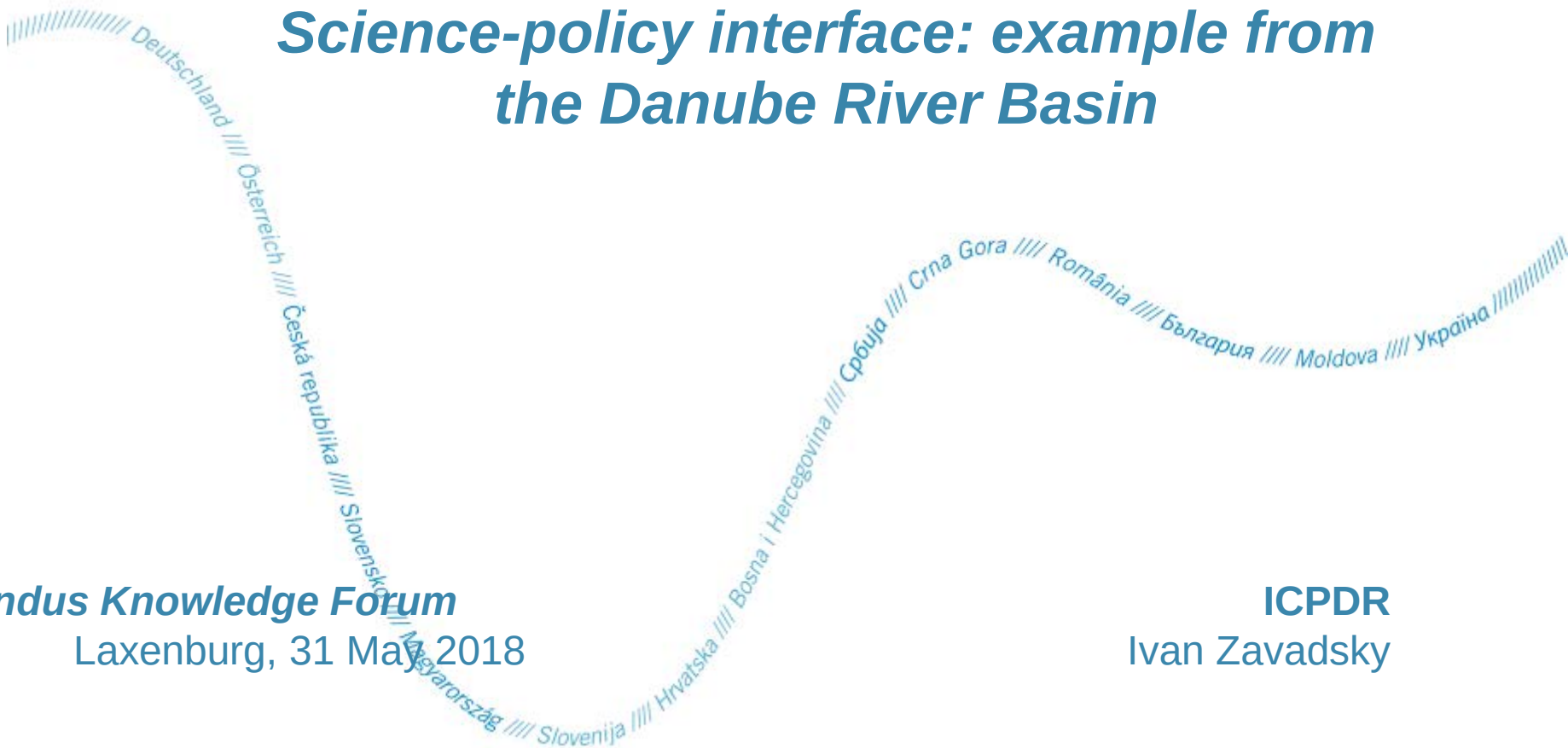
Science-policy interface: example from the Danube River Basin



Indus Knowledge Forum
Laxenburg, 31 May 2018

ICPDR
Ivan Zavadsky

Welcome to the Danube River Basin!

800 000 km^2, 2900 km, 6500 m^3/s, 85 Mio PE, **19 countries**

From Black Forest to Black Sea






1, 2, 4, 6: wikipedia/GFDL; 5 ICPDR/Mello

Large variety of micro-climates and ecosystems

Block I – Setting the scene

- ✓ Part I – history and background
- ✓ Part II - role and functioning of ICPDR
  - ✓ Legal base
  - ✓ structure
- ✓ Part III – Science underpins the policy
- ✓ Part IV – River Basin Management
  - ✓ Danube RBM Plan
  - ✓ Danube Flood Risk Management Plan
- ✓ Part V - Public participation and stakeholders involvement
- ✓ Q & A's

The Danube River Basin anno 1990

environmental degradation

19 countries

environmental awareness

pollution: istockphoto; barb wire: wikipedia, GFDL

Human activities and their impact on the Danube






Water **pollution**, **hydromorphological** alterations

The Danube River Protection Convention (1)

- Full name:

Convention on Co-operation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention

- legal instrument for co-operation and transboundary water management in the Danube River Basin
- Signed on June 29 1994 in Sofia (Bulgaria)
- Came into force in October 1998 when ratified by the 9th signatory
- 11 Danube countries are signatories

The Danube River Protection Convention (2)

- Main objective:

ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably. It involves the following:

- the conservation, improvement and rational use of surface waters and groundwater
- preventive measures to control hazards originating from accidents involving floods, ice or hazardous substances
- measures to reduce the pollution loads entering the Black Sea from sources in the Danube River Basin

The DRPC as the legal mandate of the ICPDR

Sustainable & equitable use of water

Protection of water & ecological resources

Reduce nutrients & hazardous substances

Manage floods & ice hazards

ICPDR: platform for **transboundary cooperation** on water management:

- Implementation of the **DRPC**(1998)
- Coordination of the implementation of EU **Water Framework** Directive (2000) & EU **Floods** Directive (2007)

The ICPDR as the main tool for the implemention of the Convention

- A cooperation on fundamental water management issues

The signatories agree to take “all appropriate legal, administrative and technical measures to at least maintain and where possible improve the current water quality and environmental conditions of the Danube river and of the waters in its catchment area, and to prevent and reduce as far as possible adverse impacts and changes occurring or likely to be caused."

ICPDR
Contracting Parties


Germany


Austria


Czech Republic


Slovakia


Hungary


Slovenia

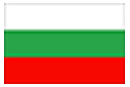

Croatia


Bosnia & Herzegovina


Serbia


Montenegro


Romania


Bulgaria


Rep. of Moldova


Ukraine


European Union

- EU Member States (9)
- Non-EU Member States (5)

ICPDR
Delegations of
15 Contracting Parties

ICPDR PS
Permanent Secretariat

Expert Groups

FP EG
Flood Protection

APC EG
Accident Prevention & Control

PP EG
Public Participation

IMGIS EG
Information Management & GIS

S EG
ad-hoc Strategic EG

MA EG
Monitoring & Assessment

PM EG
Pressures & Measures

RBM EG
River Basin Management

Task Groups

GROUNDWATER TG

NUTRIENTS TG

ECONOMICS TG

HYDROMORPHOLOGY TG

Water quality monitoring: Major drivers

- **DRPC** (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)

- **EU WFD** (establishing of WFD compliant monitoring networks)

Trans National Monitoring Network – TNMN

TNMN

Monitoring activity	Data collection	Final product
Surveillance Monitoring 1	Aggregated data	Status assessment in DRBMP
Operational monitoring	Aggregated data	Status assessment in DRBMP
Surveillance Monitoring 2	Raw data	TNMN Yearbooks & reporting to BSC
Investigative monitoring	Raw data	Joint Danube Survey reports

Quality element	Concentrations	Load assessment
Flow	anually / 12 x per year	daily
Temperature	anually / 12 x per year	
Transparency (1)	anually / 12 x per year	
Suspended Solids (5)	anually / 12 x per year	anually / 26 x per year
Dissolved Oxygen	anually / 12 x per year	
pH (5)	anually / 12 x per year	
Conductivity @ 20 °C (5)	anually / 12 x per year	
Alkalinity (5)	anually / 12 x per year	
Ammonium (NH_4^+ -N) (5)	anually / 12 x per year	anually / 26 x per year
Nitrite (NO_2^- -N)	anually / 12 x per year	anually / 26 x per year
Nitrate (NO_3^- -N)	anually / 12 x per year	anually / 26 x per year
Organic Nitrogen	anually / 12 x per year	anually / 26 x per year
Total Nitrogen	anually / 12 x per year	anually / 26 x per year
Ortho-Phosphate (PO_4^{3-} -P) (2)	anually / 12 x per year	anually / 26 x per year
Total Phosphorus	anually / 12 x per year	anually / 26 x per year
Calcium (Ca^{2+}) (3, 4, 5)	anually / 12 x per year	
Magnesium (Mg^{2+}) (4, 5)	anually / 12 x per year	
Chloride (Cl^-)	anually / 12 x per year	
Atrazine	anually / 12 x per year	
Cadmium (6)	anually / 12 x per year	
Lindane (7)	anually / 12 x per year	
Lead (6)	anually / 12 x per year	
Mercury (6)	anually / 12 x per year	
Nickel (6)	anually / 12 x per year	
Arsenic (6)	anually / 12 x per year	
Copper (6)	anually / 12 x per year	
Chromium (6)	anually / 12 x per year	
Zinc (6)	anually / 12 x per year	
p,p´-DDT and its derivatives (7)	see below	
COD_{Cr} (5)	anually / 12 x per year	
COD_{Mn} (5)	anually / 12 x per year	
Dissolved Silica		anually / 26 x per year
BOD_5	anually / 12 x per year	

ICPDR IKSD

SM2 - Chemistry

(1) Only in coastal waters

(2) Soluble reactive phosphorus SRP

(3) Mentioned in the tables of the CIS Guidance document but not in the related mind map

(4) Supporting parameter for hardness-dependent EQS of PS metals

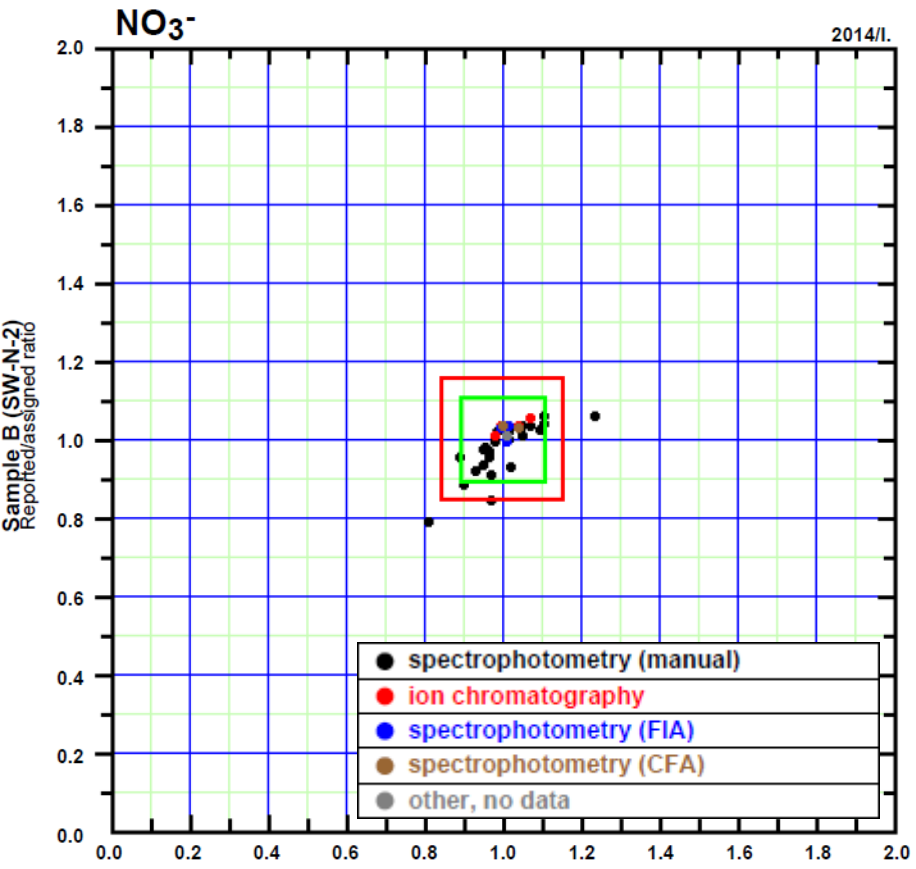
(5) Not for coastal waters

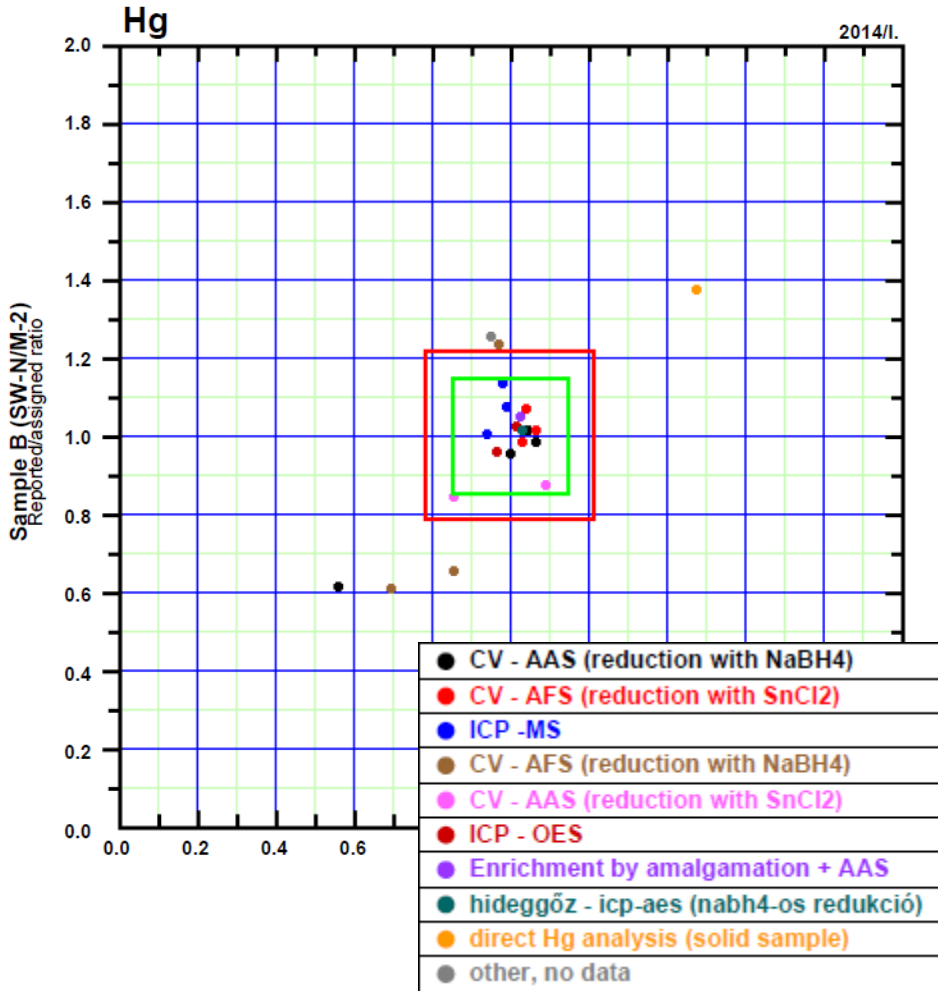
(6) Measured in a dissolved form. Measurement of total concentration is optional

(7) In areas with no risk of failure to meet the environmental objectives for DDT and Lindane the monitoring frequency is 12 x per a RBMP period; in case of risk the frequency is 12 x year

> 40 national labs!

Analytical Quality Control



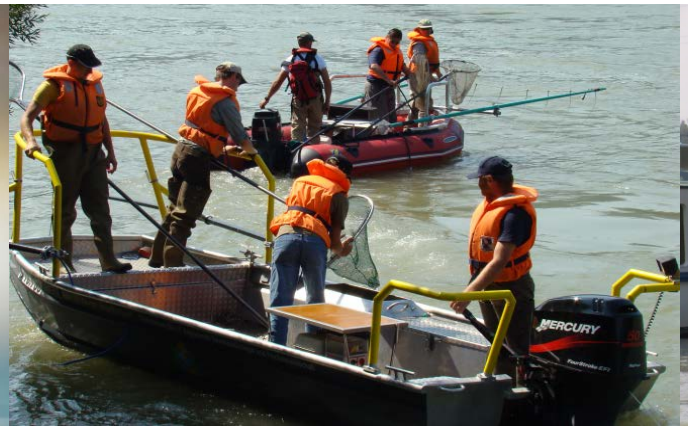


Variation in the reported values of NO3-N and Hg in AQC samples

Investigative monitoring

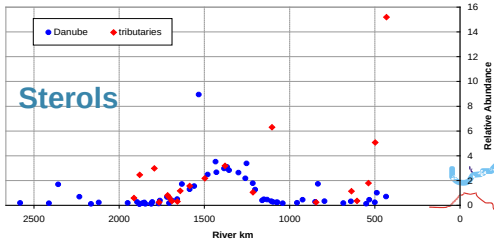
Joint Danube Surveys (every 6 years)

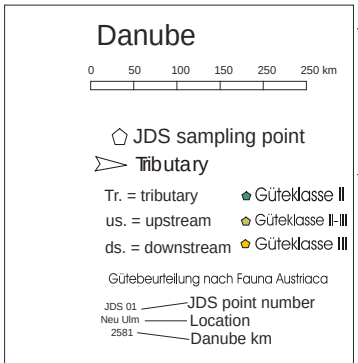
- Producing homogeneous information on water quality for the whole of the length of the Danube River including the major tributaries.
- Providing information necessary for the implementation of EU WFD (ecological & chemical status)
- Complementing the basic data set from annual TNMN.

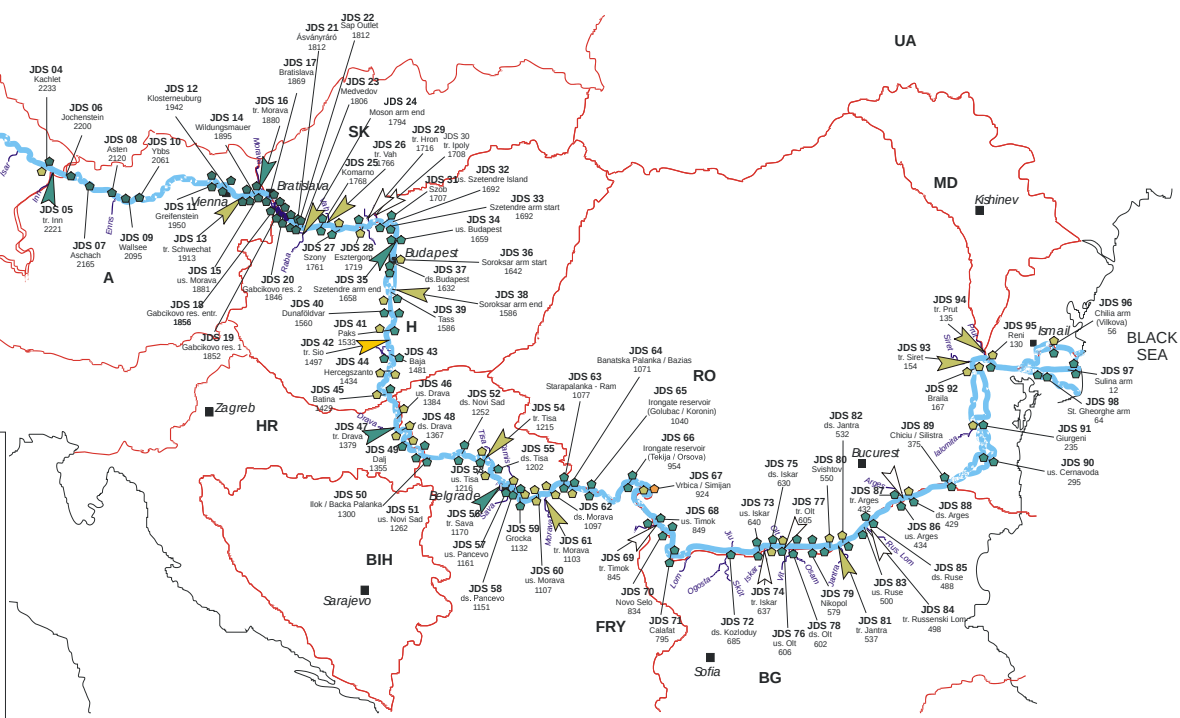


JDS1 – setting the scene

- First comprehensive survey on the whole Danube;
- Massive positive feedback from water managers, research institutions and stakeholders







Water quality classification by saprobity

JDS2 – support to 1st DRBMP

- Valuable support to the Danube countries for their national activities in WFD status assessment
- Important tool for the preparation of the DRBMP
- First ever hydromorphological and fish survey

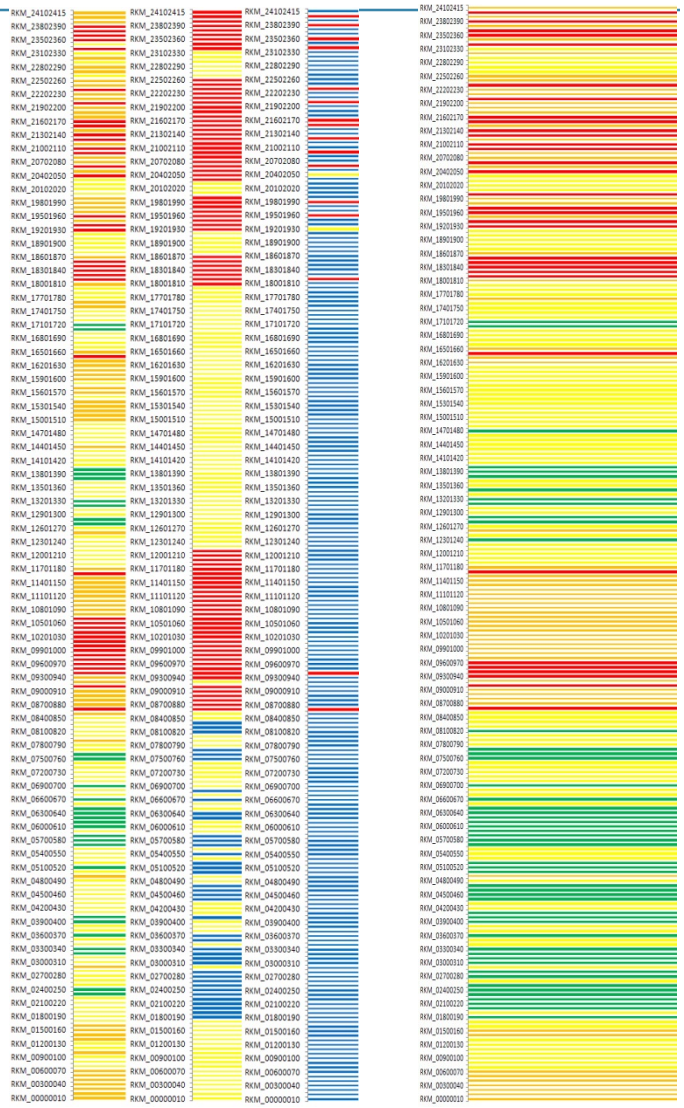
JDS3

Hydromorphology

- Hydromorphological survey confirmed the main findings of JDS 2 in 2007 however the increased resolution allowed a more precise assessment

- WFD-3digit analysis of the entire Danube (morphology, hydrology, continuity) indicated the general alteration (prevailing classes 3-5)

- CEN hydromorphological analysis indicated that about 60% of the



Hydromorphology

bed material

flow velocity& discharge

surface flow velocity

suspended sediment concentration

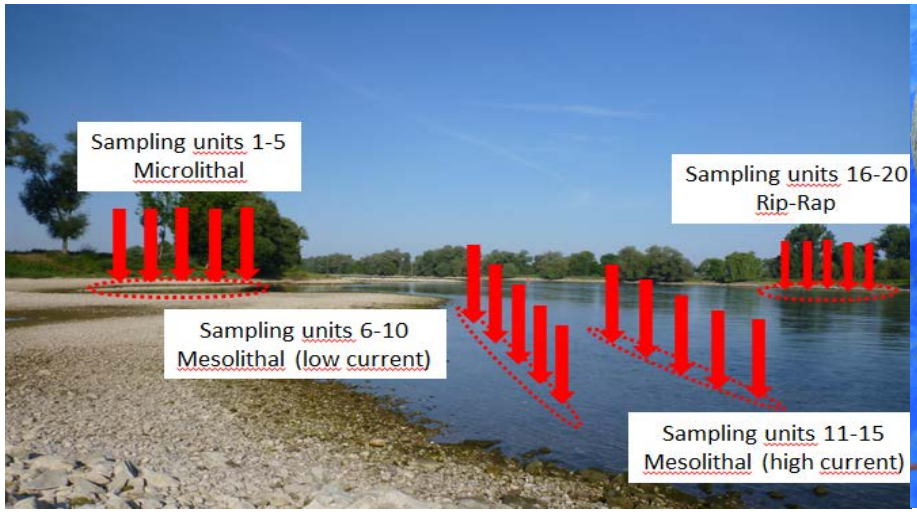
water level fluctuation

water level slope

Macrozoobenthos

- 77% of sites could be classified according to the most widely used Saprobic Index of Macrozoobenthos as good or high
- hot-spots indicating significant organic pollution were detected on the whole Danube

JDS3JDSrkm [JDS*/JDS3]		JDS2 Airlift SI	JDS2 Airlift Class	JDS3 MHS SI	JDS3 MHS Class	JDS3 DWS SI	JDS3 DWS Class	SK Class
2599.8	/	1.94	II					
	/ 2581			2.08	II			2
2412.4	/ 2415	2.23	II	2.14	II			2
	/ 2365			1.94	II	2,19	II	3
2353.5	/	2.2	II	1.88	II	2,15	II	3
2287	/ 2285	2.18	II	1.93	II	2,14	II	3
	/ 2258			1.90	II	2,10	II	2*
2203,5	/ 2205	2.31	III	2,33	III	2,95	IV	4
2120,5	/ 2121	2.12	II	2.18	II	2,11	II	3
2007.5	/ 2007	1.87	II	2.00	II	2,02	II	3
1942	/ 1942	1.84	II	2.06	II	2,19	II	1
1895	/ 1895	1.83	I	2.03	II	2,12	II	2
1881.9	/ 1882	1.95	I	2.02	II	2,16	II	2
	/ 1868			2.20	II	2,25	II	2
1865	/ 1865	2.27	II	2.30	II	2,23	II	2
1851.5	/ 1855	2.3	II	2.27	II	2,25	II	2
1806	/ 1806	2.09	II	2.03	II	2,20	II	2
	/ 1790			2.05	II	2,24	II	2
1761	/ 1761	2.09	II	2.13	II	2,08	II	2*
1707	/ 1707	2.11	II	2.12	II	2,02	II	2
1659	/ 1660	2.07	II	2.16	II	2,05	II	3
1632	/ 1630	1.94	I	2.44	III	2,08	II	3
1560	/ 1560	2.06	II	2.13	II	2,38	II	2
1533	/ 1532	2.26	II	2.24	II	2,11	II	2
1481	/ 1481	2.35	II	2.06	II	2,01	II	2*
1434	/ 1434	2.23	II	2.17	II	2,05	II	3
1384	/ 1384	2.2	II	3.05	IV	2,03	II	3
1367	/ 1367	2.17	II	2.51	III	2,16	II	3
1300	/ 1300	2.13	II	2.27	II	2,14	II	3
1262	/ 1262	2.25	II	3.32	V	2,00	II	4
1252	/ 1252	2.15	II	2.33	II	2,01	II	3
1216	/ 1216	2.16	II	2.41	III	2,10	II	3
1200	/ 1199	2.11	II	2.03	II	2,01	II	2
	/ 1159	2.22	II	2.12	II	2,13	II	3
	/ 1151	3.09	IV	2.41	III	2,10	II	2
	/ 1107	2.26	II	2.62	III	2,48	III	2
	/ 1095	2.27	II	2.86	IV	2,00	II	3
	/ 1073	2.15	II	2.36	II	2,00	II	2
	/ 1040	2.58	III	2.35	II	2,00	II	2
	/ 956	2.44	III	2.67	III	2,44	III	3
	/ 926	2.47	III	3.02	IV	2,16	II	3
	/ 847	2.21	II	2.39	II	2,26	II	3
	/ 837	2.13	II	2.08	II	2,05	II	2
	/ 686	2.29	II	2.02	II	2,01	II	2
	/ 604	1.9	I	2.36	II	2,09	II	2
	/ 550	2.38	II	2.27	II	2,01	II	3
	/ 532	2.32	II	2.00	I	2,01	II	2
	/ 488	1.48	I	2.00	I	2,03	II	3
	/ 429	1.81	I	2.12	II	2,03	II	2
	/ 375	2.76	III	2.04	II	2,00	II	3
	/ 232	3.15	IV	2.49	III	2,02	II	3
	/ 170	2.23	II	2.12	II	2,34	II	3
	/ 132	2.16	II	2.19	II	2,00	II	3
	/ 18	2.24	II	2.72	III	2,01	II	3
	/ 31	2.16	II	2.01	II	2,05	II	3
	/ 104	2.11	II	2.08	II	2,00	II	2*



Fish

- High fish species diversity was found in the Danube (over 139 000 fish of 67 species were sampled)
- Due to existing pressures (hydropower, poaching and fishery) about 50 to 90% sites (based on the method applied) did not meet the requirements of the WFD.

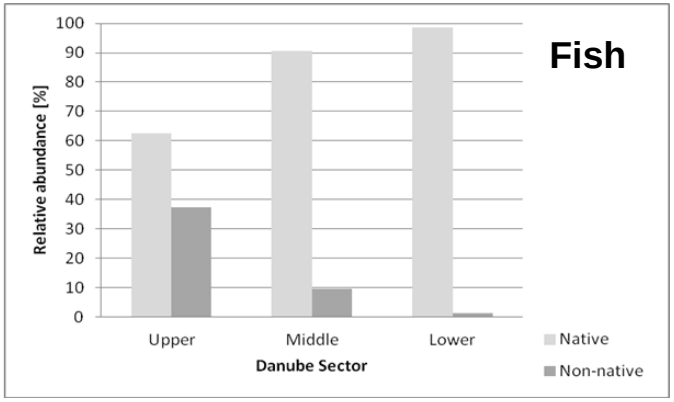
site name	rkm	JDS 2		JDS 3		
		Status FIA	Status EFI	Status FIA	Status EFI	Status FIS
Kelheim, DE_JDS02	2420	Good	Good	Good	Good	Poor
Niederalteich, DE_JDS05	2278	Good	Good	Good	Good	Bad
Jochenstein, AT_JDS07	2215	Poor	Good	Bad	Good	Bad
Ybbs, AT_JDS09	2072	Bad	Moderate	Bad	Good	Poor
Oberloiben, AT_JDS10	2010	Poor	Good	Bad	Good	Good
Wildungsmauer - Hainburg, AT_JDS13	1894	Good	Good	Moderate	Moderate	Moderate
Bratislava, SK_JDS16	1876	Moderate	Moderate	Good	Moderate	Moderate
Cunovo, SK_JDS17	1852	Bad	Poor	Moderate	Poor	Bad
Medvedov, HU_JDS18	1807	Bad	Good	Moderate	Moderate	Moderate
Szob, HU_JDS26	1705	Moderate	Good	Good	Moderate	Moderate
Budapest downstream, HU_JDS32	1632	Good	Good	Good	Moderate	Poor
Mohacs Hercegszanto, HU_JDS39a	1446	Good	Good	Good	Moderate	Moderate
Upstream Drava, Aljmas, HR_JDS41	1380	Moderate	Moderate	Good	Moderate	Moderate
Ilok, Backa Palanka, HR_JDS45	1303	Moderate	Moderate	Moderate	Moderate	Bad
Novi Sad downstream, RS_JDS47	1252	Moderate	Moderate	Moderate	Moderate	Poor
Belegish, RS_JDS50	1202	Moderate	Moderate	Poor	Moderate	Moderate
Downstream Sava, RS_JDS52	1163	Moderate	Moderate	Moderate	Bad	Poor
Grocka, RS_JDS54	1132	Moderate	Moderate	Moderate	Poor	Bad
Velika Morava downstream, RS_JDS57	1107	Good	Moderate	Good	Moderate	Bad
Golubak Koronin, RO JDS 60	1046	Moderate	Bad	Good	Poor	
Vrbica, Simijan, RO_JDS63	1027			Good	Moderate	
Near Timok, RO JDS 65	850		Moderate	Moderate	Poor	
Downstream Kozloduy, BG_JDS69	690		Poor	*	*	
Downstream Iskar, BG_JDS72	634		Poor	*	*	
Downstream Olt, RO JDS 75	602		Moderate	Moderate	Poor	
Downstream Ruse - Giurgiu, RO JDS 82	485		Moderate	*	*	
Chiciu, Silistra, BG_JDS86	383	Bad	Poor	Poor	Moderate	
Downstream Braila, RO JDS 89	172		Moderate	Good	Moderate	
Reni, RO JDS 91a	136		Moderate	Good	Moderate	
Chilia Arm-Valcov, RO JDS 93a	60		Moderate	Good	Moderate	
Sulina - Sulina Arm, RO JDS 95	21		Moderate	Good	Moderate	

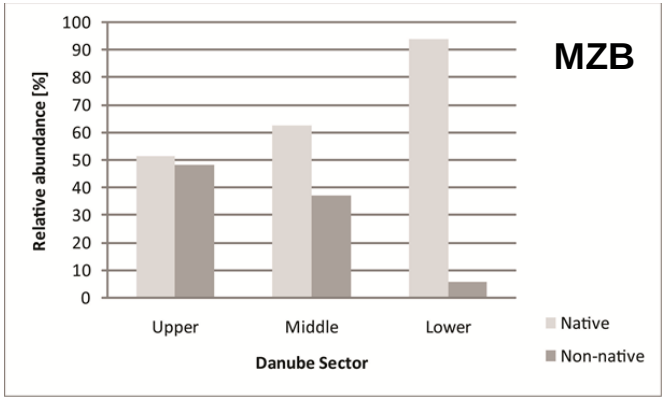
Invasive Alien Species

- Comparison with JDS2 showed a constant impact of IAS on native biota (fish, macrozoobenthos and macrophytes)

- Considerable increase of the number of non-native aquatic macroinvertebrate species was found

- A specific example: Neogobius fish species were found in high or even dominating abundance along the rip-rap protected banks in the upper and middle course of the Danube

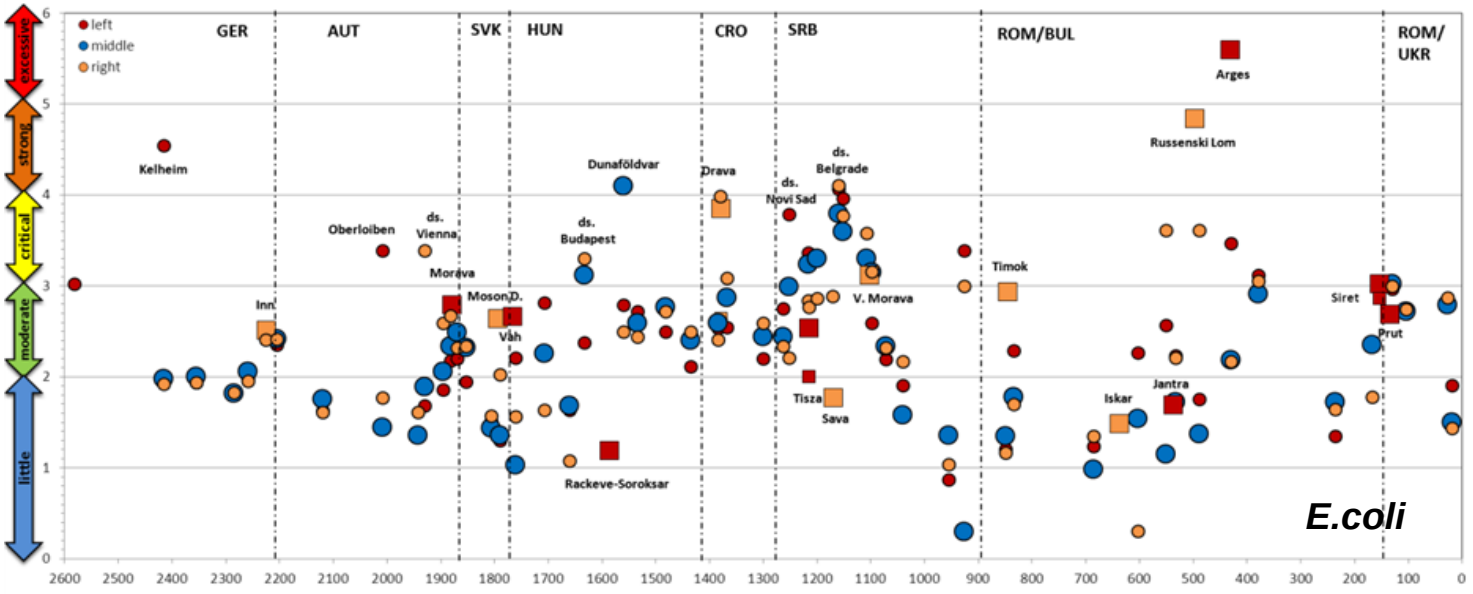




Microbiology

- 42 out of 186 JDS sampling points were classified as critically (34), strongly (5) or excessively (3) polluted by Bacterial Faecal Indicators

- Comparison with JDS 2 data revealed very similar median values for both faecal indicators E.coli and Enterococci



Microbiology

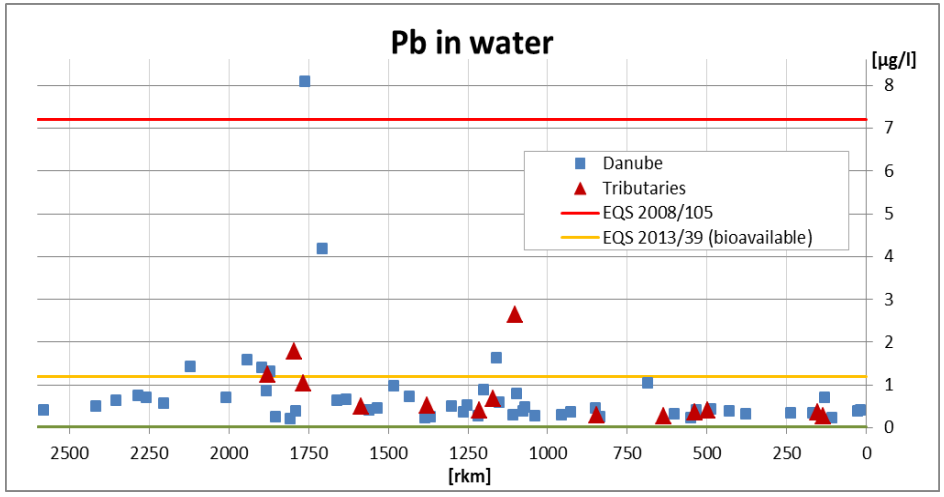
- The results of the **microbial source tracking** investigation demonstrate that human faecal impact is the main driver for faecal pollution levels in the Danube & its major tributaries

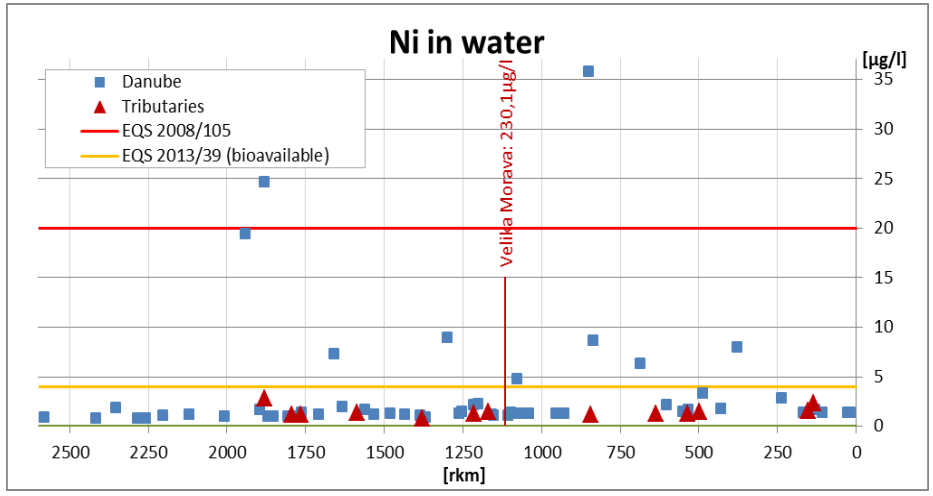
- More than 50% of the E.coli showed a modified **antibiotic resistance** pattern, but most of them were only resistant against one or two tested antibiotics. Multi-resistant isolates (with resistance in ≥3 antibiotic classes) were rare

- Novel microbial metagenomics approach (without cultivation) was applied at four sites

Metals

- Contents of metals in water, SPM and bottom sediments were similar to those observed during JDS1 and JDS2
- WFD EQS in water were exceeded occasionally for Ni & Pb
- In sediment the DE targets for metals were with one exception (Cu at JDS48) met at all sites for all elements;
- Concentrations of Hg in all analyzed fish samples exceeded the EQS significantly.





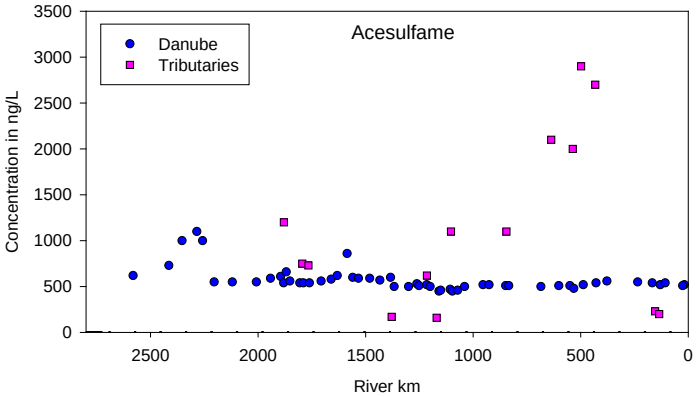
Organics – WFD PS

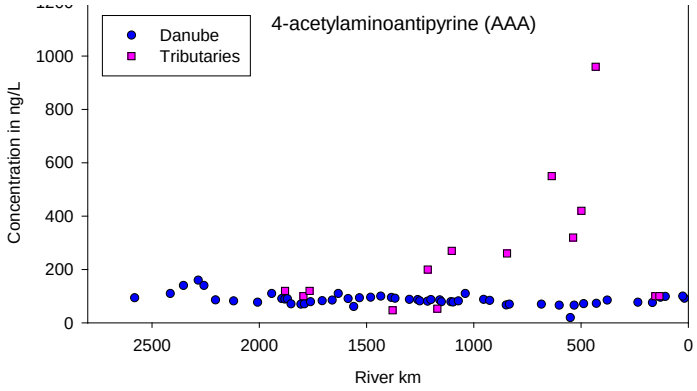
- Most of the analyzed WFD Priority Substances were found below the newly set EQS
- Concentrations of PFOS exceeded EQS at 94% of the sampling sites
- For PAH and tributyl-tin the AA-EQS for water was exceeded only at few sampling sites
- DEHP in water was present in all samples significantly below the AA-EQS
- For the first time C10-C13-chloroalkanes were analyzed, all concentrations in water were below the AA-EQS;

Emerging substances

- Large number of emerging polar organic substances was found but they were at very small concentrations
- Concentrations for most of the contaminants were lower in 2013 compared to JDS2 in 2007

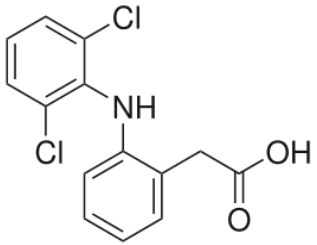
- Pharmaceuticals mostly < 40 ng/l
- Elevated concentrations: metamizol metabolites FAA and AAA, artificial sweeteners acesulfame, cyclamate and sucralose, metformin, enalapril, triphenylphosphinoxide, iodinated X-ray contrast media, benzotriazoles, and the stimulant caffeine.

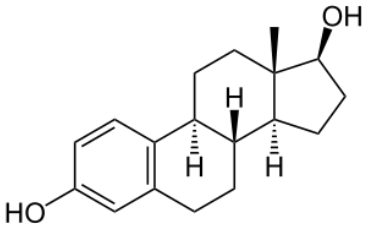


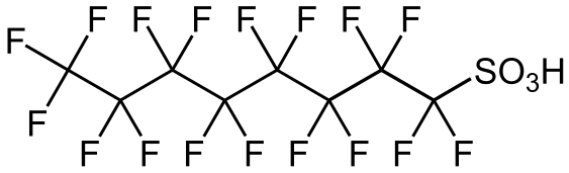


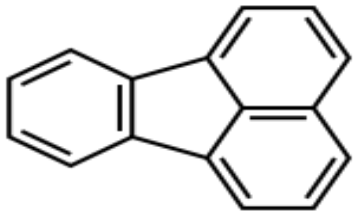
RBSP prioritization

- Prioritization methodology developed by NORMAN network produced a list of 22 substances suggested as relevant for the DRB based on the results of the JDS3 target screening of 654 substances in the Danube water samples by 13 laboratories
- PNEC values were available for 189 out of 277 JDS3 substances actually determined in the samples
- The list contains five WFD priority substances (three PAHs, fluoranthene and PFOS) and two EU Watch List candidate compounds (17beta-estradiol, diclofenac).









JDS3 – filling the gaps in RBM planning

- Findings of JDS3 were supportive to WFD implementation as they provided an extensive homogeneous dataset based on WFD compliant methods jointly applied by the Danube experts

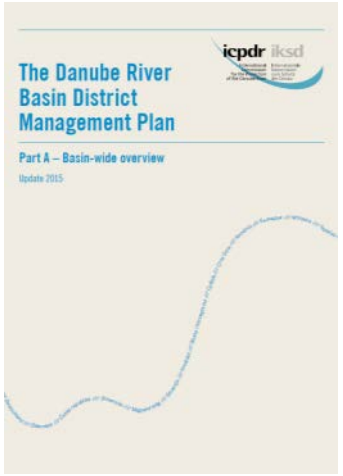
- The JDS3 reference database is available for future harmonization of sampling & assessment methods for biological quality elements in the DRB and for the prioritization of the Danube river basin specific pollutants

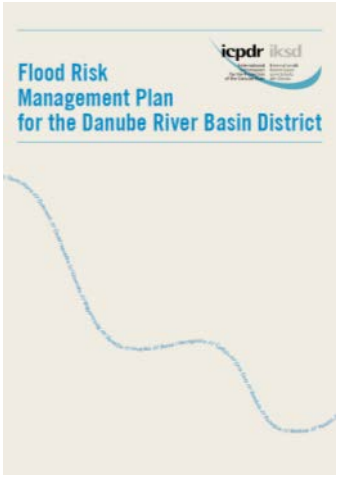
- JDS3 report available at:

  https://www.icpdr.org/main/activities-projects/jds3

Two Management Plans for the Danube River Basin

Danube River Basin Management Plan Update 2015

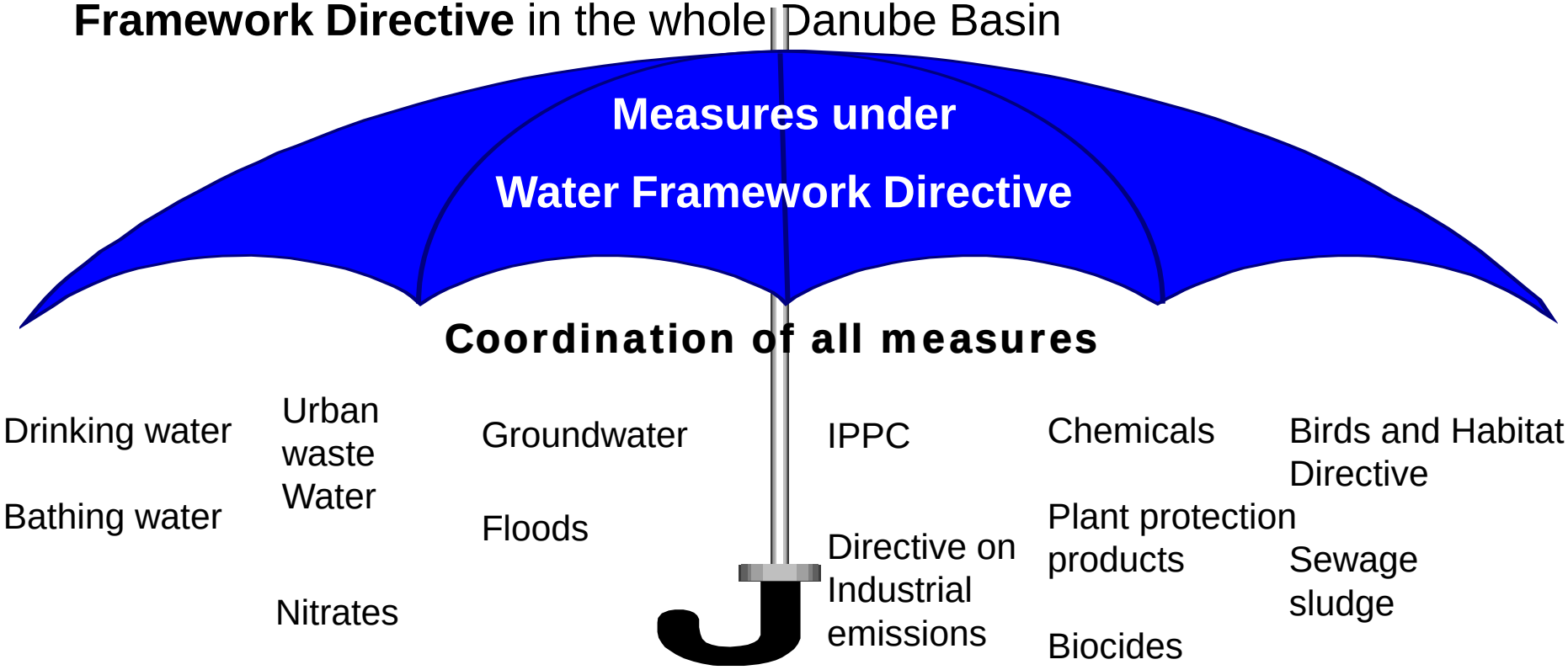




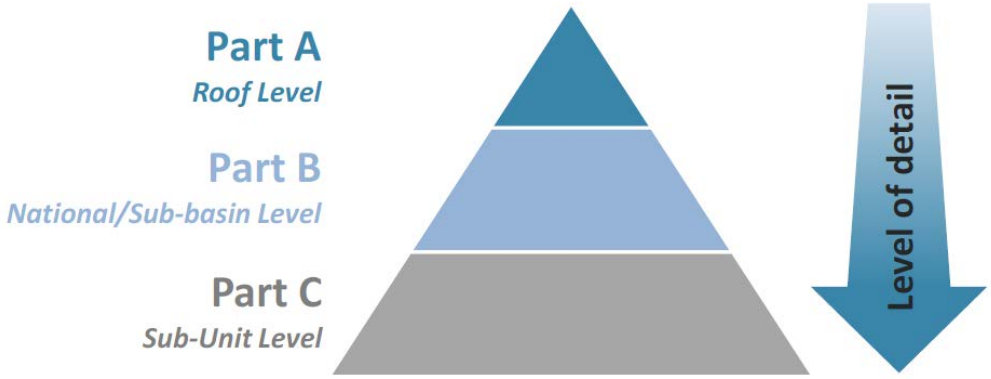
1st Danube Flood Risk Management Plan

Water Framework Directive and the Danube River Basin

- Adoption of the **Water Framework Directive in the year 2000**
- All Danube countries cooperating under the Convention for the Protection of the Danube River **committed to implement Water Framework Directive** in the whole Danube Basin



Water Framework Directive and its coordination mechanisms in the Danube



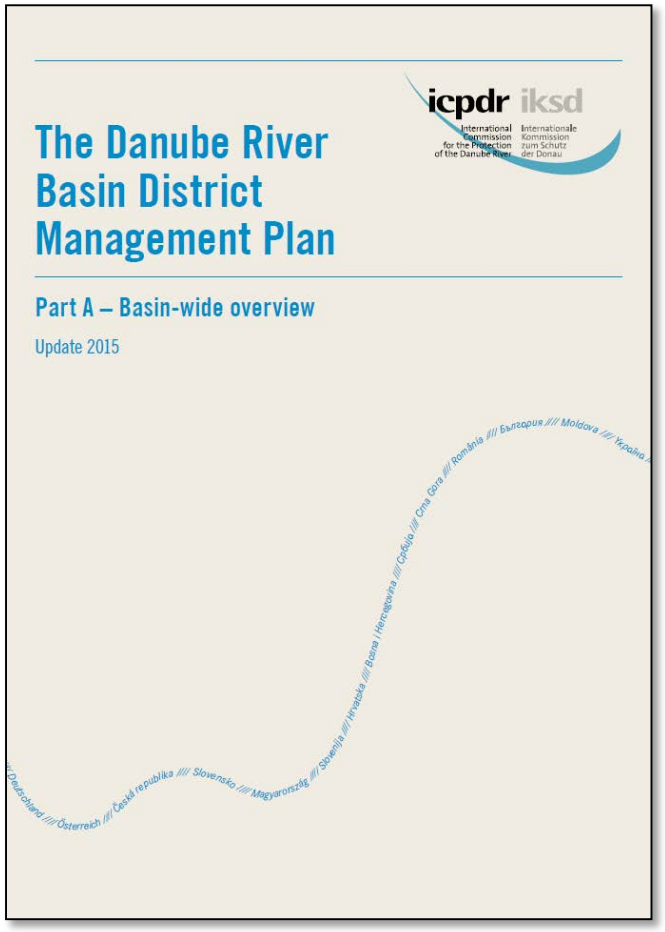
River Basin Management is based on three levels of coordination

Part A	International, **basin-wide level** - the roof level (**ICPDR**)
Part B	**National level** and/or the internationally coordinated sub-basin level for selected sub-basins (e.g. Sava and Tisza)
Part C	**Sub-unit level**, defined as management units within the national territory

The information increases in detail from **Part A** to **Parts B** and **C, Part A covers**

- rivers with catchment areas > 4,000 km^2;
- lakes > 100 km^2;
- transitional and coastal waters;
- transboundary groundwater bodies of basin-wide importance.

Danube River Basin Management Plan (DRBM Plan)



- Assessment of **pressures on water**
- Results **monitoring** programs
- **Program of Measures** for 6 years
- Based on **public consultation**
- 1st Plan: 2009; 2nd Plan: 2015
- **Adopted** by International Commission for the Protection of the Danube River
- **Endorsed by Danube Ministers**

Significant Water Management Issues on basin-wide level

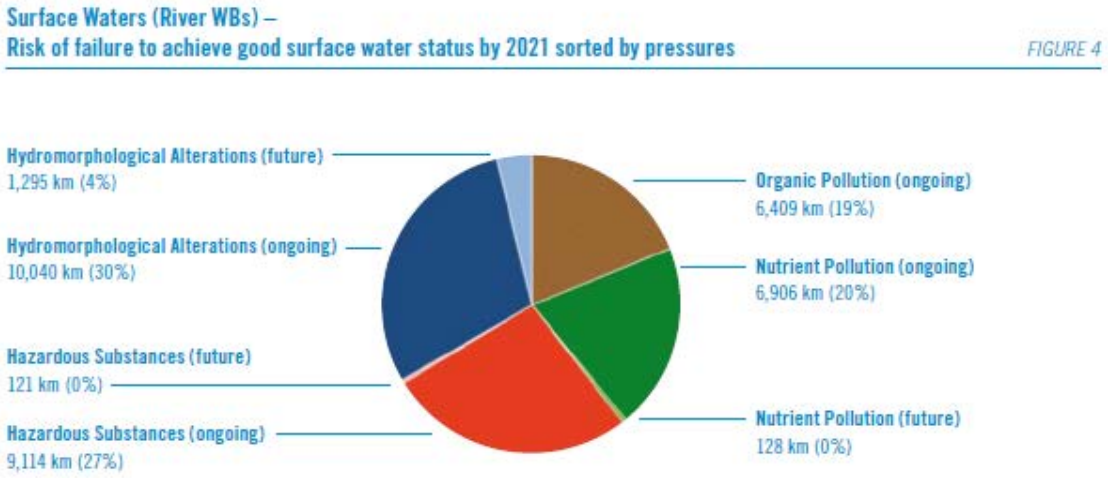
Organic Pollution

Nutrient Pollution

Hazardous Substances Pollution

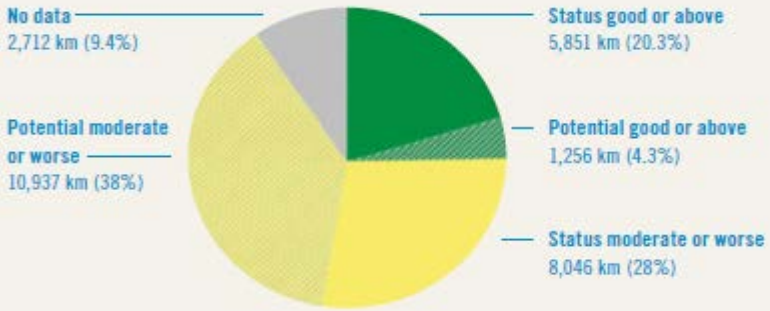
Hydromorphological Alterations

- **Priority pressures for actions** requiring **joint actions** by Danube countries
- Updated **every 6 years**

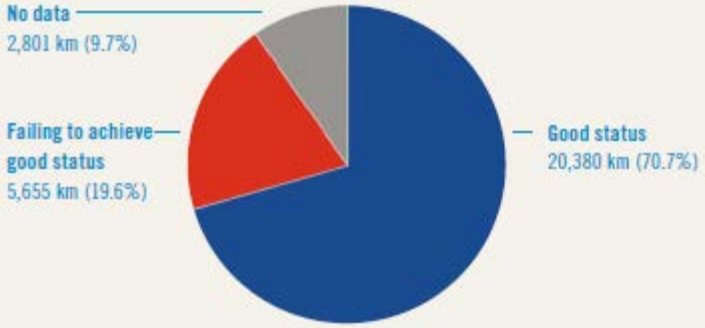


Status assessment - Surface Water Bodies

Ecological status and ecological potential for river water bodies in 2015 (indicated in length in km)



Chemical status for river water bodies in 2015 (indicated in length in km)



Chemical status for river water bodies in the DRBD in 2015, based on mercury in biota (indicated in length in km)

the analysis of mercury in biota is a decisive element for the assessment of the chemical status because in all surface water bodies, in which this quality element was analysed, it exceeded its Environmental Quality Standard (EQS) and caused bad chemical status.

Programme of Measures: Organic pollution

- **Measures** to be implemented (Joint Program of Measures)
  - Implementation of the **Urban Waste Water Treatment Directive** (EU MS, specific requirements for agglomerations > 2,000 PE), constructing a specific number of wastewater **collecting systems** and wastewater **treatment plants** (Non-EU MS)
  - Implementation of the **Industrial Emissions Directive** (EU MS, specific requirements for industrial facilities), introducing **Best Available Techniques** at a specified number of industrial facilities (Non-EU MS)
- **Orienting** financial institutions for appropriate investments
- Strengthening **capacity** and supporting knowledge transfer
- Promoting enhanced **technologies** and good **practices**

Programme of Measures: Nutrient pollution

- **Measures** to be implemented (Joint Program of Measures)
  - Implementation of the management objectives for **organic** pollution
  - Implementation of the **Nitrates Directive** according to action programs in vulnerable zones (good agricultural practices, EU MS)
  - Implementation of **agri-environmental** basic and supplementary **measures** linked to the **Common Agricultural Policy** (EU MS) and implementation of **best management practices** in the agriculture considering cost-efficiency (Non-EU MS)
  - Implementation of the **Regulation on the phosphate-free detergents** (EU MS) and **reduction of phosphates** in laundry detergents (Non-EU MS)
- **Promoting** best agricultural practices and cost effective measures
- **Policy recommendations** to achieve sustainable agriculture

Programme of Measures: Hazardous substances

- **Measures** to be implemented (Joint Program of Measures)
  - Implementation of the management objectives for **organic** pollution
  - Implementation of **agri-measures** linked to CAP, the Sewage Sludge Directive and the Pesticides Directive (EU MS) and by implementation of **best management practices** in the agriculture (Non-EU MS)
  - Ensuring the **authorisation**, **safe application** and **controlled release** of chemicals (EU MS: by implementing inter alia the EQS, the Plant Protection Products Directive, the REACH and the Biocides Regulation)
- **Awareness** raising to emerging chemicals

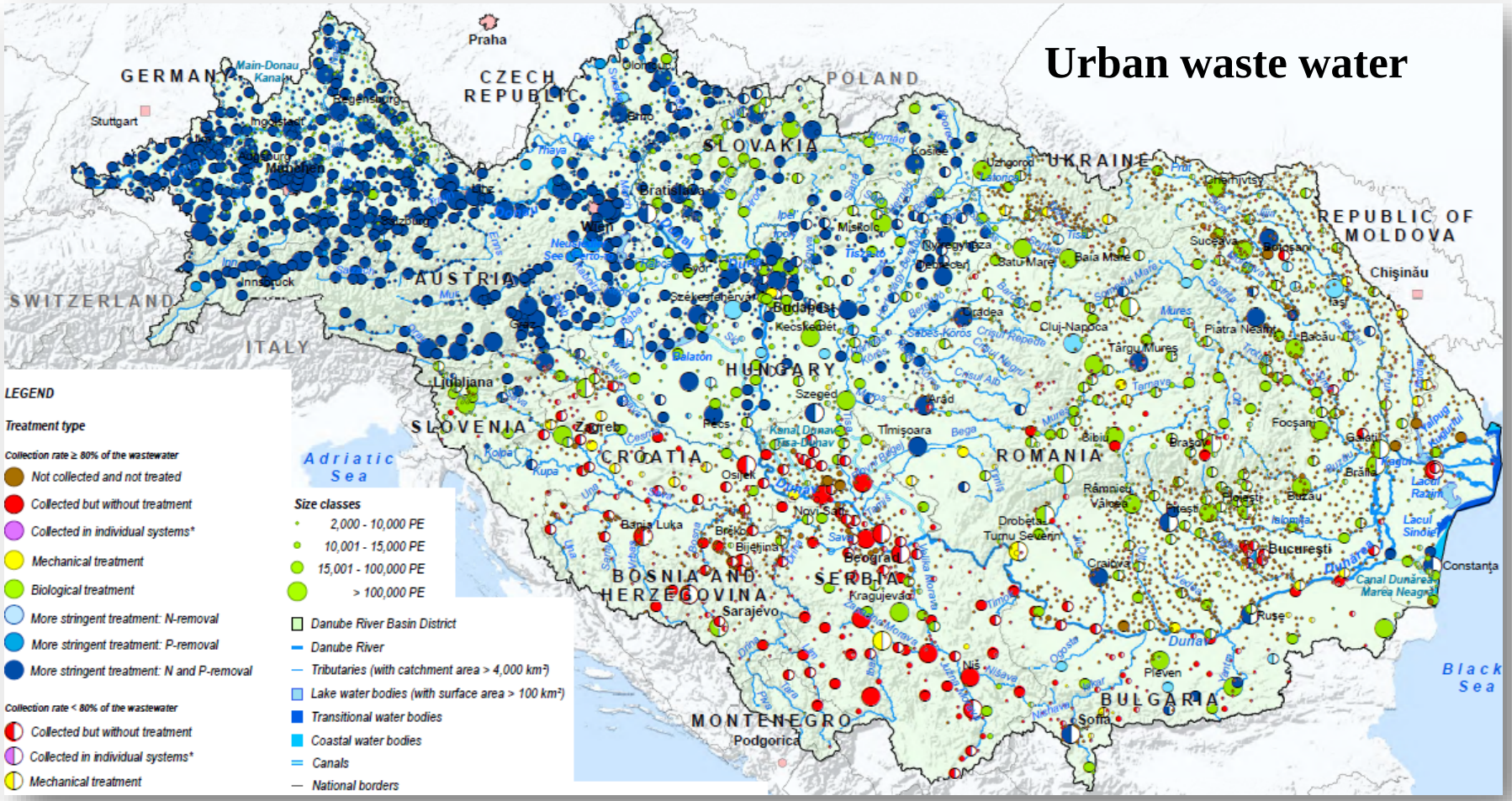
Programme of Measures: Hydromorphological alterations

- **Measures** to be implemented (Joint Program of Measures)
  - Interruption of **river continuity and morphological alterations** – restoration projects for fish migration and habitat continuity projects
    - Construction of additional 100+ fish migration aids until 2021
    - Improvement of river morphology (river bed, riparian zones)
  - **Disconnected adjacent wetlands/floodplains**
    - Reconnection of 15,000+ ha of wetlands/floodplains
  - **Hydrological alterations**
    - Improvement of impoundments, ensuring ecological flows, addressing hydropeaking
  - Sustainability of **future infrastructure projects** (i.e. flood protection measures, inland navigation, hydropower)

Point source pollution: data collection

- **Urban** waste water
  - Data collection at agglomeration level above 2,000 PE (2012)
  - Data on PE, connection rates and treatment types, flow and pollution discharges (BOD, COD, TN and TP)
  - Foreseen infrastructural development for short-, mid- and long-term management scenarios
- **Industrial** waste water
  - Data collection at facility level above certain capacity value (2012)
  - Data on industrial sector types and pollution discharges (TOC, TN, TP and hazardous substances)
- **Assessment**: situation of point source emissions, information of substance occurrence at source, impacts of infrastructural developments

Point source pollution: data mapping



Diffuse nutrient pollution: data collection

- **Spatial catchment data**
  - Digital maps on elevation, soil, hydrogeology, hydrography, land use
  - Agricultural measures applied on field, sanitation at small settlements
- **Temporal data (2009-2012)**
  - Hydrometeorological, hydrological and water quality data
  - Data on population, nutrient balance, atmospheric deposition
- **Future management scenarios (short-, mid- and long-term)**
  - Foreseen measures implemented in agriculture and urban areas
- **Assessment (with modelling)**: regional hotspots, emission pathways and sources, loads to Black Sea, management scenarios to reduce emissions

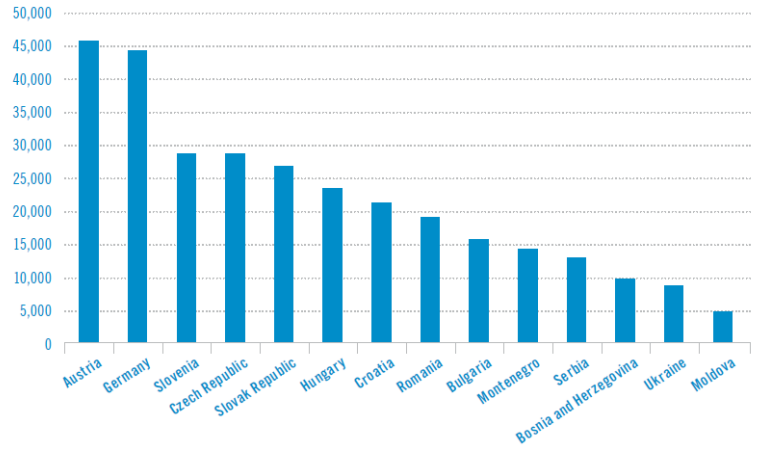
Diffuse nutrient pollution: emission mapping

Economic analysis: data collection

- **General socio-economic indicators**
  - Population, national GDP, GDP per capita
- **Characterisation of water services**
  - Water supply, waste water collection, sewage treatment
- **Economic characterisation of water uses**
  - Production of main economic sectors
  - Importance of hydropower generation and inland navigation
- **Questionnaires** on water pricing, cost recovery and environmental and resource costs, approaches for disproportionality of costs and exemptions as well as projections of trends regarding socio-economic developments

Economic analysis: data assessment

GDP per capita (PPP/International $) of Danube countries (2013) FIGURE 44



Production of main economic sectors (national level) TABLE 26

Country	Agriculture	Industry	Electricity Generation
	Share of GDP (in %)	Share of GDP (in %)	Share of GDP (in %)
Austria	0.97 (average 2011–2013)	26.4 (2012)	2.5 (2012)
Bosnia and Herzegovina (2013)	14.24	5.75	16.36
Bulgaria (in 2011)	4.7	26.4	n. a.
Croatia (in 2010)	4.9	15.93	2..25
Czech Republic (in 2010)[72]	2.8	35	n. a.
Germany[73]	0.8 (DRB)	30.3 (DRB)	n. a.
Hungary (2012)	4.7	23	2.7
Moldova (2010)	28	39	3.4
Montenegro	No information		
Romania	4.2	20	1.2
Serbia[74] (2013)	7.9	16.1	4.1
Slovak Republic (in 2013)	2.83	22.57	2.86
Slovenia (2012)	2.34	18.5	2.47
Ukraine	9.82[75]	–	–

Characteristics of Water Services

"Water services" means all services which provide, for households, public institutions or any economic activity:

- Abstraction, impoundment, storage, treatment & distribution of surface water or groundwater;
- Wastewater collection and treatment facilities which subsequently discharge into surface water.

Country	Water supply production (industry, agriculture and households from public systems)	Supply to households	Population connected to public water supply
	in Mio. m³	*in Mio. m³*	*in %*
Austria	791	ca. 525	91.6
Bosnia and Herzegovina	320	109	60-65
Bulgaria (in 2013)	188.85 (Danube), 387.82 (national level)	129.68 (Danube), 260.69 (national level)	99.8 (Danube), 99.3 (national level)
Croatia (in 2012)	286 (Danube), 513 (national level)	124 (Danube), 184 (national level)	80 (Danube), 84 (national level)
Czech Republic	327.8 (Danube)	147.2 (Danube)	94.9 (Danube)
Germany	683.9 (Danube)	453.2 (Danube)	98.9 (Danube)
Hungary (in 2012)	598.5	341.7	94.2
Moldova	851 (130 from GW)	118	75 (urban); 13 (rural)
Montenegro	47	0.2	97.4
Romania	2,701	507	62.9
Serbia (2013)	658	324	86.6
Slovak Republic (2013)	2,488.5	291.4	84.1
Slovenia (2011)	100 (Danube)	73 (Danube)	88.6
Ukraine	-	-	-

Characteristics of Water Uses –Production of Main Economic Sectors

Country	Agriculture	Industry	Electricity Generation
	Share of GDP (in %)	Share of GDP (in %)	Share of GDP (in %)
Austria	0.97 (average 2011-2013)	26.4 (2012)	2.5 (2012)
Bosnia and Herzegovina (2013)	14.24	5.75	16.36
Bulgaria (in 2011)	4.7	26.4	n. a.
Croatia (in 2010)	4.9	15.93	2..25
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Romania	4.2	20	1.2
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Slovak Republic (in 2013)	2.83	22.57	2.86
Slovenia (2012)	2.34	18.5	2.47
Ukraine	9.82	-	-

Projections trends in key economic sectors

Country	Economic growth in agriculture until 2021	Economic growth in industry until 2021	Growth in energy production from hydro-power until 2020	Growth in energy production from biomass until 2021	Population growth until 2021
Austria	Slight decrease in area and intensity	Slight increase in metals, chemicals	+11%	+8%	+2,2%
Bosnia and Herzegovina	-	-	+607%	-	-2,9%
Bulgaria	-	-	+10%	+45%	-7,3%
Croatia	-	+3%	-	+1.280%	-1,3
Czech Republic	-	-	+18%	+30%	+1%
Germany	Slight decrease	Slight increase	-	-	-1,8%
Hungary	-	-	+26%	+59%	-2,7
Moldova	-	-	-	+620%	-5,3
Montenegro	-	-	-	Very high growth	+/-0%
Romania	-	+5,4 (until 2018)	+/-0%	+42%	-3,4%
Serbia	-	-	+15,2%	Very high growth	-4,1%
Slovak Republic	Slight increase	Slight increase	+6%	+63%	-0,7%
Slovenia	-	-	+22%	48%	+0,1%
Ukraine	-	-	+25%	Very high growth	-6,3%

Progress from 1st DRBMP (2009) to 2nd DRBMP-Update 2015

-50%
organic emmission

120
fish migration aids constructed

50,000
hectares of wetlands & floodplains reconnected

-10%
nitrogen emmissions

-30%
phosphorus emmissions

Recent catastrophic floods in Danube River Basin

2002 2005 2006 2010 2013 2014

EU Floods Directive

Three steps of flood risk management:

a) Preliminary flood risk assessment (2011),

b) Flood risk and flood hazard maps (2013),

c) Flood risk management plans (2015).

Mapping and coping with flood risks

ICPDR IKSD

Danube flood risk management plan

The objectives of the plan are linked to the respective measures:

- ✓ Avoidance of new risks
- ✓ Reduction of existing risks
- ✓ Strengthening resilience
- ✓ Raising awareness
- ✓ Solidarity principle

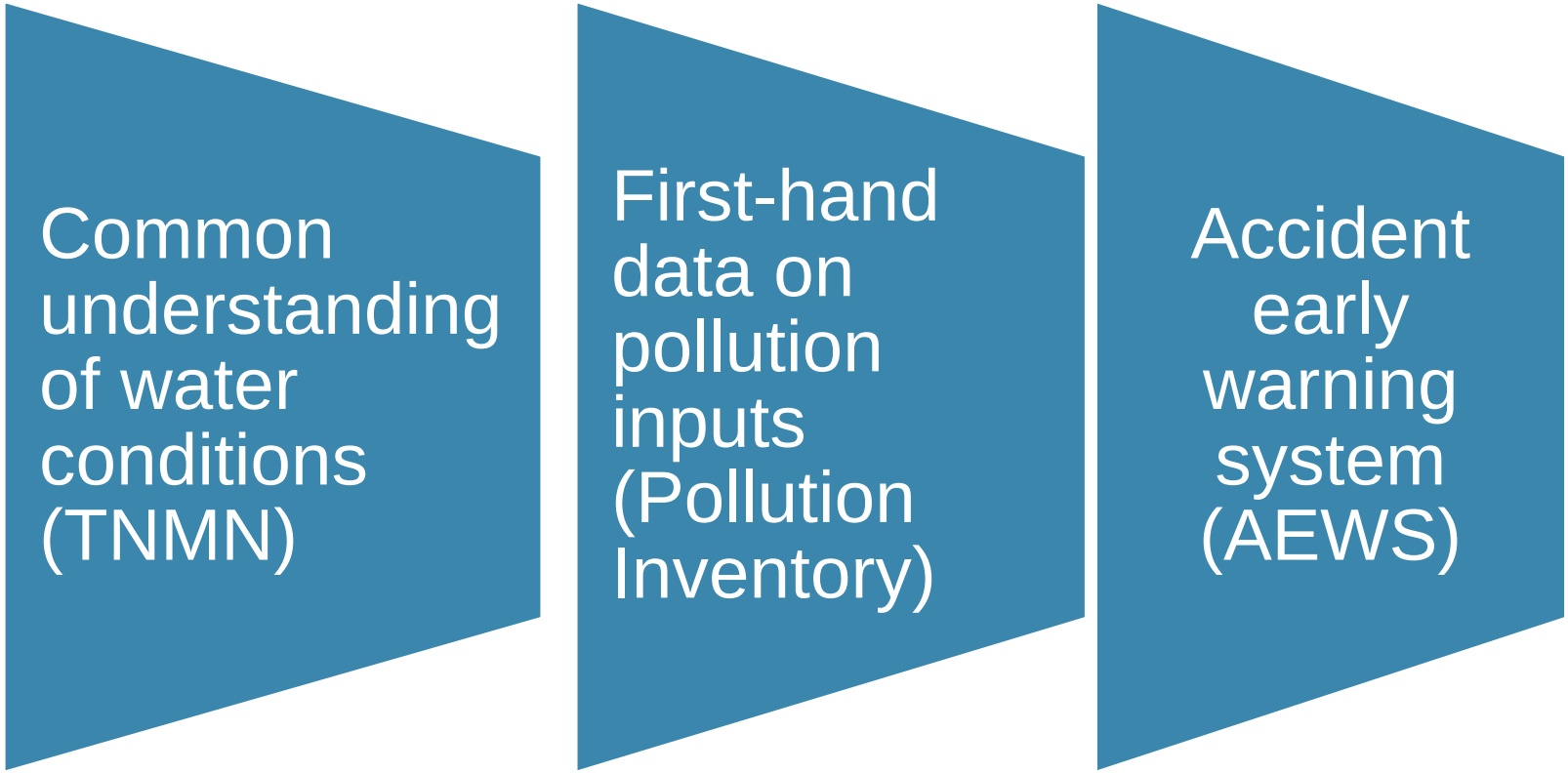
Danube flood risk management plan

1. Introduction
2. Conclusions of the preliminary flood risk assessment
3. Flood hazard maps and flood risk maps
4. Objectives
5. Measures
6. Water retention
7. Cost-benefit analysis
8. Coordination with WFD
9. Impacts of climate change
10. International coordination
11. Solidarity principle
12. Public information and consultation
13. Conclusions and next steps.

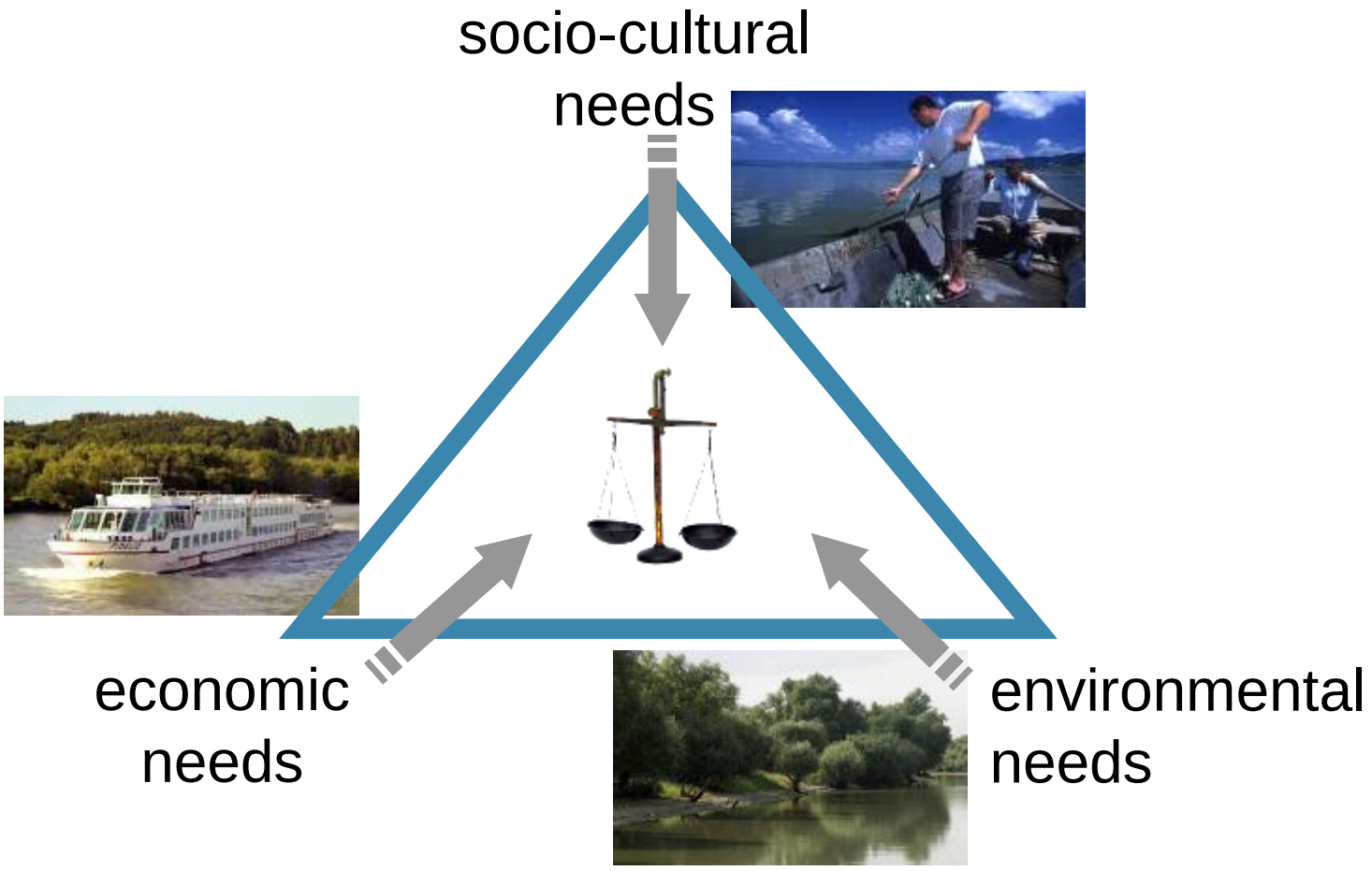
And it goes on ... WFD cycle 2015 to 2021 and beyond

Source: http://www.gov.scot/Publications/2007/12/05141702/4.

ICPDR – a forum for technical cooperation



Balancing of interests



Areas of inter-sectoral work

Navigation

Climate Adaptation

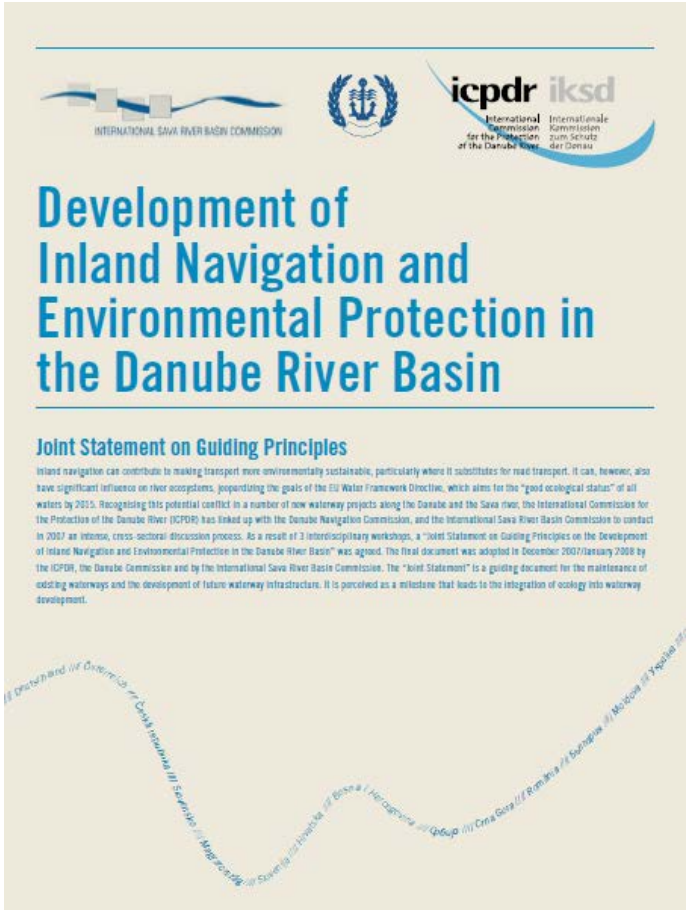
Agriculture

Hydropower

Images: wikipedia, GFDL

Navigation

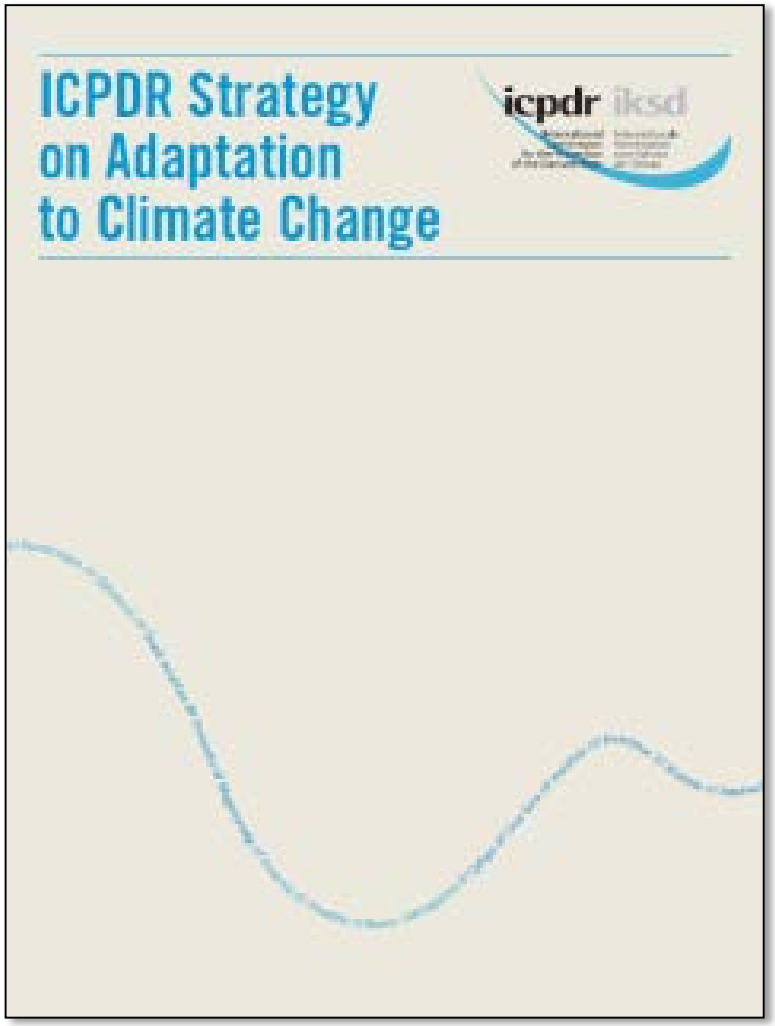
- **Joint Statement initiative** was launched in **2007 by the ICPDR** in cooperation with the **Danube Commission and the International Sava Commission**
- Joint Statement summarises **principles and criteria for environmentally sustainable inland navigation** on the Danube and its tributaries
- **Regular meetings** with cross-sectoral discussion process



Climate Change Adaption (1)

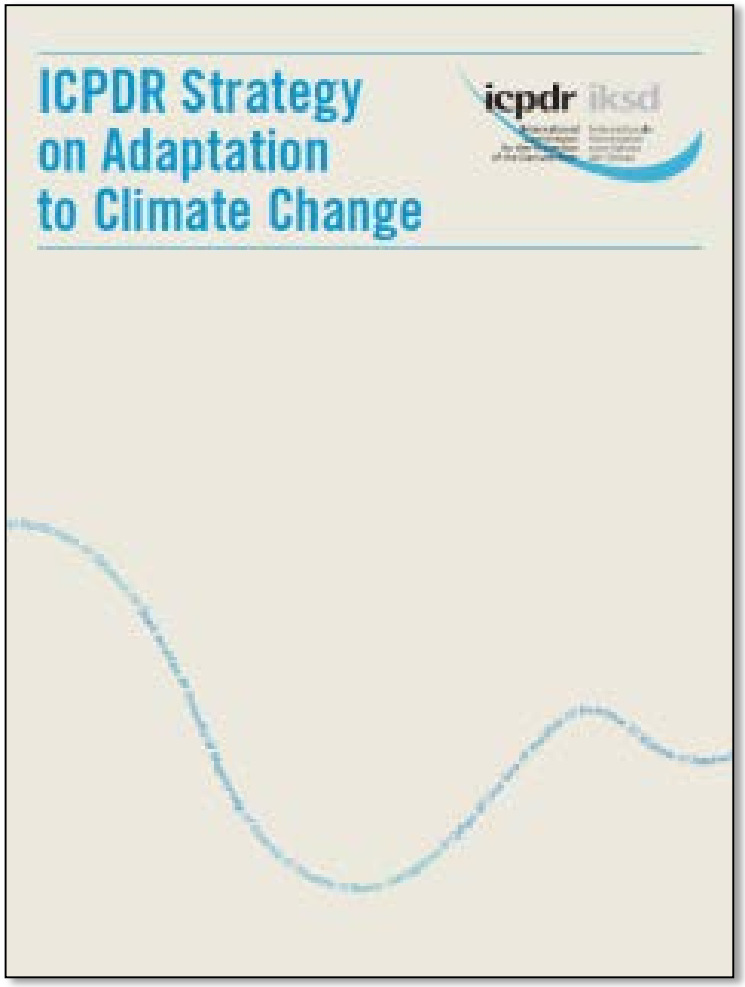
- First Climate Change Adaptation Strategy jointly **elaborated with all ICPDR Expert Groups in 2012**

- **Tool to support adaptation measures** as part of the 2nd Danube River Basin Management Plan and the 1st Flood Risk Management Plan by 2015



Climate Change Adaption (2)

- **Sound, institutionalised water management** is a key to climate change adaptation
- ICPDR countries use their **River Basin & Flood Risk Management Plans to address water scarcity, droughts and climate change pressures**
- A **cyclical, adaptive approach** is needed to continuously address **uncertainties and new scientific findings**



Guiding Principles on Hydropower

Sustainable Hydropower in the Danube River Basin (1)

- Need to **increase energy from renewable sources** plays a significant driver for hydropower in the Danube River Basin

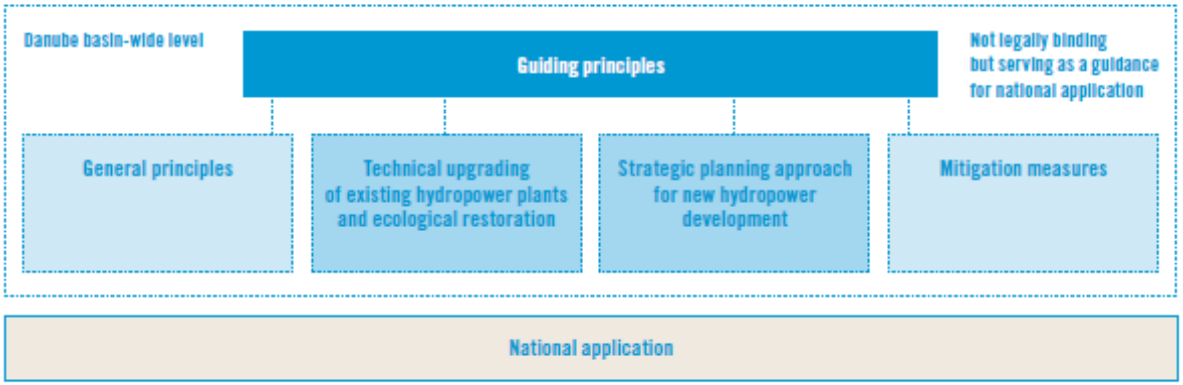
- ICPDR **"Guiding Principles on Sustainable Hydropower Development** in the Danube Basin" adopted in 2013

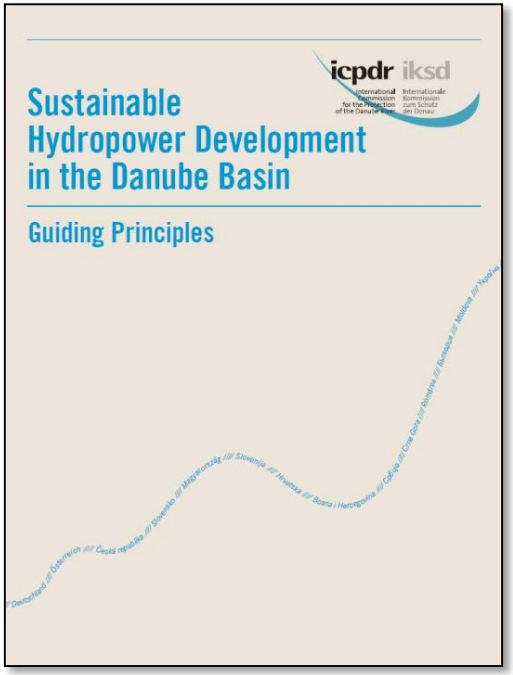
- Impacts of hydropower development – why should we care?
  - **Environmental protection and biodiversity conservation** issues
  - Economic, social and environmental benefits can be maximised in case all **benefits and impacts are considered from the very beginning**

Sustainable Hydropower in the Danube River Basin (2)

- Set of **general principles**
- Technical **upgrading of existing hydropower plants** combined with **ecological restoration**
- **Strategic planning approach** for new hydropower based on two level assessment (regional + site specific)
- **Mitigation** of negative ecological impacts

Main elements of the Guiding Principles FIGURE 10





The instruments of Public Participation

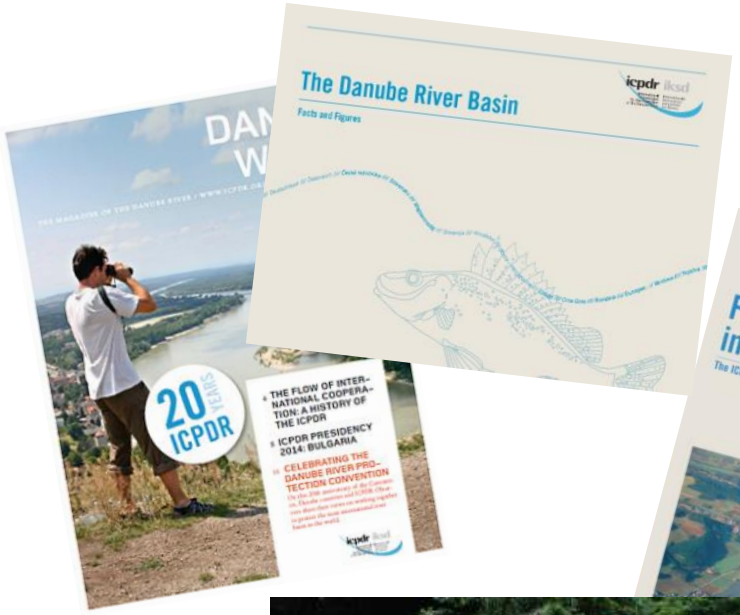
- 23 Observer Organisations
- A dedicated Public Participation Expert Group
- Outreach activities accross a broad spectrum
- Educational tools
- Public information
- Stakeholder consultation
- Social Media
- Intersectorial dialogue
- Branding campaigns

Stakeholder Involvement: 23 Observers

The ICPDR approach to Public Participation

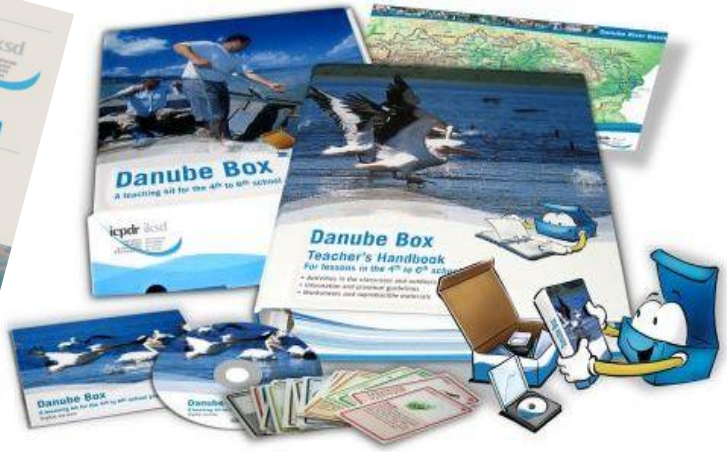
- A commitment to active public participation in decision-making
- A belief that public participation facilitates broader support for policies and leads to increased efficiency in implementation efforts
- Understanding that stakeholders should be consulted in the entire cycle of activities – from conceptualisation to implementation

Outreach, education & public information



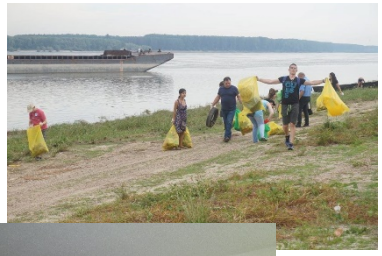
Inform → engage

involve → consult



JDS3 NEWS BLOG

Danube Day, 29 June



Summary and Conclusions

- The ICPDR has a **sound scientific** and **technical** basis for **policy making** in transboundary context
- The basin-wide approach has a proven track record of success in water resources management
- **Science is** instrumental for filling the gaps in the RBM planning (e.g. **JDS3)**
- Joint work, good co-ordination and achieved agreement on **key strategies and policies constitute a basis for implementation of plans and measures**
- **Integration issues** need to adress different challenges in the river basin to meet objectives of the plans and policies and requires **coordination with key sectors**

More information?
#seeyousoon@www.icpdr.org