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Work package 3: Quality and Impact assessment

Former Working group 2: Contaminant behaviour and fate (Jan 2002 –Sept 2003)

Group leader: Prof. Dr. Damià Barceló

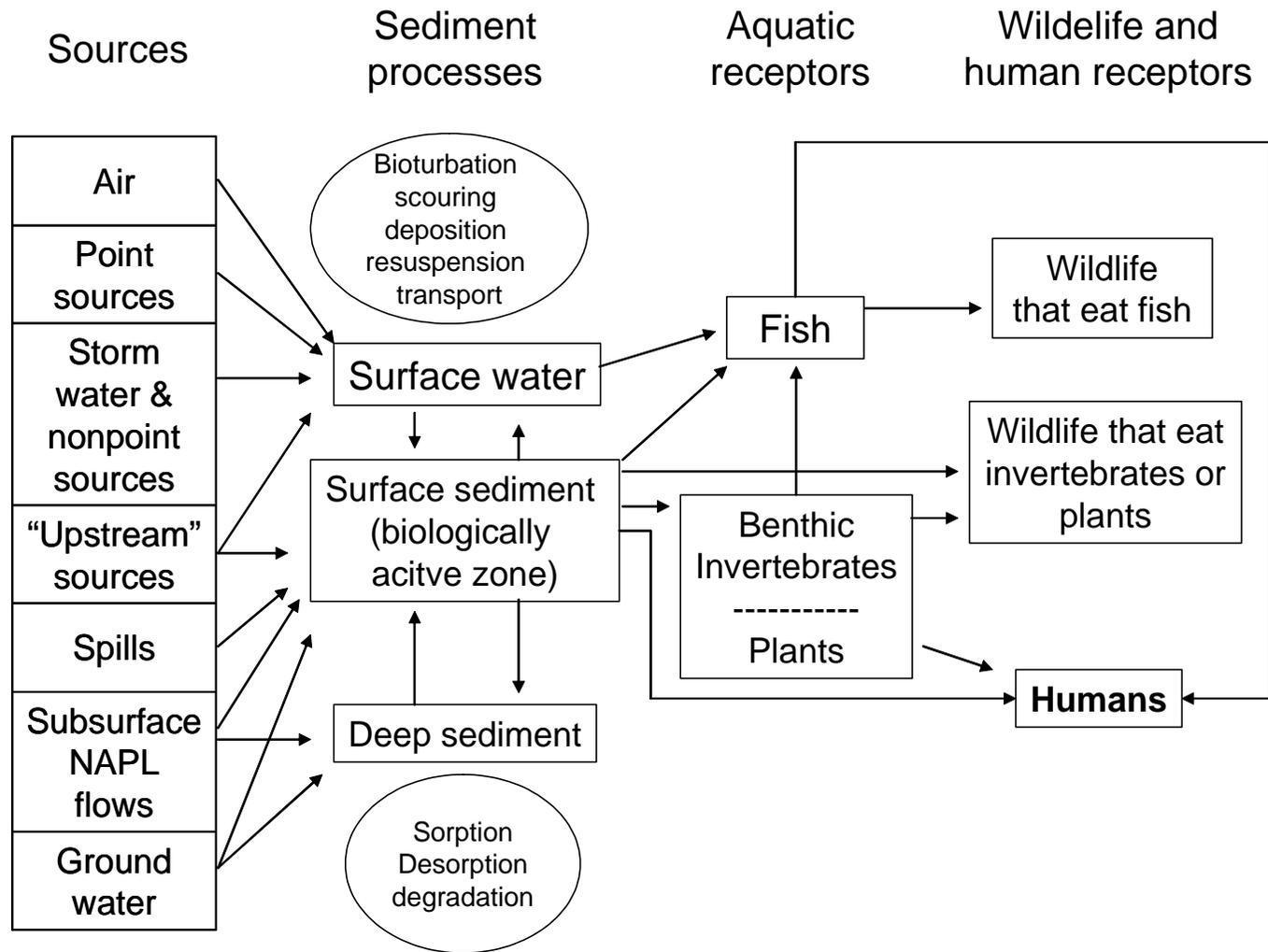


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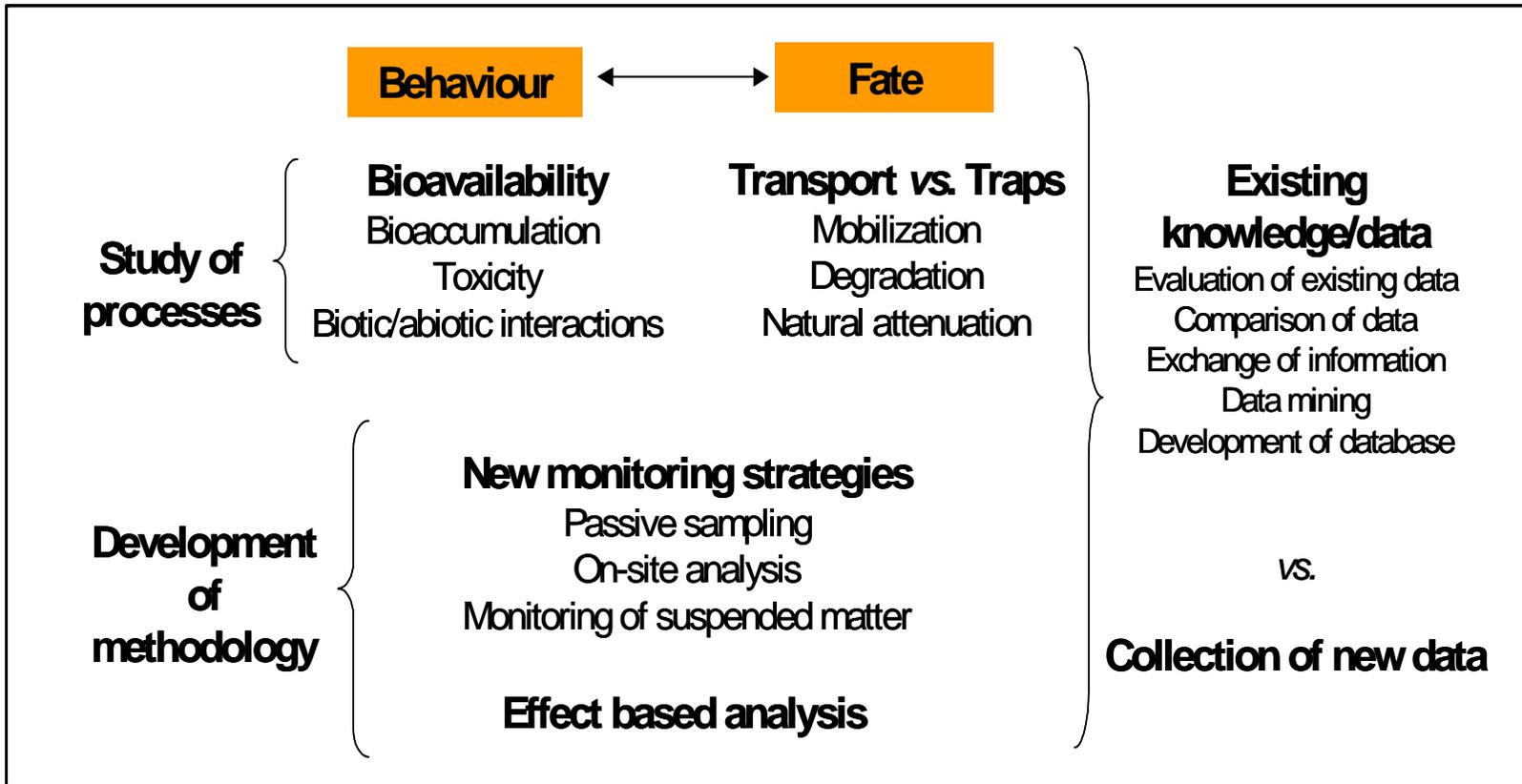
Basic conceptual model for sediment risk assessment



Reminder: all of the above have specific spatial and temporal scales



Sediment quality and impact assessment



Contaminants in sediments: analysis and impact assessment

- Understanding of the relation between sediment contamination (hazard) and its actual risk to the ecosystem functioning (ecological quality) requires an **integration of physical/chemical techniques**, effect monitoring techniques (e.g. bioassays, functional monitoring, etc.) and ecological monitoring/assessment (community surveys) techniques.
- Different chemical and biological protocols and EDA/TIE/TRIAD schemes included in national regulations are **not harmonized**,
- The **variety of schemes** do not allow comparison of data and the interpretation of data by the different regulatory bodies.
- The **complementary integration** of 'bridging tools' like Toxicity Identification Evaluation (TIE), Model Ecosystems and modelling is also needed.



WHY MONITORING SEDIMENT QUALITY

POLICY oriented

Look at the Water Framework Directive - quality standards for priority substances in water, SEDIMENT and biota should be submitted

Guidelines for Monitoring Contaminants in sediments - recommended by EU expert group AMPS (frequency/location/time of the year for sampling, Monitoring of TRENDS in contaminations-relevant for the River basin Manager

RESEARCH oriented

Aim to understand chemical, physical and biological factors in order to assess sediment quality and impact assessment

- lack of information on

- Nature and extend of contamination

- Expected or acceptable diversity and abundance of benthic biota - in absence of contamination

- Bioavailability, bioaccumulation and effects

- Stability of sediments and contaminants (fate transport)

- Risk of contamination to aquatic biota and associated resources

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Work package 3: Quality and Impact assessment

WP3 focuses on ***technical issues*** regarding physical, chemical and biological investigations and characterisation of sediments and on study of behaviour and fate of contaminants including following topics:

- development and implementation of monitoring techniques and advanced sampling strategies;
- contaminants characterization (bioavailability, sorption, bioaccumulation, toxicity, degradation);
- chemical analysis of priority pollutants and non-regulated contaminants;
- biological analysis: bioassays (in vivo and in vitro), biomarkers, biosensors;
- integrated EDA/TIE/TRIAD protocols for quality assessment.



SEDNET WP 3 networking activities

1. Core group (10 members) was established with the role to lead the discussions, list priorities of problems to be solved, identify appropriate solutions etc.
2. Organization and planning of Workshops in line with Key topics identified by WP core group/workshop participants

Review of current EU research projects in relation to the WP (WELCOME, ABACUS, PHYTODEC, AQUATERRA)
3. Network structure that assures communication transfer between Workshop participants (Who is who: list of groups and expertise)
4. Dissemination activities (5 printed Newsletters, 1200 copies each)



EXPLOITATION OF RESULTS

Creation of spin-offs and take up activities

Input to the Expert Group on the Analysis and Monitoring of Priority Substances and Chemical Pollutants (AMPS) to implement WFD

- Monitoring of Priority substances in sediments and/or suspended solids
- Emerging pollutants identified (future priority substances in WFD)

Spin-off networking activity- Sediment network established in Poland

Workshop held in Cracow, May 29-31 2003 on Perspective studies of accumulation and fate of chemical compounds in sediments in the region of Dobczyce reservoir.
Assessment of potential risk of water contamination.

Co-operation with River Basin Managers on validated monitoring protocols for WFD implementation

- Instituto do Ambiente, Ministry of Environmental Affairs, Lisbon (Portugal).
- Ebro river basin Authority , Zaragoza (Spain)
- Catalan Water Agency (Agencia Catalana de l'Aigua), Barcelona (Catalonia,Spain)



Work package 3: Quality and Impact assessment

1st WORKSHOP

Chemical analysis and risk assessment of emerging contaminants in sediments and dredged materials, 28-30 November 2002, Barcelona, Spain

2nd WORKSHOP

Impact, bioavailability and assessment of pollutants in sediments and dredged materials under extreme hydrological conditions, 3-5 April 2003, Berlin, Germany

3rd WORKSHOP

Monitoring sediment quality at river basin scale. Understanding the behaviour and fate of pollutants, 29-31 January, 2004, Lisbon, Portugal

4th WORKSHOP

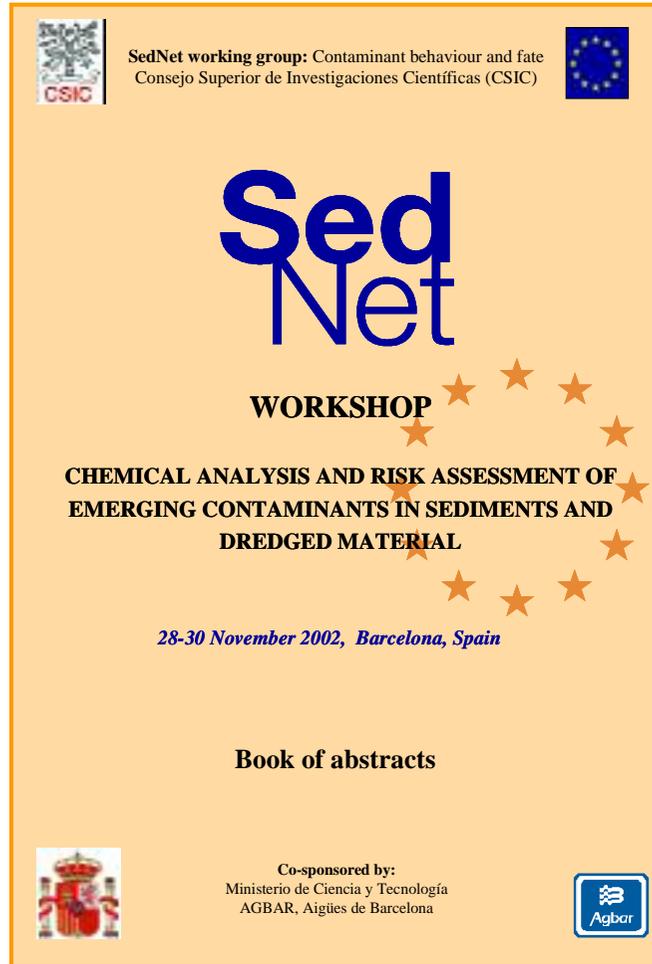
Harmonization of impact assessment tools for sediment and dredged materials
10-11 June, 2004, San Sebastian, Spain

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1st Workshop

28-30 November 2002, Barcelona, Spain



 SedNet working group: Contaminant behaviour and fate
Consejo Superior de Investigaciones Científicas (CSIC) 

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WORKSHOP

**CHEMICAL ANALYSIS AND RISK ASSESSMENT OF
EMERGING CONTAMINANTS IN SEDIMENTS AND
DREDGED MATERIAL**

28-30 November 2002, Barcelona, Spain

Book of abstracts

Co-sponsored by:
Ministerio de Ciencia y Tecnología
AGBAR, Aigües de Barcelona 



Specific goals

- To review the state-of-the-art of chemical analysis of emerging contaminants in sediments
- To collect more information on toxicity, risk assessment, behaviour and fate of emerging contaminants to water resources
- To understand the mechanism by which contaminants are sorbed into soil and how contaminant behavior and fate affects **SEDIMENT QUALITY**

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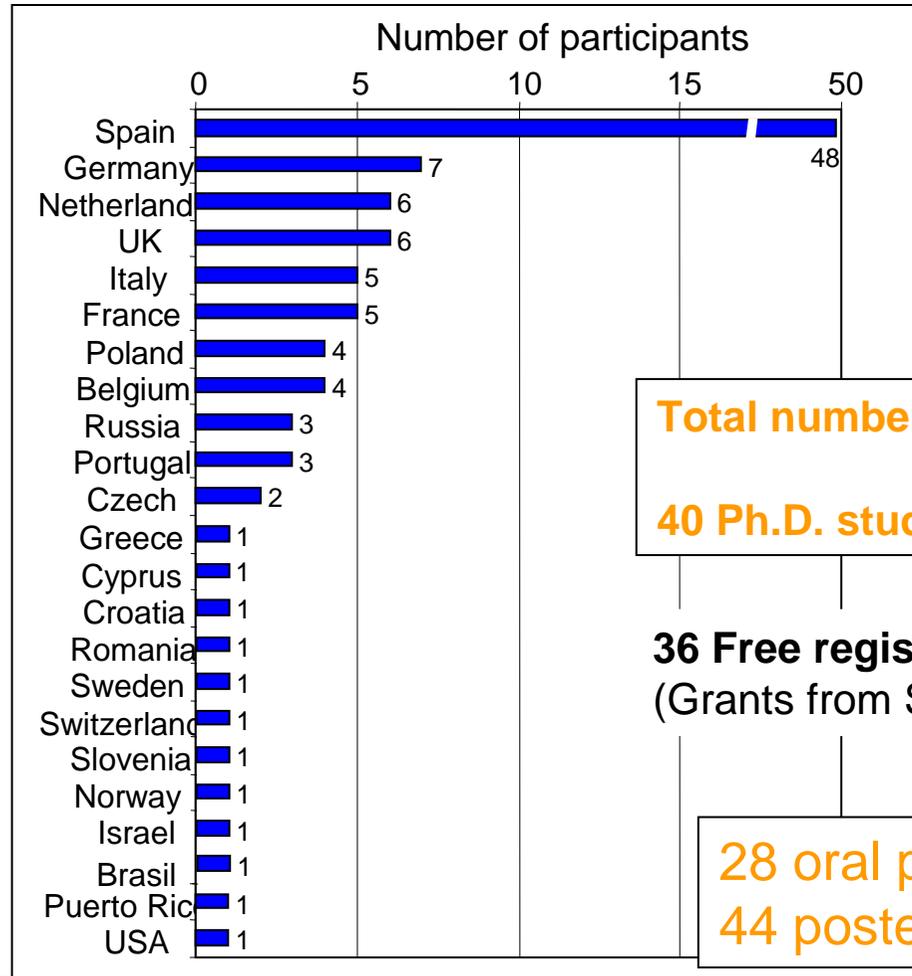


Financial support:

40% EU (Sednet project)

60% CSIC, Spanish Ministry of Science and Technology, AGBAR, Registration fees

Participants of the 1st workshop



	States	Participants
EU Member states	10	94
Associated states	8	14
Other states	5	6

Total number of participants: 106

40 Ph.D. student

36 Free registration fees for Ph.D. students

(Grants from Spanish Ministry of Science and Technology)

28 oral presentations

44 posters

Main conclusions

- Because of their high potential for accumulation of contaminants, sediments are particularly sensitive to anthropogenic impacts, which may disturb the natural state of waters. **Ignoring their special character as sink and source of contaminants can lead to wrong conclusions concerning the status already reached.**
- Consequently, sediment monitoring today should, among others, address aspects like the **mobility** of contaminants within sediments after once they have transferred there, their **bioavailability**, pore water concentrations or *in-situ* quality.
- A river monitoring should necessarily include that of the **suspended matter**.
- There is an urgent need for **a European list of emerging contaminants**, as possible candidates for the introduction into the WFD list of priority substances.
- Adequate monitoring and analytical concepts are necessary. Without appropriate tools it will not be possible to investigate behaviour, environmental stability, bioavailability and fate of pollutants. That is why there is a need to:
- Develop and accept when ready, **standard procedures** of determination of compounds, which is more urgent for emerging contaminants, together with inter-comparison studies in order to validate the analytical protocols.



2nd Workshop

3-5 April 2003, Berlin, Germany



SedNet working group: Contaminant fate and behaviour

SedNet



2nd WORKSHOP

Impact, bioavailability and assessment of pollutants in sediments and dredged materials under extreme hydrological conditions

3-5 April 2003, Berlin, Germany



Specific goals

- Impact of climate change on sediment/water quality issues
- The role of natural attenuation and organisms on sediment modification
- Do we have sediment quality indicators to be incorporated into the Water Framework Directive?

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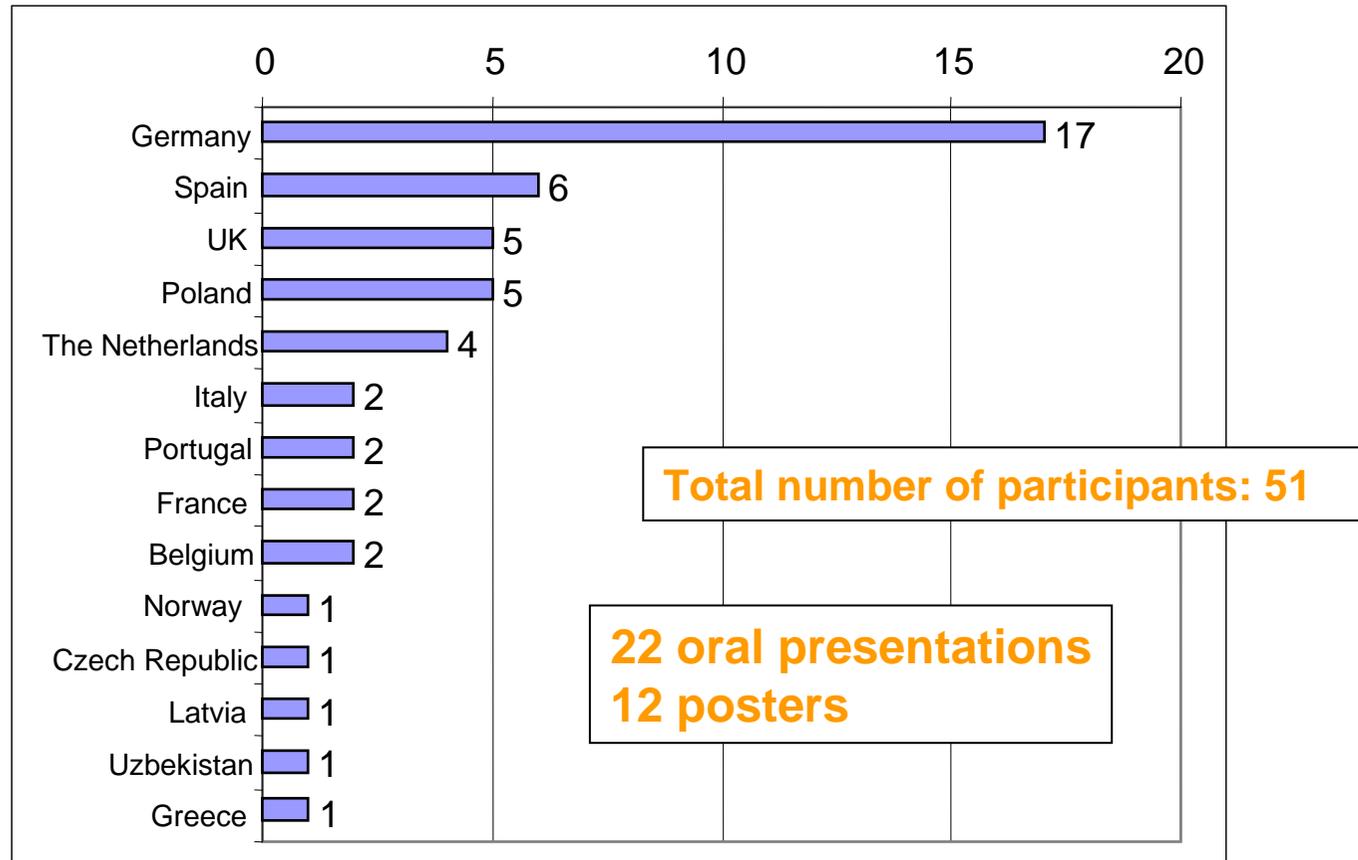


Financial support:

40% EU (Sednet project)

60% CSIC, Technical University of Berlin, Vivendi Water, Registration fees

Participants of the 2nd workshop



Main conclusions

- **Freshwater sediments are always associated to the main hydrological events.** In a simplified way their potential effects may be grouped: (i) the marked floods with large mechanical effects (important erosion of bed sediment, increased transfer of suspended solids with a down stream settling, in the rivers themselves or in flooded soils) and (ii) changes in wetting and drying processes affecting the rivers' banks or the flooding plains.
- The **resuspension** of fine cohesive sediments plays the key role for the remobilisation of sediment bound contaminants and the release of toxic substances.
- More research is needed in order to achieve the best method **to measure bioavailability** for risk assessment studies.
- There is still **a lack of knowledge on the fundamental processes** constituting bioavailability and the lack of generalized procedures to translate results of bioavailability research into procedures suited for risk assessment and standard setting.



3rd Workshop

29-31 January, 2004, Lisbon, Portugal



SedNet
3rd WORKSHOP
MONITORING SEDIMENT QUALITY AT RIVER BASIN SCALE
Understanding the behaviour and fate of pollutants
29-31 January, 2004, Lisbon, Portugal

Book of abstracts

Logos at the top: CSIC, IPIMAR, INIAP, and the European Union flag.

SedNet work package: Quality and impact assessment
INIAP-IPIMAR, Lisbon, Portugal
IIQAB-CSIC, Barcelona, Spain

Specific goals

Bioavailability of contaminants in sediments

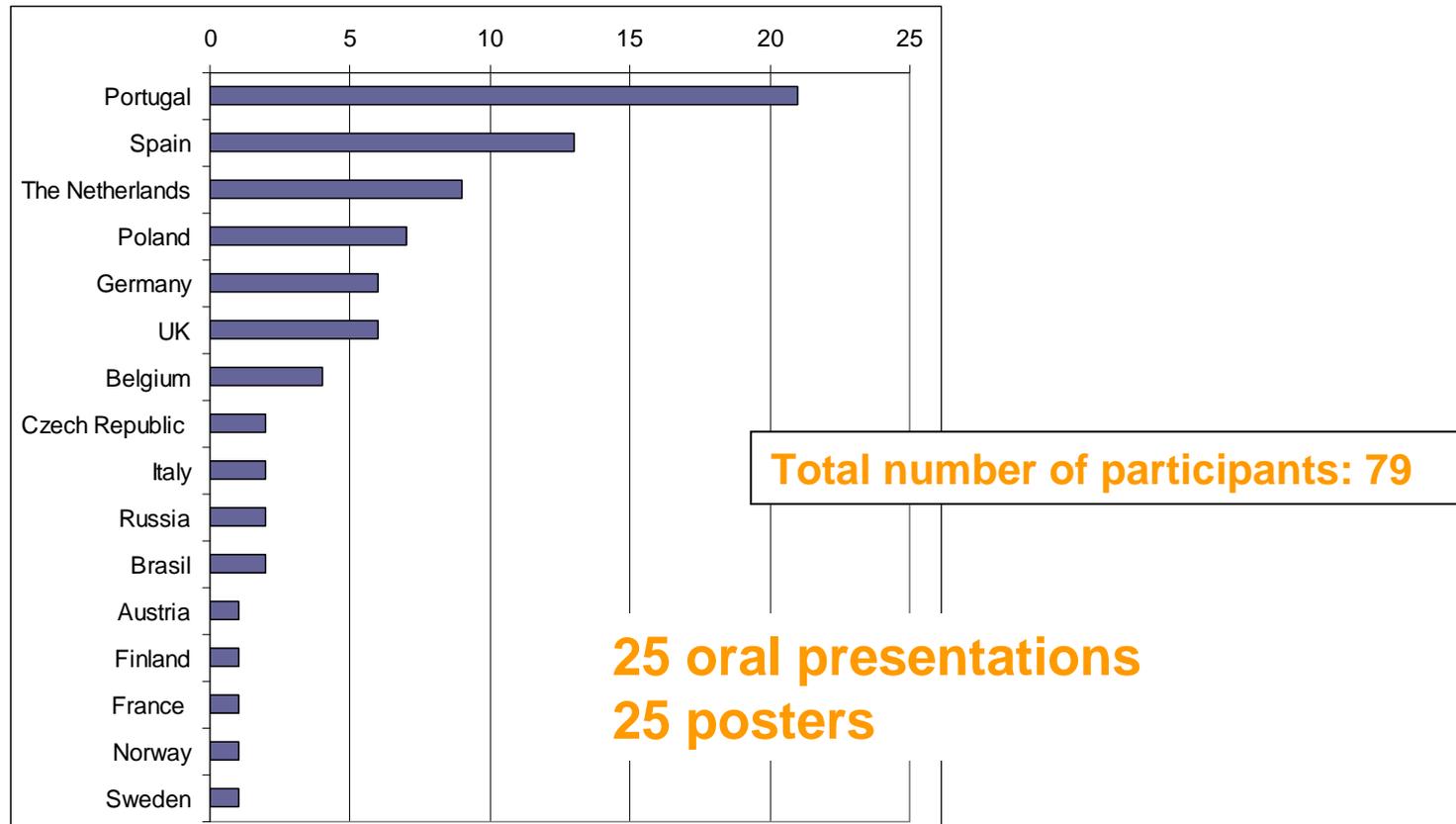
- Relationships bioavailability and bioaccumulation/toxicity;
 - Relationships bioavailability and degradation;
 - Sorption processes underlying bioavailability;
 - Methods to estimate bioavailable fractions;
 - Risk assessment using bioavailability concepts
- **Fate of contaminants in dredged material**



Organized by:

Consejo Superior de Investigaciones Cientificas (CSIC), Barcelona, Spain
INIAP – IPIMAR, Lisbon, Portugal

Participants of the 3rd workshop



Main conclusions

- **Bioavailability** is the key parameter to elucidate routes and pathways of contaminants from source (sediment) to targets (organisms, populations, ecosystems), which implies highly complex processes with a multitude of interactions between abiotic environment and the different parts of the biocenosis in sediments (different organisms from bacteria to fish).
- There is a strong need for the development and application of *in situ* on-site methods.
- Extraction and clean-up method has **a determining influence** on the results of testing the bioavailability of contaminants and their toxicity to benthic or aquatic organisms.
- It was concluded that:

Biotic indices and the consideration of the bioavailable fraction of contaminants will improve the predictability of effects in the natural situations

Molecular methods will provide the opportunity to get *in situ* and on site information on the effects of contaminants on the structure and function of the biocoenosis.

Mechanistic and field research is needed to derive applicable *in situ* methods for assessment of bioavailability present at the contaminated site.



4th Workshop

Harmonization of impact assessment tools for sediment and dredged materials

10-11 June, 2004, San Sebastian, Spain

Topics:

- Harmonization of chemical analysis
 - total composition vs. bioavailable fraction
 - quality control system
- Harmonization of biological protocols: *in vivo* and *in vitro* bioassays;
 - test methods and recent developments in standardisation
- Harmonization of integrated EDA/TIE/TRIAD protocols for quality assessment of sediments and dredged materials
 - whole sediment/whole organism TIE
 - EDA and TIE using extracts and screening assays
 - scenario approach vs. arbitrary approaches assessment.



Chair: Damià Barceló
Co-chair: Maria Jesus Belzunce

Organization:

SedNet work package: Quality and impact assessment



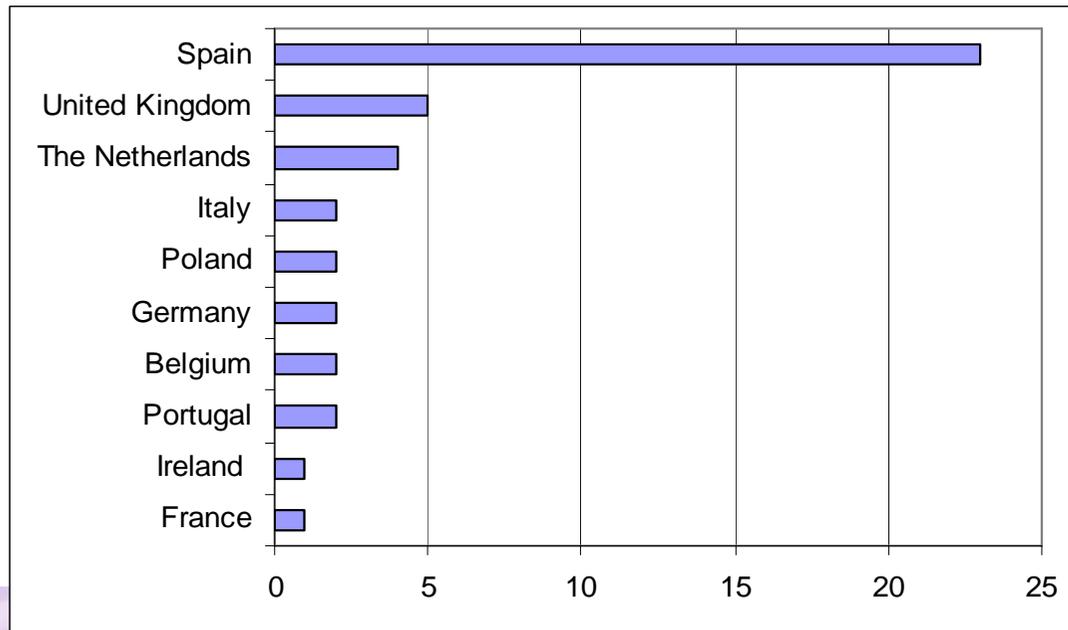
AZTI, Pasaia (San Sebastian), Spain



CSIC, Barcelona, Spain

Participants: 46

Oral presentations: 17
Posters: 12



Main conclusions

- **Effect monitoring protocols** that should be able to give us a better understanding about sediment contamination (hazard) and its actual risk to the ecosystem functioning (ecological quality), require **multi-disciplinary research**, integrating physical and chemical techniques, effect monitoring techniques (e.g. bioassays, functional monitoring, etc.) and ecological monitoring/assessment (community surveys) techniques.
- There is **a broad variety of biotest methods** available for evaluating sediments and for an integrated assessment it is necessary to use a complementary combination of several test methods.
- **A tiered testing** is suggested in a hierarchical approach covering the cellular, species, population and community level with a wide range of sensitivity.
- To assist in **standardisation of chemical methods**, a more rational approach in the development of standard methods should be undertaken and to achieve this, a modular, horizontal approach may be of benefit in rationalising standard methods and promote their use.



Key recommendations (I)

Monitoring of sediment quality and impact assessment

- WP3 recommends that **the selection of target compounds** to be monitored in sediments should be based on: (1) Persistence; (2) Bioaccumulation/adsorption; (3) Relevance at the large scale (river basin); (4) High fluxes (tendency to increase concentrations/fluxes on the long term basis); (5) Toxicity
- We recommend **to undertake monitoring of sediments and/or suspended solids**. Substances which tend to accumulate in the geo-sphere and are transported bound to particles may to be better measured in the suspended matter than in the water phase
- We recommend the development of **Guidelines for Monitoring Contaminants** in Sediment in agreement with the EU Expert Group on Analysis and Monitoring of Priority Substances (AMPS).
- Monitoring should include assessment of **bioavailable fraction** of pollutants (metal speciation, organics), in both the laboratory and the real field situations.



Key recommendations (II)

Monitoring of sediment quality and impact assessment

- The **chemical analysis should not be used for deciding** whether intervention in sediment quality is required, but rather, that the effects of the anthropogenic contamination on the ecosystem should be the determining factor.
- The tools for sediment assessment are available and we recommend the need to **use coherent international standards**, already implemented and accepted by industry and governmental authorities, that will give a clear picture for management at landscape scale and ecological relevant handling of sediments. Thus, it is important to use the advantage of the international standards e.g. after ISO (International Organisation for Standardisation) or CEN (European Organisation for Standardisation) or national well established standard protocols, e.g. under AFNOR (Association Francaise de Normalisation), BSI (British Standard Institute), DIN (German Organisation for Standardisation) etc. all those standards are formed by ISO-Working Groups and validation studies into ISO - and CEN – Standards.



WP end- product

Book on Sediment Quality and Impact Assessment of Pollutants

Containing:

*an overview of the state-of-the art,
a digestion & synthesis of the information available
management solutions and recommendations.*

Content:

Introduction

Ch. 1. Site characterization .

Ch. 2. Characterization of contaminants in sediments – effects of bioavailability on impact

Ch. 3. Sampling of sediments and suspended matter

Ch. 4. Chemical analysis of contaminants in sediments and dredged materials

Ch. 5. Biological analysis

Ch. 6. Effect Directed Analysis and Toxicity Identification Evaluation (EDA & TIE)

Ch. 7. Biotic indices

Ch. 8. Modelling of Contaminant fate and Behaviour in Bed Sediments

Ch. 9. Sediment Quality Guidelines : an overview

Conclusions and recommendations



WP3 core group

Workshop moderators

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