Assessment of the Ecological Status and Classification of Surface Water Bodies

- Approaches and Tools

Dr. Ursula Schmedtje
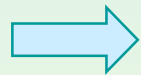
Environmental Objectives (Art. 4)

The Member States shall

◆ **...**

➡ **achieve the good surface water status at the latest 15 years after the date of entry into force of this Directive**

➡ **protect and enhance all artificial and heavily modified bodies of water with the aim of achieving good ecological potential and good surface water chemical status at the latest 15 years from the date of entry into force of this Directive**

◆ **...**

icpdr iksd
International Kommission
Commission zum Schutz
for the Protection der Donau
of the Danube River

Categories of Surface Water Bodies

■ **natural surface water bodies**

♦ **rivers** (> 10 km² catchment area)

♦ **lakes** (> 0,5 km² surface area)

♦ **transitional waters** (partly saline)

♦ **coastal waters** (distance: 1 nautical mile)

⟹ *characterization (Annex II)*

■ **heavily modified surface water bodies** (substantially changed in character as a result of physical alterations by human activity)

■ **artificial surface water bodies**

icpdr iksd
International Commission for the Protection of the Danube River Internationale Kommission zum Schutz der Donau

Typology of rivers

Descriptors according to Annex II of WFD

System A

Ecoregion: Ecoregions shown on Map A in Annex XI

Type: **Altitude typology**
high: > 800 m
mid-altitude: 200 to 800 m
lowland: < 200 m

Size typology based on catchment area
small: 10 - 100 km^2
medium: > 100 to 1.000 km^2
large: > 1.000 to 10.000 km^2
very large: > 10.000 km^2

Geology
calcareous
siliceous
organic

Typology of rivers

Descriptors according to Annex II of WFD

System B

Obligatory factors
- altitude
- latitude
- longitude
- geology
- size

Optional factors
- distance from river source
- energy of flow (function of flow and slope)
- mean water width
- mean water depth
- mean water slope
- form and shape of main river bed
- river discharge (flow) category
- valley shape
- transport of solids
- acid neutralising capacity
- mean substratum composition
- chloride
- air temperature range
- mean air temperature
- precipitation

Typology of lakes

Descriptors according to Annex II of WFD

System A

Ecoregion: Ecoregions shown on Map A in Annex XI

Type:

Altitude typology
high: > 800 m
mid-altitude: 200 to 800 m
lowland: < 200 m

Depth typology based on mean depth
< 3 m
3 m to 15 m
> 15 m

Size typology based on surface area
$0{,}5 - 1\ km^2$
$1\ to\ 10\ km^2$
$10\ to\ 100\ km^2$
$> 100\ km^2$

Geology
calcareous
siliceous
organic

Typology of lakes

Descriptors according to Annex II of WFD

System B

Obligatory factors
- altitude
- latitude
- longitude
- depth
- geology
- size

Optional factors
- mean water depth
- lake shape
- residence time
- mean air temperature
- air temperature range
- mixing characteristics (e.g. monomictic, dimictic, polymictic)
- acid neutralising capacity
- background nutrient status
- mean substratum composition
- water level fluctuation

Steps to take for the development of a typology according to EU-WFD

- **Development of geomorphological types**
  - ◆ Development of „water landscapes"
  - ◆ Definition of geomorphological types: these may occur in different water landscapes

- **Verification by biocoenotic types**

  Adaptation of geomorphological types to biologically relevant types
  - ◆ by aggregation and/or
  - ◆ by differentiation

icpdr iksd
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Monitoring of Water Status (Art. 8)

Natural surface water bodies:

rivers, lakes, transitional waters and coastal waters

⟹ *ecological status*

⟹ *+ chemical status*
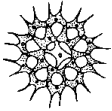
= *Surface water status*
result is <u>the lower of the two</u> ⟹ *details (Annex V)*

Programs must be operational: at the latest
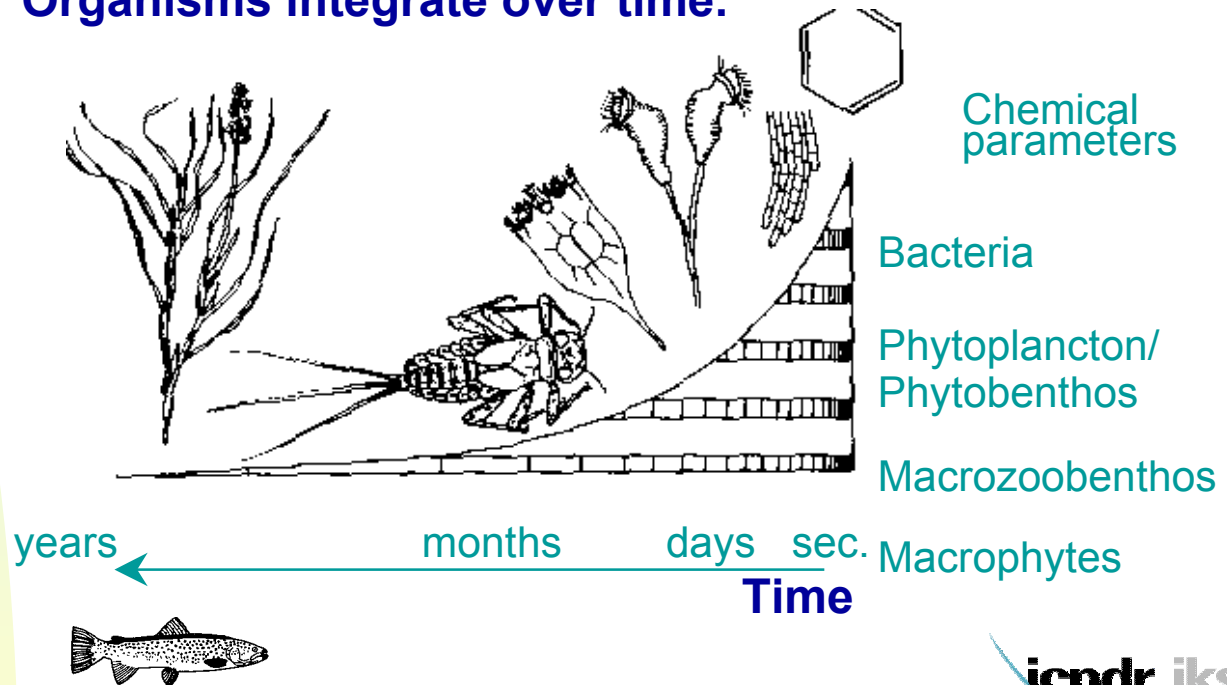six years after the date of entry into force of WFD

icpdr iksd
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Quality Elements for the Classification of the Ecological Status

Basis: Biological Elements

		Rivers	Lakes	Transitional waters	Coastal waters
Phytoplancton		X	X	X	X
Macroalgae and angiosperms				X	X
Macrophytes and phytobenthos		X	X		
Benthic invertebrate fauna		X	X	X	X
Fish fauna		X	X	X	

icpdr iksd

International Commission for the Protection of the Danube River

Internationale Kommission zum Schutz der Donau

Why are biological elements the basis for ecological classification?

- **Organisms are bioindicators, indicating the status of the water body.**

    - **Organisms integrate over all environmental factors.**

        - **Organisms integrate over time.**

Chemical parameters

Bacteria

Phytoplancton/ Phytobenthos

Macrozoobenthos

years   months   days   sec.   Macrophytes

Time

Quality Elements for the Classification of Ecological Status

Supportive Elements

- **Hydromorphological elements**

  - ◆ Continuity (only in rivers), Hydrology (in rivers and lakes) and Morphology

- **Chemical and physicochemical elements**

  - ◆ General: Thermal conditions, Oxygenation, Salinity (not in coastal waters), Nutrient Status, Acidification Status (only in rivers and lakes), Other Pollutants

  - ◆ Specific Pollutants: Priority substances and other substances identified as being discharged into the body of water

Ecological Classification

■ **Reference based classification**

  ◆ Definition of type specific reference conditions

  ◆ Quantification of deviation from the reference condition

■ **Classification criteria for biological elements**

  ◆ generally: taxonomic composition and abundance

  ◆ for fish fauna: taxonomic composition and abundance <u>and age structure</u>

■ **Biological classification supported by**

  ◆ Chemical and physicochemical elements

  ◆ Hydromorphological elements

Monitoring of Water Status (Art. 8)

- **heavily modified surface water bodies**
  (substantially changed in character
  as a result of physical alterations)

- **artificial surface water bodies**

⟹ *ecological potential*

Quality elements:

those to whichever of the four natural surface water
categories most closely resemble the heavily
modified or artificial water body concerned

Monitoring of Ecological and Chemical Status

- **Surveillance monitoring**

    – to receive a coherent and comprehensive overview within each river basin district

    – measuring points where water flow is significant; including catchment areas
    > 2.500 km², large lakes and reservoirs

- **Operational monitoring**

    – for those water bodies at risk of failing to meet the good ecological status and for monitoring changes in the status after rehabilitation measures

    – catchment areas down to 10 km²

- **Investigative monitoring**

    – for investigative purposes, e.g. due to unknown pressures or impacts or due to accidental pollution

icpdr iksd
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Frequency of Monitoring

- **Biological Elements**

  – every 3 years
    (phytoplancton: every 6 months)

- **Hydromorphological Elements**

  – every 6 years
    (hydrology: continuously in rivers, every month in lakes)

- **Physico-chemical Elements**

  – general chemical elements: every 3 months

  – priority substances: every month

Joint Danube Survey

- **receive uniform data set**

- **get basic data for the implementation of the WFD**

Danube near Regensburg 🇩🇪
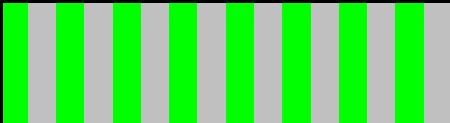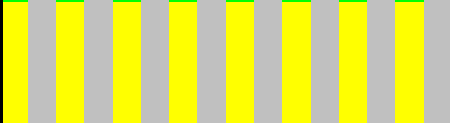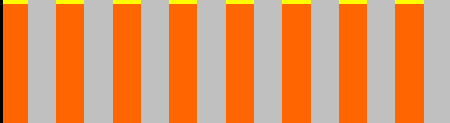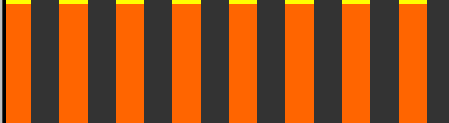
Monitoring program

• **chemical water analysis**

• **sediment analysis**

• **flora and fauna**

Classification and Presentation of Ecological Status

Class	Ecological Status Classification	EQR-Value	Color Code
I	high	> 0,95 - 1,00	
II	good	> 0,80 - 0,95	
III	moderate	> 0,60 - 0,80	
IV	poor	> 0,30 - 0,60	
V	bad	0 - 0,30	

icpdr iksd

International Commission for the Protection of the Danube River

Internationale Kommission zum Schutz der Donau

Classification and Presentation of Ecological Potential

Ecological Potential Classification	Color Code	
	Artificial Water Bodies	Heavily Modified
good and above		
moderate		
poor		
bad		

Projects for the Classification of the Ecological Status in Germany and the EU

■ **Phytoplancton**

◆ Development of a Classification System to Assess the Ecological Status with Phytoplancton in Lakes and Rivers (TU Cottbus, GERMANY)

■ **Macrophytes and Phytobenthos**

◆ Development of a Classification System to Assess the Ecological Status with Macrophytes and Phytobenthos in Rivers and Lakes (Bayer. Landesamt für Wasserwirtschaft, GERMANY)

◆ **ECOFRAME: Classification of shallow lakes with macrophytes and phytobenthos (EU-Project, Univ. Liverpool, GREAT BRITAIN)**

Projects for the Classification of the Ecological Status in Germany and the EU

- **Benthic invertebrate fauna**

    - **AQEM: Classification System to Assess the ecological Status with Macrozoobenthos in Rivers (EU-Project, Univ. Essen, GERMANY)**

    - **Interim Solution for the Ecological Assessment with Macrozoobenthos in rivers based on the Saprobic System (Univ. Essen, GERMANY)**

    - Classification System to Assess the Ecological Status with Macrozoobenthos in Lakes (Univ. Hohenheim, GERMANY)

- **Fish fauna**

    - Classification System to Assess the Ecological Status using the Fish Fauna (IGB, GERMANY)

icpdr iksd
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau