



Sediments and the Water Framework Directive

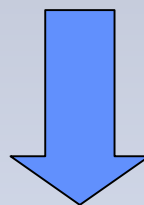
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Background and Outline

WFD is the main tool to safeguard and manage water bodies in the next decades



- Where are **sediments** explicitly or implicitly taken into account in WFD?
- How do **sediments** contribute to determine the ecological and chemical status according to WFD?
- How can an integrated assessment & evaluation of **sediment quality** (Triad or Hexad?) contribute to the implementation of WFD?



WFD Environmental Objectives (Art.4)

- No deterioration of the status of all water bodies
- Good Ecological and Chemical Status by 2015
- Reduce emissions of priority substances and eliminate priority hazardous substances by 2020

Ecological status:

expression of the quality of the structure and functioning of aquatic ecosystems

Chemical status:

concentrations of specific pollutants not exceeding specified levels



Quality Elements

Quality Elements for Ecological Status:

Biological elements

Phytoplankton, aquatic flora, benthic invertebrate fauna, fish fauna

Hydro-morphological elements supporting the biological elements

Morphological conditions, Hydrological and Tidal regime

Chemical and physico-chemical elements supporting the biological elements

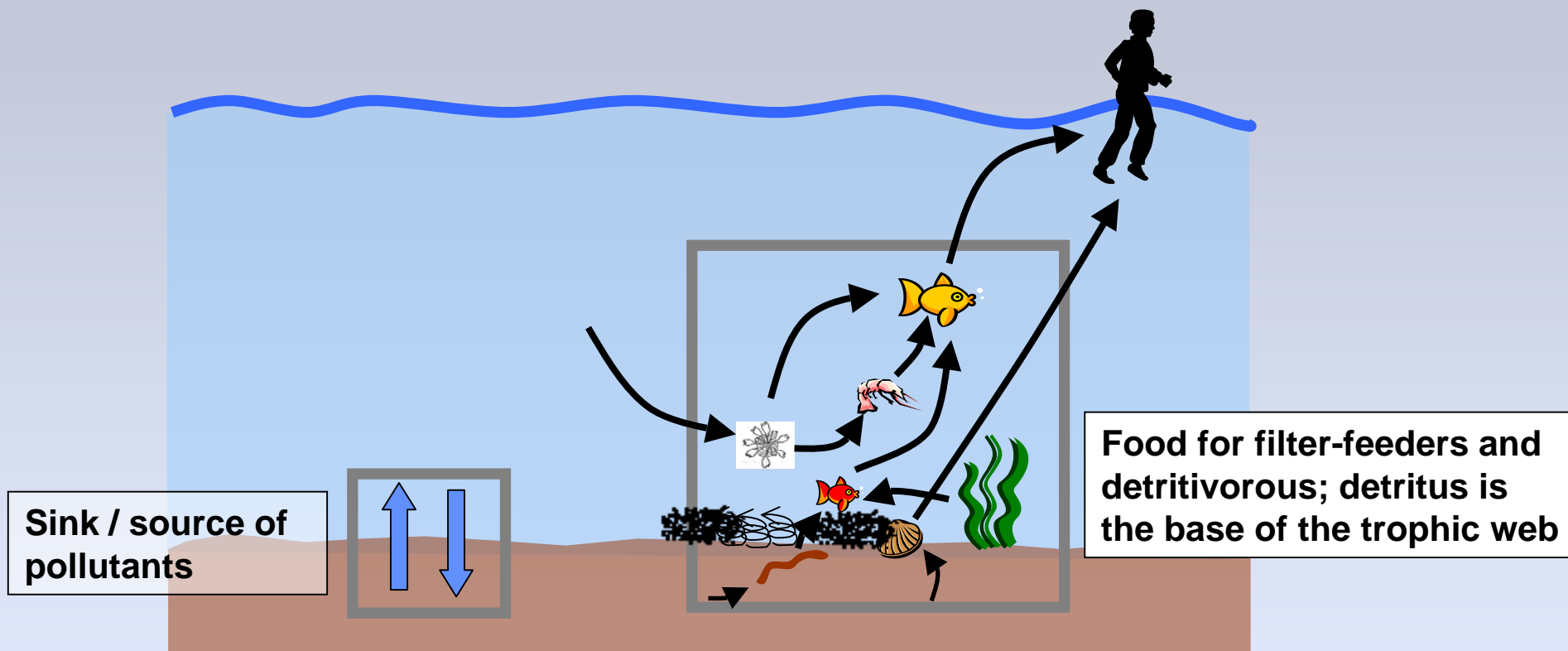
General (DO, nutrients, transparency, temperature, etc.), Specific synthetic and non-synthetic pollutants

Quality Elements for Chemical Status:

Priority Substances ex Art. 16 (33) and other pollutants (8) of Directive 76/464/CE daughters (Annex 1 COM(2006)398 final)



Some reasons why sediments are a fundamental component of most ecosystems



Fundamental component of most habitats

Habitat (92/43/EEC; Art.1): "an environment defined by specific abiotic and biotic factors, in which the species lives at any stage of its biological cycle"



Where are then sediments cited in WFD?

Sediments are considered in the Directive as far as two distinct aspects are concerned:

- **chemical quality**
- **physical and physico-chemical aspects conditioning the biological communities**



Where are then sediments cited in WFD?

Chemical quality

Sediments are explicitly cited in the **Articles** only 2 times, in connection with the derivation of EQS. In particular:

Art.16(7): *“the Commission shall submit proposals for quality standards applicable to the concentrations of the priority substances in surface water, **sediments** or biota”.*

Annex V:

1.2.6: Procedure for the setting of chemical quality standards by Member States.

*“...Standards may be set for water, **sediments** or biota”.*

PNEC: ecotoxicological data x Safety Factor depending on the level of uncertainty and availability of data

COM(2006)398 final: EQS have been proposed **only for water**. Art.2 states that *“Member States shall ensure, on the basis of monitoring, that concentrations of substances in Annex 1 do not increase in sediments and biota”* = TREND MONITORING (Guidance on Chem. Monit., 2007, Draft)



Where are then sediments cited in WFD?

Physical and physico-chemical aspects conditioning the biological communities

Annex V:

- *Hydro-morphological parameters (QE supporting the biological elements) (sum of all categories): structure and substrate of the bed: grain-size, organic content, solid rock, general characteristics, water content/density, elemental composition, sedimentation rate*
- *“Physico-chemical quality of sediments” in the definition of “good ecological status” of phytoplankton and macrophytes and phytobenthos in rivers.*
- *“Physico-chemical quality of sediments” in the definition of “good and moderate ecological status” of phytoplankton in lakes.*
- *“Sediment transport” in the definition of “high status” of hydro-morphological elements in rivers.*
- *“Presence of taxa indicative of pollution” (evidently from sediments and/or pore water) in the definition of “moderate status” for benthos in transitional and coastal waters*



Where are then sediments cited in WFD?

Physical and physico-chemical aspects conditioning the biological communities

Annex II - Typology:

Solid transport (Rivers); Mean substratum composition (All categories)

Annex II - Identification of pressures:

...

- *Significant morphological alterations to water bodies*
- *Other significant anthropogenic impacts on the status of surface waters*

“*Dredging*” is explicitly cited as a “Pressure” to be considered for evaluating “the risk of failing the objectives” in Guidance n.3 (EC, 2003)



Sediment is a “Pressure”

that influences the ecological and chemical status of water bodies in different ways:

- sediment mobility: transport and dispersion, physico-chemical equilibria above and below the sediment-water interface, water column quality,...
- sediment contaminants speciation: bioavailability and bioaccumulation / biomagnification potential
- contaminants in sediments can influence the communities (chronic or acute toxicity, biomarkers, bioaccumulation)
- exchanges between solid (sediment, suspended particles) and liquid (column water, pore water) and variability in time and space
- in shallow water sediments influence water column physico-chemical parameters supporting the ecological status: dissolved oxygen, nutrients, others
- besides contamination, other indicators related to sediments are relevant (directly or indirectly) to the communities: TOC, carbonates, sulfides, redox,...



It is evident that sediments have an impact on ecological quality because of their quantity and / or their quality: how can this be taken into account?

Chemical status:

- measure most priority substances (except metals) as total concentrations (unfiltered samples) (*COM(398)final*)
- measure priority substances on sediments if lipophilic / high partition coefficient ($\log K_p > 3$): not only simple “trend monitoring”
- develop EQS for biota and sediments for lipophilic / high partition coefficient priority substances. Measures on whole water samples are not sufficient (*CSTEE, 2004*)



Should we have for sediments mandatory chemical thresholds (EQS) requiring immediate regulatory actions or **trigger values for further investigations (other LoE) following a ERA/HHRA approach?**

Sediment EQS should not be pass/fail standards, but lead to further site-specific investigations



It is evident that sediments have an impact on ecological quality because of their quantity and / or their quality: how can this be taken into account?

Ecological status:

- measure all hydro-morphological and physico-chemical parameters indicated in WFD to support the Biological Quality Elements
- use of sediment parameters (contaminants, but not only) to recognize / quantify Pressure - Response relationships and define indicators and scales for classification



It is evident that sediments have an impact on ecological quality because of their quantity and / or their quality: how can this be taken into account?

River Basin Management Plan (RBMP):

Include and coordinate Sediment Management Plans within RBMP. This should include both:

- Ex Situ management (i.e. management of sediments to achieve socioeconomic goals (e.g., construction, navigational dredging, flood defense, etc.) - *management certainly needed*)

AND

- In situ management (i.e. management of sediment to achieve ecological goals – *management potentially needed*)

- ✓ *Chemical contamination and hydro-morphology are often closely linked*
- ✓ *It means also, recognize that Sediment Management is a Basin-Scale issue that requires cost-sharing*
- ✓ *Presently, this is a notable omission in Annex VI (List of measures to be included in the programmes of measures)*



The present tendency: Water Directors (Committee ex Art. 21) point of view

- Discussion is underway, with the different Member States having different positions.
- Under examination are also the relationships among WFD, the Waste Framework Directive (2006/12/EC) and the proposed Soil Protection Directive, as far as sediments are concerned.
- In the recent Inari (Finland) meeting (Dec.2006) it was agreed that the Committee should discuss the aspect again on the basis of a report from the recent SEDNET conference in Venice.
- The Report was released in April 2007, recommending that “*Sediment Management in terms of quality and quantity should receive due attention in RBMP, and exceptions should be justified*”.
- Most probably, EQS on sediments and biota for selected priority substances will be included in the Directive (*COM(398)final*) under discussion at the EU Parliament.



Specific contributes to WFD from the TRIAD or a MLoE approach

- Data on benthic macroinvertebrates are already and themselves a WFD Biological Quality Element
- Data to calculate Sediment EQS (*Ann. V, 1.2.6*) and approaches / methods to go beyond EQS (*ERA/HHRA*)
- Experimental evidences to support the Pressure - Response analysis to define indicators and EQR scales (i.e. sediment chemistry vs benthic community)
- Early warning of negative (some biomarkers)
- Important in Investigative Monitoring



Conclusion

- WFD offers an opportunity to further improve our knowledge about the relation between sediment quality and water quality and to harmonise quality assessment and sediment management on a River-Basin scale
- Sustainable Sediment Management should become an integrated part of WFD
- New and better biologically / ecologically - oriented tools are needed to assess sediment quality in the WFD - perspective



Thank you for your attention

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