Water Quality in the Danube River Basin - 2010

TNMN – Yearbook 2010

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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 evaluated data for 2010.

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. Revision of the TNMN to meet the objectives of EU WFD

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 has been completed in 2007.

The major objective of the revised TNMN is to provide an overview of the overall status and long-term changes of surface water and – where necessary – groundwater status in a basin-wide context with a particular attention paid to the transboundary pollution load. In view of the link between the nutrient loads of the Danube and the eutrophication of the Black Sea, it is necessary to monitor the sources and pathways of nutrients in the Danube River Basin District and the effects of measures taken to reduce the nutrient loads into the Black Sea.

To meet the requirements of both EU WFD and the Danube River Protection Convention the revised TNMN for surface waters consists of following elements:

- Surveillance monitoring I: Monitoring of surface water status

- Surveillance monitoring II: Monitoring of specific pressures
- Operational monitoring
- Investigative monitoring

Surveillance monitoring II is a joint monitoring activity of all ICPDR Contracting Parties that produces annual data on concentrations and loads of selected parameters in the Danube and major tributaries.

Surveillance monitoring I and the operational monitoring is based on collection of the data on the status of surface water and groundwater bodies in the DRB District to be published in the DRBM Plan once in six years.

Investigative monitoring is primarily a national task but at the basin-wide level the concept of Joint Danube Surveys was developed to carry out investigative monitoring as needed, e.g. for harmonization of the existing monitoring methodologies, filling the information gaps in the monitoring networks operating in the DRB, testing new methods or checking the impact of "new" chemical substances in different matrices. Joint Danube Surveys are carried out every 6 years.

A new element of the revised TNMN is monitoring of groundwater bodies of basin-wide importance. More information on this issue is provided in the respective chapter in this Yearbook.

Detailed description of the revised TNMN is given in the Summary Report to EU on monitoring programmes in the Danube River Basin District designed under WFD Article 8.

This Yearbook presents the results of the Surveillance monitoring II: Monitoring of specific pressures.

2. Description of the TNMN Surveillance Monitoring II: Monitoring of specific pressures

2.1. Objectives

Surveillance Monitoring II aims at long-term monitoring of specific pressures of basin-wide importance. Selected quality elements are monitored annually. Such denser monitoring programme is needed to identify the specific pressures in the Danube River Basin District in order to allow a sound and reliable long-term trend assessment of specific quality elements and to achieve a sound estimation of pollutant loads being transferred across states of Contracting Parties and into the Black Sea.

Surveillance Monitoring II is based on the set-up of the original TNMN and is fitted to respond to pressures of basin-wide importance. The monitoring network is based on the national monitoring networks and the operating conditions are harmonized between the national and basin-wide levels to minimise the efforts and maximise the benefits.

2.2. Selection of monitoring sites

The selection of monitoring sites is based on the following criteria:

- Monitoring sites that have been monitored in the past and are therefore suitable for long-term trend analysis; these include sites
  - located just upstream/downstream of an international border,
  - located upstream of confluences between Danube and main tributaries or main tributaries and larger sub-tributaries (to enable estimation of mass balances),
  - located downstream of the major point sources,
  - located to control important water uses.

- Sites required to estimate pollutant loads (e.g. of nutrients or priority pollutants) which are transferred across boundaries of Contracting Parties, and which are transferred into the marine environment.

The sites are located in particular on the Danube and its major primary or secondary tributaries near crossing boundaries of the Contracting Parties. List of monitoring sites is in the Table 1.

Table 1: List of monitoring sites

No.	Country code	DEFF Code	New TNMN code	River	Name of site	Locations	x- coord.	y-coord.	River-km	Altitude	Catch-ment
1	DE	L2130	DE2	Danube	Jochenstein	M	13.703	48.520	2 204	290	77 086
2	DE		DE5	Danube	Dillingen	L	10.499	48.568	2 538	420	11 315
3	DE	L2150	DE3	/Inn	Kirchdorf	M	12.126	47.782	195	452	9 905
4	DE	L2160	DE4	/Inn/Salzach	Laufen	L	12.933	47.940	47	390	6 113
5	AT	L2220	AT1	Danube	Jochenstein	M	13.703	48.521	2 204	290	77 086
6	AT		AT5	Danube	Enghagen	R	14.512	48.240	2 113	241	84 869
7	AT	L2180	AT3	Danube	Wien-Nussdorf	R	16.371	48.262	1 935	159	101 700
8	AT		AT6	Danube	Hainburg	R	16.993	48.164	1 879	136	130 759
9	CZ	L2100	CZ1	/Morava	Lanzhot	M	16.989	48.687	79	150	9 725
10	CZ	L2120	CZ2	/Morava/Dyje	Pohansko	M	16.885	48.723	17	155	12 540
11	SK	L1840	SK1	Danube	Bratislava	LMR	17.104	48.139	1 869	128	131 329
12	SK	L1860	SK2	Danube	Medveďov	M	17.652	47.794	1 806	108	132 168
13	SK	L1960	SK4	/Váh	Komárno	MR	18.142	47.761	1	106	19 661
14	SK	L1871	SK5	Danube	Szob	M	18.964	47.787	1 707	100	183 350
15	SK		SK6	/Morava	Devín	M	48.188	16.976	1	145	26 575
16	SK		SK7	/Hron	Kamenica	M	47.826	18.723	1.7	114	5 417
17	SK		SK8	/Ipoly	Salka	M	47.886	18.763	12	110	5 060
18	HU	L1470	HU1	Danube	Medvedov	M	17.652	47.792	1 806	108	131 605
19	HU	L1475	HU2	Danube	Komarom	LMR	18.121	47.751	1 768	101	150 820
20	HU	L1490	HU3	Danube	Szob	LMR	18.964	47.787	1 708	100	183 350
21	HU	L1520	HU4	Danube	Dunafoldvar	LMR	18.934	46.811	1 560	89	188 700
22	HU	L1540	HU5	Danube	Hercegszanto	LMR	18.814	45.909	1 435	79	211 503
23	HU	L1604	HU6	/Sio	Szekszard-Palank	M	18.720	46.380	13	85	14 693
24	HU	L1610	HU7	/Drava	Dravaszabolcs	M	18.200	45.784	78	92	35 764
25	HU	L1770	HU8	/Tisza/Sajo	Sajopuspoki	M	20.340	48.283	124	148	3 224
26	HU	L1700	HU9	/Tisza	Tiszasziget	LMR	20.105	46.186	163	74	138 498
27	HU		HU10	/Tisza	Tiszabecs	M	22.830	48.102	757	114	9707
28	HU		HU11	/Tisza/Szamos	Csenger	M	22.404	47.513	45	113	15283
29	HU		HU12	/Tisza/Hármas-Körös/Sebes-Körös	Korosszakal	M	21.392	47.011	59	92	2489
30	HU		HU13	/Tisza/Hármas-Körös/Kettõs-Körös/Fekete-Körös	Sarkad	M	21.255	46.414	16	85	4302
31	HU		HU14	/Tisza/Hármas-Körös/Kettõs-Körös/Fehér-Körös	Gyulavari	M	21.201	46.374	9	85	4251
32	HU		HU15	/Tisza/Maros	Nagylak	R	20.421	46.094	51	80	30149

No.	Country code	DEFF Code	New TNMN code	River	Name of site	Locations	x- coord.	y-coord.	River-km	Altitude	Catch-ment
33	SI	L1390	SI1	/Drava	Ormoz	LM	16.155	46.403	300	192	15 356
34	SI	L1330	SI2	/Sava	Jesenice	R	15.692	45.861	729	135	10 878
35	HR	L1315	HR1	Danube	Batina	MR	16.938	46.241	1 429	86	210 250
36	HR	L1320	HR2	Danube	Borovo	R	18.201	45.783	1 337	89	243 147
37	HR	L1300	HR9	/Drava	Ormoz	LM	16.155	46.403	300	192	15356
38	HR	L1240	HR4	/Drava	Botovo	MR	18.829	45.875	227	123	31 038
39	HR	L1250	HR5	/Drava	Donji Miholjac	MR	16.691	46.419	78	92	37 142
40	HR	L1220	HR6	/Sava	Jesenice	LR	18.696	45.040	729	135	10 834
41	HR	L1150	HR7	/Sava	Upstream Una Jasenovac	L	16.369	45.484	525	87	30 953
42	HR	L1060	HR8	/Sava	Zupanja	LMR	16.953	45.251	254	85	62 890
43	HR		HR10	/Sava	Drenje	L	15.690	45.862	728.8	135	10 878
44	RS	L2350	RS1	Danube	Bezdan	L	18.854	45.864	1 427	83	210 250
45	RS	L2360	RS2	Danube	Bogojevo	L	19.084	45.529	1 367	80	251 253
46	RS	L2370	RS3	Danube	Novi Sad	R	19.842	45.225	1 258	75	254 085
47	RS	L2380	RS4	Danube	Zemun	R	20.417	44.849	1 174	71	412 762
48	RS	L2390	RS5	Danube	Pancevo	L	20.594	44.856	1 155	70	525 009
49	RS	L2400	RS6	Danube	Banatska Palanka	M	21.345	44.826	1 077	69	568 648
50	RS	L2410	RS7	Danube	Tekija	R	22.424	44.700	955	0	574 307
51	RS	L2420	RS8	Danube	Radujevac	R	22.686	44.263	851	32	577 085
52	RS	L2430	RS9	Danube	Backa Palanka	L	19.386	45.234	1 287	0	253 737
53	RS	L2440	RS10	/Tisza (Tisa)	Martonos	R	20.087	46.114	152	76	140 130
54	RS	L2450	RS11	/Tisza (Tisa)	Novi Becej	L	20.140	45.586	66	74	145 415
55	RS	L2460	RS12	/Tisza (Tisa)	Titel	M	20.320	45.205	9	73	157 147
56	RS	L2470	RS13	/Sava	Jamena	L	20.320	45.205	195	78	64 073
57	RS	L2480	RS14	/Sava	Sremska Mitrovica	L	19.608	44.966	136	75	87 996
58	RS	L2490	RS15	/Sava	Sabac	R	19.704	44.770	104	74	89 490
59	RS	L2500	RS16	/Sava	Ostruznica	R	20.317	44.732	17	0	37 320
60	RS	L2510	RS17	/Velika Morava	Ljubicevski Most	R	21.138	44.585	35	75	37 320
61	BA		BA5	/Sava	Gradiska	M	17.255	45.141	457	86	39 150
62	BA		BA6	/Sava/Una	Kozarska Dubica	M	16.849	45.200	16	94	9 130
63	BA		BA7	/Sava/Vrbas	Razboj	M	17.458	45.050	12	100	6 023
64	BA		BA8	/Sava/Bosna	Modrica	M	18.313	44.961	24	114	10 500
65	BA		BA9	/Sava/Drina	Foca	M	18.833	43.344	234	442	3 884
66	BA		BA10	/Sava/Drina	Badovinci	M	19.344	44.779	16	90	19 226
67	BA		BA11	/Sava	Raca	M	19.335	44.891	190	80	64 125
68	BA		BA12	/Sava/Una	Novi Grad	M	16.295	44.988	70	137	4 573
69	BA		BA13	/Sava/Bosna	Usora	M	18.074	44.664	78	148	7 313
70	BG	L0730	BG1	Danube	Novo Selo harbour	LMR	22.785	44.165	834	35	580 100
71	BG		BG9	Danube	Lom	R	23.270	43.835	741	24	588 860
72	BG		BG10	Danube	Orjahovo	R	23.997	43.729	679	22	607 260
73	BG	L0780	BG2	Danube	Bajkal	R	24.400	43.711	641	20	608 820
74	BG		BG11	Danube	Nikopol	R	25.927	43.701	598	21	648 620
75	BG	L0810	BG3	Danube	Svishtov	R	25.345	43.623	554	16	650 340
76	BG	L0820	BG4	Danube	Upstream Russe	R	25.907	43.793	503	12	669 900
77	BG	L0850	BG5	Danube	Silistra	LMR	27.268	44.125	375	7	698 600
78	BG		BG12	/Iskar	mouth	M	24.461	43.706	4	27	8 646
79	BG		BG13	/Vit	Guljantzi	M	24.728	43.644	7	29	3 225
80	BG		BG14	/Jantra	mouth	M	25.579	43.603	4	25	7 869
81	BG		BG15	/Russenski Lom	mouth	M	25.936	43.813	1	17	2 974
82	RO	L0020	RO1	Danube	Bazias	LMR	21.384	44.816	1 071	70	570 896
83	RO		RO18	Danube	Gruia/Radujevac	LMR	22.684	44.270	851	32	577 085
84	RO	L0090	RO2	Danube	Pristol/Novo Selo	LMR	22.676	44.214	834	31	580 100
85	RO	L0240	RO3	Danube	Dunare - upstream Arges (Oltenita)	LMR	26.619	44.056	432	16	676 150
86	RO	L0280	RO4	Danube	Chiciu/Silistra	LMR	27.268	44.128	375	13	698 600
87	RO	L0430	RO5	Danube	Reni	LMR	28.232	45.463	132	4	805 700
88	RO	L0450	RO6	Danube	Vilkova-Chilia arm/Kilia arm	LMR	29.553	45.406	18	1	817 000
89	RO	L0480	RO7	Danube	Sulina - Sulina arm	LMR	29.530	45.183	0	1	817 000
90	RO	L0490	RO8	Danube	Sf. Gheorghe-Ghorghe arm	LMR	29.609	44.885	0	1	817 000
91	RO	L0250	RO9	/Arges	Conf. Danube (Clatesti)	M	26.599	44.145	0	14	12 550
92	RO	L0380	RO10	/Siret	Conf. Danube (Sendreni)	M	27.933	45.406	0	4	42 890
93	RO	L0420	RO11	/Prut	Conf. Danube (Giurgiulesti)	M	28.203	45.469	0	5	27 480
94	RO		RO12	/Tisza/Somes	Dara (frontiera)	M	22.720	47.815	3	118	15 780
95	RO		RO13	/Tisza/Hármas-Körös/Sebes-Körös/Crisul Repede	Cheresig	M	21.692	47.030	3	116	2 413

No.	Country code	DEFF Code	New TNMN code	River	Name of site	Locations	x- coord.	y-coord.	River-km	Altitude	Catch-ment
96	RO		RO14	/Tisza/Hármas-Körös/Kettős-Körös/Crisul Negru	Zerind	M	21.517	46.627	13	86.4	3 750
97	RO		RO15	/Tisza/Hármas-Körös/Kettős-Körös/Crisul Alb	Varsand	M	21.339	46.626	0.2	88.9	4 240
98	RO		RO16	/Tisza/Mures	Nadlac	M	20.727	46.145	21	85.6	27 818
99	RO		RO17	/Tisza/Bega	Otelec	M	20.847	45.620	7	46	2 632
100	RO		RO19	/Jiu	Zaval	M	23.845	43.842	9	30.9	10 046
101	RO		RO20	/Olt	Islaz	M	24.797	43.744	3	32	24 050
102	RO		RO21	/Ialomita	Downstream Tandarei	M	27.665	44.635	24	8.5	10 309
103	MD	L2230	MD1	/Prut	Lipcani	L	26.483	48.152	658	100	8 750
104	MD	L2270	MD3	/Prut	Conf. Danube-Giurgiulesti	LMR	28.124	45.285	0	5	27 480
105	MD		MD5	/Prut	Costesti Reservoir	L	27.145	47.513	557	91	11 800
106	MD		MD6	/Prut	Braniste	L	27.145	47.475	546	63	12 000
107	MD		MD7	/Prut	Valea Mare	L	27.515	47.075	387	55	15 200
108	UA	L0630	UA1	Danube	Reni	M	28.241	45.463	132	4	805 700
109	UA	L0690	UA2	Danube	Vylkove	M	29.246	45.436	18	1	817 000
110	UA		UA4	/Tisza	Chop	M	22.184	48.416	342	92	33000
111	UA		UA5	/Tisza/Bodrog/Latoritsa	Strazh	M	22.212	48.454	144	97	4418
112	UA		UA6	/Prut	Tarasivtsi	M	26.336	48.183	262	122	9836
113	UA		UA7	/Siret	Porubne	M	26.030	47.981	100	303	2070
114	UA		UA8	/Uzh	Storozhnica	R	22.200	48.617	106	112	1582
115	ME		ME1	/Lim	Dobrakovo	L	19º46'22"	43º07'17"	112	609	2875
116	ME		ME2	/Cehotina	Gradac	L	19º09'14"	43º23'45"	55.5	55	809.8

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	

Figure 2.2.1: The Danube Stationmap TNMN

2.3. Quality elements

2.3.1. Parameters indicative of selected biological quality elements

To cover pressures of basin-wide importance as organic pollution, nutrient pollution and general degradation of the river, following biological quality elements have been agreed for SM2:

- Phytoplankton (chlorophyll-a)
- Benthic invertebrates (mandatory parameters: Saprobic index and number of families once yearly, both Pantle&Buck and Zelinka&Marvan SI are acceptable; optional parameters: ASPT and EPT taxa)
- Phytobenthos (benthic diatoms – an optional parameter)

2.3.2. Priority pollutants and parameters indicative of general physico-chemical quality elements

The list of parameters for assessment of trends and loads and their monitoring frequencies are given in Table 2

Table 2: Determinand list for water for TNMN

	Surveillance Monitoring 2	
	Water	**Water**
	concentrations	**load assessment**
Parameter		
Flow	anually / 12 x per year	daily
Temperature	anually / 12 x per year	
Transparency (1)	anually / 12 x per year	
Suspended Solids (5)	anually / 12 x per year	anually / 26 x per year
Dissolved Oxygen	anually / 12 x per year	
pH (5)	anually / 12 x per year	
Conductivity @ 20 °C (5)	anually / 12 x per year	
Alkalinity (5)	anually / 12 x per year	
Ammonium (NH_4^+-N) (5)	anually / 12 x per year	anually / 26 x per year
Nitrite (NO_2^- -N)	anually / 12 x per year	anually / 26 x per year
Nitrate (NO_3^- -N)	anually / 12 x per year	anually / 26 x per year
Organic Nitrogen	anually / 12 x per year	anually / 26 x per year
Total Nitrogen	anually / 12 x per year	anually / 26 x per year
Ortho-Phosphate (PO_4^{3-} -P) (2)	anually / 12 x per year	anually / 26 x per year
Total Phosphorus	anually / 12 x per year	anually / 26 x per year
Calcium (Ca^{2+}) (3, 4, 5)	anually / 12 x per year	
Magnesium (Mg^{2+}) (4, 5)	anually / 12 x per year	
Chloride (Cl^-)	anually / 12 x per year	
Atrazine	anually / 12 x per year	
Cadmium (6)	anually / 12 x per year	
Lindane (7)	anually / 12 x per year	
Lead (6)	anually / 12 x per year	

	Surveillance Monitoring 2	
	Water	Water
	concentrations	load assessment
Parameter		
Mercury (6)	anually / 12 x per year	
Nickel (6)	anually / 12 x per year	
Arsenic (6)	anually / 12 x per year	
Copper (6)	anually / 12 x per year	
Chromium (6)	anually / 12 x per year	
Zinc (6)	anually / 12 x per year	
p,p´-DDT and its derivatives (7)	see below	
COD_{Cr} (5)	anually / 12 x per year	
COD_{Mn} (5)	anually / 12 x per year	
Dissolved Silica		anually / 26 x per year
BOD_5	anually / 12 x per year	

(1) Only in coastal waters
(2) Soluble reactive phosphorus SRP
(3) Mentioned in the tables of the CIS Guidance document but not in the related mind map
(4) Supporting parameter for hardness-dependent eqs of PS metals
(5) Not for coastal waters
(6) Measured in a dissolved form. Measurement of total concentration is optional
(7) In areas with no risk of failure to meet the environmental objectives for DDT and lindane the monitoring frequency is 12 x per a RBMP period; in case of risk the frequency is 12 x year

2.4. Analytical Quality Control (AQC)

The 2010 analytical quality control scheme involved quarterly distribution of surface water samples to be analysed for general parameters, nutrients, metals and organic pollutants. Overall, 78 laboratories from 8 Danubian countries participated in the scheme, which is comparable to previous years. Nonetheless 2010 showed, for the first time in the history of the AQC programme, a considerable decrease in participation for individual parameters (up to 50%), meaning that laboratories analysed only part of parameters on offer. Reasons for this partial non-participation were mainly of financial nature. However, interest for organic micropollutants remained high.

Following the Youden-pair experimental design and evaluation technique, samples were prepared in duplicates, i.e. two samples of identical matrix and similar concentration were sent out for each determinand. In accordance with previous experience, general components were measured with negligible problem; overall performance even improved with a marked reduction in the occurrence and severity of systematic and also random errors. The same holds true for nutrients, traditionally among the successful determinations as well. Agreement of results for metals and organic indicator parameters remained relatively good and consistent with previous performance.

The most challenging parameter group was organic micropollutants. Dispersion of results somewhat lessened in case of PAHs and pesticides compared to the previous year, thus redistribution was not necessary for these components.

Diminishing influence of systematic error for all but one PAH with remaining prevalence of random errors suggests a typical learning curve associated with AQCs and underlines teaching potential of periodic proficiency tests. Traditionally the most successful group of micropollutants is PCBs, where target concentrations were lowered in 2010 in order to better match real-world samples. This resulted in a marked increase in the occurrence of random errors and the need for a repetition round.
Concentration ranges for organic micropollutants had been criticised by some participants to be unnaturally high. Efforts have been made to gradually decrease pollutant content in samples over the years for all determinands, with mixed results (see poor performance for PCBs). There is a clear conflict of interests between more experienced laboratories wishing to see complex, challenging samples in the AQC, and other participant where our programme can rather be described as a learning tool. Resolution of this conflict is a major challenge for the QualcoDanube AQC programme.

2.5. 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).

3. Results of basic statistical processing

155 sites at 109 TNMN monitoring stations were monitored in the Danube River Basin in 2010 (some monitoring stations contain two or three sampling sites - left, middle and/or right side of the river). The data was collected from 73 sampling sites at 40 stations on the Danube river and from 82 sampling sites at 69 stations at the tributaries.

The basic processing of the TNMN data includes the calculation of selected statistical characteristics for each determinand/monitoring site. Results are presented in tables in the Annex I 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 2010
Mean	arithmetical mean of the measurements done in the year 2010
Max	maximum value of the measurements done in the year 2010
C50	50 percentile of the measurements done in the year 2010
C90	90 percentile of the measurements done in the year 2010

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

- *If "less than the quantification limit" values were present in the dataset for a given determinand, then the ½ value of the limit of quantification 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.*
- *The statistic value "C90" 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 "C90" value is represented by a maximum value from a data set (a minimum value for dissolved oxygen and lower limit of pH value).*

2010 TNMN data were processed in accordance with the Directive 2009/90/EC using the limit of quantification (LOQ). In this case if concentration values were less than LOQ the value of ½ LOQ was used for further calculation.

Persisting problem was the reduced monitoring frequency for certain determinands such as dissolved phosphorus, biological determinands, heavy metals and specific organic micropollutants, mainly for the lower part of the Danube River Basin.

Table 3 uses the data from the Annex I and shows in an aggregated way the concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2010. These include indicators of the oxygen regime, nutrients, heavy metals, biological determinands and organic micropollutants.

Table 3 also includes information about the number of monitoring locations and sampling sites providing the data as well as the minimal and maximal values for all determinands in the

Danube and the tributaries and minimal and maximal values of the annual averages for all sites on the Danube and tributaries.

* For some heavy metals in Table 3, 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 3: Concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2010

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	70/40	-6,0	29,5	6,3	27,0	71/69	0,0	30,0	8,2	18,8
Suspended Solids	mg/l	69/39	< 0.3	275	10	95	70/68	< 0.05	3493	3	879
Dissolved Oxygen	mg/l	70/40	3,2	17,2	7,6	11,2	71/69	2,6	14,9	6,5	11,7
BOD$_5$	mg/l	70/40	< 0.4	17,6	1,1	4,5	71/69	< 0.1	22,6	0,8	7,4
COD$_{Mn}$	mg/l	63/35	1,3	19,1	2,3	5,8	38/36	< 0.50	20,2	1,7	10,7
COD$_{Cr}$	mg/l	60/30	< 1.0	49	4,4	24,9	57/55	1,3	74,9	3,4	53,1
TOC	mg/l	31/23	1,2	7,4	2,6	6,1	26/26	0,8	15,5	1,6	10,1
DOC	mg/l	5/5	1,7	4,8	2,275	2,657	3/3	0,8	7,6	1,2	7,2
pH		65/37	6,6	8,7	7,6	8,4	69/67	5,9	8,8	7,3	8,3
Alkalinity	mmol/l	69/39	1,2	8,9	1,7	4,6	53/51	0,8	12,9	1,3	7,1
Ammonium-N	mg/l	70/40	< 0.004	0,62	0,02	0,22	71/69	< 0.005	4,60	0,03	2,38
Nitrite-N	mg/l	70/40	< 0.0010	0,608	0,007	0,045	71/69	< 0.0015	0,63	0,004	0,16
Nitrate-N	mg/l	70/40	0,10	5,70	0,50	3,10	71/69	< 0.005	7,95	0,20	5,43
Total Nitrogen	mg/l	47/27	< 0.500	6,2	1,5	3,9	46/46	0,4	15,2	0,6	6,8
Organic Nitrogen	mg/l	29/21	< 0.050	2,40	0,26	1,57	33/31	< 0.020	30,64	0,16	3,71
Ortho-Phosphate-P	mg/l	70/40	< 0.0025	0,700	0,023	0,142	71/69	< 0.0025	2,480	0,007	0,911
Total Phosphorus	mg/l	70/40	< 0.0090	0,795	0,054	0,246	59/57	< 0.0035	1,795	0,015	0,413
Total Phosphorus - Dissolved	mg/l	14/10	< 0.0050	0,220	0,039	0,112	20/20	< 0.0035	0,696	0,009	0,181
Chlorophyll-a	µg/l	45/26	< 0.5000	71,10	1,18	27,69	36/36	0,09	92	1,179	49,8
Conductivity 20°C	µS/cm	68/38	240	726	351	521	66/64	119	1298	217	1031
Calcium	mg/l	69/39	28,6	141,0	49,4	86,7	63/61	22,9	113,0	29,1	80,6
Sulphates	mg/l	65/39	10,5	140,0	18,3	62,5	50/48	2,1	186,0	10,5	129,6
Magnesium	mg/l	66/38	< 0.25	34,0	10,8	21,8	63/61	< 0.50	40773,0	3,8	3717,8
Potassium	mg/l	61/35	1,0	20,8	2,0	4,5	33/31	< 0.01	16,0	0,9	11,3
Sodium	mg/l	61/35	7,20	41,9	12,1	22,8	33/31	2,00	71,00	4,32	54,18
Manganese	mg/l	39/21	< 0.0010	0,78	0,01	0,14	23/23	< 0.0001	0,85	< 0.0010	0,25
Iron	mg/l	44/24	0,01	5,6	0,057	1,616	30/30	< 0.005	28,70	0,03	7,21
Chlorides	mg/l	70/40	8,6	56	15,9	31,2	70/68	0,4	171,6	2,4	157,50
Silicates (SiO2)	mg/l	10/6	1,5	18,9	4,7	11,7	10/8	1,6	22,9	5,4	14,4
Macrozoobenthos- saprobic index		14/12	1,9	2,6	1,9	2,5	28/28	1,4	3,5	1,6	3,4
Macrozoobenthos - no.of taxa		5/3	4	52	4	49	11/11	13	43280	15	20230
Macrozoobenthos-number of families		11/9	8	16	8	16	17/17	4	32	4,5	32

Table 3: Concentration ranges and mean annual concentrations of selected determinands in the Danube River and its tributaries in 2010 (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	56/34	< 0.500	805	2.267	121.8	56/54	0.25	371	1.29	120.6
Copper - Dissolved	µg/l	57/35	< 0.250	260	0.884	31.6	58/56	< 0.250	48.2	0.662	20.1
Chromium - Dissolved	µg/l	54/34	< 0.05	25	0.1	9.6	51/49	0.04	26	0.2	17.9
Lead - Dissolved	µg/l	55/33	0.013	8	0.058	2.0	58/56	0.018	20.81	0.063	2.7
Cadmium - Dissolved	µg/l	55/33	< 0.005	3	0.01	0.5	58/56	< 0.005	13	0.01	1.7
Mercury - Dissolved	µg/l	55/33	< 0.0010	6	0.0013	0.6	43/41	< 0.02	1	0.0009	0.2
Nickel - Dissolved	µg/l	54/32	< 0.250	84	0.40	22.3	58/56	< 0.150	51	< 0.500	10.9
Arsenic - Dissolved	µg/l	55/33	< 0.005	4.62	< 0.005	2.3	48/46	< 0.005	9.08	0.35	5.9
Aluminium - Dissolved	µg/l	4/4	< 5.00	43.7	8.97	32.7	12/10	< 2.50	1740	6.31	261.7
Zinc *	µg/l	43/21	< 0.50	191.01	< 0.50	79.2	34/34	< 0.50	270	3.35	115.5
Copper	µg/l	44/22	< 0.500	120	< 0.500	34.30	37/37	< 0.500	115	< 0.500	46.44
Chromium - total	µg/l	43/21	< 0.5000	13	< 0.5000	4.20	29/29	< 0.1250	49.3	0.40	19.79
Lead	µg/l	43/21	< 0.1500	8.90	< 0.5000	3.00	36/36	< 0.1500	100.00	< 0.1500	25.00
Cadmium	µg/l	38/18	< 0.01000	1.7	< 0.02500	0.5	33/33	< 0.02500	53.0	< 0.02500	5.4
Mercury	µg/l	39/17	< 0.0150	0.6	0.024	< 0.25	27/27	< 0.0150	0.56	< 0.0150	0.3
Nickel	µg/l	41/19	< 0.500	20.0	< 0.500	7.5	36/36	< 0.150	52.5	< 0.500	19.8
Arsenic	µg/l	43/21	< 0.005	25.0	< 0.005	4.5	22/22	< 0.005	13.8	< 0.350	3.7
Aluminium	µg/l	10/6	< 1.500	2165	< 1.500	304	9/9	25	21400	64	6015
Phenol index	mg/l	25/17	< 0.0010	0.011	< 0.0010	0.004	40/38	< 0.0004	0.090	0.0005	0.029
Anionic active surfactants	mg/l	43/23	< 0.0050	0.170	< 0.0050	0.080	35/35	< 0.0050	0.209	< 0.0050	0.065
AOX	µg/l	10/6	< 2.5000	44.0	5.3	14.8	9/9	< 2.5000	32.0	< 5.0000	29.7
Petroleum hydrocarbons	mg/l	46/24	< 0.0025	21.000	0.004	15.15	33/33	< 0.01	15.000	0.004	15.000
PAH (sum of 6)	µg/l	0/0					2/2	0.006	0.151	0.015	0.046
PCB (sum of 7)	µg/l	0/0					0/0				
Lindane	µg/l	49/29	< 0.0005	< 0.0250	< 0.0005	< 0.0250	47/45	< 0.01	0.02	<0.0003	0.02
pp´DDT	µg/l	46/28	< 0.0005	< 0.0250	< 0.0005	< 0.0250	48/46	< 0.0005	< 0.0250	< 0.0005	< 0.0250
Atrazine	µg/l	46/28	< 0.0025	0.050	< 0.0025	0.046	41/39	< 0.0010	0.660	< 0.0025	0.281
Chloroform	µg/l	5/5	< 0.100	< 0.500	< 0.100	< 0.500	17/17	< 0.015	< 0.500	0.021	< 0.500
Carbon tetrachloride	µg/l	5/5	< 0.100	< 0.200	< 0.100	< 0.200	8/8	< 0.050	< 0.200	< 0.050	< 0.200
Trichloroethylene	µg/l	5/5	< 0.010	< 0.100	< 0.010	< 0.100	8/8	< 0.010	< 0.100	< 0.010	< 0.100
Tetrachloroethylene	µg/l	5/5	< 0.100	0.31	0.115	< 0.250	8/8	< 0.050	< 0.250	< 0.050	< 0.250

4. Profiles and trend assessment of selected determinands

4.1. Physico-chemical parameters, macrozoobenthos and chlorophyll-a

The 90 percentiles (C90) of selected determinands (dissolved oxygen, BOD_5, CODcr, $N\text{-}NH_4$, $N\text{-}NO_3$, $P\text{-}PO_4$, P_{total} and Cd) measured in last ten years are displayed in the Figures 4.1-4.16. Due to the revision of the TNMN in 2006 following monitoring points on the Danube were replaced : AT2 rkm 2120 to AT5 rkm 2113, AT4 rkm 1874 to AT6 rkm 1879, DE1 rkm 2581 to DE5 rkm 2538. Among tributaries the site HR3 rkm 288 was replaced by HR9 rkm 300 BG8 rkm 54 to BG14 rkm 4 and BG8 rkm 13 to BG15 rkm 1. In 2008 the site HR6 rkm 729 was replaced by HR10 rkm 728.8. In 2009 SK3 was replaced with SK5, this monitoring point is also in graphs illustrated as Hungarian site HU3. For trend graphs SK3 and HU3 were used, because for SK5 there is data only from one year of monitoring available.
To indicate the long-term trends in the upper, middle and lower Danube a more detailed analysis for selected parameters (BOD_5, $N\text{-}NO_3$, P_{total}) is provided for the sites SK1 Bratislava, HU5 Hercegszanto and RO5 Reni (Figures 4.17-4.33).

As regards a general spatial distribution of key water quality parameters along the Danube River in 2010 the highest concentrations of biodegradable organic matter were observed in the middle and lower parts of the river. The concentration of nutrients and cadmium reached their highest concentration values also in the lower part of the Danube. The highest pollution by the biodegradable organic matter in 2010 was measured in Russenski Lom, Arges, Jantra, Siret and Prut.

The highest values of dissolved oxygen were observed in the upper part of the Danube, in the lower Danube the dissolved oxygen levels decrease (Figure 4.1). The lowest DO value was observed at the monitoring point BG5. Low values of dissolved oxygen were measured in 2010 in tributaries Arges, Jantra and Russenski Lom.

Taking into account the entire period of TNMN operations positive changes in the levels of biodegradable organic matter has been recorded in the upper Danube and also at some stations of the lower Danube (see Figure 4.3). In 2010 a decrease in BOD levels was observed at HU5 and RO5, while at SK1 the BOD concentration increased (Figure 4.17-4.19).
A decreasing tendency of the BOD levels was observed in the tributaries Dyje, Morava, Sava, Arges and Siret (Figure 4.14).

The decreasing levels of ammonium-N were recorded in the whole Danube River. Especially the elevated concentration at BG2 in 2009 dropped down in 2010 by some 89%. During the last ten years of TNMN operation, concentration of ammonium was decreasing in the upper Danube tributaries (Inn, Salzach, Morava, Dyje) as well as in the Siret, Sava, Tisza and Prut rivers. In 2010 concentration of ammonium-N in Arges decreased as well (see Figure 4.8).

The level of nitrate-N concentrations is rather stable during the recent years. A decrease was observed at several stations in the whole Danube also in lower part (e.g., BG4, RO3, RO5-RO8, see Figure 4.9). The nitrate-N has also a decreasing tendency in the tributaries Dyje, Vah, Tisza/Sajo, Sio, Sava, Arges, Prut and Siret (Figure 4.10). In the three selected Danube sites the nitrate-N concentrations in 2010 decreased (Figure 4.20-4.22).

In the last decade a decreasing tendency of ortho-phosphate-P concentrations is mostly seen in the upper part of the Danube, but in 2010 the concentration decreased also at a number of lower Danube sites (BG2, RO6, RO7, RO8, Figure 4.11). Decreasing tendency of ortho-phosphate-P was observed in the tributaries Dyje, Vah, Prut, Arges and Siret (Figure 4.12).

P-total concentrations also declined in the last decade in the upper and middle Danube (Figure 4.13). A P-total concentration has decreasing tendency in the tributaries Dyje, Morava, Inn, Sio, Tisza, Arges and Sava (see Figure 4.14). In 2010 the P-total concentration has decreased in tributaries Sio and Morava. At SK1 Bratislava, HU5 Hercegszanto and RO5 Reni P-total concentration was decreasing over the last decade (Figure 4.23-4.25).

The trends of COD in Danube River was rather stable during last ten years, the highest concentrations were observed in the lower Danube. The highest COD concentrations in 2010 were observed in tributaries Prut., Siret, Russenski Lom.

The cadmium concentration is constant or slightly decreasing in the whole Danube River as well as in its tributaries (Figures 4.15 and 4.16).

The 90 and 10 percentiles of selected determinands (N-NH_4, P-PO_4, CODcr, BOD_5) measured in 2010 are displayed in the Figures 4.26-4.33. Pictures indicate the margins of a usual annual concentration range for a given parameter and site. In graphs for tributaries the rkm values in the Danube are indicated at which tributaries discharge to the Danube.

The annual differences between C90 and C10 has an insignificant variation for N-NH_4 and P-PO_4 in the upper Danube and in the upper and middle Danube tributaries. The apparent differences were observed for BOD_5 along the whole Danube reach. Differences were observed also for BOD_5 in the tributaries.
Large variations for N-NH_4 were observed in the Iskar and Arges and for P-PO_4 in Russenski Lom and Prut. For COD_{cr} and BOD_5 10 and 90 percentiles were different in majority of the Danube tributaries. The most significant differences were observed in lower Danube tributaries, for BOD_5 in Mures and Iskar, for COD_{cr} in Iskar and Russenski Lom.

Figure 4.1.: Temporal changes of dissolved oxygen (c10) in the Danube river.

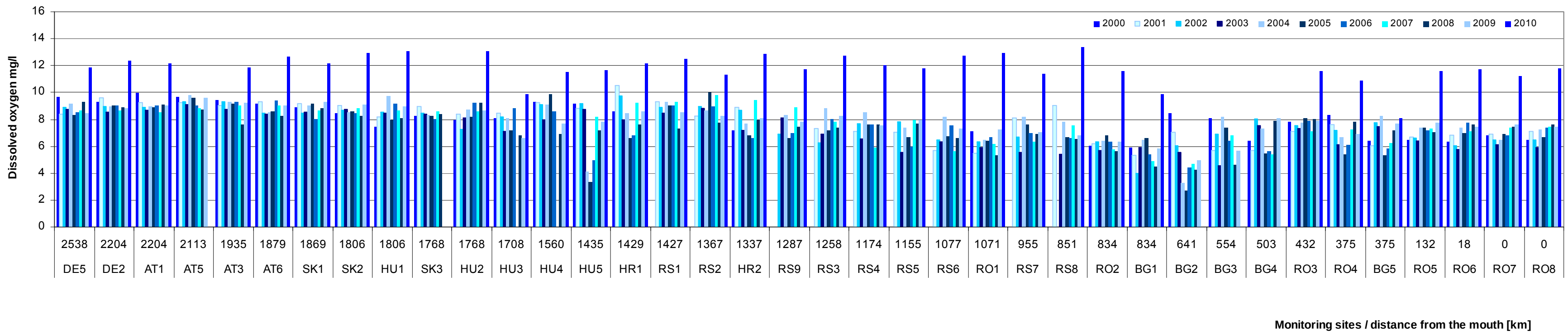


Figure 4.2.: Temporal changes of dissolved oxygen (c10) in tributaries.

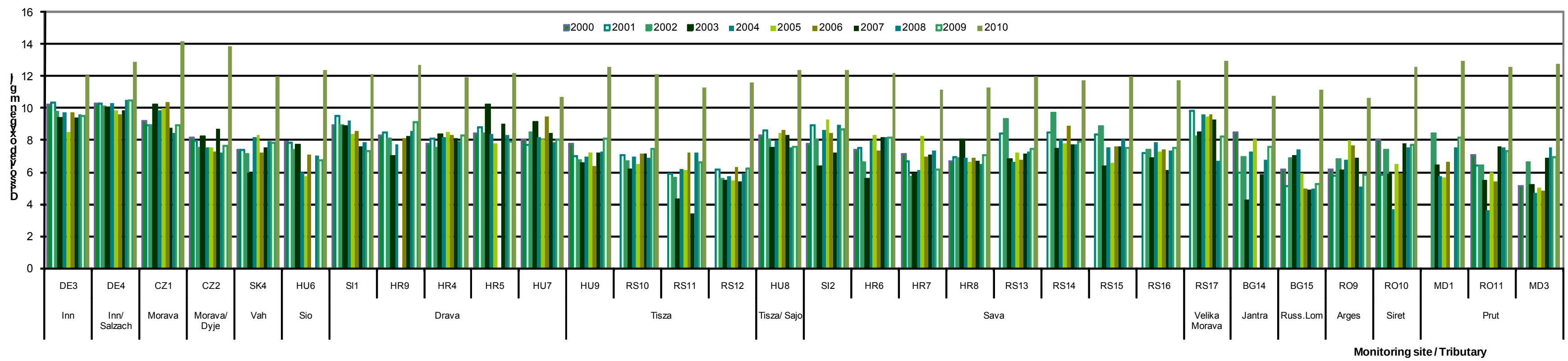


Figure 4.3.: Temporal changes of BOD_5 (c90) in the Danube river.

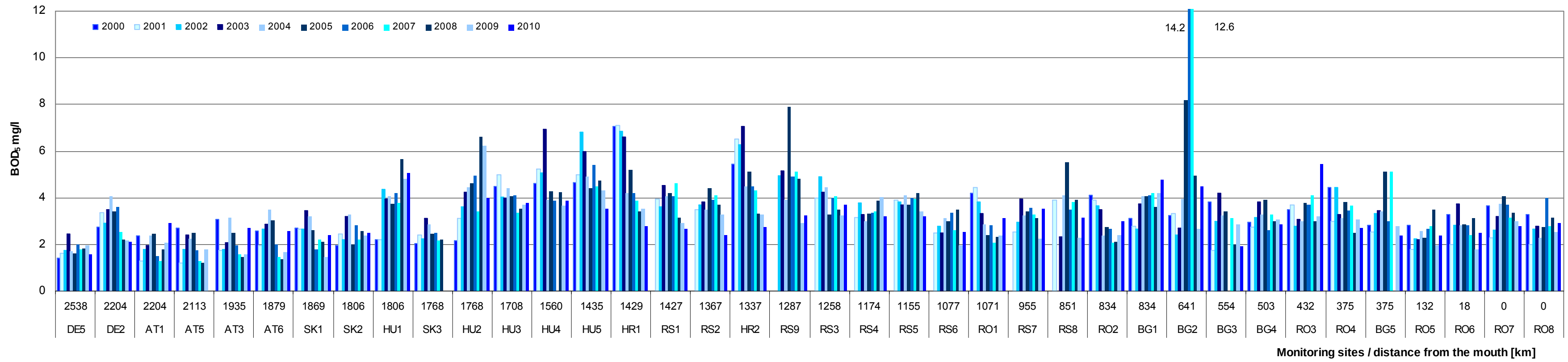


Figure 4.4.: Temporal changes of BOD_5 (c90) in tributaries.

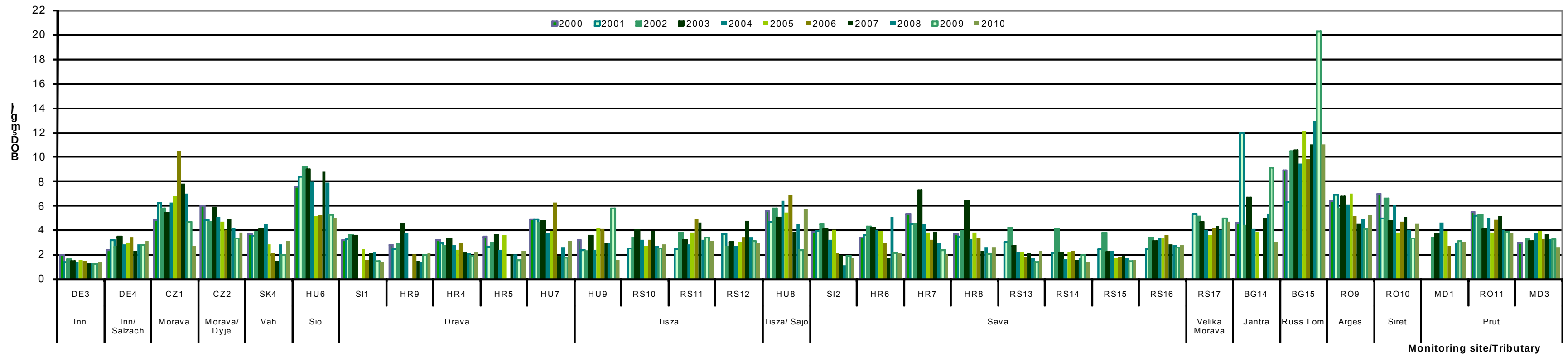


Figure 4.5.: Temporal changes of COD_{Cr} (c90) in the Danube river.

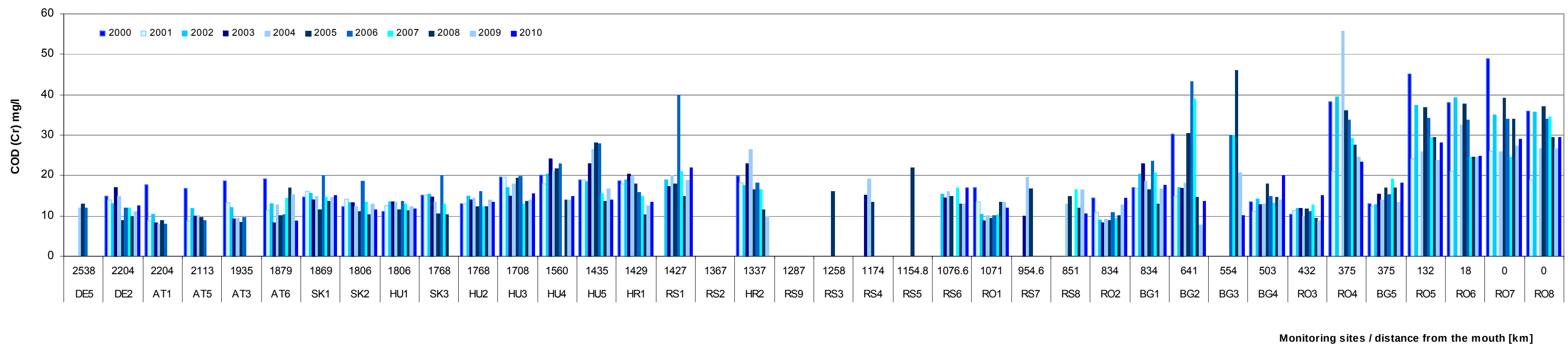


Figure 4.6.: Temporal changes of COD_{Cr} (c90) in tributaries.

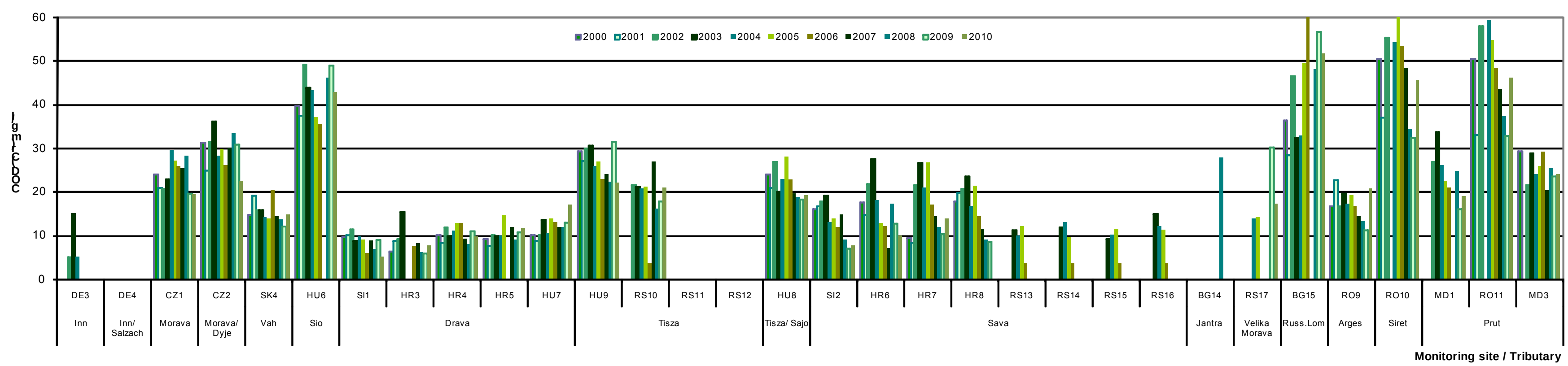


Figure 4.7.: Temporal changes of ammonium-nitrogen (c90) in the Danube river.

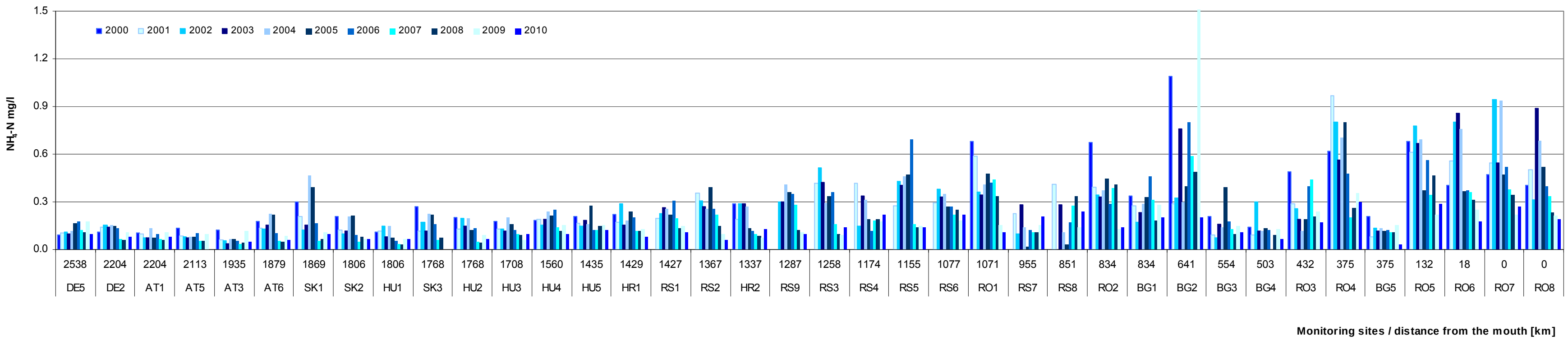


Figure 4.8.: Temporal changes of ammonium-nitrogen (c90) in tributaries.

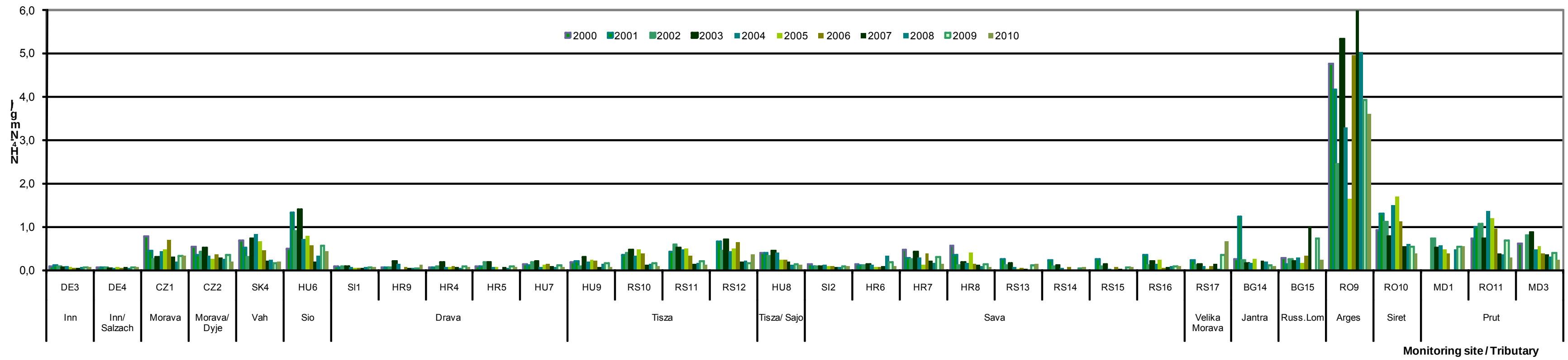


Figure 4.9.: Temporal changes of nitrate-nitrogen (c90) in the Danube river.

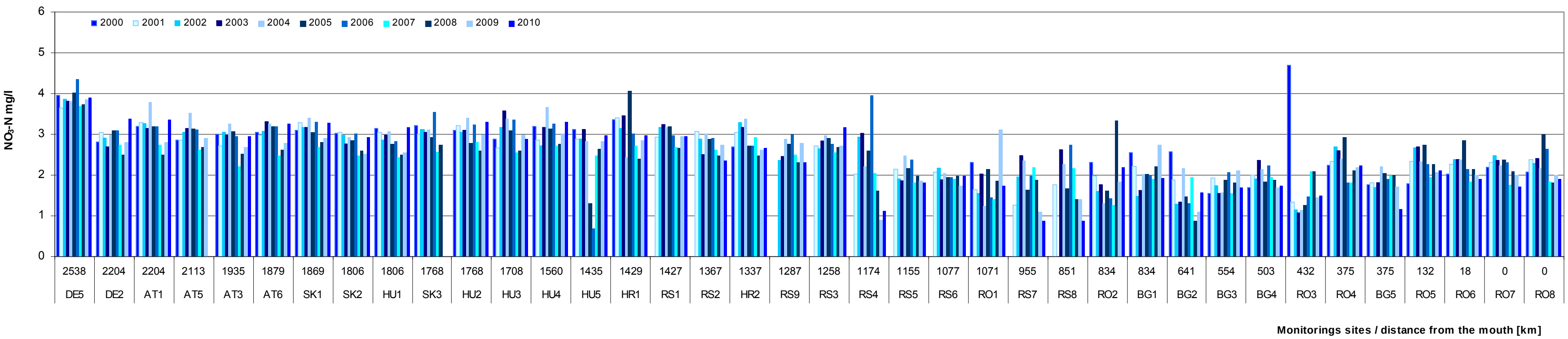


Figure 4.10.: Temporal changes of nitrate-nitrogen (c90) in tributaries.

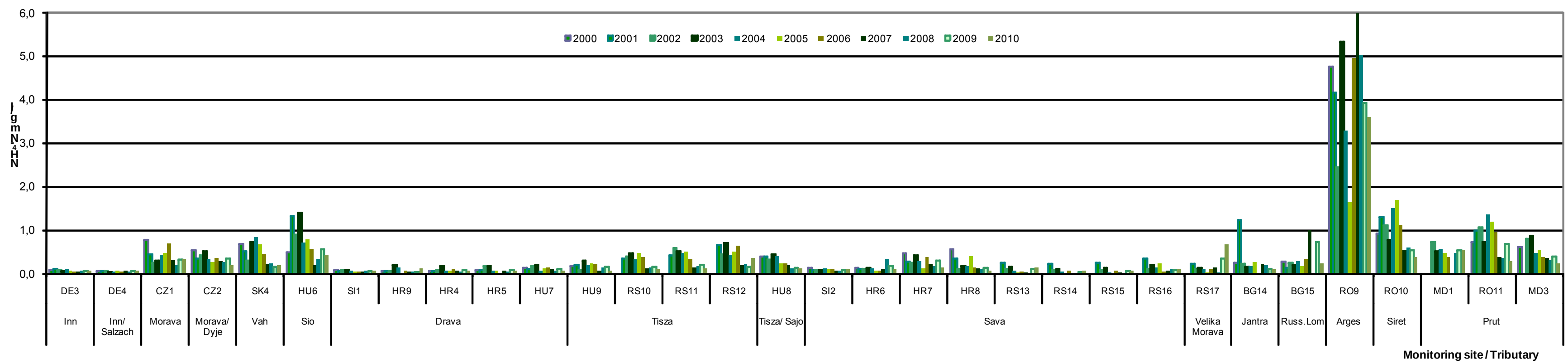


Figure 4.11: Temporal changes of ortho-phosphate-phosphorus (c90) in the Danube river.

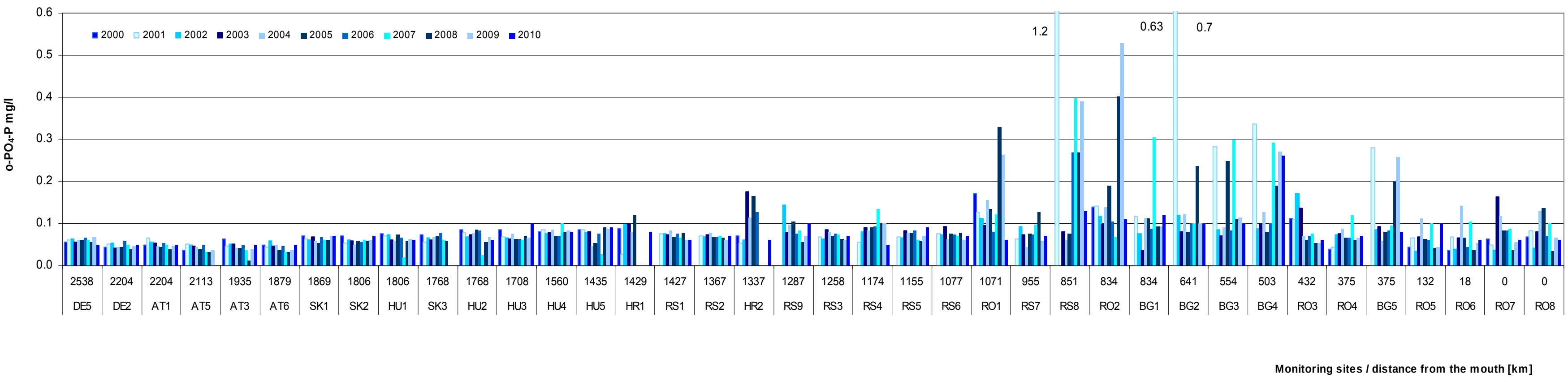


Figure 4.12: Temporal changes of ortho-phosphate-phosphorus (c90) in tributaries

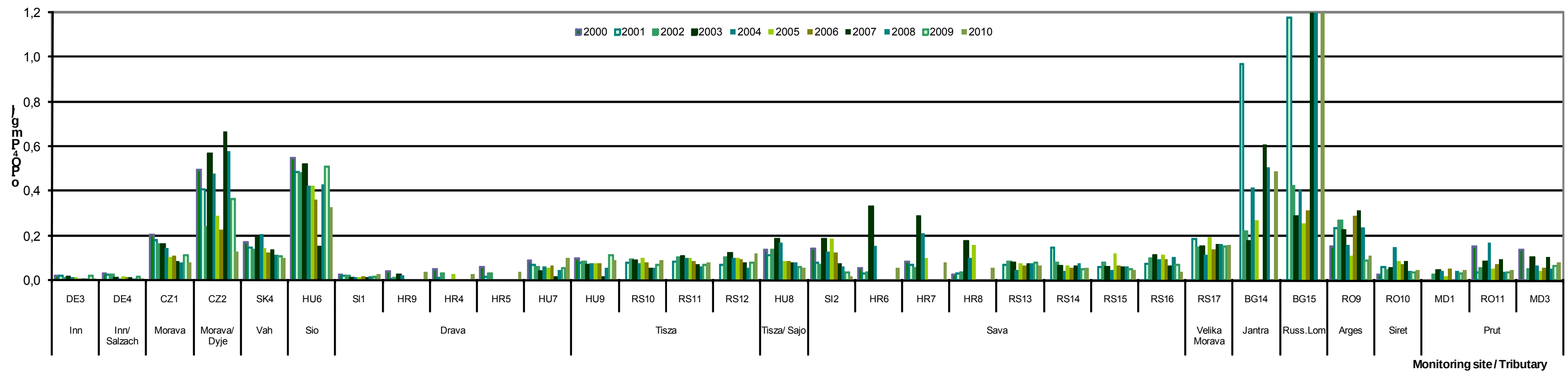


Figure 4.13: Temporal changes of total phosphorus (c90) in the Danube river.

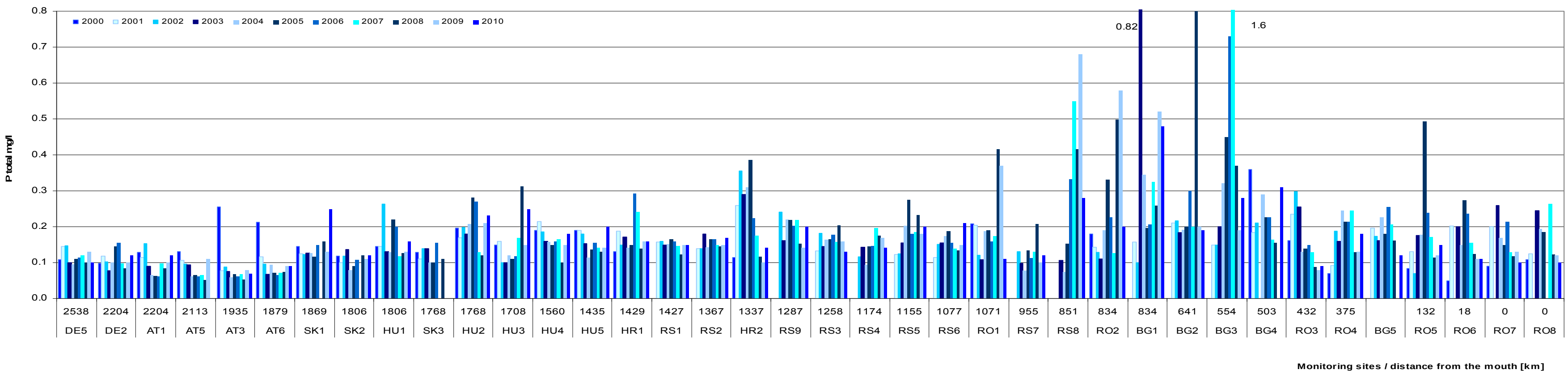


Figure 4.14: Temporal changes of total phosphorus (c90) in tributaries.

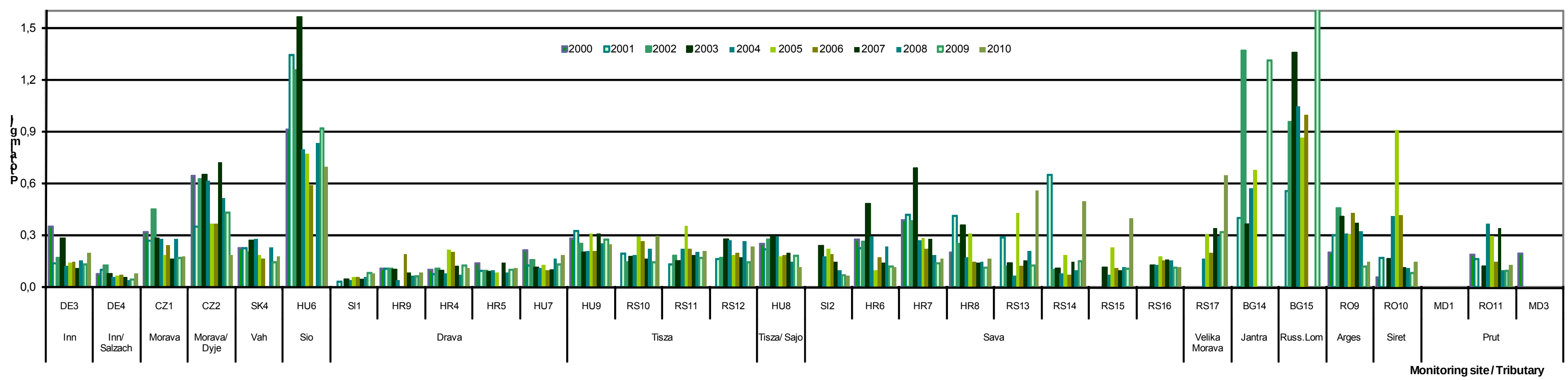


Figure 4.15: Temporal changes of cadmium (c90) in the Danube river.

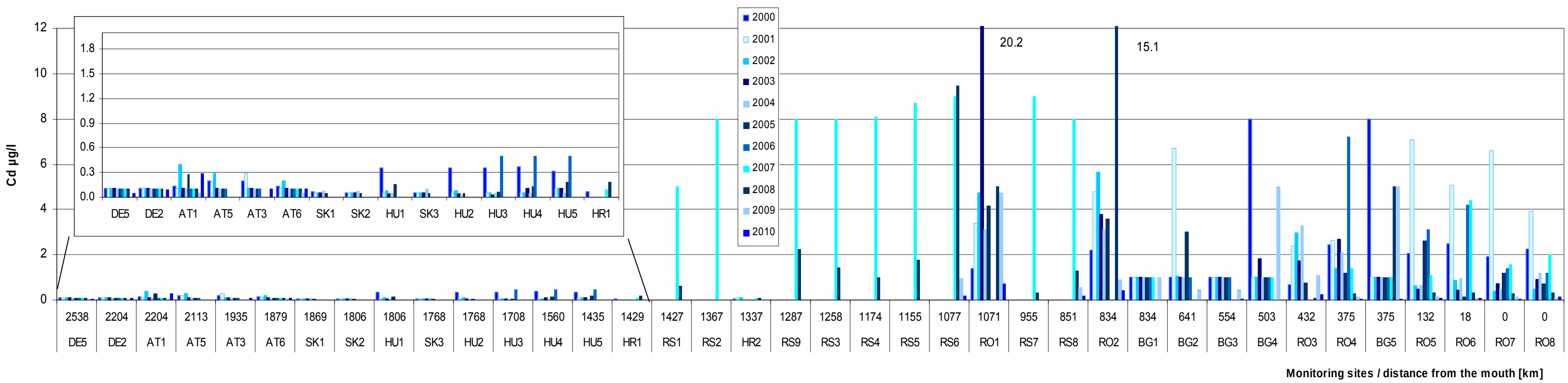


Figure 4.16: Temporal changes of cadmium (c90) in tributaries.

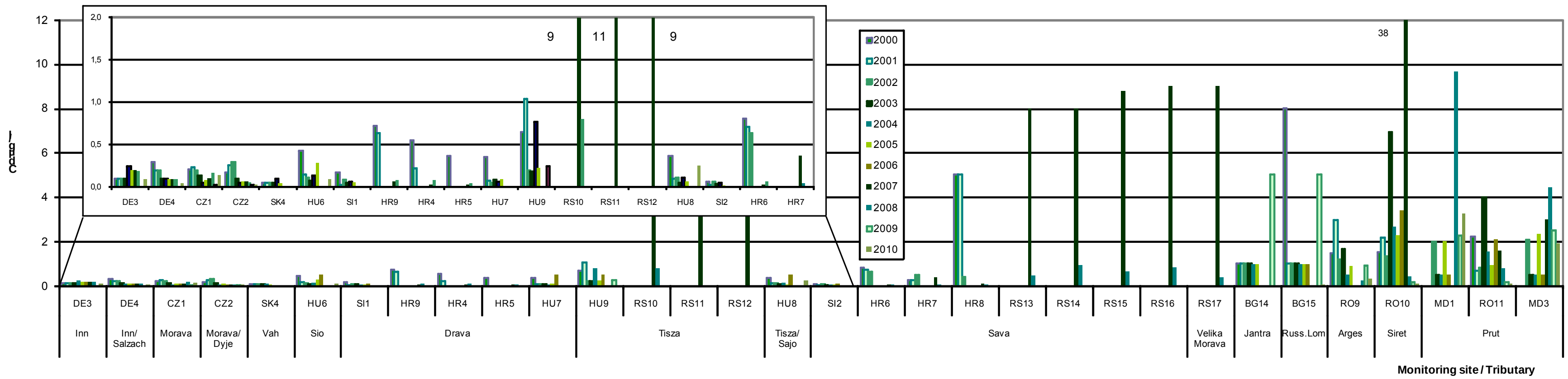


Figure 4.17: Temporal changes of BOD_5 (c90) in Bratislava

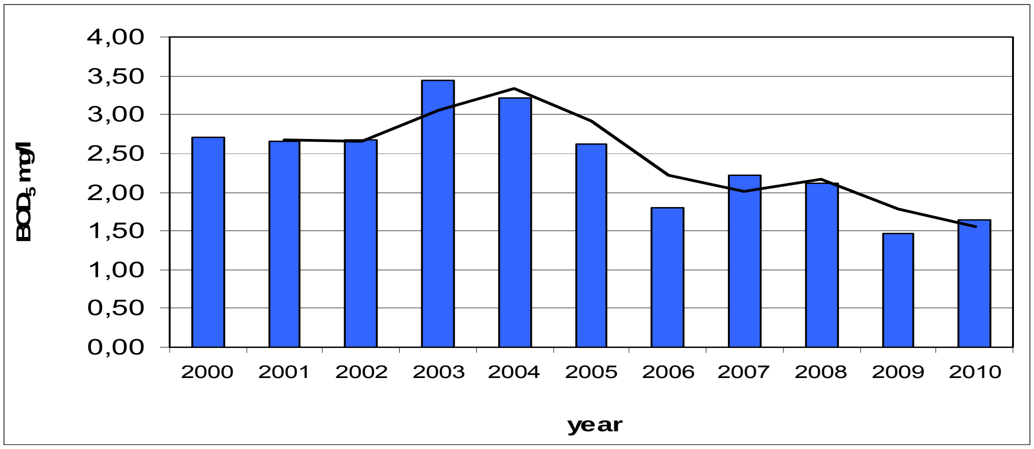


Figure 4.18: Temporal changes of BOD_5 (c90) in Hercegszanto

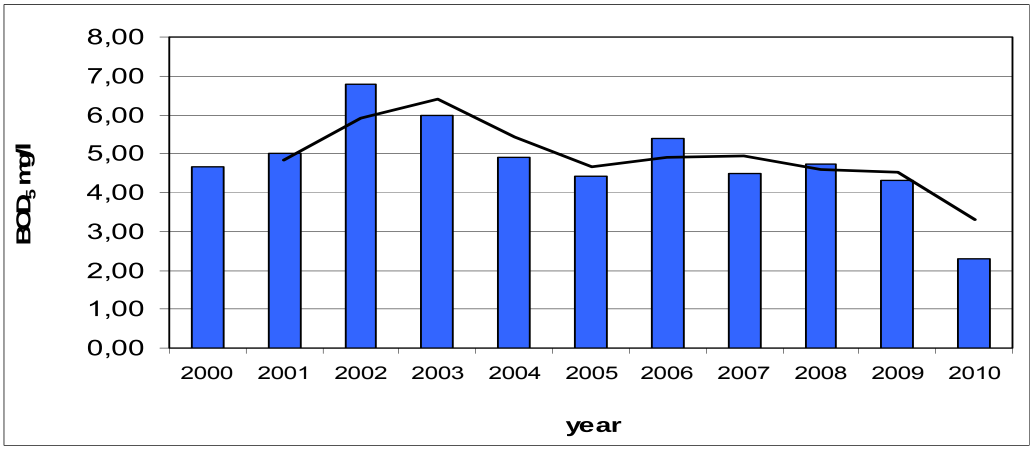


Figure 4.19: Temporal changes of BOD_5 (c90) in Reni

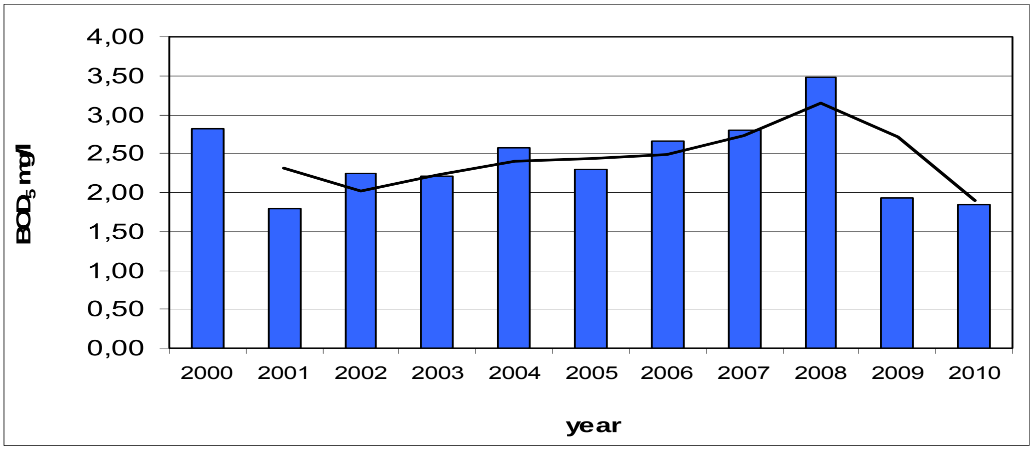


Figure 4.20: Temporal changes of nitrate-nitrogen (c90) in Bratislava

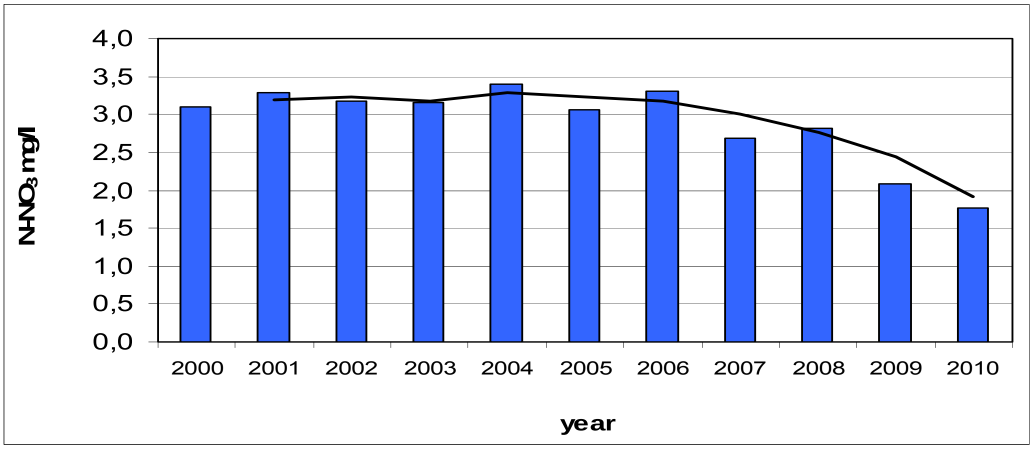


Figure 4.21: Temporal changes of nitrate-nitrogen (c90) in Hercegszanto

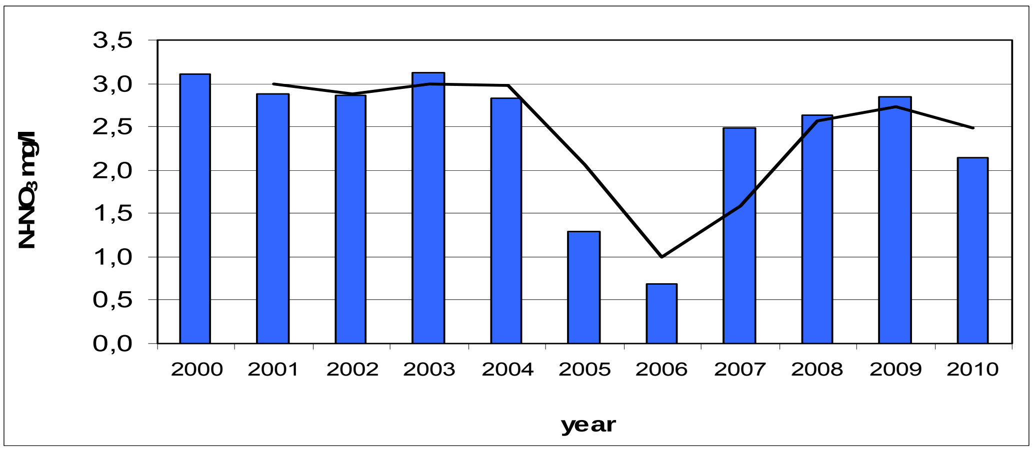


Figure 4.22: Temporal changes of nitrate-nitrogen (c90) in Reni

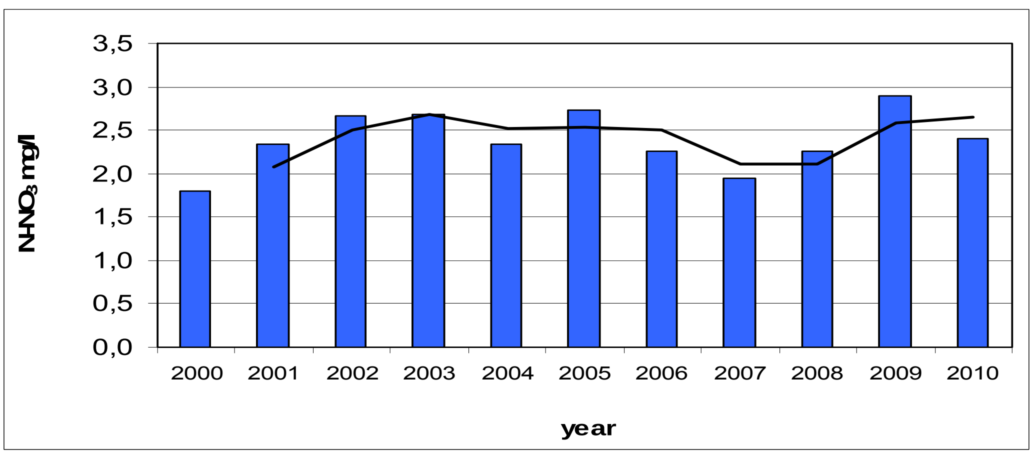


Figure 4.23: Temporal changes of total phosphorus (c90) in Bratislava

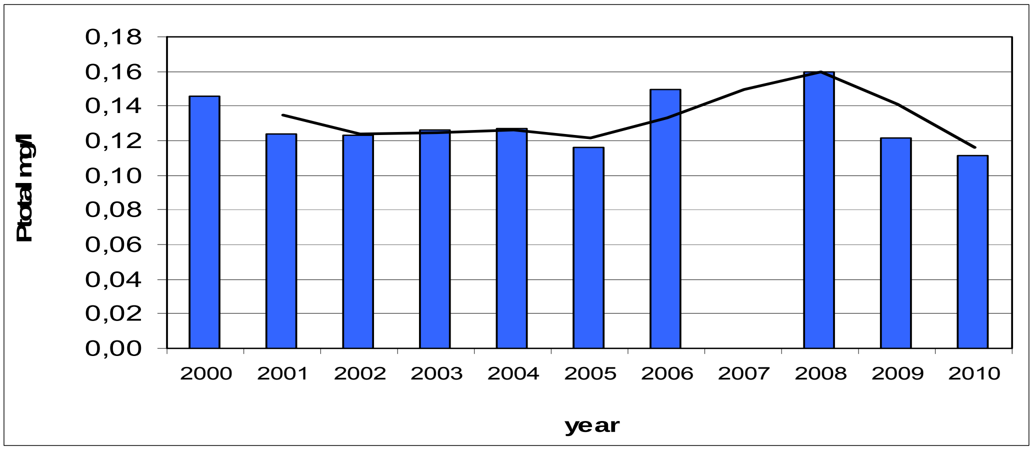


Figure 4.24: Temporal changes of total phosphorus (c90) in Hercegszanto

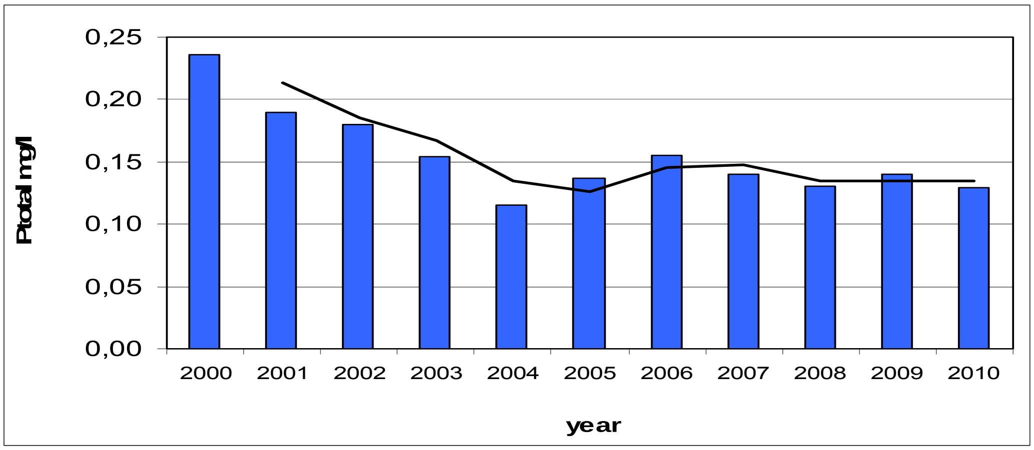


Figure 4.25: Temporal changes of total phosphorus (c90) in Reni

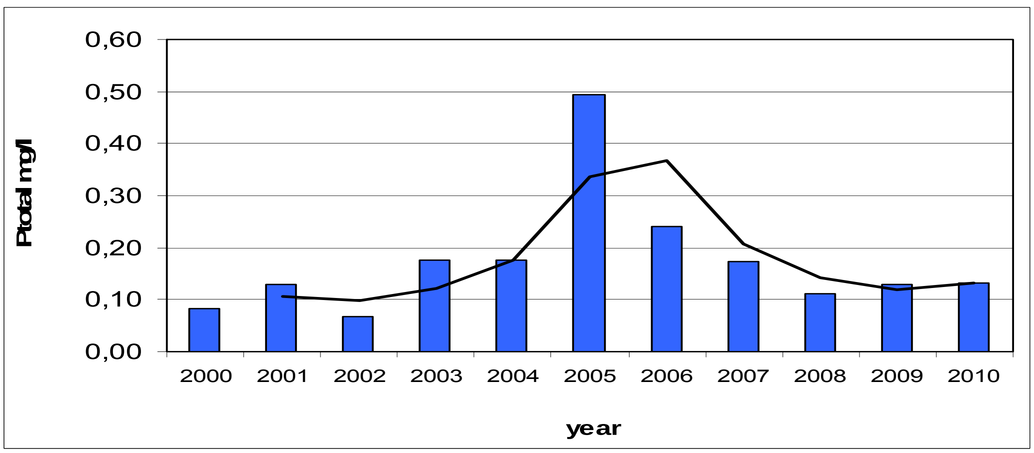


Figure 4.26: The percentile (90, 10) of $N\text{-}NH_4$ concentration along the Danube river in 2010.

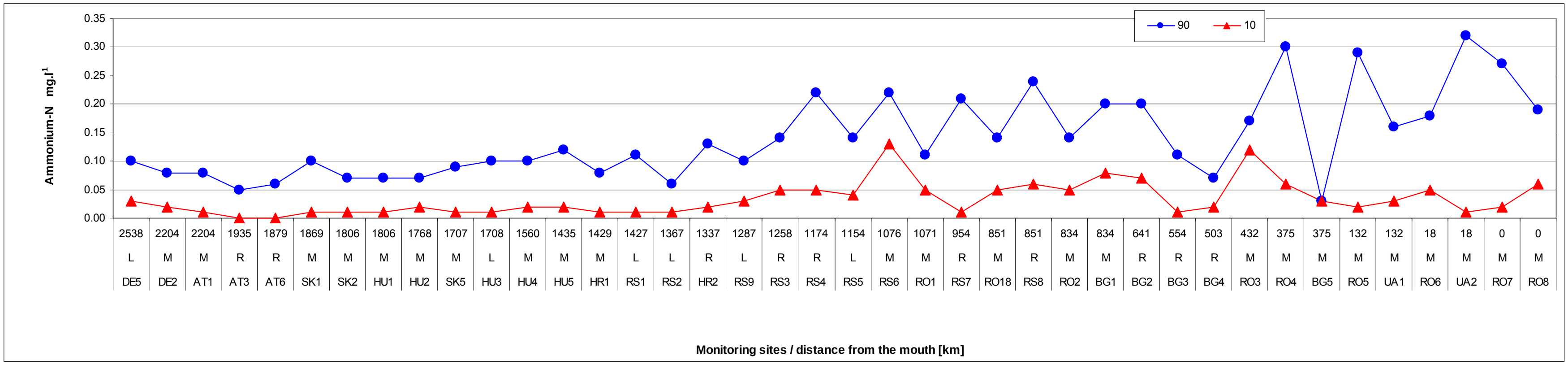


Figure 4.27: The percentile (90, 10) of $N\text{-}NH_4$ concentration in the tributaries in 2010.

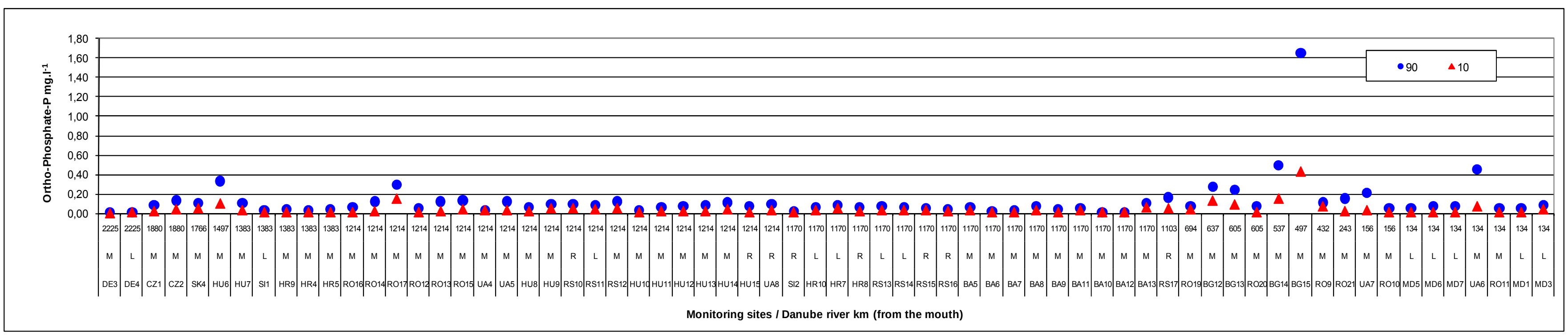


Figure 4.28: The percentile (90, 10) of P-PO_4 concentration along the Danube river in 2010.

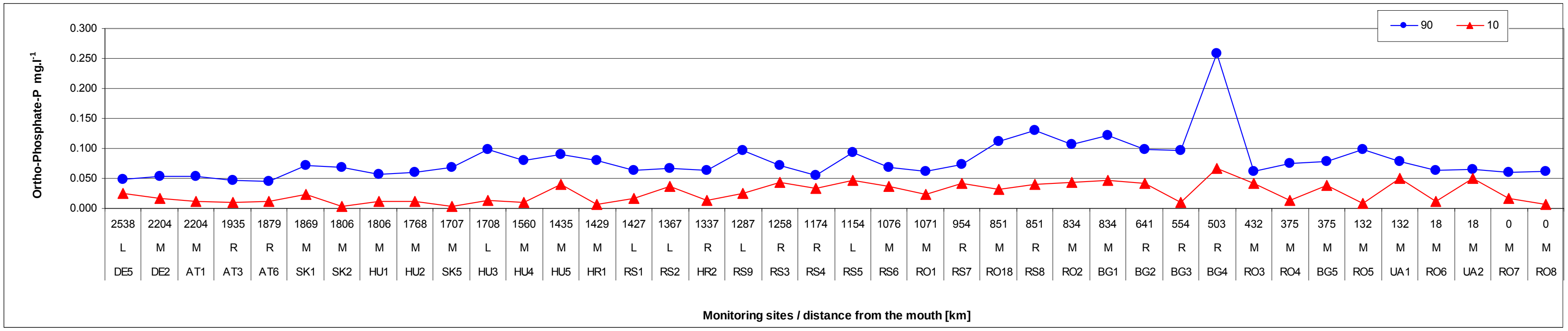


Figure 4.29: The percentile (90, 10) of P-PO_4 concentration in the tributaries in 2010.

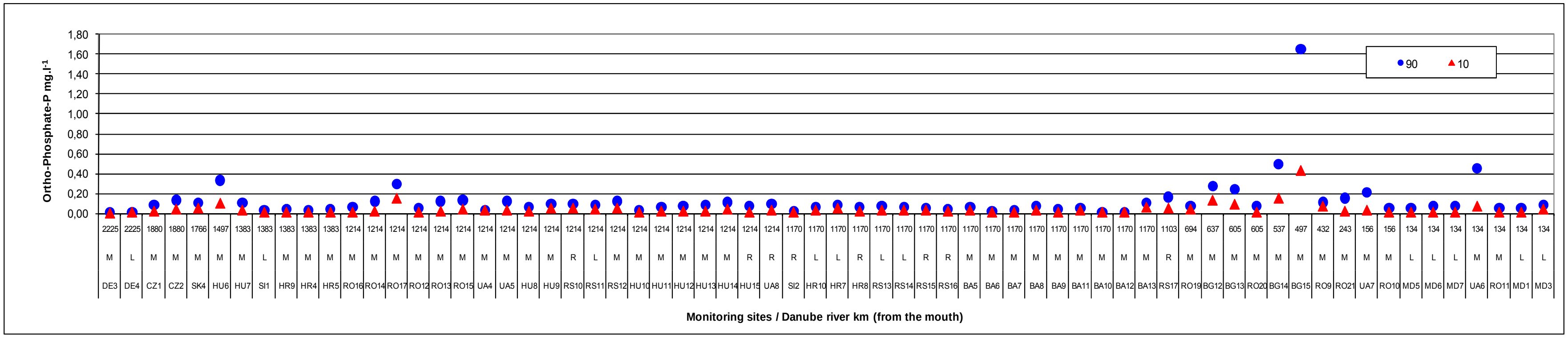


Figure 4.30: The percentile (90, 10) of COD_{cr} concentration along the Danube river in 2010.

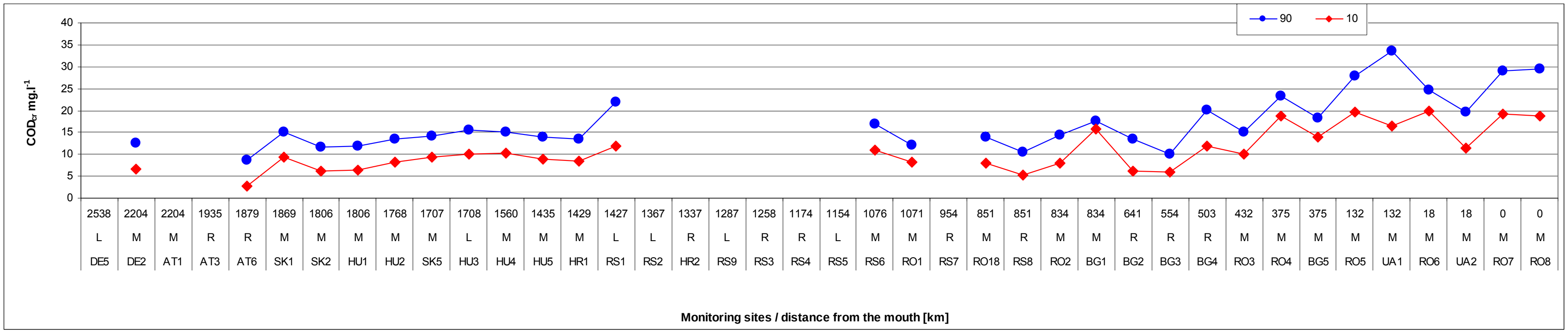


Figure 4.31: The percentile (90, 10) of COD_{cr} concentration in the tributaries in 2010.

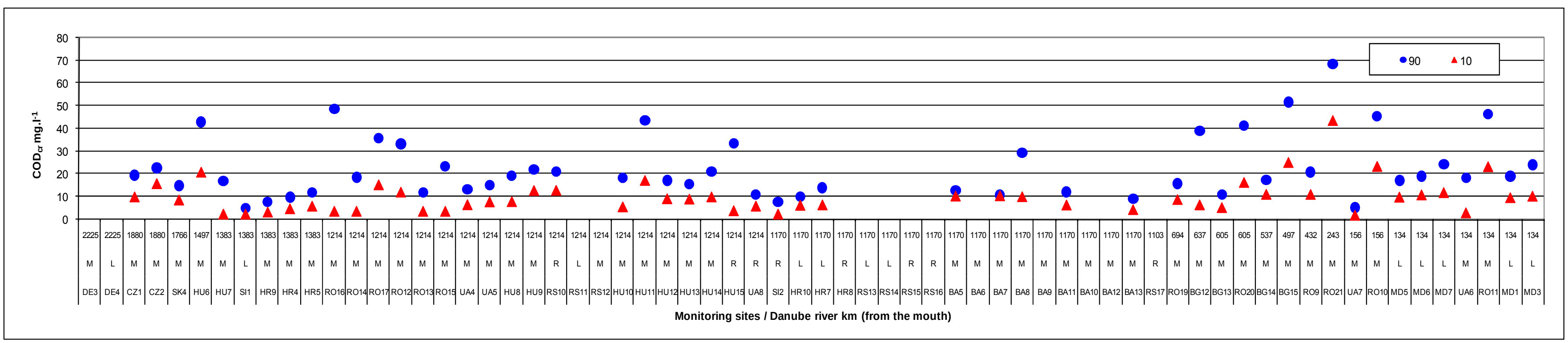


Figure 4.32: The percentile (90, 10) of BOD_5 concentration along the Danube river in 2010.

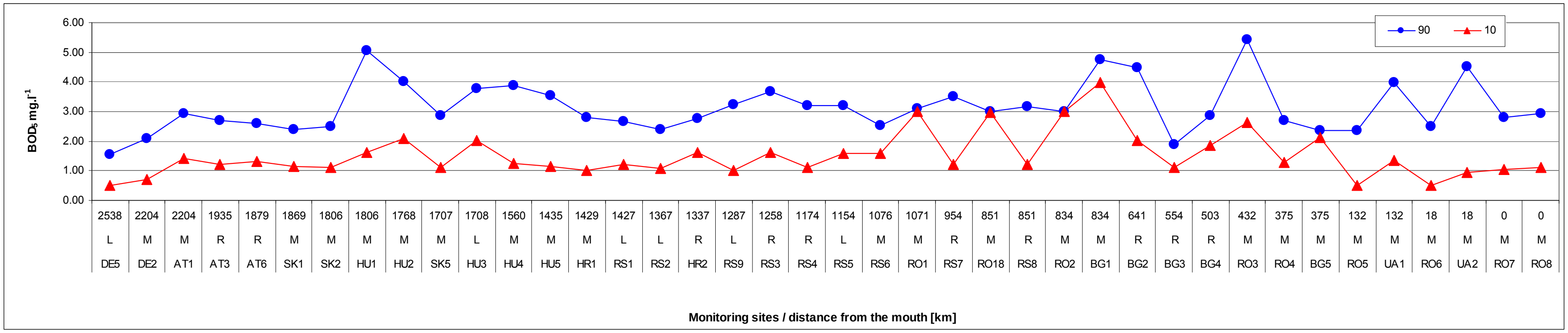


Figure 4.33: The percentile (90, 10) of BOD_5 concentration in the tributaries in 2010.

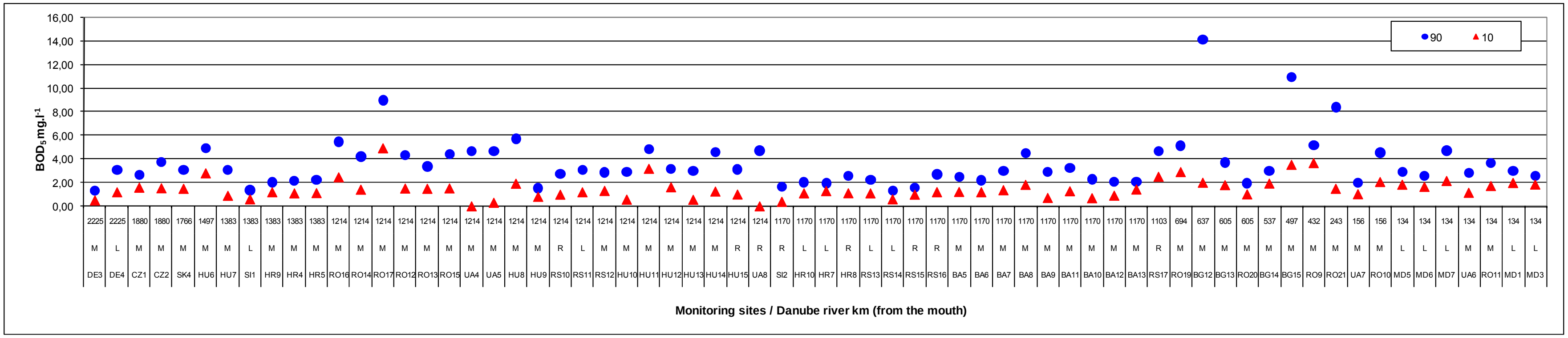


Figure 4.34: The maximum of Macrozoobenthos- saprobic index along the Danube river in 2010.

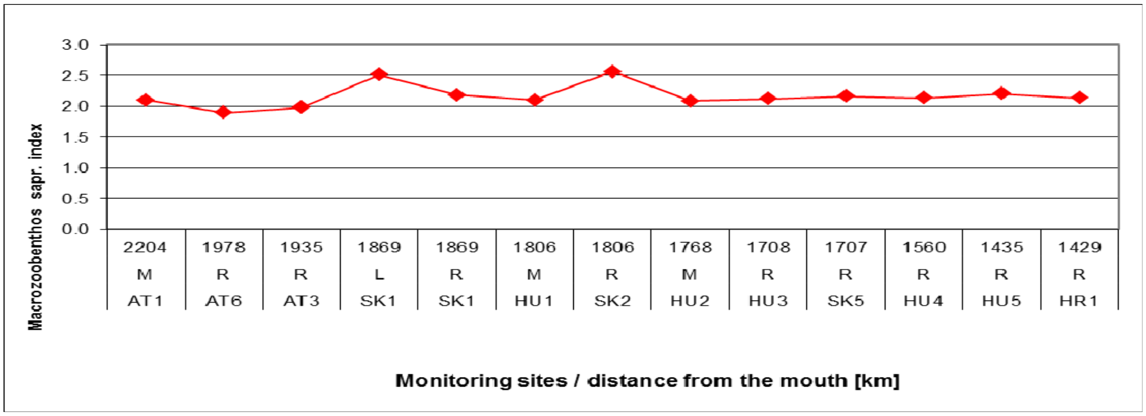
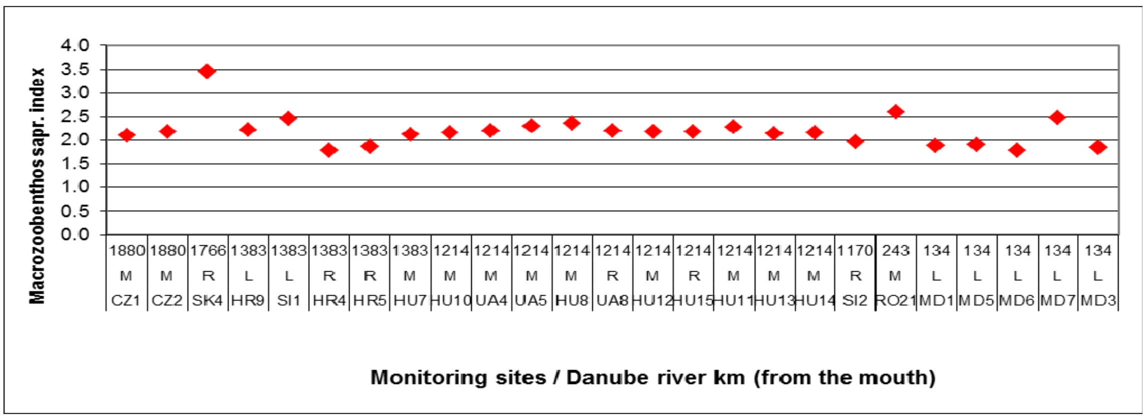
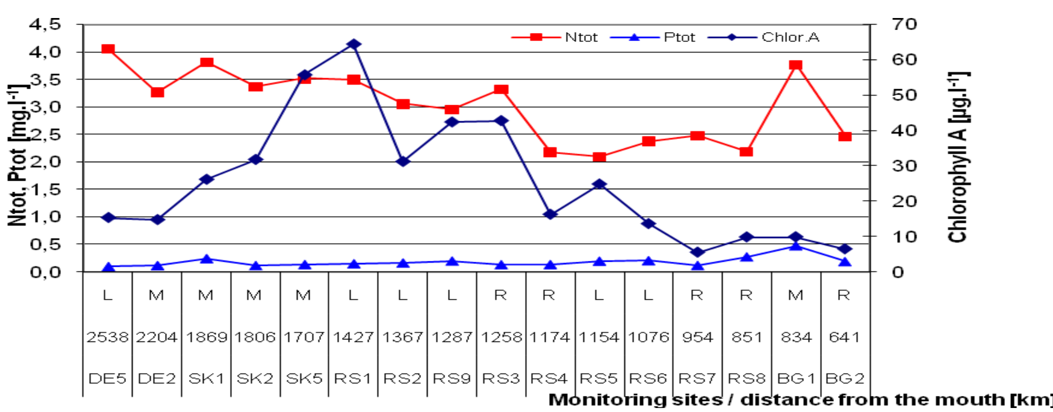


Figure 4.35: The maximum of Macrozoobenthos- saprobic index in the tributaries in 2010



The maximum of macrozoobenthos- saprobic index in Danube river and tributaries. is presented in the Figures 4.34 and 4.35. The data of macrozoobenthos was delivered during the year 2010 for 12 monitoring points located in the Danube river and in 28 monitoring points in tributaries. The maximal value of saprobic index was determined in SK2 Medveďov. The highest macrozoobenthos- saprobic index was found in tributary Vah (SK4).

Figure 4.36: The percentile (90) of total nitrogen, phosphorus and chlorophyll-A concentration along the Danube river in 2010.



The concentration of nutrients and chlorophyll A are presented in Figure 4.36 (only those monitoring points are shown at which all three determinands were measured). The maximal concentration of chlorophyll A was observed at RS1. The highest concentration of N_{total} was observed in DE5 Dillingen.

Figure 4.37: The percentile (90) of $N_{tot.}$, N-NH_4 and N-NO_3 concentration along the Sava river in 2010.

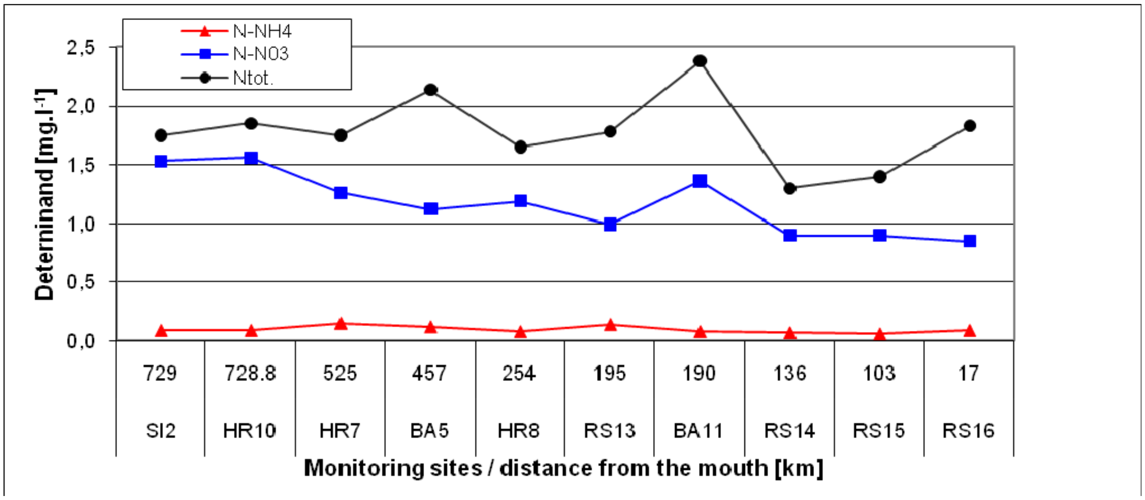
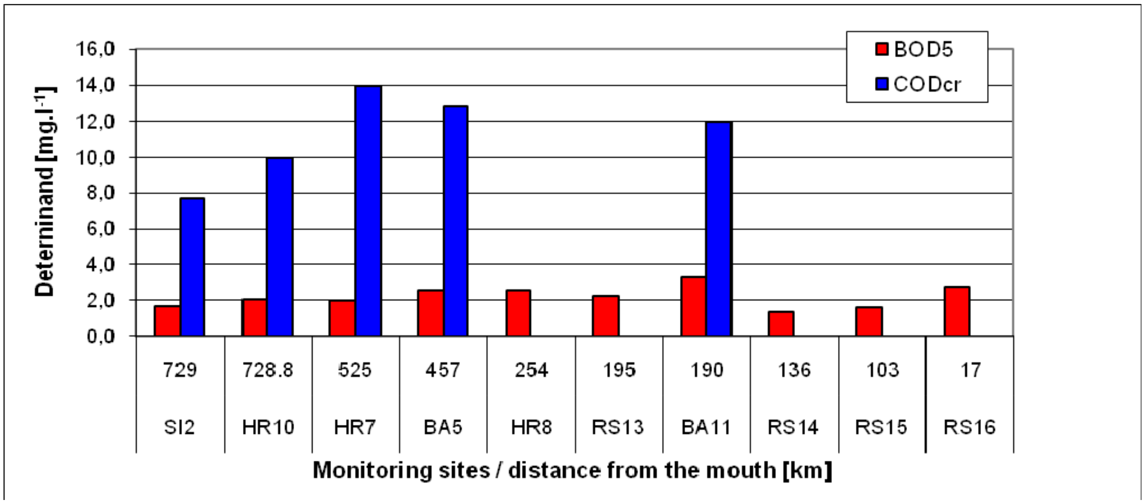


Figure 4.38: The percentile (90) of BOD_5 and COD_{cr} concentration along the Sava river in 2010.



C90 of nutrients and CODcr, BOD_5 in the Sava and Tisza rivers are presented in the Figures 4.37-4.38. The highest value of N-NH_4 in the Sava river was observed at the monitoring point HR7 (rkm 525). The maximal concentration of N-NO_3 was observed at HR10 (rkm 728.8) and the maximum of N_{total} was measured at BA11 (rkm 190, Figure 4.37). The highest values of BOD_5 in the Sava river was measured at the monitoring point BA11 rkm 190 and the highest COD_{cr} value was measured at the monitoring point HR7 (rkm 728.8), Figure 4.38).

Figure 4.39: The percentile (90) of total nitrogen, $N\text{-}NH_4$ and $N\text{-}NO_3$ concentration along the Tisza river in 2010.

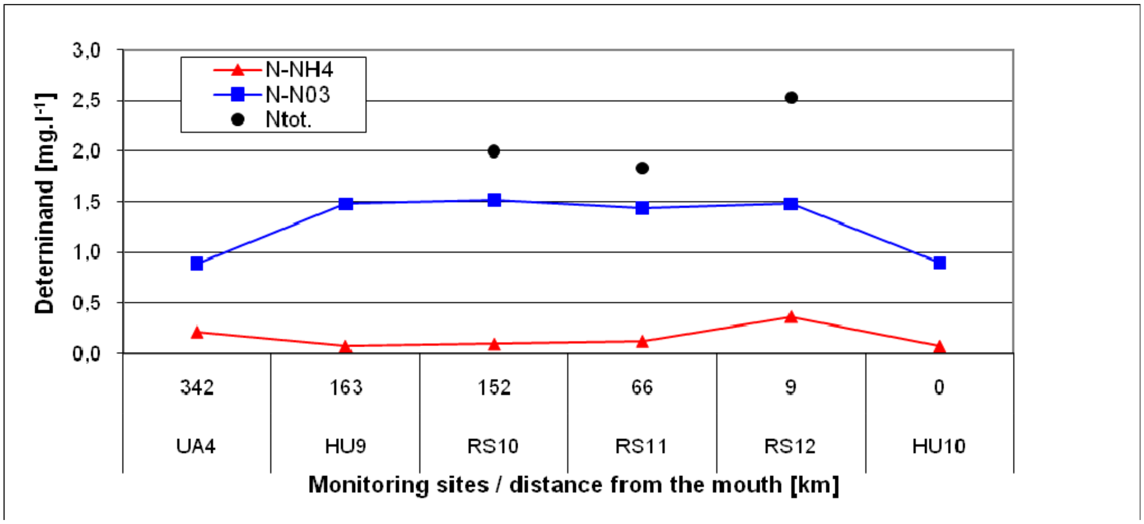
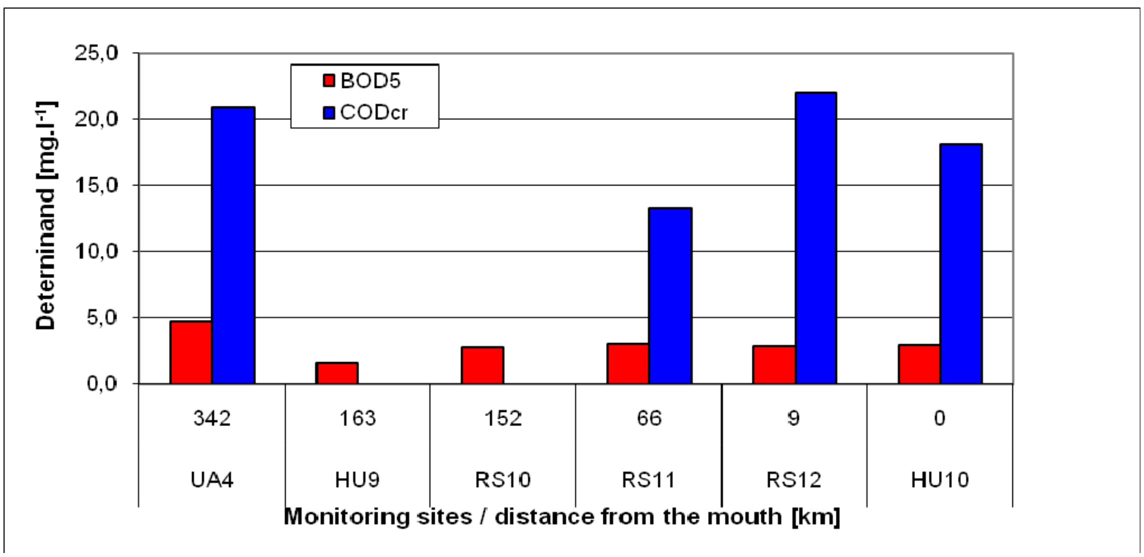


Figure 4.40: The percentile (90) of BOD_5 and COD_{cr} concentration along the Tisza river in 2010.



The maximal value of $N\text{-}NH_4$ in the Tisza river was measured at the monitoring point RS12 and the maximal value of $N\text{-}NO_3$ was observed at RS10 (see Figure 4.39). The highest value of N total was measured in RS10. The highest value of BOD_5 in the Tisza river was found at monitoring point UA4 (rkm 342) and the highest COD_{cr} at RS12 (rkm 9, Figure 4.40).

4.2. Phytobenthos

Cyanophytes and algae are important primary producers using for bio-indicating long-term changes in aquatic ecosystems, especially related to eutrophication. Phytobenthos is considered to be a suitable parameter to determine the impact of nutrient pollution in running waters, because the organisms are generally sessile and therefore represent the status of realized nutrients at the sampled stretch.

As a part of Trans National Monitoring Network of the Danube river basin benthic diatoms (phytobenthos) have been proposed to monitor as an optional parameter. In the year 2010 benthic diatoms were monitored by two countries Slovakia and Austria.

IPS (the Specific Pollution Sensitivity Index) was proposed for evaluation of benthic diatoms in the Danube River and its tributaries because this index was used in the process of the intercalibration of Central Baltic and Eastern Continental Geographical Intercalibration Groups as well as of Cross Geographical Intercalibration Group for large rivers.

Data on monitoring of phytobenthos of the TNMN in the year 2010 are shown in table 4 and in figure 4.41.

Table 4: IPS values of selected TNMN sampling sites in the year 2010

Country code/River/Site	Date	IPS
AT1 – Danube- Jochenstein	15.09.2010	13.9
AT3 – Danube - Nussdorf	17.03.2010	14.1
AT5 – Danube - Enghagen	15.09.2010	12.4
AT6 – Danube- Hainburg	16.11.2010	13.2
SK1- Danube - Bratislava (left/right)	6.4.2010/4.10.2010	13.9
SK2 – Danube - Medvedov	7.4.2010/5.10.2010	13.4
SK4 - Vah - Komarno	6.4.2010/4.10.2010	12.2
SK5 – Danube – Szob (left/right)	8.4.2010/6.10.2010	12.4
SK6 – Morava - DevIn	30.8.2010/18.11.2010	11.9
SK7 – Hron - Kamenica	6.4.2010/4.10.2010	12.7
SK8 - Ipel - Salka	6.4.2010/4.10.2010	11.5

There are 7 sampling stations on the Danube (blue collour of the columns in the fig.4.41) and 4 tributaries (Vah, Hron, Ipel, Morava – yellow colour in the fig.4.41).

The values ranged in the Danube from 12.4 up to 14.1 and in the tributaries from 11.5 up to 12.7. On the scale of IPS index (0-20) results indicate good and moderate status in term of the sensitivity to the pollution.

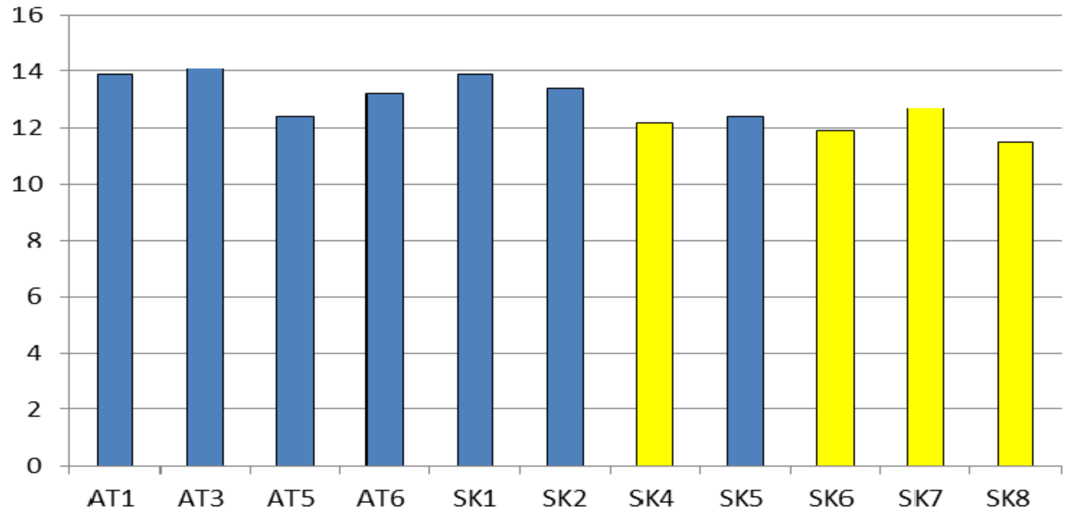


Figure 4.41: IPS values of selected TNMN sampling sites in the year 2010.

5. Load Assssment

5.1. 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.

5.2. 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 program. It also provides information about hydrological stations collecting flow data for load assessment. Altogether 23 monitoring locations from nine countries are included in the list. Two locations – Danube-Jochenstein and Sava-Jesenice – have been included by two neighboring countries, therefore the actual number of locations is 22, with ten locations on the Danube River itself and 12 locations on the tributaries. Rivers Prut and Siret were added in 2010.

5.3. Monitoring Data in 2010

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 2010 there were 12 measurements for load assessment available from Ukraine. Data are shown in tables 7 and 9. Flow data are missing from one Croatian monitoring locations. In most of the locations, the number of samples was higher than 20, lower frequency was observed for chlorides. A frequency of 12-15 times per year was applied only in Morava, Dyje and at Croatian monitoring stations. In 2010 the load calculation for Slovak monitoring points on tributaries Morava, Hron and Ipoly was added based on 12 measurements per year.

The loads in the Danube at Jochenstein are being assessed on the basis of combined data from Germany and Austria.
The second location that could potentially be processed by using combined data from two countries is Sava-Jesenice, but from 2009 Croatian site performed samplings at the location Drenje (left side of the river Sava) located under the influence of the estuary Sotla. In 2010 there were no flow data from the location Sava Drenje available so the loads have not been calculated.
There is still a lack of data on dissolved phosphorus as it was measured at six locations only. At four monitoring points the silicate load was calculated.

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	DE2	Jochenstein	2204	Achleiten	2223
Germany	Inn	DE3	Kirchdorf	195	Oberaudorf	211
Germany	Inn/Salzach	DE4	Laufen	47	Laufen	47
Austria	Danube	AT1	Jochenstein	2204	Aschach	2163
Austria	Danube	AT6	Hainburg	1879	Hainburg (Danube) Angern (March)	1884 32
Czech Republic	Morava	CZ1	Lanzhot	79	Lanzhot	79
Czech Republic	Morava/Dyje	CZ2	Pohansko	17	Breclav-Ladná	32,3
Slovak Republic	Danube	SK1	Bratislava	1869	Bratislava	1869
Slovak Republic	Váh	SK4	Komárno		Sum of: Maly Dunaj -Trstice Vah- Sala Nitra -Nove Zamky	22,5 58,8 12,3
Slovak Republic	Morava	SK6	Devín		Zahorska Ves	32,5
Slovak Republic	Hron	SK7	Kamenica		Kanenin	10,9
Slovak Republic	Ipoly	SK8	Salka		Salka	12,2
Hungary	Danube	HU3	Szob	1708	Nagymaros	1695
Hungary	Danube	HU5	Hercegszántó	1435	Mohács	1447
Hungary	Tisza	HU9	Tiszasziget	163	Szeged	174
Croatia	Danube	HR2	Borovo	1337	Borovo	1337
Croatia	Sava	HR10	Drenje	728.8	Jesenice	729
Croatia	Sava	HR7	Una Jesenovac	525	Una Jesenovac	525
Croatia	Sava	HR8	Zupanja	254	Zupanja	254
Slovenia	Drava	SI1	Ormoz	300	Borl HE Formin Pesnica-Zamusani	325 311 10.1(to the Drava)
Slovenia	Sava	SI2	Jesenice	729	Catez Sotla -Rakovec	737 8.1 (to the Sava)
Romania	Danube	RO2	Pristol-Novo Selo	834	Gruia	858
Romania	Danube	RO4	Chiciu-Silistra	375	Chiciu	379
Romania	Danube	RO5	Reni	132	Isaccea	101
Romania	Siret	RO10	Sendreni	0	Sendreni	0
Romania	Prut	RO11	Giurgiulesti	0	Giurgiulesti	0
Ukraine	Danube	UA2	Vylkove	18		

5.4. 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:

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

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:

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

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 2010

Country Code	River	Location	Location in profile	River Km	Number of meausrements in 2010: Q	SS	N_{inorg}	$P\text{-}PO_4$	P_{total}	BOD_5	Cl	P_{diss}	SiO_2
DE2	Danube	Jochenstein	M	2204	365	25	35	36	36	25	25	34	
DE3	Inn	Kirchdorf	M	195	365	25	25	25	24	25	21	24	
DE4	Inn/Salzach	Laufen	L	47	365	25	25	25	25	25	25	24	
AT1	Danube	Jochenstein	M	2204	365	12	36	37	37	12	12	35	
AT6	Danube	Hainburg	R	1879	365	24	24	24	24	24	24	24	
CZ1	Morava	Lanzhot	M	79	365	15	15	15	15	15	15		
CZ2	Morava/Dyje	Pohansko	M	17	365	12	12	12	12	12	12		
SK1	Danube	Bratislava	M	1869	365	25	25	25	25	25	12	25	25
SK4	Váh	Komárno	M	1	365	12	12	12	12	12	12	12	
SK6	Morava	Devín	M	1	365	12	12	12	12	12	12	12	
SK7	Hron	Kamenica	M	2	365	12	12	12	12	12	12	12	
SK8	Ipoly	Salka	M	12	365	12	12	12	12	12	12	12	
HU3	Danube	Szob	L	1708		24	24	24	24	24	24		
			M	1708	365	23	23	23	23	22	23		
			R	1708		24	24	24	24	23	24		
HU5	Danube	Hercegszántó	M	1435	365	21	24	24	24	24	24		24
HU9	Tisza	Tiszasziget	L	163		26	26	26	26	12	12		26
			M	163	365	26	26	26	26	12	12		26
			R	163		26	26	26	26	12	12		26
HR2	Danube	Borovo	R	1337	0	12	12	12	12	12	12		
HR10	Sava	Drenje	L	729	0	12	12	12	12	12	12		
HR7	Sava	us Una Jesenovac	L	525	365	12	12	11	12	12	12		
HR8	Sava	ds Zupanja	MR	254	365	12	12	12	12	12			
SI1	Drava	Ormoz	L	300	365	26	26	26	26	26	12		
SI2	Sava	Jesenice	R	729	365	26	26	26	26	26	12		
RO2	Danube	Pristol-Novo Selo	L	834		24	24	24	24	19	20		
			M	834		23	23	23	23	18	19		
			R	834		22	22	22	22	17	18		
RO4	Danube	Chiciu-Silistra	L	375		26	26	26	26	26	15		
			M	375		26	26	26	26	26	15		
			R	375		26	26	26	26	26	15		
RO5	Danube	Reni	L	132		26	26	26	26	26	14		
			M	132		26	26	26	26	26	14		
			R	132		26	26	26	26	26	14		
RO10	M	Siret	M	0		23	23	23	23	23	10		
RO11	M	Prut	M	0		24	24	24	24	24	12		
UA2	Danube	Vylkove	M	18	365	12	11	12	12	12	12	12	12

5.5. 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 2010
c_{mean}	arithmetical mean of the concentrations in the year 2010
Annual Load	annual load of given determinand in the year 2010

Table 10 shows loads of selected 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 bigger at the lower Danube than in 2009, especially at Reni. There were no significant differences in discharges measured in the upper part of the Danube river and in tributaries during last two years.
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, BOD_5 ortho-phosphate, total phosphorus and chlorides, the highest load is observed in the lower part of the Danube river. The maximum values of suspended solids, inorganic nitrogen and chlorides were ercorded at monitoring location Danube-Reni (RO5) and for BOD_5, ortho-phosphate and total phosphorus the maximum was measured at Pristol-Novo Selo (RO2).

In the case of tributaries, the highest loads of suspended solids, ortho-phosphate, total phosphorus and chlorides are coming from the Tisza river. The highest load for inorganic nitrogen, BOD_5 was discharged by the Sava river.

Table 7: Mean annual concentrations in monitoring locations selected for load assessment on Danube River in 2010

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
					$(m^3.s^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$
DE2 +AT1	M	Danube	Jochenstein	2204	1420	13.806	2.332	0.033	0.070	1.688	20.499	0.174	
AT6	R	Danube	Hainburg	1879	2124	10.385	2.343	0.033	0.068	1.829	20.792	0.049	
SK1	M	Danube	Bratislava	1869	2130	48.104	2.466	0.047	0.132	1.844	21.050	0.061	6.208
HU3	LMR	Danube	Szob	1708	2615	33.097	2.053	0.075	0.156	3.438	26.656		
HU5	M	Danube	Hercegszántó	1435	2879	29.429	2.220	0.067	0.129	2.313	26.242		4.925
HR2	R	Danube	Borovo	1337		16.400	1.951	0.044	0.117	2.175	20.300		
RO2	LMR	Danube	Pristol-Novo Selo	834	7424	36.750	1.660	0.106	0.152	2.866	19.357		
RO4	LMR	Danube	Chiciu-Silistra	375	8515	31.026	2.036	0.044	0.108	1.987	27.700		
RO5	LMR	Danube	Reni	132	9598	47.071	1.975	0.054	0.105	1.627	29.530		
UA2	M	Danube	Vylkove	18	4947	72.792	1.512	0.057	0.102	2.254	29.208	0.102	7.339

Table 8: Mean annual concentrations in monitoring locations selected for load assessment on tributaries in 2010

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
					$(m^3.s^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$
DE3	M	Inn	Kirchdorf	195	283	75.380	0.599	0.008	0.073	0.764	6.048	0.023	
DE4	L	Inn/Salzach	Laufen	47	225	24.120	0.655	0.009	0.048	2.076	9.036	0.019	
CZ1	M	Morava	Lanzhot	79	103	53.000	3.523	0.046	0.126	2.187	23.060		
CZ2	L	Morava/Dyje	Pohansko	17.00	76	16.583	4.896	0.096	0.148	2.592	38.733		
SK4	M	Váh	Komárno	1	308	21.833	2.114	0.072	0.136	2.150	18.817	0.093	
SK6	M	Morava	Devín	1	195	52.250	3.816	0.113	0.233	3.425	33.442	0.138	
SK7	M	Hron	Kamenica	2	95	30.333	2.239	0.086	0.143	1.717	11.917	0.114	
SK8	M	Ipoly	Salka	12	56	44.667	1.980	0.139	0.240	2.042	20.525	0.181	
HU9	LMR	Tisza	Tiszasziget	163	1422	73.347	1.136	0.061	0.171	1.296	28.639		9.629
SI1	L	Drava	Ormoz	300	324	13.254	1.083	0.013	0.049	0.946	7.167		
SI2	R	Sava	Jesenice	729	370	7.262	1.365	0.015	0.053	0.964	8.484		
HR10	L	Sava	Drenje	729		16.125	1.207	0.043	0.093	1.483	12.318		
HR7	L	Sava	us. Una Jasenovac	525	1655	15.417	1.135	0.068	0.130	1.775	7.705		
HR8	ML	Sava	ds. Zupanja	254	1136	11.692	1.076	0.047	0.107	1.960			
RO10	M	Siret	Conf. Danube (Sendreni)	0	308	145.520	2.018	0.020	0.090	3.290	49.300		
RO11	M	Prut	Conf. Danube (Giurgiulesti)	0	151	67.670	1.706	0.030	0.080	2.680	46.280		

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

Station Code	Profile	River Name	Location	River km	Annual Load in 2010: Suspended Solids ($x10^6$ tonns)	Inorganic Nitrogen ($x10^3$ tonns)	Ortho-Phosphate Phosphorus ($x10^3$ tonns)	Total Phosphorus ($x10^3$ tonns)	BOD_5 ($x10^3$ tonns)	Chlorides ($x10^6$ tonns)	Phosphorus - dissolved ($x10^3$ tonns)	Silicates ($x10^6$ tonns)
DE2 +AT1	M	Danube	Jochenstein	2204	0.76	99.69	1.49	3.43	74.75	0.87	2.06	
AT6	R	Danube	Hainburg	1879	0.73	150.30	2.19	4.47	126.17	1.31	3.21	
SK1	M	Danube	Bratislava	1869	4.54	160.58	3.32	9.78	121.63	1.32	4.44	0.41
HU3	LMR	Danube	Szob	1708	3.26	164.89	6.46	12.76	304.28	2.12		
HU5	LMR	Danube	Hercegszántó	1435	3.08	189.73	6.25	12.53	195.44	2.27		0.44
HR2	R	Danube	Borovo	1337								
RO2	LMR	Danube	Pristol-Novo Selo	834	9.02	381.97	25.80	36.00	653.07	4.42		
RO4	LMR	Danube	Chiciu-Silistra	375	9.07	541.75	12.30	29.05	548.32	7.48		
RO5	LMR	Danube	Reni	132	13.74	563.05	14.88	28.75	477.35	8.37		
UA2	M	Danube	Vylkove	18	12.25	217.68	8.89	28.53	372.74	4.53	15.55	1.17

Table 10: Annual load in selected monitoring locations on tributaries

Station Code	Profile	River Name	Location	River km	Annual Load in 2010: Suspended Solids ($x10^6$ tonns)	Inorganic Nitrogen ($x10^3$ tonns)	Ortho-Phosphate Phosphorus ($x10^3$ tonns)	Total Phosphorus ($x10^3$ tonns)	BOD_5 ($x10^3$ tonns)	Chlorides ($x10^6$ tonns)	Phosphorus - dissolved ($x10^3$ tonns)	Silicates ($x10^6$ tonns)
DE3	M	Inn	Kirchdorf	195	1.15	4.60	0.07	0.95	7.19	0.04	0.19	
DE4	L	Inn/Salzach	Laufen	47	0.35	4.30	0.07	0.51	13.22	0.05	0.17	
CZ1	M	Morava	Lanzhot	79	0.19	11.95	0.16	0.41	7.02	0.07		
CZ2	L	Morava/Dyje	Pohansko	17	0.04	11.47	0.19	0.31	5.70	0.08		
SK4	M	Váh	Komárno	1	0.25	19.73	0.71	1.39	21.78	0.18	92.00	
SK6	M	Morava	Devín	1	0.32	23.67	0.69	1.44	21.84	0.20	0.83	
SK7	M	Hron	Kamenica	2	0.09	6.55	0.26	0.43	5.11	0.03	0.35	
SK8	M	Ipoly	Salka	12	0.07	3.13	0.30	0.47	3.60	0.03	0.37	
HU9	LMR	Tisza	Tiszasziget	163	3.67	51.25	2.84	8.47	63.25	1.14		0.18
SI1	L	Drava	Ormoz	300	0.14	10.53	0.14	0.49	9.62	0.07		
SI2	R	Sava	Jesenice	729	0.09	15.82	0.17	0.59	9.18	0.10		
HR10	L	Sava	Drenje	728.8								
HR7	L	Sava	us. Una Jasenovac	525	0.46	36.33	1.68	4.06	55.13	0.25		
HR8	ML	Sava	ds. Zupanja	254	0.64	53.85	2.09	5.04	105.60			
RO10	M	Siret	Conf. Danube (Sendreni)	0	0.99	14.02	0.18	0.77	25.67	0.30		
RO11	M	Prut	Conf. Danube (Giurgiulesti)	0	0.22	5.66	0.11	0.33	13.10	0.16		

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

River	Location	Location	River	Number of measurements in 2010												
		in profile	km	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	$Hg_{diss.}$
Danube	Reni	LMR	132	365	26	26	26	26	8	20	8	20	8	20	8	20
River	**Location**	**Location**	**River**	c_{mean}												
		in profile	**km**	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	$Hg_{diss.}$
				$(m^3.s^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(mg.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$	$(\mu g.l^{-1})$
Danube	Reni	LMR	132	9598	0.179	0.026	1.781	2.367	3.125	2.907	2.617	1.777	0.075	0.063	0.063	0.040
River	**Location**	**Location**	**River**	**Annual Load in 2010**												
		in profile	**km**		$N\text{-}NH_4$	$N\text{-}NO_2$	$N\text{-}NO_3$	N_{total}	Cu	$Cu_{diss.}$	Pb	$Pb_{diss.}$	Cd	$Cd_{diss.}$	Hg	$Hg_{diss.}$
					(x10^{3}tonns)	(x10^{3}tonns)	(x10^{3}tonns)	(x10^{3}tonns)	(tonns)	(tonns)	(tonns)	(tonns)	(tonns)	(tonns)	(tonns)	(tonns)
Danube	Reni	LMR	132		50.87	7.50	504.88	675.03	470.99	779.27	381.57	500.65	11.80	16.48	8.90	11.49

Figure 5.5.1: Annual load of suspended solids at monitoring locations along the Danube River.

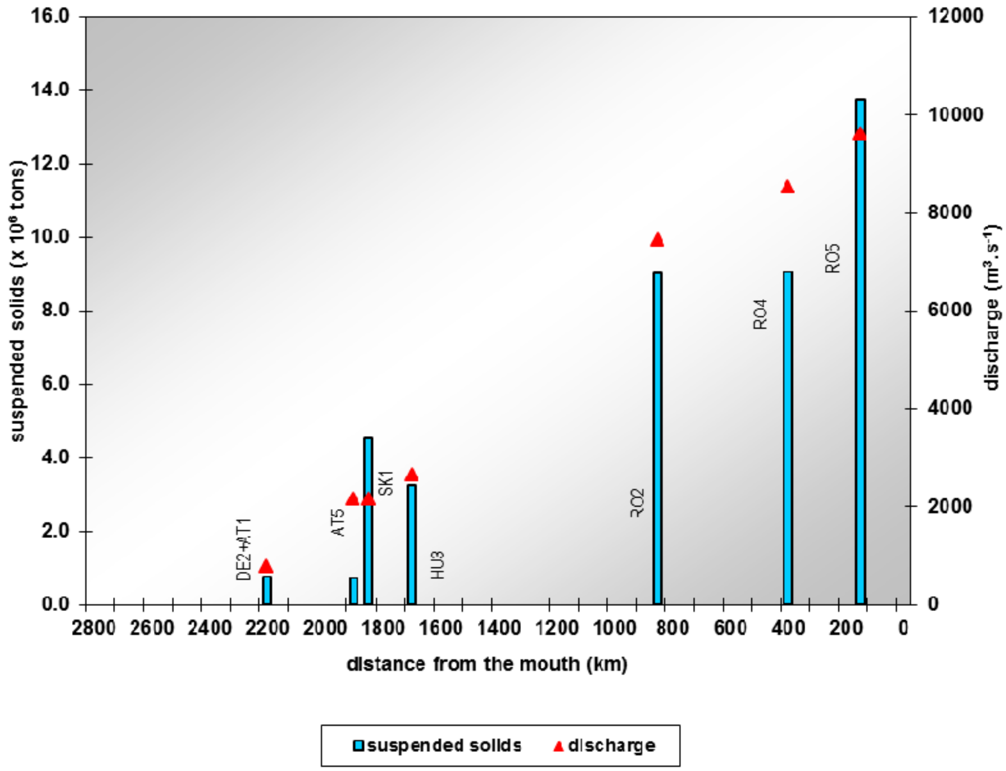


Figure 5.5.2: Annual load of suspended solids at monitoring locations on tributaries.

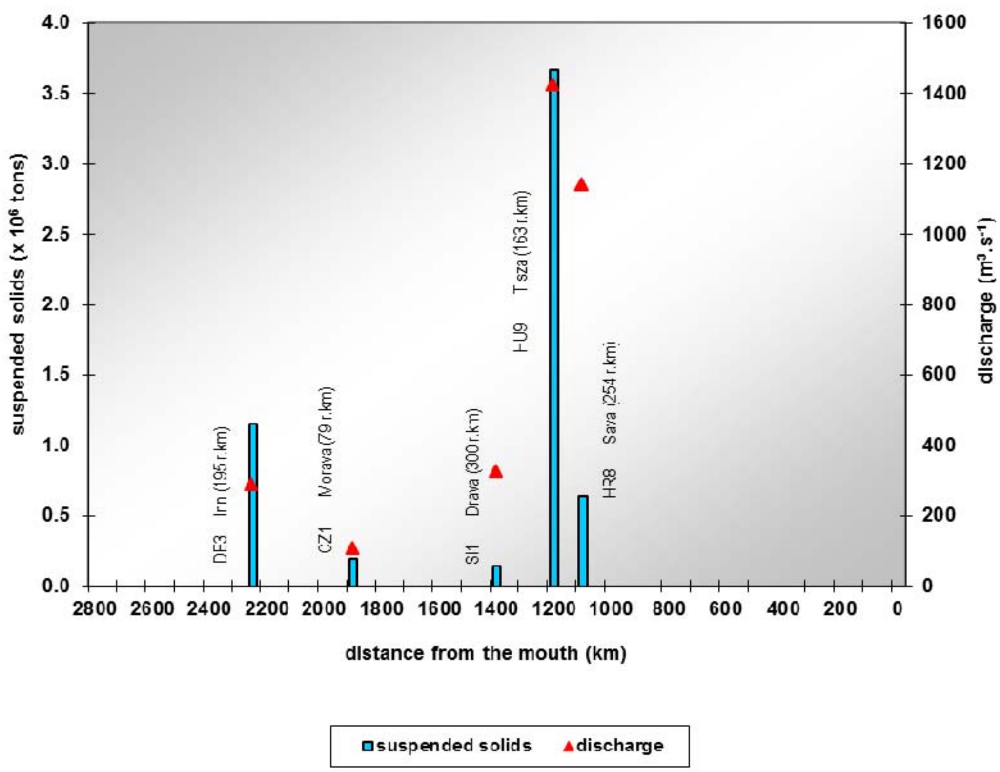


Figure 5.5.3: Annual loads of inorganic nitrogen at monitoring locations along the Danube River.

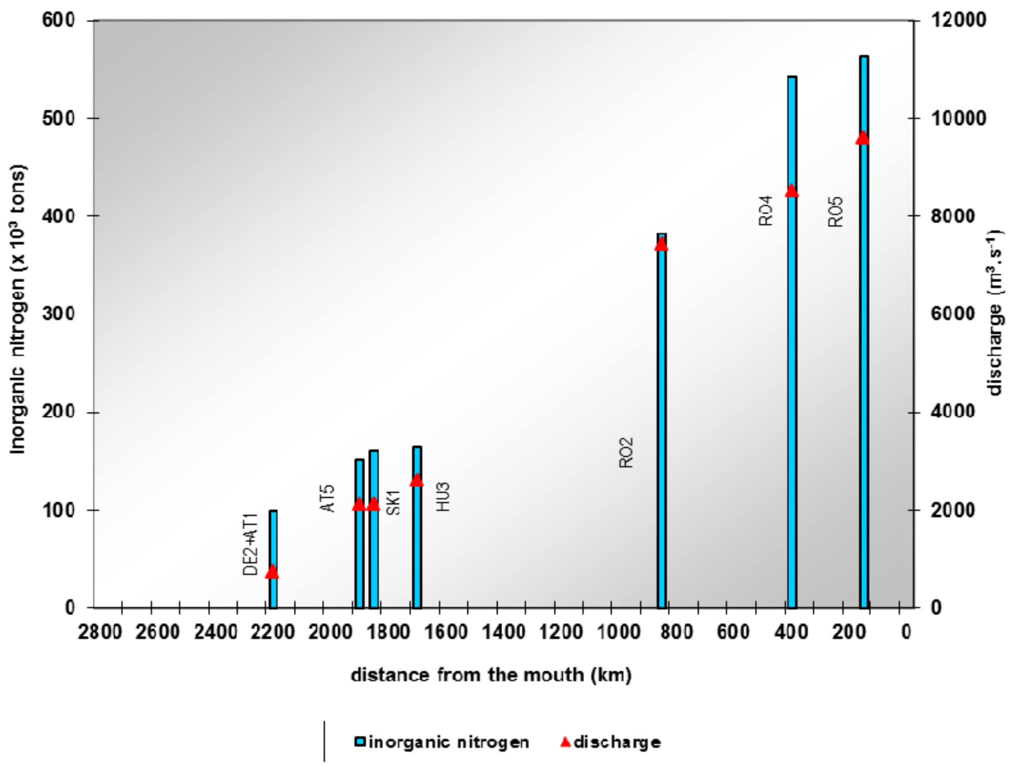


Figure 5.5.4: Annual loads of inorganic nitrogen at monitoring locations on tributaries.

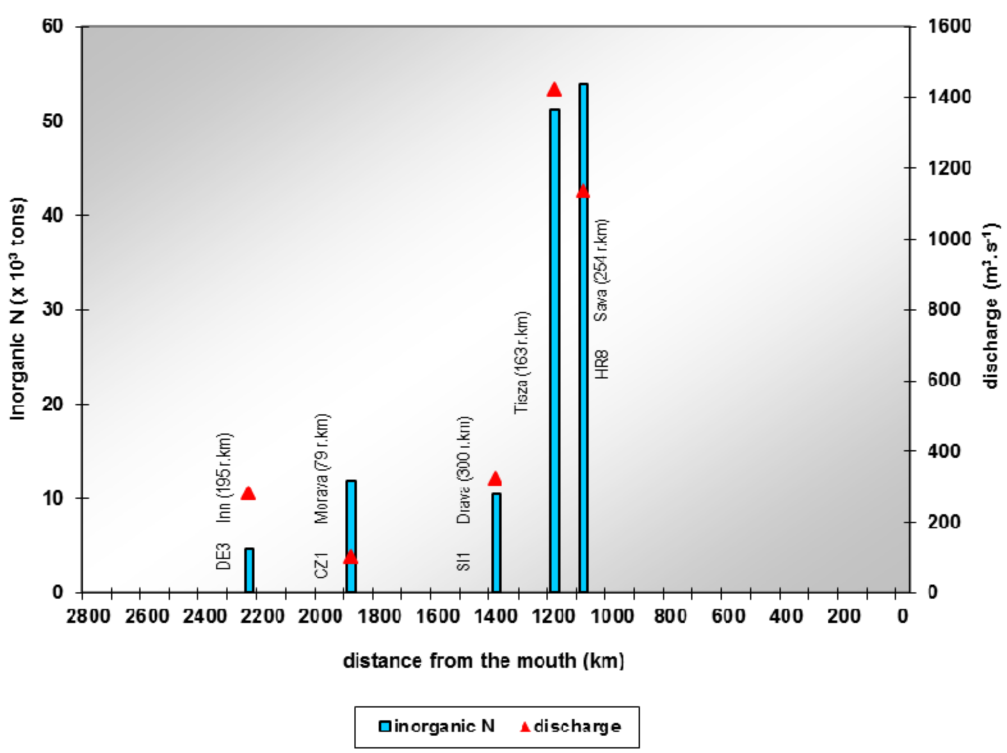


Figure 5.5.5: Annual loads of ortho-phosphate-P at monitoring locations along the Danube River.

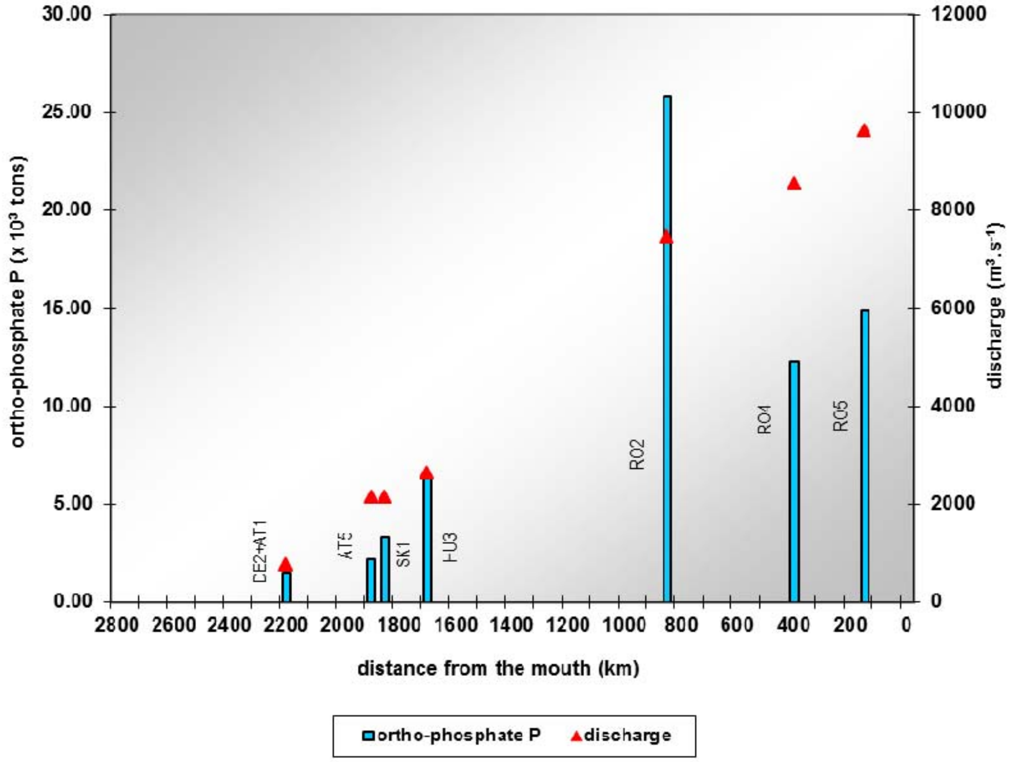


Figure 5.5.6: Annual loads of ortho-phosphate-P at monitoring locations on tributaries.

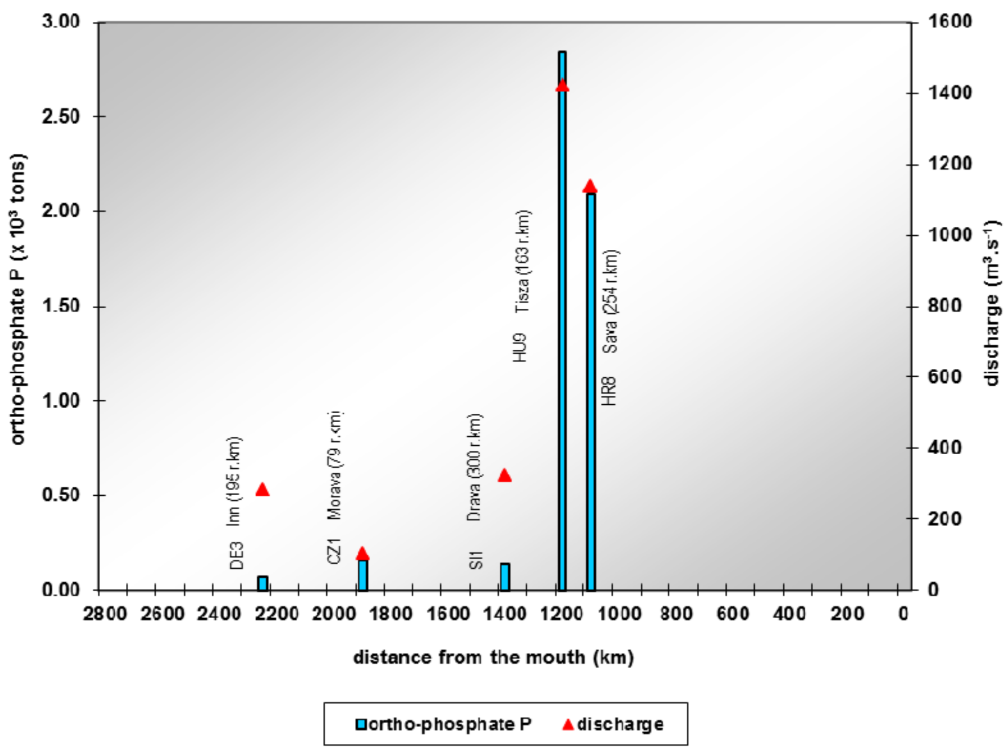


Figure 5.5.7: Annual loads of total phosphorus at monitoring locations along the Danube River.

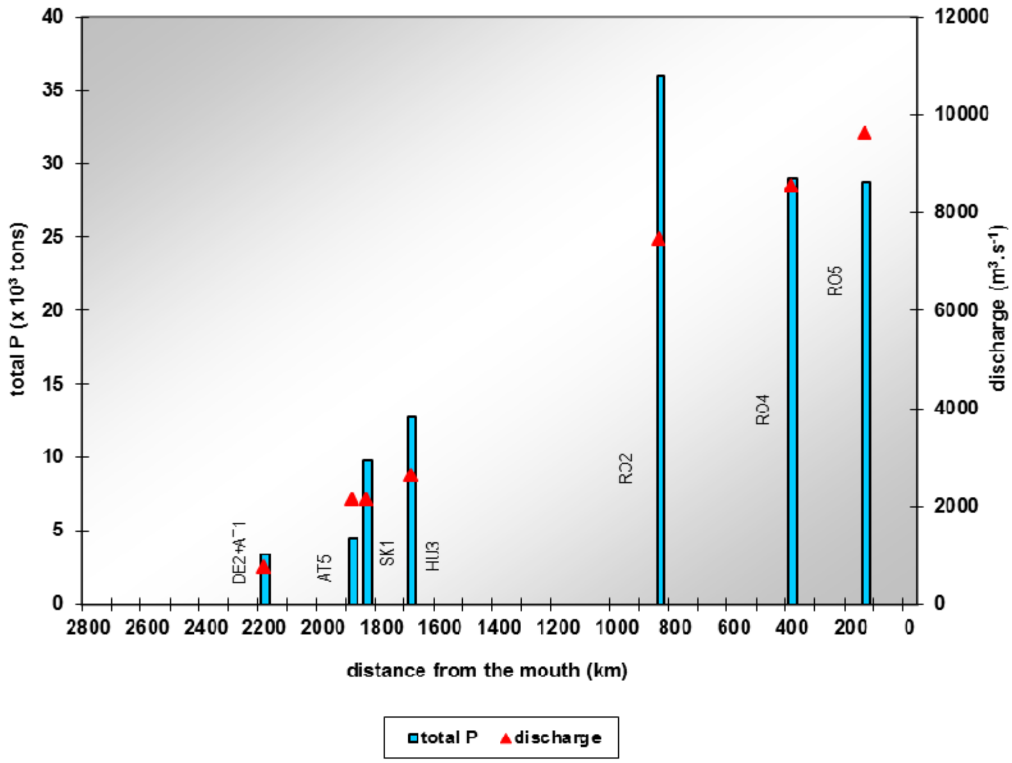


Figure 5.5.8: Annual loads of total phosphorus at monitoring locations on tributaries.

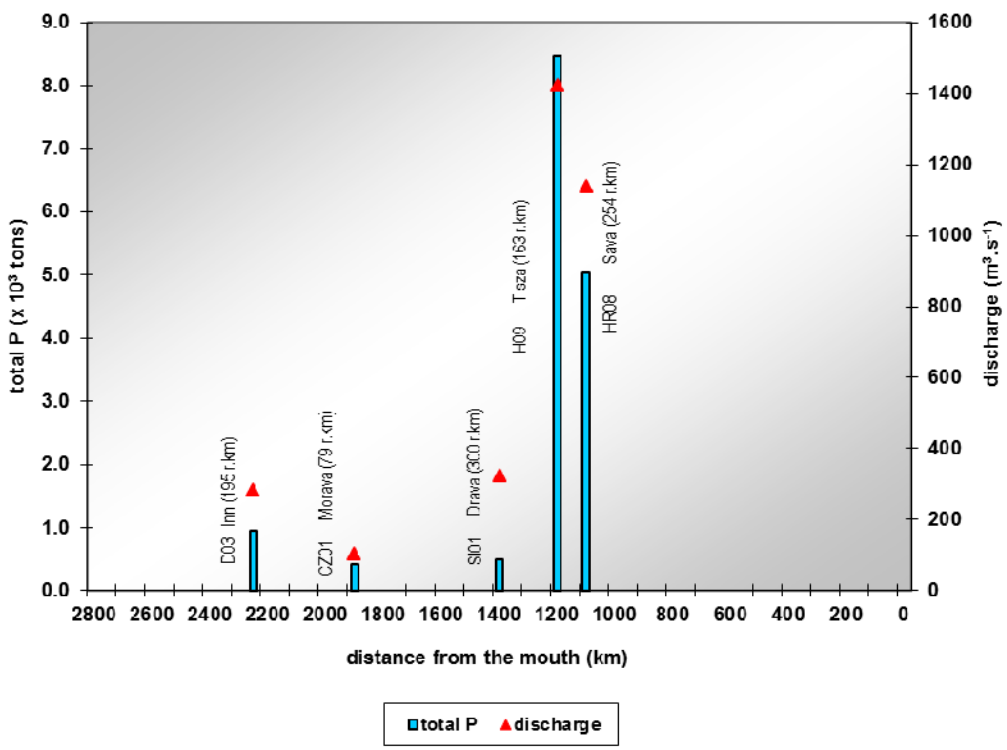


Figure 5.5.9: Annual loads of BOD_5 at monitoring locations along the Danube River.

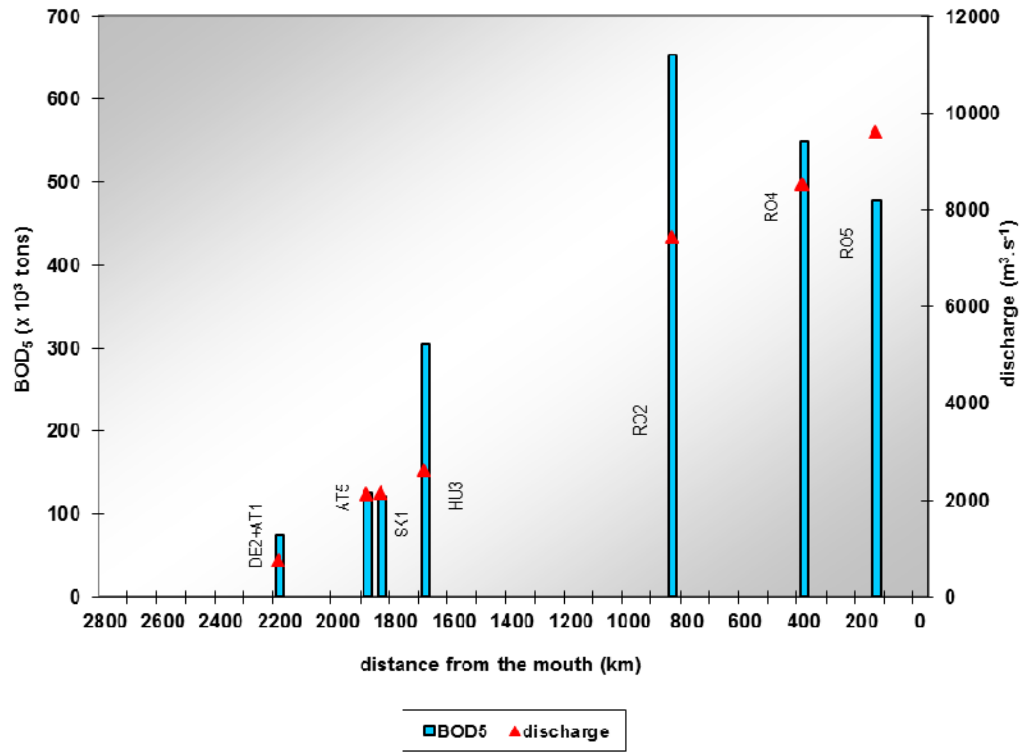


Figure 5.5.10: Annual loads of BOD_5 at monitoring locations on tributaries.

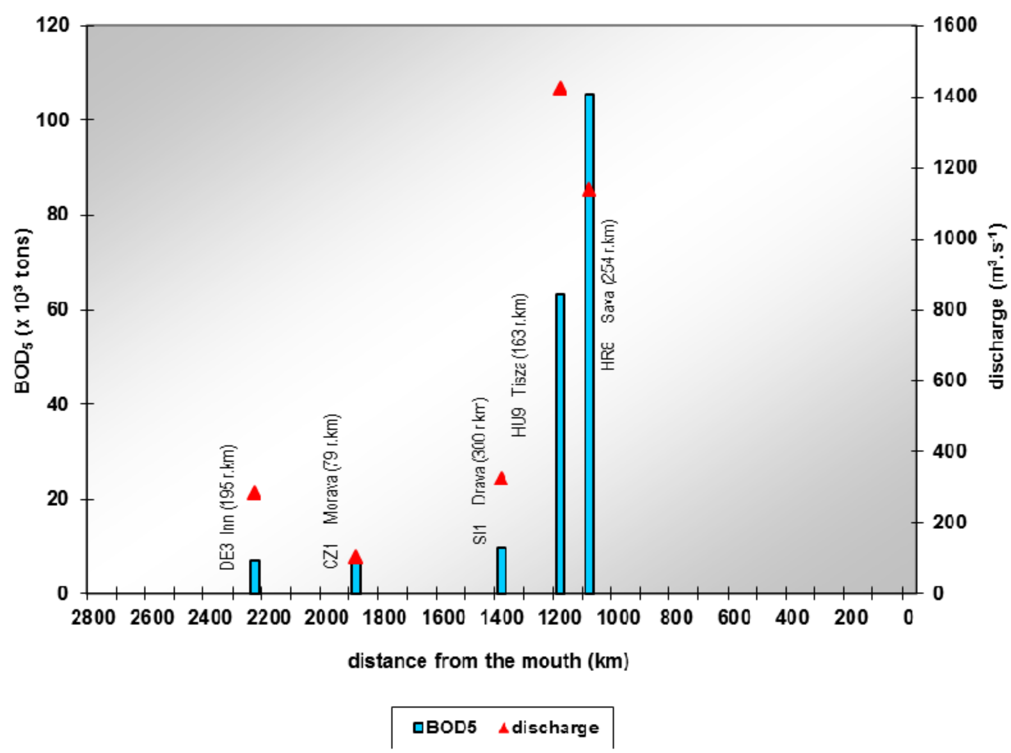


Figure 8.5.11: Annual loads of chlorides at monitoring locations along the Danube River.

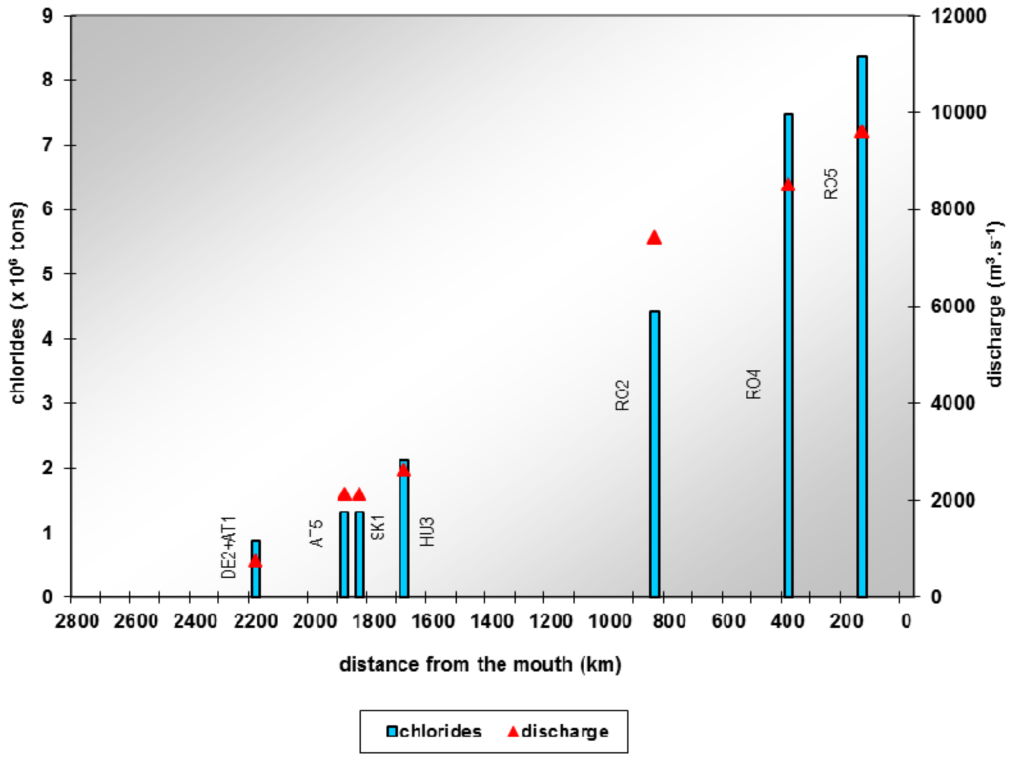
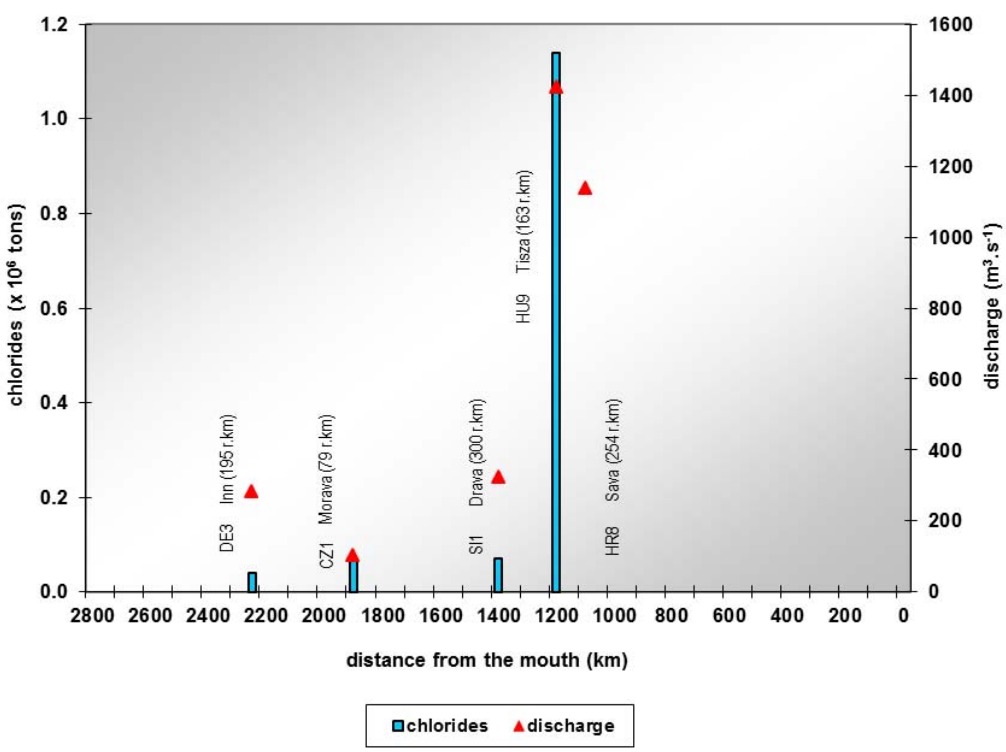


Figure 5.5.12: Annual loads of chlorides at monitoring locations on tributaries.



6. Groundwater monitoring

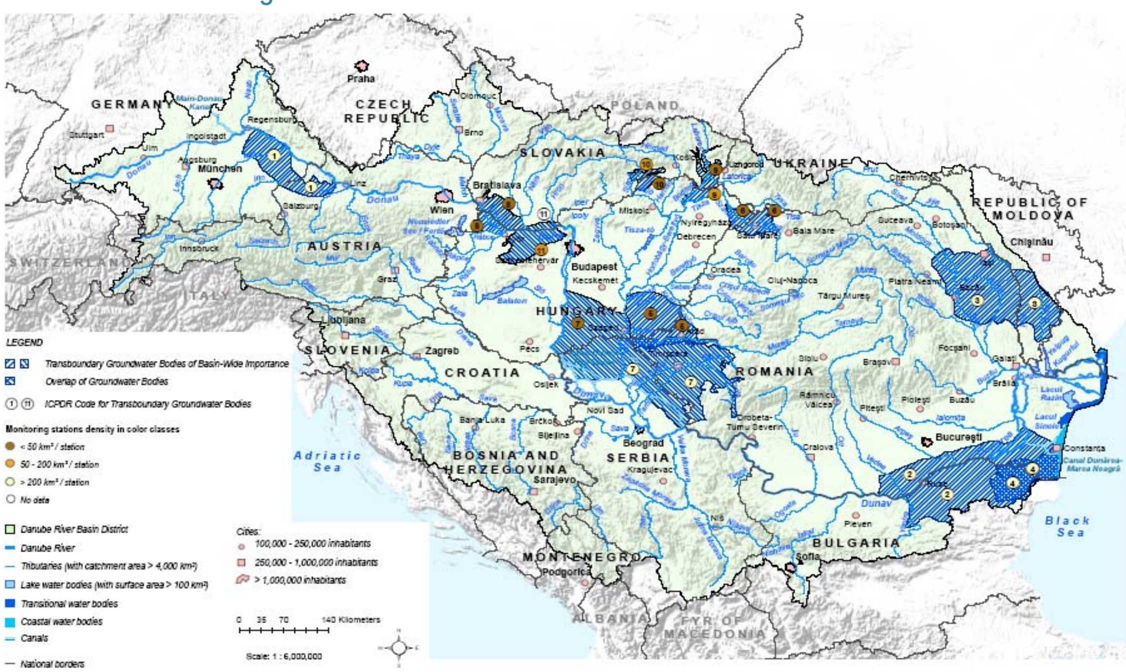
6.1. GW bodies of basin-wide importance

According to the Article 2 of the EU Water Framework Directive (2000/60/EC) 'Groundwater' means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. The analysis and review of the groundwater bodies in the Danube River Basin as required under Article 5 and Annex II of the WFD was performed in 2004 and it identified 11 GW-bodies or groups of GW-bodies of basin-wide importance, which are shown in Map (Figure 6.1.1).
GW-bodies of basin-wide importance were defined as follows:

- important due to the size of the groundwater body which means an area larger than 4000 km² or
- important due to various criteria e.g. socio-economic importance, uses, impacts, pressures interaction with aquatic eco-system. The criteria need to be agreed bilaterally.

This means that the other groundwater bodies even those with an area larger than 4000 km², which are fully situated within one country of the DRB are dealt with at the national level. A link between the content of the DRBMP and the national plans is given by the national codes of the groundwater bodies.

Figure 6.1.1: Transboundary GW-bodies of basin-wide importance and their transnational monitoring network



6.2. Reporting on groundwater quality

According to the WFD groundwater is an integral part of the river basin management district and therefore monitoring of groundwater of basin-wide importance was introduced into the TNMN in the Danube River Basin. The detailed description of the current status in development of the groundwater monitoring network in the Danube River Basin District is given in the TNMN Groundwater monitoring report (Part II of the Summary Report to EU on monitoring programs in the Danube River Basin District designed under Article 8).

For groundwater monitoring under TNMN a six-year reporting cycle is foreseen, which is in line with the WFD reporting requirements. Information on status of the groundwater bodies of basin-wide importance will be regularly provided in the DRBM Plans. This will sufficiently allow for making any relevant statement on significant changes of groundwater status for these GW-bodies.

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
DRB	Danube River Basin
DRBMP	Danube River Basin Management Plan
GW	Groundwater
BOD_5	Biochemical oxygen demand (5 days)
COD_{Mn}	Chemical oxygen demand (Potassium permanganate)
COD_{Cr}	Chemical oxygen demand (Potassium dichromate)
TOC	Total organic carbon
DOC	Dissolved organic carbon
AOX	Adsorbable organic halogens
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls

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