WATER QUALITY

in the Danube River Basin

TNMN Yearbook 2002

Information

ICPDR – International Commission for the Protection
of the Danube River / Permanent Secretariat
Vienna International Centre, D0412
P. O. Box 500, 1400 Vienna / Austria
Tel: 0043-1-260 60-5738, Fax: 0043-1-260 60-5895
e-mail: icpdr@unvienna.org, www.icpdr.org

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1. Introduction

1.1 Preface

In the TNMN Yearbook 2001 (Transnational Monitoring Network) for the first time all data on water quality were presented in electronic form on a CD-ROM attached to the report. This enabled better practical utilisation of the data and also helped to economise the production of TNMN Yearbooks. This year, a further revision was introduced to achieve sustainable publishing of the TNMN Yearbook series. The printed version of TNMN Yearbook 2002 contains only the essential background information and a basic overview of the water quality status in the Danube River Basin. A full version of the TNMN Yearbook including all figures and data tables is available on the attached CD-ROM.

1.2 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 rational use of surface and ground waters in the Danube catchment area. DRPC also emphasises that the Contracting Parties shall cooperate in the field of monitoring and assessment. In this respect the operation of the TransNational 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 2002. The TNMN has been in operation since 1996, but the first steps towards creating it 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 on the Danube River was established. The TNMN was designed in 1993 with the support of the EC PHARE project and launched in 1996. It is based on national monitoring networks. The expert support is provided by the Monitoring, Laboratory and Information Management Expert Group (MLIM EG) of the ICPDR.

1.3 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 had experience of the TNMN in 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. The discussion on improvements of TNMN was influenced also by the fact that in 2000 the EU Water Framework Directive (WFD Directive 2000/60/EC) came into force establishing a framework for Community action in the field of water policy. At present, WFD implementation represents the highest priority for the ICPDR, providing a platform for coordination of the activities leading to the development of a Danube River Basin Management Plan. The activities that focused on the implementation of specific requirements of WFD towards monitoring and assessment of surface water status were initiated and will lead to the revision of the TNMN.

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 the international monitoring network in 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 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 location included in TNMN should meet at least one of the selection criteria.

The selection procedure led to preparation of a list of 61 monitoring locations to be included in TNMN Phase I. In spite of the fact that locations from Bosnia and Herzegovina create a part of the monitoring network, no data had been provided from them till now. On the other hand, in 2001 monitoring stations from Yugoslavia have extended the monitoring network filling the gap in water quality data in the middle part of the Danube River and related tributaries. With some other minor changes the final list contains 78 monitoring locations.

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 Tisza and Prut rivers.

In 2002, the countries provided data from 71 monitoring locations, including 99 sampling sites. Samples were taken from 37 monitoring stations (63 sampling sites) located in the Danube River itself and from 34 monitoring stations (36 sampling sites) in tributaries.

2. Description of the TNMN

Table 2.1.1: List of monitoring sites

Station list Country code	River Name	Town/location Name	Latitude d. m. s.	Longitude d. m. s.	Distance (km)	Altitude (m)	Catchment (km²)	DEFF code	Loc. in profile
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	Abwinden-Asten	48 15 21	14 25 19	2120	251	83992	L2200	R
A03	Danube	Wien-Nussdorf	48 15 45	16 22 15	1935	159	101700	L2180	R
A04	Danube	Wolfsthal	48 8 30	17 3 13	1874	140	131411	L2170	R
CZ01	/Morava	Lanzhot	48 41 12	16 59 20	79	150	9725	L2100	R
CZ02	/Morava/Dyje	Pohansko	48 48 12	16 51 20	17	155	12540	L2120	R
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	Varazdin	46 19 21	16 21 46	288	169	15616	L1290	M
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	R
HR07	/Sava	us. Una Jasenovac	45 16 02	16 54 52	525	87	30953	L1150	L
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
SCG01	Danube	Bezdan	45 51 15	18 51 51	1427	83	210250	L2350	L
SCG02	Danube	Bogojevo	45 31 49	19 5 2	1367	80	251253	L2360	L
SCG03	Danube	Novi Sad	40 15 3	19 51 40	1258	75	254085	L2370	L
SCG04	Danube	Zemun	44 50 56	20 25 2	1174	71	412762	L2380	R
SCG05	Danube	Pancevo	44 51 25	20 36 28	1155	70	525009	L2390	L
SCG06	Danube	Banatska	44 49 6	21 20 4	1077	69	568648	L2400	L
SCG07	Danube	Tekija	44 41 56	22 25 24	955		574307	L2410	R
SCG08	Danube	Radujevac	44 15 50	22 41 9	851	32	577085	L2420	R
SCG09	Danube	Backa Pal	45 15 13	19 31 35	1287		253737	L2430	L
SCG10	/Tisza	Martonos	46 5 59	20 3 50	152	76	140130	L2440	R
SCG11	/Tisza	Novi Becej	45 35 9	20 8 23	66	74	145415	L2450	L
SCG12	/Tisza	Titel	45 11 52	20 19 9	9	73	157147	L2460	M
SCG13	/Sava	Jamena	44 52 40	19 5 21	195	78	64073	L2470	L
SCG14	/Sava	Sremska	44 58 1	19 36 26	136	75	87996	L2480	L
SCG15	/Sava	Sabac	44 46 12	19 42 17	104	74	89490	L2490	R
SCG16	/Sava	Ostruznica	44 43 17	20 18 51	17		37320	L2500	R
SCG17	/Velika Morava	Ljubicevska	44 35 6	21 8 15	35	75	37320	L2510	R
RO01	Danube	Bazias	44 47	21 23	1071	70	570896	L0020	LMR
			55 57 58	24 40 54					
RO02	Danube	Pristol/Novo Selo Harbour	44 11	22 45	834	31	580100	L0090	LMR
			18 23 29	57 64 69					
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-Chilia/Kilia arm	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

2. Description of the TNMN

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	22 47	834	35	580100	L0730	LMR
			50 58 66	36 47 58					
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	M
UA01	Danube	Reni-Kilia arm/Chilia arm	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

Key to Table 2.1.1

Distance:	The distance in km from the mouth of the mentioned river
Altitude:	The mean surface water level in metres above sea level
Catchment:	The area in square km, from which water drains through the station
ds.	Downstream of
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

Sampling location in profile:
L: Left bank
M: Middle of river
R: Right bank

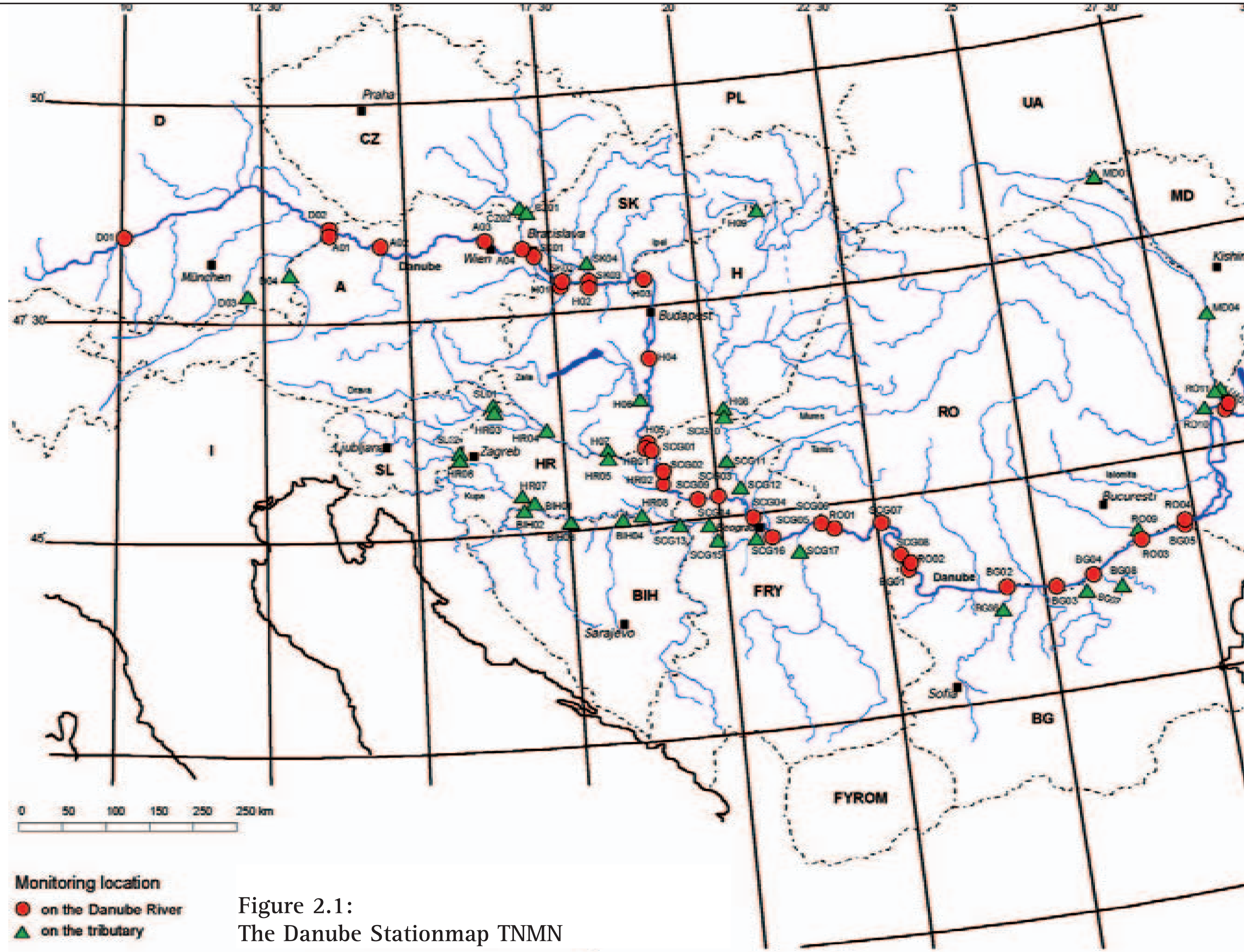

Figure 2.1:
The Danube Stationmap TNMN

2. Description of the TNMN

2.2 Determinands

The list of TNMN determinands for water is presented in Table 2.2.1. 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 2.2.1: 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	-	-	-	-
Salmonella sp.	in 1 litre	-	-	-	-
Macrozoobenthos - no. of taxa	-	-	-	-	-
Macrozoobenthos - Saprobic index	-	-	-	-	-
Chlorophyll - a	µg/l	-	-	-	-

2. Description of the TNMN

2.3 Analytical quality control (AQC)

As regards the analytical methodologies used for the TNMN determinands it has been decided not to require that each laboratory should use the same method, providing that laboratory would be 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 2.2.1), so that the laboratories can check the compliance of their methods. Moreover, a basin-wide AQC programme is regularly organised by the ICPDR.

Performance testing in the TNMN laboratories:
The organisation of interlaboratory comparison in the Danube laboratories started in 1992 to support monitoring activities under the Bucharest Declaration. Since then the organiser of the AQC programme for the Danube River Basin is the Institute for Water Pollution Control of VITUKI, Budapest, Hungary (QualcoDanube programme).

In 2002 three QualcoDanube distributions have been made using synthetic samples (concentrates), real surface water samples, spiked samples as well as sediment samples. 31 out of the 33 participating laboratories reported their results. The results and evaluation of the three distributions have been published in the QualcoDanube Summary Report 2002.

2.4 TNMN data management

The procedure of TNMN data collection starts at a national level. The National Data Managers (NDMs) are responsible for collecting data from TNMN laboratories as well as for checking them, converting them into an agreed data exchange file format (DEFF) and sending them to the TNMN data management centre at the Slovak Hydrometeorological Institute in Bratislava. This centre rechecks the data and uploads them into the central TNMN database. In cooperation with the ICPDR Secretariat the TNMN data are uploaded into the ICPDR web site (www.icpdr.org).

2.5 Water quality classification

To evaluate the data collected by the TNMN an interim water quality classification scheme was developed that serves exclusively for the presentation of current status and assessment of trends of the Danube River water quality (i.e., it is not considered as a tool for the implementation of national water policies) (Table 2.5.1).

In this classification scheme five classes are used for the assessment, with target value being the limit value of class II. Class I should represent reference conditions or background concentrations. For number of determinands it was not possible to establish real reference values due to the many types of water bodies in Danube River Basin differing in physico-chemical characteristics naturally. For synthetic substances the detection limit or minimal likely level of interest was chosen as the limit value for class I. The classes III to 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 the exceedence of the target value and help to recognise the 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 2.5.1: Water quality classification used for 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
pp'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. Tables of data from statistical processing

In 2002, 71 monitoring locations had been monitored in the frame of TNMN in the Danube River Basin. As some locations consist of more sampling sites in the profile (usually left, middle and right side of the river), data had been collected from altogether 99 sampling sites, out of which 63 are located on the Danube River itself and 36 on the tributaries. Comparing the number of monitoring locations with the list, presented in Table 2.1.1, it can be concluded that except Ukraine and Bosnia and Herzegovina countries provided data for all TNMN sites. Ukraine and Bosnia and Herzegovina did not provide any data in 2002.

The basic processing of the TNMN data consists of calculation of selected statistical characteristics and classification of water quality determinands for each monitoring site. Results of the processing are presented in tables in Annex 1 (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 2002
Mean	Arithmetical mean of the measurements done in 2002
Max	Maximum value of the measurements done in 2002
C50	50 percentile of the measurements done in 2002
C90	90 percentile of the measurements done in 2002
Class	Result of classification of the determinand

When processing the TNMN data and presenting them in the tables of Annex 1, the following rules have been applied:

❍ If “less than the detection limit” values were present in the dataset for a given determinand, the value of detection limit was used in statistical processing of the data.

❍ If a number of measurements for the determinand was lower than four, from the set of statistical characteristics only minimum, maximum and mean were presented in the tables of Annex 1.

❍ For the purposes of classification, testing value has been calculated for each determinand, which was further compared to limit values for water quality classes given in Chapter 2.5 and the 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 11. If the number of measurements in a year was lower than 11, 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).

3. Tables of data from statistical processing

❍ 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 the statistics were calculated and presented in a table, but classification has not been carried out.

❍ An indication of water quality class for each determinand in the tables of Annex I 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 the sampling site, the result of classification was presented in tables in light blue to indicate the lower reliability of such results.

The frequencies of measurements in sampling sites and completeness of datasets regarding the determinands have gradually improved since the start of TNMN operation. In 2002, the agreed sampling frequency of at least 12 times per year had been kept for monitoring locations, excluding some locations from Jugoslavia, Romania and Moldavia. But there are differences between the number of measurements of respective determinands; further improvements are still needed in the group of biological determinands, heavy metals and specific organic micropollutants, especially in the lower part of the Danube River Basin.

Table 3.1 summarises data from Annex 1 and shows in aggregated way the concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2002.

The statistical results indicate that in general the concentration ranges of measured determinands were larger in the tributaries than in the Danube itself except for several heavy metals, where higher concentrations were measured in the Danube River.

3. Tables of data from statistical processing

Table 3.1: Concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2002

Determinand	Unit	Danube River			Tributaries		
		Annual mean values	Concentration range	No. of sites with measurement	Annual mean values	Concentration range	No. of sites with measurement
Dissolved Oxygen	$mg.l^{-1}$	6.7-11.6	3.2-15.4	63	7.8-11.4	3.9-26.3	36
BOD_5	$mg.l^{-1}$	1.2-5.1	<0.5-9.9	63	1.2-10.2	0.4-48.8	36
COD_{Cr}	$mg.l^{-1}$	7.8-31.4	1.9-50.0	55	<5.0-42.8	2.0-160.0	27
COD_{Mn}	$mg.l^{-1}$	1.6-5.8	0.9-14.0	61	1.4-10.8	0.7-34.0	32
pH		7.2-8.3	6.4-9.0	63	7.5-8.3	6.9-8.8	36
Ammonium-N	$mg.l^{-1}$	0.041-0.438	<0.004-1.92	63	0.034-1.774	<0.01-2.79	36
Nitrite-N	$mg.l^{-1}$	0.015-0.094	0.002-0.273	61	<0.003-0.108	<0.003-0.7	34
Nitrate-N	$mg.l^{-1}$	0.79-3.11	0.05-7.20	63	0.55-4.69	<0.10-8.23	36
Organic Nitrogen	$mg.l^{-1}$	0.10-1.58	0.01-3.18	26	0.20-2.08	0.02-5.42	20
Total Nitrogen	$mg.l^{-1}$	1.87-3.87	0.80-8.04	21	0.80-5.88	0.50-9.78	23
Ortho-Phosphate-P	$mg.l^{-1}$	0.017-0.143	<0.003-0.290	63	0.006-0.388	<0.003-0.727	36
Total Phosphorus	$mg.l^{-1}$	0.04-0.26	<0.01-1.62	63	0.06-0.70	0.01-1.80	31
Total Phosphorus-Dissolved	$mg.l^{-1}$	0.04-0.07	0.01-0.10	8	0.01-0.11	0.02-0.20	8
Chlorophyll-a	$\mu g.l^{-1}$	3.0-32.7	0.2-123.0	29	3.7-101.1	<0.3-243.0	12
Conductivity@20°C	$\mu S.cm^{-1}$	301-474	209-742	63	217-954	140-1092	33
Zinc	$\mu g.l^{-1}$	3.9-167.5	<0.8-1054.0	48	6.6-181.1	<0.8-969.0	24
Copper	$\mu g.l^{-1}$	1.72-62.60	0.60-401.00	48	1.38-30.80	<0.02-194.00	24
Chromium-total	$\mu g.l^{-1}$	0.62-10.17	0.10-43.76	48	0.54-10.00	<0.04-13.40	21
Lead	$\mu g.l^{-1}$	0.86-6.67	<0.05-30.00	48	1.00-7.57	<0.04-27.00	24
Cadmium	$\mu g.l^{-1}$	0.03-3.64	<0.02-14.76	48	0.03-1.70	<0.01-8.00	24
Mercury	$\mu g.l^{-1}$	0.045-0.184	0.010-1.100	15	0.010-0.475	<0.010-1.180	13
Nickel	$\mu g.l^{-1}$	<1.00-5.99	0.06-31.14	48	0.79-13.72	<0.08-25.00	24
Arsenic	$\mu g.l^{-1}$	0.10-3.60	0.10-9.00	30	0.21-8.09	<0.03-15.00	16
Zinc-Dissolved	$\mu g.l^{-1}$	3.5-82.0	<0.8-82.0	42	3.1-42.0	1.0-117.0	31
Copper-Dissolved	$\mu g.l^{-1}$	1.50-77.20	0.13-303.00	42	0.82-67.50	<0.10-185.00	31
Chromium-Dissolved	$\mu g.l^{-1}$	0.46-2.61	0.05-9.70	36	0.51-3.21	0.05-7.60	20
Lead-Dissolved	$\mu g.l^{-1}$	0.50-8.67	0.05-22.00	42	0.29-6.02	<0.04-11.60	31
Cadmium-Dissolved	$\mu g.l^{-1}$	0.04-1.03	<0.02-10.03	42	0.05-0.50	<0.02-0.92	31
Mercury-Dissolved	$\mu g.l^{-1}$	0.049-0.323	<0.020-0.500	29	<0.010-0.400	<0.010-0.700	25
Nickel-Dissolved	$\mu g.l^{-1}$	0.70-3.20	0.10-5.90	36	0.76-9.98	<0.08-27.00	23
Arsenic-Dissolved	$\mu g.l^{-1}$	<0.70-3.28	<0.10-4.60	17	0.49-3.42	0.23-6.90	13
Atrazine	$\mu g.l^{-1}$	0.011-0.237	0.001-1.060	33	0.010-0.426	<0.001-2.480	10
Saprobic index of macrozoobenthos		2.06-2.24	2.04-2.25	9	1.50-2.62	1.50-2.94	8

4. Presentation of results of classification

The maps presented in figures 4.1 to 4.11 show water quality classes in TNMN monitoring locations for selected determinands. The sites on the Danube River and those located on the 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 for a particular location is based on lower number of measurements than 11. If there were data from more sampling sites (left, middle, right) at one monitoring location, only the data from the middle of a river are presented in the maps.

More results of classification of TNMN data in 2002 are shown in the full version of the TNMN Yearbook on the attached CD-ROM.

From this classification following conclusions may be drawn:

❍ concentrations of oxygen comply with the target value in 85% of monitoring locations in the Danube River, while only 7,5% of locations correspond to classes III and IV. There is a similar situation is in tributaries: 82% of locations correspond to class I and II.

❍ The concentrations of BOD_5, which is used as an indicator of biodegradable organic pollution in waters, belong to classes I and II in 80% of the profiles on the Danube River. The non-complying sites on the Danube River are concentrated exclusively in its middle part. In the tributaries the percentage of locations complying with the target value is 66% and 24% of locations belong to classes III and IV. These results are similar to those in 2001.

❍ COD_{Cr} is not measured in 31% of the monitoring locations. Compliance with target value is observed in 57,5% of locations in the Danube River and 39% of locations in tributaries. Non-compliance is observed in 15% of locations in the Danube River (class III) and 26% of locations in tributaries (classes III and IV).

❍ Concerning ammonium-N, the Danube River belongs to classes I and II in 60% of the monitored locations; in the tributaries this figure is slightly lower: 55%. Non-compliance is observed in 32% and 34% of the locations in the Danube River and the tributaries, respectively. In the tributaries, the situation has improved in comparison with 2001. It can also be concluded that class I is observed in the locations in the upper part of the Danube River until Hercegszanto, downstream of which the deterioration is apparent.

❍ For nitrate-N 60% of sites on the Danube River and 74% on the tributaries belong to classes I and II showing good quality. Unlike the results for ammonium-N, the spatial distribution of nitrate-N observed in the Danube River shows better results in the lower part of the river.

❍ The concentration of ortho-phosphate-P belongs to classes I and II in 80% of the locations in the Danube River and on 58% of the locations in the tributaries. The majority of the non-complying sites are located in the lower part of the Danube River.

❍ The content of total phosphorus complies with the classes I and II in 77.5% of the Danube sites and only in 34% of the sites on the tributaries.

❍ For heavy metals, the percentage of sites with no data reported varied between 33 - 64%.

For chromium and nickel, class II was achieved in all monitored locations. For cadmium, for one-third of the locations no data were reported. Out of available data, 57,5% of the sites on the Danube River and 47% on the tributaries correspond to class II (class I has not been specified for heavy metals). 12,5% of sites on the Danube River and 16% of sites on the tributaries, fall into Classes III-IV.

❍ The target value for pp'DDT was achieved in 55% of sites on the Danube River and 45% of sites on the tributaries. Non-compliance is observed in 17,5% and 16% of locations on the Danube River and the tributaries, respectively. For the rest of the sites no data are available.

❍ Concerning the occurrence of Atrazine in the Danube River, 40% of stations corresponded to classes I to II, 7.5% to class V and for 52,5% of sites no data were reported. Worse is the reporting status for the tributaries, in which the data are available from only 26% of the sites - 18% correspond to classes I and II, and 8% belong to classes III-V.

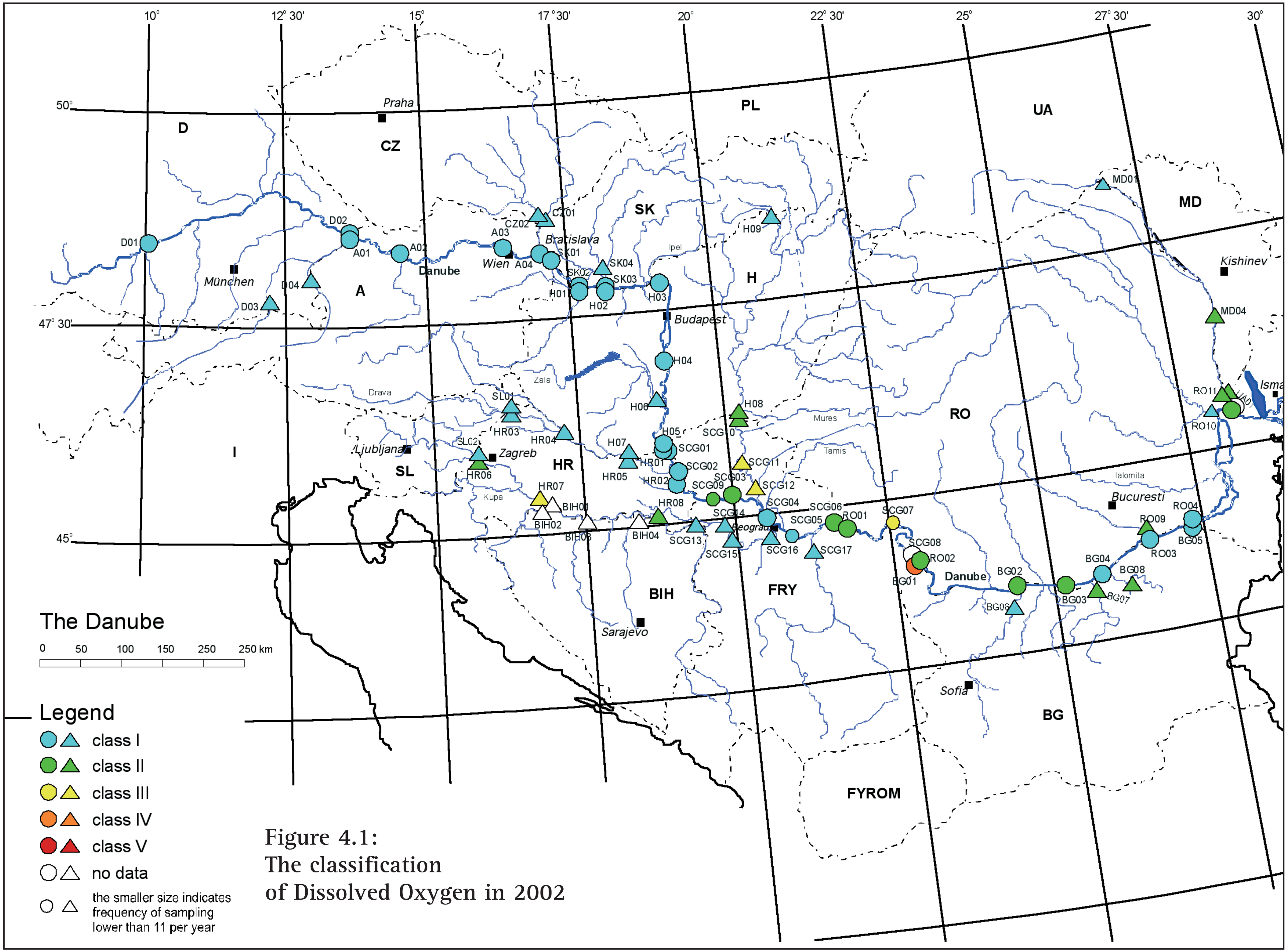

Figure 4.1:
The classification
of Dissolved Oxygen in 2002

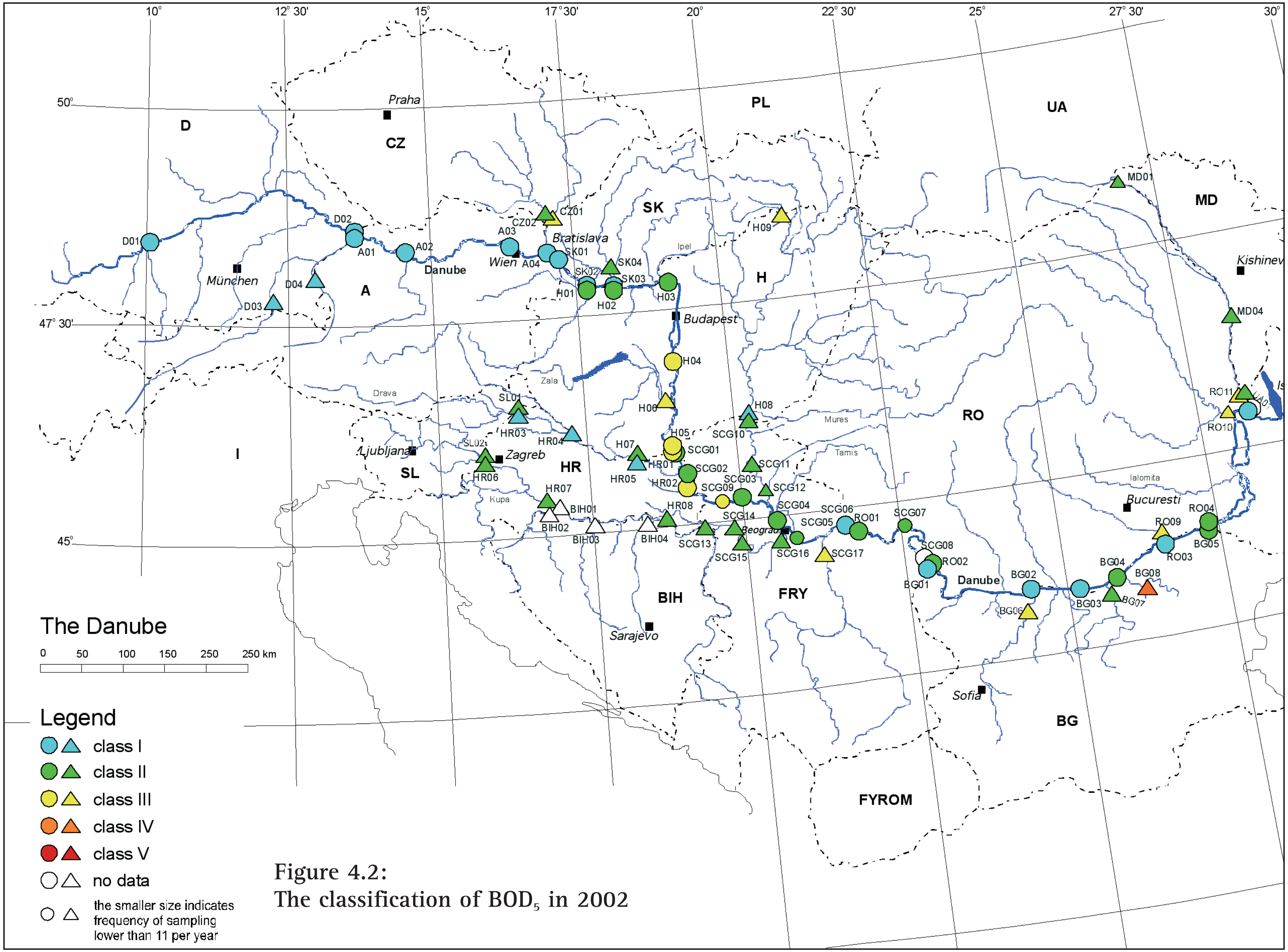

Figure 4.2:
The classification of BOD_5 in 2002

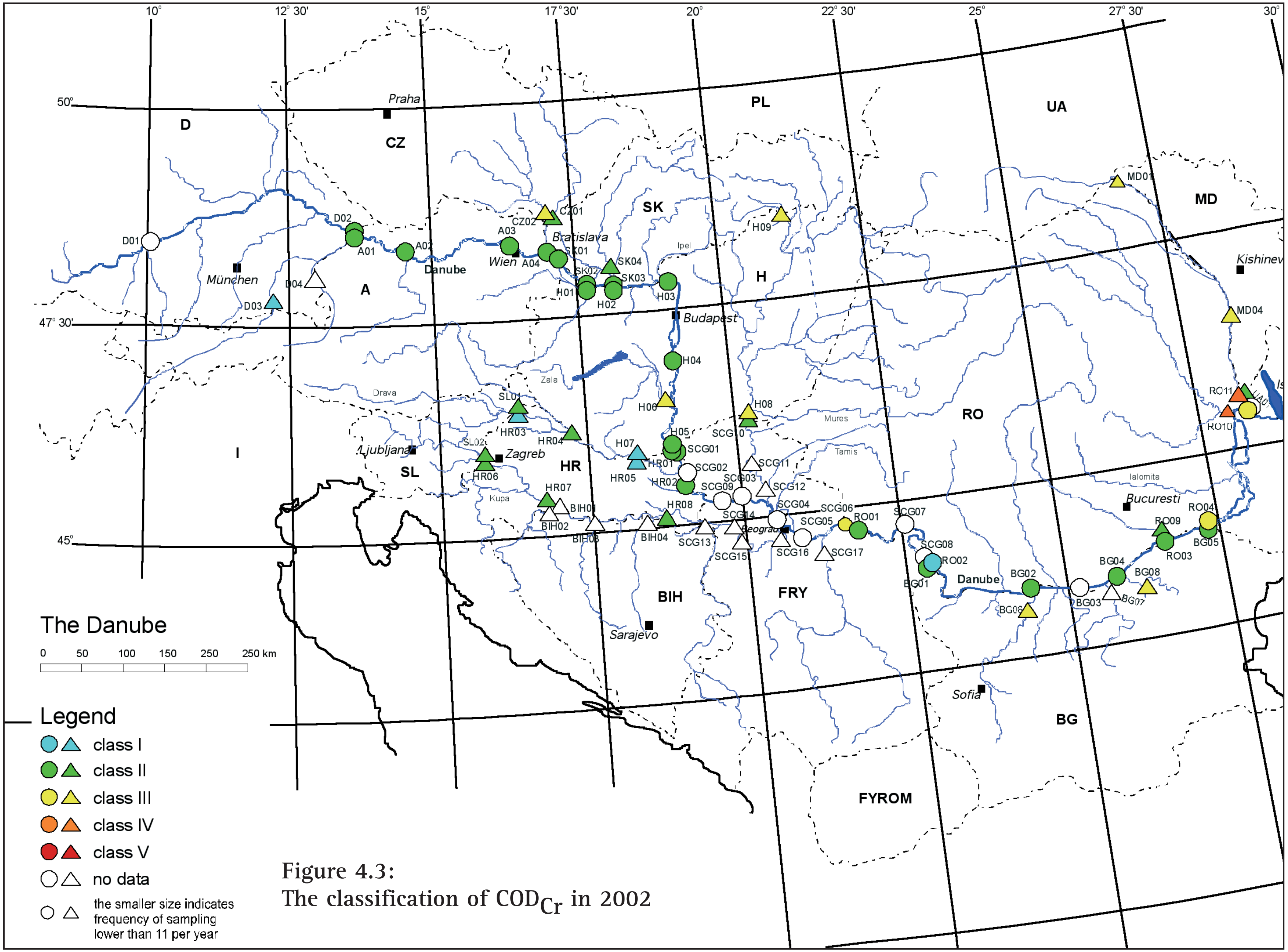

Figure 4.3:
The classification of COD_{Cr} in 2002

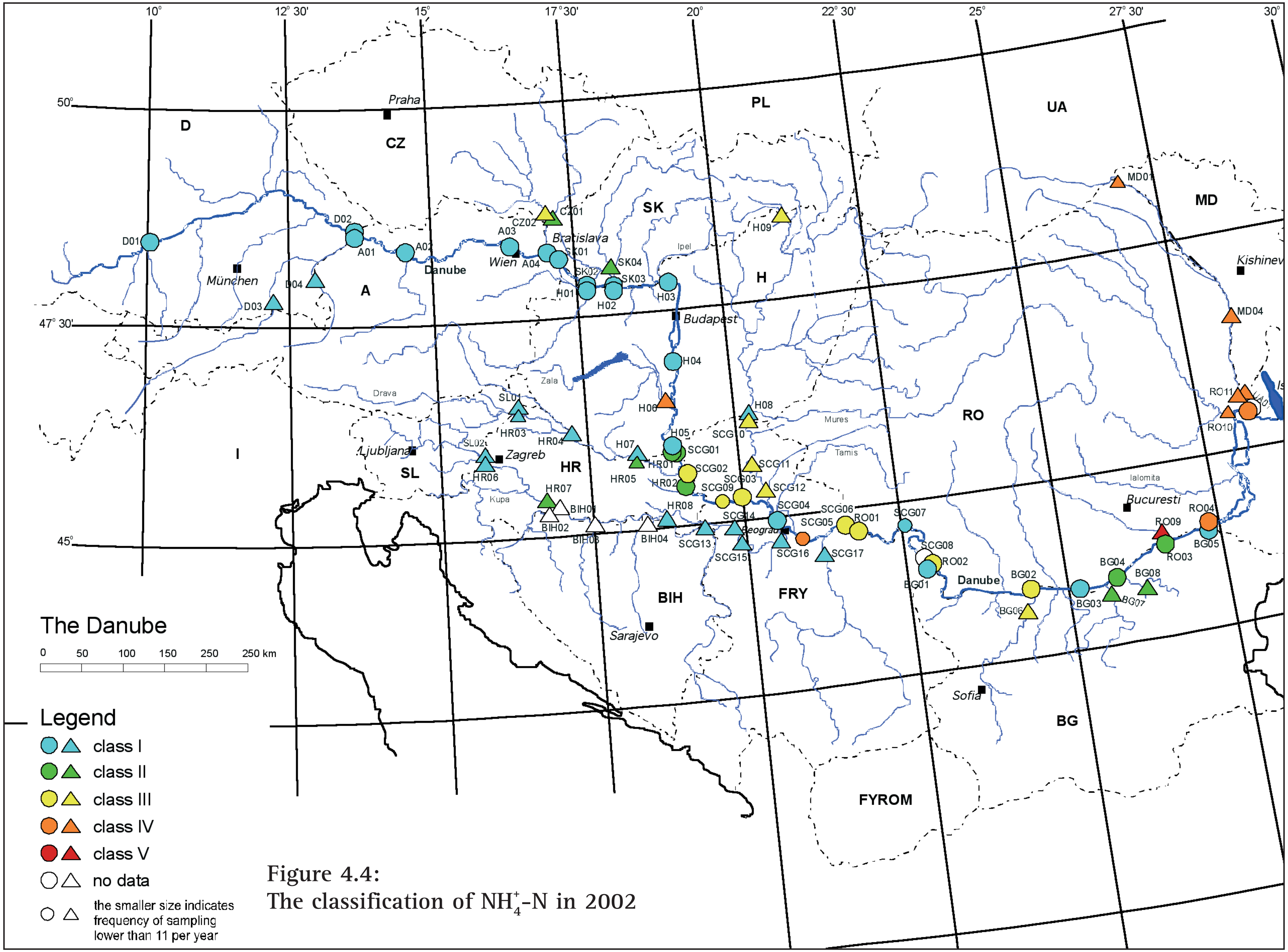

Figure 4.4:
The classification of NH_4^+-N in 2002

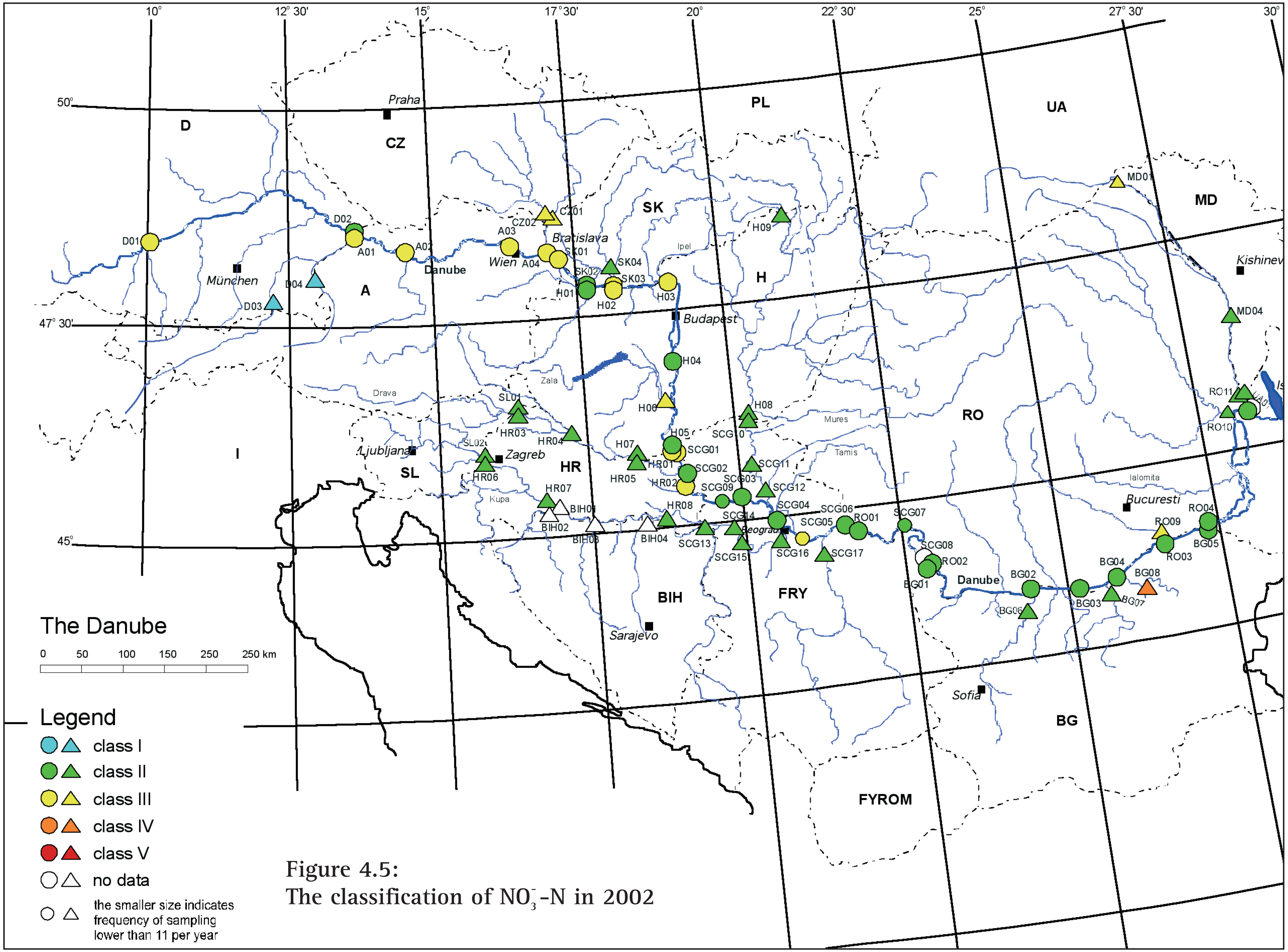

Figure 4.5:
The classification of NO_3^--N in 2002

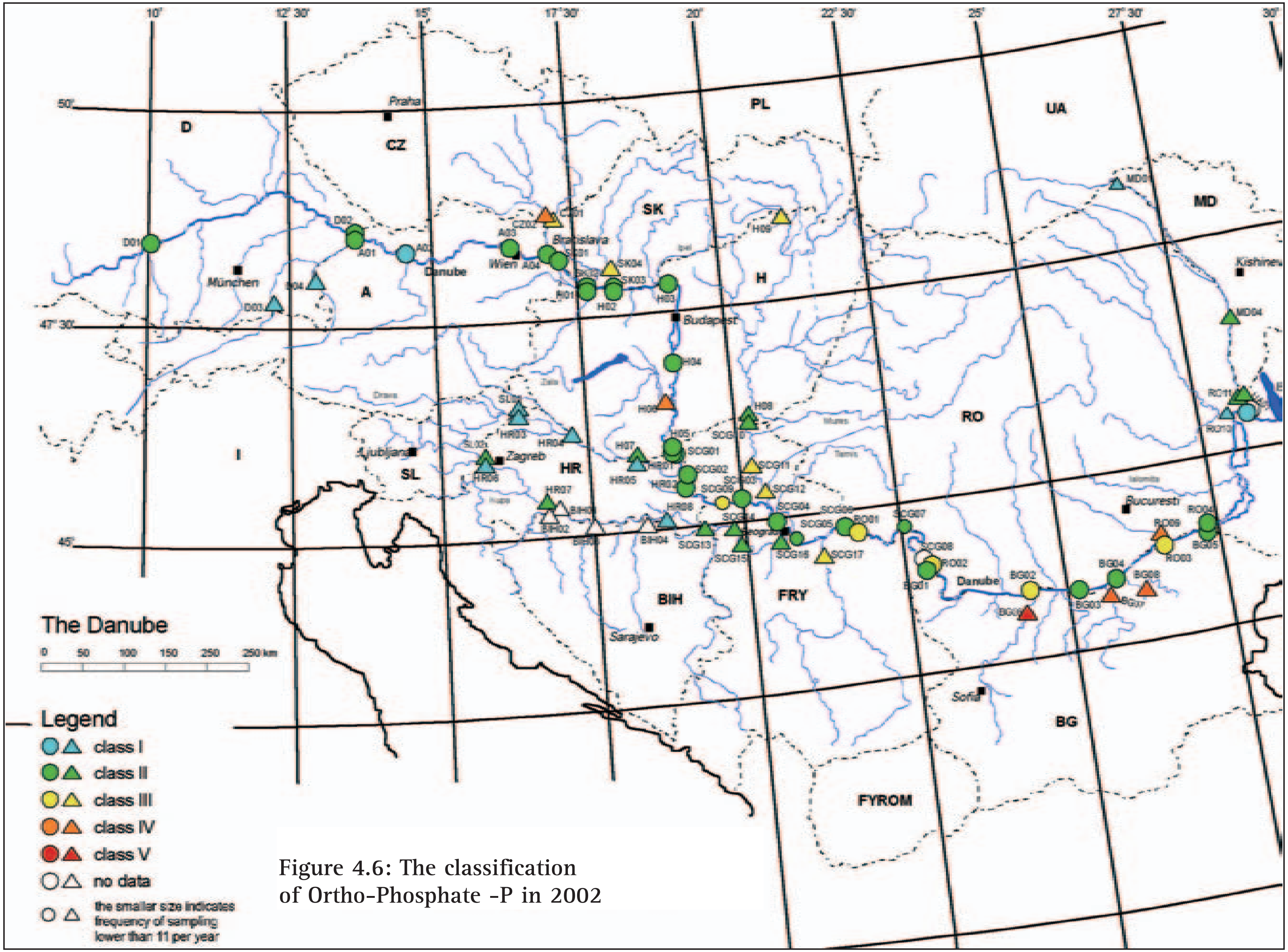

Figure 4.6: The classification of Ortho-Phosphate -P in 2002

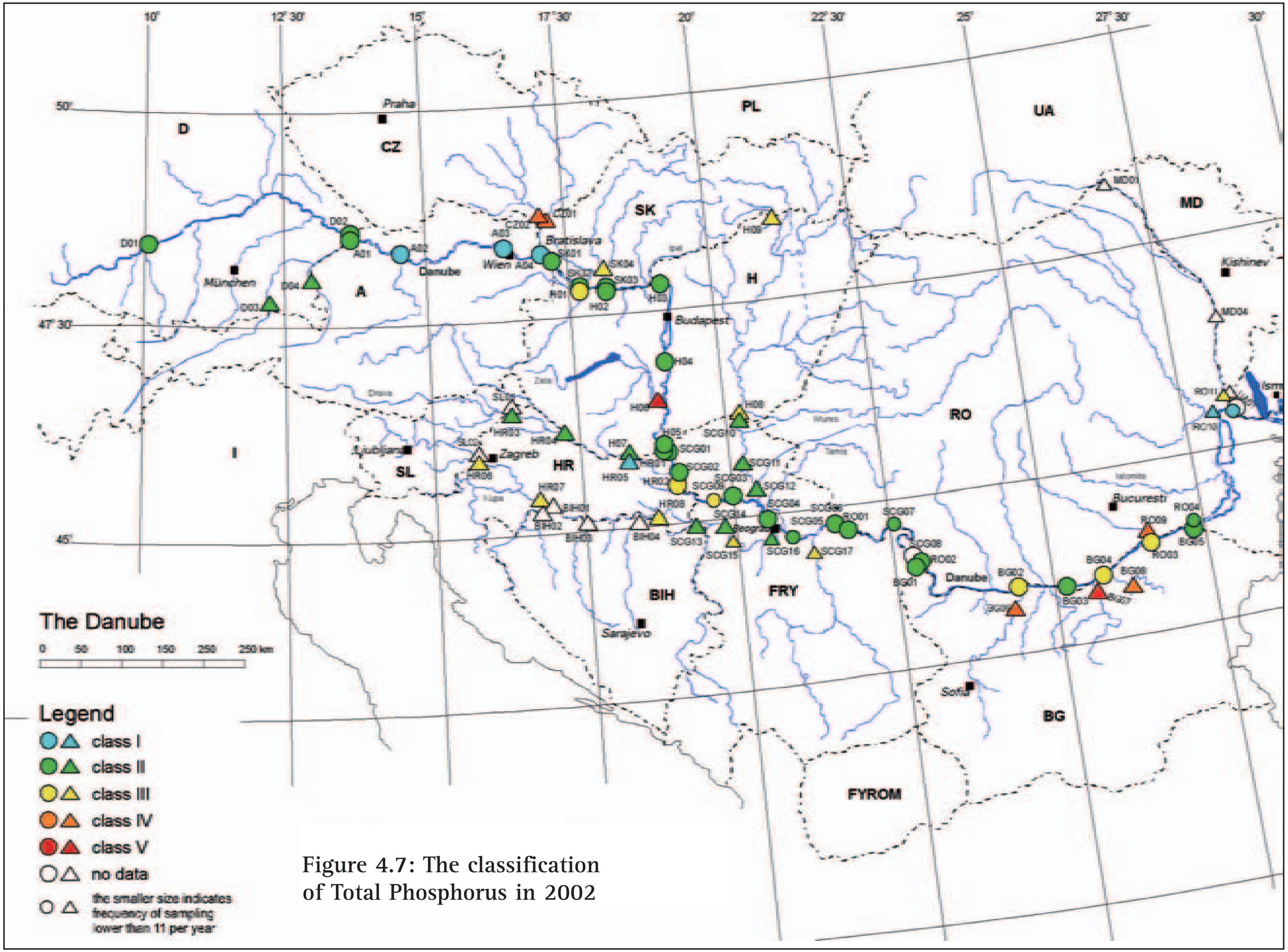

Figure 4.7: The classification of Total Phosphorus in 2002

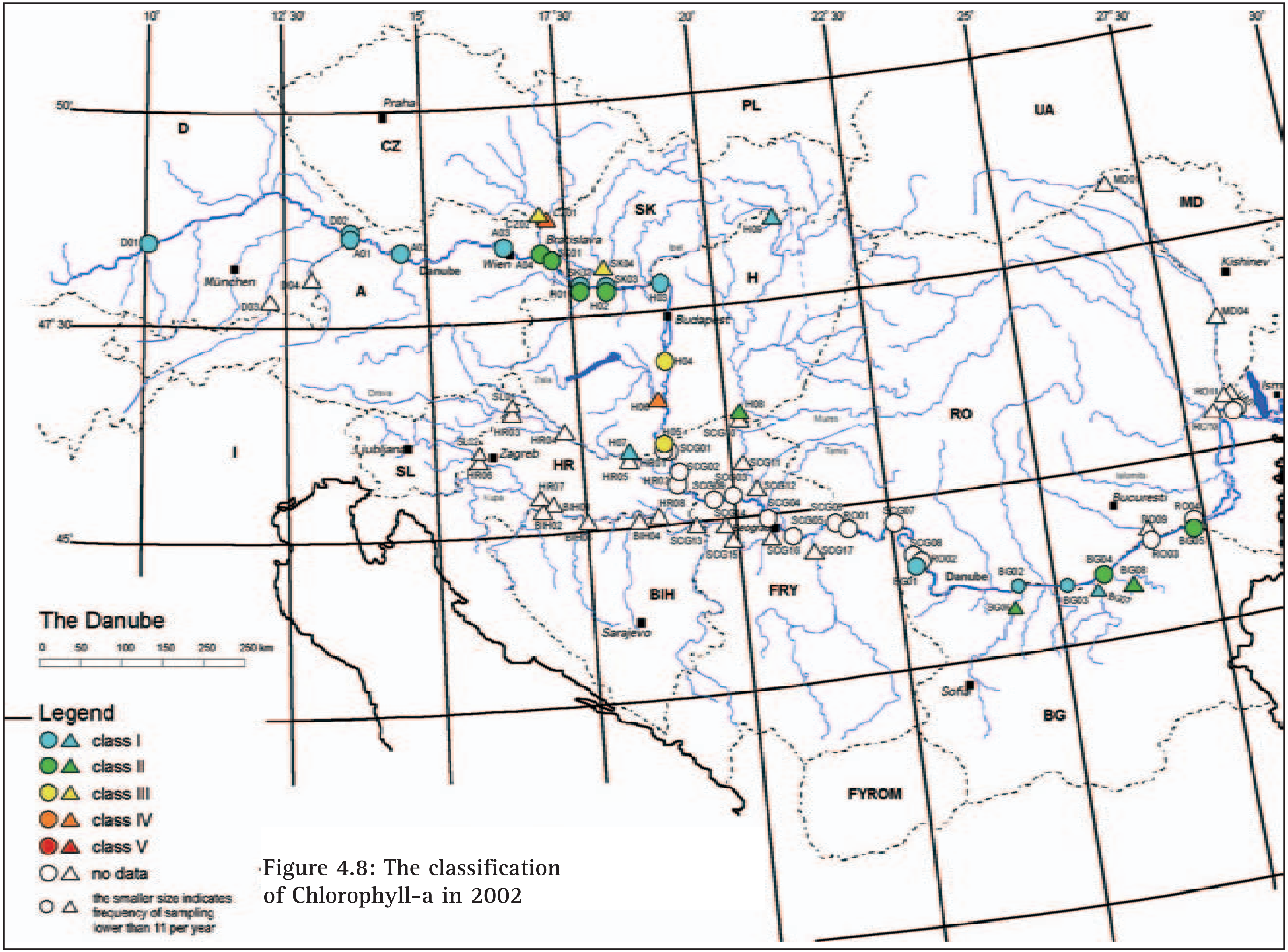

Figure 4.8: The classification of Chlorophyll-a in 2002

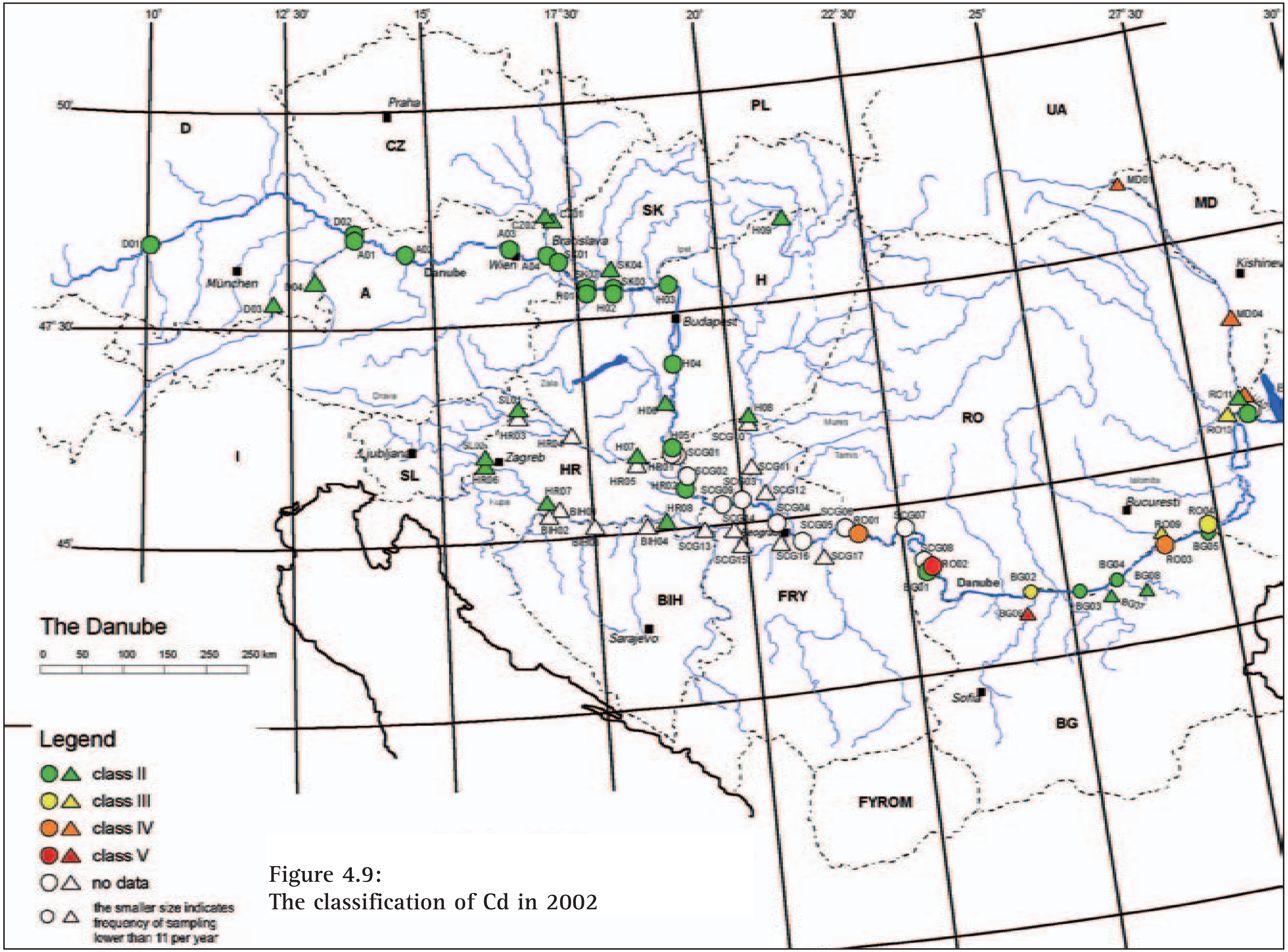

Figure 4.9:
The classification of Cd in 2002

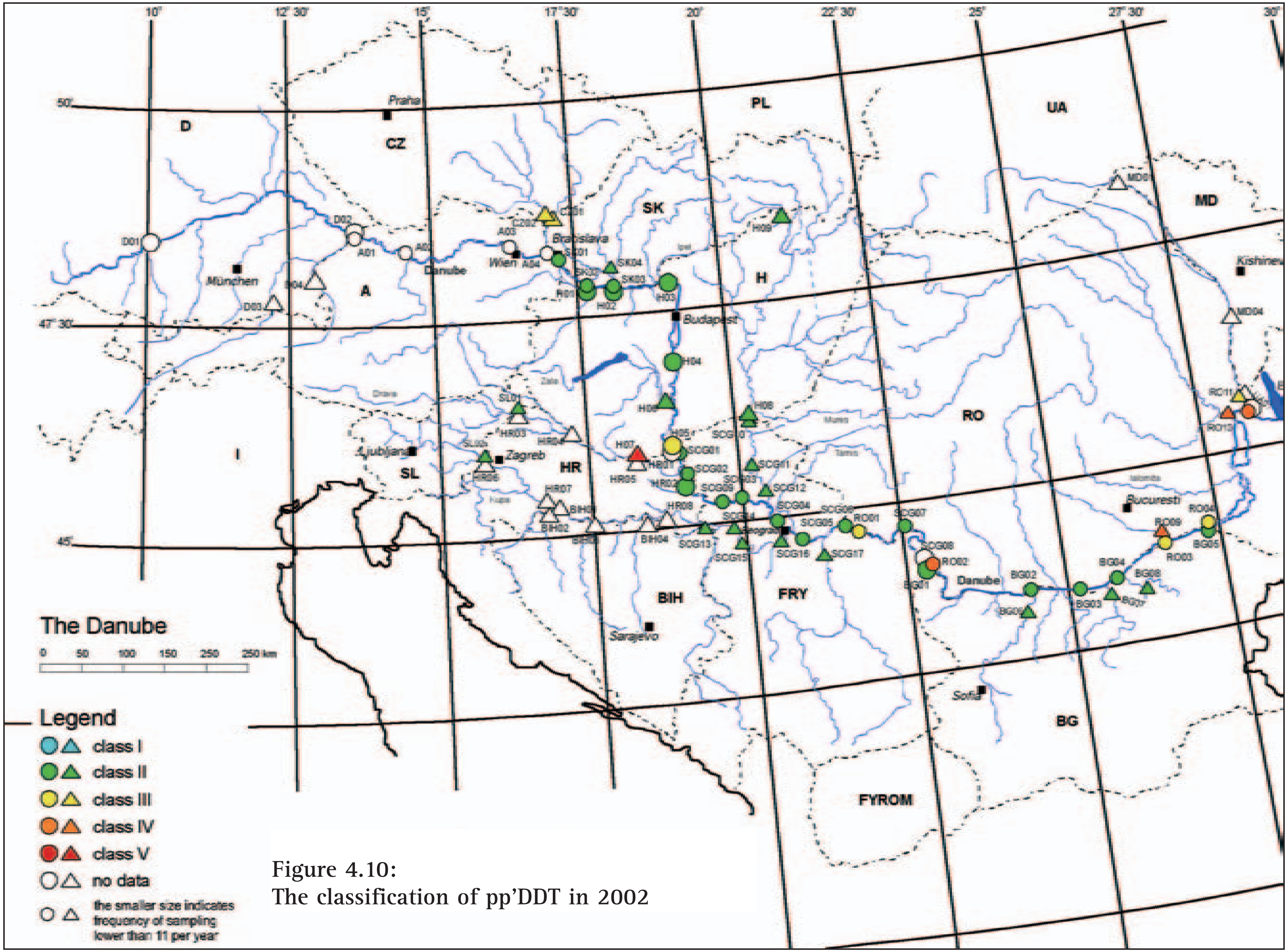

Figure 4.10:
The classification of pp'DDT in 2002

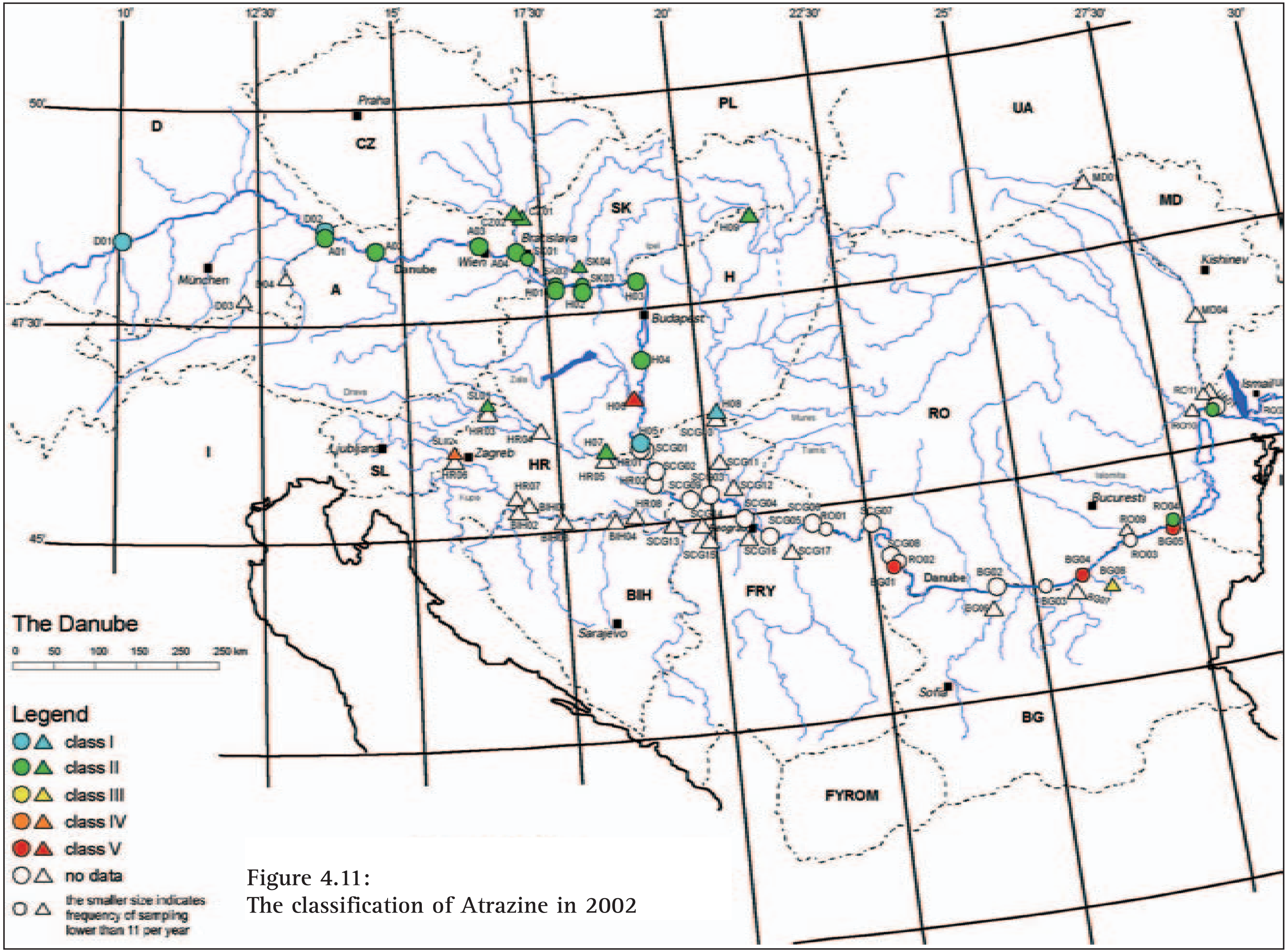

Figure 4.11:
The classification of Atrazine in 2002

5. Profiles and trend assessment of selected determinands

Regarding the spatial pattern of water quality along the Danube River in 2002, the highest content of degradable organic matter is observed in the middle part of the river, whilst COD_{Cr}, ammonium-N, ortho-phosphate-P and cadmium reach the highest values in the lower Danube part. Concentration of nitrate-N is higher in the upper part of the river with an intermediate decrease in the Serbian section of the Danube River and a further increase downstream.

The most polluted tributaries from the point of view of degradable organic matter are Russenski Lom, Sio and Siret. In case of nutrients there are to be more tributaries considered polluted - Prut, Arges, Russenski Lom, Iskar, Jantra, Sio and Dyje. Positive changes in water quality can be seen in several TNMN locations. Taking into account the whole period of TNMN operation, a decrease of biodegradable organic pollution is visible in the Austrian and Slovak section of the Danube River and in the lower section downstream of Chiciu/Silistra. The tributaries Inn, Salzach, Dyje, Vah, Drava, Tisza at Tiszasziget and Arges show the same tendency.

As for the nutrients, ammonium-N decreases in locations of the upper part of Danube River down to Hercegszanto (H05), at Danube-Sf. Gheorghe, in the tributaries of the upper section down to river Vah (Inn, Salzach, Morava, Dyje, Vah) and further in Drava, Tisza-Tiszasziget, Sava and Arges. A significant decrease is apparent also in Danube-Silistra/Chiciu (BG05), but is not supported by Romanian data from the same monitoring location.

Nitrate-N content decreases in several locations of the German - Austrian part of the Danube River, at Danube-Dunafoldvar and in some locations of the lower Danube part like Danube-us., Iskar-Bajkal and Danube-us.Arges. The trend at the location of Danube-Silistra-Chiciu differs according to the results of measurements done by Bulgaria and Romania. Nitrate-N decrease was observed in the tributaries Morava, Dyje, Vah, Drava and at Sava-us.Una Jasenovac.

A decreasing tendency of ortho-phosphate-P is observed at Slovak monitoring locations, at Danube Szob and most of the downstream locations on the Danube River starting from the Reni Chilia/Kilia arm. An improvement can be seen also in the tributaries of the upper part of the Danube river, in Drava, Siret and at Sava-us.Una Jasenovac.

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

6. Load assessment

6.1 Introduction

Making an analysis of 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. Therefore, the load assessment programme in the Danube River Basin started in 2000 and the countries agreed to use for its operation a Standard Operational Procedure (SOP) developed in the frame of the EU PHARE Project "Transboundary Assessment of Pollution Loads and Trends" (1998).

6.2 Description of load assessment procedure

The agreed load assessment procedure is based on the following principles:

❍ Load is calculated for the following determinands: BOD_5, inorganic nitrogen, ortho-phosphate-phosphorus, dissolved phosphorus, total phosphorus, suspended solids and - voluntarily - chlorides.

❍ Minimum sampling frequency in the sampling sites selected for load calculation is set to 24 per year.

❍ Load calculation is processed according to the procedure recommended by the Project "Transboundary assessment of pollution loads and trends" and is described in Chapter 6.4. Additionally, the countries can calculate the 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 the load assessment those TNMN monitoring sites where valid flow data is available (see Table 6.2.1).

Table 6.2.1 shows TNMN monitoring locations selected for the load assessment programme. Information on hydrological stations, which are used for obtaining flow data needed for load assessment in respective locations, is also presented there.

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 itself and nine locations on the tributaries.

Table 6.2.1: List of TNMN locations selected for load assessment programme

Country	River	Water quality monitoring location			Hydrological station	
		Country code	Location	Distance from the mouth (km)	Location	Distance from the 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-Chilia arm	132	Isaccea	101
Ukraine	Danube	UA02	Vilkova-Kilia arm	18		

6.3 Monitoring data in 2002

The frequency of measurements is essential for the assessment of pollution loads. Table 6.3.1 presents the number of the measurements of flow and water quality determinands in TNMN locations selected for load assessment. The availability of data is comparable with the previous year.

There are no data from Ukraine, and flow data are missing in three Croatian monitoring locations. In most of the locations, the number of samples collected in 2002 was higher than 20; the frequency 12 times per year occured only in Morava, Dyje and Danube-Jochenstein (A01). But as the Danube-Jochenstein is assessed on the basis of combined data from two countries, there is no problem with insufficient frequency there. The

second location that could be processed by using combined data from two countries is Sava-Jasenovac, but this approach was not applied there due to the different measuring methods used for some determinands, that led to differences in results.

Regarding particular determinands, there is still lack of data on dissolved phosphorus as it was measured in seven locations only. Results for dissolved P are therefore only given in tables but they are not presented in figures showing the load in the context of the whole river basin. Data on total phosphorus in locations Danube-Chiciu Silistra and Danube-Reni were not processed due to their low number and uneven distribution during the year.

Table 6.3.1: Number of measurements in TNMN locations selected for assessment of pollution load in 2002

Country code	River	Location	River km	Number of measurements							
				Q	SS	N_{inorg}	$P\text{-}PO_4$	P_{total}	BOD_5	CI	P_{diss}
D02	Danube	Jochenstein	2204	365	25	25	25	25	25	25	12
D03	Inn	Kirchdorf	195	365	24	26	26	26	25	26	14
D04	Inn/Salzach	Laufen	47	365	26	26	26	26	26	26	24
A01	Danube	Jochenstein	2204	365	12	12	12	12	12	12	12
A04	Danube	Wolfsthal	1874	365	24	24	24	24	24	24	24
CZ01	Morava	Lanzhot	79	365	12	12	12	12	12	12	0
CZ02	Morava/Dyje	Pohansko	17	365	12	12	12	12	12	12	0
SK01	Danube	Bratislava	1869	365	25	25	25	25	25	25	12
H03	Danube	Szob	1708	365	26	26	26	26	26	26	0
H05	Danube	Hercegszántó	1435	365	26	36	36	36	36	26	0
H08	Tisza	Tiszasziget	163	365	12	26	26	26	26	12	0
HR02	Danube	Borovo	1337	0	26	26	26	26	26	0	0
HR06	Sava	Jesenice/D	729	26	26	26	26	26	26	12	0
HR07	Sava	us Una Jesenovac	525	0	23	23	23	23	23	12	0
HR08	Sava	ds Zupanja	254	0	25	25	25	25	25	12	0
SI01	Drava	Ormoz	300	365	24	24	24	0	24	24	24
SI02	Sava	Jesenice	729	365	24	24	24	0	24	24	24
RO02	Danube	Pristol-Novo Selo	834	365	24	24	24	24	23	23	0
RO04	Danube	Chiciu-Silistra	375	365	21	21	21	7	20	15	0
RO05	Danube	Reni-Chilia arm	132	365	21	21	21	7	19	13	0
UA02	Danube	Vilkova-Kilia arm	18	0	0	0	0	0	0	0	0

6.4 Calculation procedure

The loads have been calculated in accordance with the following procedure:

❍ For several sampling sites in the profile, average concentration at the location is calculated for each sampling day.

❍ For values "below limit of detection", the value of limit of detection is used in the further calculation.

❍ The average monthly concentrations are calculated according to the formula:

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

where:
C_m represents average monthly concentrations
C_i represents concentrations on the sampling days of each month
Q_i represents discharges on the sampling days of each month

❍ The monthly load is calculated by using the formula:

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

where:
L_m represents monthly load
Q_m represents average monthly discharge

- If discharges are available only for the sampling days, 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:

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

6. Load assessment

6.5 Results

Mean annual concentrations and annual loads of suspended solids, inorganic nitrogen, ortho-phosphate-phosphorus, total phosphorus, BOD_5, chlorides and - where available - dissolved phosphorus are presented in tables 6.5.1 to 6.5.4, separately for monitoring locations on the Danube River and monitoring locations on tributaries. The explanation of terms used in tables 6.5.1 to 6.5.4 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 site
River km	distance to mouth of the river
Q_a	mean annual discharge in 2002
c_{mean}	arithmetical mean of the concentrations in 2002
Annual load	annual load of given determinand in 2002

The mean annual discharge and annual loads of suspended solids, inorganic N, ortho-phosphate-P, total P, BOD_5 and chlorides presented in the form of plots are given in the full version of the TNMN Yearbook on the attached CD-ROM.

From the data presented it is apparent that the spatial pattern of the annual load along the Danube River is similar to the previous year.

In the Danube River, the load of inorganic nitrogen and chlorides increases continuously along the river. In the case of organic pollution, orthophosphate phosphorus and suspended solids, the highest load is also observed in the lower part of the Danube River; the maximum is reached in the monitoring location Danube-Pristol-Novo Selo (RO02). A decrease of the annual load of the suspended solids in the middle part of the Danube River is due to reduced flow velocity through damming. In the case of tributaries, the highest load of BOD_5, inorganic nitrogen, phosphorus and chlorides are observed in the Tisza River. However, it should be pointed out that in 2002 the flow data from Sava River were available only for the site Sava-Jesenice. This site is rather distinct from the confluence with the Danube River. In 2001, the load of inorganic N, total P and BOD_5 in the Sava River (more downstream from site Sava-ds.Zupanja) was the highest one among all of the tributaries.

Sensitivity of suspended solids load towards the flow regime and the time of sampling is apparent. A very high load of suspended solids in Inn (D03) in 2002, comparable with that of Tisza River, was caused by extreme value measured under high flow conditions.

Table 6.5.1: Mean annual concentrations in monitoring locations selected for load assessment on Danube River

Station code	Profile	River name	Location	River km	Q_a	c_{mean}						
						Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phos-phorus	BOD_5	Chlorides	Phosphorus dissolved
					($m^3.s^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)	($mg.l^{-1}$)
D02+A01	M	Danube	Jochenstein	2204	1803.9	18	2.14	0.035	0.08	1.8	13	0.045
A04	R	Danube	Wolfsthal	1874	2669.9	27	2.35	0.036	0.08	1.7	16	0.045
SK01	M	Danube	Bratislava	1869	2683.0	33	2.30	0.043	0.10	2.1	16	0.066
H03	LMR	Danube	Szob	1708	2855.6	17	2.32	0.061	0.09	3.0	19	
H05	M	Danube	Hercegszántó	1435	2824.9	30	2.09	0.047	0.14	4.0	17	
HR02	R	Danube	Borovo	1337		55	2.86	0.032	0.25	4.1		
RO02	LMR	Danube	Pristol-Novo Selo	834	5392.0	37	1.46	0.076	0.09	3.2	20	
RO04	LMR	Danube	Chiciu-Silistra	375	6100.1	14	2.29	0.036	0.08	2.7	32	
RO05	LMR	Danube	Reni-Chilia arm	132	6837.1	23	2.29	0.023	0.05	1.7	34	

Table 6.5.2: Mean annual concentrations in monitoring locations selected for load assessment on tributaries

Station code	Profile	River name	Location	River km	Q_a	c_{mean}						
						Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phos-phorus	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	281.9	170	0.59	0.006	0.12	1.2	4	0.011
D04	L	Inn/Salzach	Laufen	47	279.9	72	0.70	0.011	0.07	1.9	7	0.015
CZ01	M	Morava	Lanzhot	79	68.5	24	2.82	0.126	0.27	3.9	22	
CZ02	L	Morava/Dyje	Pohansko	17	52.2	15	4.44	0.185	0.34	3.3	35	
H08	LMR	Tisza	Tiszasziget	163	798.5	66	1.16	0.055	0.21	1.9	37	
SI01	L	Drava	Ormoz	300	269.3	19	0.95	0.013		2.4	4	0.023
SI02	R	Sava	Jesenice	729	236.4	12	1.57	0.053		3.1	7	0.073
HR06	L	Sava	Jesenice	729	157.7	28	2.09	0.024	0.16	2.6	11	
HR07	L	Sava	us. Una Jasenovac	525		18	1.40	0.038	0.22	2.8	10	
HR08	R	Sava	ds. Zupanja	254		28	1.16	0.023	0.16	2.7	14	

Table 6.5.3: Annual load in selected monitoring locations on Danube River

Station code	Profile	River name	Location	River km	Annual load						
					Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phos-phorus	BOD_5	Chlorides	Phosphorus dissolved
					($x10^6$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^6$tonnes)	($x10^3$tonnes)
D02+A01	M	Danube	Jochenstein	2204	1.2	125	2.0	4.7	102	0.8	2.6
A04	R	Danube	Wolfsthal	1874	3.1	199	3.2	6.7	159	1.3	4.0
SK01	M	Danube	Bratislava	1869	3.2	199	3.9	8.4	176	1.3	5.7
H03	LMR	Danube	Szob	1708	1.6	213	6.0	8.6	291	1.7	
H05	M	Danube	Hercegszántó	1435	2.9	190	4.6	12.9	334	1.5	
RO02	LMR	Danube	Pristol-Novo Selo	834	6.3	253	12.2	13.8	555	3.3	
RO04	LMR	Danube	Chiciu-Silistra	375	2.6	453	8.2		504	5.9	
RO05	LMR	Danube	Reni-Chilia arm	132	5.1	493	5.0		343	7.3	

Table 6.5.4: Annual load in selected monitoring locations on tributaries

Station code	Profile	River name	Location	River km	Annual load						
					Suspended Solids	Inorganic Nitrogen	Ortho-Phosphate Phosphorus	Total Phos-phorus	BOD_5	Chlorides	Phosphorus dissolved
					($x10^6$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^3$tonnes)	($x10^6$tonnes)	($x10^3$tonnes)
D03	M	Inn	Kirchdorf	195	2.53	4.6	0.05	1.77	10.8	0.03	0.09
D04	L	Inn/Salzach	Laufen	47	1.02	5.8	0.09	0.78	16.9	0.06	0.13
CZ01	M	Morava	Lanzhot	79	0.05	6.8	0.27	0.58	7.5	0.04	
CZ02	L	Morava/Dyje	Pohansko	17	0.03	8.2	0.26	0.58	5.1	0.05	
H08	LMR	Tisza	Tiszasziget	163	2.39	30.5	1.27	5.66	48.7	0.80	
SI01	L	Drava	Ormoz	300	0.23	7.5	0.13		19.2	0.03	0.21
SI02	R	Sava	Jesenice	729	0.13	11.4	0.37		21.0	0.05	0.50
HR06	L	Sava	Jesenice	729	0.66	9.9	0.11	1.03	15.7	0.05	

7. Abbreviations

Abbreviation	Explanation
AQC	Analytical Quality Control
ARP	Applied Research Programme
BD	Bucharest Declaration
CIP	Central Information Point (for information management)
DEFF	Data Exchange File Format
DRPC	Danube River Protection Convention
EPDRB	Environmental Programme for the Danube River Basin
ICPDR	International Commission for the Protection of the Danube River
IM/ESG	Information Management Expert Sub-Group
IMWG	Information Management Working Group
LM/ESG	Laboratory Management Expert Sub-Group
LMWG	Laboratory Management Working Group
LOD	Limit of Detection
M/ESG	Monitoring Expert Sub-Group
MCEP	Multi-Country Environmental Programme
MLIM-EG	Monitoring, Laboratory and Information Management Expert Group
MLIM-SG	Monitoring, Laboratory and Information Management Sub-Group
MWG	Monitoring Working Group
NIC	National Information Centre
NRL	National Reference Laboratory
PCU	Programme Coordination Unit
QA	Quality assurance
QC	Quality control
SAP	Strategic Action Plan
SIP	Strategic Action Plan Implementation Programme
SOP	Standard Operational Procedure
TNMN	Trans National Monitoring Network
TOR	Terms of Reference
WTV	Consortium that carried out the first MLIM-study (WRc, TNO, VKI/DHI)