Water Quality in the Danube River Basin – 2006

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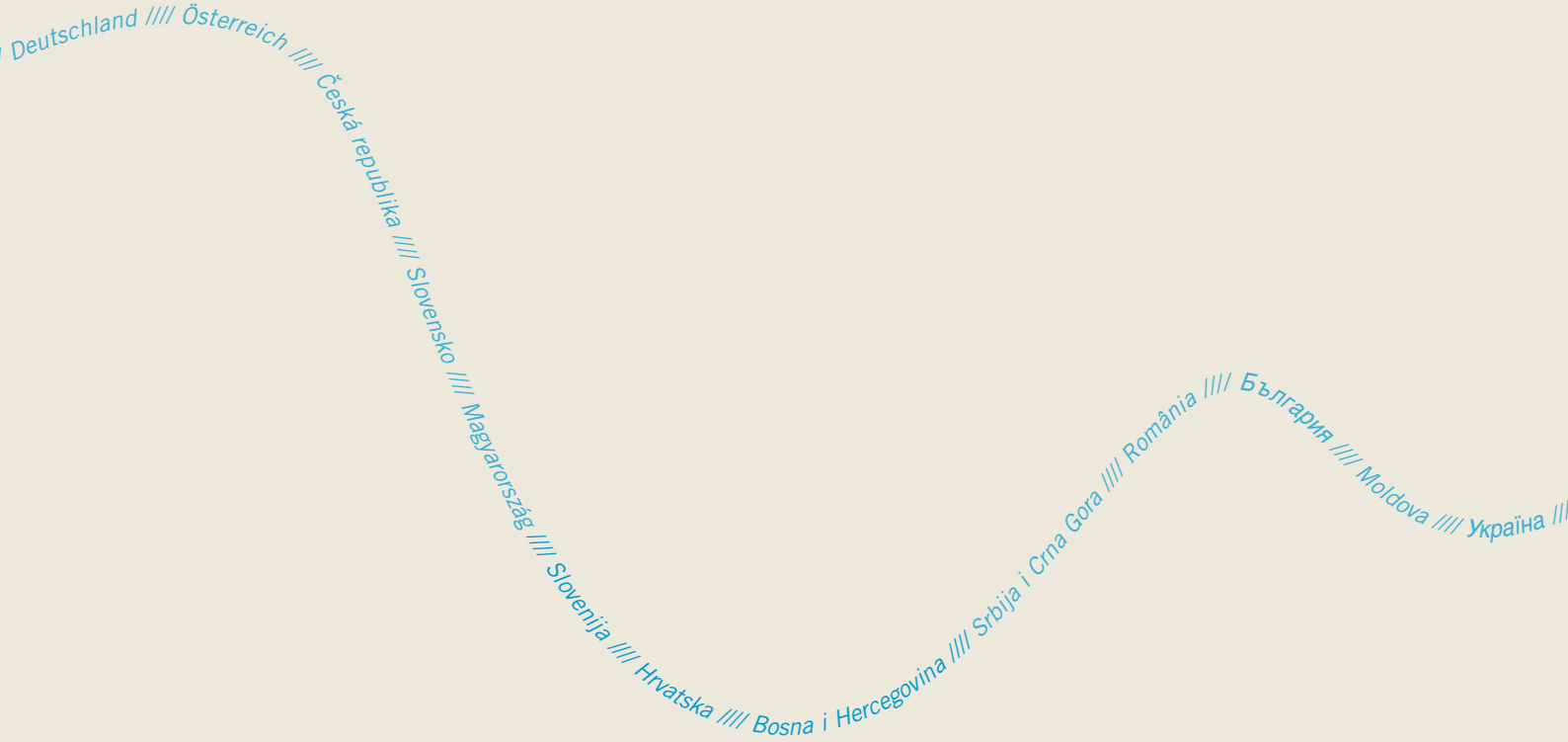
International Commission for the Protection of the Danube River

Internationale Kommission zum Schutz der Donau

TNMN – Yearbook 2006



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The printed version of TNMN Yearbook 2006 contains only the essential background information on TNMN and a basic overview of the water quality status in the Danube River Basin. The full version of the TNMN Yearbook 2006 including all figures and data is available on the attached CD-ROM.

1. Introduction

1.1. History of the TNMN

In June 1994, the Convention on Cooperation for the Protection and Sustainable Use of the Danube River (DRPC) was signed in Sofia, coming into force in October 1998 with the main objectives of achieving sustainable and equitable water management, including the conservation, improvement and the rational use of surface and ground waters in the Danube catchment area. The DRPC also emphasizes that the Contracting Parties shall cooperate in the field of monitoring and assessment. In this respect, the operation of the Trans National Monitoring Network (TNMN) in the Danube River Basin aims to contribute to the implementation of the DRPC. This Yearbook reports on results of the basin-wide monitoring programme and presents TNMN data for 2006.

The TNMN has been in operation since 1996, although the first steps towards its creation were taken about ten years earlier. In December 1985 the governments of the Danube riparian countries signed the Bucharest Declaration. The Declaration had as one of its objectives to observe the development of the water quality of the Danube, and in order to comply with this objective, a monitoring programme containing 11 cross-sections of the Danube River was established.

1.2. Objectives of the TNMN

The original objective of the TNMN was to strengthen the existing network set up by the Bucharest Declaration, to enable a reliable and consistent trend analysis for concentrations and loads of priority pollutants, to support the assessment of water quality for water use and to assist in the identification of major pollution sources.

In 2000, having the experience of the TNMN operation, the main objective of the TNMN was reformulated: to provide a structured and well-balanced overall view of the status and long-term development of quality and loads in terms of relevant constituents in the major rivers of the Danube Basin in an international context.

Implementation of the EU Water Framework Directive (2000/60/EC, short WFD) after 2000 necessitated the revision of the TNMN in the Danube River Basin District; in line with the WFD implementation timeline, the revision process will be completed in 2007.

2. Description of the TNMN

2.1. Monitoring stations network

The TNMN builds on national surface water monitoring networks. To select monitoring locations for the purposes of international monitoring network in the Danube River Basin, the following selection criteria for monitoring location had been set up:

- *located just upstream/downstream of an international border*
- *located upstream of confluences between the Danube and main tributaries or main tributaries and larger sub-tributaries (mass balances)*
- *located downstream of the biggest point sources*
- *located according to control of water use for drinking water supply*

Monitoring locations included in the TNMN should meet at least one of the selection criteria.

The current TNMN network contains 78 sampling points. The monitoring locations can have up to three sampling points, located on the left side, right side or in the middle of a river. More than one sampling point was proposed for the selected monitoring locations in the middle and lower part of the Danube River and for the large tributaries such as the Tisza and Prut rivers.
In 2006, the Danube countries provided data from 77 monitoring locations, including 107 sampling sites. In 2006, a complete data set was missing from monitoring point L0930 (BG06 –Iskar) and for monitoring point L0990 where only a few determinands were measured. Samples were taken from 40 monitoring stations (68 sampling sites) located in the Danube River itself and from 37 monitoring station in tributaries.

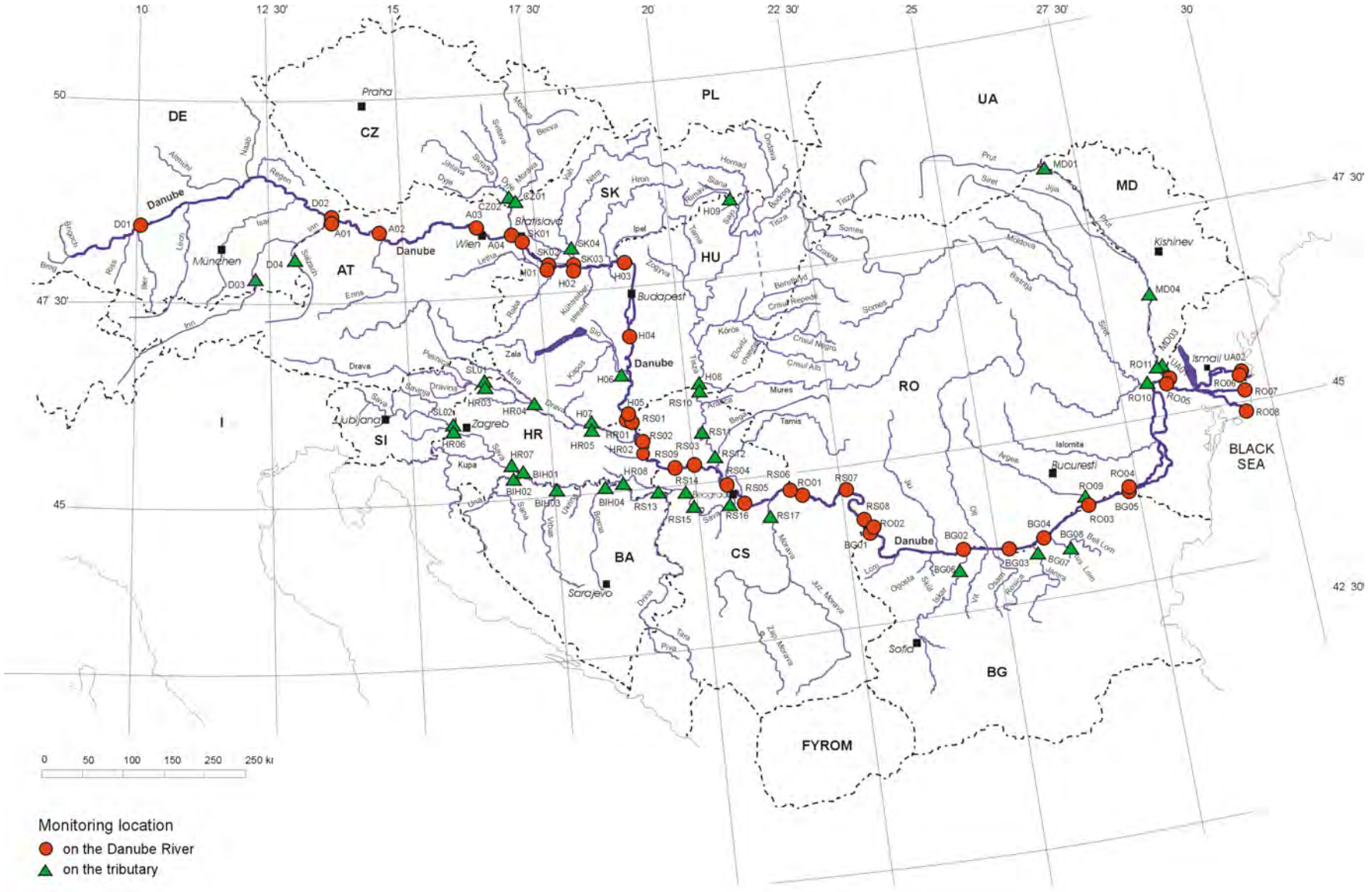
Table 1: List of monitoring sites

Country Code	River Name	Town/Location Name	Latitude d. m. s.	Longitude d. m. s.	Distance [Km]	Altitude [m]	Catch-ment [km²]	DEFF Code	Loc.inprofile
D01	Danube	Neu-Ulm	48 25 31	10 1 39	2581	460	8107	L2140	L
D02	Danube	Jochenstein	48 31 16	13 42 14	2204	290	77086	L2130	M
D03	/Inn	Kirchdorf	47 46 58	12 7 39	195	452	9905	L2150	M
D04	/Inn/Salzach	Laufen	47 56 26	12 56 4	47	390	6113	L2160	L
A01	Danube	Jochenstein	48 31 16	13 42 14	2204	290	77086	L2220	M
A02	Danube	Enghagen	48 24 04	14 51 20	2113	241	84869		R
A03	Danube	Wien-Nussdorf	48 15 45	16 22 15	1935	159	101700	L2180	R
A04	Danube	Hainburg	48 16 44	16 99 26	1879	136	130759		R
CZ01	/Morava	Lanzhot	48 41 12	16 59 20	79	150	9725	L2100	M
CZ02	/Morava/Dyje	Pohansko	48 48 12	16 51 20	17	155	12540	L2120	M
SK01	Danube	Bratislava	48 8 10	17 7 40	1869	128	131329	L1840	M
SK02	Danube	Medvedov/Medve	47 47 31	17 39 6	1806	108	132168	L1860	M
SK03	Danube	Komarno/Komarom	47 45 17	18 7 40	1768	103	151961	L1870	M
SK04	/Váh	Komarno	47 46 41	18 8 20	1	106	19661	L1960	M
H01	Danube	Medve/Medvedov	47 47 31	17 39 6	1806	108	131605	L1470	M
H02	Danube	Komarom/Komarno	47 45 17	18 7 40	1768	101	150820	L1475	LMR
H03	Danube	Szob	47 48 44	18 51 42	1708	100	183350	L1490	LMR
H04	Danube	Dunafoldvar	46 48 34	18 56 2	1560	89	188700	L1520	LMR
H05	Danube	Hercegszanto	45 55 14	18 47 45	1435	79	211503	L1540	LMR
H06	/Sio	Szekszard-Palank	46 22 42	18 43 19	13	85	14693	L1604	M
H07	/Drava	Dravaszabolcs	45 47 00	18 12 22	78	92	35764	L1610	M
H08	/Tisza	Tiszasziget	46 9 51	20 5 4	163	74	138498	L1700	LMR
H09	/Tisza/Sajo	Sajopuspoki	48 16 55	20 20 27	124	148	3224	L1770	M
SI01	/Drava	Ormoz	46 24 12	16 9 36	300	192	15356	L1390	L
SI02	/Sava	Jesenice	45 51 41	15 41 47	729	135	10878	L1330	R
HR01	Danube	Batina	45 52 27	18 50 03	1429	86	210250	L1315	M
HR02	Danube	Borovo	45 22 51	18 58 22	1337	89	243147	L1320	R
HR03	/Drava	Ormoz	46 24 12	16 9 36	300	192	15356	L1300	L
HR04	/Drava	Botovo	46 14 27	16 56 37	227	123	31038	L1240	M
HR05	/Drava	D.Miholjac	45 46 58	18 12 20	78	92	37142	L1250	R
HR06	/Sava	Jesenice	45 51 40	15 41 48	729	135	10834	L1220	L
HR07	/Sava	us. Una Jasenovac	45 16 02	16 54 52	525	87	30953	L1150	L

Country Code	River Name	Town/Location Name	Latitude d. m. s.	Longitude d. m. s.	Distance [Km]	Altitude [m]	Catch-ment [km²]	DEFF Code	Loc.inprofile
HR08	/Sava	ds. Zupanja	45 02 17	18 42 29	254	85	62890	L1060	MR
BIH01	/Sava	Jasenovac	45 16 0	16 54 36	500	87	38953	L2280	M
BIH02	/Sava/Una	Kozarska Dubica	45 11 6	16 48 42	16	94	9130	L2290	M
BIH03	/Sava/Vrbas	Razboj	45 3 36	17 27 30	12	100	6023	L2300	M
BIH04	/Sava/Bosna	Modrica	44 58 17	18 17 40	24	99	10308	L2310	M
RS01	Danube	Bezdan	45 51 15	18 51 51	1427	83,15	210250	L2350	L
RS02	Danube	Bogojevo	45 31 49	19 5 2	1367	80,41	251253	L2360	L
RS03	Danube	Novi Sad	40 15 3	19 51 40	1258	74,52	254085	L2370	R
RS04	Danube	Zemun	44 50 56	20 25 2	1174	70,76	412762	L2380	R
RS05	Danube	Pancevo	44 51 25	20 36 28	1154,8	70,14	525009	L2390	L
RS06	Danube	Banatska	44 49 6	21 20 4	1076,6	68,58	568648	L2400	M
RS07	Danube	Tekija	44 41 56	22 25 24	954,6		574307	L2410	R
RS08	Danube	Radujevac	44 15 50	22 41 9	851	32,45	577085	L2420	R
RS09	Danube	Backa Palanka	45 15 13	19 31 35	1287		253737	L2430	L
RS10	/Tisza	Martonos	46 5 59	20 3 50	152	75,54	140130	L2440	R
RS11	/Tisza	Novi Becej	45 35 9	20 8 23	66	74,03	145415	L2450	L
RS12	/Tisza	Titel	45 11 52	20 19 9	8,9	72,55	157147	L2460	M
RS13	/Sava	Jamena	44 52 40	19 5 21	195	77,67	64073	L2470	L
RS14	/Sava	Sremska	44 58 1	19 36 26	136,4	75,24	87996	L2480	L
RS15	/Sava	Sabac	44 46 12	19 42 17	103,6	74,22	89490	L2490	R
RS16	/Sava	Ostruznica	44 43 17	20 18 51	17		37320	L2500	R
RS17	/Velika Morava	Ljubicevska	44 35 6	21 8 15	34,8	75,09	37320	L2510	R
RO01	Danube	Bazias	44 47 55 57 58	21 23 24 40 54	1071	70	570896	L0020	LMR
RO02	Danube	Pristol/Novo Selo Harbour	44 11 18 23 29	22 45 57 64 69	834	31	580100	L0090	LMR
RO03	Danube	us. Arges	44 4 25	26 36 35	432	16	676150	L0240	LMR
RO04	Danube	Chiciu/Silistra	44 7 18	27 14 38	375	13	698600	L0280	LMR
RO05	Danube	Reni	45 28 50	28 13 34	132	4	805700	L0430	LMR
RO06	Danube	Vilkova-Chilia arm/Kilia arm	45 24 42	29 36 31	18	1	817000	L0450	LMR
RO07	Danube	Sulina - Sulina arm	45 9 41	29 40 25	0	1	817000	L0480	LMR
RO08	Danube	Sf.Gheorghe-Ghorghe arm	44 53 10	29 37 5	0	1	817000	L0490	LMR
RO09	/Arges	Conf. Danube	44 4 35	26 37 4	0	14	12550	L0250	M
RO10	/Siret	Conf. Danube Sendreni	45 24 10	28 1 32	0	4	42890	L0380	M
RO11	/Prut	Conf.Danube Giurgiulesti	45 28 10	28 12 36	0	5	27480	L0420	M
BG01	Danube	Novo Selo Harbour/Pristol	44 09 50 58 66	22 47 36 47 58	834	35	580100	L0730	LMR
BG02	Danube	us. Iskar - Bajkal	43 42 58	24 24 45	641	20	608820	L0780	R
BG03	Danube	Downstream Svishtov	43 37 50	25 21 11	554	16	650340	L0810	MR
BG04	Danube	us. Russe	43 48 06	25 54 45	503	12	669900	L0820	MR
BG05	Danube	Silistra/Chiciu	44 7 02	27 15 45	375	7	698600	L0850	LMR
BG06	/Iskar	Orechovitza	43 35 57	24 21 56	28	31	8370	L0930	M
BG07	/Jantra	Karantzi	43 22 42	25 40 08	12	32	6860	L0990	M
BG08	/Russ.Lom	Basarbovo	43 46 13	25 57 34	13	22	2800	L1010	M
MD01	/Prut	Lipcani	48 16 0	26 50 0	658	100	8750	L2230	L
MD03	/Prut	Conf. Danube-Giurgiulesti	45 28 10	28 12 36	0	5	27480	L2270	LMR
MD04*	/Prut	Leova	46 20 0	28 10 0	216	14	23400	L2240	L
UA01	Danube	Reni	45 28 50	28 13 34	132	4	805700	L0630	M
UA02	Danube	Vilkova-Kilia arm/Chilia arm	45 24 42	29 36 31	18	1	817000	L0690	M

Distance:	The distance in km from the mouth of the mentioned river	Sampling location in profile:
Altitude:	The mean surface water level in meters above sea level	L: Left bank
Catchment:	The area in square km, from which water drains through the station	M: Middle of river
ds.	Downstream of	R: Right bank
us.	Upstream of	
Conf.	Confluence tributary/main river	
/	Indicates tributary to river in front of the slash. No name in front of the slash means Danube	
*	Monitoring site MD04 replaces the site MD02 that was originally selected for TNMN.	

Figure 1: The Danube Stationmap TNMN



2.2. Determinands

The list of TNMN determinands for water is presented in Table 2. The minimum sampling frequency is 12 times per year for water and twice a year for biomonitoring. The definitions of levels of interest and analytical accuracy targets are given on the attached CD-ROM.

Table 2: Determinand list for water for TNMN

Determinands in Water	Unit	Minimum likely level of interest	Principal level of interest	Target Limit of Detection	Tolerance
Flow	m^3/s	-	-	-	-
Temperature	°C	-	0-25	-	0.1
Suspended Solids	mg/l	1	10	1	1 or 20%
Dissolved Oxygen	mg/l	0.5	5	0.2	0.2 or 10%
pH	-	-	7.5	-	0.1
Conductivity @ 20 °C	µS/cm	30	300	5	5 or 10%
Alkalinity	mmol/l	1	10	0.1	0.1
Ammonium (NH_4^+ -N)	mg/l	0.05	0.5	0.02	0.02 or 20%
Nitrite (NO_2^- -N)	mg/l	0.005	0.02	0.005	0.005 or 20%
Nitrate (NO_3^- -N)	mg/l	0.2	1	0.1	0.1 or 20%
Organic Nitrogen	mg/l	0.2	2	0.1	0.1 or 20%
Ortho- Phosphate (PO_4^{3-} -P)	mg/l	0.02	0.2	0.005	0.005 or 20%
Total Phosphorus	mg/l	0.05	0.5	0.01	0.01 or 20%
Sodium (Na^+)	mg/l	1	10	0.1	0.1 or 10%
Potassium (K^+)	mg/l	0.5	5	0.1	0.1 or 10%
Calcium (Ca^{2+})	mg/l	2	20	0.2	0.1 or 10%
Magnesium (Mg^{2+})	mg/l	0.5	5	0.1	0.2 or 10%
Chloride (Cl^-)	mg/l	5	50	1	1 or 10%
Sulphate (SO_4^{2-})	mg/l	5	50	5	5 or 20%
Iron (Fe)	mg/l	0.05	0.5	0.02	0.02 or 20%
Manganese (Mn)	mg/l	0.05	0.5	0.01	0.01 or 20%
Zinc (Zn)	µg/l	10	100	3	3 or 20%
Copper (Cu)	µg/l	10	100	3	3 or 20%
Chromium (Cr) - total	µg/l	10	100	3	3 or 20%
Lead (Pb)	µg/l	10	100	3	3 or 20%
Cadmium (Cd)	µg/l	1	10	0.5	0.5 or 20%
Mercury (Hg)	µg/l	1	10	0.3	0.3 or 20%
Nickel (Ni)	µg/l	10	100	3	3 or 20%
Arsenic (As)	µg/l	10	100	3	3 or 20%
Aluminium (Al)	µg/l	10	100	10	10 or 20%
BOD_5	mg/l	0.5	5	0.5	0.5 or 20%
COD_{Cr}	mg/l	10	50	10	10 or 20%
COD_{Mn}	mg/l	1	10	0.3	0.3 or 20%
DOC	mg/l	0.3	1	0.3	0.3 or 20%
Phenol index	mg/l	0.005	0.05	0.005	0.005 or 20%
Anionic active surfactants	mg/l	0.1	1	0.03	0.03 or 20%
Petroleum hydrocarbons	mg/l	0.02	0.2	0.05	0.05 or 20%
AOX	µg/l	10	100	10	10 or 20%
Lindane	µg/l	0.05	0.5	0.01	0.01 or 30%
pp'DDT	µg/l	0.05	0.5	0.01	0.01 or 30%
Atrazine	µg/l	0.1	1	0.02	0.02 or 30%
Chloroform	µg/l	0.1	1	0.02	0.02 or 30%
Carbon tetrachloride	µg/l	0.1	1	0.02	0.02 or 30%
Trichloroethylene	µg/l	0.1	1	0.02	0.02 or 30%
Tetrachloroethylene	µg/l	0.1	1	0.02	0.02 or 30%
Total Coliforms (37 °C)	10^3 CFU/100 ml	-	-	-	-
Faecal Coliforms (44 °C)	10^3 CFU/100 ml	-	-	-	-
Faecal Streptococci	10^3 CFU/100 ml	-	-	-	-

Determinands in Water	Unit	Minimum likely level of interest	Principal level of interest	Target Limit of Detection	Tolerance
Salmonella sp.	in 1 litre	-	-	-	-
Macrozoobenthos - no. of taxa	-	-	-	-	-
Macrozoobenthos - Saprobic index	-	-	-	-	-
Chlorophyll - a	µg/l	-	-	-	-

2.3. Analytical Quality Control (AQC)

The TNMN laboratories are free to choose an analytical method, providing they are able to demonstrate that the method in use meets the required performance criteria. Therefore, the minimum concentrations expected and the tolerance required of actual measurements have been defined for each determinand (as reported in Table 2), so that method compliance can be checked. In addition, a basin-wide AQC programme is regularly organized by the ICPDR.

In 2006 the AQC programme for the Danube River Basin was organized by the Institute for Water Pollution Control of VITUKI, Budapest, Hungary (QualcoDanube AQC programme). Three types of check samples were delivered to 38 laboratories in four distributions. In accordance with previous years, general parameters were measured with negligible problems in 2006; moreover, performance even improved in case of certain parameters (chloride, sulphate, potassium) as compared to 2005. A slight positive change can be observed with nutrients as well (especially nitrate and nitrite); however this group of parameters in general is somewhat more affected by systematic error. As regards to metals/heavy metals, determination definitely improved for most parameters (examples could be iron, manganese, mercury or arsenic), but in many cases stagnation or even slight deterioration (chromium) is observable in comparison with previous years. In addition, an effect of systematic or random error is still pronounced in case of several elements (e.g. aluminium, lead, copper). Similar to previous years, performance of analysis of organic micropollutants is still not satisfactory.

Detailed results of the four distributions and their evaluation have been published elsewhere (QualcoDanube, AQC in Water Analytical Laboratories in the Danube River Basin, Summary Report 2006, VITUKI, Budapest).

2.4. TNMN Data Management

The procedure of TNMN data collection is organized at a national level. The National Data Managers (NDMs) are responsible for data acquisition from TNMN laboratories as well as for data checking, conversion into an agreed data exchange file format (DEFF) and sending it to the TNMN data management centre in the Slovak Hydrometeorological Institute in Bratislava. This centre performs a secondary check of the data and uploads them into the central TNMN database. In cooperation with the ICPDR Secretariat, the TNMN data are uploaded into the ICPDR website (www.icpdr.org).

2.5. Water Quality Classification

To enable evaluation of the TNMN data, an interim water quality classification scheme was developed that exclusively serves the presentation of the current status and the assessment of trends of Danube River water quality (i.e. it is not considered as a tool for the implementation of national water policies) (Table 3).

In this classification scheme, five classes are used for the assessment, with the target value being the limit value of class II. Class I should represent reference conditions or background concentrations.

For a number of determinands, it was not possible to establish real reference values due to the existence of many types of water bodies in the Danube River Basin with natural differences in

physico-chemical characteristics. For synthetic substances, the detection limit or minimal likely level of interest was chosen as the limit value for class I. Classes III – V are on the "non-complying" side of the classification scheme and their limit values are usually two to five times the target values. They should indicate the extent of exceeding the target value and help to recognise a positive tendency in water quality development. For compliance testing, the 90-percentile value of at least 11 measurements in a particular year should be used.

Table 3: Water Quality Classification used for TNMN purposes

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	$\mu g.l^{-1}$	25	50	100	250	> 250
**Metals (dissolved) ** **						
Zinc	$\mu g.l^{-1}$	-	5	-	-	-
Copper	$\mu g.l^{-1}$	-	2	-	-	-
Chromium (Cr-III+VI)	$\mu g.l^{-1}$	-	2	-	-	-
Lead	$\mu g.l^{-1}$	-	1	-	-	-
Cadmium	$\mu g.l^{-1}$	-	0.1	-	-	-
Mercury	$\mu g.l^{-1}$	-	0.1	-	-	-
Nickel	$\mu g.l^{-1}$	-	1	-	-	-
Arsenic	$\mu g.l^{-1}$	-	1	-	-	-
Metals (total)						
Zinc	$\mu g.l^{-1}$	bg	100	200	500	> 500
Copper	$\mu g.l^{-1}$	bg	20	40	100	> 100
Chromium (Cr-III+VI)	$\mu g.l^{-1}$	bg	50	100	250	> 250
Lead	$\mu g.l^{-1}$	bg	5	10	25	> 25
Cadmium	$\mu g.l^{-1}$	bg	1	2	5	> 5
Mercury	$\mu g.l^{-1}$	bg	0.1	0.2	0.5	> 0.5
Nickel	$\mu g.l^{-1}$	bg	50	100	250	> 250
Arsenic	$\mu g.l^{-1}$	bg	5	10	25	> 25
Toxic substances						
AOX	$\mu g.l^{-1}$	10	50	100	250	> 250
Lindane	$\mu g.l^{-1}$	0.05	0.1	0.2	0.5	> 0.5
p,p´-DDT	$\mu g.l^{-1}$	0.001	0.01	0.02	0.05	> 0.05
Atrazine	$\mu g.l^{-1}$	0.02	0.1	0.2	0.5	> 0.5
Trichloromethane	$\mu g.l^{-1}$	0.02	0.6	1.2	1.8	> 1.8
Tetrachloromethane	$\mu g.l^{-1}$	0.02	1	2	5	> 5
Trichloroethene	$\mu g.l^{-1}$	0.02	1	2	5	> 5
Tetrachloroethene	$\mu g.l^{-1}$	0.02	1	2	5	> 5
Biology						
Saprobic index of macrozoobenthos	-	≤ 1.8	1.81 – 2.3	2.31 – 2.7	2.71 – 3.2	> 3.2

* values concern 10-percentile value
bg background values
** for dissolved metals only guideline values are indicated
TV target value

3. Results of basic statistical processing

77 TNMN monitoring stations were monitored in the Danube River Basin in 2006. Because some monitoring stations contain more sampling sites (usually left, middle and right side of the river), data was collected from a total of 107 sampling sites, out of which 68 are located on the Danube River and 39 on the tributaries.
The basic processing of the TNMN data includes the calculation of selected statistical characteristics and water quality classification for each determinand/monitoring site. Results are presented in tables in the Annex (see the attached CD-ROM) using the following format:

Term used	Explanation
Determinand name	name of the determinand measured according to the agreed method
Unit	unit of the determinand measured
N	number of measurements
Min	minimum value of the measurements done in the year 2006
Mean	arithmetical mean of the measurements done in the year 2006
Max	maximum value of the measurements done in the year 2006
C50	50 percentile of the measurements done in the year 2006
C90	90 percentile of the measurements done in the year 2006
Class	result of classification of the determinand

When processing the TNMN data and presenting them in the tables of the Annex, the following rules have been applied:

- *If "less than the detection limit" values were present in the dataset for a given determinand, then the value of the detection limit was used in statistical processing of the data.*
- *If the number of measurements for a particular determinand was lower than four, then only the minimum, maximum and mean are reported in the tables of the Annex.*
- *For the purposes of classification, the testing value was calculated for each determinand, which was further compared to the limit values for water quality classes given in Chapter 2.5 and a corresponding class was assigned to the determinand. The testing value is equal to 90 percentile (10 percentile for dissolved oxygen and lower limit of pH value) if the number of measurements in a year was at least eleven. If the number of measurements in a year was lower than eleven, then the testing value is represented by a maximum value from a data set (a minimum value for dissolved oxygen and lower limit of pH value).*
- *It happened in some cases that the limit of detection used by a country was higher than the limit value for class II, representing the target value. In these cases, only statistics were calculated and presented in a table, but a classification was not done.*

An indication of the water quality class for each determinand in the tables of the Annex is presented by the respective class number and highlighted by using colouring of the respective field of the table, using the colours given below:

blue	class I
green	class II
yellow	class III
orange	class IV
red	class V

- *If the number of measurements for a classified water quality determinand was lower than four in a sampling site, then the result of the classification was presented in the tables by a light blue colour to indicate a lower reliability of such results (with an exception of the saprobic index).*

As regards the agreed monitoring frequencies (12 times per year), a significant discrepancy was reported by monitoring locations in Bosnia and Herzegovina (8 times per year in 2006). Another persisting problem is the reduced monitoring frequency for certain determinands such as dissolved phosphorus, biological determinands, heavy metals and specific organic micropollutants, primarily in the lower part of the Danube River Basin.
Table 4, created on the basis of data in tables in the Annex (see attached CD-ROM), shows in an aggregated way the concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2006. These include indicators of the oxygen regime, nutrients, heavy metals, biological determinands and organic micropollutants. Table 4 also includes information about the number of monitoring locations and sampling sites providing measurements of the determinands.

* For some heavy metals in Table 4, the statistical values for dissolved form are in certain cases higher than those for the total content. The reason is that not all countries report on the dissolved metals which leads to differences in the processed statistical values.

Table 4: Concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2006

Determinand name	Unit	Danube					Tributaries				
		No.of monitoring locations / No. of monitoring sites with measurements	Range of values		Mean		No.of monitoring locations / No. of monitoring sites with measurements	Range of values		Mean	
			Min	Max	Min_{avg}	Max_{avg}		Min	Max	Min_{avg}	Max_{avg}
Temperature	°C	40/68	0.1	28.4	9.6	18.0	36/38	0.1	29.7	5.8	20.5
Suspended Solids	mg/l	40/68	< 0.5	332.0	9.2	138.2	37/39	< 1	2260.0	5.0	344.2
Dissolved Oxygen	mg/l	40/68	3.1	16.2	6.6	11.3	37/39	3.8	16.9	7.2	12.7
BOD_5	mg/l	39/67	< 0.2	16.6	1.1	10.4	35/37	< 0.2	35.5	1.2	8.3
COD_{Mn}	mg/l	40/68	1.0	34.9	2.0	19.7	27/29	3.1	108.0	3.5	41.9
COD_{Cr}	mg/l	34/62	1.0	53.0	3.5	31.3	22/24	0.5	36.0	1.7	12.7
TOC	mg/l	23/35	0.5	11.4	2.0	6.3	17/17	0.5	91.0	1.5	10.0
DOC	mg/l	12/25	1.0	7.9	2.1	7.9	14/14	0.6	14.1	1.3	8.1
pH		40/68	6.8	8.7	7.5	8.3	37/39	6.5	9.0	7.0	8.3
Alkalinity	mmol/l	36/64	2.0	5.7	3.0	4.2	30/32	1.0	9.7	1.8	7.5
Ammonium-N	mg/l	40/68	< 0.004	1.470	0.027	0.339	35/37	0.005	6.418	0.017	3.402
Nitrite-N	mg/l	40/68	< 0.002	0.273	0.010	0.068	37/39	0.001	0.405	0.003	0.069
Nitrate-N	mg/l	40/68	< 0.1	7.320	0.740	3.350	37/39	0.070	11.400	0.436	9.531
Total Nitrogen	mg/l	16/27	0.73	7.63	1.60	3.37	22/22	0.56	858.00	1.03	688.00
Organic Nitrogen	mg/l	15/23	< 0.01	2.13	0.07	1.00	24/26	< 0.01	2.63	0.10	1.41
Ortho-Phosphate-P	mg/l	39/67	< 0.003	1.480	0.029	0.197	30/32	< 0.003	0.488	0.007	0.236
Total Phosphorus	mg/l	40/68	0.010	2.080	0.046	0.486	33/35	0.013	764	0.036708	747
Total Phosphorus - Dissolved	mg/l	9/9	<0.005	0.107	0.038	0.065	10/10	< 0.005	0.288	0.011846	0.12
Chlorophyll-a	µg/l	32/60	0.02	104.0	0.7	24.8	11/13	1.2	152.0	2.2	43.6
Conductivity @ 20°C	µS/cm	38/66	219	678	368	511	35/37	148	1999	251	965
Calcium	mg/l	40/68	27.1	87.0	47.1	79.8	35/37	25.6	130.0	38.7	98.1
Sulphates	mg/l	38/66	5.4	98.8	18.3	59.1	31/33	1.1	252.0	11.6	160.0
Magnesium	mg/l	40/68	1.4	70.9	11.3	36.4	37/39	5.4	86.0	9.3	70.8
Potassium	mg/l	37/65	0.8	11.4	1.6	4.0	31/33	0.4	14	0.9125	10.1167
Sodium	mg/l	39/67	1.9	177.5	11.2	45.3	30/32	2.4	83.0	5.9	72.1
Manganese	mg/l	22/38	< 0.00001	0.585	0.009	0.082	21/21	< 0.001	8.000	0.012	1.094
Iron	mg/l	23/39	< 0.010	7.340	0.087	0.953	20/20	0.010	17.000	0.288	3.374
Chlorides	mg/l	39/67	4.7	83.9	18.4	39.9	31/33	0.5	100.9	6.2	62.5
Macrozoobenthos- saprobic index		6/6	2.0	4.9	2.0	4.8	5/5	1.2	2.6	1.5	2.4
Macrozoobenthos - no.of taxa		4/4	26	44	26	44	11/11	2.0	68.0	2.3	62.5

Table 4: Concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2006 (cont.)

Determinand name	Unit	Danube					Tributaries				
		No.of monitoring locations / No. of monitoring sites with measurements	Range of values		Mean		No.of monitoring locations / No. of monitoring sites with measurements	Range of values		Mean	
			Min	Max	Min_{avg}	Max_{avg}		Min	Max	Min_{avg}	Max_{avg}
Zinc - Dissolved *	µg/l	31/53	< 0.8	600.0	1.3	144.2	29/31	< 1.0	90.0	2.0	34.0
Copper - Dissolved	µg/l	29/52	< 0.5	200.00	0.96	29.00	29/31	< 0.046	58.00	0.873	29.00
Chromium - Dissolved	µg/l	29/52	< 0.2	< 20	< 0.2	< 20	29/31	0.19	14.56	0.23	5.70
Lead - Dissolved	µg/l	31/53	0.10	7.50	0.67	7.50	24/26	0.17	25.00	0.50	6.40
Cadmium - Dissolved	µg/l	30/52	< 0.036	5.00	< 0.05	5.00	17/19	< 0.03	10	0.05	0.95
Mercury - Dissolved	µg/l	30/52	< 0.025	1.100	0.039	0.233	21/23	< 0.005	3.1	0.0627	0.36382
Nickel - Dissolved	µg/l	31/53	0.45	64.00	0.72	9.63	24/26	< 0.4	87	1	6.95
Arsenic - Dissolved	µg/l	31/53	0.23	9.00	0.23	2.61	21/23	0.16	9.00	0.16	5.38
Aluminium - Dissolved	µg/l	12/20	< 5	96.0	11.4	63.4	11/13	< 3.0	88.0	5.0	78.8
Zinc *	µg/l	24/46	< 0.8	118.0	3.5	33.5	22/24	< 1.0	152.0	10.2	59.8
Copper	µg/l	27/46	< 0.7	103.00	1.00	23.50	26/28	< 0.5	66.60	1.23	31.92
Chromium - total	µg/l	24/44	< 0.001	40.00	0.27	10.00	22/24	0.20	36.50	0.23	10.00
Lead	µg/l	23/44	< 0.05	107.00	0.14	9.60	17/19	< 0.5	19.00	0.98	6.40
Cadmium	µg/l	20/42	< 0.036	7.50	< 0.05	1.50	24/26	< 0.03	3.40	0.05	1.56
Mercury	µg/l	18/35	< 0.01	1.700	0.040	0.358	23/25	< 0.01	7.000	0.022	2.200
Nickel	µg/l	33/44	< 0.1	43.00	0.60	9.00	27/29	< 0.004	83.240	0.052	29.438
Arsenic	µg/l	21/48	0.04	5.00	0.26	2.90	14/16	0.10	9.00	0.52	6.71
Aluminium	µg/l	14/32	< 20	1792.0	26.0	406.3	12/14	8.5	3900.0	35.4	1835.0
Phenol index	mg/l	36/62	< 0.001	0.084	< 0.001	< 0.020	27/29	< 0.0008	0.013	0.001	0.0065
Anionic active surfactants	mg/l	38/66	< 0.006	0.126	< 0.010	0.058	27/29	< 0.006	0.236	0.01	0.12433
AOX	µg/l	17/33	4.9	69.0	9.9	22.4	7/7	<10	137	10	63.1
Petroleum hydrocarbons	mg/l	36/64	< 0.002	0.800	< 0.005	0.317	27/29	< 0.002	20.080	0.005	19.525
PAH (sum of 6)	µg/l	0/0					2/2	0.008	0.103	0.016	0.034
PCB (sum of 7)	µg/l	0/0					2/2	< 0.002	0.004	< 0.002	0.002
Lindane	µg/l	29/56	< 0.001	4.520	< 0.001	0.378	29/29	< 0.0005	< 0.1	< 0.0005	< 0.1
pp´DDT	µg/l	27/59	< 0.001	1.300	< 0.001	0.110	28/28	< 0.00005	0.08	< 0.00005	0.05
Atrazine	µg/l	33/58	< 0.001	0.500	0.006	0.500	20/20	0.007	0.5	0.009	0.5
Chloroform	µg/l	25/49	< 0.01	542.14	0.02	42.51	11/13	< 0.01	4.00	0.02	2.90
Carbon tetrachloride	µg/l	22/51	< 0.01	< 1.2	< 0.01	< 1.2	12/12	< 0.01	1.20	0.01	1.20
Trichloroethylene	µg/l	22/50	< 0.01	< 1.7	< 0.02	< 1.7	12/12	< 0.01	< 1.7	< 0.01	< 1.7
Tetrachloroethylene	µg/l	22/50	< 0.01	< 2.1	< 0.02	< 2.1	12/12	< 0.01	< 2.1	< 0.02	< 2.1
Total Coliforms (37°C)	10^3 CFU/ 100 ml	26/54	0.02	750.00	0.36	287.50	15/17	0.40	3800.00	2.05	747.91
Faecal Coliforms (44°C)	10^3 CFU/ 100 ml	18/40	0.009	240.00	0.07	41.77	14/16	0.07	400.00	0.82	137.04
Faecal Streptococci	10^3 CFU/ 100 ml	23/51	0.001	35.00	0.009	7.14	15/17	0.02	325.00	0.13	52.95

4. Presentation of classification results

The maps presented in Figures 2 – 12 show water quality classes at TNMN monitoring locations. The locations in the Danube River and those located in tributaries are differentiated by various marks. The spot indicating water quality class on a map is of a smaller size in case the classification result in a location is based on a number of measurements lower than eleven. If there were data from more sampling sites (i.e. left, middle, right) at one monitoring location, then only the data from the middle of a river are presented in the maps.
From this classification, the following conclusions may be drawn:
The dissolved oxygen content in water can be affected by human activities in both directions – a decrease from normal levels is a result of pollution by degradable organic matter, and an increase can be associated with eutrophication processes. In 2006, 90 % of all locations in the Danube River fell into class I and class II. This is more than in 2005, when 85 % of all locations in the Danube fell into in classes I and II. The situation is similar as in 2005, when no monitoring points in any tributaries were classified in classes IV and V.

BOD_5 is used as an indicator of biodegradable organic pollution in waters. The share of locations satisfying the target value for BOD5 in 2006 is 95 % of the locations in the Danube River which corresponds to classes I and II. This is more than in 2005. Regarding locations in tributaries, 71 % could be classified as classes I and II while class III included 18 % of all locations.

For COD_{Cr} *(characterizes the presence of oxidizable organic compounds in waters)* in 2006, 68 % of the locations in the Danube River and 50 % of the locations in tributaries were in classes I and II. The results of the classification are similar to the situation in the year 2005. For 19 % of the monitoring locations, no COD_{Cr} data were available.

In 2006, concentrations of ammonium-N corresponded to classes I and II in 68 % of the locations in the Danube River and 45 % of the locations in tributaries. It is the same situation for the Danube as in the year 2005, while for tributaries it is worse than in 2005.

The compliance for nitrate-N does not change significantly in the Danube River over recent years. In 2006, one site on the Danube was classified as class I while class II was observed in 68 % of locations. Non-compliance with the target value was observed in 35 % of sites.

Regarding ortho-phosphate-P, the situation in the Danube River is comparable to the years 2005 and 2006, with 88 % of the locations satisfy the target value (in 2005 it was 75 %). The situation of ortho-phosphate-P in the tributaries in the year 2006 is somewhat better than in 2005, with 53 % sites corresponding to classes I and II, 18 % to class III, and 11 % to class IV.

In 2006, for the deteminand Ptotal, 60 % of the locations in the Danube River corresponded to classes I and II, while class III was represented by 38 %. Class IV was represented in 3 % of

the Danube River locations. Tributaries indicate a worsening quality. The target value was satisfied in only 37 % of all locations.
The concentration of chlorophyll-a is an indicator of primary production and is closely related to nutrient content in the river. This determinand is especially important in slow-flowing lowland rivers, but the TNMN still does not possess related information in 37 % of its locations. Nonetheless, classes I and II were observed in 80 % of the measured sites in the Danube River and 34 % of the sites in tributaries. Only classes I and II were observed in the Danube River in 2006.

Similar data gaps can be seen for heavy metals. In 2006, the data on cadmium, chromium, copper, zinc, nickel and lead concentrations in the Danube River were missing for about one third of the locations, while concentration data for mercury and arsenic were not available for 40 % and 53 % of the locations, respectively. The percentage of missing data for heavy metals in the tributaries is even higher.
In the Danube River, from the available data on heavy metals, class II was achieved in the following percentage of TNMN locations: 43 % for cadmium, 55 % for copper, 63 % for zinc, 33 % for mercury, 60 % for arsenic, 40 % for lead, 70 % for chromium and 60 % for nickel.
Regarding tributaries, the percentage satisfying the target value represented by class II is the following: 40 % for cadmium, 42 % for mercury, 58 % for chromium, 55 % for copper, 60 % for zinc, 66 % for nickel, 34 % for arsenic and 55 % for lead.
The situation is similar to results observed in the Danube River and its tributaries in 2005.

As regards the organic micropollutants, the target value for p,p-DDT was achieved at 43 % of the locations in the Danube River and 50 % of the locations in tributaries. In 2006, 42 % of all TNMN locations are without p,p-DDT data. A similar situation was observed in the year 2005.

On the basis of available information, it can be concluded that in the case of atrazine, 60 % of all locations corresponded to classes I – II, none fell into class III and 23 % were in class IV in the Danube River. For 18 % of the sites on the Danube, data were not available. In 2006, the percentage of tributary locations with no atrazine measurements was 50 %. In the tributaries, the atrazine levels at 42 % of all locations corresponded to classes I and II, and 8 % to class IV.

More detailed results of classification of TNMN data in 2006 are shown in the full version of the TNMN Yearbook on the attached CD-ROM.

Figure 2: The classification of Dissolved Oxygen in 2006

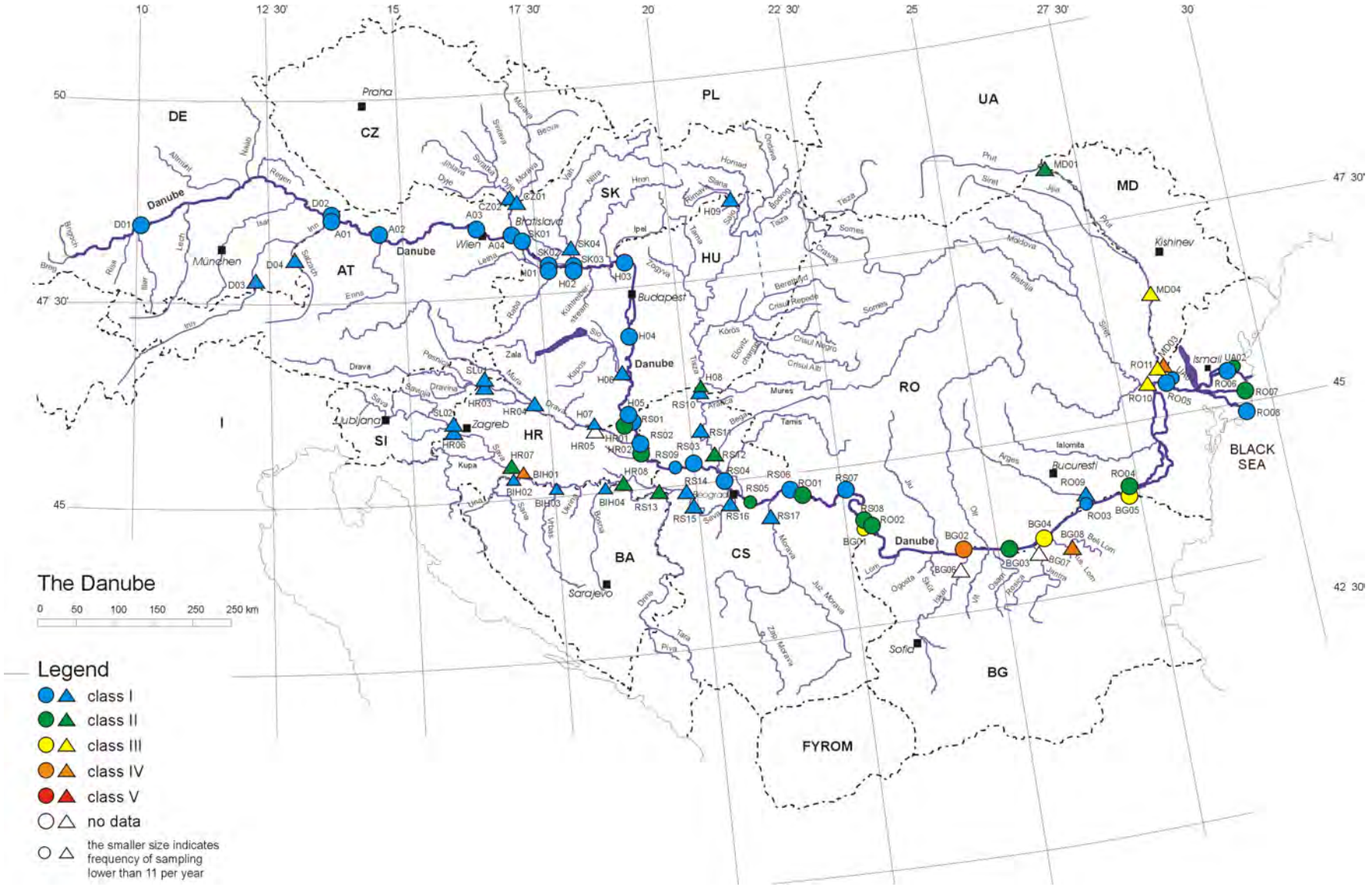


Figure 3: The classification of BOD_5 in 2006

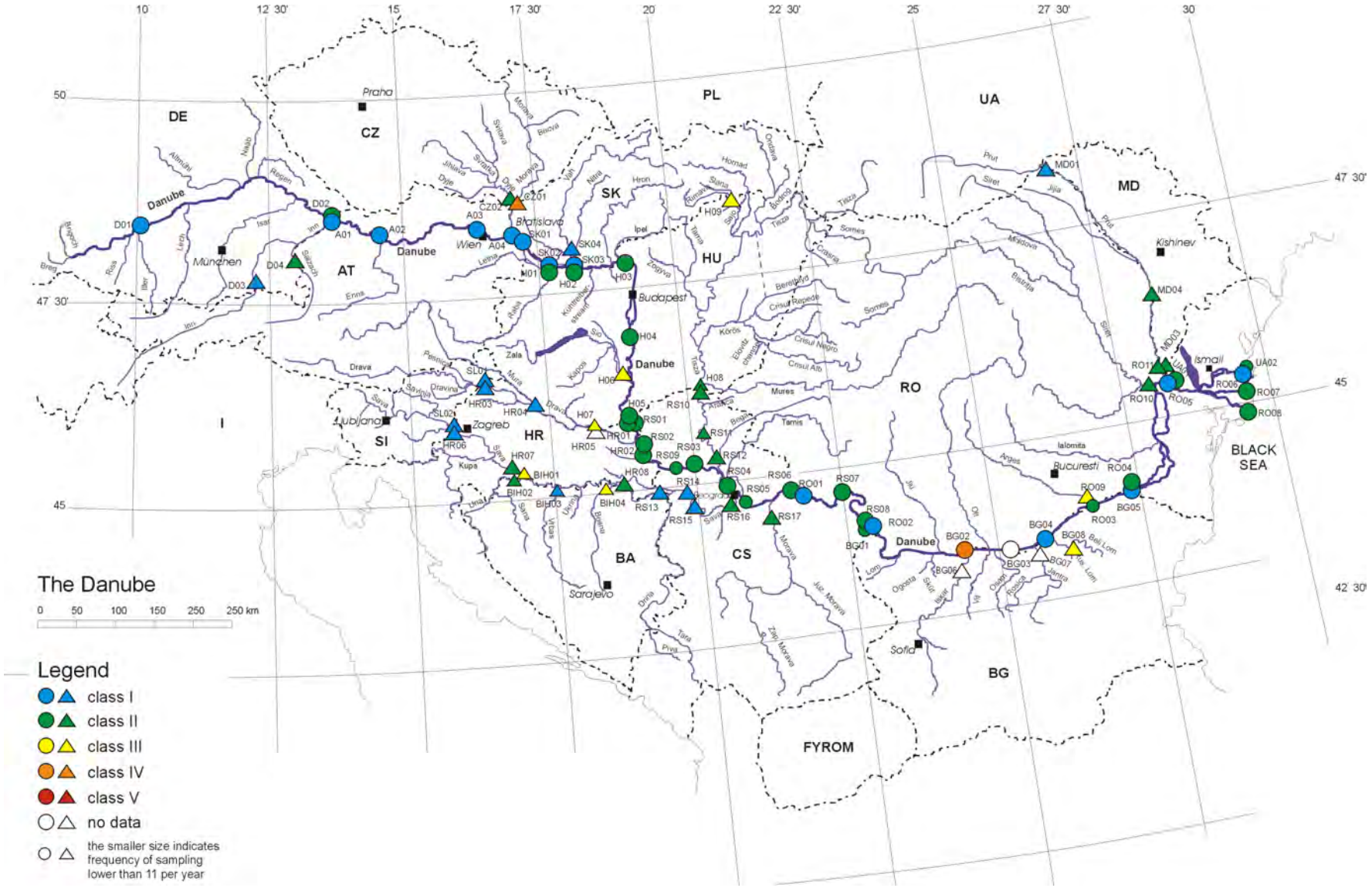


Figure 4: The classification of COD_{Cr} in 2006

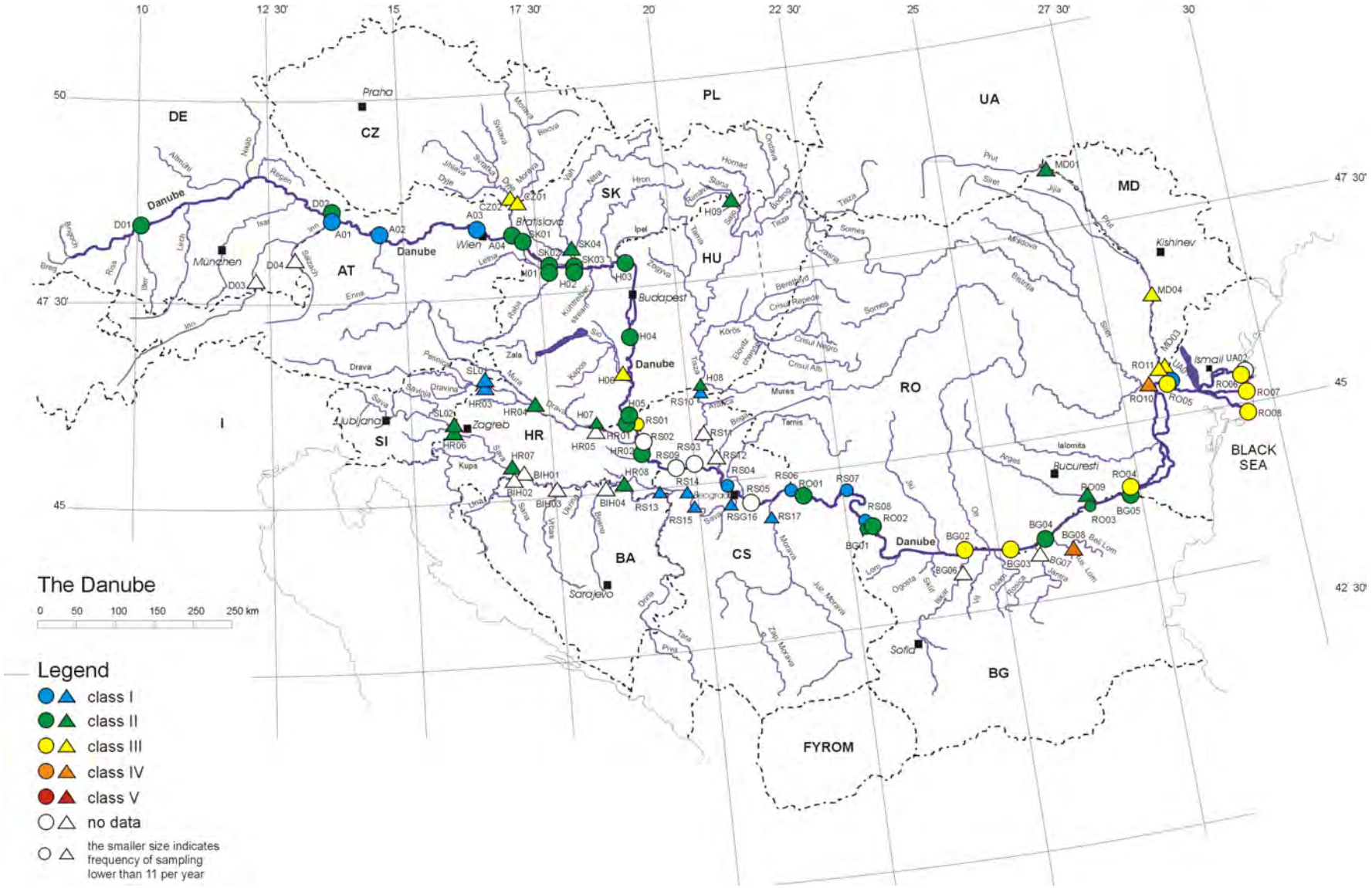


Figure 5: The classification of NH^{+}_{4}-N in 2006

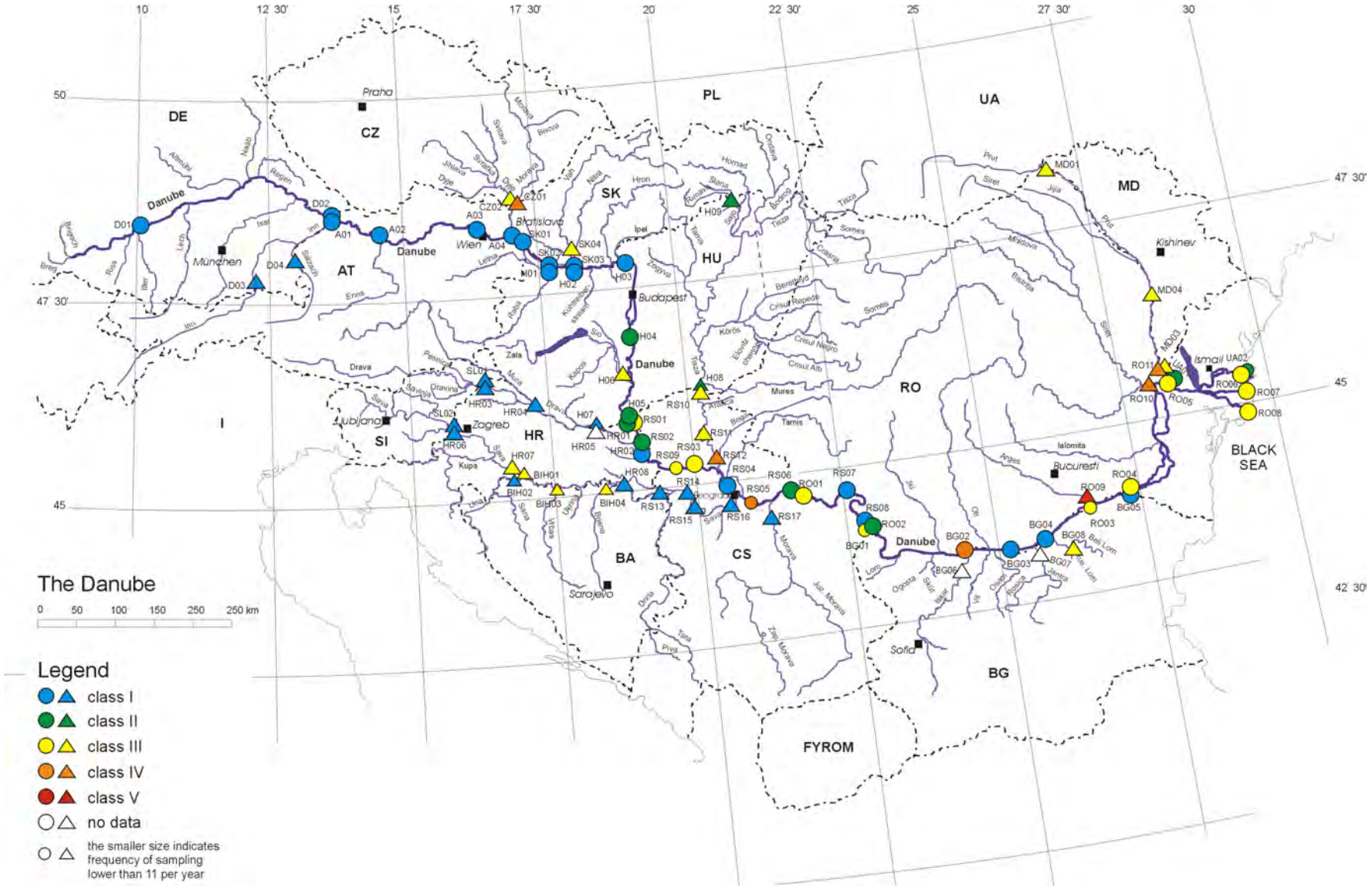


Figure 6: The classification of NO^-_3-N in 2006

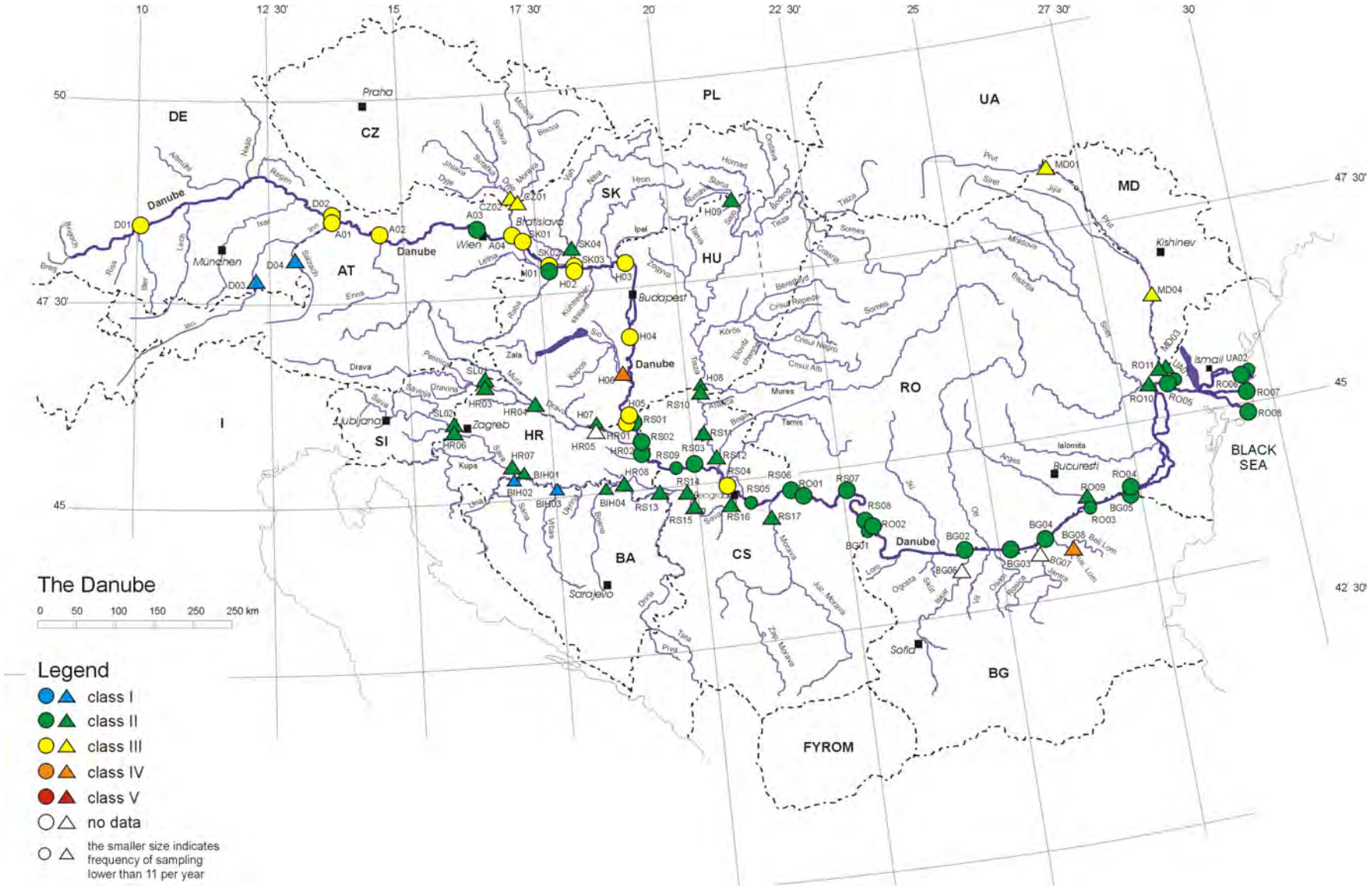


Figure 7: The classification of Ortho-Phosphate-P in 2006

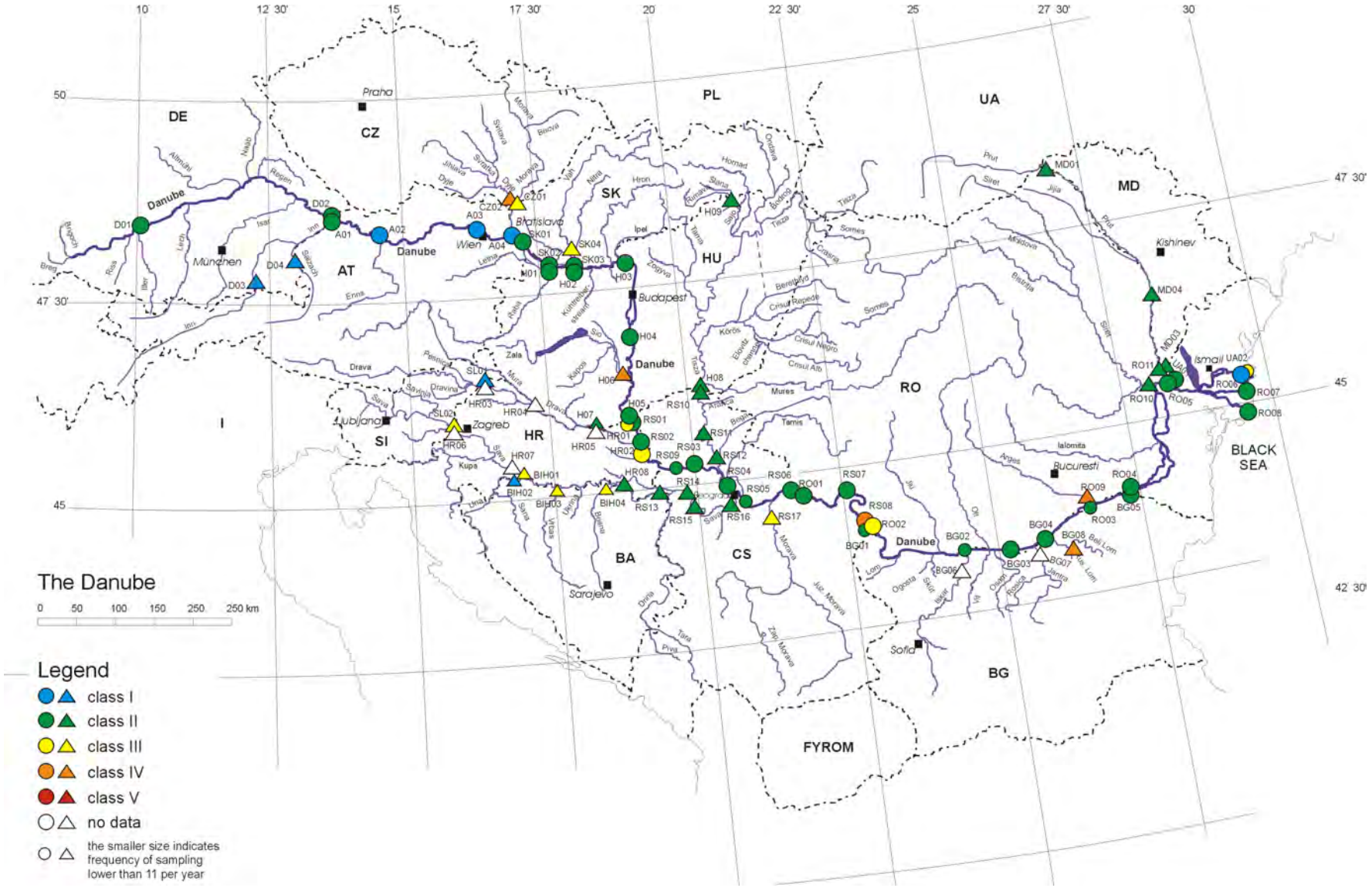


Figure 8: The classification of Total Phosphorus in 2006

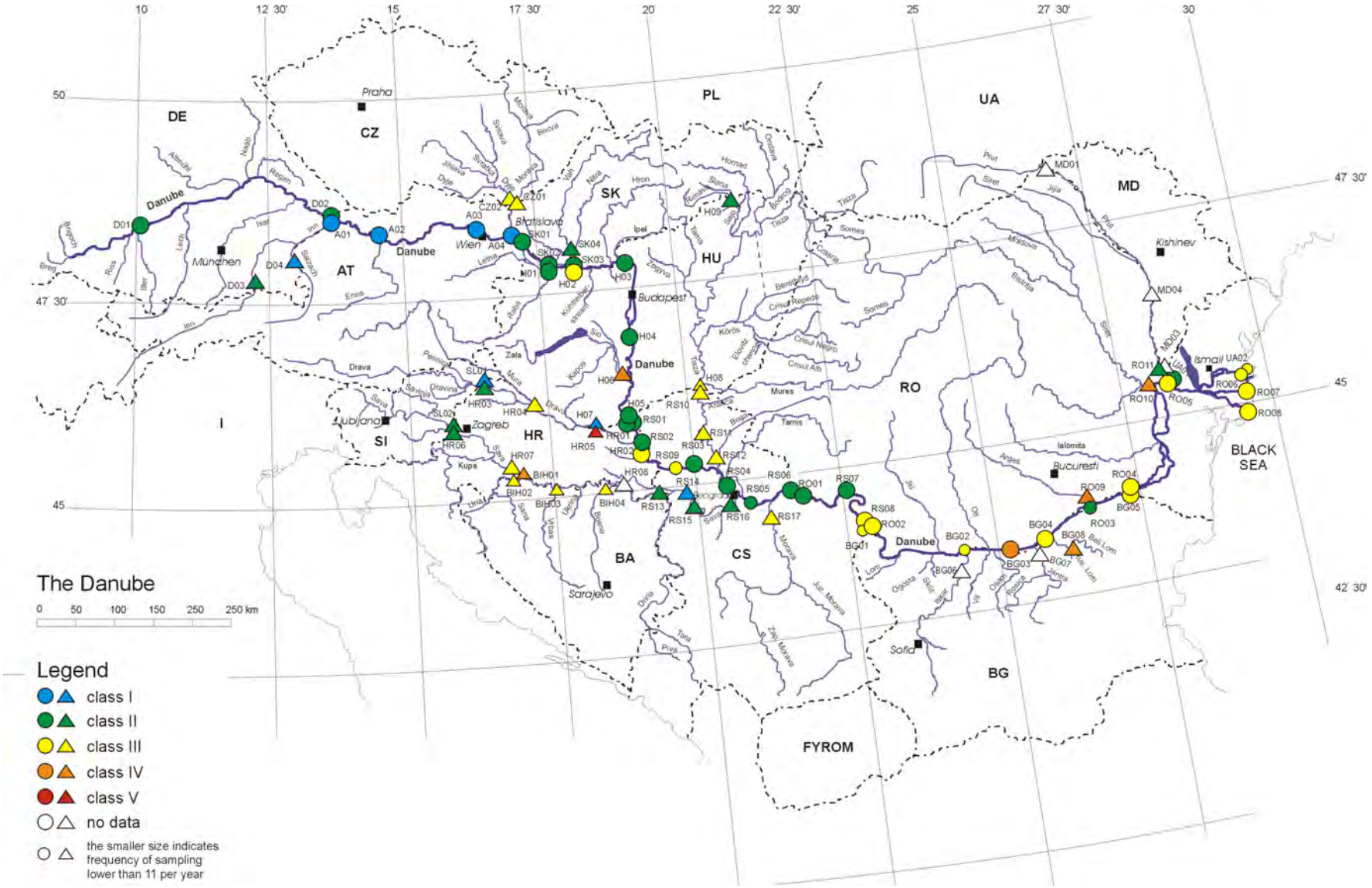


Figure 9: The classification of Chlorophyll-a in 2006

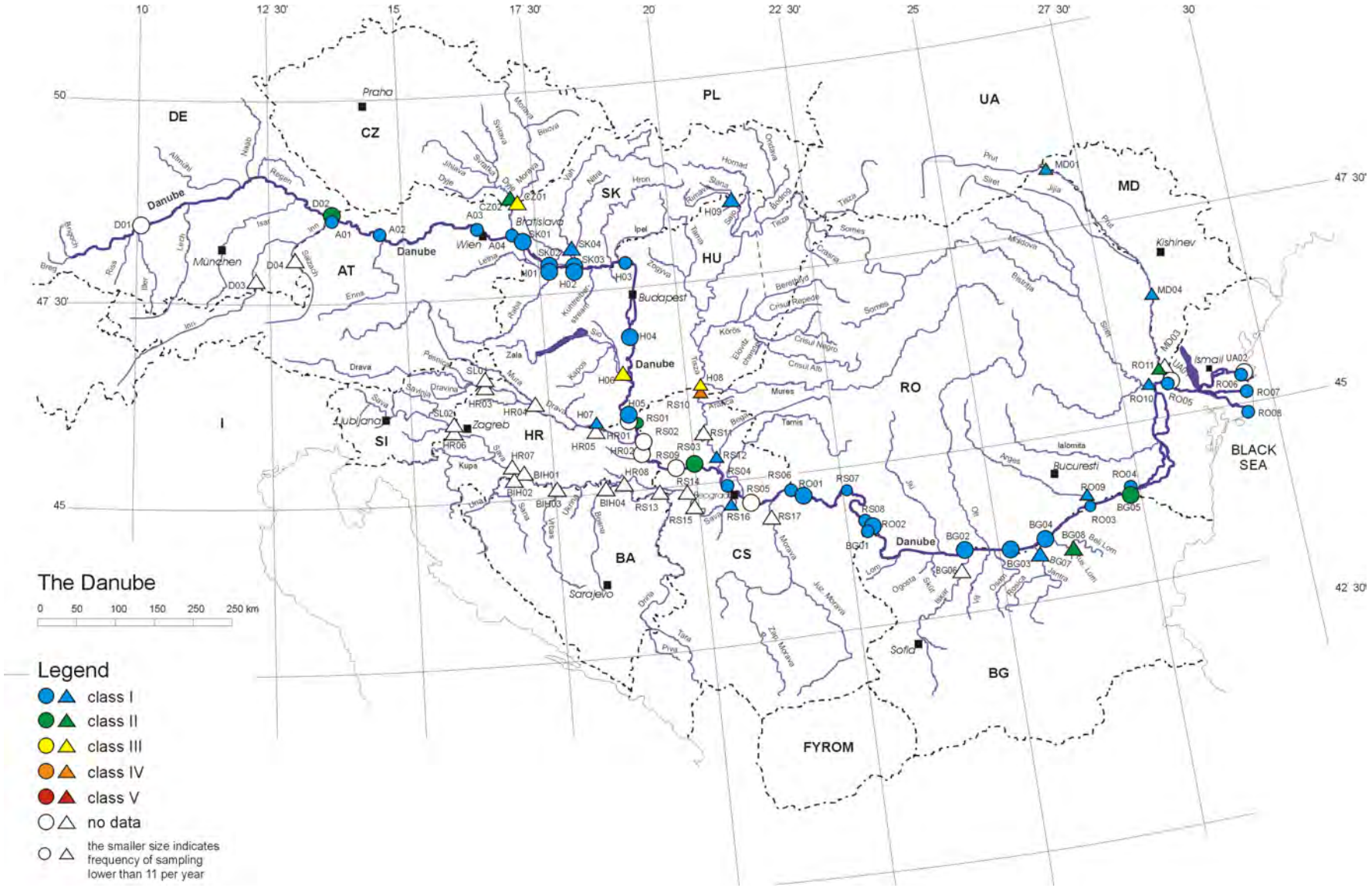


Figure 10: The classification of Cd in 2006

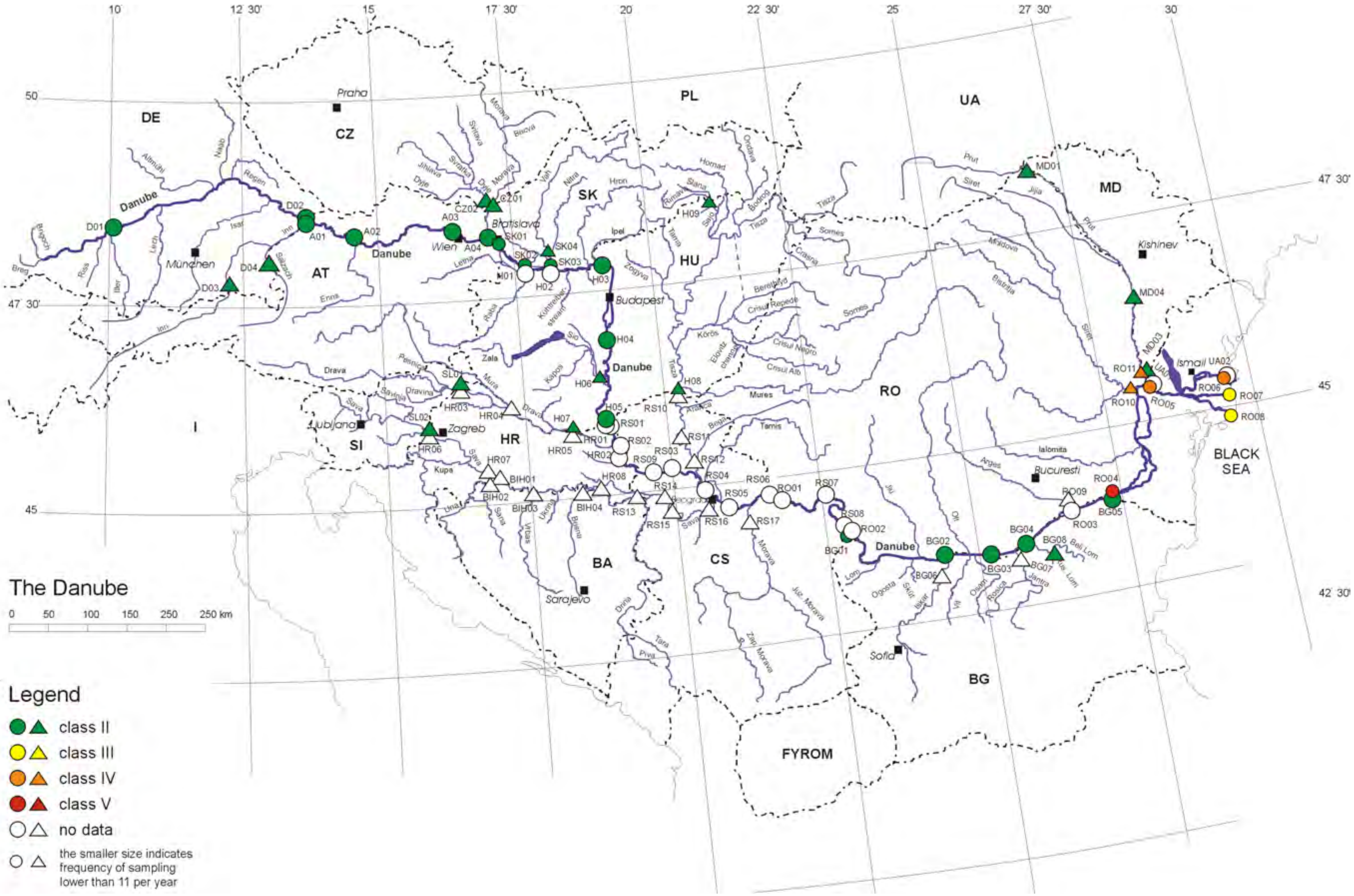


Figure 11: The classification of p,p' DDT in 2006

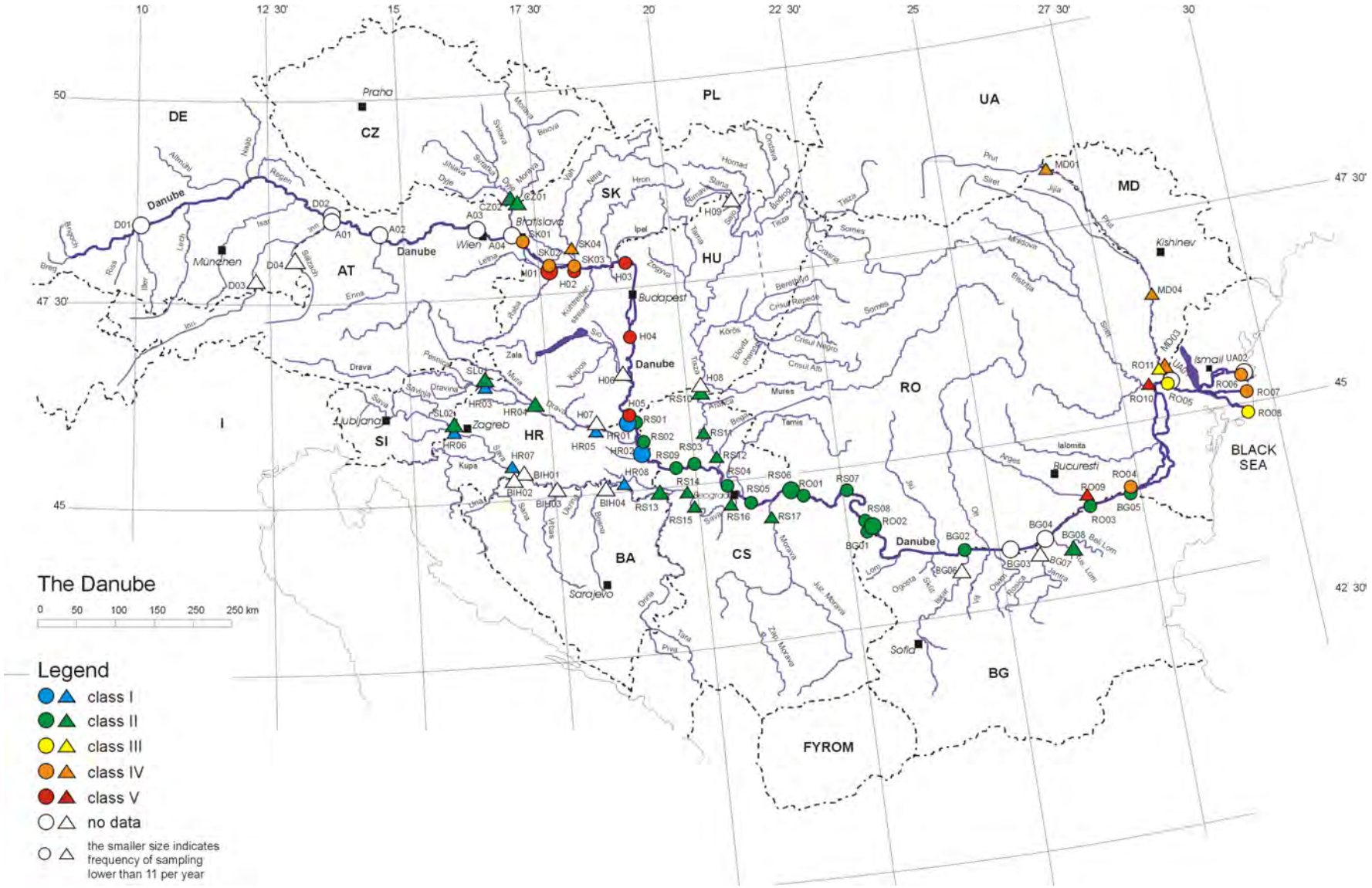


Figure 12: The classification of Atrazine in 2006

5. Profiles and trend assessment of selected determinands

Regarding the spatial pattern of water quality along the Danube River in 2006, the highest content of biodegradable organic matter was observed in the middle and lower part of the river, while ammonium-N, ortho-phosphate P, total P and cadmium reached their highest values in the lower part of the Danube. The concentration of nitrate-N was higher in the upper part of the river.
The most polluted tributaries, from the point of view of biodegradable organic matter in 2006, were the Russenski Lom, Sio, Morava, Drava Tizsa and Sajo. A number of tributaries were found polluted by nutrients in 2006 – Prut, Arges, Russenski Lom and Sio.

Positive changes in water quality can be seen at several TNMN locations. Taking into account the entire period of TNMN operations, a decrease of biodegradable organic pollution is visible in the upper parts and in some parts of the lower Danube in Bulgarian and Romanian sections (Bazias, Pristol, Reni and mouth). The tributaries Dyje, Inn, Sava, Arges, Siret, Sio and Vah also show a decreasing tendency in pollution. The tributaries Morava, Sajo and Drava (HR04, H07) showed an increasing trend in year the 2006.
As for nutrients, ammonium-N was observed to decrease in locations in the upper part of the Danube River down to (H04). During the entire period of TNMN operation, ammonium also decreased in the upper Danube tributaries down to the river Vah (Inn, Salzach, Morava, Dyje) and in the Sava, Arges and Siret rivers.

The level of nitrate-N concentrations is rather stable during the last years, however it decreased in several locations in the upper and middle parts of the Danube River. Among tributaries nitrate-N has a decreasing tendency in the Dyje, Vah, Tisza/Sajo, Sio, Sava, Arges and Siret.

Decreasing tendency of ortho-phosphate-P concentrations was prevailing in 2006. Similar pattern was observed also in tributaries such as the Morava, Dyje, Vah, Sio, Siret and Russenski Lom. In the Arges River, however, ortho-phosphate-P concentrations increased slightly in the year 2006. P-total concentrations had also a decreasing tendency during the last years in the upper part of the Danube River.

The cadmium concentration has a decreasing or stable trend in the Danube River as well as in its tributaries. The results for cadmium are improved during the last years.

A more detailed description of the water quality along the Danube River and in the main tributaries including the respective figures is given in the full version of the TNMN Yearbook on the attached CD-ROM.

6. Load Assessment

6.1. Introduction

The long-term development of loads of relevant determinands in the important rivers of the Danube Basin is one of the major objectives of the TNMN. This is why the load assessment programme in the Danube River Basin started in 2000. For the calculation of loads, a commonly agreed standard operational procedure is used.

6.2. Description of load assessment procedure

The following principles have been agreed for the load assessment procedure:

- *Load is calculated for the following determinands: BOD_5, inorganic nitrogen, ortho-phosphate-phosphorus, dissolved phosphorus, total phosphorus, suspended solids and - on a voluntary basis - chlorides; based on the agreement with the Black Sea Commission, silicates are measured at the Romanian load assessment sites since 2004;*
- *The minimum sampling frequency at sampling sites selected for load calculation is set at 24 per year;*
- *The load calculation is processed according to the procedure recommended by the Project "Transboundary assessment of pollution loads and trends" and described in Chapter 6.4. Additionally, countries can calculate annual load by using their national calculation methods, results of which would be presented together with data prepared on the basis of the agreed method;*
- *Countries should select for load assessment those TNMN monitoring sites for which valid flow data is available (see Table 5).*

Table 5 shows TNMN monitoring locations selected for the load assessment programme. It also provides information about hydrological stations collecting flow data for load assessment. Altogether 21 monitoring locations from nine countries are included in the list. Two locations – Danube-Jochenstein and Sava-Jesenice – have been included by two neighbouring countries, therefore the actual number of locations is 19, with ten locations on the Danube River itself and nine locations on the tributaries.

6.3. Monitoring Data in 2006

The monitoring frequency is an important factor for the assessment of pollution loads in water courses. Table 6 shows the number of measurements of flow and water quality determinands in the TNMN load assessment sites.

In 2006 there were seven measurements for load assessment available from Ukraine; this enabled a rough calculation of loads. These are shown in tables 7 and 9. Flow data are missing from two Croatian monitoring locations and one Hungarian location. In most of the locations, the number of samples was higher than 20; a frequency of 12 times per year was applied only in Morava, Dyje and Danube-Jochenstein (A01). However, as the loads in the Danube at Jochenstein are being assessed on the basis of combined data from Germany and Austria, there is no problem with insufficient frequency there.

The second location that could potentially be processed by using combined data from two countries is Sava-Jesenice, but this approach was not applied there due to the different

methods of measurements used for some determinands, leading to differences in results. In addition, Croatia does not have flow data for this monitoring location. Regarding particular determinands, there is still a lack of data on dissolved phosphorus as it was measured in four locations only. At Reni the silicate load was calculated to respond to the agreements with the Black Sea Commission.

Table 5: List of TNMN locations selected for load assessment program

Country	River	Water quality monitoring location			Hydrological station	
		Country Code	Location	Distance from mouth (Km)	Location	Distance from mouth (Km)
Germany	Danube	D02	Jochenstein	2204	Achleiten	2223
Germany	Inn	D03	Kirchdorf	195	Oberaudorf	211
Germany	Inn/Salzach	D04	Laufen	47	Laufen	47
Austria	Danube	A01	Jochenstein	2204	Aschach	2163
Austria	Danube	A04	Wolfsthal	1874	Hainburg (Danube) Angern (March)	1884 32
Czech Republic	Morava	CZ01	Lanzhot	79	Lanzhot	79
Czech Republic	Morava/Dyje	CZ02	Pohansko	17	Breclav-Ladná	32,3
Slovak Republic	Danube	SK01	Bratislava	1869	Bratislava	1869
Hungary	Danube	H03	Szob	1708	Nagymaros	1695
Hungary	Danube	H05	Hercegszántó	1435	Mohács	1447
Hungary	Tisza	H08	Tiszasziget	163	Szeged	174
Croatia	Danube	HR02	Borovo	1337	Borovo	1337
Croatia	Sava	HR06	Jesenice	729	Jesenice	729
Croatia	Sava	HR07	Una Jesenovac	525	Una Jesenovac	525
Croatia	Sava	HR08	Zupanja	254	Zupanja	254
Slovenia	Drava	SI01	Ormoz	300	Borl HE Formin Pesnica-Zamusani	325 311 10.1(to the Drava)
Slovenia	Sava	SI02	Jesenice	729	Catez Sotla -Rakovec	737 8.1 (to the Sotla)
Romania	Danube	RO 02	Pristol-Novo Selo	834	Gruia	858
Romania	Danube	RO 04	Chiciu-Silistra	375	Chiciu	379
Romania	Danube	RO 05	Reni	132	Isaccea	101
Ukraine	Danube	UA02	Vilkova-Kilia arm	18		

6.4. Calculation Procedure

Regarding several sampling sites in the profile, the average concentration at a site is calculated for each sampling day. In case of values "below the limit of detection", the value of the limit of detection is used in the further calculation. The average monthly concentrations are calculated according to the formula:

$$C_m\ [mg.l^{-1}] = \frac{\sum_{i \in m} C_i\ [mg.l^{-1}] \cdot Q_i\ [m^3.s^{-1}]}{\sum_{i \in m} Q_i\ [m^3.s^{-1}]}$$

where C_m average monthly concentrations
C_i concentrations in the sampling days of each month
Q_i discharges in the sampling days of each month

The monthly load is calculated by using the formula:

$$L_m\ [tones] = C_m\ [mg.l^{-1}] \cdot Q_m\ [m^3.s^{-1}] \cdot days\ (m) \cdot 0{,}0864$$

where L_m monthly load
Q_m average monthly discharge

- *If discharges are available only for the sampling days, then Q_m is calculated from those discharges.*
- *For months without measured values, the average of the products $C_m.Q_m$ in the months with sampling days is used.*

The annual load is calculated as the sum of the monthly loads:

$$L_a\ [tones] = \sum_{m=1}^{12} L_m\ [tones]$$

Table 6: Number of measurements in TNMN locations selected for assessment of pollution load in 2006

Country Code	River	Location	Location in profile	River Km	Number of meausrements in 2006								
					Q	SS	N_{inorg}	$P\text{-}PO_4$	P_{total}	BOD_5	Cl	P_{diss}	SiO_2
D02	Danube	Jochenstein	M	2204	365	26	26	26	26	26	26	11	0
D03	Inn	Kirchdorf	M	195	365	20	25	25	25	26	25	18	0
D04	Inn/Salzach	Laufen	L	47	365	26	26	26	26	26	26	26	0
A01	Danube	Jochenstein	M	2204	365	12	12	12	12	12	12	12	0
A04	Danube	Hainburg	R	1879	365	24	24	24	24	24	24	24	0
CZ01	Morava	Lanzhot	M	79	365	12	12	12	12	12	12	0	0
CZ02	Morava/Dyje	Pohansko	M	17	365	12	12	12	12	12	12	0	0
SK01	Danube	Bratislava	M	1869	365	25	25	12	25	25	25	12	0
H03	Danube	Szob	L	1708		25	25	25	25	25	24	0	0
			M	1708	365	23	23	23	23	23	22	0	0
			R	1708		25	25	25	25	25	25	0	0
H05	Danube	Hercegszántó	M	1435	0	11	12	12	12	12	12	0	0
H08	Tisza	Tiszasziget	L	163		12	12	12	12	9	11	0	0
			M	163	365	9	10	11	10	7	10	0	0
			R	163		12	12	12	12	8	12	0	0
HR02	Danube	Borovo	R	1337	0	26	26	0	26	26	0	0	0
HR06	Sava	Jesenice/D	L	729	0	25	25	0	25	25	12	0	0
HR07	Sava	us Una Jesenovac	L	525	365	25	25	0	25	25	12	0	0
HR08	Sava	ds Zupanja	R	254	365	25	25	0	25	25	12	0	0
SI01	Drava	Ormoz	L	300	365	24	24	24	24	24	24	0	0
SI02	Sava	Jesenice	R	729	365	24	24	24	24	24	24	0	0
RO02	Danube	Pristol-Novo Selo	L	834		21	21	21	21	21	21	0	19
			M	834	365	20	20	20	20	20	20	0	17
			R	834		20	20	20	20	20	20	0	16
RO04	Danube	Chiciu-Silistra	L	375		22	22	22	21	21	12	0	23
			M	375	365	22	22	22	21	21	12	0	23
			R	375		22	22	22	21	21	12	0	23
RO05	Danube	Reni	L	132		24	24	24	22	22	18	0	24
			M	132	365	24	24	24	22	22	18	0	24
			R	132		24	24	24	22	22	18	0	24
UA02	Danube	Vilkova-Kilia arm	M	18	365	7	7	7	7	7	7	0	0

6.5. Results

The mean annual concentrations and annual loads of suspended solids, inorganic nitrogen, ortho-phosphate-phosphorus, total phosphorus, BOD_5, chlorides and – where available – dissolved phosphorus and silicates - are presented in tables 7 to 10, separately for monitoring locations on the Danube River and for monitoring locations on tributaries. The explanation of terms used in the tables 7 to 10 is as follows.

Term used	Explanation
Station Code	TNMN monitoring location code
Profile	location of sampling site in profile (L-left, M-middle, R-right)
River Name	name of river
Location	name of monitoring location
River km	distance to mouth of the river
Q_a	mean annual discharge in the year 2006
c_{mean}	arithmetical mean of the concentrations in the year 2006
Annual Load	annual load of given determinand in the year 2006

Table 11 shows loads of other determinands (nitrogen forms and heavy metals) at the profile Reni, which are monitored since 2005 based on the agreement with the Black Sea Commission.
The mean annual discharge was similar in 2006 and 2005. There are no significant differences in discharges measured in the Danube River and in tributaries during these two years.

A higher annual load of suspended solids was observed in comparison to that in 2005 only in Jochenstein. The rest of the annual load values were similar as in 2005.
The spatial pattern of the annual load along the Danube River is similar to the previous year. In the case of suspended solids, inorganic nitrogen, P-total and chlorides, the highest load is observed in the lower part of the Danube River, reaching a maximum at monitoring location Danube-Reni (RO05). The maximum ortho-phosphate load was found at the location Danube-Pristol-Novo Selo (RO02), and the maximum BOD_5 load was found at Danube-Chiciu-Silistra (RO04).
In the case of tributaries, the highest load of suspended solids, nutrients and chlorides is coming from the Tisza River. The maximum BOD_5 amount is coming from the Sava River.

Table 7: Mean annual concentrations in monitoring locations selected for load assessment on Danube River in 2006

Station Code	Profile	River Name	Location	River km	Q_a	c_{mean}							
						Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phosphorus	BOD_5	Chlorides	Phosphorus - dissolved	Silicates
					($m^3.s^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)
D02 +A01	M	Danube	Jochenstein	2204	1396	35.54	2.25	0.03	0.08	1.90	19.76	0.04	
A04	R	Danube	Hainburg	1879	2183	27.01	2.17	0.03	0.05	1.38	20.01	0.04	
SK01	M	Danube	Bratislava	1869	2186	41.24	2.25	0.05	0.09	1.22	21.05	0.05	
H03	LMR	Danube	Szob	1708	2503	19.893	2.953	0.049	0.088	3.155	24.544		
H05	M	Danube	Hercegszántó	1435		7.00	0.48	0.03	0.09	3.47	24.59		
HR02	R	Danube	Borovo	1337		38.19	2.07		0.11	3.383			
RO02	LMR	Danube	Pristol-Novo Selo	834	6616	29.65	1.31	0.06	0.12	1.74	21.06		6.06
RO04	LMR	Danube	Chiciu-Silistra	375	7370	41.44	1.53	0.04	0.11	2.52	30.60		5.76
RO05	LMR	Danube	Reni	132	8428	48.01	1.67	0.03	0.15	2.13	31.72		5.77
UA02	M	Danube	Vilkova-Kilia arm	18	1034	138.17	1.37	0.04	0.12	2.44	30.94		

Table 8: Mean annual concentrations in monitoring locations selected for load assessment on tributaries in 2006

Station Code	Profile	River Name	Location	River km	Q_a	c_{mean}						
						Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phosphorus	BOD_5	Chlorides	Phosphorus - dissolved
					($m^3.s^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)
D03	M	Inn	Kirchdorf	195	335	22.00	0.70	0.01	0.07	1.16	6.17	0.02
D04	L	Inn/Salzach	Laufen	47	262	105.50	0.72	0.01	0.11	2.31	9.82	0.01
CZ01	M	Morava	Lanzhot	79	75	44.08	3.05	0.06	0.16	4.82	31.51	
CZ02	L	Morava/Dyje	Pohansko	17.00	55	17.92	3.61	0.16	0.23	2.81	41.33	
H08	LMR	Tisza	Tiszasziget	163	1224	44.89	1.30	0.05	0.16	1.79	45.53	
SI01	L	Drava	Ormoz	300	265	12.09	1.37	0.01	0.04	1.18	6.79	
SI02	R	Sava	Jesenice	729	235	8.73	1.88	0.08	0.12	1.34	9.76	
HR06	L	Sava	Jesenice	729		5.01	1.52		0.12	1.74	9.96	
HR07	L	Sava	us. Una Jasenovac	525	578	11.68	1.40		0.16	2.41	10.28	
HR08	R	Sava	ds. Zupanja	254	1068	24.48	1.14		0.12	2.34	18.88	

Table 9: Annual load in selected monitoring locations on Danube River

Station Code	Profile	River Name	Location	River km	Annual Load in 2006							
					Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phosphorus	BOD_5	Chlorides	Phosphorus - dissolved	Silicates
					($x10^6$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^6$tonns)	($x10^3$tonns)	($x10^6$tonns)
D02 +A01	M	Danube	Jochenstein	2204	2.317	94.744	1.377	4.281	87.367	1.119	2.384	
A04	R	Danube	Hainburg	1879	2.804	145.634	1.988	3.058	100.714	1.261	2.457	
SK01	M	Danube	Bratislava	1869	3.957	161.181	3.517	7.347	82.709	1.367	3.778	
H03	LMR	Danube	Szob	1708	1.942	235.674	3.446	6.065	272.324	1.760		
H05	M	Danube	Hercegszántó	1435								
HR02	R	Danube	Borovo	1337								
RO02	LMR	Danube	Pristol-Novo Selo	834	5.339	227.332	10.805	21.742	308.798	3.407		0.893
RO04	LMR	Danube	Chiciu-Silistra	375	11.151	378.743	9.540	25.480	579.436	6.766		1.410
RO05	LMR	Danube	Reni	132	13.994	484.209	8.044	35.722	481.479	8.300		1.626
UA02	M	Danube	Vilkova-Kilia arm	18	3.468	33.965	1.182	3.040	61.102	0.699		

Table 10: Annual load in selected monitoring locations on tributaries

Station Code	Profile	River Name	Location	River km	Annual Load in 2006						
					Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phosphorus	BOD_5	Chlorides	Phosphorus - dissolved
					($x10^6$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^6$tonns)	($x10^3$tonns)
D03	M	Inn	Kirchdorf	195	0.295	6.560	0.072	1.009	12.739	0.065	0.153
D04	L	Inn/Salzach	Laufen	47	1.748	5.476	0.067	1.655	17.714	0.062	0.086
CZ01	M	Morava	Lanzhot	79	0.131	8.290	0.133	0.371	9.270	0.065	
CZ02	L	Morava/Dyje	Pohansko	17	0.043	8.788	0.223	0.349	5.894	0.067	
H08	LMR	Tisza	Tiszasziget	163	1.920	47.043	1.904	5.854	48.857	1.286	
SI01	L	Drava	Ormoz	300	0.111	11.050	0.089	0.323	9.474	0.054	
SI02	R	Sava	Jesenice	729	0.103	14.931	0.549	0.758	9.790	0.069	
HR06	L	Sava	Jesenice	729							
HR07	L	Sava	us. Una Jasenovac	525	0.221	24.587		2.468	38.884	0.177	
HR08	R	Sava	ds. Zupanja	254	0.697	38.823		3.961	71.130	0.445	

Table 11: Additional annual load data at Reni for reporting to the Black Sea Commission

Country Code	River	Location	Location in profile	River km	Number of measurements in 2005											
					Q	$N\text{-}NH_4$	$N\text{-}NO_2$	$N\text{-}NO_3$	N_{total}	Cu	$Cu_{diss.}$	Pb	$Pb_{diss.}$	Cd	$Cd_{diss.}$	Hg
RO05	Danube	Reni	LMR	132	365	24	24	24	24	8	1	8	1	8	1	8
Country Code	**River**	**Location**	**Location in profile**	**River km**	c_{mean}											
					Q_a	$N\text{-}NH_4$	$N\text{-}NO_2$	$N\text{-}NO_3$	N_{total}	Cu	$Cu_{diss.}$	Pb	$Pb_{diss.}$	Cd	$Cd_{diss.}$	Hg
					($m^3.s^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)	($\mu g.l^{-1}$)
RO05	Danube	Reni	LMR	132	8428	0.31	0.04	1.33	2.13	4.65	-	1.97	-	0.93	-	0.05
Country Code	**River**	**Location**	**Location in profile**	**River km**	**Annual Load in 2006**											
						$N\text{-}NH_4$	$N\text{-}NO_2$	$N\text{-}NO_3$	N_{total}	Cu	$Cu_{diss.}$	Pb	$Pb_{diss.}$	Cd	$Cd_{diss.}$	Hg
						($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	($x10^3$tonns)	(tonns)	(tonns)	(tonns)	(tonns)	(tonns)
RO05	Danube	Reni	LMR	132		82.99	12.25	389.37	612.92	-	-	-	-	-	-	-

7. Abbreviations

Abbreviation	Explanation
AQC	Analytical Quality Control
BSC	Black Sea Commission
DEFF	Data Exchange File Format
DRPC	Convention on Cooperation for the Protection and Sustainable Use of the Danube River (short: Danube River Protection Convention)
ICPDR	International Commission for the Protection of the Danube River
LOD	Limit of Detection
MA EG	Monitoring and Assessment Expert Group (former MLIM EG)
MLIM EG	Monitoring, Laboratory and Information Management Expert Group
NRL	National Reference Laboratory
SOP	Standard Operational Procedure
TNMN	Trans National Monitoring Network
WFD	EU Water Framework Directive

The long and short versions of the TNMN Yearbook 2006 including all figures and data are available on the attached CD-ROM.

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