



**Sediment Quality
Management
under the ICPDR**

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ICPDR Secretariat

The Danube River Protection Convention

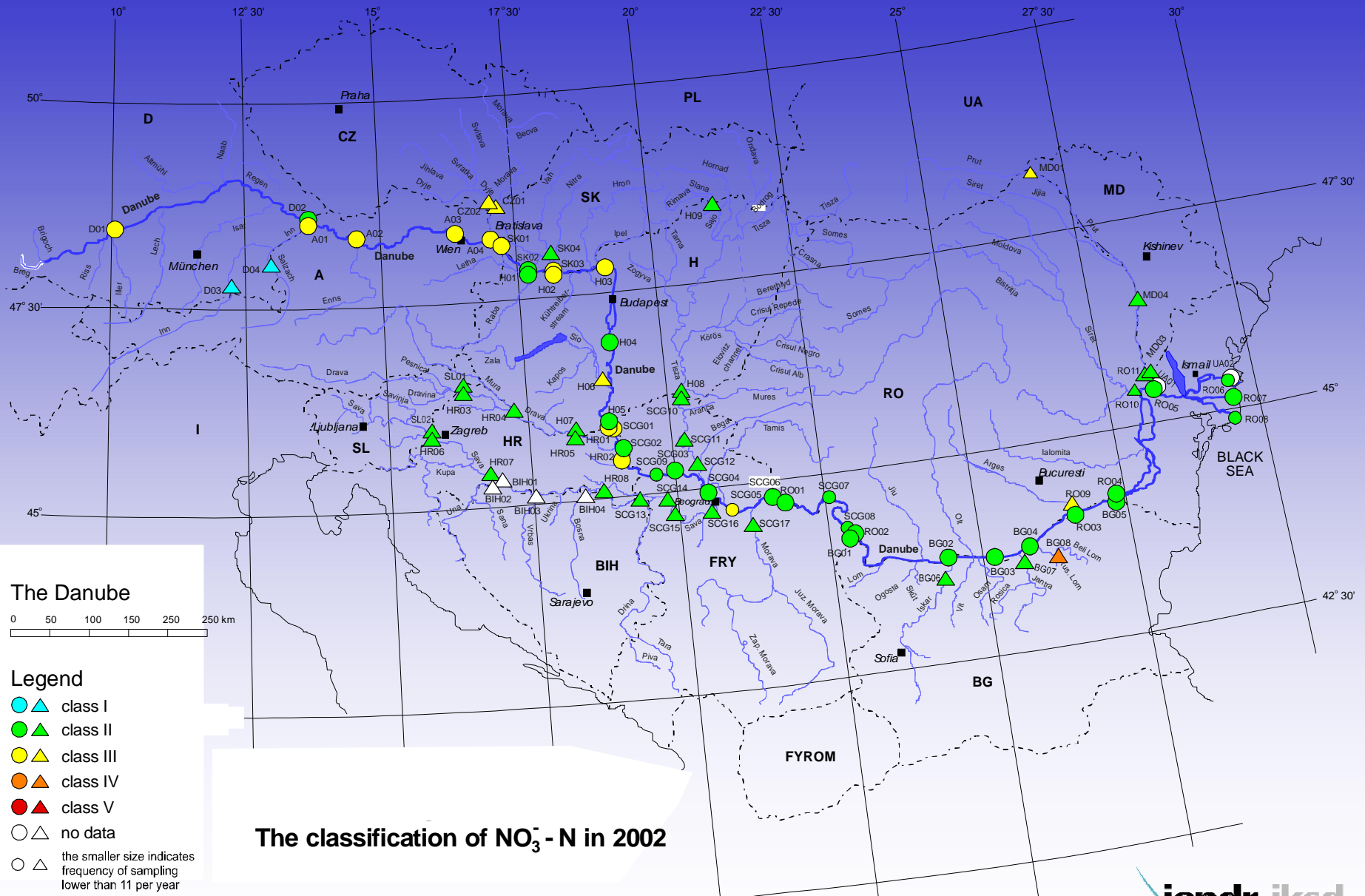
**A legal frame for co-operation to assure
the protection of water and ecological
resources and their sustainable use in the
Danube River Basin**

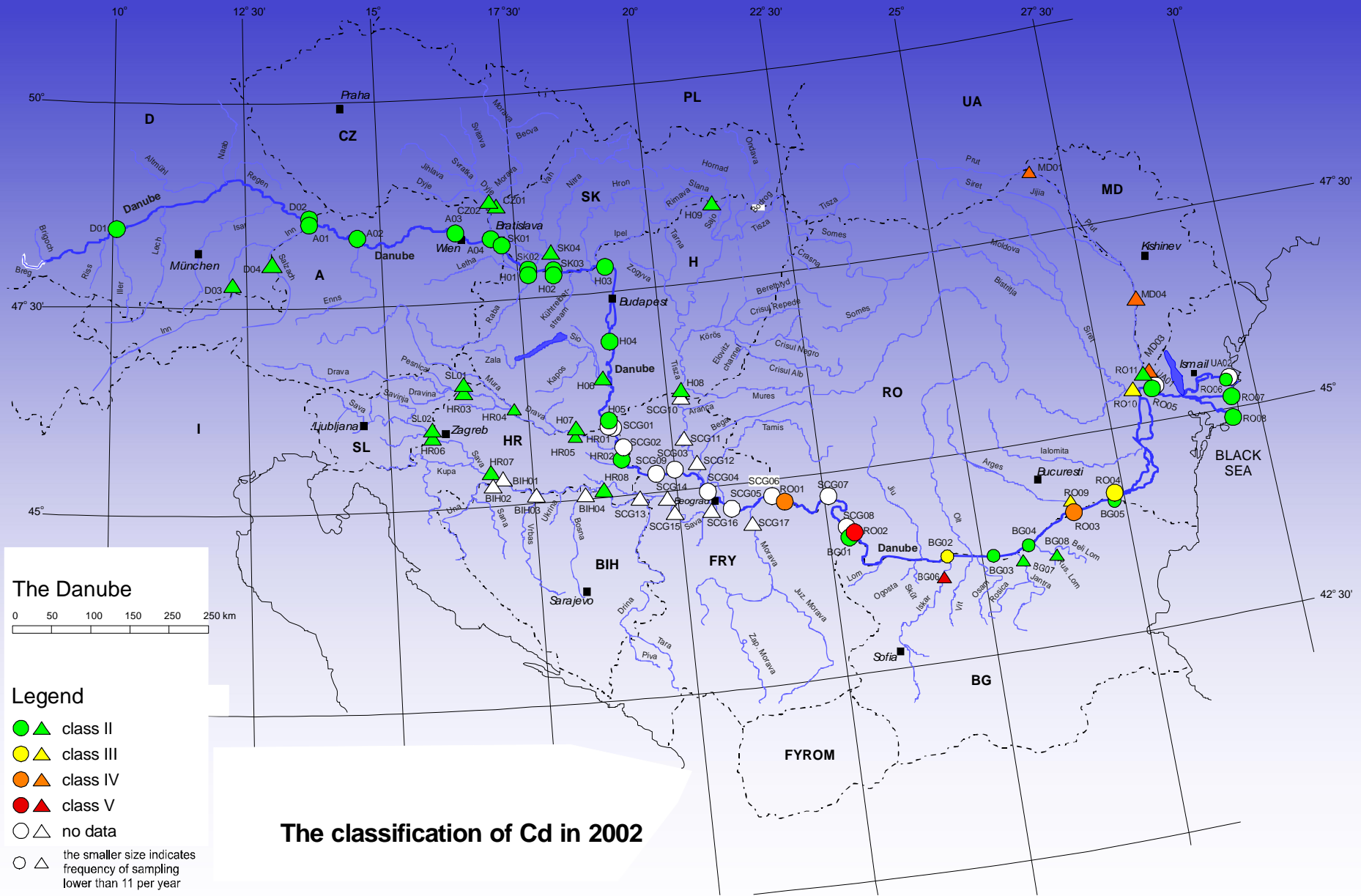
According to the Article 9 of the DRPC the Contracting Parties to DRPC have agreed to co-operate in the field of monitoring and assessment of the water resources.

TNMN

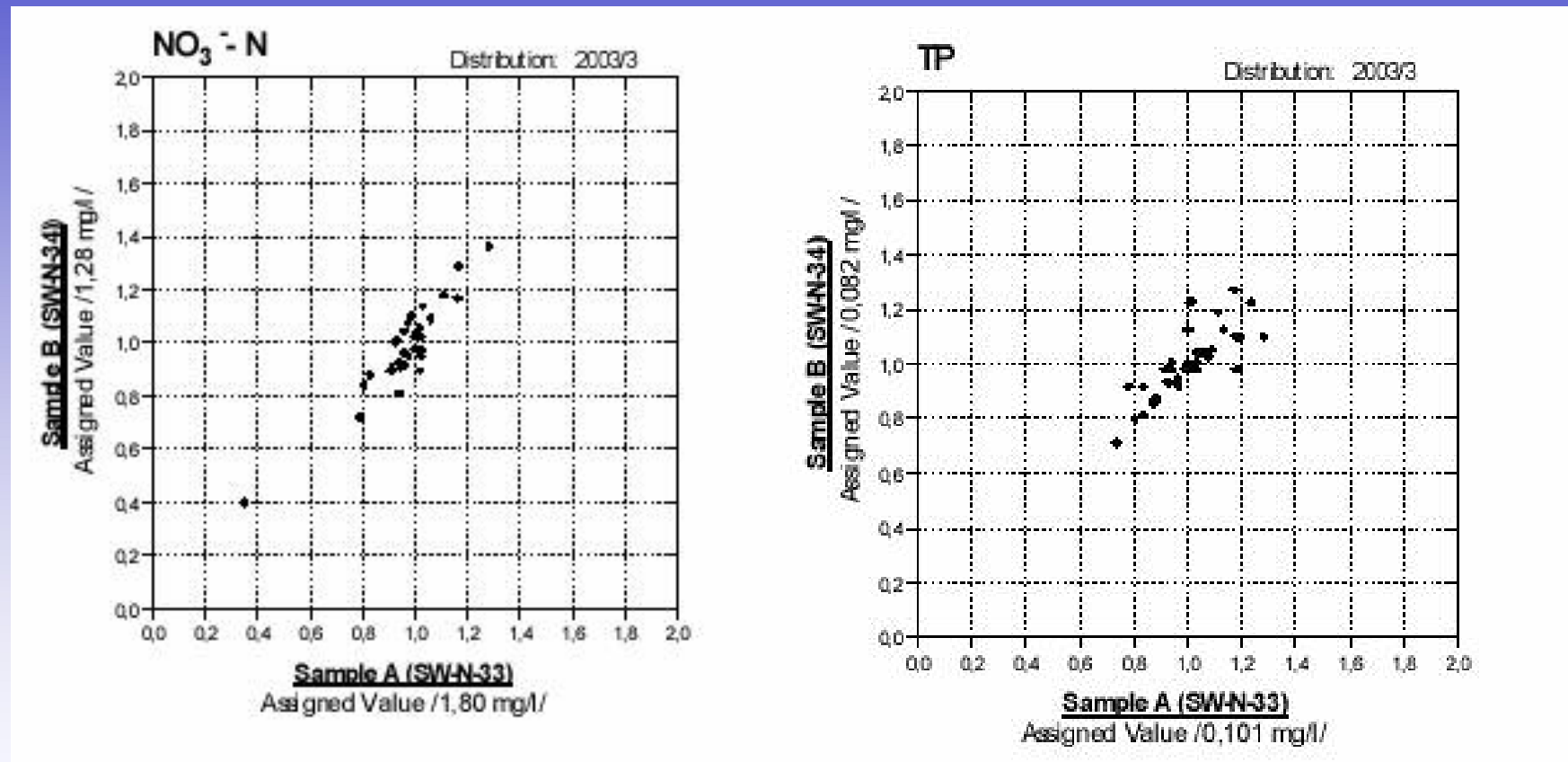
- **Based on national monitoring networks**
- **78 sampling stations (72 provided data in 2002)**
- **52 determinands in water**
- **Minimum sampling frequency 12/year (chem) 2/year (biol)**

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	5	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





Analytical Quality Control

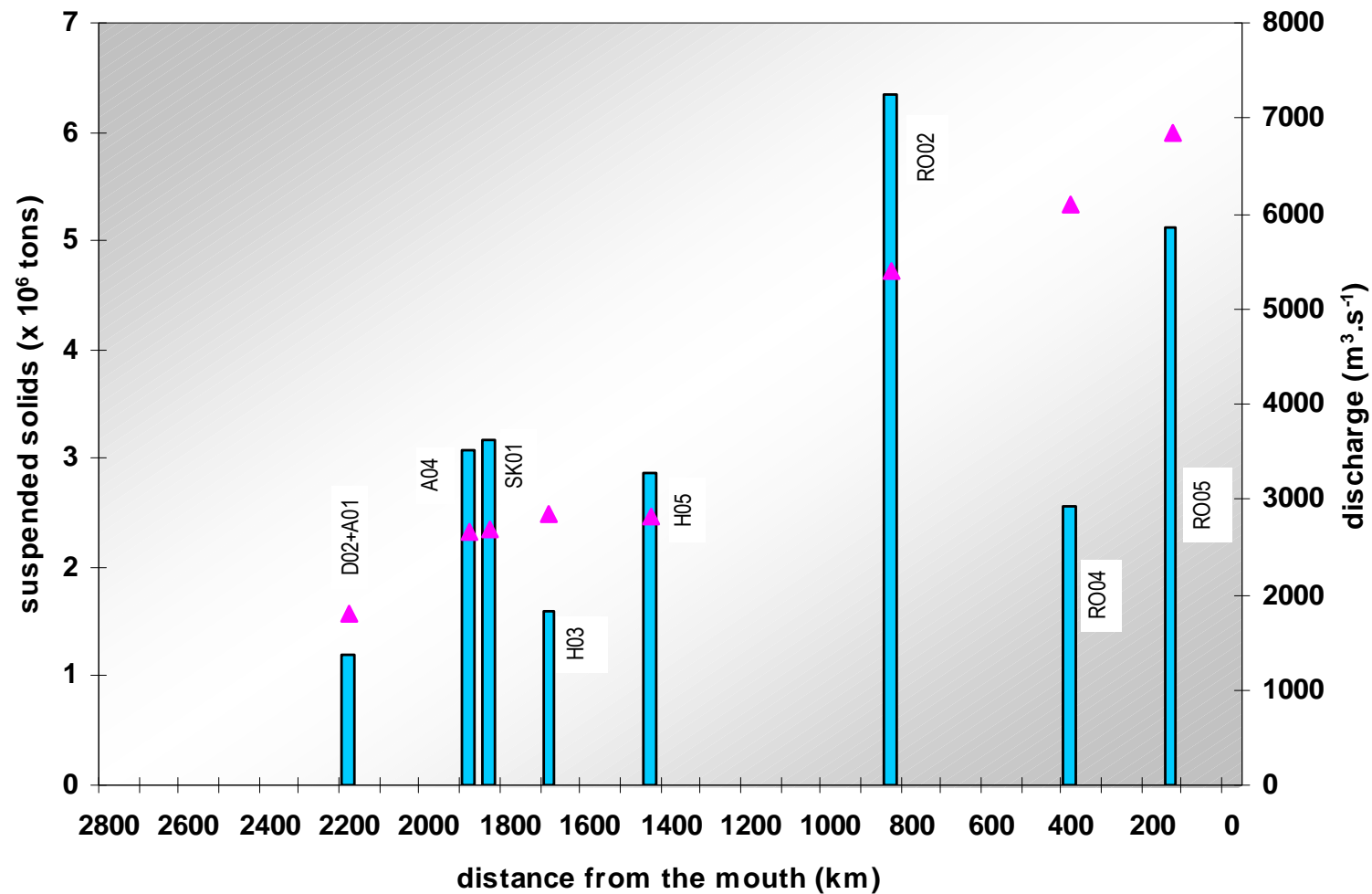


Variation in the reported values of $\text{NO}_3^- \text{ - N}$ and TP in AQC water samples

Load assessment programme

- Integrated with the TNMN
- Loads are calculated for BOD₅, inorganic nitrogen, ortho-phosphate-phosphorus, dissolved phosphorus, total phosphorus, **suspended solids** and chlorides (*voluntary*)
- Minimum sampling frequency - at least 24 per year

Annual loads of suspended solids at monitoring stations along the Danube River in 2002



■ suspended solids ▲ discharge

TNMN sediment monitoring

Determinands in sediments (dry matter)	Unit	Minimum likely level of interest	Principal level of interest	Target Limit of Detection	Tolerance
Organic Nitrogen	mg/kg	50	500	10	10 or 20%
Total Phosphorus	mg/kg	50	500	10	10 or 20%
Calcium (Ca ²⁺)	mg/kg	1000	10000	300	300 or 20%
Magnesium (Mg ²⁺)	mg/kg	1000	10000	300	300 or 20%
Iron (Fe)	mg/kg	50	500	20	20 or 20%
Manganese (Mn)	mg/kg	50	500	20	20 or 20%
Zinc (Zn)	mg/kg	250	500	50	50 or 20%
Copper (Cu)	mg/kg	2	20	1	1 or 20%
Chromium (Cr) – total	mg/kg	2	20	1	1 or 20 %
Lead (Pb)	mg/kg	2	20	1	1 or 20 %
Cadmium (Cd)	mg/kg	0.05	0.5	0.05	0.05 or 20%
Mercury (Hg)	mg/kg	0.05	0.5	0.01	0.01 or 20%
Nickel (Ni)	mg/kg	2	20	1	1 or 20 %
Arsenic (As)	mg/kg	2	20	1	1 or 20 %
Aluminium (Al)	mg/kg	50	500	50	50 or 20%
TOC	mg/kg	500	5000	100	100 or 20%
Petroleum hydrocarbons	mg/kg	10	100	1	1 or 20 %
Total Extractable matter	mg/kg	100	1000	10	10 or 20 %
PAH – 6 (each)	mg/kg	0.01	0.1	0.003	0.003 or 30%
Lindane	mg/kg	0.01	0.1	0.003	0.003 or 30%
pp' DDT	mg/kg	0.01	0.1	0.003	0.003 or 30%
PCB – 7 (each)	mg/kg	0.01	0.1	0.003	0.003 or 30%

TNMN sediment monitoring

- Only few countries participated
- Regular sediment monitoring considered as superfluous in some countries (low cost/information gain)
- Therefore – regular monitoring replaced by investigative surveys (each 5-6 years)

Joint Danube Survey - Objectives

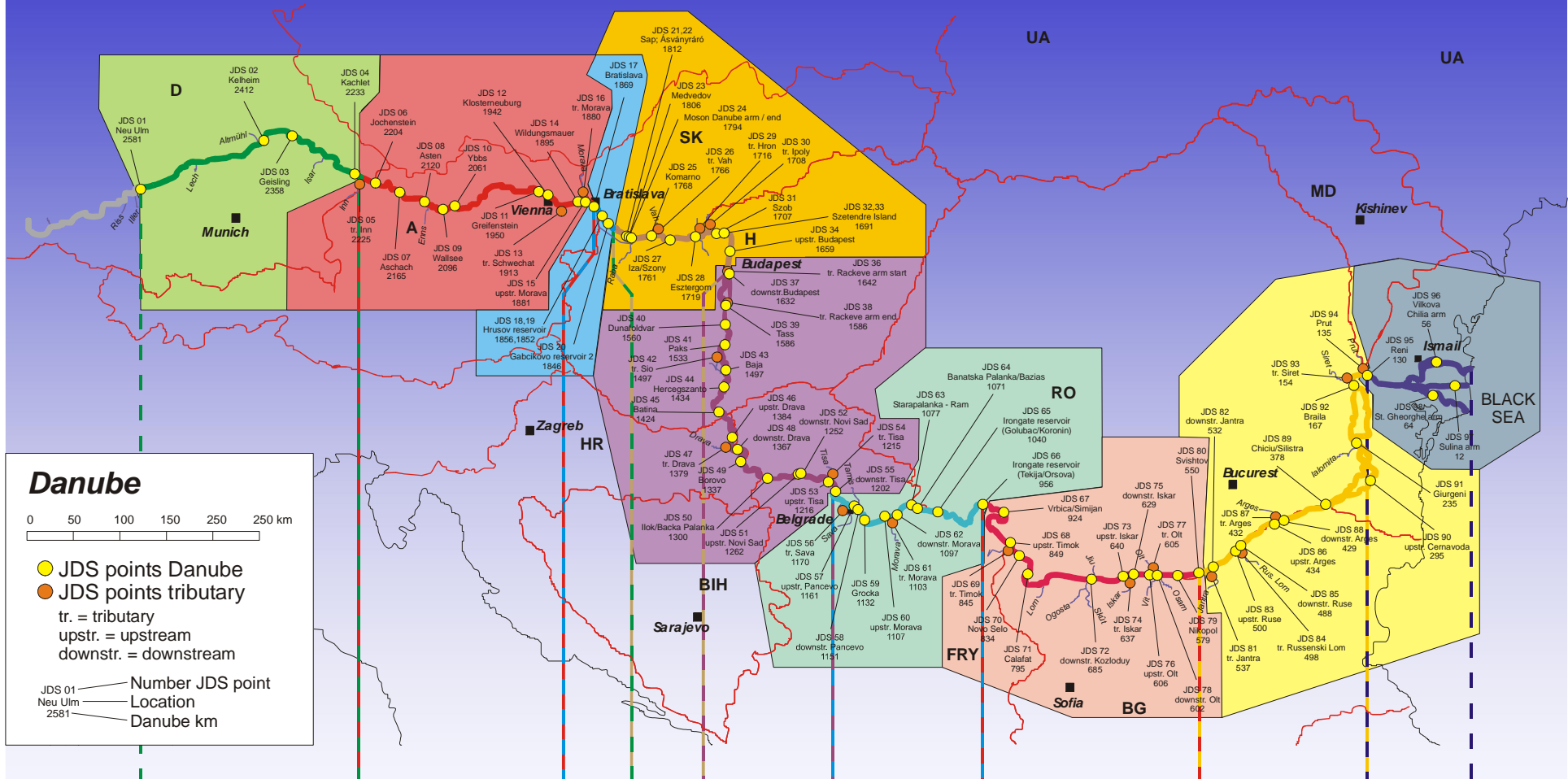
- To produce a homogenous data set for the Danube River based on a single laboratory analysis of selected determinands;
- To identify and confirm specific pollution sources;



- To screen the pollutants as specified in the proposed EU Water Framework Directive;
- To provide a forum for riparian/river basin country participation for sampling and intercomparison exercises;
- To facilitate specific training needs and improve in-country experience;
- To promote public awareness.

JDS – activities

- Surface water, **sediment**, mussels and biological (macrozoobenthos, phytobenthos, macrophytes, phytoplankton, zooplankton) samples were collected from 98 sampling sites
- **Suspended solids samples were collected from 63 sections of the Danube**
- Fifteen parameters (e.g., conductivity, dissolved oxygen, nitrites, nitrates, total coliforms, faecal coliforms) were analysed on-board
- All samples were sent in regular intervals to the JDS Reference Laboratories for analyses of more than 80 additional determinands
- JDS National Teams worked together with the JDS Core Team, collected samples from the respective national stretches of the Danube and analyzed them in parallel



Danube

0 50 100 150 250 250 km

- JDS points Danube
- JDS points tributary
- tr. = tributary
- upstr. = upstream
- downstr. = downstream

JDS 01 — Number JDS point
 Neu Ulm — Location
 2581 — Danube km

Reach 1

Reach 2

Reach 3

Reach 4

Reach 5

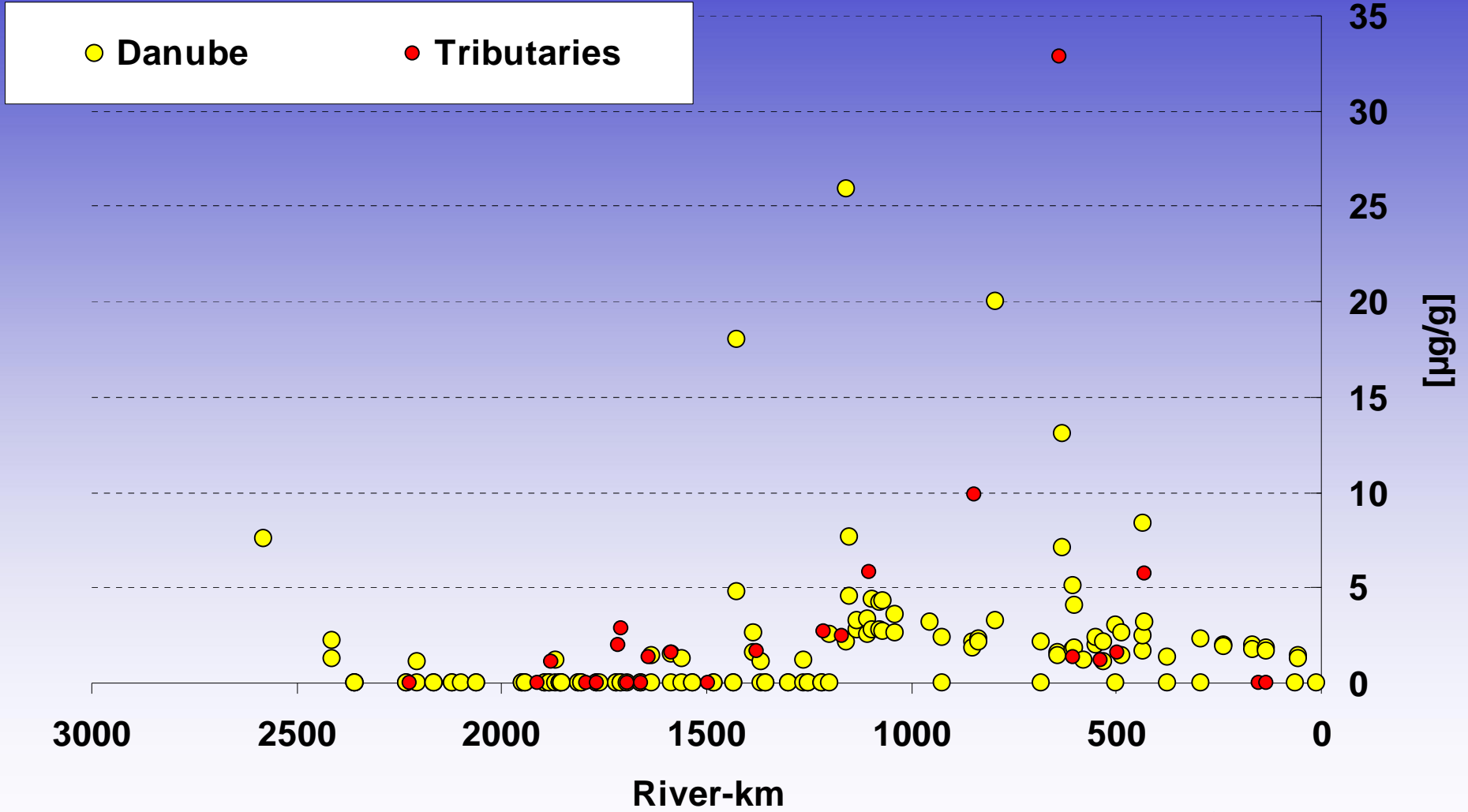
Reach 6

Reach 7

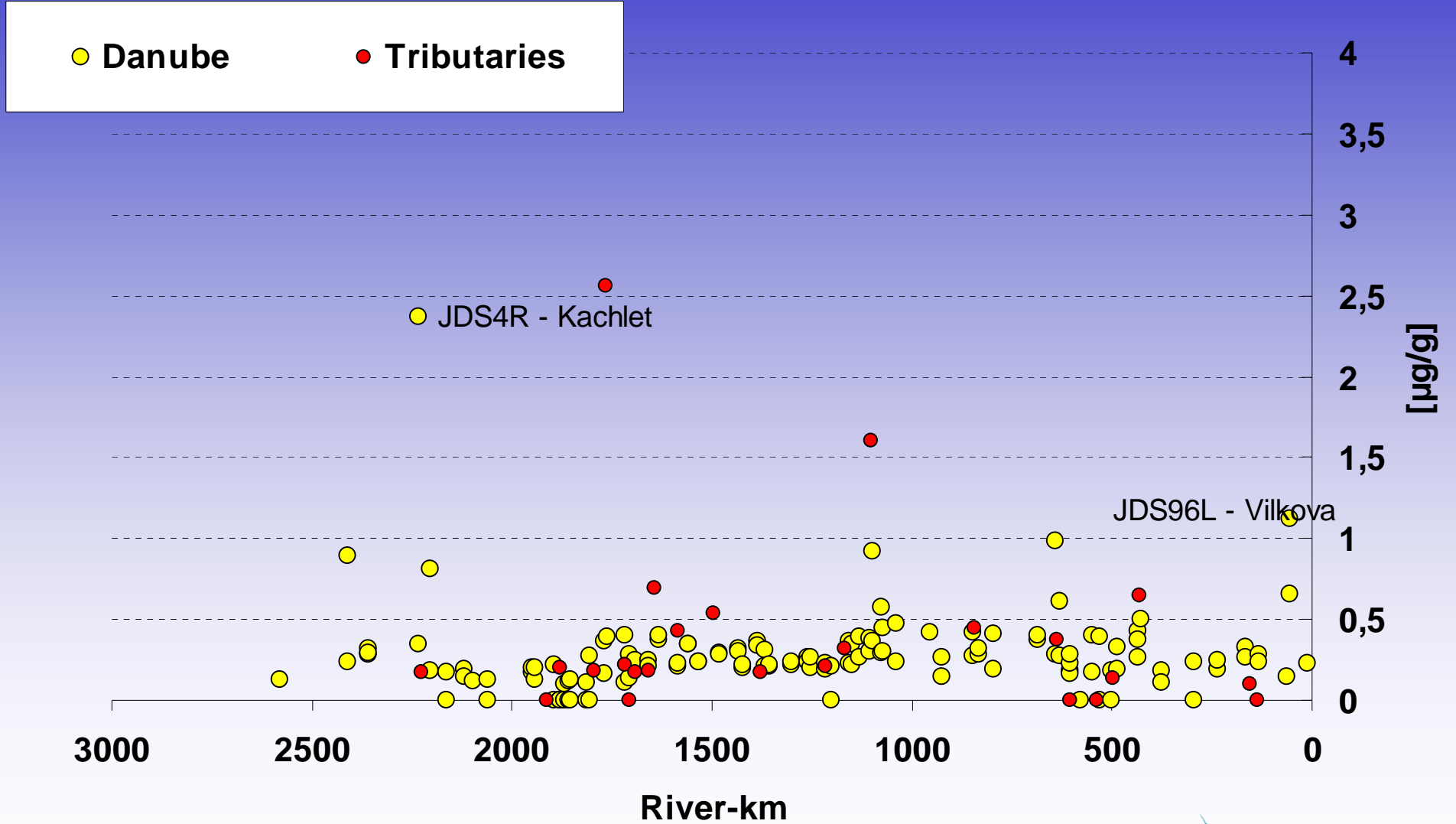
Reach 8

Reach 9

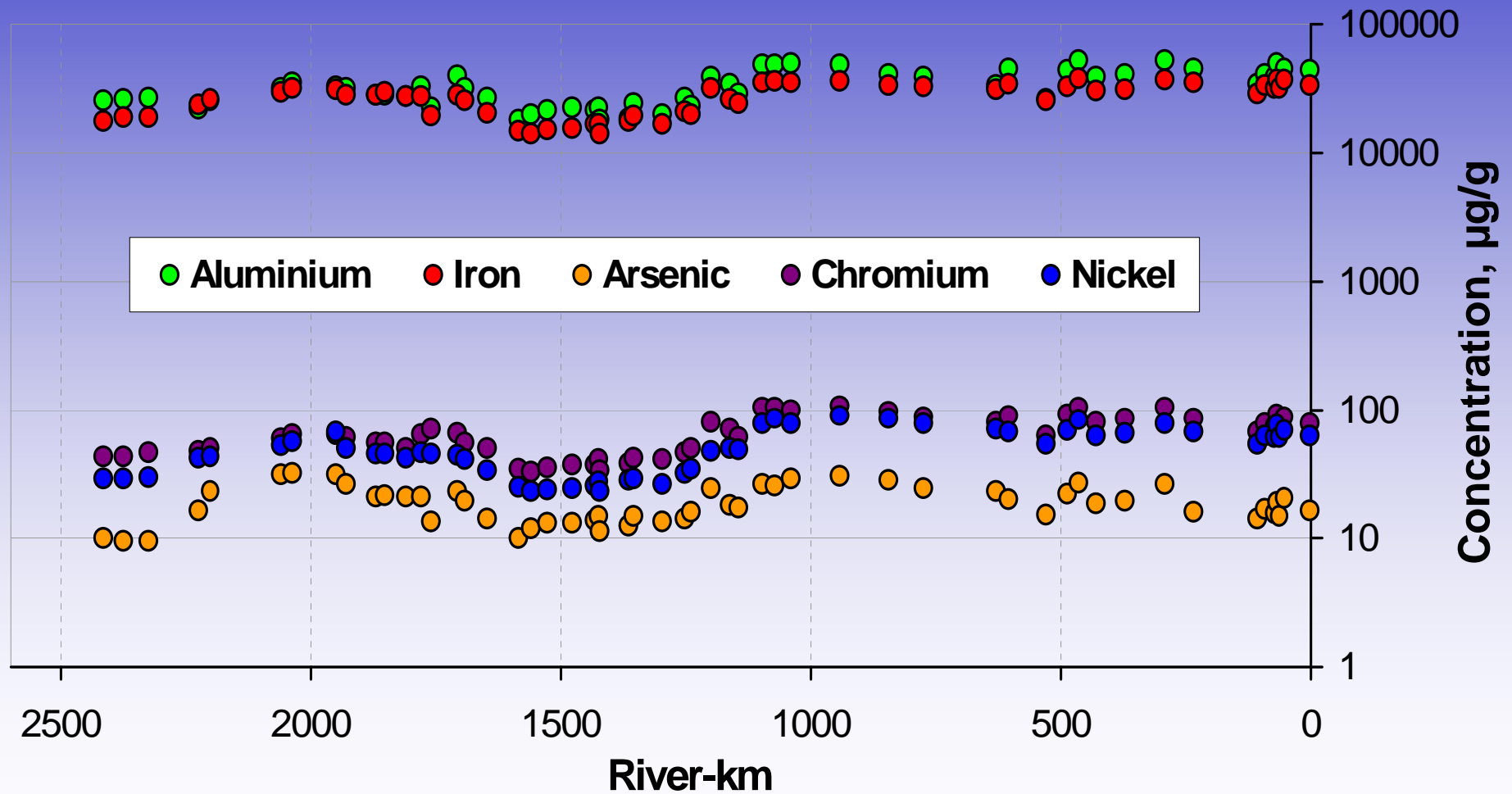
Cadmium in Sediments



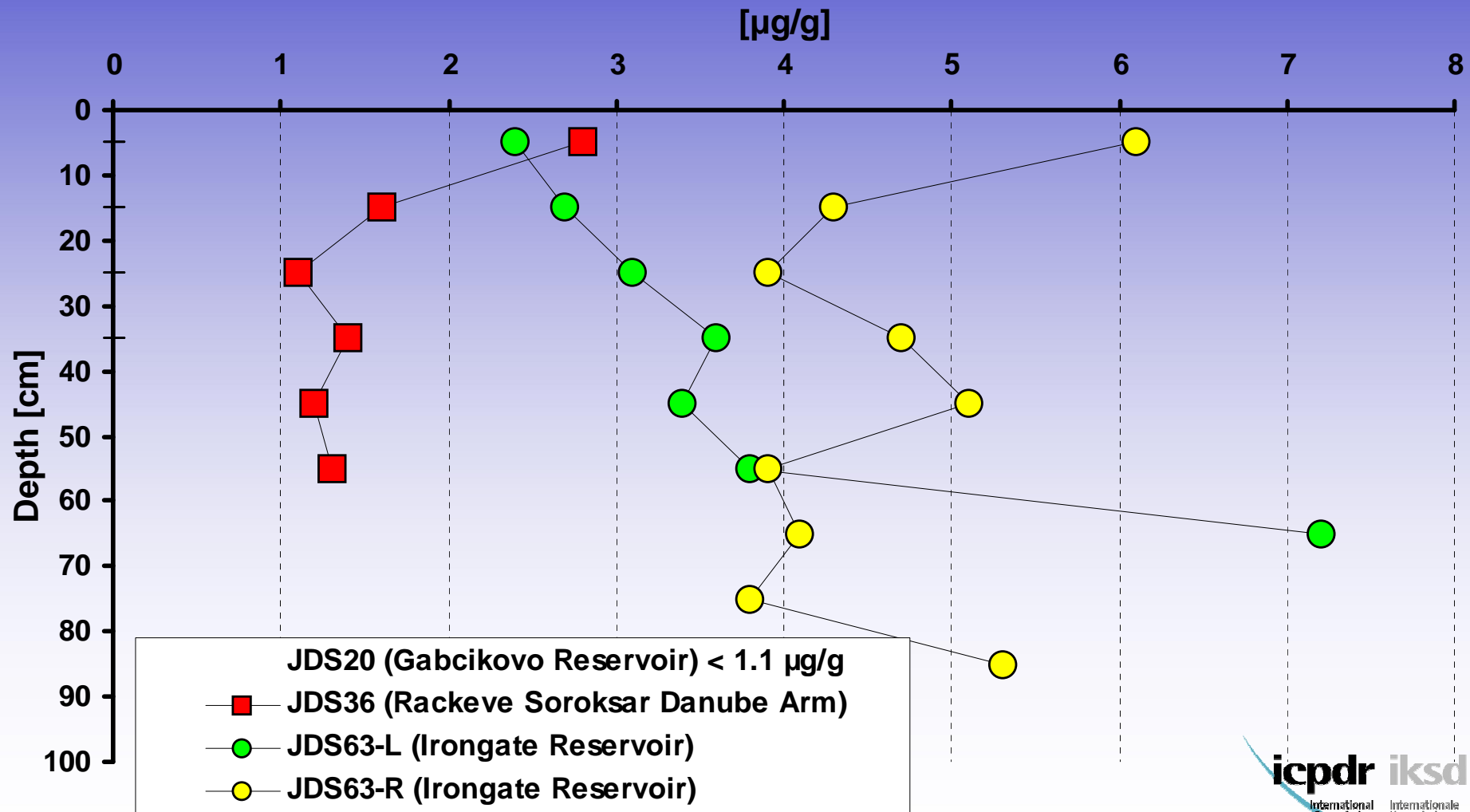
Mercury in Sediments



Spatial distribution of selected elements (logarithmic scale) in suspended solids samples of the Danube river (without tributaries)



Concentration of Cadmium in the investigated sediments core samples



Significant changes in the element concentration between layers of the sediment cores

(concentration difference > uncertainty of the analytical procedure)

Element	As	Cr	Hg	Pb	Cu	Ni	Cd	Zn	Fe	Mn	Al
Uncertainty of Analytical Method [%]	15	11	14	14	7	8	11	10	11	10	15
Gabcikovo Reservoir (JDS20)	≈	≈	↑	≈	≈	≈	≈	≈	≈	≈	≈
Rackeve-Soroksar Danube (JDS36)	≈	≈	↑	≈	↑	≈	↑	≈	≈	≈	≈
Irongate Reservoir (JDS63-L)	↓	↓	↓	↓	≈	↓	↓	↓	≈	≈	≈
Irongate Reservoir (JDS63-R)	↓	↓	↓	↓	≈	↓	≈	↓	≈	≈	≈

(“↓” - decreasing temporal trend, “↑” - increasing temporal trend, “≈” – no significant change)