TOTAL DISSOLVED CHROME	50
122-34-9	SIMAZINE	1	7440-02-0	NICKEL EXPRESSED AS Ni	$CaCO_3 \leq 50$: 50; $50 < CaCO_3 \leq 100$: 100; $100 < CaCO_3 \leq 150$: 150; $CaCO_3 \geq 200$: 200
5915-41-3	TERBUTHYLAZINE	1	7439-92-1	LEAD EXPRESSED AS Pb	50
108-88-3	TOLUENE	50	7782-49-2	DISSOLVED SELENIUM	1
No apicable	TBT	0,02	7440-66-6	TOTAL ZINC	$CaCO_3 \leq 10$: 30; $10 < CaCO_3 \leq 50$: 200; $50 < CaCO_3 \leq 100$: 300; $CaCO_3 \geq 100$: 500

Pesticides subnetwork

- 45 stations:
  - Zones affected by agriculture
- 2 Kinds of campaigns:
  - Routine: River Basin District Authorities (8)
  - Intensive: CSIC (Centro superior de investigaciones científicas)



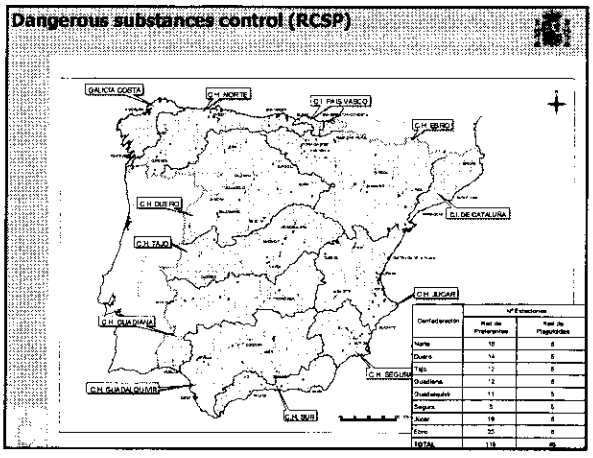
[illegible]	8 sampling/year spring-summer: monthly autumn-winter: 2	17 pesticides with EQS (+ the pollutants)
[illegible]	2 sampling/year Spring-summer Autumn-winter	55 pesticides and search of new pesticides

EQS (µg/l) for the pesticides measured in the routine campaign

Alachlor			0,3 (0,7)	Endosulfan			0,005 (0,01)
Aldrin	0,01			Endrin	0,005		
Atrazine		1	0,6 (2,9)	Metolachlor		1	
Chlorfenvinphos			0,06 (0,3)	Isodrin	0,005		
Chlorpyrifos			0,03 (0,1)	Isoproturon			0,3 (1,3)
Total DDT pp'DDT	25 10			Total HCH Lindane	0,05		0,02 ¿?
Dieldrin	0,01			Simazine		1	0,7(3,4)
Diuron			0,2 (1,8)	Terbuthylazine		1	
				Trifluralin			0,03 (1)
				Herbicides			

LIST I: Directive 76/464/EEC; PREF: RD 995/2000; PRIORITY: Decisión 2455/01
(VALUES: AA: Average amount, MAC: maximum admissible concentration).

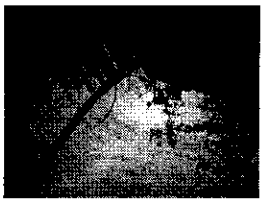
Dangerous substances control (RCSP)



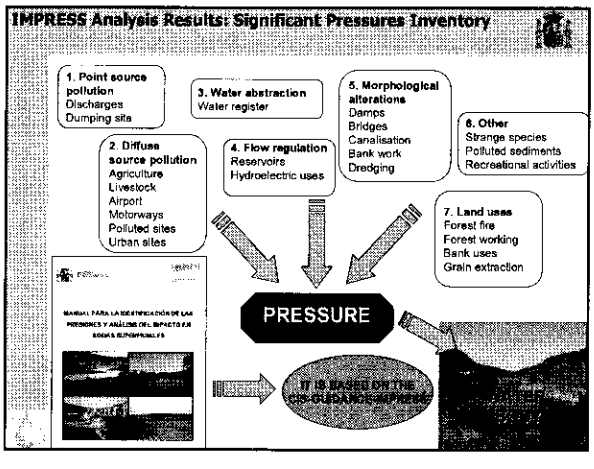


WFD Monitoring networks design

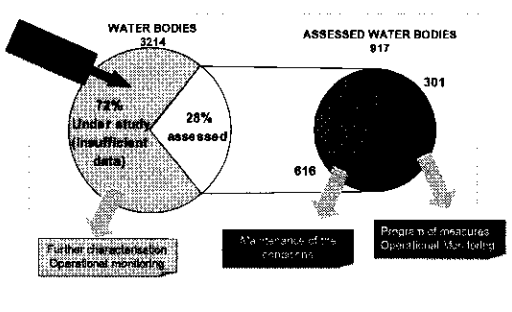
- Previous studies: IMPRESS Analysis Results
- Surveillance Monitoring
- Operational Monitoring
- Investigative Monitoring



IMPRESS Analysis Results: Significant Pressures Inventory



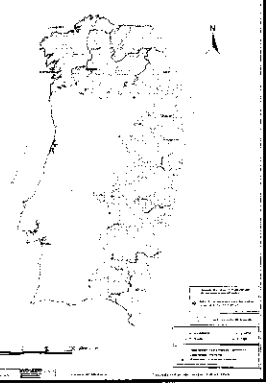
IMPRESS Analysis Results: Risk Management



Surveillance monitoring: Selection of monitoring points

- Points in significant bodies of water cross a Member State boundary:

  ALBUFEIRA CONVENTION

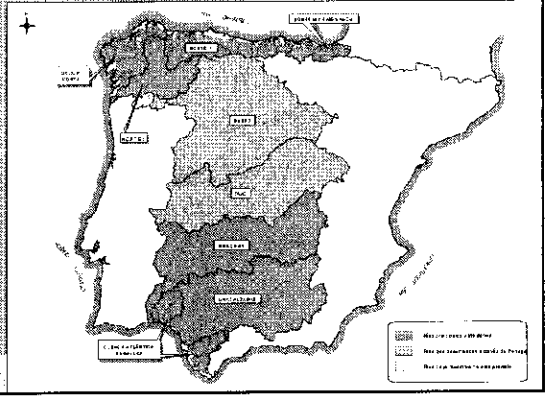


Surveillance monitoring: Selection of monitoring points

- Sampling or measuring stations identified under the ***Identification Exchange Decision 77/795/EEC*** (15 stations)

DU-002	Duero	Garray	C.H. Duero
DU-054	Duero	Villamarciel	C.H. Duero
DU-093	Duero	Embalse de Villalcampo	C.H. Duero
TA-093	Tajo	Trillo	C.H. Tajo
TA-011	Tajo	Aranjuez	C.H. Tajo
TA-015	Tajo	Talavera de la Reina	C.H. Tajo
TA-019	Tajo	Alcántara	C.H. Tajo
GU-006	Guadiana	Balbuena	C.H. Guadiana
GU-016	Guadiana	Badajoz	C.H. Guadiana
GV-004	Guadalquivir	Menjibar	C.H. Guadalquivir
GV-006	Guadalquivir	Peñaflor	C.H. Guadalquivir
GV-074	Guadalquivir	Sevilla	C.H. Guadalquivir
EB-001	Ebro	Miranda de Ebro	C.H. Ebro
EB-011	Ebro	Zaragoza	C.H. Ebro
EB-027	Ebro	Tortosa	C.H. Ebro

Surveillance monitoring: Selection of monitoring points: OSPAR CONVENTION



Surveillance monitoring: Selection of monitoring parameters

- **Priority substances discharged and other pollutants discharged in significant quantities in the river basin or sub-basin**
  1. *Any priority substance or pollutant discharged in water-bodies located upstream the surveillance monitoring point (not too far from it)*
     - For point sources:
       - Urban wastewater discharges
       - Industrial wastewater discharges
       - Emissions of List I and II substances
       - Emissions of priority substances
       - European Pollutant Emission Register (EPER)
       - Municipal landfil sites
       - Waste dumping sites
     - For diffuse source:
       - CORINE LAND COVER





  2. *Substances detected by means screening techniques*

Potential pollutants associated to land uses according to CLC

AIRPORTS	PAH'S	Hydrocarbons Biocides
TRANSPORT INFRASTRUCTURE	Alachlor Atrazine Diuron PAH's Isoproturon Simazine Trifluralin Lead	Organophosphorous compounds Hydrocarbons Biocides
CONTAMINATED SOILS	Depending on uses	Metals Hydrocarbons
IRRIGATED AND IRRIGATED CULTIVATED AREAS	Alachlor Atrazine Chlortriamophos Chlorpyrifos Diuron Endosulphan Hexachlorocyclohexane Isoproturon Simazine Trifluralin	Organochlorogen compounds Organophosphorous compounds Biocides and plant protection products Materials ins suspension Nitrates and phosphates Oxigen demand substances (BOD,COD)
BURNED AREAS	PAH's	Materials ins suspension Nitrates and phosphates
URBAN AREAS	Diuron	Materials ins suspension Nitrates and phosphates Oxigen demand substances (BOD,COD)
MINING AREAS	Depending on the activity	Metals
RECREATIVE AREAS		Nitrates and phosphates Oxigen demand substances (BOD,COD)
MEADOWS		Nitrates and phosphates Oxigen demand substances (BOD,COD)

Surveillance monitoring: Frequency

- According to the WFD, surveillance monitoring shall be carried out at each monitoring site during 1 year in the period covered by the river basin management plan (once in 6 years)
- In our case, surveillance monitoring shall be carried out during all the years in the period covered by the river basin management plan with the frequency shown in the following table:

Quality elements	FREQUENCY		
	Water	Sediment[2]	Biota
Thermal conditions	3 months	-	not relevant for surveillance monitoring
Oxygenation conditions	3 months	-	
Salinity	3 months	-	
Nutrient conditions	3 months	-	
Acidification status	3 months	-	
Other pollutants	3 months	12 months	
Priority Substances	3 months	12 months	

[1]Target matrix for volatile compound
[2]Target matrix for semivolatile and hydrophobic compounds

TARGET MATRIX: The most contaminant where the concentration will accumulate and/or where the bioavailability is higher

Surveillance monitoring: Target matrix

➢ **Proposed table by Spain in the CMA (Chemical Monitoring Activity) Drafting Gr created for the elaboration of the Guidance on WFD in Chemical Monitoring of Surface Water**

SUBSTANCE	WATER	SEDIMENT	SUBSTANCE	WATER	SEDIMENT
ALACHLOR	P	O	HEXACHLORBUTADIENE	P	O
ANTHRACENE	O	P	HEXACHLOROCYCLOHEXANE	P	O
ATRAZINE	P		ISOPROTURON	P	O
BENZENE	P		LEAD	O	P
PENTABROMODIPHENYLETHER	O	P	MERCURY	O	P
CADMIUM	O	P	NAPHTALENE	P	O
C10-13 CHLOROALKANES	O	P	NICKEL	O	P
CHLORFENVINPHOS	P	O	NONYLPHENOL	P	O
CHLORPYRIFOS	P	O	OCTYLPHENOL	P	O
1,2-DICHLOROETHANE	P		PENTACHLOROBENZENE	O	P
DICHLOROMETANE	P		PENTACHLOROPHENOL	O	P
DI(2-ETHYLHEXYL)PHTALATE	P	O	POLYAROMATIC HYDROCARBONS (PAH)	O	P
DIURON	P		SIMAZINE	P	
ENDOSULFAN	P	O	TRIBUTILTYN COMPOUNDS	O	P
FLUORANTHENE	O	P	TRICHLOROBENZENES	P	
HEXACHLOROBENZENE	O	P	TRICHLOROMETHANE	P	
TRIFLURALIN	P	O			

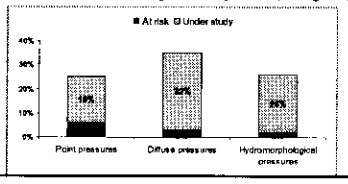
P: Preferred medium; O: Optional medium

Operational monitoring: Selection of monitoring points

➢ Water bodies at risk



- Water bodies at risk from significant point source pressures
- Water bodies at risk from significant diffuse sorce pressures
- Water bodies at risk from significant hydromorphological pressures



Operational monitoring: Frequency

Quality elements	FREQUENCY		
	Water[1]	Sediment[2]	Biota[3]
Thermal conditions	3 months	-	-
Oxygenation conditions	3 months	-	-
Salinity	3 months	-	-
Nutrient conditions	3 months	-	-
Acidification status	3 months	-	-
Other pollutants	1 months	12 months	12 months
Priority Substances	1 months	12 months	12 months

[1] Main environmental fate for volatile compound
[2] Main environmental fate for semivolatile and hydrophobic compounds
[3] Main environmental fate for bioaccumulative compounds

Investigative monitoring

➢ **INVESTIGATIVE MONITORING SHALL BE CARRIED OUT:**

- Where the reason for any exceedances is unknown
- Where surveillance monitoring indicates that the objetives for a body of water are not likely to be achieved and operational monitoring has not already been established
- To ascertain the magnitude and impacts of accidental pollution

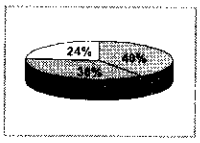


Alert network

OBJECTIVE: Global and instantaneous view of surface water quality status in Spain in 200 points.

SELECTION OF MONITORING POINTS:

- Control and surveillance of spillages
- Monitoring of accidental pollution ← INVESTIGATIVE MONITORING
- Protection of the areas of interest to environment
- Protection of the drinking water catchment areas





Investigative monitoring (Dangerous Substances)

OBJECTIVE: To identify the degree of pollution caused by persistent organic pollutants (POP's) and priority substances of high molecular Weight

MONITORING POINTS:

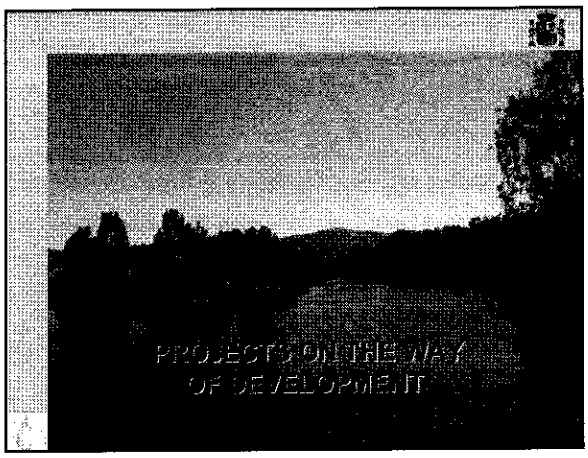
- 35 points
- Highly contaminated points
- Points located downstream the industrial areas



MATRIX: Sediment

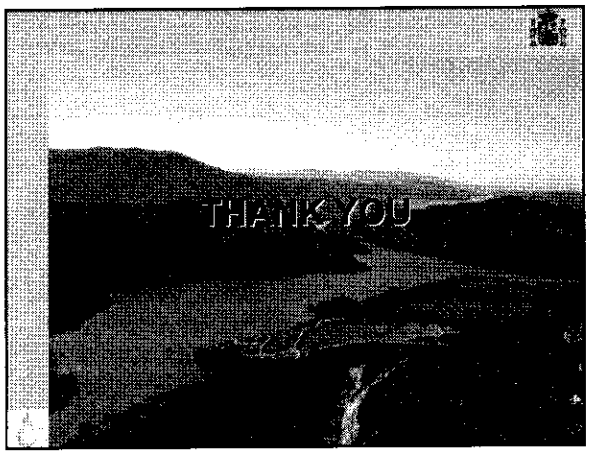
FREQUENCY: 1 campaign

RESULTS: The results have been used for identification of water bodies at risk of failing to meet their environmental objetives due to the presence of priority substances of high molecular weight in sediment



Projects on the way of development

- "Manual of design and exploitation of water quality control networks"
- "Manual of criteria for the standardization of the surveillance networks and water quality control parameters"
- Orden Ministerial de Entidades Colaboradoras de la Administración Hidraúlica
- "Manual for the calculus of Environmental Quality Standards in compliance with the WFD"



Design of monitoring network for rivers in Poland

Ryszard Myszka
Przemysław Gruszecki
The Chief Inspectorate for Environmental Protection
Warsaw, Poland

Monitoring system in Poland so far

National network
-> 360 monitoring sites on 20 rivers

Regional network
-> ca. 2000 monitoring sites

New national network (since 2007)
ca. 2300 m.s.

Monitoring system in Poland so far (2)

New national network

surveillance monitoring (ca. 1500 monitoring sites)

directive 77/795/EEC monitoring (20 monitoring sites)

EIONET-Wetlands monitoring (ca. 160 monitoring sites)

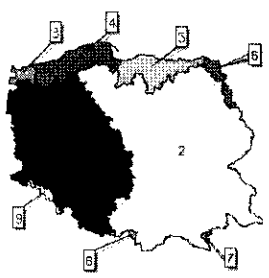
other directives monitoring

91/676/EEC
ca. 600 m.s.

76/464/EEC
ca. 2000 m.s.

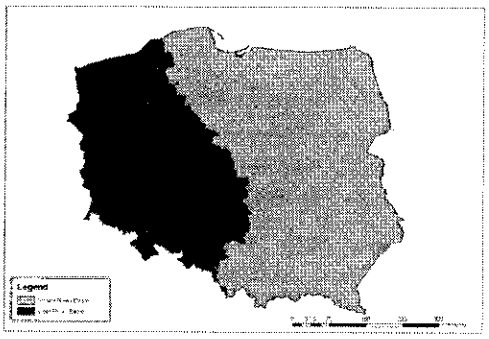
78/659/EEC
ca. 2200 m.s.

River basins in Poland



1 – the Oder
2 – the Vistula
3 – Szczecin Lagoon catchment
4 – Pomerania rivers
5 – Vistula Lagoon catchment
6 – the Niemen
7 – the Dniestr
8 – the Danube
9 – the Elbe

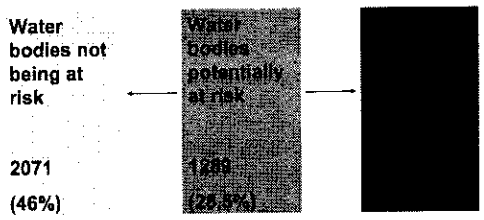
River basins in Poland (2)



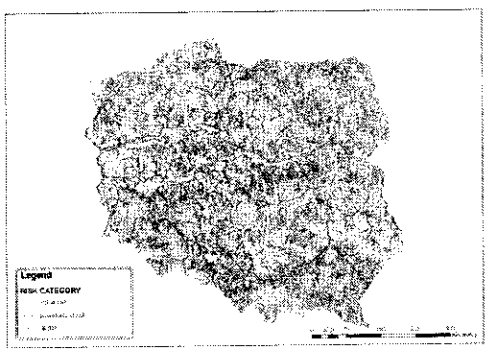
Water bodies and typology

Category	Number of types	Number of water bodies		
		Vistula RB	Odra RB	Altogether
Rivers	26	2806	1704	4510
Lakes	13	621	420	1041
Trans.	5	5	4	9
Coastal	3	6	5	11

Risk assessment – Water Bodies



Risk assessment – Water Bodies (2)



Monitoring network – 1st approach

- Surveillance monitoring:

-> Monitoring sites located in bigger tributaries, closing catchments and sub-catchments

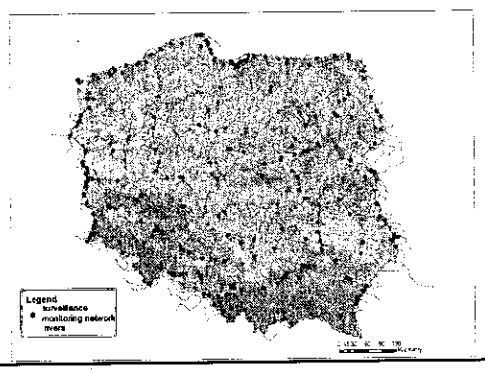
-> Number of stations: ca. 250.

- Operational monitoring:

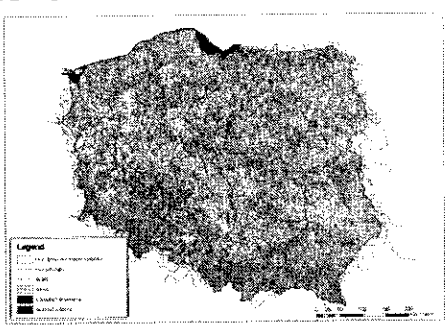
-> Monitoring sites located inside catchments and subcatchments closed with surveillance monitoring sites

-> Number of stations: ca. 1000

Monitoring network – 1st approach (2)

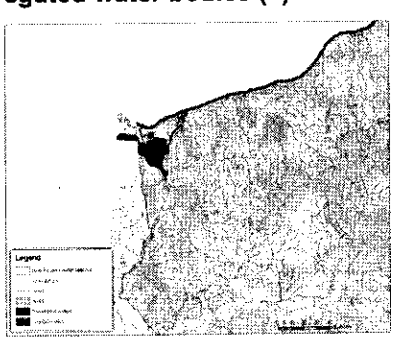


Aggregated water bodies



1105 AWB in the whole country

Aggregated water bodies (2)



Aggregation of water bodies – criterions

- Water typology
- Land management
- Population
- Morphology
- Water management
- Flood hazard
- Protected areas
- Planned investments and constructions

Aggregation carried out on the basis of 1 – 4 criterions of the most importance for the area

Monitoring network – 2nd approach

- Surveillance monitoring sampling points to close each particular aggregated water body (1105 s.p.)
- Operational monitoring sampling points to be located at each water body at risk or potentially at risk

Problems

- 1st approach:

-> probably too thin network

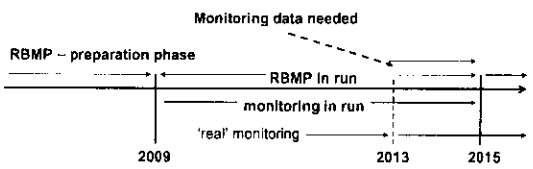
-> state assessment may not meet acceptable level of precision and confidence

- 2nd approach:

-> water bodies or aggregated water bodies?

Questions to be answered

- State of water bodies potentially being at risk -> survaillance or operational monitoring?
- Monitoring so far: survaillance?
- Calendar: monitoring and RBMP – for the new RBMP data from actual monitoring programme needed



Thank you

Przemysław Gruszecki
The Chief Inspectorate for Environmental Protection
Warsaw, Poland

Design of Monitoring Networks for Rivers in Germany - „Framework Conception" of the LAWA

Markus Lehmann, LUBW Ref. 41 – Rivers and Streams, Integrated Water Protection
Dr. Friederike Vietoris, StUA Herten (NRW), Abt. 4

Baden-Württemberg

Content

- LAWA framework Conception:
  - Objectives of the Monitoring
  - Classification
  - Design of the Monitoring Network
- Realization: Monitoring Network in Baden-Württemberg

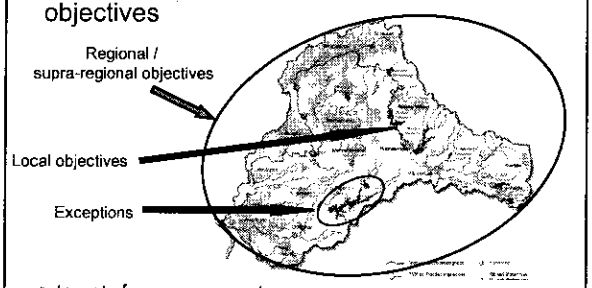
Objectives of the Monitoring

- Assessing compliance with standards and objectives (Check of status in a coherent and comprehensive way)
- Detection of long term trends (anthropogenic / natural)
- Provide sufficient Information for management plans
- Comply with reporting requirements

What´s essential new ?

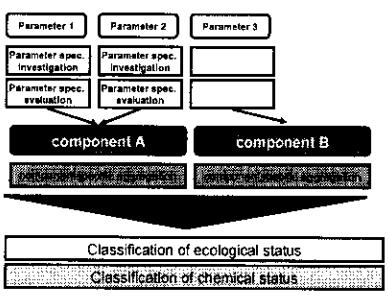
- New biological elements
- Type specific assessment / classification systems

Assessing compliance with standards and objectives

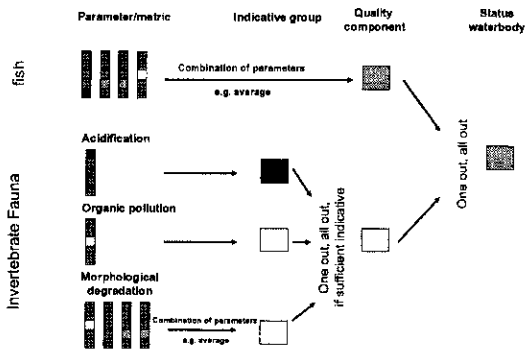


-> targets for management
-> requierements for monitoring

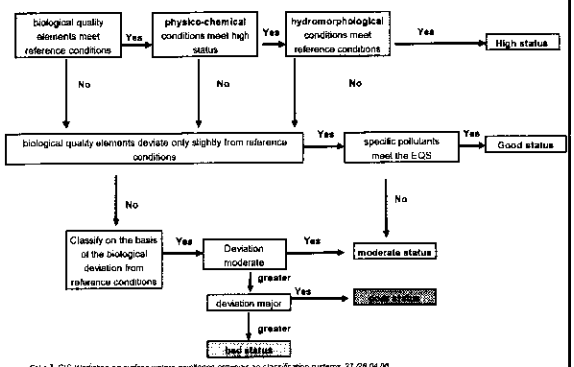
Classification
- Steps to assess the status -



Classification (biological elements)



Classification



Folie 7 CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

LUBW

Design of the Monitoring Network

- Surveillance Monitoring
- Operational Monitoring
- Investigative Monitoring

Folie 8, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Survaillance Monitoring

- Objectives -

- supplementing and validating the impact assessment procedure
- assessment of long term changes (anthropogenic / natural)
- efficient and effective design of future monitoring programmes
- guarantee of a coherent approach within the whole catchment area (e.g. Rhine)

Consists of two elements:

Monitoring of all quality components at important and representative sites (biological and chemical elements)

Aggregated Interpretation of the status within the catchment area

Surveillance Monitoring

- Selection of Monitoring points -

- Representative and important monitoring sites for the whole catchment area (in general, at least A > 2500 km²)
- Monitoring sites of the EU-directive 77/795/EWG
- Sites at important and border crossing rivers (Q > 10 m³/s)
- Preferably basing on existing monitoring networks, which has been used for following EU-directives / purposes:
  - 76/464/EWG hazardous substances
  - 91/676/EWG Nitrate
  - LAWA/EEA
  - OSPAR / HELCOM
- Monitoring points with reference conditions

Surveillance Monitoring

- Selection of Quality Elements -

Complete overview of all quality elements within waterbody (not necessarily at the same points -> representativity):

- General physico-chemical components
- Specific synthetic / unsynthetic pollutants
- Priority list substances
- Biological quality elements
  - Invertebrate fauna
  - Fish
  - Macrophytes / phytobenthos
  - phytoplankton

Folie 11, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

LUBW

General physico-chemical Components

- Thermal conditions: T, Δ T (calculated)
- Oxygenation conditions: O2, Saturation, TOC, BOD (TOC > 5 mg/l)
- Salinity: electrical conductivity, chloride, sulphate
- Nutrient conditions: total phosphorus, soluble reactive phosphorus, total nitrogen, nitrate, nitrite, ammonium
- Acidification status: pH, Acid-neutralisation-capacity

Folie 12, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Specific synthetic / non-synthetic pollutants

Substances of IX and X

- If they are used / discharged in the catchment

Realization of Appendix VIII in Germany:

- 133 substances (-> 76/464/-directive: Pesticides, heavy metals, halogenated hydrocarbons, industrial pollutants,...)
- About 100 further candidate / emerging substances are in evaluation

Definition of **Significant: average > ½ EQS**

Matrices:
Whole water, filtrated water (heavy metals classified as priority substances) (SPM)

Folie 13, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Surveillance Monitoring
- Frequencies Part I -

Component	Frequency
General physico-chemical components	13/a
Priority (hazardous) substances and substances of Appendix IX	13/a
Specific substances of appendix VIII:	
Average > EQS	4a (13/a)
½ EQS < Average < EQS	4a (13/a)
Average < ½ EQS	At least according to reporting requirements

Chemical Surveillance monitoring will be continued every year (-> trends)

Folie 14, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Surveillance Monitoring
- Frequencies Part II -

Component	Frequency	Season	Intervall
Phytoplankton	7/a	March - October	Every year
Makrophytes/ phytobenthos	1/a	June - September	Every 3 years
Invertebrate fauna	1/a	March – September (typespecific)	Every 3 years
Fish			
salmonid	1/a	August – mid of October	Every 3 years
cyprinid	2/a	April – June September - October	Every 3 years

Folie 15, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Operational Monitoring
- Objectives -

- limited to waterbodies which (probably) fail the good status or other targets (e.g. in protected areas)
- Fundamental basis for planing of measures
- control of outcome of measures

need for a comparably dense monitoring network

Folie 16, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

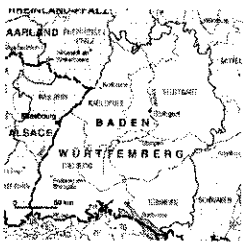
Operational Monitoring

- Temporal monitoring element at representative monitoring sites (possibility to group waterbodies)
- Investigated Parameters are limited to problematic aspect(s) (and most sensitive indicators therefore)
- Spacial and temporal monitoring density according to demands for reliability and accuracy of the assessment

-> results will be transfered to waterbody supported e.g. by expert judgement, result of the pressure and impact analyis, modelling.

Folie 17, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Baden-Württemberg
- Some facts -



Position in Germany: South-west
Area: 35.751 km²
Inhabitants: 10,5 Mio
293 persons/km²
1150 sewage plants (20,7 Mio EW)

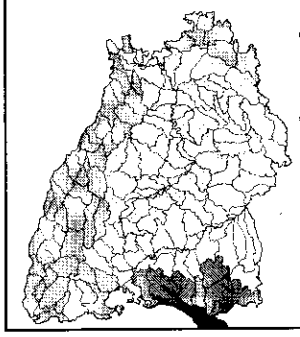
Land use:
34% forest
61% agriculture
3,3% towns

13.500 km rivers (A > 10km²)

Main Rivers: Rhine, Neckar, Danube

Folie 18, CIS Workshop on surface waters monitoring networks an classification systems, 27./28.04.06

Water-bodies -> Monitoring network



„significant":
- hydrology
- management aspects
- acceptance in public

„discrete (homogeneous)":
- Sensitivity (Typology/limnology)
- pressures
- congruent to ground water areas

→ about **160 waterbodies** (A ~100 - 500 km²)

Chemical Monitoring Network in Baden-Württemberg - State of Discussion -



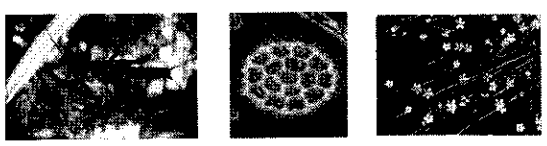
Chemical Monitoring Network Baden-Württemberg

Surveillance monitoring ← → **operational monitoring**

Importance / component	international Area >> 2500 km² (11)	national Area 500 – 2500 km² (18)	reference Sites	Regional (water bodies) Area ~100 – 500 km² (117)	Local	notes
physico-chemical components						
temperature	26 / a	13 / a	13/6a	13 / a or every 2a	()	(in only if problematic, temporary)
oxygenation conditions	26 / a	13 / a	13/6a	13 / a or every 2a	*	* = monitored by biological element
salinity	26 / a	13 / a	13/6a	13 / a or every 2a		
acidification status	26 / a	13 / a	13/6a	13 / a or every2a	()	(* only if problematic, temporary)
nutrient conditions	26 / a	13 / a	13/6a	13 / a or every 2a		
supplementary: Ca, Mg, Na, K (can be elements of waste water)	13 /a	13 / a	13 /6a *)			*) Only Ca, Mg, Na, K
hazardous substances						
Priority substances:						
o relevant	13/ a	13 / a		13 / 3a	()	(in only if problematic, temporary
o not relevant	13 / 6a	-		-		
Specific substances (acc. to WFD)	13 / a	13 / a		13 / a or every 2a	()	(in only if problematic, temporary

Biological Monitoring Network in Baden-Württemberg - State of Discussion -

Invertebrate Fauna | Phytoplankton | Phytobenthos/ Macrophytes



Biological Monitoring Network Baden-Württemberg

Surveillance monitoring ← → **operational monitoring**

Importance / component	international Area >> 2500 km² (11)	national Area 500 – 2500 km² (18)	reference Sites	Regional (water bodies) Area ~100 – 500 km² (117)	Local	Number of monitoring sites
Biological components						
Invertebrate fauna	1/3a				1/6a	ca. 1000 (Screening-element)
Macrophytes /phytobenthos	1/ 3a				()	ca. 200-300
phytoplankton	6/3a		-	-		ca. 15
fish	1/3a				()	ca. 100
hydromorphology						
Hydrological regime	continuosly		-	continuosly	-	
Durchgängigkeit	1/3a					Only review
morphology	1/3a					Only review

The design of the monitoring network for lakes and rivers in Finland

Heidi Vuoristo
Finnish Environment Institute

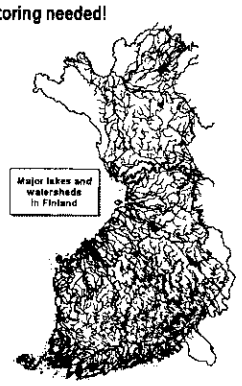
SYKE

The number of water bodies in Finland is high ⟹ Cost-efficient monitoring needed!

Number of lakes > 50 ha: 4 600

Number of rivers 647 (discharge area > 100 km2, river stretch > 10 km)

Coastal line of Baltic Sea 20 000 km



Surface water quality monitoring in Finland, Administration

Finnish Environment Institute SYKE	13 Regional Environment Centres (REC's)	Industries, municipalities, fish farms, peat mining etc.
National-wide monitoring programme for rivers, lakes and coastal waters	Regional monitoring programmes for rivers, lakes and coastal waters	Obligatory monitoring of local pollution
• Reference waters • Large lakes and rivers • Transboundary waters • Waters impacted by diffuse loads • Design according to Eurowaternet	• Reference waters • Regionally important waters • Waters impacted by diffuse loads More flexibility in programme desing than in the national monitoring	• Based on enviromental law • "Polluter pays" principle • Sampling, analyses by private laboratories • "Taylor-made" desing of programmes • Programmes has to be accepted by REC's
Surveillance monitoring, operational monitoring of diffuse load		Operational monitoring of point sources

---

National monitoring of surface waters

Revisions to the Eurowaternet in 2006:

- number of sites in small rivers and lakes was added in order to get a better overview of all surface water types
- new substances were included in the monitoring of harmful substances
- biological monitoring was added (number of sites increased, more biological elements included)
- monitoring of impacts from diffuse loading will be added later in 2006 (a pilot study ongoing)
- the volume of water quality monitoring was decreased

Surveillance monitoring 2006-2008

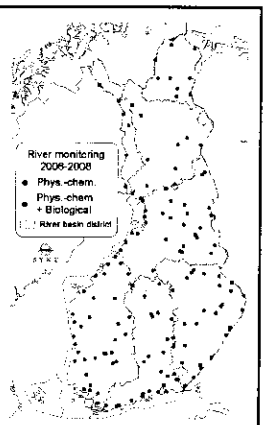
New sites added to the national monitoring network

- the new sites are in or near to reference condition
- the new sites belong to lake and river types, which were poorly represented in the previous network
- especially the number of small humic rivers and lakes was unsufficient in the previous network, but has now been increased

---

Surveillance monitoring
River sites in national programme

- Total 147 sites
- 57 reference sites
- water quality annually at every site (4-22 times/year; about 30 variables)
- Biological monitoring at reference sites: bottom fauna, fish, phytobenthos



Number of lake sites in the national monitoring programme for surveillance monitoring and monitoring of diffuse loads

Site type	Lake type and number							
	Northern 1	Naturally eutrophic or calcareous 2, 3	Small, clear water 4	Large, clear water 5	Small mesohumic 6	Medium size, mesohumic 7	Large mesohumic 8	Humic 9
Reference lake,	6	6	28	12	15	9		14
Reference lake, intensive biological monitoring	1		4	3	2	1	1	2
Reference lake, intensive phytoplankton monitoring				2			2	
Large lake, slight human impact		1					5	1
Large lake, slight human impact, intensive phytoplankton monitoring				2			1	
Validating the impact assessment of Annex II	1	7	10	25	4	21	27	14
Operational monitoring of lakes impacted by agriculture		6	1		9	1		8
Total	8	20	41	44	27	32	36	37
Total reference	7	6	30	17	17	10	3	16

Surveillance monitoring 2006-2008 Biological monitoring

Lakes:

- phytoplankton in all lakes (biomass, species composition) once in the monitoring period (August)
- phytoplankton annually 6 times (May-September) at 10% of sites
- profundal benthic fauna in lakes (50% of the sites) once in the monitoring period
- fish: number of sites not decided yet
- intensive biological monitoring (all elements) at 6% of sites

Rivers:

- fish, benthic fauna, phytobenthos at reference sites (40% of sites)

Phytoplankton monitoring 2006-2008

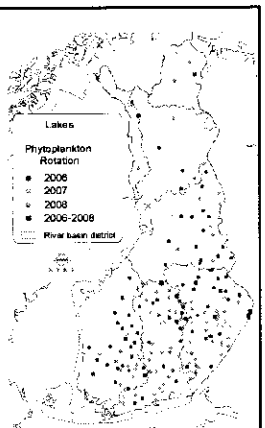
Sampling rotation according to the lake typology

2006
- humic lakes (previous data sparse)

2007
- northern lakes, small clear water lakes and naturally eutrophic lakes (previous data sparse)

2008
- large lakes (sufficient amount of previous data)

2006-2008
- annually (6 times a year): lakes with intensive biological monitoring



Surveillance monitoring in national programme Subset: "Intensive biological monitoring in lakes"

Selection criteria of the sites:

- reference status confirmed with assessing the water quality and, if available, also the biological data
- no point source loading, minor land use
- characteristics fit very well to the description of the lake type
- situated within or partly in a protected area
- preference to lakes which are in the vicinity of research stations of e.g. universities or other institutes

Surveillance monitoring in the national programme Subset: "Intensive biological monitoring in lakes"

Intensive biological monitoring focused on a few, but representative lakes
- reference status checked, many of the lakes are situated in protected areas
- littoral benthic fauna only at lakes where stony shores can be found
- macrophyte monitoring only at lakes which lack previous data

Lake	Lake type number	Phytoplankton 6vk	Profundal benthic fauna	Littoral benthic fauna	Macro-phytes	Phyto-benthos	Fish	Harmful substances/background
Kilpisjärvi	1	2006-2008	2006-2008	2007			x	
Pallasjärvi	4	2006-2008	2006-2008	2007			x	
Iso-Hietajärvi	4	2006-2008	2006-2008	2006	2007		x	
Kakkinen	4	2006-2008	2007	2007			x	
Kattilajärvi	4	2006-2008	2006-2008		2007	2007	x	
Kuolimo	5	2006-2008	2008	2006	2008		x	
Konnevesi	5	2006-2008	2008		2008		x	
Inarinjärvi	5	2006-2008	2006-2008				x	fish/sediment
Haukijärvi	6	2006-2008	2006-2008		2006	2006	x	
Kovero	6	2006-2008	2006-2008	2006	2006		x	
Pääjärvi	7	2006-2008	2008				x	
Lentua	8	2006-2008	2009				x	
Valkea-Kotinen	9	2006-2008	2006-2008				x	fish/sediment
Pelkeljärvi	9	2006-2008	2006-2008	2006	2006		x	

Surveillance monitoring in the national programme Subset: "Intensive biological monitoring in lakes"

Background information of the sites

Lake	Lake type number	Within the borders of Natura 2000 area: Whole lake and catchment area	Within the borders of Natura 2000 area: Most part of the lake and catchment area	Research station in the vicinity	Water quality time series	Number of water quality samplings	Previous biological data
Kilpisjärvi	1	x		x	1975-2005	61	x
Pallasjärvi	4	x			1974-2005	36	x
Iso-Hietajärvi	4	x			1977-2006	236	x
Kakkinen	4	x			1971-2006	148	x
Kattilajärvi	4	x			1978-2005	131	x
Kuolimo	5	x			1985-2006	133	x
Konnevesi	5	x		x	1965-2005	213	x
Inarinjärvi	5		x		1965-2006	162	x
Haukijärvi	6				1975-2004	16	x
Kovero	6	x			1976-2006	47	x
Pääjärvi	7			x	1981-2005	218	x
Lentua	8		x		1984-2006	337	x
Valkea-Kotinen	9	x		x	1983-2005	318	x
Pelkeljärvi	9		x	x	1973-2006	12	x

Surveillance monitoring 2006-2008

Biological monitoring

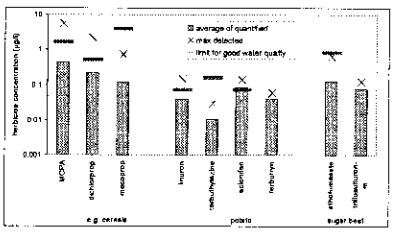
- The requirements of WFD are not met to the whole extent – all biological elements are not monitored at every site
- Biological monitoring is focused only on a few, but very representative sites
- Biological monitoring will be increased gradually after the first monitoring period

Surveillance monitoring 2006-2008

Harmful substances

- background status monitored at a few sites (< 10 rivers, < 10 lakes)
- substances to be analyzed in water, sediments or biota chosen according to previous surveys and risk assessments
- the new substances included in monitoring are: PAH's, pesticides, nonyl-phenols and phtalates
- the need to monitor also e.g. bromated flame retardants will be assessed by pilot studies

Pilot study to select harmful substances to be monitored: Pesticides in surface waters 2005





Monthly sampling from 7 rivers in areas of intensive agriculture

OBS. Additional 76 pesticides were also analysed, but not detected

Jaakko Mannio, FEI 2005

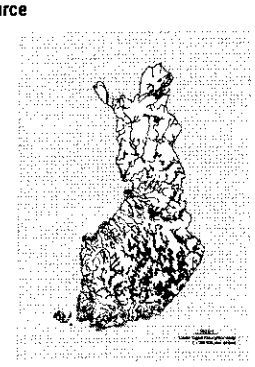
Operational monitoring

- will be based on sites in obligatory monitoring of local pollution (industries, municipalites etc.)
- areas polluted by diffuse sources (agriculture, forestry) will be included in the national monitoring programme (financed by the state)
- sites to be included in operational monitoring will be selected by regional enviromental centres in 2006

Obligatory monitoring of local point source pollution

- 5000 water quality sampling sites
- water quality at all sites (2-20 times/a)
- phytoplankton monitoring at 100 sites every 3. year
- benthic fauna monitoring at 1000 sites every 3. year
- macrophyte and phytobenthos: < 100 sites

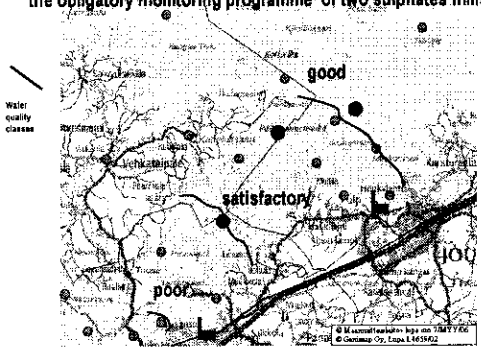
Sites to be included in operational monitoring will be selected from the sites of obligatory monitoring by risk assessment



Operational monitoring

- from 5000 water quality sites in local pollution control programmes approximately 100 – 300 sites will be chosen to the WFD operational monitoring network
- most of these sites already include biological monitoring, but because of many laboratories involved, the methods are different and need to be harmonized (e.g the number of duplicate samples in benthic fauna monitoring)
- harmful substances need to be added to the programmes after risk assessment

Selection of sites to the WFD operational monitoring network from the obligatory monitoring programme of two sulphates mills



- The monitoring programmes of the River Basin Districts (Annex V in WFD) will be finalished in 2006

- The national surface monitoring programme is the main part of the surveillance monitoring
  - will be supplemented by a selection of regionally important sites later in 2006

- selection of sites to the operational monitoring ongoing
  - a draft programme will be presented to the interested partes (NGO's, industries,municipalities, the public etc.) before the end of the year 2006

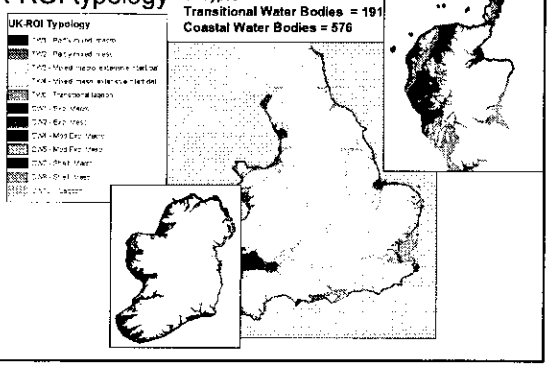
Monitoring Programme Design in Transitional and Coastal Waters - Classification Issues

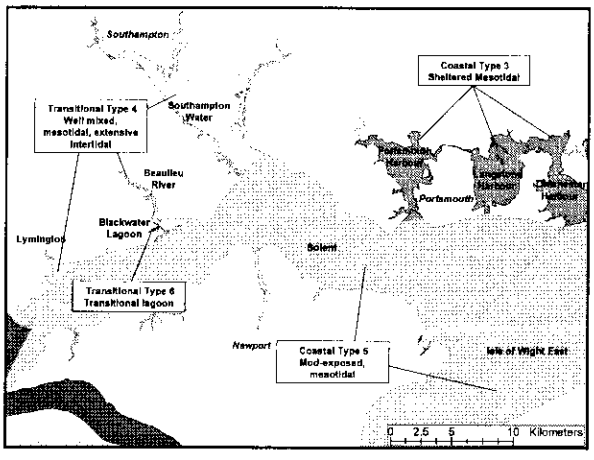
Dave Jowett, Coast Group Chair and NEA GIG Co-ordinator

CIS Workshop Brussels 27-28 April 2006

Characterisation: UK-ROI typology

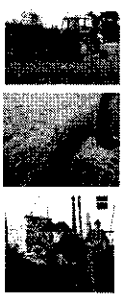
18 Types
Transitional Water Bodies = 191
Coastal Water Bodies = 576





UK Significant Pressures Transitional and Coastal Waters

- Nutrients
- Organic Enrichment
- Hazardous Substances
- Catchment Abstraction
- Morphological Alterations
- Aquaculture
- Industrial Abstraction
- Alien Species



Pressure & Impact Assessment Approach: e.g. Nutrients

Activity ⇨ Waste water treatment

⇩

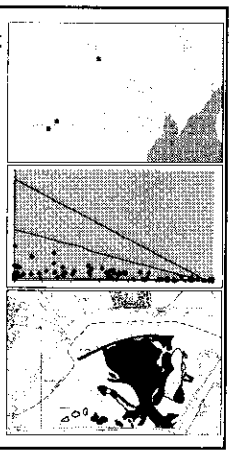
Source pressure ⇨ Treated sewage discharge

⇩

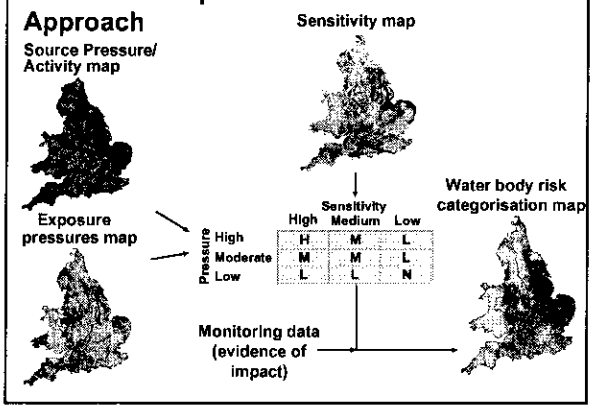
Exposure pressure ⇨ Elevated nitrogen in water

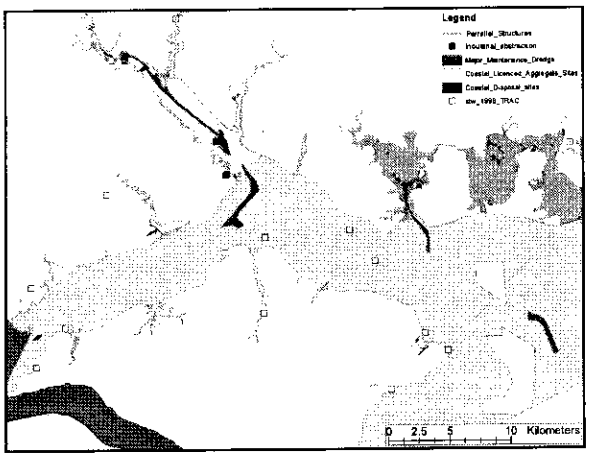
⇩

Impact ⇨ Seaweed mats



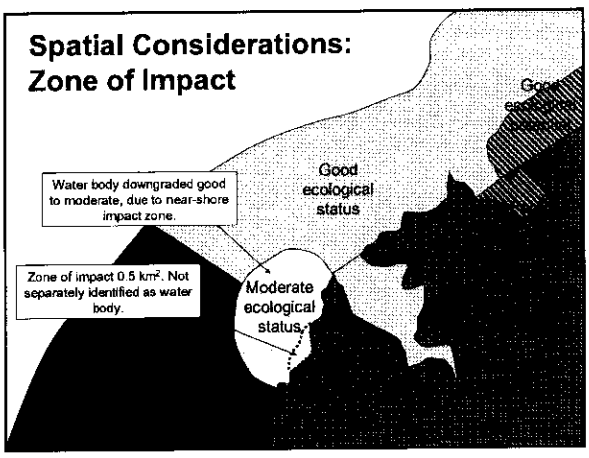
Pressure & Impact Assessment Approach





Implications for monitoring?

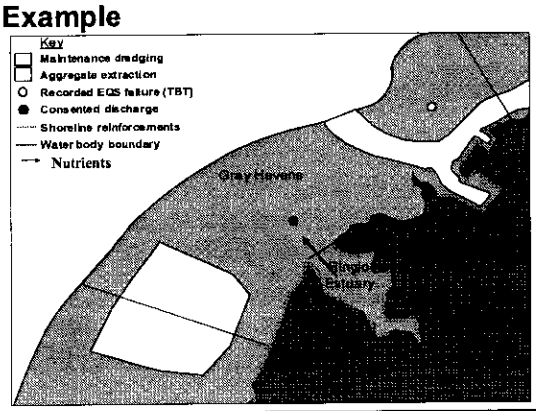
- Consideration of Allowable Zone of Effect (AZE)
- Outside AZE Good Status Achieved
- Problem with cumulative pressures
- Set a spatial impact threshold above which GES is compromised
- Ensures impacts from all industrial sectors assessed at the same scale
- For physical pressures may lead to Heavily Modified Water Body designation



Planning Assumptions for England and Wales

Area (ha) of transitional water	Area (ha) of coastal water	Number of Sites		
		Water column Inverts Transitional Fish Angiosperms - Saltmarsh	Macroalgae	Angiosperms - Seagrass
<400	<4,000	3	3	2
400 to <2,000	4,000 to <20,000	5	5	2
2,000 or greater	20,000 or greater	10	5	2

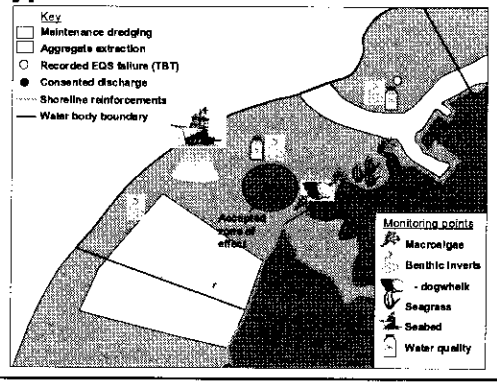
Example



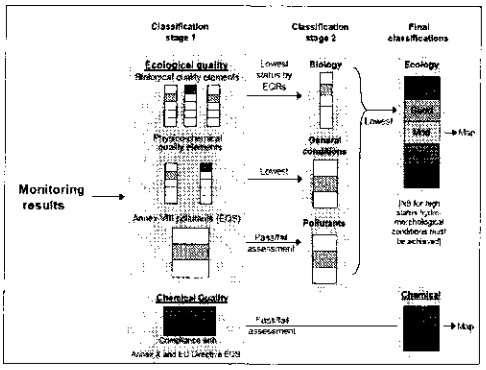
Monitoring required

Quality Elements	Maintenance dredging	Aggregate extraction	Shore reinforcement	Hazardous substances	Nutrients	Tributylin	Monitor
Ecological Q.E.s							
Phytoplankton					X		
Macroalgae				X			X
Seagrass	X	X					X
Saltmarsh	X	X					X
Benthic invertebrates	X	X		X		X	X
Physico-chemical Q.E.s							
Nutrients							X
Temperature							
Dissolved oxygen							
Salinity							
Annex VIII substances							X
Hydro-morphological Q.E.s							
Seabed structure & substrate	X	X	X				X
Depth							
Water chemistry							
Annex IX substances				X		X	X
Annex X substances						X	X

Hypothetical sites



Classification



Waterbody Classification Multiple Sites - "One out all out" or "average"?

Waterbody "X"							
QE	Site 1	Site 2	Site 3	Site 4	Site 5	OOAO	AV
Inverts							
Phytoplankton							
Macroalgae							
Angiosperms							
Fish							
					Overall		

Summary

- Waterbodies are selected for either surveillance or operational monitoring
- Quality elements to be monitored (operational) are derived from the risk assessments
- Monitoring sites are established based on the numbers of pressures and size of the waterbody
- Question - How are quality elements classified? "One out all out" or an "average"?
- Final classification IS "one out all out"
- What do we agree?

THANK YOU
FOR YOUR
ATTENTION

Rijkswaterstaat

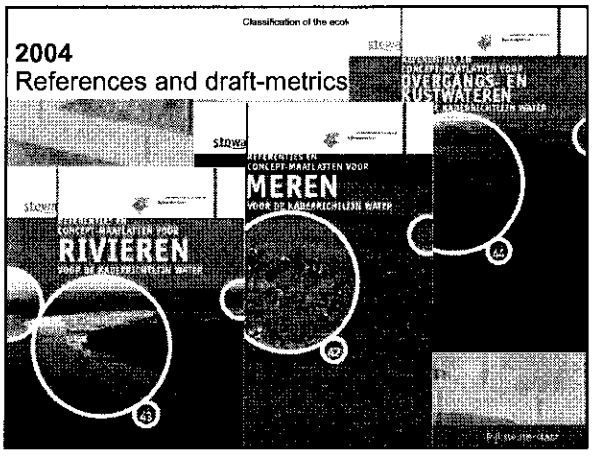
Classification of the ecological status of surface waters in the Netherlands

28 april 2006

Classification of the ecological status of surface waters in the Netherlands

- **2001** Analysis of Dutch classification systems → insufficient for WFD
- **2002** Typology → restricted to natural water types (40)
- **2003-2004** Set-up of an ecological classification system
  - By 40+ ecological specialists
  - Funded by Ministry of Transport, Public Works and Water Management and regional water boards
  - Part of the Intercalibration Working Group WFD Objectives

2004
References and draft-metrics



Time for reflection....



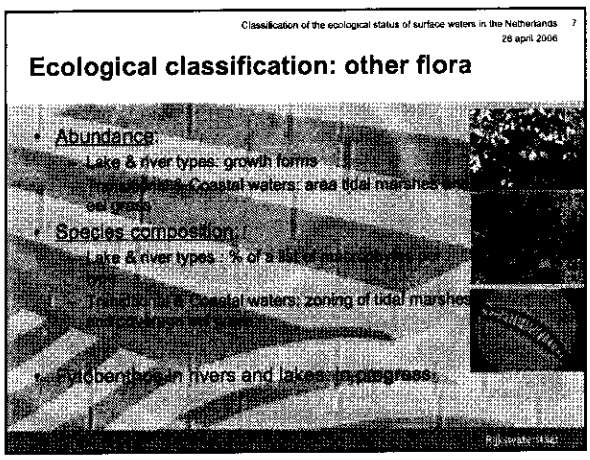
- "This is impossible with so many species and 'one-out-all-out'!"
- No insight in choices, too complex (→ no room for specialists)
- No insight in (economic) consequences
- "Can it be translated to judicial?"
- Too much / too little types → nr of types has been halved
- Too much / too little ambition
- "*Pyedroeciella psilopterus* is missing"/ need for validation
- "System does not fit to monitoring practice"

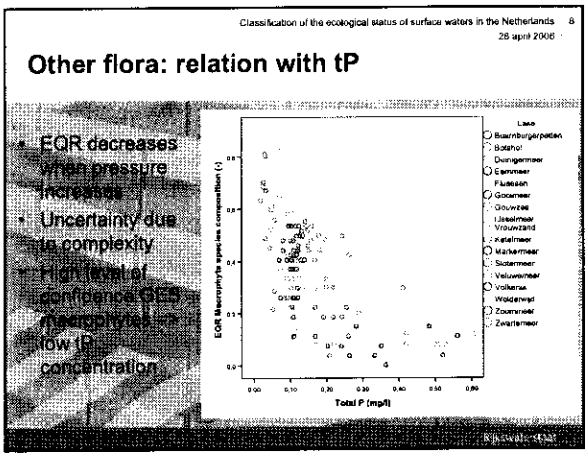
But many compliments also!

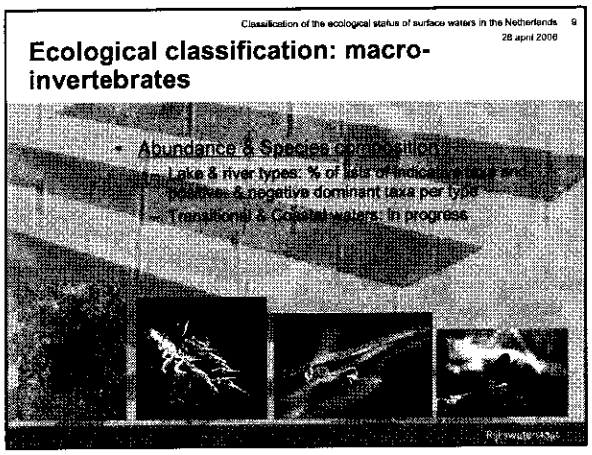
- ✓ References were endorsed for Art. 5 report
- ✓ Draft-metrics endorsed for intercalibration
- **2005** Validation & further operationalisation of metrics
- Results:

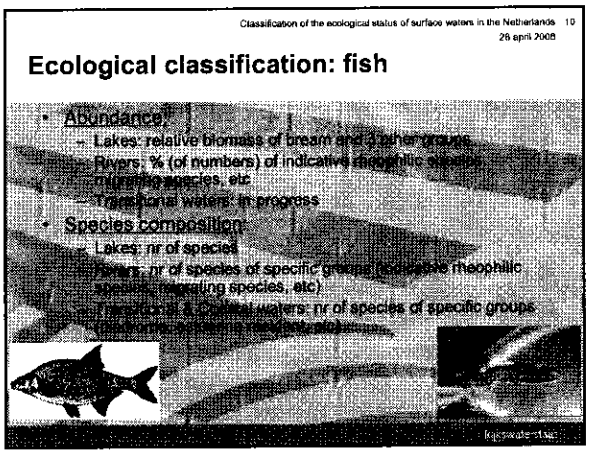
Ecological classification: fytoplankton

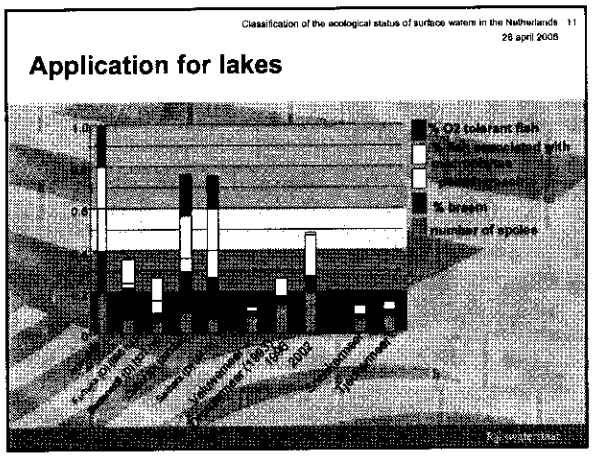
- Abundance: chlorophyll-a
  - Lake types: GES derived from intercalibration
  - Transitional & Coastal water types: GES = 5-12 µg/l
- Species composition: biomass
  - Of several groups in Lakes
  - Of *Phaeocystis* in Transitional & Coastal waters

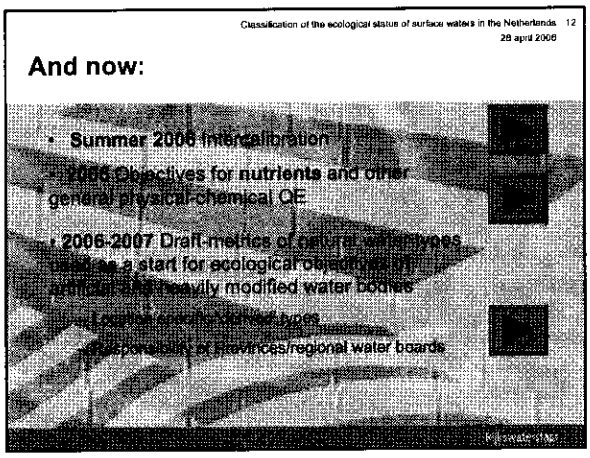

Classification of the ecological status of surface waters in the Netherlands 7
26 april 2006
Ecological classification: other flora
Abundance:
Species composition:
Rijkswaterstaat

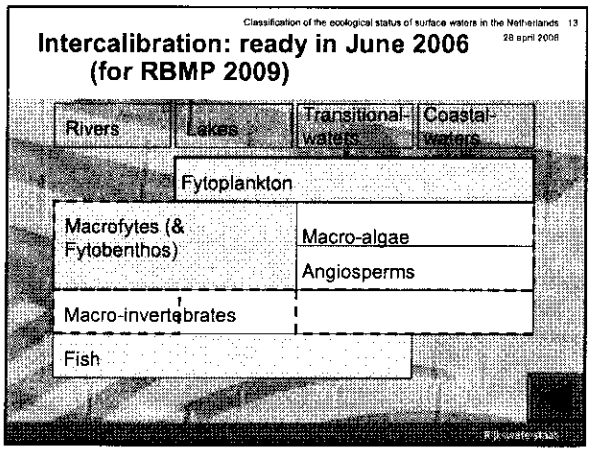

Classification of the ecological status of surface waters in the Netherlands 8
26 april 2006
Other flora: relation with tP
EQR decreases when pressure increases
Uncertainty due to complexity
High level of confidence QES macrophytes – low tP concentration
Total P [mg/l]
Rijkswaterstaat

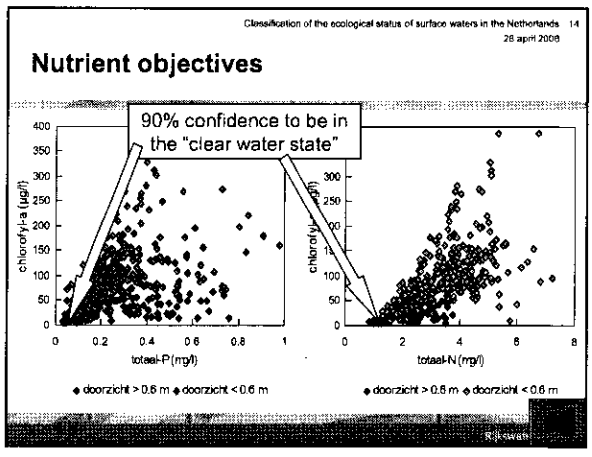

Classification of the ecological status of surface waters in the Netherlands 9
26 april 2006
Ecological classification: macro-invertebrates
Abundance & Species composition:
Rijkswaterstaat

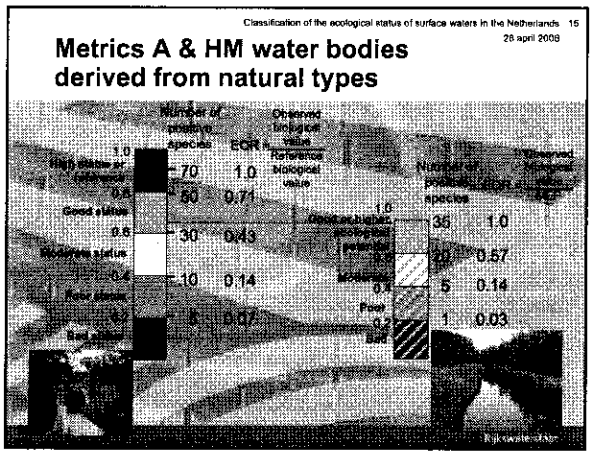

Classification of the ecological status of surface waters in the Netherlands 10
26 april 2006
Ecological classification: fish
Abundance:
Species composition:
Rijkswaterstaat

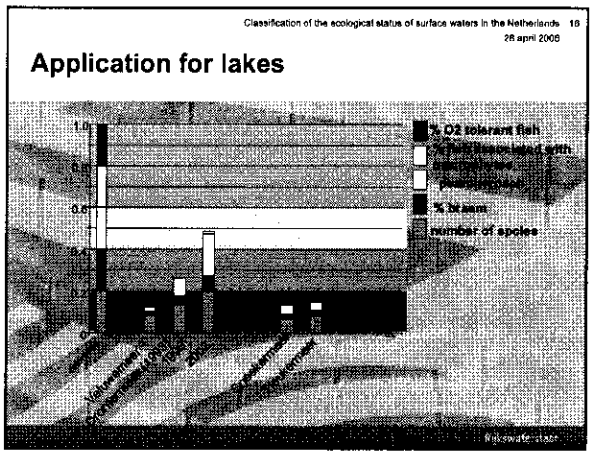

Classification of the ecological status of surface waters in the Netherlands 11
26 april 2006
Application for lakes
% O2 tolerant fish
% breem
number of species
Rijkswaterstaat


Classification of the ecological status of surface waters in the Netherlands 12
26 april 2006
And now:
Summer 2006 intercalibration
2006 Objectives for nutrients and other general physical-chemical QE
2006-2007 Draft metrics of natural water types
Rijkswaterstaat


Classification of the ecological status of surface waters in the Netherlands 13
28 april 2006
Intercalibration: ready in June 2006
(for RBMP 2009)
Rivers
Lakes
Transitional-waters
Coastal-waters
Fytoplankton
Macrofytes (& Fytobenthos)
Macro-algae
Angiosperms
Macro-invertebrates
Fish


Classification of the ecological status of surface waters in the Netherlands 14
28 april 2006
Nutrient objectives
90% confidence to be in the "clear water state"
chlorofyl-a (µg/l)
totaal-P (mg/l)
totaal-N (mg/l)
doorzicht > 0.6 m
doorzicht < 0.6 m


Classification of the ecological status of surface waters in the Netherlands 15
28 april 2006
Metrics A & HM water bodies
derived from natural types
Number of positive species
EQR =
Observed biological value
Reference biological value
70 1.0
50 0.71
30 0.43
10 0.14
5 0.07
35 1.0
20 0.57
5 0.14
1 0.03


Classification of the ecological status of surface waters in the Netherlands 16
28 april 2006
Application for lakes
% O2 tolerant fish
% bream
number of species

Session 4.3 - CZ - Nemethova

Methodology of evaluation of ecological state of surface waters in the Czech Republic

Danka Némethová, Jiří Jarkovský, Ladislav Dušek, Jiří Hřebíček,
Petr Pavliš, Petr Brabec, Klára Kubošová, Eva Gelnarová

Arrow (Czech Approach)
Assessment and Reference reports of Water Monitoring

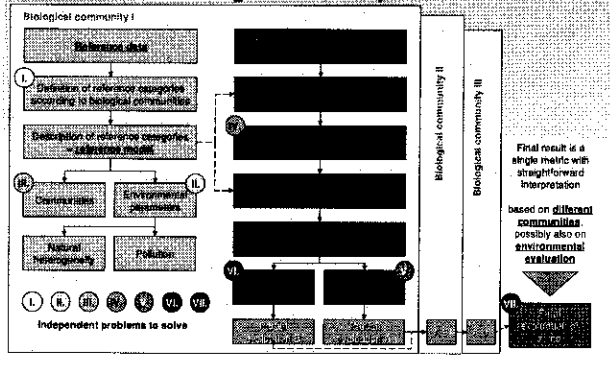
Aims and assumptions

- The aim of this presentation is to present the methodology of evaluation of ecological state of surface waters using an analysis of monitoring data.
- The approach presented is compatible with the EU Water Framework Directive and will be implemented in the national-wide information system of the ecological state of surface waters of the Czech Republic.
- Assumptions of presented methodology are follows:
  - computations are mathematically verifiable
  - method is exploitable in Czech conditions and is not dependent on special SW licences

Entering data

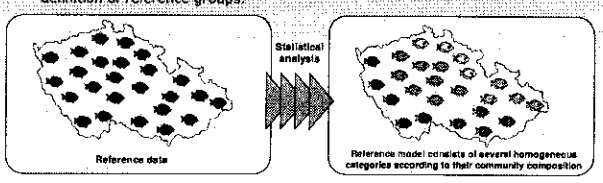
- Database of reference sites for different biological communities
- Evaluated data from monitoring network
  - Species composition and abundance of biological communities
  - Environmental parameters of natural heterogeneity
    - Parameters minimally influenced by human activity which are connected with community composition; individual biological communities can differ in these parameters
  - Environmental parameters characterizing disturbed conditions
    - A set of parameters (disturbance, pollution etc.) for each type of community; the computation is not dependent on evaluation based on communities
  - Community indices
    - Biological communities can be characterized by different specialized indices. Deviation of the index from natural state indicate changes in natural character of site.

Diagram of analysis



I. Definition of reference categories

- defining **homogenous groups** within the reference database according to **composition of biological communities**
- statistical method: Hierarchical agglomerative clustering on distance matrix (Gower distance metric) of biological communities followed by algorithm for definition of optimal number of clusters and expert opinion will be used for definition of reference groups.

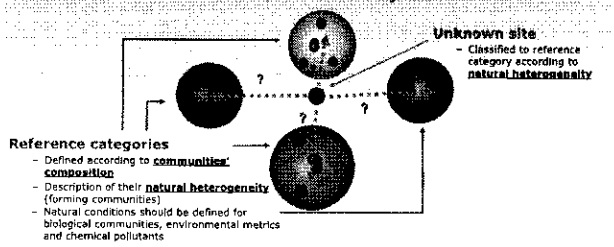


Results of the analysis have to be

- confirmed by expert knowledge (valuable reference groups)
- at least 10 – 15 sites in each reference group

II. Reference model

- Reference categories are described by **environmental parameters** which are minimally influenced by human activity = **natural heterogeneity**
- These parameters are used for classification of unknown sites (standard monitoring) into reference groups according to theory that sites with similar environmental conditions should have similar biological communities

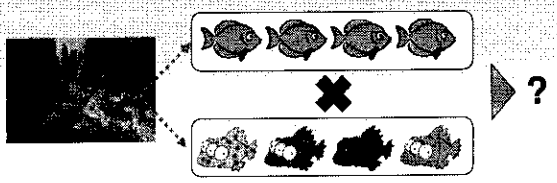


Session 4.3 - CZ - Nemethova

MINISTERSTVO ŽIVOTNÍHO PROSTŘEDÍ
odbor ochrany vod

III. Description of reference communities

- Structure of reference communities is a part of reference model
  - **probability of occurence of species** in individual reference categories is recorded



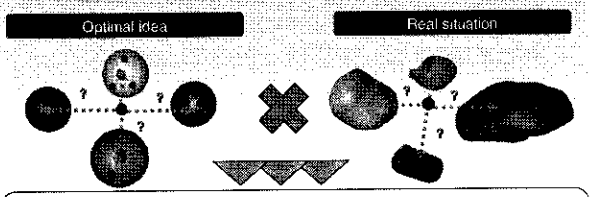
- The most valuable result of the analysis is the comparison of **existing and theoretical „natural" community**

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IV. Classification of unknown site to reference group

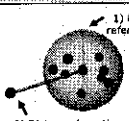
- Unknown sites are classified into **reference categories** according their **natural heterogeneity**



- Our **simple but robust method** is able to answer two basic questions:
  - Does unknown site belong to **a reference category**?
  - How far is the unknown site from reference category considering **multivariate distribution of reference data**

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IV. Centroid distance as the classification method



- **Centroids of reference data** represent reference categories
- **95% percentile of radius of reference category** represent variability of reference data
- Distance of unknown site to the centroid of reference data **(1)** is compared with size of reference category**(2)**
- Result is expressed in multiplies of radius of reference category

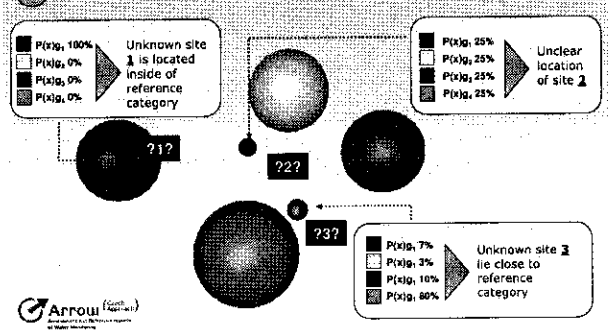


- Due to the fact that reference categories are not multivariate spheres we had to add a safety measure reflecting the real multivariate shape of the reference data. There are two parameters incorporated in the computation: the distance of an unknown case to the nearest neighbour in the reference group (**N**) and the measure of intragroup distances (**I**) within the reference group.
- Calculation is repeated for each reference category and weighted to 100% probability of classification

Robust classification method with minimum sensitivity to data distribution

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IV. Result of the centroid distance

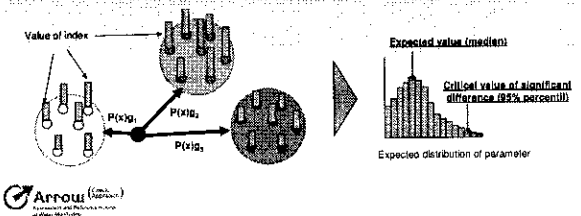


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VI. Predicted vs. observed state of parameter I

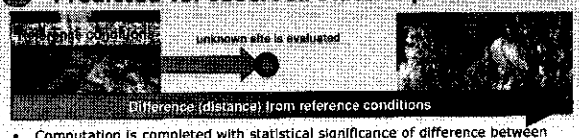
- Each **biotic index** or **chemical parameter** can be characterized by its expected distribution according to values of parameter on reference sites and probability of classification of unknown site into reference group which is used as the frequency weight of the given reference value
- The predicted value is computed as median of predicted distribution and compared to observed value.



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VI. Predicted vs. observed state of parameter II



- Computation is completed with statistical significance of difference between expected and observed value
- The final value for evaluation of disturbance in particular parameter is $EQI_{DI(x)}$ (ecological quality index according to RIVPACS methodology)

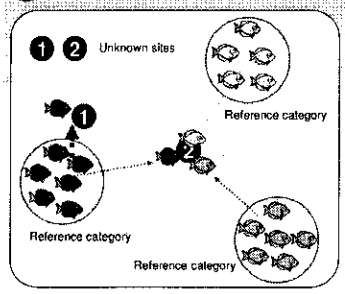
$$EQI_{DI(x)} = \frac{DI_{observed}}{DI_{expected}}$$

computed as a ratio of measured value and median of predicted distribution (range 0 – 100%, higher value indicates worser state)

EQI is defined to each parameter being used. It provides a means of standardizing the biotic indices, so that a particular value of the EQI ratio implies the same ecological quality for that index, no matter what the type of site.

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VI. Prediction of biological community



- RIVPACS methodology adopted
- If the **unknown site belongs to a reference category**, it should have **similar community**.
- Expected community is a result of
  - **communities' composition of reference categories**
  - **membership of unknown site to reference categories**

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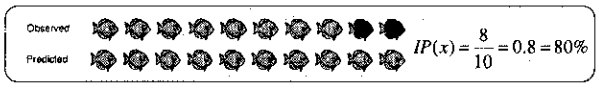
VI. Algorithm of prediction of biological community

- Probability of species' occurence in unknown site is predicted
  - according to occurence of species in reference group
  - according to classification of unknown site into reference categories
  - according to size of reference categories (weight)
- Predicted community include species with low probability of occurence
  - the next step of the computation is the **cut-off** of species with low probability of occurence
  - the threshold value is according to experiences of RIVPACS set to 50% probability of occurence

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VI. Comparison of observed and expected community

- Predicted composition of community is known
  - Total number of species $S_{max}(x)$ is computed according to their **probability of occurence**
  - Comparison of expected and observed biological community is based on **Jaccard simmilarity index**
  - **similarity index IP** (range 0 - 100%) of expected and observed community is weighted by variability of reference data



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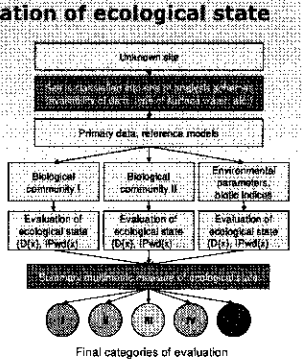
VII. Partial results of analysis

- Partial results of analysis are:
- Probability of classification of unknown site into reference category
  - $P(x)$ at PO_{50}
  - range 0-100%, higher value indicates higher probability of classification
- Evaluation of overall environmental state of unknown site
  - D(x)
  - range 0-100%, higher value indicates worser state
- Comparison of observed and expected composition of biological community
  - IPwd(x)
  - range 0-100%, higher value indicates worser state
- Values D(x), DI(x), $EQI_{DI(x)}$ and IPwd(x) are used for final evaluation

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VII. Final results of evaluation of ecological state

- Final aim of the analysis is one measure of ecological state which should include results of analysis of environment as well as different biological communities
- The last step of the analysis is combination of partial measures of ecological states into one **final measure** of ecological state which could be categorized into **five categories** according to WFD EU (**from natural to most disturbed ecological state**) and used for environmental reporting and management.



Final categories of evaluation

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Conclusion

- ☑ The presented methodology of evaluation of ecological state is useful for evaluation of surface waters with respect to general methodology of comparison of biological communities with reference state; moreover it can include also some methodological approaches from other types of evaluation of ecological state (biotic indices, multimetric approach) or modification according to demands of particular type of biological community.
- ☑ The methodology is **universal** for any type of date (i.e. any biological communities) and respects the problems of data distribution and variability.
- ☑ The results of analysis are simple measures with straightforward interpretation for environmental reporting and management

Robust universal method with straighforward interpretable results

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