MONITORING OF ENVIRONMENTAL IMPACT OF THE WORKS FOR IMPROVEMENT OF NAVIGATION CONDITIONS ON THE DANUBE BETWEEN CĂLĂRAŞI AND BRĂILA, km 375 and km 175

REPORT ON PRECONSTRUCTION PHASE

2011

- FINAL VERSION -

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ABBREVIATIONS

3D	Three-dimensional (about numerical modelling)
ADCP	Acoustic Doppler Current Profiler (technical for the measurements of water velocities and flow rates)
ADV	Acoustic Doppler Velocity (technical for the measurements of water current velocities)
AOX	Adsorbable Organic Halogens
As	Arsenic
AQC	Assurance Quality Control
Ba	Barium
BQE	Biological Quality Elements
CBO_5	Biochemical Oxygen Demand at 5 days
CCO-Cr	Chemical Oxygen Demand using potassium dichromate method
CCO-Mn	Chemical Oxygen Demand using potassium permanganate method
Cd	Cadmium
Cl	Chlorine
CN	Center (concerning to the place where the measurements were made, or sampling)
Co	Cobalt
CPUE	Catch per unit effort
Cr	Chromium
Cu	Copper
Fe	Iron
GIS	Geographic Information System
GPS	Global Positioning System
Hg	Mercury
HSI	Habitat Suitability Index
HMS	Habitat Modification Score
HQA	Habitat Quality Assessment
ICPDR	International Commission for the Protection of the Danube River
IE/OE	Epuraşu Island/ Epuraşu Islet
IFIM	Instream Flow Incremental Methodology
IL	Lupu Island
INCDDD	Danube Delta National Institute for Research and Development
INCDM	National Institute for Marine Research and Development Constanța
INCDPM	National Institute for Research and Development in Environmental Protection
JDS	Joint Danube Survey (JDS_1, JDS_2 international expeditions of Danube quality monitoring organized by ICPDR)
kg dm	Kilograms of dry matter
LD	Limit of detection
Lmax	Maximum sound intensity (is measured in dB)

Lzeq	Equivalent continuous intensity with Z-weighted linear (to noise - unit of measure: dB)
MNS	Black Sea – Sulina quote
MD	Right bank
mdMN	Meters above the Black Sea (on odds)
Mn	Manganese
MS	Left bank
Natura 2000	EU network of protected areas (include SPA and SCI)
NH_4^+	Ammonium
Ni	Nickel
NO_2^-	Nitrites
NO_3^-	Nitrates
N_T	Total nitrogen
NTU	Unit of measurement for turbidity
OF	Fermecatu Islet
OL	Lupu Islet
OT	Turcescu Islet
PAH	Polycyclic Aromatic Hydrocarbon
Pb	Lead
CP	Critical point
PCB	Polychlorinated Biphenyls
CPs	Critical points
PHABSIM	Physical Habitat Simulation System
P_T	Total phosphorus
TSP	Total Suspended Particles
RX	X rays
Q	Water flow
SCI	Site of Community Importance
Se	Selenium
SI	Suitability Index
SLD	Below detection limit
SOP	Standard Operation Procedure
SPA	Special Protected Area
TNMN	TransNational Monitoring Network
U.M.	Unit of measurement
Zn	Zinc

1. INTRODUCTION

The Report prepared at the finalization of the preconstruction phase, in order to characterize the state of reference, before the start of the hydraulic works, is based on the following reference documents:

(i) Monthly reports (4) summarizing the activities carried out by the Contractor as specified in the Terms of References.

(ii) Historical data (Basic Framework) by which (where was the case) the observations and evaluations of the preconstruction monitoring period have been analyzed and corroborated in order to assess two basic characteristics:

- *the degree of congruence, respectively of evaluation previously obtained, with the one resulted from monitoring activities during the project; along with the strenghtening of own arguments of specific project activities, in this way a statistical sampling of determined parameters for a period of time is ensured, which practically allows the elimination of some potential errors caused by the exclusive use of certain determinations on a relative short period (April-August 2011), when only low water discharges have been recorded on Danube river at the critical points monitored;*
- *temporal and especially spatial trend of hydrochemical, hydrobiological and hydrological parameters, by integrating data from April to August 2011 in the series of historical data, this way allowing the obtaining corroborating data algorithms both abiotic and biotic level at aquatic ecosystem level specific to Danube on the monitored section; at least the interconnections between the characterization parameters of water quality with water discharge, of mass loadings associated (in particular particulate matter carried from upstream to downstream in the studied area), specific to preconstruction state, will serve as reference data to the direct assessment of impact caused by hydro technical works.*

The Phase Report is structured according to the table of contents transmitted by the Contracting Authority, presenting the reference state characterization (preconstruction) in correlation with the specific monitoring objectives/critical points, as follows:

A – air quality monitoring

B - noise monitoring

C - soil monitoring

D - hydro-morphological monitoring

E – water quality monitoring

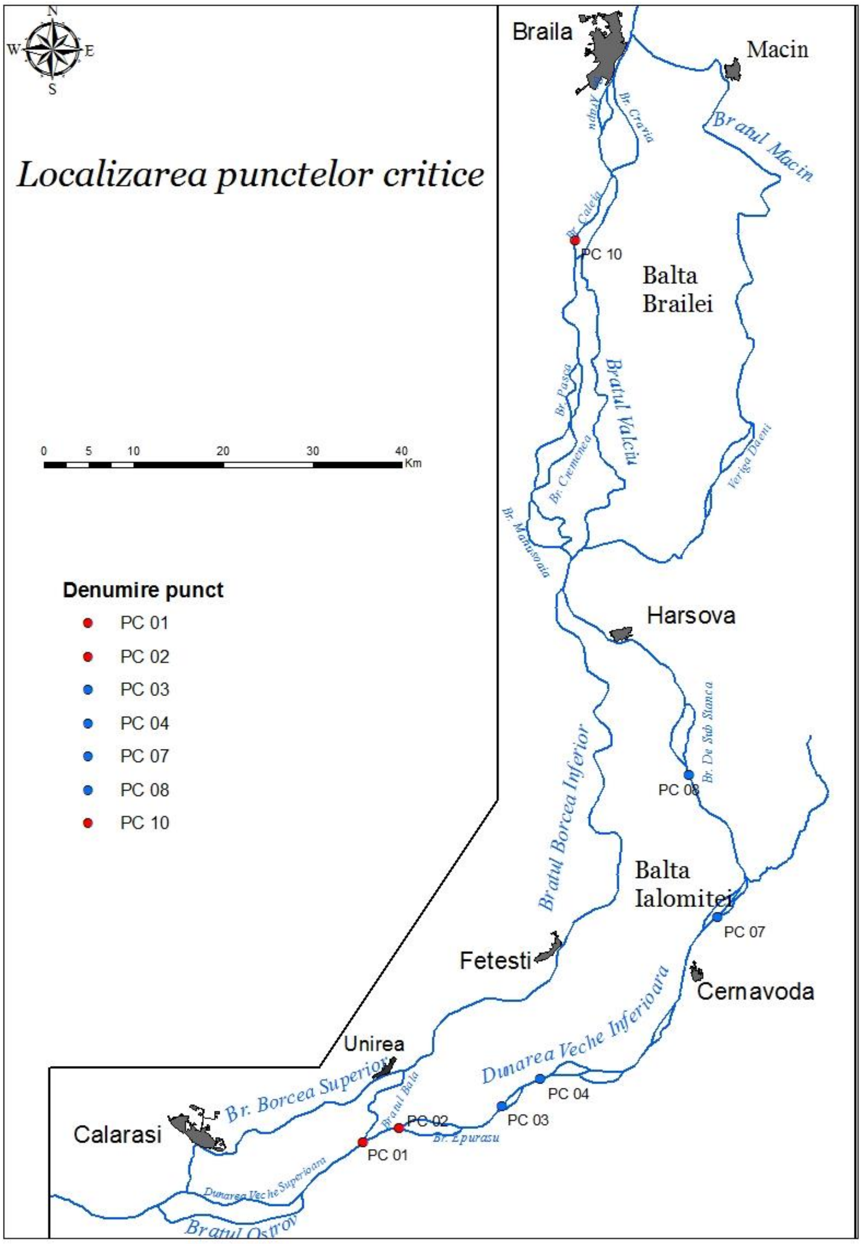
F - aquatic flora and fauna monitoring, with specific subchapters (hydrobiology, ichthyofauna)

G - terrestrial flora and fauna monitoring (vegetation, avifauna)

H – Natura 2000 sites monitoring

I – construction site activities monitoring and compliance with the intervention plan in case of accidental pollution.

The critical points, in which the environmental factors monitoring has been carried out, are schematically shown in the following:



In the first part of the Phase Report, an overall analysis of the specific activities progress with the appropriate methodology and equipment and references regarding the numerical modeling, are presented for each of the monitoring objectives (cap. 2.2).

The second part of the Phase Report shows the detailed results of biotic and abiotic parameters monitoring at the level of specific objectives (A-H) and critical points. Also integrated analysis elements are indicated at the aquatic and terrestrial ecosystems level by assessments on specific interrelation between biotope and biocenosis, and on the basis of some intercorrelations - at least the hydrochemical indicators - with water flow.

The last part of the Phase Report presents the specific conclusions at this stage and a series of recommendations.

The present Report develops a several new elements, allowing to obtain an overview suitable to integration in analytical modeling, respectively numerical modeling, work otherwise pursued by the Contracting Authority. The Reference Database which integrates historical data (Basic Framework) and those obtained under contract (April-August 2011) is also presented.

Alongside the properly organization and conduct of field and laboratory activities, a permanent cooperation between INCDPM as Consortium Coordinator and its Partners has been assured. The support of the National Agency of Fisheries and Aquaculture, the Border Police, Naval Transport Police and fishermen's associations has been assured.

In this context, we can appreciate that the project management structure submitted by the Provider in Technical Proposal proved viable, ensuring the flow of necessary informations at consortium level INCDPM.

Elements related to sampling periods for monitored objectives are shown in Table 1.1.

Table 1.1 - Preconstruction phase - monitored objectives

MONITORING OBJECTIVES		Sampling period/field activities period	Campaign	Main Critical Points			Secondary Critical Points					
				01	02	10	03A	03B	04A	04B	07	09
A.	AIR	02-06.06.2011	C 01	YES	YES	YES	NO	NO	NO	NO	NO	NO
		10-13.06.2011	C 01	YES	NO	YES	YES	YES	YES	YES	NO	YES
		06-08.07.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	YES
		26-29.07.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	YES
B.	NOISE	12-17.05.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	YES
		10-13.06.2011	C 02	YES	YES	YES	YES	YES	YES	YES	YES	YES
		07-08.07.2011	C 03	YES	YES	YES	YES	YES	YES	YES	YES	YES
		26.07-29.07.2011	C 04	YES	YES	YES	YES	YES	YES	YES	YES	YES
C.	SOIL	12-17.05.2011	C01	YES	YES	YES	YES	YES	YES	YES	YES	YES
		03-06.06.2011	C02	YES	YES	YES	YES	YES	YES	YES	YES	YES
		12.06.2011	C02	NO	NO	NO	NO	NO	NO	NO	YES	YES
		06-08.07.2011	C02	YES	YES	YES	NO	NO	NO	NO	NO	NO
D.	HIYDROMORPHOLOGY	15.04-15.08.2011	C01	YES	YES	YES	YES	YES	YES	YES	YES	YES
E.	WATER QUALITY	11-17.05.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	YES
		10-13.06.2011	C 02	YES	YES	YES	NO	NO	NO	NO	YES	YES
		06-08.07.2011	C 03	YES	YES	YES	NO	NO	NO	NO	NO	NO
		26-28.07.2011	C 04	YES	YES	YES	NO	NO	NO	NO	NO	NO
	SEDIMENTS	11-17.05.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	YES
		10-13.06.2011	C 02	YES	YES	YES	NO	NO	NO	NO	YES	YES
		06-08.07.2011	C 03	YES	YES	YES	NO	NO	NO	NO	NO	NO
		26-28.07.2011	C 04	YES	YES	YES	NO	NO	NO	NO	NO	NO

MONITORING OBJECTIVES		Sampling period/field activities period	Campaign	Main Critical Points			Secondary Critical Points					
				01	02	10	03A	03B	04A	04B	07	09
F.	AQUATIC FLORĂ	06-08.07.2011	C 01	YES	YES	YES	NO	NO	NO	NO	NO	NO
		28-29.07.2011	C 01	NO	NO	NO	YES	YES	YES	YES	YES	NO
	AQUATIC FAUNA AQUATIC FLORĂ	11-16.05.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	NO
		06-08.07.2011	C 01	YES	YES	YES	NO	NO	NO	NO	YES	NO
		06-08.07.2011	C 01	YES	YES	YES	NO	NO	NO	NO	NO	NO
	F.is. STURGEONS AND BARBEL	11.06-10.07.2011	C 01	YES	YES	YES	NO	NO	NO	NO	NO	NO
	F.i. OTHER FISH SPECIES	27.04-27.05.2011 01.06-30.07.2011	C 01	YES	YES	YES	NO	NO	NO	NO	NO	NO
G.	TERRESTRIAL FLORA	16.05-08.07.2011	C 01	YES	YES	YES	NO	YES	YES	YES	YES	NO
		26-30.05.2011	C 02	NO	YES	YES	NO	NO	NO	NO	NO	NO
		06-10.06.2011	C 03	NO	NO	NO	YES	YES	YES	YES	YES	NO
	TERRESTRIAL FAUNA	23.05-10.06.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	NO
H.	NATURA 2000 SITES	16.05-08.07.2011	C 01	YES	YES	YES	YES	YES	YES	YES	YES	NO
		26-30.05.2011	C 02	NO	YES	YES	NO	NO	NO	NO	NO	NO
		06-10.06.2011	C 03	NO	NO	NO	YES	YES	YES	YES	YES	NO
I.	CONSTRUCTION SITE ACTIVITIES	27.04-15.08.2011	C 01	YES	NO	YES	NO	NO	NO	NO	NO	NO

NOTE:
YES – samples have been taken / field activities have been conducted
NO - samples have not been taken / field activities have not been conducted

Monitoring frequencies on each point in the preconstruction phase are shown succinctly in the following table:

Table 1.2 - Preconstruction phase - monitoring objectives - Frequencies with differentiations at critical points

Monitoring Objectives			Main Critical Points			Secondary Critical Points				
			01	02	10	03A	03B	04A	04B	07
A.	AIR		1*	1	1	1	1	1	1	1
B.	NOISE		M	M	M	M	M	M	M	M
C.	SOIL		2*	2	2	2	2	2	2	2
D.	HIYDROMORPHOLOGY	Water level	C	C	C	Q	Q	Q	Q	Q
		Water velocity	M	M	M	Q	Q	Q	Q	Q
		Turbidity	C	C	C	Q	Q	Q	Q	Q
		2D bathymetric elevation	Q	Q	Q	Q	Q	Q	Q	Q
		3D bathymetric elevation	Q	Q	Q	Q	Q	Q	Q	Q
E.	WATER QUALITY		M	M	M	S	S	S	S	S
	SEDIMENTS		M	M	M	S	S	S	S	S
F.	AQUATIC FLORA		1	1	1	1	1	1	1	1
	AQUATIC FAUNA		1	1	1	1	1	1	1	1
	F. is STURGEONS AND BARBEL		Two seasons / year			Two seasons / year				
			(Feb, Mar, Apr, May/Aug, Sep, Oct, Nov, Dec)			(Feb, Mar, Apr, May/ Aug, Sep, Oct, Nov, Dec)				
	F. i OTHER FISH SPECIES		Annual			Annual				
			(Apr, May, July, Aug, Sep)			(Apr, May, July, Aug, Sep)				
G.	TERRESTRIAL FLORA		1	1	1	1	1	1	1	1
	TERRESTRIAL FAUNA		1	1	1	1	1	1	1	1
H.	NATURA 2000 SITES		C	C	C	C	C	C	C	C
	CONSTRUCTION SITE ACTIVITIES		M	M	-	-	-	-	-	-

NOTE:
M- monthly, S - semester, Q - quarterly, C- continuous, X* - number of investigations /preconstruction

The means of transportation used during the preconstruction phase are shown in Table 1.3.

Table 1.3 - Means of transportation used for preconstruction period

Domain	Means of transport
WATER	SAM boat with sonar and 75 HP engine
	Linder boats with 10 HP engine
	boats with 10-125 HP engines
	RIB boat with 25 HP engine
	VITUKI sampling ship, 500 HP engine
	COLEGIU sampling ship, Galaţi, 500 HP engine
LAND	cars
	land vehicles
	minibus
	auto-laboratory

2. STATUS OF THE ACTIVITIES

To control the stage of progress of specific activities of monitoring objectives at the critical points, was developed a synthetic indicator - approach degree GA (%) - which allows highlighting regular of way of accomplishing the program of works performed by the Provider in the base of the liabilities deriving from the Technical specification.

The value of this indicator is calculated according to the formula (2.1) [Deák Gy., Petrescu A.]:

$$GA(\%) = \frac{100 \times \sum_{i=1}^{9} R_i}{\sum_{i=1}^{9} F_i} \tag{2.1}$$

where:

- R_i is frequencies of monitoring ACCOMPLISHED for each PC_i critical point in the preconstruction phase;

- F_i is frequencies of monitoring REQUESTED in the Technical specification for each PC_i critical point in the preconstruction phase.

After the decisional analysis of the specialists team of the Consortium, critical points were grouped into three categories:

A- Main critical points (CP 01, CP 02, CP 10)

B- Main critical secondary (CP 03A, CP 03B, CP 04A, CP 04B, CP 07)

C- Critical point useful the 3D modeling 3D (CP 09).

For this phase, at the level those 9 PC were determined geographical coordinates, realizing concurrently a coding system for each specific objective of the monitoring.

In order to optimize overall the field activities - campaigns of sampling, measurements and observations "in situ" - the program of the monitoring activities was planned so research craft ensure maximum efficiency for obtaining data and information. The main criterion used in this sense it was the degree of overlap of the frequencies and the monitoring locations (eg hydromorphology and water quality).

As a consequence of the above, in Table 2.1. is summarized the approach degree of monitoring objectives achieved for the period afferent the I phase (preconstruction).

Table 2.1 - Approach degree GA (%) period April - August 2011

No. crt.	Monitoring objective	Phase	Approach degree GA(%) after 4 months
1.	Calitatea aerului	Preconstrucție (STAREA DE REFERINȚĂ)	100
2.	Solul		110
3.	Zgomot		100
4.	Hidromorfologia		100
5.	Calitatea apei		102,3
6.	Ihtiologie - sturioni		100
7.	Ihtiologie - alte specii		100
8.	Flora acvatică		100
9.	Faună acvatică		100
10.	Flora terestră		100
11.	Faună terestră		100
12.	Situri Natura 2000		100
13.	Monitorizare păsări		100
14.	Activități șantier		100
15.	Modelare 3 D		100

It can be appreciated that, overall, for the preconstruction phase the Provider is framed in work schedule established according to the technical specification.

In the following are presents the basics about the status and evolution of monitoring program on each phase/activity/critical point in part.

2.1. Monitoring progress

2.1.A. Air quality monitoring

2.1.A.1. Campaigns and monitoring periods

Air quality monitoring was conducted in 4 expeditions representing one measurements campaign throughout period of the preconstruction, the monitoring program being shown in Table 2.1.A.1.1.

Table 2.1.A.1.1 - Centralizer on the campaigns and air quality monitoring periods

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 01 02-06.06.2011 10-13.06.2011 06-08.07.2011 26-29.07.2011	04.06 10.06 06.07 26.07 27.07	03.06 07.07 27.07	02.06 06.06 13.06 08.07 29.07	11.06 07.07 28.07	11.06 07.07 28.07	11.06 07.07 28.07	11.06 07.07 28.07	05.06 08.07 29.07	12.06 08.07 29.07

* CP 09 - useful for numerical modeling

2.1.A.2. Methodology and equipment

Methodology

In order to assess air quality were determined the indicators mentions in the technical specifications: NO_x, CO, CO_2, particulate matter and lead oxides. The measurements of air "in situ" and the laboratory tests carried out to determine these indicators were carried out in accordance with the standards outlined in the table 2.1.A.2.1.

Table 2.1.A.2.1 - Standard operating procedures, methodologies specific, referential

Standard/Method	Analysis
SR EN 14211/2005	Ambient air quality. Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence
SR EN 14626/2005	Ambient air quality. Standard method for the measurement of the concentration of carbon monoxide by non-dispersive infrared spectroscopy
SR ISO 9855:1999	Ambient air. Determination of the particule lead content of aerosols collected on filters. Atomic absorption spectrometric method
STAS 10813/1976	Air quality. Determination of suspended particulates (TSP)
SR EN 12341:2002	Air quality. Determination of the PM 10 fraction of suspended particulate matter - Reference method and field test procedure to demonstrate reference equivalence of measurement methods
SR EN 14902:2006	Ambient air quality. Standard method for the measurement of Pb, Cd, As and Ni in the PM10 fraction of suspended particulate matter

Equipment

Measurement of the concentrations of NO_x, CO and CO_2 was carried out "*in situ*" with the mobile laboratory and analyzers type Horiba APNA 370 and APMA 370. Samples of particulate matter and lead oxides were taken with sampling apparatus of type DESAGA GS 450 and were analyzed in the laboratory.

2.1.A.3. Investigations conducted

In order to characterize the state of reference of the air quality, 452 samples of the air were taken from CP 01, CP 02, CP 10, CP 3A, CP 3B, CP 4A, CP 4B, CP 07 AND CP 9, for which were carried out 1315 analysis, a centralization on the critical points is shown in Table 2.1.A.3.1.

Table 2.1.A.3.1 - Centralizer on air quality monitoring

Characteristics	Main critical points			Secondary critical points					Additional critical point	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*	
number of samples	93	81	90	23	23	23	24	65	30	**452**
number of analysis	235	205	225	100	100	100	100	150	100	**1315**

* CP 09 - useful for numerical modeling

2.1.B. Noise monitoring

2.1.B.1. Campaigns and monitoring periods

Noise monitoring was conducted in 4 expeditions representing 4 measurements campaign throughout period of the preconstruction, the monitoring program being shown in Table 2.1.B.1.1.

Table 2.1.B.1.1 - Centralizer on the campaigns and noise monitoring periods

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 01 12-17.05.2011	14-15.05	13.05	17.05	16.05	16.05	16.05	16.05	12.05	-
Campaign 02 10-13.06.2011	10.06	10.06	13.06	11.06	11.06	11.06	11.06	12.06	12.06
Campaign 03 07-08.07.2011	07.07	07.07	07-08.07	-	-	-	-	-	-
Campaign 04 29-29.072011	26-28.07	26-27.07	29.07	28-29.07	28.07	28.07	28.07	29.07	-

* CP 09 - useful for numerical modeling

2.1.B.2. Methodology and equipment

Noise level - Intensity (dBA) - was measured for short periods of time, in the monitoring points set for situation devoid of naval traffic and with naval traffic. For processing of date and preparation of noise maps were used information on weather conditions and terrain.

The noise measurements were made using sonometer Bruel & Kjaer 2250 model.

As a measurement technique it was used continuous monitoring with a duration of 60s and 78S. Noise intensity was sampled with one step of 1s.

The appliances calculates and keeps in memory the minimum intensity or the maximum monitoring interval and the L_{zeq} value - equivalent intensity continuous with weighted Z-linear.

This corresponds to a level of constant noise that would result if the same total energy of sound would be produced in the measuring range.

The noise measurement equipment consisted mainly from: microphones, screen of wind, calibration of noise, sound level meter, the software of download and processing data.

It were applied working methodologies in according to standards from Table 2.1.B.2.1.

Table 2.1.B.2.1 - Standard methods used to monitor noise

Standard/Method	Analysis
STAS 6156 – 86	Protection against noise in dwellings and public buildings. Admissible limits and sound insulation values
SR ISO 1996/1,2,3:1995	Acoustics. Description and measurement of environmental noise.

2.1.B.3. Investigations conducted

The noise measurements, carried out in four campaigns, had totaled 689 measurements, whose distribution - absolute number and percentage - on critical points are presented in Table 2.1.B.3.1.

Table 2.1.B.3.1 - Centralizer on noise monitoring

Characteristics	Main critical points			Secondary critical points					Additional critical point	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*	
Number of measurements	271	104	147	17	25	25	17	50	33	**689**

* CP 09 - useful for numerical modeling

2.1.C. Soil monitoring

2.1.C.1. Campaigns and monitoring periods

Monitoring of soil quality was conducted in 4 expeditions representing 2 measurements campaign throughout period of the preconstruction, the monitoring program being shown in Table 2.1.C.1.1.

Table 2.1.C.1.1 - Centralizer on the campaigns and the periods of quality soil monitoring

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 1 12-17.05.2011	14.05 15.05	13.05	17.05	17.05	16.05	16.05	16.05 17.05	12.05	-
Campaign 2 03-06.06.2011 12.06.2011 06-08.07.2011	03.06 04.06 06.07	03.06 04.06 07.07	06.06 08.07	03.06 05.06	05.06	05.06	05.06	12.06	12.06

* CP 09 - useful for numerical modeling

2.1.C.2. Methodology and equipment

Establishment the effective program of sampling and harvesting of soil samples had into account the provisions contained in the documents of Table 2.1.C.2.1.

Table2.1.C.2.1 - Standard methods for determining indicators from soil samples

Standard/Method	Analysis
STAS 7184/1-1984	Recoltarea probelor pentru studii pedologice şi agrochimice
ISO 10381/1-2002	Soil quality - Sampling. Part 1. Guidance on the design of sampling programmes
ISO 10381/2-2002	Soil quality - Sampling. Part 2. Guidance on sampling techniques
ISO 10381/3-2001	Soil quality - Sampling. Part 3. Guidance on safety
ISO 10381/4-2003	Soil quality - Sampling. Part 4. Guidance on the procedure for investigation of natural, near-natural and cultivated sites
ISO 10381/5-2005	Soil quality - Sampling. Part 5. Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination

Soil samples were collected from two different depths, respectively from 5 cm and 30 cm from the surface, with the sampler Burkle type; were coded and labeled according to the coding instructions, were complemented sampling sheets, and to each sampling point it have been established geographic coordinates.

To assess the physico-chemical properties of soil were determined indicators enumerated in the Order 756/1997 - head. III, Annex, Table 1 - Traces of chemicals in soil: organic compounds and they salts contained at point 2 of the Table - "other elements" in accordance with the technical specifications. The analysis methods used to determine these parameters are shown in Table 2.1.C.2.2.

Table 2.1.C.2.2 - Standard methods for determining indicators from soil samples

Standard/Method	Analysis
Preparation of test samples	
SR ISO 11464:1998	• Pre-treatment of soil samples
SR ISO 11466:1999	• The mineralization of soil samples
Chemical determinations	
SR ISO 11047:1999 ISO 20280/2007 ISO 16772/2004 ISO 122036/2008	Metals: Sb, Ag, As, Ba, Be, B, Cd, Co, Cr, Cu, Mn, Hg, Mo, Ni, Pb, Se, Sn, V, Zn
SR ISO 11262:1998 SR ISO 11048:1999 SR EN ISO 10304:2009 SR ISO 10530:1997 STAS 7184/7-87	Other elements: cyanide, sulphocyanates, fluoro, bromo, sulphides, sulphates
STAS 7184/21-82	Determination of humus
SR ISO 14235:2000	Determination of soil organic matter - organic carbon
Analysis of physical characteristics physico-mechanical:	
STAS 7184/10-79 STAS 1913/5-85	- granulometry
SR EN ISO 22476:2006	- porosity
STAS 1913-83	- other mechanical characteristics (compressibility, compaction)
STAS 8942-89	

2.1.C.3. Investigations conducted

In order to characterize the state of reference of the soil quality, were taken in two campaign, a 1150 number of soil samples from CP 01, CP 02, CP 10, CP 3A, CP 3B, CP 4A, CP 4B and CP 07 (Annex 5.3.1), for which were carried out 40250 chemical analysis. A centralization on critical points of the monitoring data is shown in Table 2.1.C.3.1.

Table 2.1.C.3.1 - Centralizer on soil monitoring

Characteristics	Main critical points			Secondary critical points					Additional critical point	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*	
number of samples	456	204	216	38	46	42	36	80	32	**1150**
number of analysis	15960	7140	7560	1330	1610	1470	1260	2800	1120	**40250**

* CP 09 - useful for numerical modeling

2.1.D. Hydromorphological monitoring

The hydromorphological monitoring it took into account the following elements:

- Water quantity (flow rate)
- Water flow dynamics – flow velocity
- Water level
- Bed morphology
- Sediment carried in suspended.

2.1.D.1 Flow and flow velocity measurements using ADCP technique

For the measurements of flow and speed were used several boats, such as boats “Zodiac”, „RIB”, „Bombard”.

Methodology and equipment

<u>Work methodology</u>

The ADCP system (Advance Doppler Current Profiler) it measures in real time the profiles of flow velocity of water and based on them determine the flows on the respective profiles. This system was used attached to the crafts. Hydrometric measurements were performed with a spatial resolution according to the technical specifications at each critical point.

The ADCP RDI 600kHz system composed from: Bottom Track circuit, module of profiling of high resolution, cables, bateries, memory card and an dedicated software, has required the existence a computer shockproof and moisture for data collection, and was served by DGPS OmniSTAR 8200 HP, and/or GPS constructive supplied. ADCP used have four /eight sensors with different orientation, for generating a acoustic narrow beam projected through the water without reflections caused to particles from water (par example: sediment and suspended, organic matter, organisms or gas bubbles), in order to determine the flow velocity of water.

For data processing it was used a software of Teledyne RDI - WinRiver II manufacturer's, used at recording, processing and analysis data of flow velocity and flow rates.

2.1.D.2 Single-beam bathymetric measurements and surveying measurments of the banks

It were performed approximately 550 bathymetric cross profiles of single-beam, which were continued, in the extension, with surveying measurements of banks on profile in zone of the main riverbed.

<u>Work methodology for single-beam hydromorphological measurements</u>

The bathymetric profiles were executed on predetermined/marked sections having at least one landmark on the shore where runs topographic profile with the perpendicular orientation along the Danube, from one shore to another. At the beginning and end of the measurement series was made the registration Danube level at the nearest hydrometric station. Displacement speed of the boat was about 2 knots (aprox.3.5 km/h), according to the hydro-meteorologic conditions, wind, the nature of the bottom, etc.

Single beam bathymetric measurements were performed using a portable system EchoSounders StrataBox, being an portable sonar is an accurate of measuring of water depth ±0.5%. The transducer of ceramic type it has a power of 300W at a frequency of 10KHz.

Central unit of sonar is connected to power supply of 10-30VDC, with the transducer, with GPS and laptop to enable recording, integration and storage of information at each measurement /profile.

This system installed on the craft “Zodiac” has been immersed to a depth of 30-40 cm, the measurements being performed on cross-sections, starting at a distance from the shore which ensures a minimum depth of 2 m and crossing toward the opposite shore of the Danube under the same conditions.

During measurements were performed the continuous GPS records; it was used DGPS Omnistar 8200 HP, with dual frequency (L1 and L2), operating in RTK regim, having a the sub-meter accuracy (0.20 m) of positioning, a accuracy of time of 20 ns RMS, and a accuracy of the speed of 0.05 m/s.

It has tried to maintain a trajectory as straight, as well as a speed as constant.

Work methodology for the surveying measurements of the shores

Geodetic network of thickening and uplift was made up of old points/topographic landmarks, taken from existing national networks and new points that will be materialized and determined at this stage of preconstruction. New points materialized, according to the technical specifications, were highlighted by wooden stakes and/or topographic landmarks Feno, depending on conditions on the ground.

By adding the points it was achieved thickening the existing networks to represent an support for the bathymetric measurements and for the topographical survey of the shores, still on the same section, but also for future uses on the area monitoring of the riverbed and the shores in sights.

Deforestations of the main riverbed in zone the alignments of the cross profiles

From the landmarks of the geodetic network of thickening and uplift were determined by DGPS measurements the coordinates of topographic landmarks/wooden stakes from alignments of cross bathymetric profiles.

It has pursued as far as possible in every point to ensure the visibility to other two points of network, to guide the total topographic station.

Were determined coordinates X, Y, Z in the stereographic projection system 1970 and reference plan of the Black Sea Sulina for all the points of geodetic network of thickening and uplift.

The methods for determining the coordinates have included the GPS measurements with the Trimble R5 receivers, L1 / L2 and clasic surveying measurements with total stations/Leica 1200+, thus it was obtained the documentation of the geodetic network of thickening and uplift (topographical descriptions and inventories of coordinated in stereographic system 1970, network sketches etc.).

The materialization and linking of the bathymetric profiles at the geodetic network of thickening and uplift

In zone of the bathymetric profiles were planted how many 2 topographic landmarks /wooden stakes, of which at least one in the profile alignment or in extension thereof, the coordinates wooden stakes being determined by starting from network points. A second topographic landmark was planted in its alignment / extension on the upper bed or close, depending on conditions on the ground to serve the rapid identification of the alignment and respectively, in order to facilitate the topographical survey subsequent on profile of riverbed, especially for the regular calibration or after events hydrological of hydrometric sections, with the total station and 2D hydrographic sonar (single-beam).

2.1.D.3 Multie-beam bathymetric measurements

The multi-beam bathymetric measurements were made by VITUKI using specific equipment this type of measurements on ship board „Dr. Csoma János".

Throught these multi-beam bathymetry measurements was fully covered an area of 48.0 km. The details and results of these measurements are presented in Chapter 3.1.J.

2.1.D.4. Measurements of turbidity / suspended matters

Continuous turbidity measurements it not were made due to the delay of the acquisition and the mounting of the turbidity sensors.

It states that regular monitoring of turbidity assures obtaining relevant results consistent with the objectives set out in the Technical specifications.

From the point of view the turbidity monitoring / measurements of the suspended matters during the preconstruction perioad were carried out the following activities:

a) Characterization the correlation between turbidity (NTU), concentration of suspended matters (gravimetrical measurments mg/l) both in flux quasi-continuously and by correlation the granulometry of re-suspension sediments, with value of dispersion (nephelometry); was performed at the same time a determination of granulometry of suspended matters;
b) For sediment were determined the granulometric characteristics and those relating to the mineral composition thereof by identifying and quantifying approx. 20 elements (fluorescence with RX).

Tables 2.1.D.4.1 and 2.1.D.4.2 it presents an centralizer of activities of hydromorphologic order.

Table 2.1.D.4.1 - Centralizer on turbidity monitoring / measurements of the suspended matters

Calibration sets	Main critical points								Secondary critical points				CP 09	Total	
	CP 01			CP 02		CP 10			CP 3A	CP 3B	CP 4A	CP 4B			
	P1	P2	P4	P3	P5	ST6	ST7	ST8							
Observations	17	17	17	4	4	4	4	4	2	2	2	2	2	81	
	weekly			monthly		monthly									
Suspensions granulometry	a set			a set		a set			a set	a set	a set	a set	a set	07A a set	9 sets

* CP 09 - useful for numerical modeling

Table 2.1.D.4.2 - Centralizer on monitoring of sediment characteristics

Characteristics	Main critical points			Secondary critical points					CP 09	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
Sets granulometry	8	6	6	1	1	1	1	1	1	26 sets
Sets mineral composition analysis	a set	a set	a set	a set	a set	a set	a set	a set	a set	9 sets

* CP 09 - useful for numerical modeling

Correspondence that motivate in an some extent the delay of the emplacement of turbidity sensors with quasi-continuous measuring (every 15 minutes) was presented in Annex 3 of MONTHLY REPORT no. 2 and 3. How this correspondence continues and in today the relevant documents will be attached in the following Monthly Reports.

2.1.E. Water quality monitoring

2.1.E.1. Campaigns and monitoring periods

Water quality monitoring was conducted in 4 expeditions representing 4 campaign of sampling of water and sediments throughout period of the preconstruction, the monitoring program being shown in Table 2.1.E.1.1.

Table 2.1.E.1.1 - Centralizer on the campaigns and water quality monitoring periods

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 01 11-16.05.2011	14-15.05	13.05	11.05	16.05	16.05	16.05	16.05	12.05	16.05
Campaign 02 10-13.06.2011	10-11.06	10-11.06	13.06	-	-	-	-	12.06	12.06
Campaign 03 06-08.07.2011	6-7.07	6-7.07	8.07	-	-	-	-	-	-
Campaign 04 26-29.07.2011	26.07 28.07	28.07	29.07	-	-	-	-	-	-

* CP 09 - useful for numerical modeling

2.1.E.2. Methodology and equipment

In the pre-construction phase were conducted campaigns of field measurements (O_2, pH, temperature, conductivity, nutrients etc.) and the sampling of water and sediment for laboratory analyzes.

To assess the ecological status of water (Order 161/2006) were taken 272 samples for that were performed 11152 the laboratory chemical analyzes (41 indicators for each sample). Also for water, under Government Decision 1038/2010, which transposes Directive 2008/105/EC amending the Water Framework Directive (2000/60/EEC) regarding hazardous chemical substances and priority hazardous substances, were performed and the analyzes of dissolved factions concentrations of Hg, Cd, Pb and Ni to characterize the chemical status.

Indicators

a) for the water samples were monitored the indicators mentioned in Order 161/2006 table 6 point C;
b) for sediments
    - Metals: As, Cd, Cr total, Cu, Pb, Hg, Zn, Ni;
    - Organic micropollutants: PAH, PCB and organochlorine pesticides.

Parameters track

In order to evaluate the chemical status and ecological status of the water were determined following parameters:

- C_d (concentration of dissolved faction) for priority hazardous substances (Cd, Hg) and the hazardous (Pb, Ni)
- C_T (total concentration) for indicators physico-chemical, organic micropolluants and metals (As, total Cr, Cu, Zn)
- C_p (particulate concentration) respectively that of metals and organic pollutants detained on suspended matters and in re-suspended sediments
- C_{MS} concentration of suspended matters.

Standard operating procedures

Standard Operating Procedures (SOP) is referring to the following:

- Sampling water/sediment. In Table 2.1.E.2.1 are set the standards of sampling for water and sediment samples.

  The water samples were taken from three points - left bank, right bank and river, and the sediment samples - left bank and right bank. For water, were taken three samples on depth (below the water surface at 0.5 m,1.5 m and 3 m) only from the water stream. Each sample was divided into several samples from which were analyzed the specific physico-chemical indicators.
- Pre-treatment of samples (where applicable) water samples were preserved by cooling to 2-4^{0}C, their pre-treatment being performed in the laboratory, respectively filtering and fixing their. Items related to pre-treatment of sediment samples (mineralization) are presented in Table 2.1.E.2.2.
- Transport of samples. Receptacles were transported hermetically sealed, protected from light and the excessive heat.
- Performing of physico-chemical analyzes (water, sediment); the analyzes of physico-chemical indicators that not have required the fixing were carried out on the ground (pH, temperature oxygen, etc.) with portable devices. In table 2.1.E.2.3 are shown the standards used for analysis of heavy metals and organic micropollutants.
- AQC – In order ensuring and controling quality of the analytical measurements were used the certified reference materials for both water samples and sediment.

Table 2.1.E.2.1 - Standard methods for sampling of water and sediment samples

Sample type	**Standard/Metodă**
Samples of water	ISO 3696:1987, ISO 5667-1, ISO 5667-2, ISO 5667-3, ISO 5667-4, ISO 5667-5, ISO 5667-6, ISO 5667-10, ISO 5667-11, ISO 5667-17, SR EN 872
Samples of sediment	ISO 5667-12:1995, ISO 5667-14:1998, ISO 5667-15:1999

Table 2.1.E.2.2 - Standard methods for mineralization of sediment samples

Indicator	**Standard/Method**
As, Cd, total Cr, Cu, Pb, Hg, Zn, Ni;	ISO 15586/2003 ; EPA 3051
PAH, PCB and organochlorine pesticides	ISO 5667-15, EPA 8100 - Polynuclear Aromatic Hydrocarbons: 1986 EPA 3540 - Soxhlet extraction: 1996 EPA 3550

Table 2.1.E.2.3 - Standard methods for determination of some indicators in water samples

Indicator	Standard/Method
pH	SR ISO 10523/2009
CCO-Mn	SR EN ISO 8467/2001
Ammonium	SR ISO 5664/2001
Nitrites	SR EN 26777/2002
Nitrates	SR ISO 7890-3/2000
Total phosphorus	SR EN 6878/2005
Conductivity	SR EN 27888/1997
Dry filterable residue at 105^{0}C	STAS 9187/1984
Chlorides	SR ISO 9297/2001
Sulpfates	STAS 3069/1987
Calcium	SR ISO 6058/2008; SR EN ISO 17294-2
Magnesium	SR ISO 6058/2008; SR EN ISO 17294-2
Sodium	ISO9964-1/1993
Total chromium	ISO 15586/2003
Copper	ISO 15586/2003
Zinc	SR ISO 8288/2001
Arsenic	SR EN ISO 17294-2
Barium	SR EN ISO 17294-2
Selenium	SR EN ISO 17294-2
Cobalt	SR EN ISO 17294-2
Lead	ISO 15586/2003
Cadmium	ISO 15586/2003
Mercury	SR EN 1483:2003
Nickel	ISO 15586/2003
Total phenols	SR ISO 6439/2001
Anionic-active detergents	SR EN 903/2003

2.1.E.3. Investigations conducted

For sediments were taken 110 samples for that were performed 3630 analyzes at the indicators listed in the technical specifications, respectively:

- Heavy metals: As, Cd, Cr total, Cu, Pb, Hg, Zn, Ni
- Organic pollutants: PAHs, PCBs and organochlorine pesticides.

Overall (water and sediment) were collected 382 samples for which were carried 14782 physico - chemical analizes of laboratory, Tables 2.1.E.3.1 and 2.1.E.3.2 present a summary of them at critical points.

Table 2.1.E.3.1 - Centralizer on monitoring of chemical characteristics of water

Characteristics	Main critical points			Secondary critical points					CP 09*	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
number of samples	80	70	60	10	10	10	10	20	5	275
number of analysis	3157	2870	2460	410	410	410	410	820	205	11152

* CP 09 - useful for numerical modeling

Table 2.1.E.3.2 - Centralizer on monitoring of sediments quality

Characteristics	Main critical points			Secondary critical points					CP 09*	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
number of samples	32	26	26	4	4	4	4	8	2	110
number of analysis	1056	858	858	132	132	132	132	264	66	3630

* CP 09 - useful for numerical modeling

2.1.F. Monitoring of aquatic flora and fauna

2.1.F.1. Campaigns and monitoring periods

Monitoring of aquatic flora and fauna was conducted in 3 expeditions representing 1 campaign of sampling for phytoplankton, macrophytes, respectively aquatic macronevertebrates throughout period of the preconstruction, the monitoring program being shown in Table 2.1.F.1.1.

Table 2.1.F.1.1 - Centralizer on the campaigns and periods of aquatic flora and fauna monitoring

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Phytoplankton									
Campaign 01 06-08.07.2011 28-29.07.2011	06.07-07.07	06.07	08.07	28.07	28.07	28.07	29.07	29.07	-
Macrophytes									
Campaign 01 06-08.07.2011 28-29.07.2011	06.07-07.07	07.07	08.07	28.07	28.07	29.07	29.07	06.07	-
Macronevertebrates									
Campaign 01 11-16.05.2011 06-08.07.2011 28-29.07.2011	14.05-15.05, 06.07-07.07, 28.07	13.05, 07.07, 28.07	11.05, 08.07, 29.07	13.05, 16.05	16.05	16.05	16.05	12.05	-
Zooplankton									
Campaign 01 07,28-29.07.2011	28.07	28.07	29.07	28.07	28.07	28.07	28.07	07.07	-

* CP 09 - useful for numerical modeling

2.1.F.2. Methodology and equipment

Work methodology for phytoplankton

For each critical point it has analyzed a average sample, made up of 3 sub-samples taken from the following locations of the critical point / section: left bank, right bank and valley floor. Samples were taken of the surface (50 cm below the water line). Sampling was carried out in high season of development, in July.

For *the qualitative study of phytoplankton* were used concentrates samples, obtained by filtering of 50 liters water through a planktonic grid.

For the *quantitative study of phytoplankton* were used samples with a volume of 1 liter of water. In all cases, the volume of the sample it was mixed in a larger collection vessel and then transferred to a container of 1.2 liters.

The phytoplankton samples were fixed in the ground with alkaline Lugol's solution at a final concentration of 0.5% (5 ml for 1000 ml sample). Samples were labeled, marked with the type and code of sample, transported to the laboratory and stored in the dark and cold (4 and 8°C).

Sub-samples fixed with 90-96% ethyl alcohol were used for realization of mineralized preparations in order to determine correct the diatom species.

In table 2.1.F.2.1 are presented the standards of sampling and analysis used for samples of phytoplankton.

Table 2.1.F.2.1 - Standard methods for sampling and analizing the sample of phytoplankton

Sample type	Standard/Method
Phytoplankton	ISO 5667-1/1998, ISO 5667-2/1998, ISO 5667-3/2008, ISO 5667-4/2000, ISO 5667-6/1997, SR EN 15204/2007, N 109 2008/04/15

The quantitative analysis of phytoplankton was performed according to SR EN 15204/2007 (method Utermöhl) and has consisted from sedimentation the bodies from of a known volume of the sedimentation chamber, followed by analyzing samples by using the inverted microscope. After sedimentation, the bodies were identified, counted and measured for calculating biovolume.

For samples of phytoplankton were determined the following qualitative and quantitative biological indicators:

- Taxonomic composition of phytoplankton
- Anundance (numeric density) of phytoplankton
- Phytoplankton biomass
- List of the indicator species of water quality
- Dynamics the numerical abundance of phytoplankton on taxonomic groups

From the qualitative sample were determined the systematic groups and taxa present is compiling a list of identified species and the indication of their membership of a saprobic zone.

The quantitative concentrated sample was analyzed under a microscope mentioning taxa present, their number in order to calculating the density of phytoplankton (ex/l) and were made clarifications on the saprobic zone and the ecological state of water.

Appreciation (evaluation) water quality using communities of phytoplankton organisms was conducted using the method Pantle-Buck - on basis the bio-indicator species reported in the samples for the quantitative analysis was calculated the saprobic index, using the formula:

$$S = \frac{\sum (s_i x h_i)}{\sum h}$$

where

s = numerical value indicating membership of the saprobic zone

h = absolute numerical abundance of specimens of a particular taxon

i = taxon

S = saprobic index

<u>Work methodology for macrophytes</u>

Overall, the study of macrophytes an aquatic ecosystem involves establishing the following aspects:

- The area occupied by macrophytes, respectively the coverage rank of the basin. The coverage rank is determined for the complex entire of macrofite or separately by species and expressed in % compared to the total area of the basin gave;
- Density and qualitative composition of the macrophytes.

Sampling the macrophyte was done in order to establish qualitative and quantitative structure of vegetation present macrofite.

Aquatic macrophytes represent a component of the biotic factors monitored, therefore the collection stations were identical with the collection stations for other components monitored (phytoplankton), respectively the defined critical points in the project.

Sampling the macrophyte vegetation was conducted during period of maximum development their, represented by July, being the warmest month of the year.

For each sampling location was sampled an average sample - made up of three sub-samples: the left bank, right bank and valley floor.

Macrophytes were collected directly or by means of certain dredgers having the opening of 20 cm x 50 cm, dragând a length of 10 m in the vicinity of the banks. Sampling was conducted from 3 to 5 profiles perpendicular on line of the shore by dredging certain standard surfaces.

The macrophytes that could not be identified on field were stored in plastic bags, labeled, stored cold in freezer and transported to the laboratory.

Were used the following equipment and materials:

- suitable protective equipment
- rubber boots
- knife (or another blade)
- square wooden frames, with the surface of which can vary from 0.1 m^2 up to 1.0 m^2
- polyethylene bags (container) in which it can store the harvested material.

In order to determine the density of the macrophytes was used a square wooden frame, with an area of 1.0 m^2. The wooden frame it immerse using weights attached at its corners, and all the plants that are found within the framework of wood are harvested and counted to determine the density on m^2.

The botanical material collected from terrain was analized based on information contained in the literature and my own research, each species being framed by point of view systematic on gender and family, respecting the current system of phylogenetic classification of plants.

In the laboratory were determined the specie and the plants density per m^2. Plants taken were weighed to determine the weight of the biomass plant per m^2.

To determine the wet weight of the plants were washed to remove foreign matter, and then they were dried on filter paper to remove excess water and then were weighed.

Summary of vascular aquatic flora and swamp includes a number of useful information, presented thereby:

- Scientific name of the species and the author
- Popular names after speciality literature
- Lifetime (annual, biennial, perennial)
- Biological form (form of life)
- Chorology of zone: name the adjacent cities of previously studied area in terms of flora, year and authors
- The spread of the species in studied areas with a brief description from point of view of frequency (very common, frequent, sporadic, rare, very rare) and positioning (dam slope, water surface, banks of river)
- Floral element.

Work methodology for zooplankton

The zooplankton samples were collected from the horizon from the surface (0 to 0.50 m), by filtering of an measured volume of water (10-50 liters of water) with planktonic net. The concentrate with zooplankton was transferred in plastic bottles of 50-100 ml, properly labeled.

For the preservation of samples of zooplankton was used Lugol's solution (1 ml/ 100 ml sample).

In the laboratory, the samples were processed by slow sedimentation, after which the supernatant was removed, without was stirred the sample.

The samples thereby processed were analyzed qualitatively and quantitatively at microscope.

For samples of zooplankton were determined following *qualitative and quantitative biological indicators:*

- Taxonomic composition
- Anundance (numeric density)
- Biomass
- Dynamics the numerical abundance of zooplankton on taxonomic groups.

<u>Work methodology for benthic macronevertebrates</u>

Sampling of benthic macroinvertebrates was performed in accordance with standards SR EN ISO 8689-1/2003 and SR EN ISO 9391/2000.

Samples of macroinvertebrates were collected using the grasping dredgers or grabs samplers depending on the nature of the substrate. For each sampling point were collected three different subsamples to capture the heterogeneity of habitat (substrate muddy, sandy, with remnants of shells of molluscs). The amount of sediment sampled with the dredger was washed in netting with meshes of 0.5 mm. The remaining material after washing was transferred and stored in plastic bags and fixed with concentrate formalin (formaldehyde 37-40%). Because the formalin becomes acid with time and can dissolve the limestone formations of molluscs and crustaceans or can modify biomass values by solubilizing lipids and other fatty tissues, it has been buffered with borax (40 g sodium tetraborate per 1 liter of concentrated formalin).

In laboratory was achieved a additional sorting by selecting from of debris of sediments and other organic matter only benthic organisms. Those were determined in most cases up to the level of specie (when was possible; for example in the case of larvae Chironomidae is necessary, for to be possible the identification, that those are in IV development stage, stage where appear taxonomic characters sufficient) with the aid a binocular magnifying glass or at stereomicroscop.

<u>Processing of results</u>

Density. Represent the reporting of the specie per unit of area or volume. The density was expressed as number (number of specimen/m^2) and in biomas (g/m^2)

The relative abundance. Represnt the expression in percentage (%) or in probabilities of probabilities of participation of each species in population or studied biocenosis (*Stan, 1995*). Calculate from the relation:

$$A=n_i \cdot 100/N$$

where:

n_i = number of specimens of the species i, identified in the sample/samples studied

N = the total number of specimens of all species in the sample or samples studied.

Diversity. Diversity is a structural and functional parameter of ecosystems, a descriptor for the health state of their (*Kutsch, W. L. and collab., 2001*).

Shannon - Wiener index (H`) – is an index derived from information theory. It is one of the most widely used index for assessing diversity although according *Southwood and Henderson* (2000) this index is sensitive to the relationship S/N (S= total number of species), being independent of sample size. Calculate from the relation:

$$H` = -\Sigma pi \cdot \ln pi$$

where:

pi = the proportion of representation of specie

ni = number of specimens of an species

N = the total number of specimens from the perimeter analyzed.

This index can have the value 0 when it there is only one species and is maximum when it all species from the same number of specimens are represented (*Ludwig and Reynolds, 1988*).

To study the diversity of macroinvertebrates in the critical points analyzed were calculated following indicators: *Shannon - Wiener* (H_S), *maximun diversity* (**$H`_{max}$**) (theoretical) and *equitability of Shannon index (E=H_R).*

Maximun diversity (**$H`_{MAX}$**) is diversity on which can attain the ecosystem in conditions in which biocenosis studied achieve maximum of species.

Equitability of Shannon index (E=H_R) is an index which offer us a picture more accurate over the ecosystem diversity and represent the ratio between the observed value (actual) and maximum value (theoretical) on which a can achieve the ecosystem, in the conditions in that the biocenosis studied achieve maximum of species.

H_R value shows to what extent the observed diversity it departs from hypothetical value (maximum), with as the percentage is higher, with that much the real diversity it approaches of this hypothetical.

When in the samples studied are no dominant species, represented by a large number of individuals, H_S decreases and when there are many species without as some to dominate evident on the other, H_S increases and approaching of H_{max} (*Radu Cenuşă and collab., 2004*). Calculate from the relation:

$$E = H` / H_{max}$$

where:

H` = Shannon- Wiener index

H_{max} = log S

S= number of species

Saprobic index. depending on the degree of saprobity, the biological indicators are assigned to them a numerical value (s).

Calculate from the relation:

$$S = \Sigma(si \cdot hi)/h$$

where:

s = characteristic numerical value belonging at the saprobic zone

h = absolute numerical abundance of specimens of a particular taxon

i = taxon

2.1.F.3. Investigations conducted

To monitor aquatic flora and fauna (excluding ichthyology) in accordance with specifications in the Technical specifications were collected 113 samples for that were performed 339 analyzes hydrobiological regarding: (i) phytoplankton, (ii) macrofite and (iii) macroinvertebrates, a statistical summary for the preconstruction phase is shown in Table 2.1.F.3.1.

Table 2.1.F.3.1 - Centralizer on monitoring of biological characteristics of water

Characteristics	Main critical points			Secondary critical points					Total
	PC 01	PC 02	PC 10	PC 03A	PC 03B	PC 04A	PC 04B	PC 07	
PHYTOPLANKTON									
number of samples*	2	2	2	1	1	1	1	1	11
number of analysis	6	6	6	3	3	3	3	3	33
MACROPHYTES									
number of samples*	1	1	1	1	1	1	1	1	8
number of analysis	3	3	3	3	3	3	3	3	24
MACRONEVERTEBRATES									
number of samples	18	20	15	6	6	6	6	6	83
number of analysis	54	60	45	18	18	18	18	18	249
ZOOPLANKTON									
number of samples	12	9	9	6	6	6	6	6	60
number of analysis	36	27	27	18	18	18	18	18	180
number total of samples*	33	32	27	14	14	14	14	14	162
number total of analysis	99	126	81	42	42	42	42	42	486

* **Average samples** consisting of **3 sub-samples** such: one in vivinity of the left bank, one on valley floor, one in vicinity of the right bank

2.1.F.is. Sturgeon and barbel migration monitoring

2.1.F.is.1. Campaigns and monitoring periods

Sturgeons and barbel migration monitoring was conducted in a campaign of capturing and marking throughout period of the preconstruction, the monitoring program being shown in Table 2.1.F.is.1.1.

Table 2.1.F.is.1.1 - Centralizer on the campaigns and periods of monitoring of sturgeons and barbel migration

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 11.06-10.07.2011	11.06-10.07	11.06-10.07	11.06-10.07	-	-	-	-	-	-
Campaign 16.07 - 15.08.2011	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	16.07 - 15.08.	

* CP 09 - useful for numerical modeling

2.1.F.is.2. Methodology and equipment

The system of location/mounting the automatic stations in river

For location the automaticubmersible stations of reception into the river were used 4 rolls of steel cable Ø12 protected with PVC, each roll weighing 300 kg with a cable length of 500 m (ten anchors reinforced concrete of 90 kg each, 10 metalic plates with dimensions (300x300x12 mm) of 20 kg each, with role of anchoring the automatic stations). By the metalic plates was tied one end of the relon rope of Ø10 mm with length 0.7 m, sustained vertical by a yellow float of Ø200 mm.

Cable transects were placed using a special support of ongoing of cable.

With the SAM ship and boat Linder it was performed expance the cable and transportation the anchor of reinforced concrete at a place determined after lifting the bathymetric profile of that section.

Systems of installation and lifting of cable transects for mounting the automatic stations

For stretching the steel cable in the Danube was used a support from metalic profile that ensure the suspension of the roller on a pipe with size of Ø60 and length of 1.5 m. The support has ensured a efficient running from shore of the steel cable in Danube. Lifting the transects of cable for downloading data from automatic stations submersible was performed using a system with cylinders and bearings, specially commissioned to carry out this operation, which was attached on SAM at the starboard.

Boats used

For location of cable transects, lifting the submersible stations to collect the data recorded, transporting personnel and equipment on the Danube, realization the operations of implantation of ultrasonic marks, the transportation the sturgeons at place of realese, were used: ship SAM equipped with sonar and with two-stroke engine of 75 HP, boat Linder equipped with four-stroke engine of 10 HP, and boats with engine of the comercial fishermen associations with that we work. Also, RIB boat with motor of 25 HP four-stroke was used from the subunit Constanta of the National Institute of Research - Development for Environmental Protection.

Ultrasonic telemetry equipment

Ultrasonic telemetry equipments used are equipments tested previously of Sturgeon Research Group (GCS) of the National Institute of Research - Development for Environmental Protection, subunit Tulcea in project Best Combat.

Were used 12 automatic stations VR2W Vemco in project Best Combat. VR2W automatic stations operate at wavelengths of 69 kHz. They can receive the acoustic signals transmitted of the ultrasonic marks Thelma Biotel, having a storage capacity of 8 MB (1000000 detection). Electrical equipment is protected by a plastic housing shockproof which not allow water to reach circuits, resisting up to depths of 500 m. The battery life is 15 months and downloading recorded data is via Bluetooth. Each station has a number printed on the housing. Ultrasonic transmitters Thelma Biotel used are in number of 10 pieces, and are originate as the stations VR2W from the project Best Combat. They have the following characteristics: L = 55mm, Ø = 16, G in air = 17.5g, G in water = 6.5g. Are type ADT-MP-16, (Acoustic Depth Transmitters - Medium Power-16 mm), having a guaranteed lasting battery life of 53 months (4.4 years). They have sensors for depth and water temperature, on which a recorded and a send at the automatic stations in the territory of which moving the fish.

We consider that mode of the placement of the 10 automatic stations submersible (in the technical specification are set just 5 automatic stations) on that we managed to they install in period of the preconstruction has allowed us to answer the main question - whether during June - July the sturgeons use the Bala and Caleia branchs for migration /breeding.

For the next period it was envisaged the coverage with stations automatic of ultrasonic telemetry of the Old Danube route, Borcea branch downstream of Fetesti and control station of the sturgeons exit to the Delta /Sea situated at 54 km /Isaccea.

<u>The capturing, transport and handling of sturgeons</u>

For capturing of sturgeons we have concluded contracts with fishermen on Borcea (Feteşti) and Brăila (Chişcani). From ANPA were obtained permits of scientific fishing for fisherman and for boats used in fishing for sturgeons.

Capturing of sturgeons was conducted between km 375 and 175, with the support of three fishermen's associations.

In each of the zones CP 01 Bala and CP 10 Caleia were organized three points of catch on each side branch in upstream, respectively in downstream of the CP. Although these catch points were organized, majority of sturgeons were captured in the fishing nets of the commercial fishermen, with that has contract Institute.

Transport of sturgeons from the capturing place at the implantation site of ultrasonic transmitters Thelma Biotel was done in water; only in one case was used for transport the bed of wet sponge. The transportation of sturgeons to the place of release on Borcea branch, from km 57 to km 65, was made in the strecher filled with water installed in ship SAM, and at Braila (Chişcani) on the Danube, from km 180 to km 182.6, was used the stretcher and boat Linder, and boats of the association „Braifish Brăila”. For water oxygenation stretcher was used in an aeration system with the water pump connected to a battery of 12 V cc, which ensure constant recirculation pump and water oxygenation.

It has worked in mixed teams of INCDPM Bucharest and the subunit Tulcea.

<u>Non-destructive determination of sex and degree of maturation</u>

Sex determination and the degree of maturation of the ova it was done using an endoscope Welch Allyn, with an system of cold lighting with fiber optic.

Biometric measurements

The biometric measurements were performed using a common meter and a mechanical weigher. It has determined the total length (TL), standard length (SL), and the weight of the marked sturgeons. Data obtained from the biometric measurements were recorded on sheets of observations, which were then registered in a database.

The implanting surgical of ultrasonic transmitters

For surgical implantation of ultrasonic transmitters the fish were tranquilized using an system of electro-narcosis developed by GCS within the project BestCombat. To minimize operator stress was injected locally 1 ml Xylocaine. They used resorbable surgical thread.

The release of sturgeons in the zones of interest

The release of sturgeons in the zones of interest was made using a stretcher of 1.5 m long and 0.5 m from the plasticizer tarpaulin. To aerate the water from the transport stretcher was used a submersible pump Beagle fed to a 12 V battery. The stretcher was transported by ship SAM or boat Linder as appropriate.

The collection and management of dates from the automated submersible stations

For lifting the VR2W automatic stations from the Danube in view to collect data was used the system for running the cable attached to the bow SAM. Downloading the stations was done via Bluetooth to a laptop using software Vemco User Enviroment (VUE).

Investigating the presence of the sturgeon juveniles in zones of interest

At investigating the presence of the sturgeon juveniles in various places in the Danube was used a special fishing net for juveniles, 95 m long, with meshes of 20 mm, the army so as to work on the water bottom. The captured juveniles they were photographed, was sampled a fragment from the anal fin, were made biometric measurements and juveniles of marine migratory sturgeon were marked with marks of type Floy Fingerling Tag (FFT).

Collecting of qualitative samples of bottom fauna in the zones of interest

Collecting of qualitative samples of fauna in the zones of interest was made using a darling of river and ship SAM.

Viewing the bottom of the potential areas of the sturgeons breeding

For viewing the nature of the bottom in potential breeding areas was used the DIDSON room, combined with manual probe Kynard and levies substrate using river dear for bottom fauna.

2.1.F.is.3. Investigations conducted

The activities carried out during April - August 2011 related to monitoring sturgeon and barbel are summarized in Table 2.1.F.is.3.1.

For monitoring the sturgeons and the barbel, in accordance with the technical specificatins were marked 45 specimens of sturgeon, of which 10 specimens with ultrasonic marks, as well as 10 specimens of the barbel, a statistical situation for the preconstruction phase being shown in Tables 2.1.F.is.3.1, 2.1.F.is.3.2 and 2.1.F.is.3.3.

Table 2.1.F.is.3.1 - Centralizer on the marking activity of specimens of sturgeon and barbel

No. crt	Species caught	Zone of monitoring	No. of marked specimens	Marks used				Biometric measurements and samples
				Conventional (spaghetti)	PIT	Ultrasonic	CWT	
1.	*Acipenser stellatus*	Inferior Dunube, sector Călăraşi-Brăila, km 375 - km 175	15	15	1	9	-	- Dimensions - Total lenght (LT) - Standard lenght (LS) - Weight - ADN samples
2.	*Acipenser ruthenus*		30	30	3	1	6	
3.	*Acipenser gueldenstaedtii*		-	-	-	-	-	
4.	*Huso huso*		-	-	-	-	-	
5.	*Barbus barbus*		10	10	-	-	2	
6.	*Acipenser stellatus acvacultură*		10	5	5	-	-	
7.	TOTAL		65	60	9	10	8	

Table 2.1.F.is.3.2 - Centralizer on capturing and marking foreign of the white barbel *(Barbus barbus)*

No. crt	Data of capturing	Sex	Zone of capturing	Zone of releasing	Coordinates of releasing	GT (kg)	LT (cm)	LS (cm)	Mark spaghetti	ADN sample
1	1/7/2011	M	Feteşti km 48	Feteşti km 48	N 44 20 366 E27 49 271	3	64	54	998	11/3/12
2	1/7/2011	M	Chişcani km 181	Chiscani km 181	N 45 11 458 E27 56 571	1,5	54	46	994	13/6/3
3	2/07/2011	M	Borcea km 7	Borcea km 7	N 44 37 194 E27 54 907	3.5	64	53	990	13/6/7
4	2/07/2011	M	Borcea km 7	Borcea km 7	N 44 37 194 E27 54 907	4	62	62	989	13/6/8
5	2/07/2011	M	Borcea km 7	Borcea km 7	N 44 37 194 E27 54 907	2	55	45	988	13/6/9
6	2/07/2011	M	Feteşti km 48	Borcea km 47,5	N 44 20 862 E27 49 908	3,5	66	56	986	13/6/11
7	4/07/2011	M	Stelnica km 35	Borcea Km 38-39	N 44 24 556 E27 52 556	3	56	48	984	13/6/13
8	4/07/2011	F	Feteşti km 45	Feteşti km 45	N 44 21 289 E27 50 208	4,5	63	55	983	13/7/1
9	4/07/2011	F	Feteşti km 48	Feteşti km 43	N 44 22 493 E27 50 675	4	70	60	981	13/7/3
10	5/07/2011	M	Feteşti km 47 -48	Feteşti km 47 - 48	N 44 20 501 E 27 49 989	3	58	48	980	13/7/4

Legend: GT - Total weight; LT - Total lenght; LS - Standard lenght; P – Starry sturgeon; C - Sterlet sturgeon

Table 2.1.F.is.3.3 - Centralizer on capturing and marking of sturgeons with ultrasonic transmitters Thelma Biotel

No. crt.	Species	Sex	Capturing data	Hour of capturing	Place of capturing	Spaghetti series	Hour of releasing	Place of releasing	Coordinates of releasing	GT [Kg]	LT [cm]	LS [cm]	Cod Thelma	Samples	Observations
1	P	M	11-Jun-11	9:00	Borcea Km 57 - 55	0078	14:10	Borcea km 65	N:44°16,142 E:27°38,875	5	106	89	22	IA	
2	P	M	14-Jun-11	11:00	Dunare Km 182 - 180.5	0079	16:30	Dunare Km 182,6	N:45°10,470 E:27°56,456	5	107	90	023	IA	
3	P	F	18-Jun-11	6:00	Dunare Km 182 - 180.5	0081	14:45	Dunare Km 182,6	N:45°10,470 E:27°56,456	6	109	91	021	IA	sex evaluated on basis of the abdomen characteristics
4	P	M	22-Jun-11		Borcea Km 48 - 45	0082	11:46	Borcea km 65	N:44°16,175 E:27°39,029	5	101	88	25	IA	
5	C	M	24-Jun-11	13:30	Borcea Km 57 - 55	0085	18:10	Borcea km 65	N:44°16,142 E:27°38,875	4	113	95	27/28	IA	
6	P	M	24-Jun-11		Borcea Km 57 - 55	0089	18:10	Borcea km 65	N:44°16,142 E:27°38,875	3	75	64	9/10	IA	
7	P	F	24-Jun-11		Borcea Km 18	0090	23:35	Borcea km 65	N:44°16,142 E:27°38,875	6	111.6	95	29/30	IA	sex determinated with endoscope, Stage 6 / spawning submitted latterly
8	P	F	26-Jun-11	6:00	Borcea Km 57 - 55	0091/ 0092	11:15	Borcea km 65	N:44°16,142 E:27°38,875	5	119	97	17/18	IA	sex determinated with endoscope, Stage 6 / spawning submitted latterly
9	P	M	28-Jun-11	11:25	Borcea Km 57 - 55	0093	13:25	Borcea km 65	N:44°16,150 E:27°38,920	3	104	87	15/16	IA	at release, the fish lose spawning / Stage 5 - 6
10	C	M	29-Jun-11	10:00	Borcea Km 57 - 55	1000	15:30	Borcea km 67	N:44°16,152 E:27°38,880	1				IA	
11	P	M	1-Jul-11	10:00	Gropeni km 200	0995	14:15	Km 183	N:45°10,418 E:27°56,500	3	98	84	11/12	IA	

Legend: GT – Total weight; LT – Total lenght; LS – Standard lenght; P – Starry sturgeon; C – Sterlet sturgeon

2.1.F.i. Monitoring of other fish species

2.1.F.i.1. Campaigns and monitoring periods

Migration monitoring of other fish species was conducted in 4 expeditions representing a campaign of capturing and marking throughout period of the preconstruction, the monitoring program being shown in Table 2.1.F.i.1.1.

Table 2.1.F.i.1.1 - Centralizer on capturing and monitoring periods of other fish species

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Campaign 01 27.04-15.08.2011	27.04-15.06; 16.06-15.07; 16.07-15.08.	27.04-15.06; 16.06-15.07; 16.07-15.08.	27.04-15.06; 16.06-15.07.	-	-	-	-	-	-

* CP 09 - useful for numerical modeling

2.1.F.i.2. Metodology and equipment

<u>a. Shad fishing</u>

In view of monitoring ichtyofauna, other fish species except sturgeons and barbel, according to the Gantt chart, was achieved the displacement at the Main Critical Points (CP) 01, 02 and 10 in order to monitor the Alosa species (*A. immaculata* and *A. tanaica*) and in limit of the available time were made and some points of the electric fishing in zone of shore.

Sampling was conducted in accordance with:

- Guidance on the scope and methods selection for fish sampling - page16-17
- SR EN ISO 14962/2006 - Water quality. Guide for application domain and fish sampling methods.

According to the Gantt chart, species monitoring of Alosa takes place in April-May, the first expedition took place in the period 27 to 29 April 2011 and the second expedition in the period 25 to 27 May 2011, both in the main critical priority CP 01, CP 02 and CP 10.

For monitoring CP 01 the zone the Bala branch, CP 02 the zone the Epuraşu Island (Lebada) and CP 10 the Caleia branch (Lupu Islet) in two ways were sampled samples: fishing in drift with fishing net of shad (meshed of 30 mm) capturing of the adults that are in migration and the fishing with the ihtioplanctonic net of type Bongo (meshed of 500 micron) to highlight the shad larvae which move once with the water current towards sea. Adults *Alosa sp.* were measured with ihtiometer with precision of 1 mm, were weighed with electronic weigher with precision 1 g/ 5 kg and larvae of *Alosa sp.* were measured with the caliper with accuracy of 0.5 mm. From each exemplar measured were taken scales from the mediane area for to determine the age each individual with the binocular loupe magnification 10 X. Also, for each exemplar was determined the sex.

Also was done a interrogation (questionnaire with data of capturing) the licensed fishermen in the zones of main critical points, and at the same time were measured (with ihtiometer precision of 1 mm) and were weighed (with electronic weigher accurate to 1g) adults *Alosa sp*. From each exemplar measured were taken scales from the mediane area for to determine the age each individual with the binocular loupe magnification 10 X. Also, for each exemplar was determined the sex.

Samples of larvae were placed in containers with rubbing alcohol for to resist a long time and were transported in optimal conditions at Laboratory Ichthyology of INCDPM, subunit Tulcea, where they were evaluated with the naked eye and with binocular loupe magnification 10 X, and when was the case was used and the electron microscope with maximum magnification of up to 32 X. For the shad larvae was determined and the stage of development at which there is in the time of capturing. At the same time in the first expedition were made a few points of electric fishing in different zones, where was completed the list of fish species cauptured in the critical points.

Boats used

For fishing of shad, adults and larvae and for the electric fishing from shore has been used Marine boat of 15 HP.

Equipment

- fishing net of shad (meshed of 30 mm) for capturing the adults that are in migration
- ihtioplanctonic net of tip Bongo (meshed of 500 microni) for larvae
- ihtiometer with precision of 1 mm
- electronic weigher with precision of 1 g/5 kg
- caliper with precision of 0.5 mm
- binocular glass, 10 X magnification
- electronic microscope with maximum magnification up to 32 X.

b. Benthonic electric fishing

Because electric fishing method applied in the littoral zone of shallow is not suitable for study on the navigation channeles, the fishing at great depths can provide data of great importance. Therefore, in order to study the spread of the danubian fish species of community interest, have used together with our partners from the Institute VITUKI a new method, developed in Hungary, which brings the representative data on the fish fauna from the benthic habitats.

In setting the work protocol we tried to collect the representative data on the benthic fish fauna, characteristic of the studied zones to provide real data on the composition of fish fauna and to highlight any differences between the habitats examined.

In order to identify relationships between composition of fish fauna and habitats investigated parameters were passed in a bulletin abiotic data sampling and the sampling data (water depth, water temperature, weather data on the fishing method). How to use the electric trawl is shown in Figure 2.1.F.i.1 order to examine the fish fauna of the deep sea waters have combined the advantages of two fishing methods, namely electric and trawl fishing.

Figure 2.1.F.i.1 - Operating the electric trawl

Boats used

For benthic electric fishing was used the laboratory vessel of the Institute VITUKI from Hungary, with engine of 700 HP power.

Materials and equipment used

- electric trawl
- ihtiometer with precision of 1 mm
- electronic weigher with precision of 1 g/5 kg.

Monitoring of river habitats

Assessment of the habitats was done according to the technical specifications, for the three critical points main (CP 01, CP 02 and CP 10), by method of land for River Habitat Survey - RHS (Environment Agency UK, 1997) and was calculated the degree of connectivity of aquatic habitats. But this informations are not important for the fish species the sturgeons and barbel, but only for other fish species that use mainly shore areas.

Method description

River Habitat Survey (RHS) is a method designed to characterize and evaluate in general terms, the physical structure of rivers and streams. Fieldwork not require the specialists with expertise geomorphological or botany, but is necessary to recognize the vegetation types and an understanding of basic principles and geomorphological processes. RHS observations are made on a standard length of 500 m from the river. On this standard length are made detailed observations in ten points, equally spaced along the fairway, while information on the shape of valley and the use of the land along the river ensure more information.

RHS form has four pages and is accompanied by a separate form of two pages. Persons who make observations are obliged to record the presence / absence and in some cases the number or the extent of certain features. Four types of records are made:

- the counting certain items in the perimeter of 500 m (rapids, deep zones and quiet), presence / absence of vegetation and the anthropogenic changes);
- the form provides check boxes of certain characteristics to indicate whether a feature is absent, present or present in large areas;
- introducing of acronyms formated from two-letter for items characterized at the spot (for simplicity have been used english acronyms from the original version);
- realisation of measurements of the riverbed, such as quota, width and depth.

Also, to verify the forms, they can be accompanied by detailed photos of the area.

Based on these forms is calculated indices HMS and HQA.

The method has also been tested in other European countries such as Finland, France, Austria, Portugal, Italy and Slovenia, fact which has proven its viability and applicability.

2.1.F.i.3. Investigations conducted

Catches of other fish species, except sturgeons and barbel are detailed in the table below.

Table 2.1.F.i.3.1 - Centralizer on monitorinf of other fish species

Characteristics	Main critical points			Secondary critical points					Additional critical point	Total
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*	
Number of specimens	723	311	649	0	0	0	0	0	0	**1726**

* CP 09 - useful for numerical modeling

a. Shad fishing

Were conducted 12 throwing of fishing nets in both expeditions, with 1-3 blue bream at each throwing.

So only in the first expedition were analyzed 55 adult specimens of *Alosa immaculata* in all 3 Points Critical highlighting the presence of the specie in the areas of the critical points main (CP) CP 01, CP 02 and CP 10, both upstream and downstream of critical points, and in the channels /adjacent branches where will be performed the works for improving navigation.

Regarding the sampling with Bongo net (ihtioplanctonic net) for removal of the larvae and juvenile of the species *Alosa* (*Alosa immaculata* and *Alosa tanaica* not yet known the differences between them at juveniles) s were been performed 16 stations of 5 - 10 minutes each station in 11 sites (in 5 sites were carried out samplings in both the sampling period) being present 61 larvae of *Alosa sp.* in a volume of filtered water of 633 m^3 (Table 2.1.F.i.3.2).

Table 2.1.F.i.3.2 - Sampling points according to tchnical specification (first expedition)

Metode folosite	Puncte de prelevare probe					
	Punctul critic principal 01, zona braţului Bala şi pragul de nisip Caragheorghe		Punctul critic principal 02, zona insulei Epuraşu (Lebăda)		Punctul critic principal 10, braţul Caleia (ostrovul Lupu)	
	Braţ Bala	Dunăre, amonte de bifurcaţia aproape de Izvoarele	Braţul Epuraşu	Dunăre la km 333	Braţ Caleia	Dunărea Veche
Fileu ihtioplanctonic	x	x	x		x	x
Avă scrumbie în derivă	x			x	x	
Măsurători adulţi *Alosa sp.*	x km 4	x Satul Izvoarele		x	x	x Gropeni
Pescuit electric de mal	x Km 10 loc cu pietre, sălcii si rădăcini de sălcii în apă, iar malul cu aluviuni nisipoase; Km 5, plajă de nisip			x În apropiere de Oltina, pe canalul lateral, care este deja barat de un rând de pietre înspre amonte	x	x Malul drept al canalului lateral ce urmează a fi barat, în apropierea localităţii Gropeni; malul stâng al Dunării Vechi

Table 2.1.F.i.3.3 - Sampling points according to tchnical specification (second expedition)

Metode folosite	Puncte de prelevare probe								
	Punctul critic principal 01, zona braţului Bala şi pragul de nisip Caragheorghe			Punctul critic principal 02, zona insulei Epuraşu (Lebăda)			Punctul critic principal 10, braţul Caleia (ostrovul Lupu)		
	Braţ Bala	Dunăre, amonte de bifurcaţia aproape de Izvoarele	Dunăre, pe malul drept	Braţul Epuraşu	Dunăre la km 333	Dunăre, mal stâng	Braţ Caleia	Dunărea Veche	Dunăre, mal drept
Fileu ihtioplanctonic	x	x	x	x	x	x	x	x	x
Avă scrumbie în derivă	x			x	x	x	x	x	x

b. Benthonic electric fishing

On the occasion of the scientific fishing with the electric trawl occurred, on the Old Danube, the fishing in transects of 500 m each, in daytime, of which 7 in June 2011, at kilometer 344 and a transect at kilometer 345, and in July 3 transects between 347-348 kilometers.

Electric fishing of deep on the Bala branch, held on 10 transects of 500 m in length, daytime, 7 of which were caught in June 2011 at kilometer 344 and 3 in July 2011 between km 4-8.

Near the village Gropeni, between kilometers 197-198, in June were caught 572 specimens belonging to 21 species, in 8 transects of 500 m each.

Sections of sampling

Sampling sections of the campaigns are shown in Figures 2.1.F.i.3.1, 2.1.F.i.3.2, 2.1.F.i.3.3.

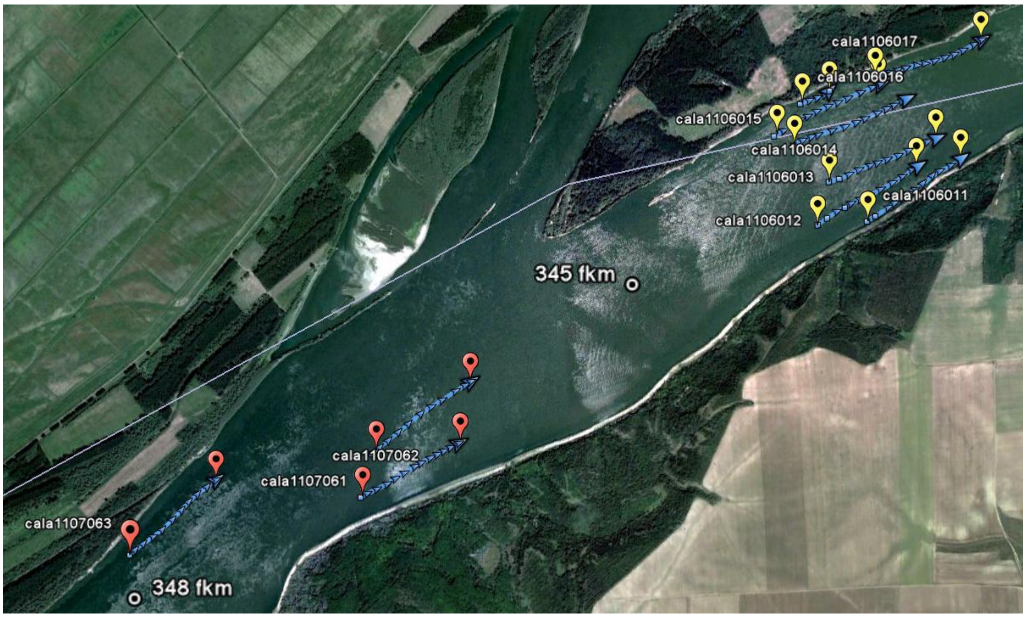


Figure 2.1.F.i.3.1 - Sections of sampling on the Danube near the town of Calarasi (yellow marking: 2011 June, red mark 2011 July)

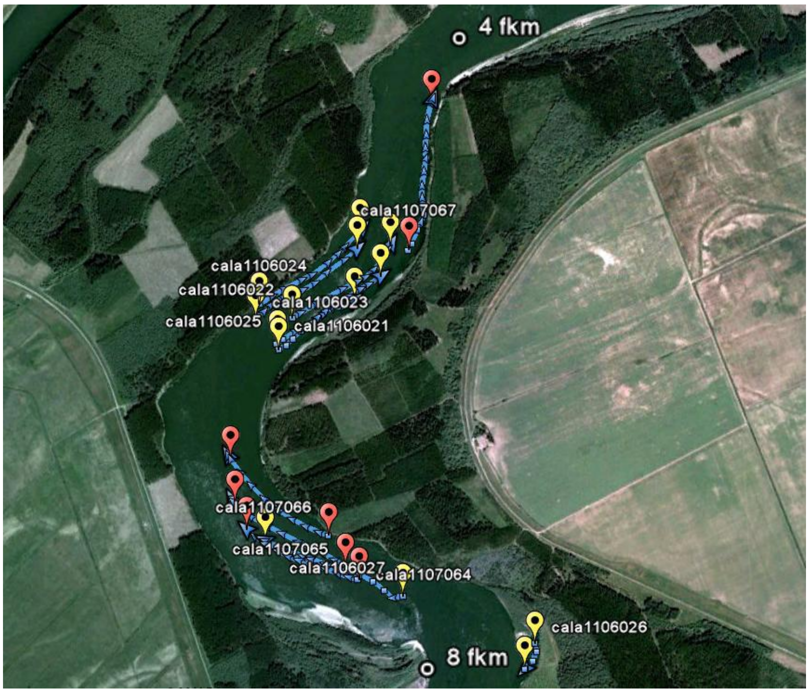


Figure 2.1.F.i.3.2 - Sections of sampling on the Bala branch (yellow marking: 2011 June, red mark 2011 July)

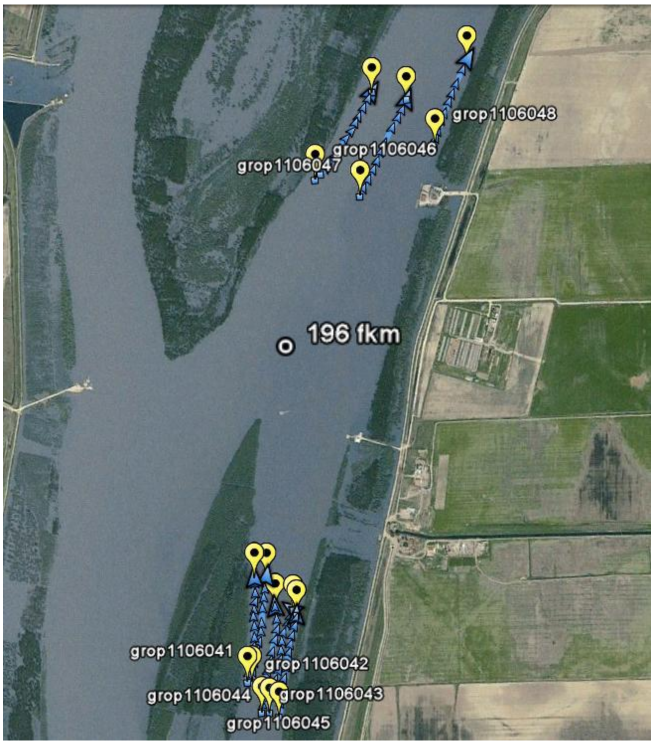


Figure 2.1.F.i.3.3 - Sections of sampling on the Danube near the locality Gropeni (yellow marking: 2011 June, red mark 2011 July)

2.1.G. Monitoring of terrestrial flora and fauna

2.1.G.1. Campaigns and monitoring periods

Monitoring of terrestrial flora and fauna was conducted in 4 expeditions representing 3 campaigns hroughout period of the preconstruction, the monitoring program being shown in Table2.1.G.1.1.

Table 2.1.G.1.1 - Centralizer on campaigns and periods of monitoring of terrestrial flora and fauna

Campaign/ Period	Main critical points			Secondary critical points					Additional critical point
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	CP 09*
Terrestrial flora									
Campaign 01/2011	16-17.05 27.06-01.07	27.06-01.07	27.06-01.07	04-08.07	04-08.07	04-08.07	04-08.07	04-08.07	-
Campaign 02/2011	-	26-30.05	26-30.05	-	-	-	-	-	-
Campaign 03/2011	-	-	-	06-14.06	06-14.06	06-14.06	06-14.06	06-14.06	-
Avifaună									
Campaign 01/2011	23-27.05	06-10.06	06-10.06	06-10.06	06-10.06	06-10.06	06-10.06	06-10.06	-

* CP 09 - useful for numerical modeling

2.1.G.2. Methodology and equipment

<u>Methods of terrestrial flora evaluation</u>

In zone the each of critical point, the habitats with forest and grassy vegetations were separate. In the forest habitats the covering of trees layer, of the shrubs and of grassy layer were estimated in surveys appropriate with the technical specifications. In habitats with grassy vegetation were recorded all species from the floristical surveys and was estimated abundance their. This method was used and when the temporarily flooded surfaces, almost lacking vegetation. Also, it was registered the allochthonous species abundance in the studied areas. Habitat types found were determined after Doniță et collaborators(2005), the plant species that have not been determined on the ground, were collected and subsequently determined after (2000) and *http://www.floraofromania.transsilvanica.net/documents_and_photographs_of_the_flora_of_ro mania.htm*.

Methods of avifauna evaluation

General diversity of aquatic avifauna on different segments of the Danube

Between 05-07.05.2011 held a campaign carried out by ship on the sector of Danube potentially affected by the project (between Brăila and Călărași). The total distance traveled on water was 348 km and included the Old Danube, the Borcea branch and 36 km from the Macin branch (inferior part).

During this campaign for recognition were periodically saved in GPS the reference points, for which it was noted each bird observed from deck. Thus it was obtained a database in which are featured the species and number of birds observed in each segment covered. Since the comments were made on the boat, were not noted certain groups of birds which avoid the open areas along the water. Thus in this database dominate waterfowl, and the birds from smaller size that are closely related to the terrestrial habitats and are active at night are practically absent (all passerines (*Passeriformes*), the owls (*Strigiformes*), the woodpeckers (*Piciformes*) etc.).

The obtained database represent the avifauna diversity (aquatic predominanat) on the respective segments. From this database it can appreciate / calculate the overall diversity of avifauna on the Danube, namely the species density on the segments associated the critical points. It should be noted that in the respective period, the spring migration was still ongoing, so a small fraction of the observed birds it do not reproduce in the area studied.

The densities of the bird species were calculated on the following segments:

- on all 348 km covered
- for critical points (each critic point separately)
- for Borcea branch
- for Măcin branch (the 36 km covered).

For each segment was calculated Shannon diversity index. This indicator is oftenly used in quantify ecological diversity:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i \qquad (2.1)$$

where: *H'* – Shannon diversity index
S – number of observed species
pi – the report of observed flock of species no. *i* to the total flock.

The densities of the observed birds (number of species and actual) on the calculated segments were compared using Mann-Whitney U test to find out if there are significant differences between different segments of the Danube. These tests were performed using the software STATISTICA 8.

Assessment of terrestrial avifauna

Assessment of terrestrial avifauna includes three methods presented below. These methods have been used mainly for the census of the brooding birds in terrestrial habitats on the islands and the shores of segments afferent the critical points. In Chapter 3.1.G will be presented a summary of the results fromthe different methods partially complementary.

The point count method

On Ostrov Turcescu and Small Ostrov were selected squares of 200 m, so that one side (2 points) was placed at the edge of the shore and the other side (2 points) in inside. Between points counting (PN) has kept a distance of 200 m. Whether the resort chosen fell into an area with vegetation very dense was elected nearest point at a distance as close to the standard of 200 m. The observations in all points of a square were performed the same day. The ornithologist specialist reached at the counting point quietly waited three minutes before begin recording the birds that was made for 10 minutes in one point. Observations began 15 minutes after sunrise and were stopped at about 4-5 hours after sunrise.

Apart from the species seen or heard has collected and information on the distance between the observer and the bird seen or heard. In the form of completition of data, the distance is given in several categories for to ease the estimates. By recording the distances it can estimate the birds density.

Data collected were: cloud cover, wind speed, the time of start and end of the observations. Birds flying over the area of observation without to land, were recorded separately. And the birds seen or heard while traveling between the observation points were recorded. However, in this case, the distances were not recorded and estimates of density were not made.

Records Night

An area larger than the square was used for these records. In the chosen zone, the sample points were chosen by using the orthophotomaps, their location has been saved in GPS. In every surface of sample were selected 3-5 sample points. Records began 30 minutes after sunset and were concluded at midnight. In bad weather conditions have not been made records.

How to use the CD to call the species was as follows:

- it has started with the smaller species after which has finished with those higher;
- the calling song was amplified with a megaphone so that song have 100-110 dB at 1 m in front of the expert which keep the speaker or the megaphone;
- before you start the calling of the birds were necessary three minutes of silence in which all songs were noted. Then each calling was launched 3 times with 30 seconds of silence between them. One of the two observers it has quietly moved up to a distance of 50 m for to increase the detectability. Both

observers have listened the calling thereof. After all callings have been completed, observers have listened the sounds of the birds for 5 minutes. Were used powerful flashlights with the focused spot.

Transect method (Evaluations on linear routes)

This method is used for the census of the passerines but is appropriate and for woodpeckers. It consists in covering some the linear routes early in the morning (between 5:00 and 10:00 AM) and the notation each songbirds and the distance its towards route (it were used the different categories of distances). The individuals seen were also registered. Thus, it determines the present species, the location and the number of their territories (of nesting pairs). With the data collected with this method, one can calculate the density/abundance of respective species and it can be made punctual estimations about the size of populations in the studied areas. In the case of small or narrow areas, this method permits a total census in respective area (the detection of every nesting pairs.

Evaluations were carried out on two transects in different habitats present in potentially affected areas. The transects were located in the main vegetation types, presented in Chapter 3.1.G. Because the detectability of the birds decreased with increasing of their distance to the observer, to correct this deviation of the datas, was used the software DISTANCE 6.0. This program was developed especially for evaluating data from censuses from the linear routes. Output of the calculations are densities estimated in areas where censuses were conducted.

For each habitat were calculated the densities of the different species of birds observed. With the aid of those densities and of the respective habitat areas (data from evaluation of flora and habitats) it can calculated the numbers of the species different in areas potentially affected.

The birds densities were calculated using partly the software for different habitats and for critical points overall. Calculation remembered later was accomplished due to high uniformity and low diversity of the habitats present in the various critical points.

From the birds species observed using this method were calculated also Shannon diversity index.

The method of direct evaluation of elevated observation points

This method is used to assess the bird populations of large waist, with glinding flight (raptors, storksetc.). These birds use columns of warm air to ascend, after which moving with glinding flight. Due to this typical behavior are easy to see and to identify from a significant distance. From their movement during breeding can draw conclusions about the number of the pairs, the territories and the lands to feed. Observers stay at height (on a high hill) from where have a good view on the investigated area. Because these birds can be seen and identified from great distances, is ideal if from the respective point we can see at a distance of 2-3 kilometers. Observers watching with binoculars and telescopes the birds with glinding flight, notes the species observed, the during observation and movement the birds on the map.

The observations are performed simultaneously on different heights so can see all the birds on respective land. On each point of observation it stay minimum 2.5 hours. The benefit of this method consisit in fact that result the accurate data about the absolute size of that population in the study area.

Using the method in the nesting season locates the nesting pairs of white-tailed eagle (*Haliaeetus albicilla*), black kite (*Milvus migrans*), harrier (*Circus sp.*) and black stork (*Ciconia nigra*) etc. Thus, also, aims the movement of the large aquatic birds (herons, cormorants, ducks) thus providing assistance in locating the colonies.

Mapping the colonies of sand martin (Riparia riparia), european bee-eater (Merops apiaster) and the territories of common kingfisher (Alcedo atthis)

The method is performed in the breeding season of the species concerned and consists in crossing with the boats of Danube sectors affected by the works. Ornithologists looking the nesting holes dug into the steep bank of the Danube and the islands. The location of the colonies found is saved in the GPS and is noted that the total number of holes, respectively of the specimens seen in area of the colony. By this method determines the location and size of nesting colonies of sand martin and european bee-eater, respectively locates the nesting pairs of common kingfisher.

Also, are noted the respective species or the colonies found during carrying out of other censuses.

Birds ringing method

The ringing will complement qualitative and quantitative assessments of the populations of the species of birds that cross autumn the studied sector of the Danube. This method will be used during autumn migration. The using this method is necessary, because the passerines not vocalize during the autumn and they spend short time in the same location, thus the detectability them with other methods presented so far is very low.

The ornithological nets are placed in vegetation areas, so as to be hidden. Preferably these will be located in several types of vegetation in order to catch and the birds with other habitat preferences. Direction the nets will be preferably to the east-west or perpendicular on the Danube. The nets will be checked hourly from 6AM until nightfall. Birds caught will be removed from nets, determined, measured, ringed and released.

With this method it will be possible to determine the species and numbers of passerines, that transiting those areas during autumn migration.

Method counting the aqvatic birds in winter

This method will be used to determine flocks of aquatic birds that wintering on the segments of Danube and thus potentially affected by the project. Ornithologists will travel on the Danube with the help of the car and will trailer the motor boat. They will conduct systematic observations from the shore using binoculars and telescopes and in areas where visibility by the shore is hampered, will use motor boat.

This method is suitable for assessing flocks of wintering birds in ripariene areas of Natura 2000 sites.

Mapping colonies of Ciconiiformes

Because the species colonies in the Order Ciconiiformes have a conservative value high and are indicators of the favorable conservation status of wetlands, we consider that particularly important is the identification and mapping of the colonies present in the sector of Danube between Calarasi and Braila and the assessment and monitoring them.

This method can be carried out in winter when the canopy of the trees is lacked of leaves. In these circumstances it becomes possible to detect the nests (colonies) of herons and cormorants. During period of nesting it will return in these locations and will determine the exact percentage of occupancy of the nests, respectively the species and the numbers of herons / cormorants that nesting in the colony in question. The best situation is when the colonies largest can be located with the help orthophotomaps, but can not rely only on the detectability from air of the colonies.

During the implementation of this method can search and white-tailed eagle, black stork and black kite in the territories of the identified with method of elevated observation points.

Evaluation methods of herpetofauna and amphibian

In assessing herpetofauna and amphibians was used method of linear routes: were covered linear routes (transects) in different habitats preferred by reptiles and/or amphibians present in the area potentially affected. On these routes the reptiles and the amphibians have been searching actively thoroughly in warmed places, hiding places, at the edge of wet habitats in all places where such animals may occur. The route has been saved in GPS so length of transect was known. SIt has calculated a band explored with a width of 2 m, so from the length of the path and width of 2 m, has been possible to calculate the surface inspected with the help of which has been appreciated the density of the species observed in respective habitats.

2.1.G.3. Investigations conducted

On basis the specific elements stipulated in the technical specifications for pre-construction phase, respectively to characterize the state of reference regarding the terrestrial flora and fauna, in Table 2.1.G.3.1 is presented a review of activities conducted in this regard and results obtained wih specyfing that an highlighter detailed is given in the Chapter 3.1.G.

Table 2.1.G.3.1 - Centralizer on monitoring of terrestrial flora and fauna

Objectives	Results
1. Identification and characterization of sites of Community importance in the project area	- ROSCI0006 „Balta Mică a Brăilei” - ROSCI0022 „Canaralele Dunării” - ROSCI0071 „Dumbrăveni - Valea Urluia - Lacul Vedroasa” - ROSCI0172 „Pădurea şi Valea Canaraua Fetii - Iortmac” - ROSCI0012 „Braţul Măcin” - *ROSCI0149 „Pădurea Eseschioi - Lacul Bugeac”*
2. Special Protection Areas in the project area	- ROSPA0005 „Balta Mică a Brăilei” - *ROSPA0007 „Balta Vederoasa”* - ROSPA0039 „Dunăre Ostroave” - ROSPA0012 „Braţul Borcea” - *ROSPA0053 „Lacul Bugeac”* - ROSPA0056 „Lacul Oltina” - ROSPA0054 „Lacul Dunăreni” - ROSPA0002 „Allah Bair - Capidava” - ROSPA0017 „Canaralele de la Hârşova” - ROSPA0040 „Dunărea Veche -Braţul Măcin”
3. Terrestrial flora	- Habitat types identified in the project area
4. Avifauna	- general diversity of aquatic avifauna in various segments of the Danube - densities calculated on segments at level of CPs - evaluation of terrestrial avifauna - herpetofauna, amphibian

2.1.H. Monitoring of Natura 2000 sites

Monitoring of flora ans habitats in protected areas Natura 2000

Evaluation of the flora and the habitats from Natura 2000 sites that overlap with different segments of the Danube was carried out simultaneously with assessing the critical points and bird censuses on the Danube (May-June 2011). The habitats and flora from Natura 2000 sites which are outside the zone of direct impact of the project (areas that do not contain segments of the Danube) were assessed after identifying of the biodiversity from the area directly affected (June-August 2011). The assessment was conducted by covering the shore areas in the case the respectiv lakes, or by covering certain routes in the case the terrestrial habitats in the vicinity of the lakes. S Were made species lists with ones characteristic, dominant or abundant, based on which were determined the habitats types after Doniţă and collaborators (2005). It is noted that given the extensive surface and number of protected natural sites in question, habitats listed are only part of ones the existing within those sites, those being preponderant characteristic habitats of the lakes with avifaunistic importance pronounced.

Sites of Community Importance (SCI)

ROSCI0006 „Balta Mică a Brăilei” - it include the critical point CP 10. In month May with using a ship have been covered both branchs of the Danube along their whole length and the observed birds were denoted.

ROSCI0022 „Canaralele Dunării” - it include the critical points CP 01 – CP 06 and area adjacent of CP 07. The methods used coincide with those presented in Chapter 2.1.G "Monitoring of terrestrial flora and fauna" and the results coincide with those presented in Chapter 3.1.G "Terrestrial flora and avifauna”.

Sites of Community Importance listed below were also analyzed in the pre-construction phase of the works. In the next phases of the project will be monitored only ROSCI0006 and ROSCI0022 sites.

ROSCI0071 „Dumbrăveni - Valea Urluia - Lacul Vederoasa” - it were made assessments of habitats, flora and avifauna in during displacement on land at Lake Vederoasa (August 2011) - were evaluated the lacustrine habitat types on the shore of the lake, and predominant terrestrial habitats in the immediate vicinity.

ROSCI0172 „Pădurea şi Valea Canaraua Fetii - Iortmac” - it were made assessments of habitats, flora and avifauna during displacement on land at the lakes Dunăreni, Iortmac and Oltina (August 2011).

ROSCI0012 „Braţul Măcin” - in month May with a boat were conducted observations of avifauna from Brăila up to Turcoaia. The results of these censuses are presented in chapter 3.1.G Terrestrial flora and avifauna.

ROSCI0149 „Pădurea Eseschioi - Lacul Bugeac” - were conducted evaluations of habitats, flora and avifauna during displacement on land at Lake Bugeac (August 2011) - was covered a portion of the shore and there were registered the habitats predominant from the lake shore, and also the habitats with herbaceous vegetation around the lake.

Methods of studying the amphibians in protected sites Natura 2000

The inventory activities of amphibian were carried out during the day (in some cases, were conducted and night investigations to obtain additional information on the species present in the investigated areas). The mapping methods of the amphibians were done using the usual methods in the field, for sampling in aquatic habitats of depth small and in the shore areas of the river being used „ciorpac”.

Determination of the species was carried out using the determination keys of the local specialized publications

The signalisation were passed on the digital support in Geographic Information System, with using ArcView software, being used to locate areas where have been identified the populations and specimens, both in coordinates G.P.S. of the sites investigated and georeferenced topographic maps, satellite images and orthophotomaps.

Methods of studying reptiles in protected sites Natura 2000

The investigations were conducted along transects represented by parallel strips with linear landscape elements (roads, waterfront, border of forest, etc.). Along the route followed were analyzed periodically the control surfaces of 250 m square located at regular intervals (at intervals of 30 m in the types of grassland habitats). The investigation a control surface has an average duration of five minutes needed to register the possible presence of specimens of reptiles, the number of assets exemplars, being considered and the additional information on habitat type, coverage of surface with vegetation, the plants species existing in survey, cloud cover, specificity the substrate, the presence of eventual predators etc.

The reptile species present in habitats from perimeter project implementation could be determined without the need for their immobilization. In order to carry out comparative studies of local populations from perimeter and elsewhere from other zones of the region, some exemplars present in of survey investigated were photographed.

Determination of the species was carried out using the determination keys from the local specialized publications.

The signalisation were passed on the digital support in Geographic Information System, with using ArcView software, for locating the areas where have been identified the specimens, being used both the coordinates G.P.S. of the sites investigated and georeferenced topographic maps, satellite images and orthophotomaps.

Methods of studying mammals in protected sites Natura 2000

The investigations were carried out along the transects perpendicular to the bank of the water. The length of transects has varied depending on topographical features local from a few tens of meters to several hundred meters, being covered the distance from the shore up to the base of the cliffs (on the right side of the Danube), respectively from the shore up to the levee of outline of Insula Mare Ialomiței. In the case of the islands, transects were covered off one shore to the other of those islands.

The mammal species present in habitats from the perimeter of project implementation have could be determined without the need for their immobilization. Also, were registered the traces of different species present in these habitats.

Determination of the species was carried out using the determination keys from the local specialized publications.

Avifauna monitoring from protected sites Natura 2000

Evaluations of the avifauna from the Natura 2000 sites that overlapping on different segments of the Danube were carried out simultaneously with assessing avifauna from critical points and with bird censuses off the Danube (May-June 2011). Evaluations of the avifauna from the Natura 2000 sites that overlapping on different segments of the Danube were carried out simultaneously with assessing avifauna from critical points and with bird censuses off the Danube (May-June 2011).

In the case of the areas that overlap with the direct impact zone of the project, the methods used in evaluation of avifauna coincide with those presented in the previous chapters. In the other sites were denoted all species and flocks observed during displacements on field. The birds were actively sought with using the binoculars and the telescopes especially in areas of agglomeration (eg lakes).

Special Protection Areas (SPA)

ROSPA0005 „Balta Mică a Brăilei" - it include the critical point CP 10. In month May with using a ship have been covered both branchs of the Danube along their whole length and all the observed aqvatic birds were denoted.

ROSPA0039 „Dunăre Ostroave" - it include the critical points CP 01 and area adjacent of CP 07. The methods used coincide with those presented in Chapter 2.1.G "Monitoring of terrestrial flora and fauna" and the results coincide with those presented in Chapter 3.1.G "Terrestrial flora and avifauna".

ROSPA0017 „Canaralele de la Hârşova" - in month May with using a ship have been performed observations of avifauna on the Danube along whole length the segment included in this protected area.

Sites of Avifaunistic Protection Areas listed below were also analyzed in the pre-construction phase of the works. In the next phases of the project will be monitored only ROSPA0005, ROSPA0039 and ROSCI0017 sites.

ROSPA0007 „Balta Vederoasa" - it were made assessments of habitats, flora and avifauna during displacement on land at the lake Vederoasa (August 2011).

ROSPA0012 „Braţul Borcea" - in month May with using a ship have been performed observations of avifauna on whole length of the Borcea branch. The results of these censuses are presented in chapter 3.1.G Terrestrial flora and avifauna".

ROSPA0053 „Lacul Bugeac" - it were made assessments of habitats, flora and avifauna during displacement on land at the lake Bugeac (August 2011).

ROSPA0056 „Lacul Oltina" - it were made assessments of habitats, flora and avifauna during displacement on land at the lake Oltina (August 2011).

ROSPA0054 „Lacul Dunăreni" - it were made assessments of habitats, flora and avifauna during displacement on land at the lake Dunăreni (August 2011).

ROSPA0002 „Allah Bair - Capidava"- in month May with using the ship have been performed observations of avifauna on Danube along whole length the segment included in this protected area.

ROSPA0040 „Dunărea Veche -Braţul Măcin" - in month May with using the ship have been performed observations of avifauna on Old Danube and the Măcin branch (between Brăila and Turcoaia). The results of these censuses are presented in chapter 3.1.G Terrestrial flora and avifauna".

2.1.I. Construction site monitoring

For critical points CP 01, CP 02 and CP 10 were made monthly displacements to the sites concerned pursuing the organizing stage and the conducting of the site works for the activities planned to be started after 15 August 2011. Also, it was performed a visitation of thepotential CPs for phase after 2017.

In period April and August 2011 the activities developed by the constructor were limited to organizing of site from CP 01 zone. The organization of site is located at km 346 on the right bank of the Danube, in the zone of the Critical Point 01 - Izvoarele.

Were followed the mode of the collection, storage and disposal of wastes, storage of construction materials and petroleum products, air quality and determining the level of noise, evolution the number of personnel found out at the site organization, collection and disposal of waste waters, situation the fleet of construction equipment, the state of the constructions on emplacement and the utilities. This action was achieved through onsite observations, video recordings and performing of photographs, discussions with existing staff.

In order the ecological restoration, blank samples were taken from soil, air and was determined level of noise.

During monitoring duringthe preconstruction period, the Contractor it has not owned the plan for prevention and control of accidental pollution, the execution plan and Gantt chart with scheduling the construction work, these being needed to correlate more efficiently the activity of monitoring. Also in talks with locals were identified two scow belonging to the constructor, one seated on the right bank and another moored at about 700 m upstream of the site organization, on the right bank of the Danube, at the trestle.

No plan to date we have not been sent, although they were required from the constructor and AFDJ.

Regarding the CP 10 - Caleia branch (Ostrovu Lupu 2) km 197-195 the site organization it is in conservation, with no activity and ungurded.

2.2. Numerical modeling

The objectives of the preconstruction phase in terms of numerical modeling have been fully achieved, namely:

- analysis the volume of the information existing initial with respect to the 3D modeling of the Danube on the interest sector of the project
- realization the campaign of bathymetric measurements trought the two complementary techniques - 2D (single-beam) and 3D (multibeam)
- realization of the periodic hydrometric measurements, at different levels of the Danube, regarding the water flow and water speed, throught measurements using 3D ADCP technique (Acoustic Doppler Current Profiler) in cross sections, having the resolution of 300-500 m, all along the sector of Danube monitored and respectively 50-100 m in the alignments afferent of the critical points
- downloading data - required 3D modeling - from the historical databases, the critical analysis and there processing, delivery of the data to the partners in the consortium in the formats required to implement 3D modeling programs
- the preliminary analysis and the construction of the discretization network for a sector of about 12 km located in the zone of CP 01. Networks of finite elements were generated with using the module corresponding of the software of hydrodynamic modeling 3D-DELFT3D - and were analyzed the characteristics of compliance of discre3tization networks with topology of the banks in the studied area. Over the network of finite elements optimized were superimposed informations bathymetric obtained following campaigns of measurements from single-beam and multi-beam.

3. RESULTS OF ABIOTIC AND BIOTIC PARAMETERS MONITORING. REFERENCE DATABASE

3.1. Preconstruction results and observations on each activity/critical point

Specific activities related to monitoring objectives provided for preconstruction phase are based on two categories of information:

(i) historical information (where applicable) for monitoring areas provided at this stage in the project

(ii) data and information obtained as a result of activities performed during the period April to August 2011.

Both categories of information have been reported to the existing quality standards in Romania (air, noise, soil and water quality from point of view hydrochemical and hydrobiological). For monitoring specific objectives (hydromorphology, ichthyology, terrestrial flora and fauna) the elements of reference status have been identified and characterized.

Because the preconstruction period is limited to four months, processing and interpretation of statistical data (can not apply the criterion of annual averages, etc.) were dependent on: (i) corroboration with historical data (where applicable) and (ii) the specificities result of an interpretation of a limited data set in terms of time.

Therefore, it is mentioned that the assessments of "ecological status", "chemical status" at the level of CPs, show a picture for April-August 2011 period. Dependencies on hydrological conditions have been assessed by interpolation of preconstruction data with the historical data.

Beside the specifications above, the results achieved for the pre-construction phase (reference status) are synthetically presented in the following. The results are reported to each specific activity of monitoring/critical point.

3.1.A. Air quality monitoring

Given the specific issue of air pollution characterization, two basic issues were essentially followed, starting from Technical spcifications:

(i) identification and evaluation of emissions from Critical Points (external sources) neighboring areas that may influence the evaluation of the reference state

(ii) characterization of the pollution degree with nitrogen oxides, carbon monoxide, suspended particles, carbon monoxide and oxides of lead, at level of CPs.

In order to identify the investigation area particularities, an overall analysis of the neighboring areas that may influence the measurements and identification of external sources, has been carried out in a first stage in Critical Points.

The analysis of pollutant concentrations level should take into account the type of monitoring points, based on their position towards the pollution sources and the monitored area character.

For this purpose, an inventory of the main sources of air pollution has been achieved for each critical point by types of sources:

- point sources (chimneys)
- line sources (roads)
- area sources (localities).

<u>Excepting the critical points CP 01 and CP 02</u>, for all other critical points the point sources are found at least 30 Km distances, <u>having not a major impact on air quality in the monitored critical points</u>.

For the two critical points - CP 01 and CP 02 – the point sources for pollutants to be monitored (NO_x, TSP, CO and Pb) are shows in graphs and tables.

Nr. Crt.	Poluant	Nume_Intreprindere	Nume_Cos	Judet	Distanta (km)	Orientare	Emisie (t/an)
1	NO_x	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	11.7
2	NO_x	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	23.5
3	NO_x	SC COMCEH SA	Cos evacuare masina Hartie	Calarasi	15.9	VEST	16.3
4	NO_x	SC SAINT GOBAIN GLASS SRL Calarasi	cos evacuare cuptor sticla	Calarasi	19.0	VEST	673.3
1	TSP	SP Pavaje Spatii Verzi Calarasi	Cos instalatie mixturi asfaltice	Calarasi	19.9	SUD-VEST	108.9
2	TSP	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	20.3
3	TSP	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	40.6
4	TSP	SC DRUMURI SI PODURI SA	Cos instalatie mixturi	Calarasi	17.7	VEST	182.4
1	CO	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	584.3
2	CO	SC ROMPLY SRL	Cos centrala termica	Calarasi	17.4	VEST	1168.6
3	CO	SC SAINT GOBAIN GLASS SRL Calarasi	cos evacuare cuptor sticla	Calarasi	19.0	VEST	27.0
0	Pb	nu exista					

The tables below show the following information regarding the linear pollution sources (roads) situated in the proximity of critical points: name, type of road, direction to CP, distance to CP.

Table 3.1.A.1 - Main linear pollution sources

	Critical point	Road name	Road type	Direction to CP	Distance to CP (km)
Main critical points	CP 01	DN 3B	national	north	5.7
	CP 01	DN 3	national	south	8.1
	CP 02	DN 3B	national	north	6.4
	CP 10	DN 21	national	west	6.6
Secondary critical points	CP 07	A 2	highway	south	6.1
	CP 07	DN 22C	national	south	6.2
	CP 09	DN 2A	national	south	0.8
	CP 09	E 60 /DN 3B	european/national	south	7.3

Table 3.1.A.2 - Total linear pollution sources (+ county roads)

	Critical point	Road name	Road type	Direction to CP	Distance to CP (km)
Main critical points	CP 01	DN 3B	national	north	5.7
	CP 01	DN 3	national	south	8.1
	CP 01	DJ 391A	county	south-east	8.4
	CP 02	DN 3B	national	north	6.4
	CP 02	DJ 391A	county	south-east	5.6
	CP 10	DJ 212	county	west	0.8
	CP 10	DJ 255A	county	west	1.3
	CP 10	DN 21	national	west	6.6
Secondary critical points	CP 03	DJ 223	county	east	8
	CP 04	DJ 223	county	east	7.4
	CP 07	A 2	highway	south	6.1
	CP 07	DN 22C	national	south	6.2
	CP 07	DJ 222	county	east	0.7
	CP 07*	DJ 223	county	east	0.6
Additional critical point	CP 09**	DN 2A	national	south	0.8
	CP 09**	E 60 /DN 3B	european/national	south	7.3

CP 07 - adjacent area CP 07

** CP 09 - useful for numerical modeling

An inventory of area sources (localities) situated in the proximity of critical points has been achieved; for each critical point the following information are shown in table below:

- locality name
- county
- km on the Danube located in the concerned locality
- distance from locality to Danube bank
- number of inhabitants
- direction from locality to PC (critical point)
- river bank on which the locality is situated
- access from locality to critical point
- the approximate distance between locality and critical point
- fuels used for heating and cooking.

Table 3.1.A.3 - Area sources situated in the proximity of CP 01

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP01	Izvoarele	Constanţa	348,3 - 349	bank - 300	162	wood, coals	south-west	right	direct	2,7
CP01	Satu Nou	Constanţa			276	wood, coals	south-east	right	direct	4,0
CP01	Dichiseni	Constanţa			490	wood, GPL	north-west	left	detour	5,7
CP01	Satnoeni	Călăraşi			507	wood, GPL	north	left	detour	5,7
CP01	Oltina	Călăraşi			517	wood, GPL	north	left	detour	6,7
CP01	Canlia	Constanţa	352,6 - 353,3	1900	703	wood, coals	south-west	right	direct	6,9
CP01	Coslugea	Constanţa			843	wood, coals	south	right	direct	7,1
CP01	Coslogeni	Călăraşi			866	wood, GPL	north-west	left	detour	7,2
CP01	Oltina	Constanţa	336,5 - 337,5	900 - 150 from Epurasu island	2098	wood, coals	east	right	direct	8,6
CP01	Strunga	Constanţa			20	wood, coals	south-east	right	direct	8,9
CP01	Unirea	Călăraşi			1179	wood, GPL	north	left	detour	8,9
CP01	Roseti	Călăraşi			5921	wood, GPL	north-west	left	detour	9,9

Table 3.1.A.4 - Area sources situated in the proximity of CP 02

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP02	Satu Nou	Constanţa			276	wood, coals	south	right	direct	4,1
CP02	Oltina	Constanţa	336,5 - 337,5	900 - 150 from Epurasu island	2098	wood, coals	south-east	right	direct	5,4
CP02	Oltina	Călăraşi			517	wood, GPL	north-west	left	detour	6,4
CP02	Satnoeni	Călăraşi			507	wood, GPL	north-west	left	detour	6,5
CP02	Izvoarele	Constanţa	348,3 - 349	bank - 300	162	wood, coals	south-west	right	direct	6,9
CP02	Unirea	Călăraşi			1179	wood, GPL	north	left	detour	7,0
CP02	Dichiseni	Călăraşi			490	wood, GPL	north-west	left	detour	7,2
CP02	Strunga	Constanţa			20	wood, coals	south-east	right	direct	8,4
CP02	Coslugea	Constanţa			843	wood, coals	south-west	right	direct	9,2
CP02	Iezeru	Călăraşi			1044	wood, coals	north	left	detour	9,6
CP02	Coslogeni	Călăraşi			866	wood, GPL	north-west	left	detour	9,9

Table 3.1.A.5 - Area sources situated in the proximity of CP 10

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP10	Gropeni	Brăila	195 - 196	800 - 1000	3604	wood, GN, CLU	west	left	direct	2,1
CP10	Tichilesti	Brăila	187 - 190	2200 - 3000	3993	wood, GN, CLU	north	left	direct	5,3
CP10	Valea Canepii	Brăila			1408	wood, CLU	south-west	left	direct	7,6
CP10	Unirea	Brăila			1179	wood, CLU	north-west	left	direct	9,5
CP10	Albina	Brăila			327	wood, GN, CLU	north	left	direct	9,8

Table 3.1.A.6 - Area sources situated in the proximity of CP 03A - CP 03B

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP03	Dunareni	Constanţa	328 - 329	900	1575	wood, coals	east	right	direct	3,5
CP03	Viile	Constanţa			1077	wood, coals	south	right	direct	5,1
CP03	Oltina	Constanţa	336,5 - 337,5	900 - 150 from Epurasu island	2098	wood, coals	south-west	right	direct	7,3
CP03	Aliman	Constanţa			783	wood, coals	south-east	right	direct	9,1
CP03	Vlahii	Constanţa			572	wood, coals	east	right	direct	9,6
CP03	Floriile	Constanţa			153	wood, coals	south-east	right	direct	9,9

Table 3.1.A.7 - Area sources situated in the proximity of CP 04A - CP 04B

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP04	Dunareni	Constanţa	328 - 329	900	1575	wood, coals	south-east	right	direct	2,7
CP04	Viile	Constanţa			1077	wood, coals	south	right	direct	6,4
CP04	Aliman	Constanţa			783	wood, coals	south-east	right	direct	8,3
CP04	Vlahii	Constanţa			572	wood, coals	east	right	direct	8,5
CP04	Oltina	Constanţa	336,5 - 337,5	900 - 150 from Epurasu island	2098	wood, coals	south-west	right	direct	9,1

Table 3.1.A.8 - Area sources situated in the proximity of CP 07

Critical point	Locality	County	km on the Danube	Distance from locality to river bank (m)	Population	Fuels	Direction	River bank	Access to PC	Distance to PC (km)
CP07	Seimeni	Constanţa	292 - 293	100	555	wood, coals	east	right	direct	1,4
CP07	Silistea	Constanţa			676	wood, coals	east	right	direct	2,3
CP07	Seimenii Mici	Constanţa	294 - 295	1600	908	wood, coals	south-east	right	direct	5,3
CP07	Dunărea	Constanţa	286 - 287	100	787	wood, coals	north-east	right	direct	7,7
CP07	Cernavoda	Constanţa	298 - 300	50 - 1300	18915	wood, coals	south-west	right	direct	9,9
CP07	Stefan cel Mare	Constanţa			573	wood, coals	south	right	direct	10,0

All data and information outlined above are used as groundwork for interpreting the reference status (air quality) and the subsequent ones.

Related to air pollution characterization at level of CPs, primary statistical values (minimum, maximum, average) are shown in tables 3.1.A.9 - 3.1.A.14. for monitored indicators according to Technical specifications.

Table 3.1.A.9 - Concentration values of nitrogen oxides (μg/m^3)

	Critical point	Minimum value	Average value	Maximum value
Main critical points	CP 01	1,88	3,916	8,13
	CP 02	3,24	6,197	9,23
	CP 10	3,3	4,852	9,92
Secondary critical points	CP 03A	3,07	4,324	6,05
	CP 03B	3,42	4,523	5,68
	CP 04A	3,21	4,7	6,39
	CP 04B	3,21	4,758	7,17
	CP 07	1,96	5,065	10,97
Additional critical point	CP 09*	3,84	5,527	8,06

* CP 09 - useful for numerical modeling

Table 3.1.A.10 - Concentration values of carbon monoxide (mg/m^3)

	Critical point	Minimum value	Average value	Maximum value
Main critical points	CP 01	0,19	0,2446	0,3
	CP 02	0,24	0,2568	0,29
	CP 10	0,21	0,2642	0,35
Secondary critical points	CP 03A	0,21	0,2595	0,31
	CP 03B	0,23	0,286	0,35
	CP 04A	0,23	0,2715	0,32
	CP 04B	0,21	0,285	0,34
	CP 07	0,2	0,2566	0,31
Additional critical point	CP 09*	0,25	0,3075	0,36

* CP 09 - useful for numerical modeling

Table 3.1.A.11 - Concentration values of suspended particulate matter (mg/m^3)

	Critical point	Minimum value	Average value	Maximum value
Main critical points	CP 01	<0,012	0,02	0,2
	CP 02	<0,012	0,0173	0,125
	CP 10	<0,012	0,017	0,072
Secondary critical points	CP 03A	<0,012	<0,012	<0,012
	CP 03B	<0,012	0,01315	0,023
	CP 04A	<0,012	0,0139	0,026
	CP 04B	<0,012	0,013	0,026
	CP 07	<0,012	0,01756	0,068
Additional critical point	CP 09*	<0,012	<0,012	<0,012

* CP 09 - useful for numerical modeling

Table 3.1.A.12 - Concentration values of lead oxides (ng/m^3)

	Critical point	Minimum value	Average value	Maximum value
Main critical points	CP 01	<2,1	<2,1	<2,1
	CP 02	<2,1	<2,1	<2,1
	CP 10	<2,1	<2,1	<2,1
Secondary critical points	CP 03A	<2,1	<2,1	<2,1
	CP 03B	<2,1	<2,1	<2,1
	CP 04A	<2,1	<2,1	<2,1
	CP 04B	<2,1	<2,1	<2,1
	CP 07	<2,1	<2,1	<2,1
Additional critical point	CP 09*	<2,1	<2,1	<2,1

* CP 09 - useful for numerical modeling

Table 3.1.A.13 - Concentration values of carbon dioxide (% vol)

	Critical point	Minimum value	Average value	Maximum value
Main critical points	CP 01	0,04	0,04	0,04
	CP 02	0,04	0,04	0,04
	CP 10	0,04	0,04	0,04
Secondary critical points	CP 03A	0,04	0,04	0,04
	CP 03B	0,04	0,04	0,04
	CP 04A	0,04	0,04	0,04
	CP 04B	0,04	0,04	0,04
	CP 07	0,04	0,04	0,04
Additional critical point	CP 09*	0,04	0,04	0,04

* CP 09 - useful for numerical modeling

Average, maximum and minimum values for all monitored critical points and for each investigated pollutant are shown in Table 3.1.A.14.

Table 3.1.A.14 - Average, maximum and minimum values of all of critical points

Pollutant	Minimum value	Average value	Maximum value
nitrogen oxides (μg/m^3)	1,88	4,886	10,97
carbon monoxide (mg/m^3)	0,19	0,265	0,36
particulate matter (mg/m^3)	<0,012	0,016	0,2
lead oxides (ng/m^3)	<2,1	<2,1	<2,1
carbon dioxide (% vol)	0,04	0,04	0,04

For a reporting at international standards, the tables 3.1.A.15 - 3.1.A.20 briefly presents the limit values of pollutants (nitrogen oxides, carbon monoxide, particulate matter, lead oxides and carbon dioxide), the critical level for vegetation protection, the alert threshold, the lower assessment threshold and upper assessment threshold, stipulated by legislation.

Table 3.1.A.15 - Limit values of pollutants concentration under the Law 104/2011 and STAS 12574 - 87

Pollutant	Law 104/2011			STAS 12574 - 87
	Averaging period			Averaging period
	one hour	daily maximum eight-hour average	year	30 min
Nitrogen oxides	200 µg/m³	-	40 µg/m³	-
Carbon monoxide	-	10 mg/m³	-	-
Suspended particulate matter	-	-	-	0,5 mg/m³
Lead	-	-	0,5 µg/m³	-
Carbon dioxide	-	-	-	-

Table 3.1.A.16 - Critical level for vegetation protection

Pollutant	Averaging period	Critical level	Tolerance margin
Nitrogen oxides	calendar year	30 µg/m³	No

Table 3.1.A.17 - Alert threshold for vegetation protection

Pollutant	Alert threshold
Nitrogen dioxide Dioxid de azot	400 µg/m³

Exceedance of the threshold must be recorded for three consecutive hours, in representative points for air quality for an area of 100 km² or a zone or agglomeration, whichever is smaller.

Table 3.1.A.18 - Upper and lower assessment threshold for nitrogen oxides

	Hourly limit value for the protection of human health	Annual limit value for the protection of human health	Annual critical level for vegetation and natural ecosystems protection
Upper assessment threshold	70 % of limit value (140 µg/m³, not to be exceeded more than 18 times in a calendar year)	80 % of limit value (32 µg/m³)	80 % of critical level (24 µg/m³)
Lower assessment threshold	50 % of limit value (100 µg/m³, not to be exceeded more than 18 times in a calendar year)	65 % of critical level (26 µg/m³)	65 % of critical level (19,5 µg/m³)

Table 3.1.A.19 - Upper and lower assessment threshold for carbon monoxide

	Eight-hour Average
Upper assessment threshold	70 % of limit value (7 mg/m³)
Lower assessment threshold	50 % of limit value (5 mg/m³)

Table 3.1.A.20 - Upper and lower assessment threshold for lead

	Annual average
Upper assessment threshold	70 % of limit value (0,35 µg/m³)
Lower assessment threshold	50 % of limit value (0,25 µg/m³)

From the monitoring data acquired during the period April to June 2011 and their reporting follows that, in terms of air quality, for the nitrogen oxides, carbon monoxide, particulate matter, lead oxides, and carbon dioxide carbon, measured concentrations do not exceed the limits imposed by law.

Annex 5.1 shows the spatial distributions maps for major pollutants concentrations in critical points where monitoring was performed.

3.1.B. Noise monitoring

Data analysis from Table 2.1.B.3.1 reveals that a number of 522 measurements performed during the preconstruction period (representing over 75 % of the total of 689) was allocated to the three main critical points - CP 01, CP 02 and CP 10.

Approximately 10% of measurements have been performed while a barge pass on the Danube River in the proximity of the location where monitoring noise was performed (distances between the barge and the location of the noise monitoring was from a few hundred meters and a maximum of 3 km - being visual approximated by field operator).

The field operators have noted in field forms for noise measurement, observations regarding the naval traffic - presence/absence of barge in proximity of monitored location, the approximate distance and the travel direction under the presence of a barge.

Observations regarding the naval traffic

Barge	**Yes**	**No**
Distance (m)		
Travel direction	**Downstream**	**Upstream**

In some situations, it was necessary that the field operators to wait a few hours the emergence of a barge to perform no more than 2-3 measurements to the barge crossing, considering the time assigned to the proper measurement and the displacement to the next measurement location.

In the 4 campaigns, monitoring sites have covered an area in close proximity of working points - up to at least 100 m towards them; measurements in grid and in parallel and perpendicular alignment on the river banks were performed.

Monitoring locations of the 4 campaigns have been raised with GPS, and transcalculate in STEREO 70 projection.

Subsequently, the measurements have been processed globally, regardless of the campaign where these have been achieved.

The field operators have noted in field forms for noise measurement, observations on weather conditions - wind intensity and precipitations - necessary for statistical processing of noise intensity.

Weather conditions

Wind	Strong	Moderate	Light	Calm
Precipitations	**Absent**	**Rain**	**Snow**	

In the 14 days of noise measurements in critical points, precipitations have been absent and wind intensity was from light to moderate and rarely strong.

The field operators have noted in field forms for noise measurements of the natural background noise sources.

Natural background noise

Source	Waves	Foliage	Frogs	Birds

Regarding these natural sources, following observations which are useful in statistical processing and interpretation of results noise measurements, can be made:

- The period in which the noise intensity measurements have been performed – mid May – late July - is the period when the trees are in leaf, and if the wind is moderate to stong, the noise from foliage had high share in recorded background noise for all monitored critical points.
- Also, during this spring-summer period, the presence of a large number of birds in the area made the chirping noise have a high intensity.
- In some locations – Epurasu island and CP 10 Gropeni, on the right river bank, in the vicinity of pier - an intense noise produced by the frogs that were in puddles left by water withdrawal has been noted.
- In locations situated near the river bank, waves noise had a high intensity in many situations due to the moderate to strong wind.

The overlap of these naturally noise sources led to a relatively high intensity of natural background noise, which in some cases has covered the noise of passing barge in the neighborhood.

Thus, a simple statistical processing of measurements performed under traffic "0" conditions has been made compared to the ones which correspond to passage of a barge the results being synthesized in Table3.1.B.1.

Table 3.1.B.1 - Noise measurements - statistical processing

	LZeq (dB)		
Traffic conditions	**Average**	**Maximum**	**Minimum**
Naval traffic "0"	42,3	59,3	24,7
Naval traffic	41,8	60,3	25,1

It can be observed that the average, minimum and maximum values are very similar; L_{zeq} average value is even lower in naval traffic conditions, due to slightly different conditions during those moments regarding natural background noise.

Highlighting of contribution of each naturally background noise sources category could be achieved using frequency spectrum analysis and filtering specific sources of noise intensity records in specific bands, but this goes beyond the object of this study.

We specify that there are no noise normatives/standards to protect terrestrial habitat, either in Romania or in the European Union.

A statistical processing at the level of monitored critical points was achieved. Noise intensity histograms Lmax (dB) and Lzeq (dB) are shown in Figures 3.1.B.1 and 3.1.B.2.

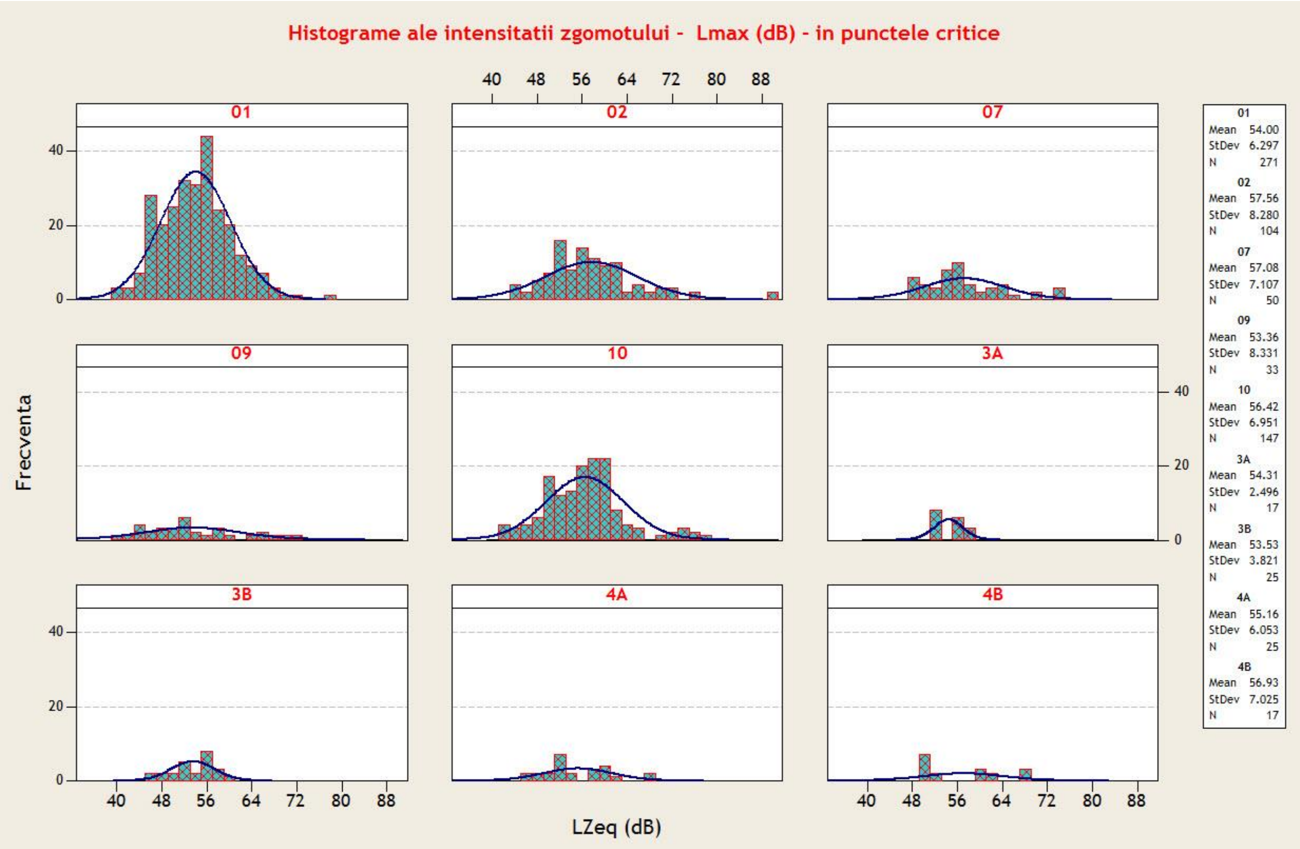


Figure 3.1.B.1 - Lmax (dB) noise intensity histograms

Following remarks can be made analyzing histograms of Figure 3.1.B1:

- Lmax noise intensity distributions can be well modeled by normal curves;
- dispersion (standard deviation from average) is high enough - except CP 3A and CP 3B, which leads to higher coefficients of variation. This is due to extremely high variability of natural background sources of noise during measurements;
- L_{max} average values for critical points are quite close; minimum value of 53.2 dB corresponds to the critical point CP 3B, the maximum value of 57.6 dB corresponds to the critical point CP 02.

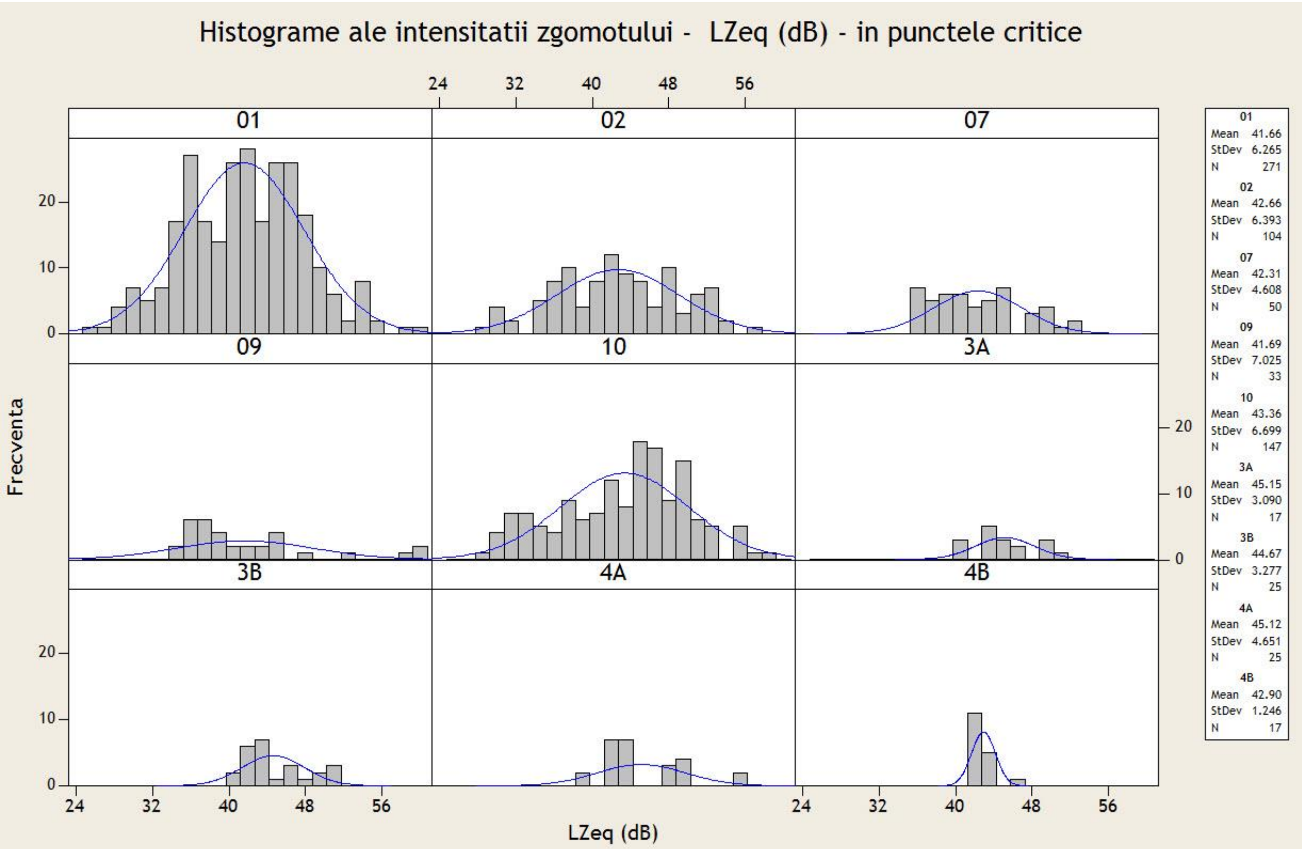


Figure 3.1.B.2 - Lzeq (dB) noise intensity histograms

Following similar remarks can be made analyzing histograms of Figure 3.1.B.2:

- all noise intensity distributions can be well modeled by normal curves;
- dispersion (standard deviation from average) is high enough – except CP 4A, CP 3A and CP 3B, which leads to higher coefficients of variation. This is due to extremely high variability of natural background sources of noise during measurements;
- L_{zeq} average values for critical points are quite close; minimum value of 41,7 dB corresponds to the critical point CP 01, maximum value of 45,2 dB corresponds to the critical point CP 3A.

Annex 5.2 shows - grouped on critical points – the spatial distributions of intensity noise classes - Lzeq (dB). In these graphs the noise monitoring locations are also highlighted.

As a general conclusion of these measurements during the preconstruction period we can affirm that the maximum intensity of naturally background noise overlapped with traffic noise – intensity expressed by indicat L_{zeq} (dB) – has not exceeded any critical value of **60 dB.**

Consequently we consider that L_{zeq} maximum intensity has a value of up to **50 dB** in zero traffic conditions, overlaid with background noise average (without the presence of birds in proximity); in conditions of high background noise, the value does not exceed **60 dB**, regardless of traffic conditions (comparable to the density of traffic from monitored period).

The above conclusions are valid for the monitoring period corresponding to the spring and entire summer end.

3.1.C. Soil monitoring

According to the Technical specifications, in the preconstruction phase, the quality soil monitoring envisaged the reference levels establishment for each Critical Point for the following indicators:

- presence/ absence of the lumbricides;
- mineral salts (Order 756/1997);
- humic acids;
- organic matter
- physical and mechanical characteristics.

Lumbricides (earthworms) are considered indicators of soil quality because they have an essential effect on the processes that take place in the soil, the lumbricides increase the level of soil aeration, decrease the soil density and increase the ability to decay the organic matter and availability of the nutrients in the soil. It is known that, lumbricides have an important role in the water transport process and of the decayed substances from the soil. Their galleries represent flow ways and have effect on the water permeate through the soil, the trickling on the surface and the soil capacity to retain the water (Ernst et al, 2009).

The soil temperature and humidity are ones of the most important parameters which determine lumbricides activity. If the soil temperature is low, the lumbricides activity will be restricted, beginning the hibernation. Neither the high temperatures does not facilitate their activity, making them to go into diapause (period of slowing down of vital functions). The optimum temperatures of the soil for the lumbricides which lives in european temperate areas are 10^0C and 20^0C.

Lumbricides generally live in wet soils. The low humidity from the droughty periods leads them to go into hibernation or diapause. Also, lumbricides does not survive in water saturated soil due to lack of oxygen.

It exist a few information about the presence of lumbricides in riparian zones. Theoretically, these areas are preferred because they are wetlands, especially riparian forests or grassy areas. However depends on the soil characteristics from these areas: if the soil structure is dens (loam) or if the soil is sandy, humus-depleted, the lumbricides are very sparse. In other words, the lumbricides are more in soil with organic matters and are less in disturbing soils (i.e. disturbed by the agriculture works or the presence of dangerous substances).

The determination of the presence or absence, as well the relative abundance of the lumbricides in the soil, offers indicators on the soil health. If the number of lumbricides is bigger in the soil, then this will be much fertile.

The presence or absence of the lumbricides in the soil during the preconstruction period was determinate by:

- the observation of their presence at the soil surface, in the areas where was sampled the soil for the quantitative analysis
- manual sampling
    - in each sampling point was made a grid with 1 m x 1 m which was divided in grid lines of 10 cm x 10 cm
    - holes of 15-20 cm were digged and in the removed soil, were counted the lumbricides; the established number of lumbricides was noted.

The mean density was calculated through the quantification of the lumbricides presence in the soil from the critical points investigated. The lumbricides density represents their number on the unit of surface (sp/m^2).

The observations "in situ" regarding the ***presence/absence of lumbricides*** for each Critical Point on the right and left river bank and in the island/islet, in those two campaigns, are presented in Table 3.1.C.1.

Table 3.1.C.1 - Lumbricides

	Critical point	Investigated area	Mean density Lumbricides (specimens/m^2)
Main critical points	CP 01	Right Bank	283
		Left Bank	200
		Turcescu Island	245
	CP 02	Right Bank	283
		Left Bank	245
		Epuraşu Island	245
	CP 10	Right Bank	224
		Left Bank	200
Secondary critical points	CP 03A	Right Bank	245
		Left Bank	283
	CP 03B	Right Bank	245
		Left Bank	283
	CP 04A	Right Bank	200
		Left Bank	224
	CP 04B	Right Bank	173
		Left Bank	283
	CP 07	Right Bank	141
		Left Bank	173

The pollution level of the soil was estimated according to the Order 756/1997 of MAPPM – Settlements regarding the environmental pollution assessment, on the basis of reference values from annex 1 and 2.

These regulations on soil pollution refers to the sensitive and less sensitive land uses, identified as follows:

a) ***sensitive land use*** *- means the land use for residential and recreational areas, for agricultural purposes, as protected areas or sanitary areas with restrictions regime and the areas of land intended for such uses in the future;*

b) ***less sensitive land use*** *- includes all existing industrial and commercial uses, and the areas of land intended for such uses in the future.*

According to the above specifications, the studied land is characterized as a land with sensitive use.

Also, in this order are presented the pollutants concentrations values in the environment which define the level of pollution, the intervention thresholds values and the alert thresholds values which are intended to alert the competent authorities about a potential impact on the environment:

Alert threshold – the concentrations of pollutants in soil which are intended to alert the competent authorities about a potential impact on the environment and that determine the beginning of supplementary monitoring process and/or decreasing the pollutants concentrations from the emissions/ discharges.

Intervention threshold – pollutants concentrations in soil at which the competent authorities will order the risk assessment studies achievement and pollutants concentrations reducing in emissions/discharges.

In Annex 5.3.1 are presented the 8 tables relating to the centralization of minimum and maximum values determined for 35 analyzed indicators/sample, for each critical point. The soil polution degree evaluation was achieved by interpretation of results of soil samples taken in the preconstruction stage, compared to the alert threshold and intervention threshold values for sensitive land uses, set by regulations concerning environmental pollution assessment of the Order 756/1997 (Table 3.1.C.2).

Table 3.1.C.2 - Reference values - Order 756/1997

No.	Quality Indicator	Unit	Reference values - from Order 756/1997		
			Normal values	pa*	pi**
1.	pH	unit. pH	-	-	-
2.	Conductivity	µS/cm	-	-	-
3.	Antimony	mg/kg dm	5	12.5	20
4.	Silver	mg/kg dm	2	10	20
5.	Arsenic	mg/kg dm	5	15	25
6.	Barium	mg/kg dm	200	400	625
7.	Beryllium	mg/kg dm	1	2	5
8.	Boron soluble	mg/kg dm	1	2	3
9.	Cadmium	mg/kg dm	1	3	5
10.	Cobalt	mg/kg dm	15	30	50
11.	Chromium total	mg/kg dm	30	100	300
12.	Chromium hexavalent	mg/kg dm	1	4	10

No.	Quality Indicator	Unit	Reference values - from Order 756/1997		
			Normal values	pa*	pi**
13.	Copper	mg/kg dm	20	100	200
14.	Manganese	mg/kg dm	900	1500	2500
15.	Mercury	mg/kg dm	0,1	1	2
16.	Molybdenum	mg/kg dm	2	5	10
17.	Nickel	mg/kg dm	20	75	150
18.	Lead	mg/kg dm	20	50	100
19.	Selenium	mg/kg dm	1	3	5
20.	Tin	mg/kg dm	20	35	50
21.	Thallium	mg/kg dm	0,1	0,5	2
22.	Vanadium	mg/kg dm	50	100	200
23.	Zinc	mg/kg dm	100	300	600
24.	Cyanides (free)	mg/kg dm	<1	5	10
25.	Cyanides (complex)	mg/kg dm	<5	100	250
26.	Sulphocyanates	mg/kg dm	<0.1	10	20
27.	Fluorine	mg/kg dm	-	150	300
28.	Bromine	mg/kg dm	-	50	100
29.	Sulfur (elementary)	mg/kg dm	-	400	1000
30.	Sulfides	mg/kg dm	-	200	1000
31.	Sulfates	mg/kg dm	-	2000	10000
32.	Calcium	mg/kg dm	-	-	-
33.	Magnesium	mg/kg dm	-	-	-
34.	Humus	%	-	-	-
35.	Organic Carbon	%	-	-	-
Observations: * p.a. – *Alert threshold*; use type – *sensitive* **p.i. - *Intervention threshold*; use type – *less sensitive*					

The results of the physical and chemical analyses for the soil samples, distinguish the following:

- soil samples pH values are situated in neutral to slightly alkaline domain;
- heavy metals content is situated below normal value in soils, being far below the alert and intervention threshold values for sensitive use types imposed by the Order 756/1997;
- pollutants concentration: cyanide, sulphocyanates, fluorine, bromine, sulfur, sulfides are situated below the ordinary values in soil;
- indicator "sulfate" value is below the alert threshold value for sensitive land use types, imposed by the Order 756/1997;
- humus content values varies from < 1% for very poor in humus soils (sandy soils), up to 8% higher values for humus rich soils (sandy-loam soils).

The values established for the indicators: antimony, silver, arsenic, barium, beryllium, boron soluble, cobalt, chromium hexavalent, mercury, molybdenum, selenium, antimony, tin, vanadium, cyanides, sulphocyanates, fluorine, bromine, sulfides were below the detection limit, therefore the statistical calculation and the graphic representations have been performed only for 14 physico-chemical indicators whose concentrations were over the detection limit.

In Table 3.1.C.3 are presented the quality indicators values of descriptive statistics (number of samples, averages, minimum and maximum values, 25 %, 50 % (median) and respectively 75 % quantile) for the 14 physical and chemical parameters (pH, conductivity, cadmium, total chromium, copper, manganese, nickel, lead, zinc, sulfates, calcium, magnesium, humus and organic carbon), separately for the two sampling depths.

Table 3.1.C.3 - Quality indicators values of the descriptive statistics for soil samples sampling from the 2 depth

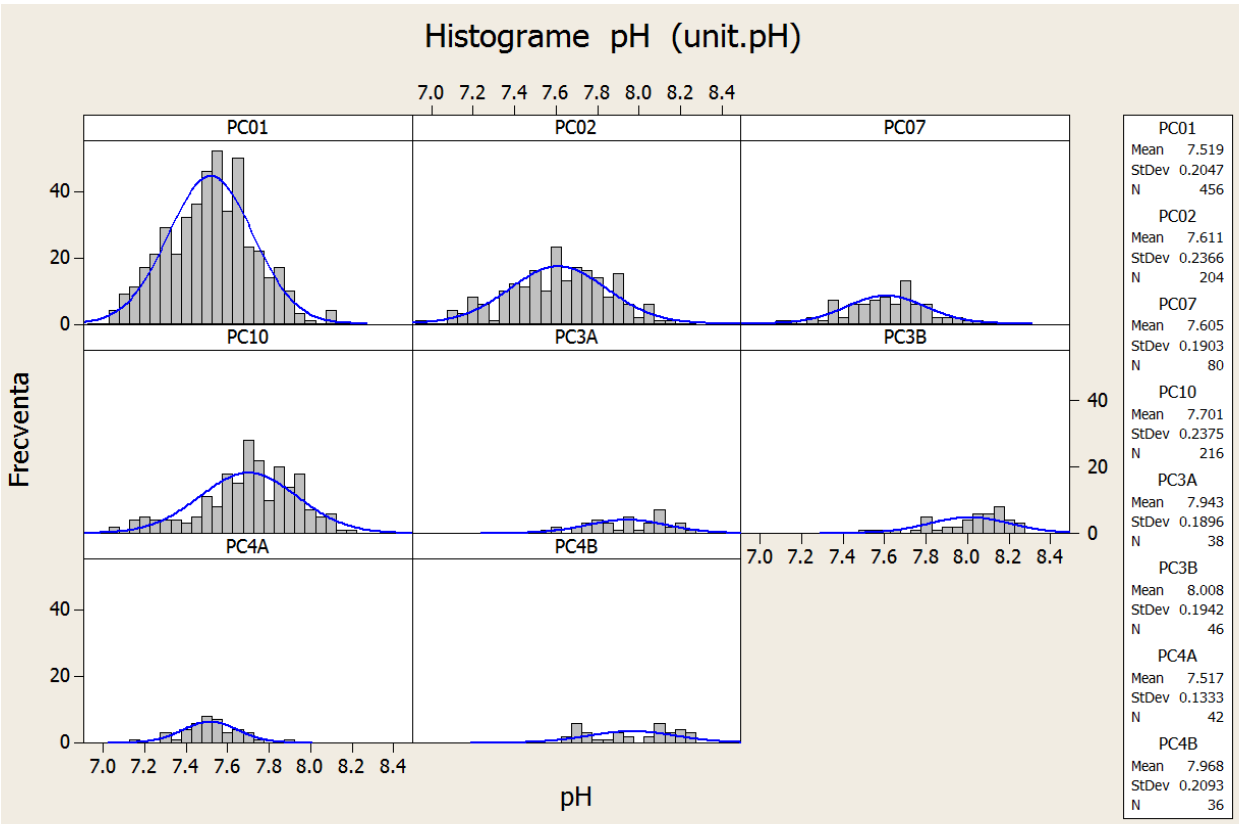
Element	Depth (cm)	No. of samples	Average	Minimum	Q(25%)	Median	Q(75%)	Maximum
pH (unit. pH)	5	559	7.67	6.94	7.52	7.65	7.82	8.27
	30	559	7.58	7.06	7.38	7.55	7.76	8.26
Conductivity (µS/cm)	5	559	294.15	97.0	230.0	267.0	309.0	2740.0
	30	559	260.85	82.0	204.0	241.0	277.0	2270.0
Cadmium (mg/kg dm)	5	559	0.04	0.01	0.01	0.02	0.06	0.28
	30	559	0.03	0.01	0.01	0.01	0.04	0.66
Total chromium (mg/kg dm)	5	559	4.16	1.00	1.79	3.35	5.82	16.13
	30	559	3.38	1.00	1.51	2.46	4.51	14.76
Copper (mg/kg dm)	5	559	8.00	0.50	5.57	7.88	10.82	16.31
	30	559	6.83	0.50	4.26	6.82	9.16	14.56
Manganese (mg/kg dm)	5	559	245.09	24.70	177.10	234.81	301.30	632.4
	30	559	197.32	16.70	141.20	185.50	247.30	558.64
Nickel (mg/kg dm)	5	559	2.61	1.00	1.53	2.12	3.17	11.60
	30	559	2.16	1.00	1.24	1.71	2.62	9.82
Lead (mg/kg dm)	5	559	2.52	0.60	0.60	1.94	3.45	11.41
	30	559	2.04	0.60	0.60	1.52	2.74	9.65
Zinc (mg/kg dm)	5	559	32.03	1.00	17.30	30.20	46.25	80.89
	30	559	35.63	1.00	20.80	33.50	51.07	88.10
Sulfates (mg/kg dm)	5	559	267.45	28.46	163.40	241.00	346.60	1336.10
	30	559	225.10	22.92	125.60	208.60	299.80	1182.30
Calcium (mg/kg dm)	5	559	242.41	64.50	184.40	224.40	268.54	1829.10
	30	559	206.80	48.10	155.30	192.40	232.46	1632.50
Magnezium (mg/kg dm)	5	559	37.30	8.36	26.34	31.46	39.72	414.10
	30	559	29.63	7.26	21.32	26.40	31.75	258.30
Organic carbon (%)	5	559	8.35	0.57	4.38	6.68	10.55	28.55
	30	559	7.20	0.43	3.58	5.52	9.56	27.20
Humus (%)	5	559	14.40	0.98	7.56	11.52	18.20	49.25
	30	559	12.42	0.75	6.18	9.52	16.49	46.92

From the analysis of data presented in the table it is notes as general trend - only exception being zinc - the fact that values for the sampling depth of 5 cm are slightly higher than those for the sampling depth of 30 cm.

Results of statistical processing for each of the 14 parameters (Table 3.1.C.4-3.1.C.17) for critical points are presented in the following.

Table 3.1.C.4 - Results of statistical processing for pH indicator

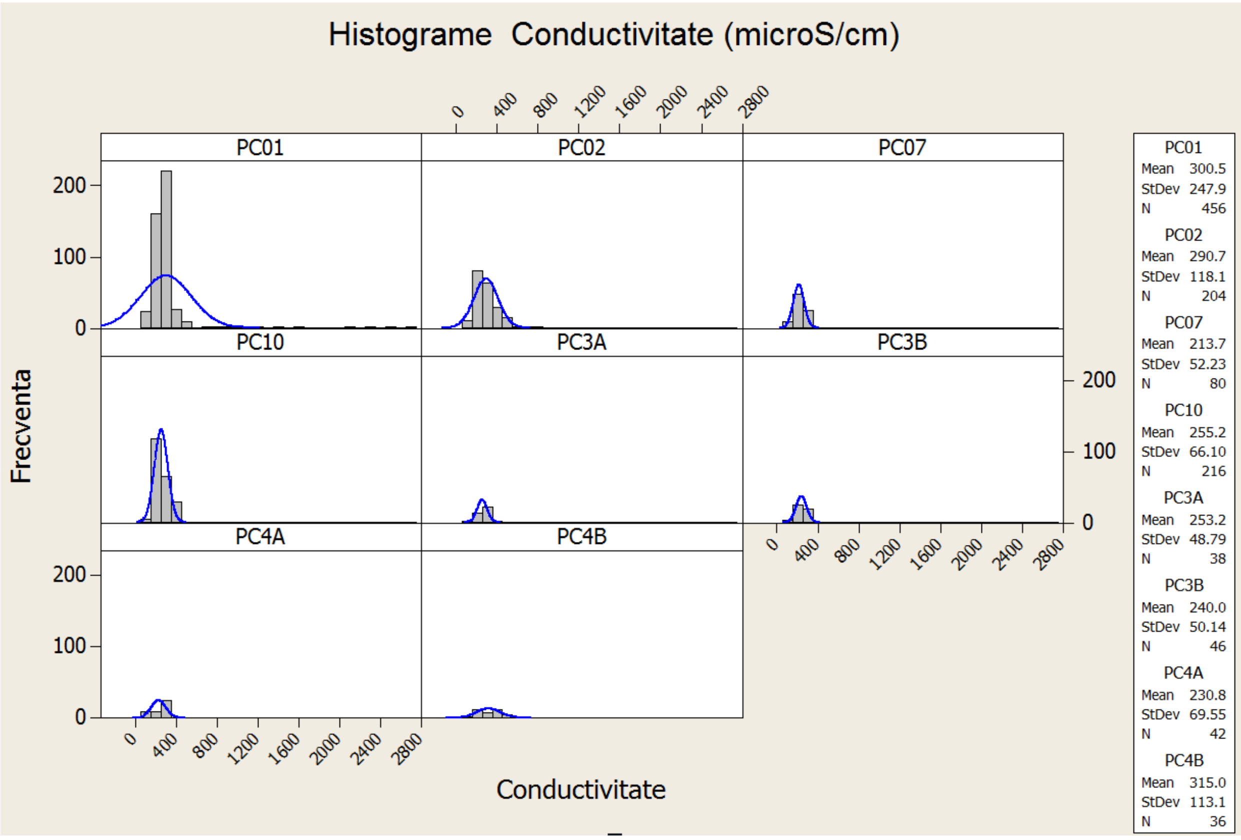
Element/ U.M.	CP	No. Of samples	Average	Standard deviation	Minimum	Q (25%)	Q (75%)	Maximum
pH (unit. pH)	CP01	456	7.52	0.20	7.07	7.38	7.64	8.09
	CP02	204	7.61	0.24	6.94	7.44	7.79	8.15
	CP10	216	7.70	0.24	7.05	7.58	7.87	8.21
	CP3A	38	7.94	0.19	7.53	7.81	8.11	8.25
	CP3B	46	8.01	0.19	7.51	7.88	8.15	8.27
	CP4A	42	7.52	0.13	7.17	7.43	7.61	7.89
	CP4B	36	7.97	0.21	7.67	7.74	8.15	8.26
	CP07	80	7.60	0.19	7.10	7.47	7.73	8.04



As can be seen from Table 3.1.C4 and from the attached histogram, the average values of pH are between 7.5 and 8 pH.unit. Standard deviations are quite low, showing a Gaussian distributions aspect.

Table 3.1.C.5 - Results of statistical processing for electrical conductivity indicator

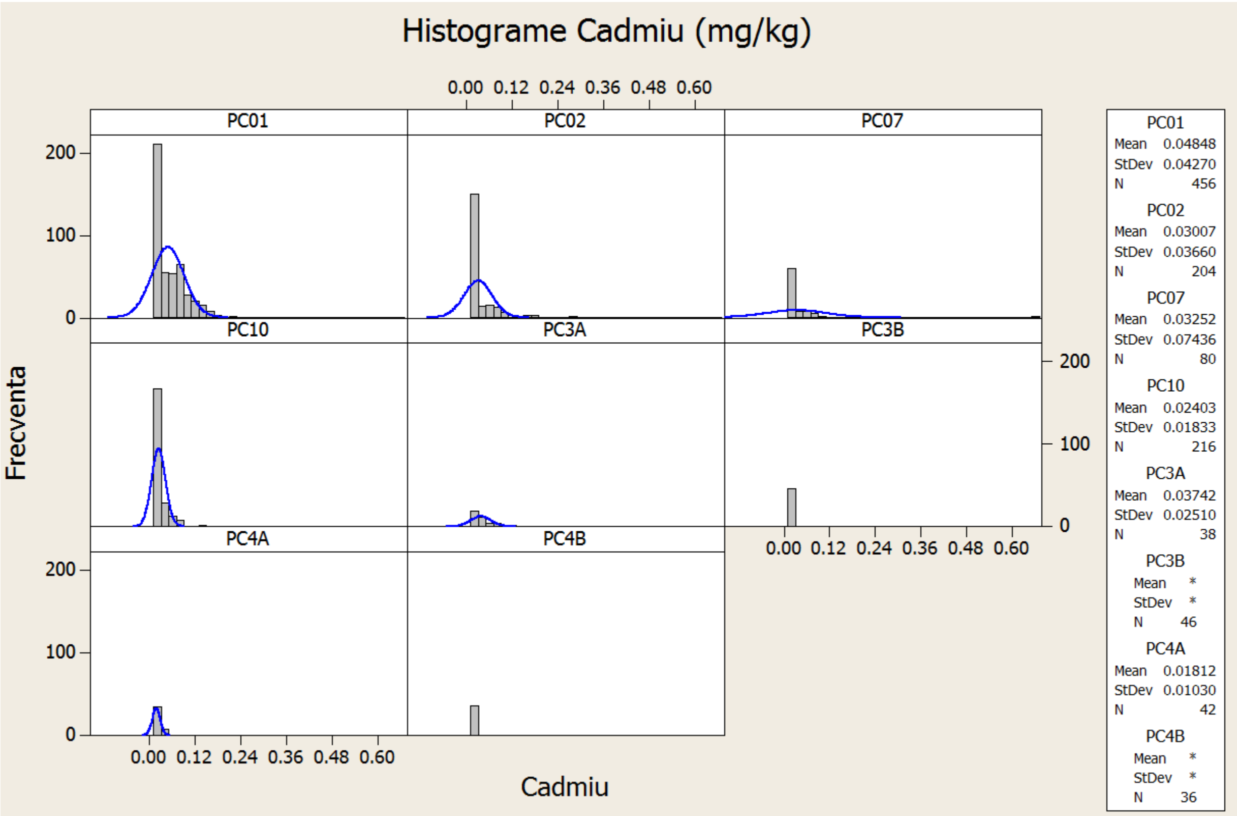
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Conductivity (µS/cm)	Main critical points	PC01	456	300.5	247.9	121.0	227.0	293.0	2740.0
		PC02	204	290.7	118.1	115.1	209.4	347.8	792.0
		PC10	216	255.2	66.1	119.8	214.6	277.2	425.0
	Secondary critical points	PC3A	38	253.2	48.8	97.1	228.0	280.3	361.0
		PC3B	46	240.0	50.1	97.0	216.0	273.4	349.0
		PC4A	42	230.8	69.5	82.0	161.8	285.8	316.0
		PC4B	36	315.0	113.1	99.1	234.0	420.3	514.0
		PC07	80	213.7	52.2	91.0	167.5	255.0	315.0



As can be seen from Table 3.1.C.5 and from the attached histogram, the average values of conductivity are situated in 213 and 315 µS/cm domain. Standard deviations are quite low, most distributions presenting a Gaussian aspect.

Table 3.1.C.6 - Results of statistical processing for cadmium indicator

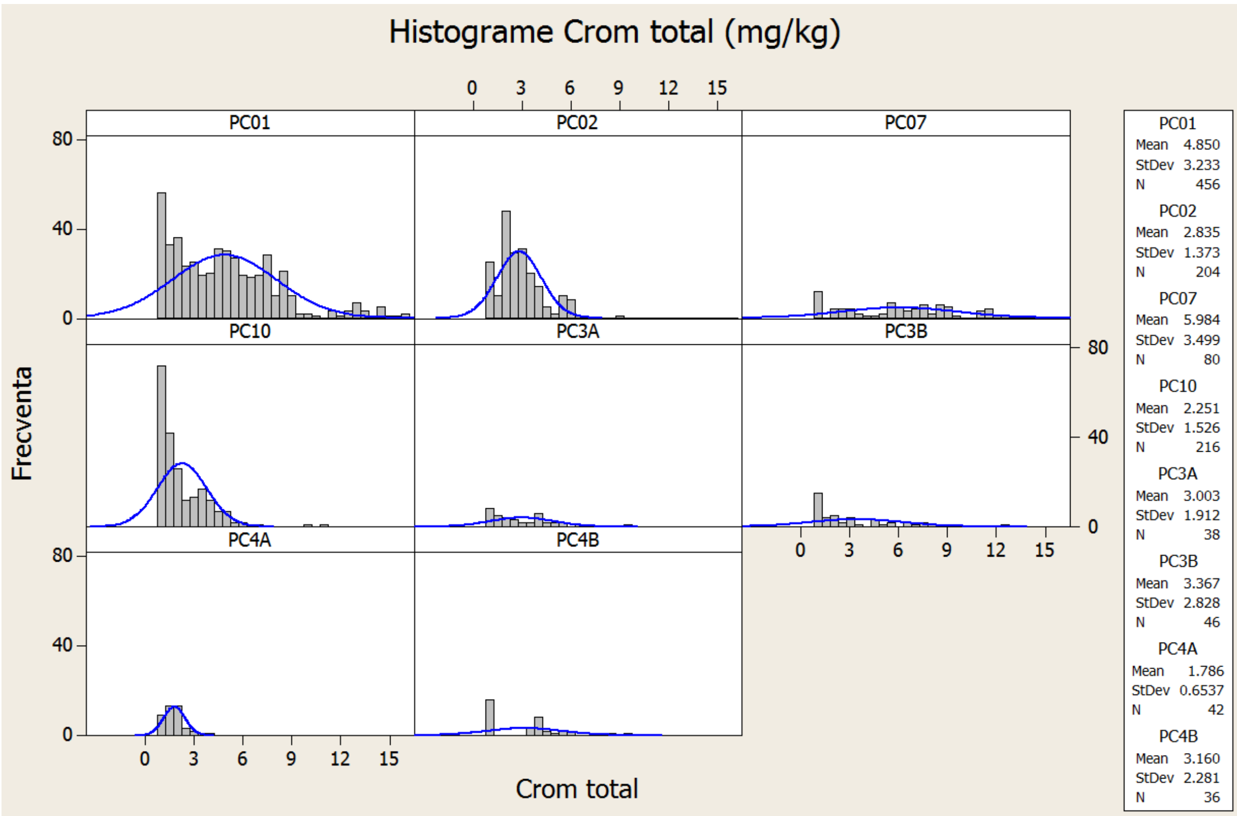
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Cadmium (mg/kg dm)	Main critical points	CP01	456	0.05	0.04	0.01	0.01	0.08	0.23
		CP02	204	0.03	0.04	0.01	0.01	0.03	0.28
		CP10	216	0.02	0.02	0.01	0.01	0.03	0.13
	Secondary critical points	CP3A	38	0.04	0.03	0.01	0.02	0.05	0.12
		CP3B	46	0.01	0.00	0.01	0.01	0.01	0.01
		CP4A	42	0.02	0.01	0.01	0.01	0.03	0.04
		CP4B	36	0.01	0.00	0.01	0.01	0.01	0.01
		CP07	80	0.03	0.07	0.01	0.01	0.04	0.66



As can be seen from Table 3.1.C.6 and from the attached histogram, the average values of cadmium concentrations are situated in 0.01 and 0.05 mg/kg domain. Standard deviations are quite low, all distributions presenting an asymmetry of left (predominant lower values).

Table 3.1.C.7 - Results of statistical processing for total chromium indicator

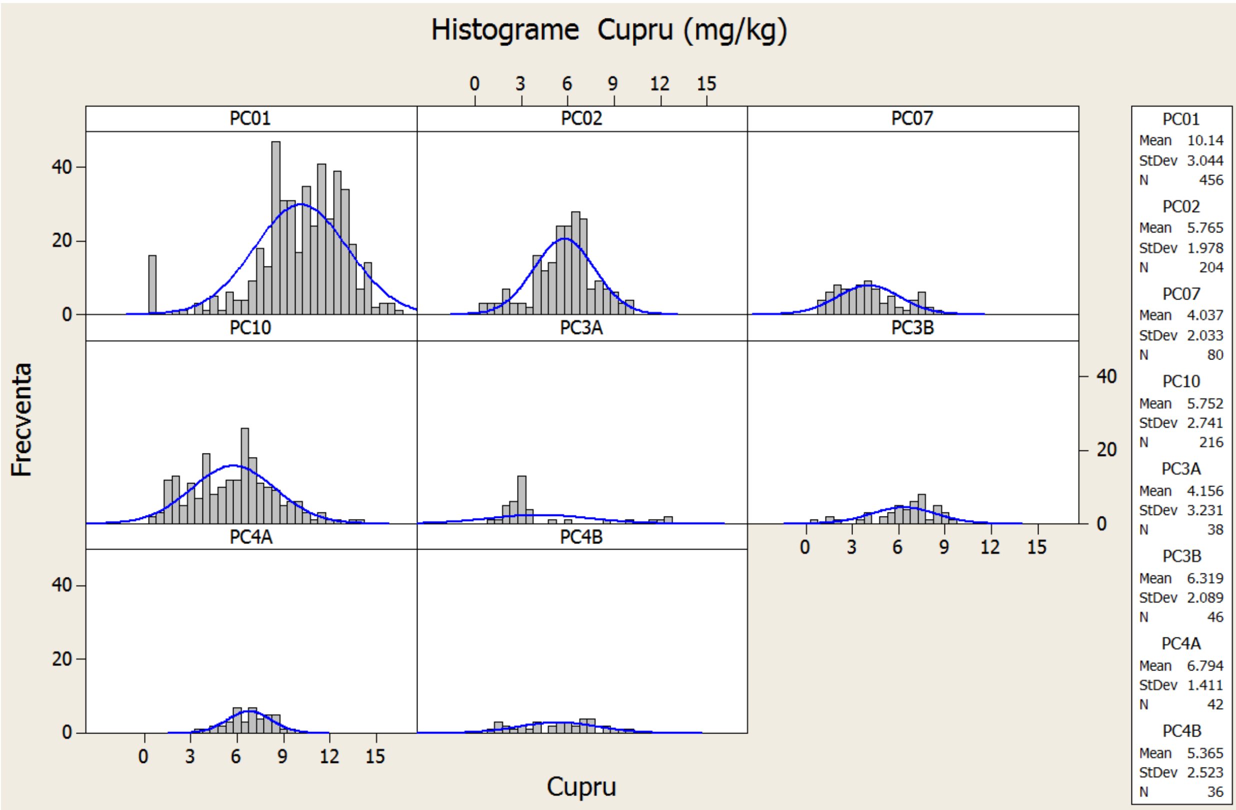
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Total chromium (mg/kg dm)	Main critical points	CP01	456	4.85	3.23	1.00	2.11	6.85	16.13
		CP02	204	2.83	1.37	1.00	1.88	3.50	8.98
		CP10	216	2.25	1.53	1.00	1.11	3.15	10.76
	Secondary critical points	CP3A	38	3.00	1.91	1.00	1.26	4.17	9.42
		CP3B	46	3.37	2.83	1.00	1.00	5.12	12.41
		CP4A	42	1.79	0.65	1.00	1.30	2.09	3.82
		CP4B	36	3.16	2.28	1.00	1.00	4.32	9.42
		CP07	80	5.98	3.50	1.00	2.68	8.48	13.31



As can be seen from Table 3.1.C.7 and from the attached histogram, the average values of total chromium concentrations are situated in 1.8 and 6.0 mg/kg domain. Standard deviations are quite low, most distributions presenting an asymmetry of left (predominant lower values).

Table 3.1.C.8 - Results of statistical processing for copper indicator

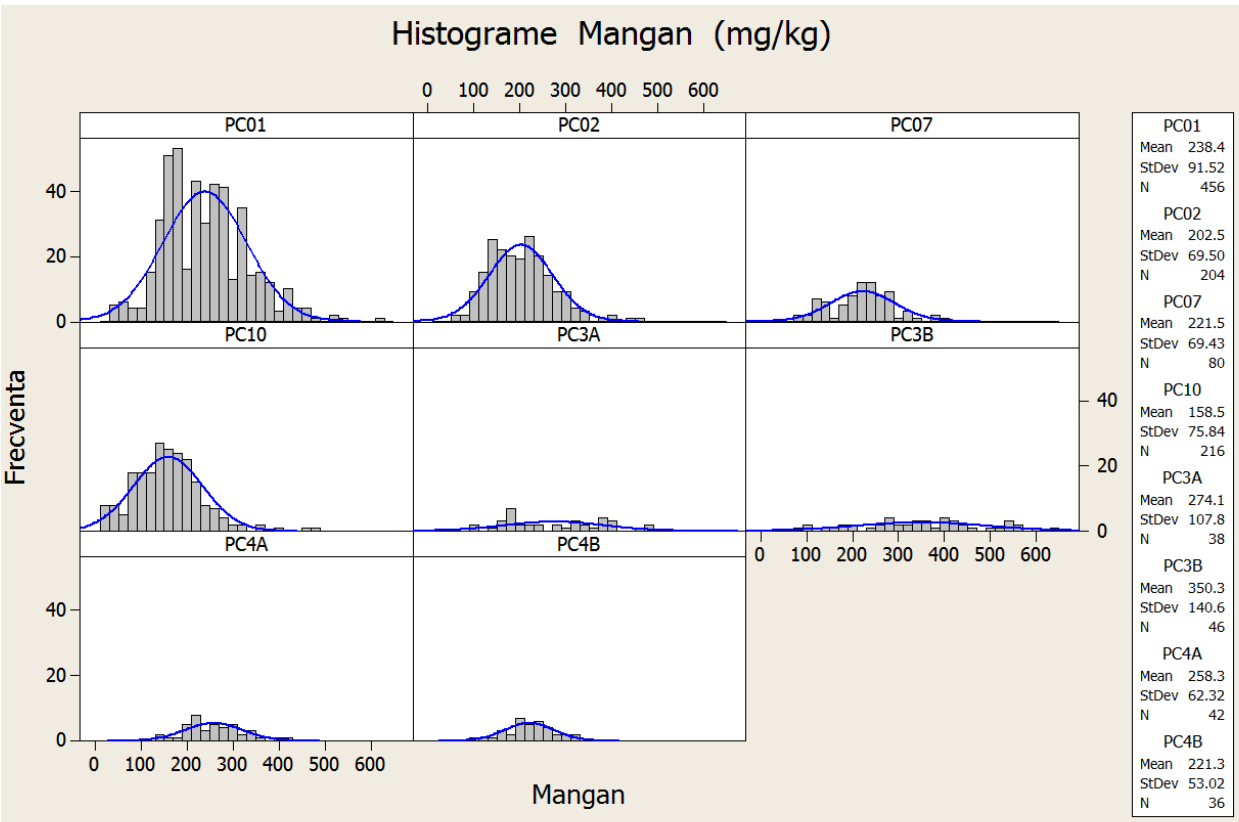
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Copper (mg/kg dm)	Main critical points	CP01	456	10.14	3.04	0.50	8.57	12.37	16.31
		CP02	204	5.77	1.98	0.50	4.60	6.96	9.88
		CP10	216	5.75	2.74	0.74	3.80	7.33	14.22
	Secondary critical points	CP3A	38	4.16	3.23	0.81	2.45	3.39	12.45
		CP3B	46	6.32	2.09	0.73	5.34	7.54	9.31
		CP4A	42	6.79	1.41	3.73	5.98	7.88	9.31
		CP4B	36	5.37	2.52	0.95	3.13	7.24	9.89
		CP07	80	4.04	2.03	0.76	2.44	5.42	8.36



As can be seen from Table 3.1.C.8 and from the attached histogram, the average values of copper concentrations are situated in 4 and 10 mg/kg domain. Standard deviations are quite low, most distributions presenting a Gaussian aspect.

Table 3.1.C.9 - Results of statistical processing for manganese indicator

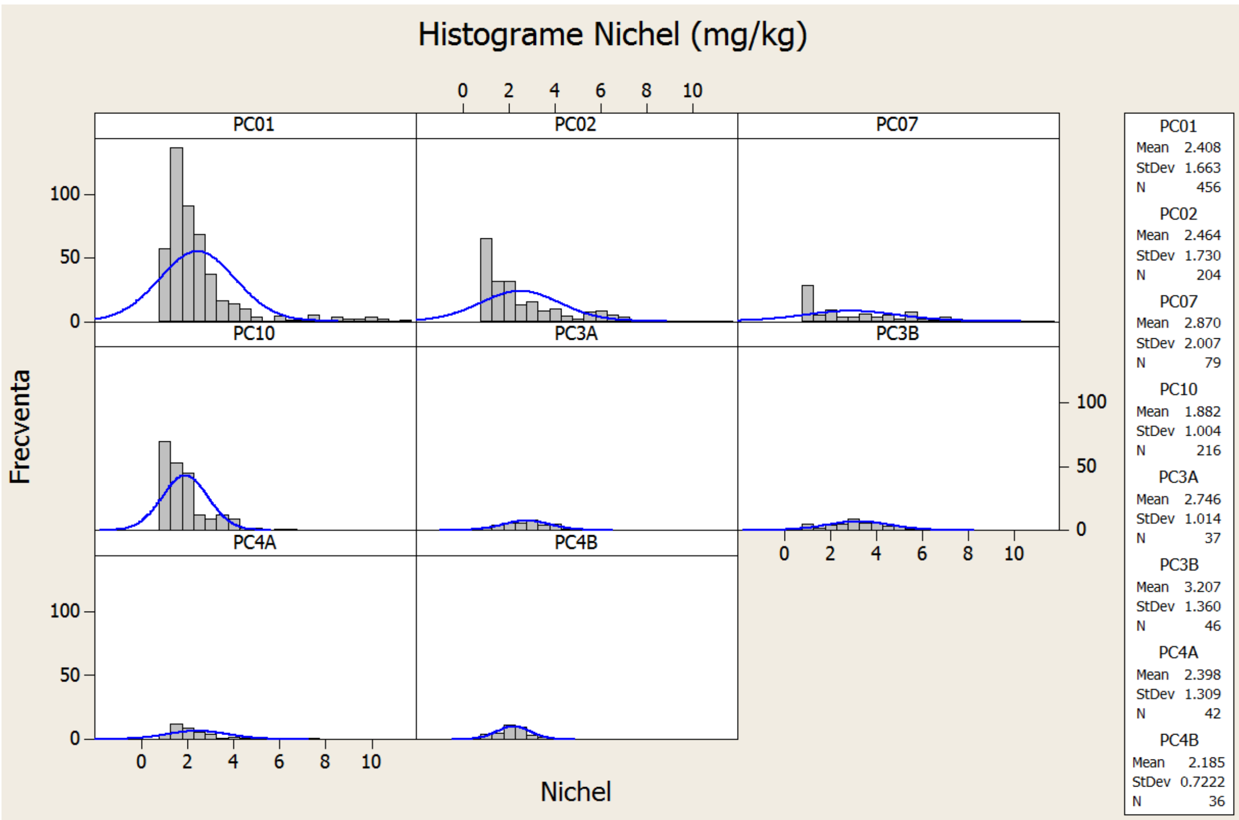
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Manganese (mg/kg dm)	Main critical points	CP01	456	238.41	91.52	37.80	168.06	292.60	626.40
		CP02	204	202.47	69.50	58.60	148.82	243.95	465.80
		CP10	216	158.47	75.84	16.70	108.02	202.15	475.20
	Secondary critical points	CP3A	38	274.10	107.80	101.30	178.10	379.60	482.60
		CP3B	46	350.30	140.60	75.50	262.40	435.60	632.40
		CP4A	42	258.25	62.32	146.30	214.15	296.55	417.60
		CP4B	36	221.26	53.02	91.10	190.50	260.08	328.10
		CP07	80	221.45	69.43	77.80	183.55	263.31	406.80



As can be seen from Table 3.1.C.9 and from the attached histogram, the average values of manganese concentrations are situated in 158 and 350 mg/kg domain. Standard deviations are quite low, most distributions presenting a Gaussian aspect.

Table 3.1.C.10 - Results of statistical processing for nickel indicator

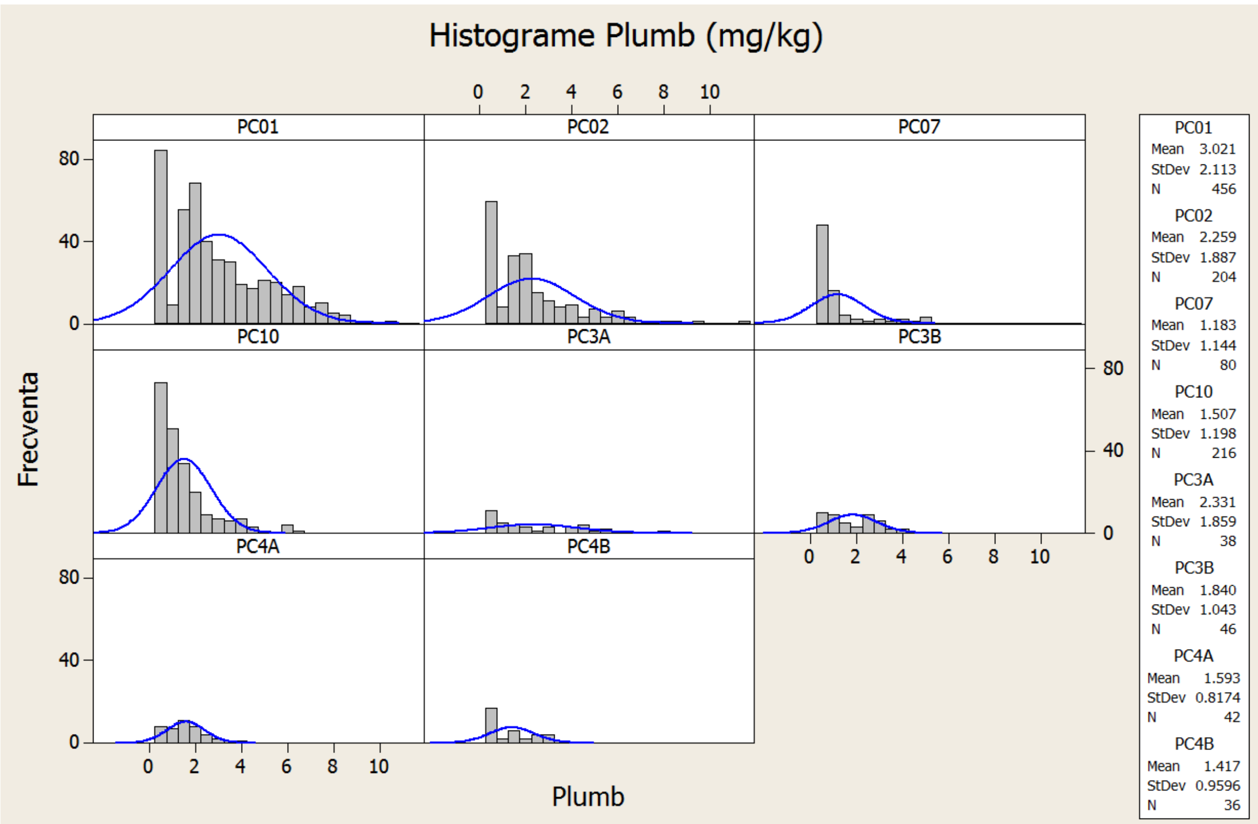
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Nickel (mg/kg dm)	Main critical points	CP01	456	2.41	1.66	1.00	1.48	2.65	11.60
		CP02	204	2.46	1.73	1.00	1.00	3.11	8.61
		CP10	216	1.88	1.00	1.00	1.09	2.17	6.56
	Secondary critical points	CP3A	38	2.75	1.01	1.00	2.00	3.39	5.55
		CP3B	46	3.21	1.36	1.00	2.28	4.10	6.58
		CP4A	42	2.40	1.31	1.00	1.55	2.82	7.45
		CP4B	36	2.19	0.72	1.00	1.72	2.68	3.85
		CP07	80	2.87	2.01	1.00	1.00	4.53	7.51



As can be seen from Table 3.1.C.10 and from the attached histogram, the average values of nickel concentrations are situated in 1.9 and 3.2 mg/kg domain. Standard deviations are quite low, most distributions presenting an asymmetry of left (predominant lower values).

Table 3.1.C.11 - Results of statistical processing for lead indicator

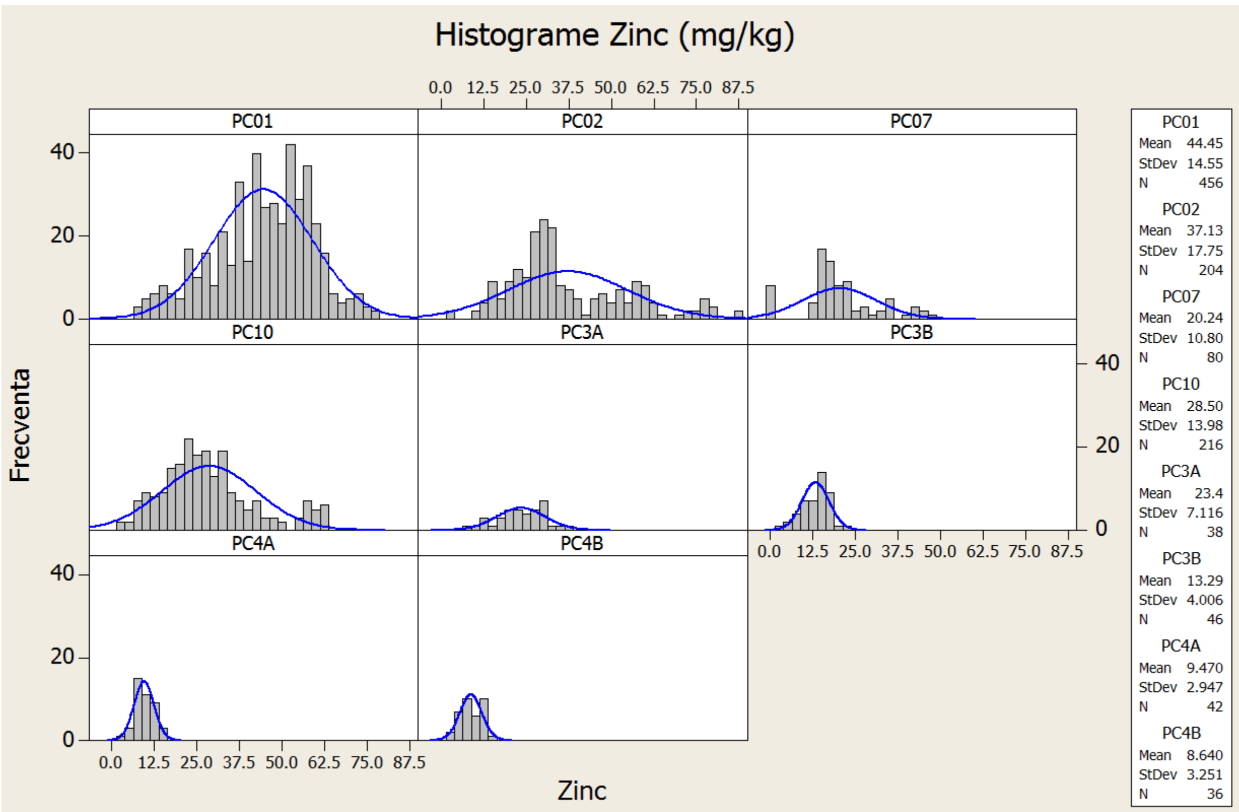
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Lead (mg/kg dm)	Main critical points	CP01	456	3.02	2.11	0.60	1.52	4.38	10.25
		CP02	204	2.26	1.89	0.60	0.60	2.93	11.41
		CP10	216	1.51	1.20	0.60	0.60	1.82	6.26
	Secondary critical points	CP3A	38	2.33	1.86	0.60	0.60	4.07	7.85
		CP3B	46	1.84	1.04	0.60	0.86	2.68	4.12
		CP4A	42	1.59	0.82	0.60	0.97	1.96	4.19
		CP4B	36	1.42	0.96	0.60	0.60	2.24	3.59
		CP07	80	1.18	1.14	0.60	0.60	1.18	5.12



As can be seen from Table 3.1.C.11 and from the attached histogram, the average values of lead concentrations are situated in 1.2 and 3 mg/kg domain. Standard deviations are quite low, most distributions presenting an asymmetry of left (predominant lower values).

Table 3.1.C.12 - Results of statistical processing for zinc indicator

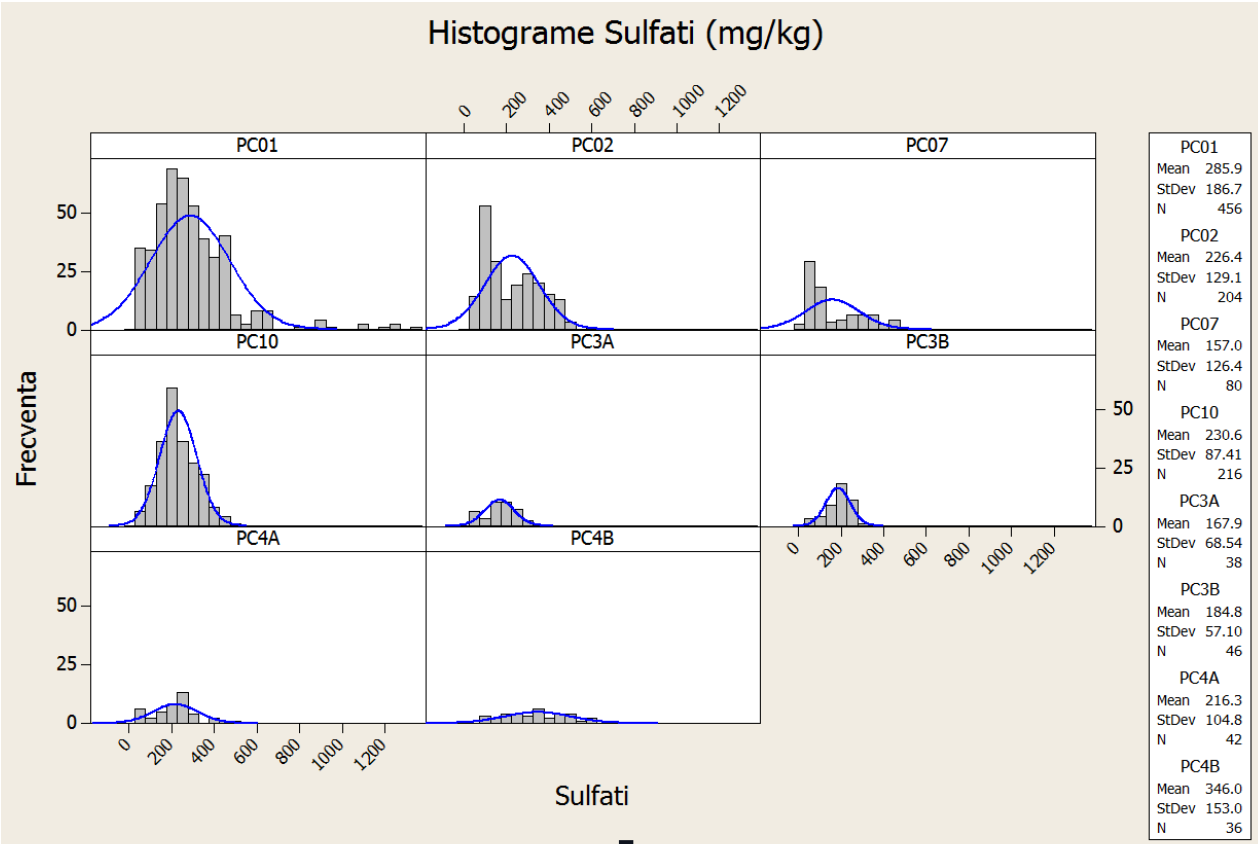
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Zinc (mg/kg dm)	Main critical points	CP01	456	44.45	14.55	6.43	35.47	55.43	77.60
		CP02	204	37.13	17.75	2.71	25.75	49.66	88.10
		CP10	216	28.50	13.98	1.35	19.33	34.40	62.10
	Secondary critical points	CP3A	38	23.40	7.12	8.36	18.99	29.30	36.50
		CP3B	46	13.29	4.01	3.41	10.58	16.15	23.10
		CP4A	42	9.47	2.95	1.76	7.17	11.68	14.80
		CP4B	36	8.64	3.25	2.95	6.14	12.02	13.76
		CP07	80	20.24	10.80	1.00	15.24	24.16	48.60



As can be seen from Table 3.1.C.12 and from the attached histogram, the average values of zinc concentrations are situated in 8.6 and 44.5 mg/kg domain. Standard deviations are quite low, most distributions presenting a Gaussian aspect.

Table 3.1.C.13 - Results of statistical processing for sulfates indicator

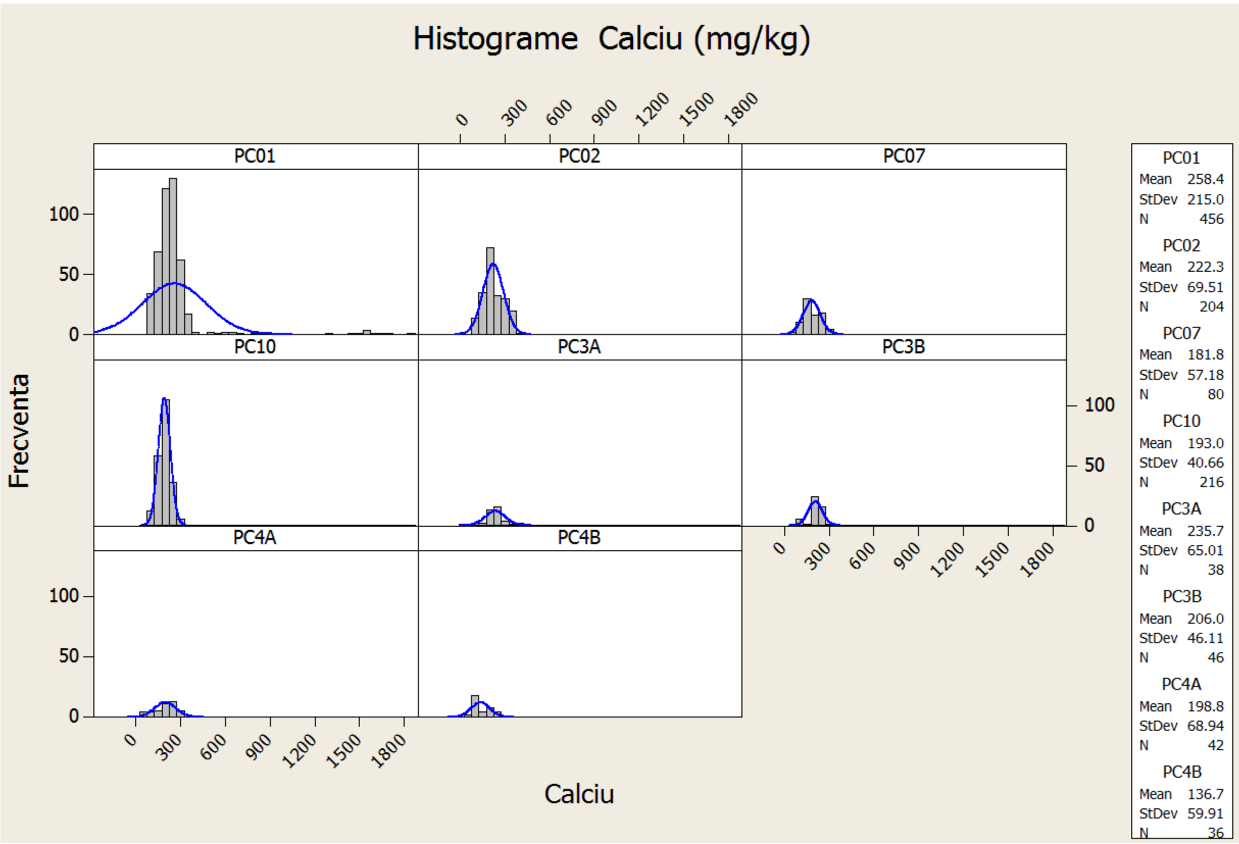
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Sulfates (mg/kg dm)	Main critical points	CP01	456	285.91	186.69	41.43	171.55	357.90	1336.10
		CP02	204	226.35	129.13	28.80	109.94	326.88	598.00
		CP10	216	230.58	87.41	61.70	168.95	286.78	477.50
	Secondary critical points	CP3A	38	167.90	68.50	40.80	125.70	223.50	286.50
		CP3B	46	184.83	57.10	55.42	157.25	227.72	285.90
		CP4A	42	216.30	104.80	45.40	152.90	267.50	490.20
		CP4B	36	346.00	153.00	76.30	224.30	471.50	686.50
		CP07	80	157.00	126.40	22.90	61.30	246.00	465.40



As can be seen from Table 3.1.C.13 and from the attached histogram, the average values of sulfates concentrations are situated in 157 and 346 mg/kg domain. Standard deviations are quite low, most distributions presenting a Gaussian aspect.

Table 3.1.C.14 - Results of statistical processing for calcium indicator

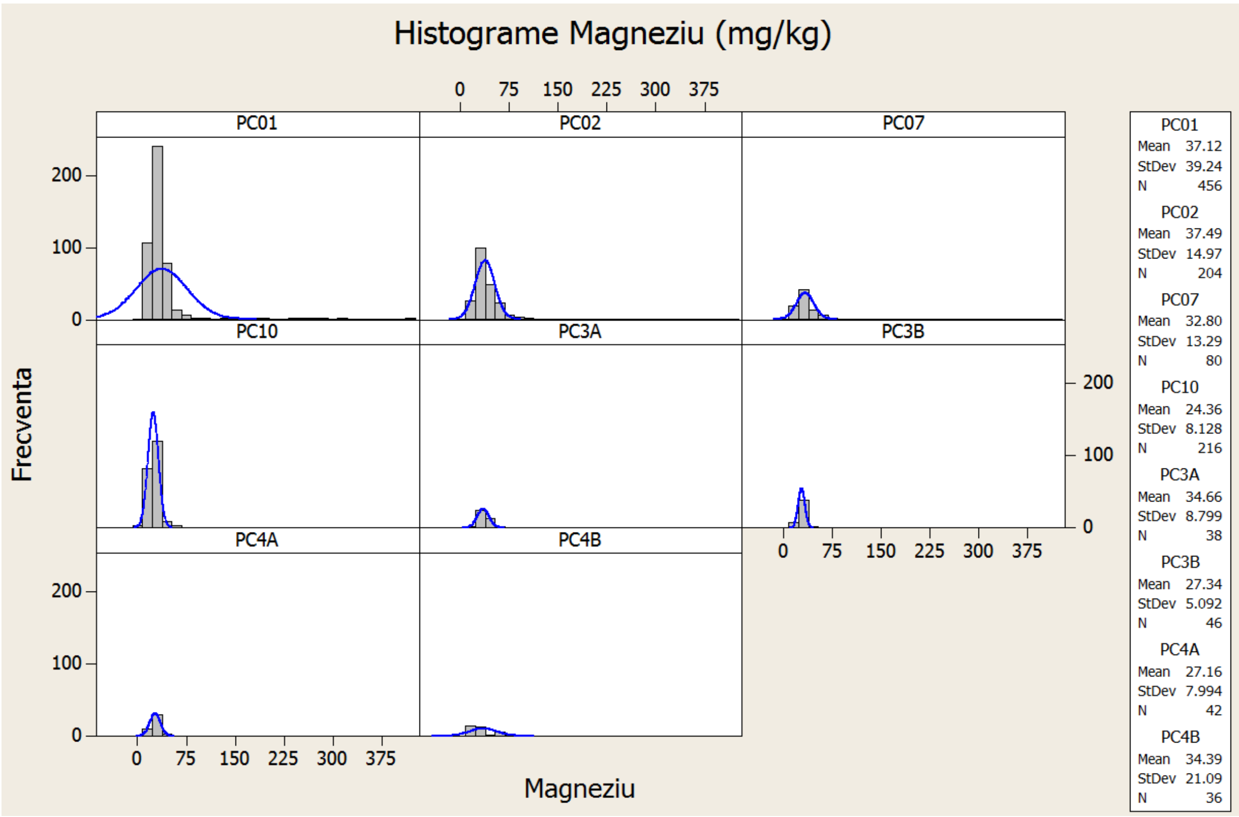
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Calcium (mg/kg dm)	Main critical points	CP01	456	258.40	215.00	88.20	181.40	271.60	1829.10
		CP02	204	222.32	69.51	96.20	176.15	276.01	376.80
		CP10	216	193.00	40.66	89.50	165.65	219.95	288.60
	Secondary critical points	CP3A	38	235.70	65.00	84.60	205.20	262.10	404.70
		CP3B	46	205.96	46.11	76.20	195.90	235.42	292.60
		CP4A	42	198.80	68.90	64.10	154.20	258.50	296.60
		CP4B	36	136.74	59.91	60.10	86.84	184.88	261.50
		CP07	80	181.83	57.18	48.10	137.67	235.27	292.60



As can be seen from Table 3.1.C.14 and from the attached histogram, the average values of calcium concentrations are situated in 137 and 258 mg/kg domain. Standard deviations are quite low, all distributions presenting a Gaussian aspect.

Table 3.1.C.15 - Results of statistical processing for magnesium indicator

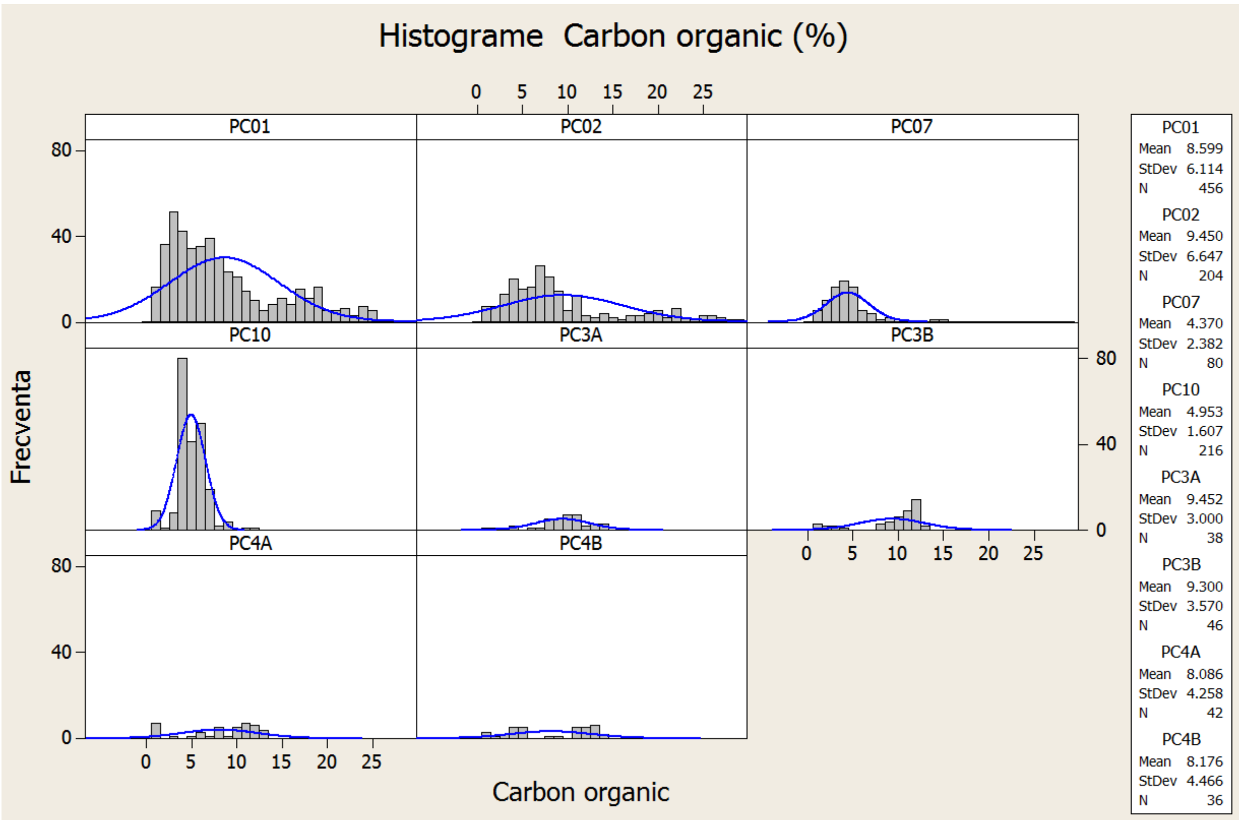
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Magnesium (mg/kg dm)	Main critical points	CP01	456	37.12	39.24	12.10	23.58	37.27	414.10
		CP02	204	37.49	14.97	9.68	28.78	44.20	99.20
		CP10	216	24.36	8.13	7.26	20.30	28.60	53.24
	Secondary critical points	CP3A	38	34.66	8.80	19.36	26.77	43.08	53.24
		CP3B	46	27.35	5.09	19.40	22.87	30.38	45.98
		CP4A	42	27.16	7.99	9.68	22.46	31.46	50.80
		CP4B	36	34.39	21.09	12.10	20.58	52.03	90.75
		CP07	80	32.80	13.29	16.94	22.95	38.22	67.80



As can be seen from Table 3.1.C.15 and from the attached histogram, the average values of magnesium concentrations are situated in 24 and 37 mg/kg domain. Standard deviations are quite low, all distributions presenting a Gaussian aspect.

Table 3.1.C.16 - Results of statistical processing for organic carbon indicator

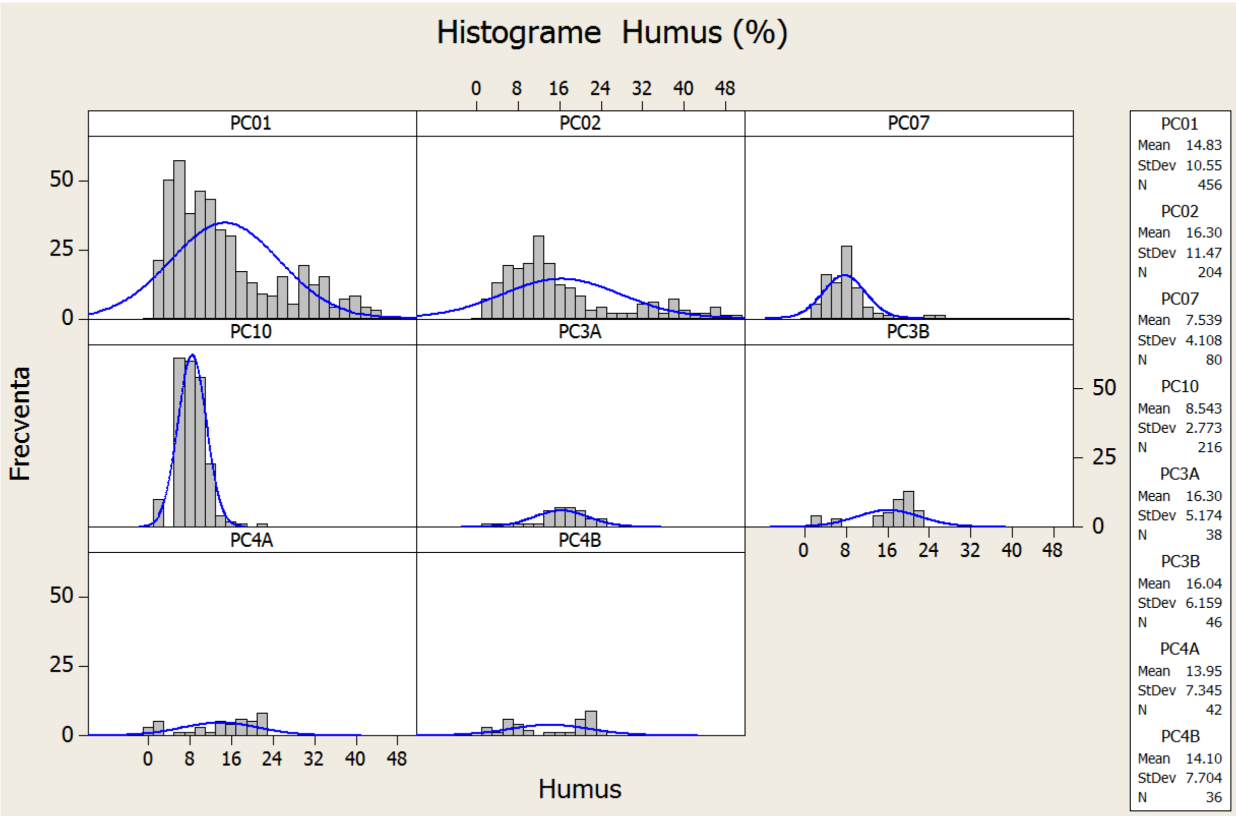
Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Organic carbon (%)	Main critical points	CP01	456	8.60	6.11	0.68	3.70	11.70	25.29
		CP02	204	9.45	6.65	0.86	4.64	11.30	28.55
		CP10	216	4.95	1.61	0.99	3.92	6.03	12.34
	Secondary critical points	CP3A	38	9.45	3.00	0.66	8.33	11.15	14.20
		CP3B	46	9.30	3.57	1.00	8.52	11.71	12.93
		CP4A	42	8.09	4.26	0.43	5.40	11.36	13.15
		CP4B	36	8.18	4.47	0.87	3.98	12.47	13.69
		CP07	80	4.37	2.38	0.74	2.72	5.22	15.15



As can be seen from Table 3.1.C.16 and from the attached histogram, the average values of organic carbon concentrations are situated in 4.4 and 9.5 % domain. Standard deviations are high especially for CP 01 and CP 02, all distributions presenting a Gaussian aspect.

Table 3.1.C.17 - Results of statistical processing for humus indicator

Element/ U.M.		Critical point	No. of samples	Average	Standard deviation	Min.	Q (25%)	Q (75%)	Max.
Humus (%)	Main critical points	CP01	456	14.83	10.55	1.17	6.37	20.18	43.63
		CP02	204	16.30	11.47	1.48	8.00	19.49	49.25
		CP10	216	8.54	2.77	1.71	6.76	10.40	21.29
	Secondary critical points	CP3A	38	16.30	5.17	1.14	14.37	19.23	24.50
		CP3B	46	16.04	6.16	1.73	14.69	20.20	22.30
		CP4A	42	13.95	7.35	0.75	9.32	19.60	22.68
		CP4B	36	14.10	7.70	1.50	6.86	21.50	23.62
		CP07	80	7.54	4.11	1.27	4.70	9.01	26.13



As can be seen from Table 3.1.C.17 and from the attached histogram, the average values of humus concentrations are situated in 7.5 and 16.3 % domain. Standard deviations are high especially for CP 01 and CP 02, all distributions presenting a Gaussian aspect.

To make a graphical representation of the spatial distribution of chemical elements concentrations in soil was proceeded as follows:

- following histograms analysis, the 75 % quantile was considered as statistically representative value;
- all calculations have been made for each river bank of each critical point, using quantile value of 75 % for the whole statistical population sample collected and analyzed from locations from the concerned river bank;
- a subunitary relative quality index has been calculated, reporting 75 % quantile value to the normal value, for 7 parameters for which there are normal concentrations (cadmium, total chromium, copper, manganese, nickel, lead, zinc), according to the Order 756/1997. In this case, the representations have been made on 4 classes;
- the absolute value of the 75% quantile has been also represented at level of 4 classes, for the other seven parameters (pH, conductivity, sulfates, calcium, magnesium, organic carbon and humus.

All 84 maps (sampling points locations of soil samples) thus obtained are presented in Annex 5.3.2.

Soil samples physicomechanical properties. The soil particles are grouped by granulometric fraction. Their percentage amounts in soil determine its texture. The soil properties are largely conditioned by granulometric composition. Thus, a coarse texture of soil induces a low fertilization potential. Soils with medium and fine textures which are richer in clay fractions, retain very well water and nutrients. Soil aeration is generally excessive at sandy soils and much reduced to clayey soils. Texture greatly influence the soil temperature. Thus, increasing the degree of fineness of soil from the sandy to the clayey texture, the soil heats and cools more slowly.

Laboratory tests have been performed for determining the percentage amounts of sand, dust and clay, in order to define the soil texture.The results for soil samples taken from the critical points CP 01, CP 02, CP 10, CP 03A, CP 03B, CP 04A, CP 04B and CP 07 highlighting the soil texture from coarse textured sandy soils to medium size coarse sand-clay structure.

3.1.D. Hydromorphological monitoring

3.1.D.1. Hidrology

3.1.D.1.1 Limnimetrical keys

Limnimetrical keys were calculated - according to the specifications from the Technical specifications - for the CP 01, CP 02 and CP 10 critical points, at 10 locations: S1-S5 – for CP 01, S6-S7 – for CP 02, S8-S10 – for C P10.

Considering the fact that the most of these locations - required in the specification - there are no gauges/hydrometric stations of ANAR or AFDJ and had not yet been installed monitoring stations continuous/quasi-continuous of the water level and of the discharge, the method of calculation of these limnimetrical keys was:

- Regarding water flow rates were taken into account daily discharges measured and reported at nearest ANAR stations - upstream - from those 10 sites considered. In situations where there is a bifurcation or confluence between locations of the ANAR stations and the stations considered by the experts of the consortium, it was calculated using the percentage distribution of historical discharge coefficients between the branches;
- For each of the 10 stations considered they were used single beam and/or multibeam bathymetry data to build cross-sections at the stations in question;
- On these cross-sections, it has been established a level (level "0") to which, depending on the discharge and mean water flow velocity of the water on that section, it was calculated analytically the value of the area below the water surface and, from here, it was determined the relative water level that corresponds to respectively discharge;
- Using these pairs (water level - discharge) were built limnimetrical keys for all 10 stations considered (Figures 3.1.D.1.1.1 - 3.1.D.1.1.10).

The precision of the analytical procedure for determining the limnimetrical keys is extremely high – the procedure being calibrated and tested in case of ANAR stations.

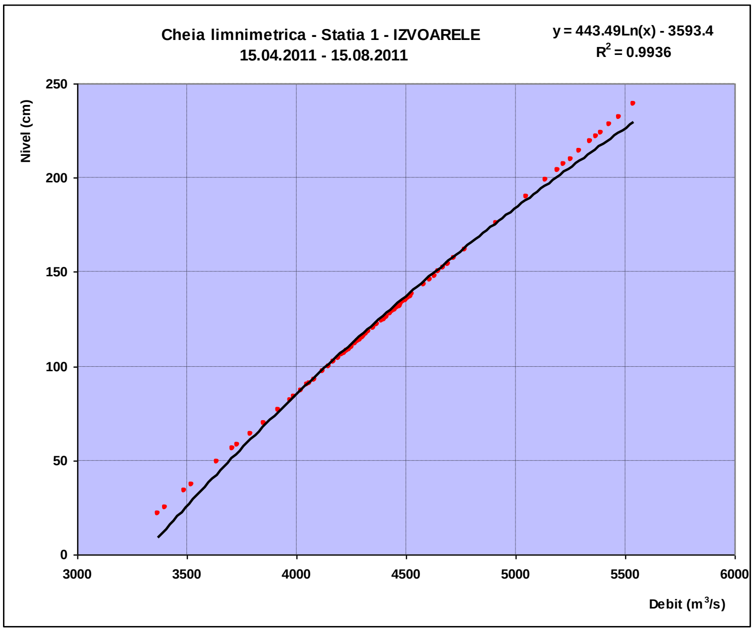


Figure 3.1.D.1.1.1

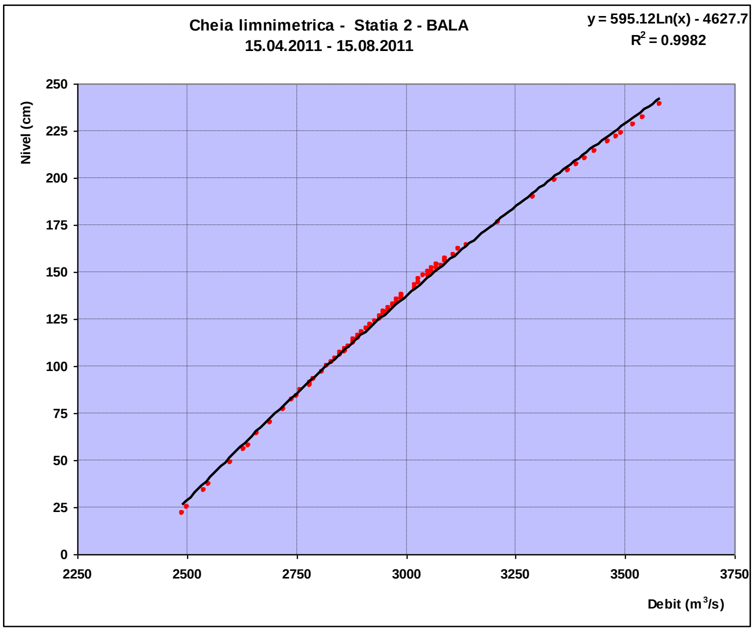


Figure 3.1.D.1.1.2

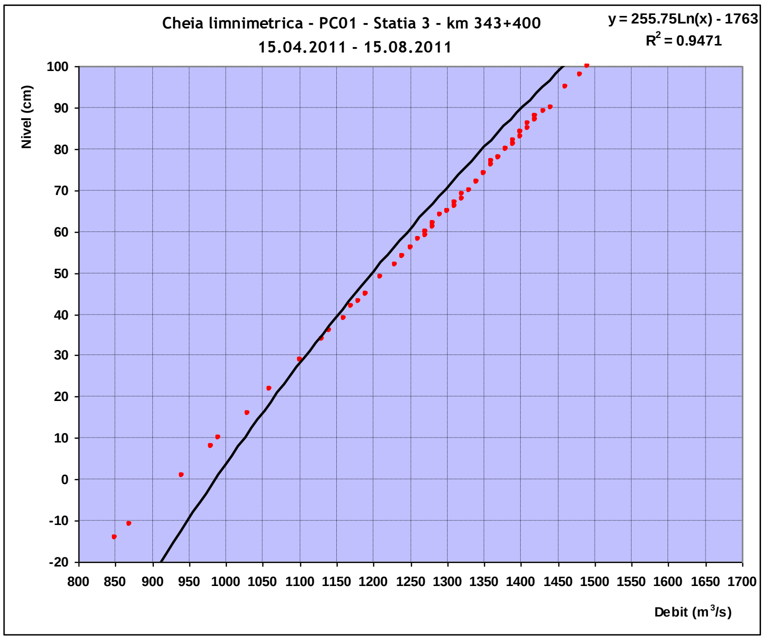


Figure 3.1.D.1.1.3

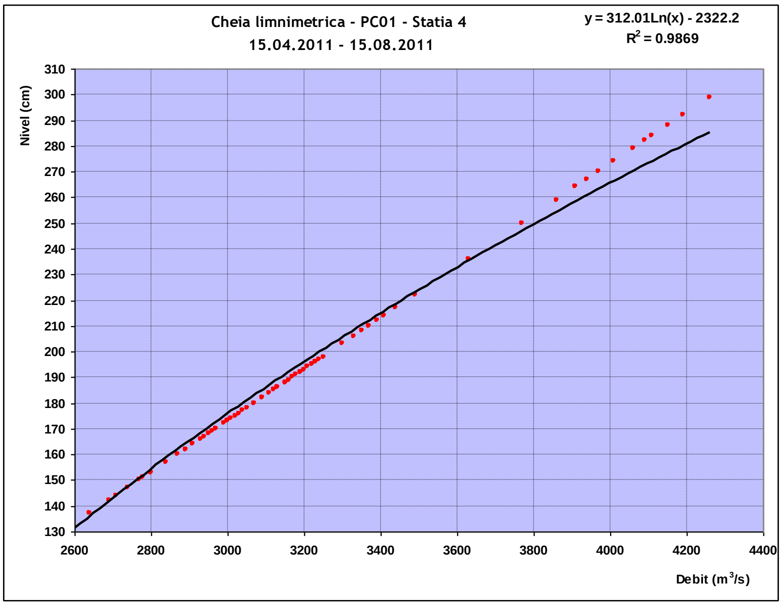


Figure 3.1.D.1.1.4

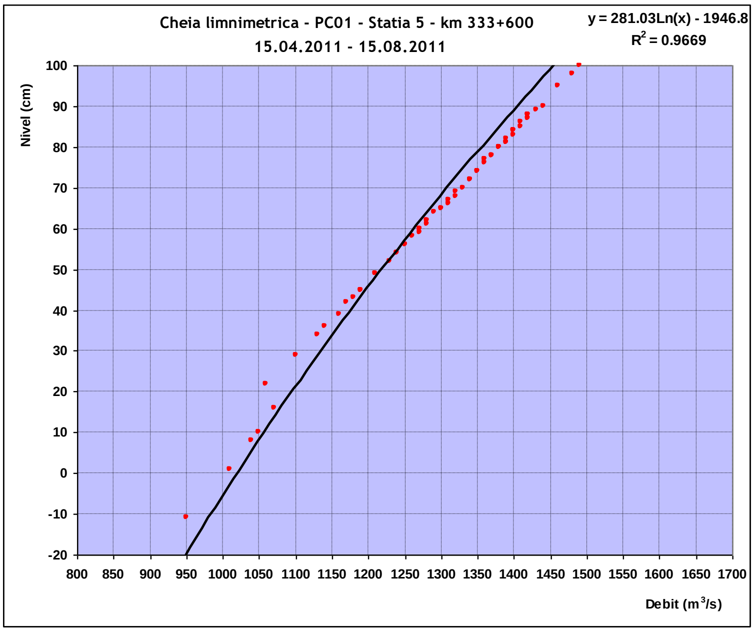


Figure 3.1.D.1.1.5

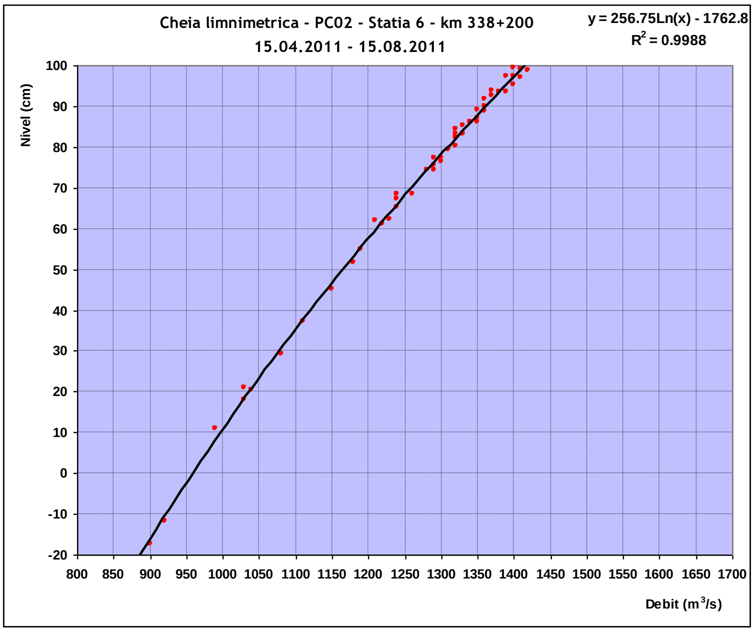


Figure 3.1.D.1.1.6

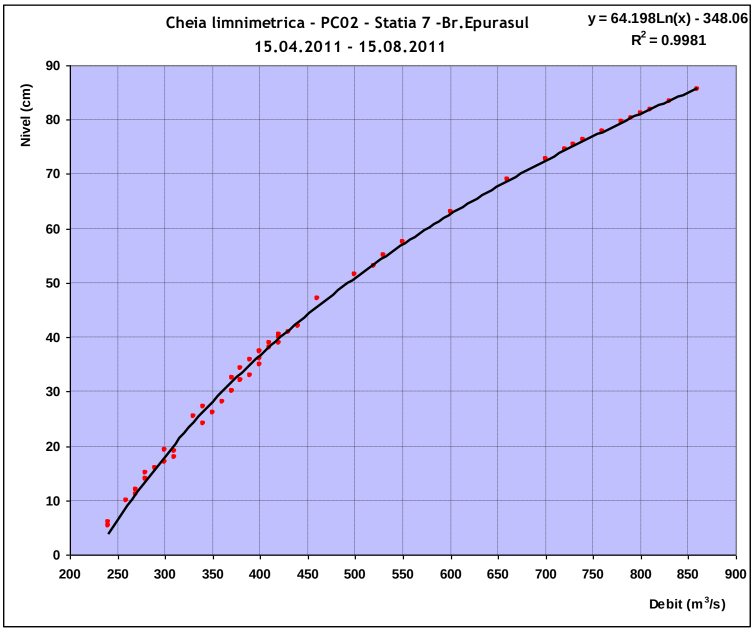


Figure 3.1.D.1.1.7

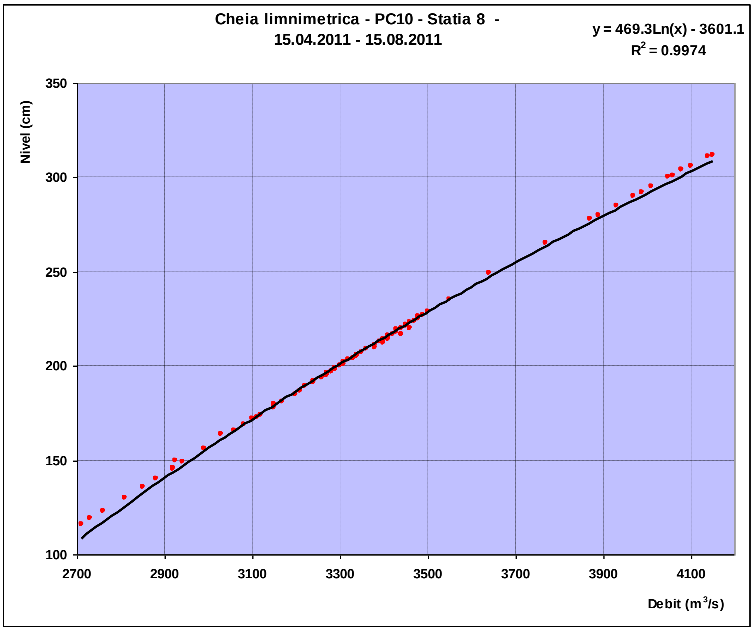


Figure 3.1.D.1.1.8

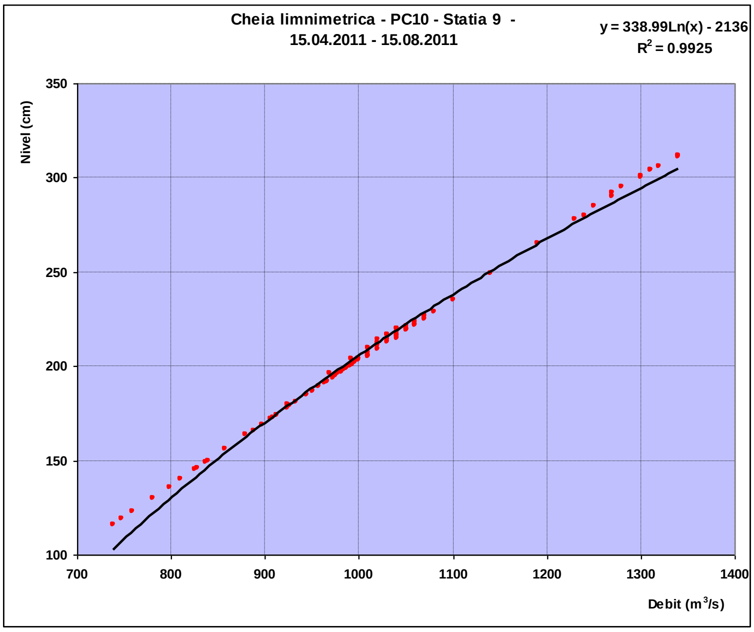


Figure 3.1.D.1.1.9

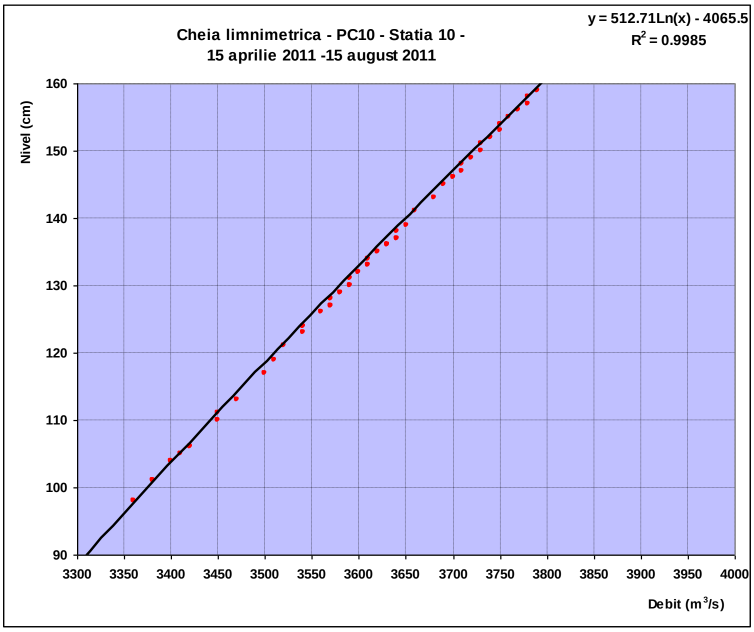


Figure 3.1.D.1.1.10

3.1.D.1.2 Hydromorphological measurements (topobathymetric)

According to the Technical specifications, were made several hydromorphological measurements (bathymetry).

Multibeam topobathymetric measurements

1. Measurements in the critical points CP 01- CP 02

The measurements made by the VITUKI team were located as follows:

- **Main Course** / km navigable course 347-334 km (length 13 cm - measured by the measurements team with multibeam bathymetric survey technology;
- **Epuraşu secondary Branch**, the entire length of the secondary Branch, 8 km, it was measured (2.5 km measured by multibeam bathymetric survey techniques, 5.5 kilometers with a small boat, measuring rod, GPS positioning on the sides);
- **Bala secondary Branch**, the entire length of the secondary Branch, 11 km, it was measured by multibeam bathymetric survey techniques;
- **Borcea secondary Branch**, on a distance of 2 km from the confluence with Bala branch (km 69-68, measured by single beam bathymetric techniques).

The total length 35.0 km:
2.0 km single beam
5.5 km with a small boat
26.5 km multibeam

2. Measurements in the critical point CP 10

The measurements taken were located as follows:

- **Main Course** / km navigable course 198 – 193 km
- **Caleia secondary Branch** / km navigable course 11-6 km
- **Vâlciu secondary Branch**, 2 km downstream of the confluence.

The total length measured by multibeam bathymetric survey technic – 12 km.

Overview measurements taken:

55,5 km entirely, from which:

2.0 km single beam

5.5 km with a small boat

48.0 km multibeam.

Figure 3.1.D.1 - Measurements in the critical points CP 01 – CP 02

Figure 3.1.D.2 - Measurements in the critical point CP 10

The multibeam bathymetric surveys were processed as follows:

- the coordinates of the points where the water depth was determined have been trans-calculate from geographical coordinate system into Stereo'70 projection for X and Y;
- the depth data were interpolated into a regular grid with 2 m resolution;
- the level corrections were made using water levels, measured during measurement campaigns, and the geodetic measurements made from the banks;
- the validation of the processed bathymetry data was performed where it was the case.

Finally, there were obtained the text files X, Y, Z - Z representing absolute level, relative to the Black Sea - Sulina level.

These data will allow the transfer of the bathymetric data with a very high resolution, to the 3D modeling program.

Hydromorphological single beam and surveying measurements

The following table contains a summary - for each critical point - the number of topographic measurements on the two sides of the Danube.

The geodetic measurements for the banks morphology

CP	km - km	Branch name	Number of topographic measurements on the sides		
			RS	LS	Total
CP 09	238-237	Dunărea Veche	9	3	12
CP 10	x	Braţul Macin	6	9	15
CP 09	x	Braţul Valciu	11	5	16
CP 10	197-186	Dunărea	22	20	42
CP 10	10.00	Braţul Caleia	4	0	4
CP 10	x	Braţul Cravia	10	9	19
CP 10	176-164	Dunărea	13	13	26
CP 09	237-198	Dunărea	18	19	37
CP01-CP02	x	Braţul Borcea Superior	7	6	13
CP01-CP03	x	Braţul Ostrov	3	3	6
CP01-CP04	373-341	Dunăre	14	11	25
CP01-CP02	x	Braţul Ostrov	3	3	6
CP01-CP02	375-371	Dunăre	1	1	2
CP01-CP02		Braţul Borcea Superior	10	10	20
CP01-CP02	370-356	Dunărea	3	3	6
CP01-CP02	355 - 346	Dunărea	2	3	5
CP01-CP02	9 - 1	Braţ Bala	18	17	35
CP01-CP02	x	Braţul Borcea Superior	21	21	42
CP01-CP02	345-341+500	Dunărea	5	5	10
CP03-CP04	341 - 334	Dunărea	9	8	17
CP03-CP04	334 - 329	Dunărea	5	5	10
CP03-CP04	329 - 326	Dunărea	4	4	8
CP03-CP04	326 - 323	Dunărea	4	2	6
CP03-CP04	323 - 310	Dunărea	6	6	12
CP 09	311 - 237	Dunărea	17	16	33
CP 09	x	Braţul Macin	3	3	6
CP 09	x	Braţul Valciu	3	2	5
CP 09	237 - 197	Dunărea	6	6	12
CP 10	10 -1	Braţul Caleia	12	13	25
CP 10	197 - 186	Dunărea	6	5	11
CP 10	x	Braţul Cravia	3	3	6
CP 10	186 - 175	Dunărea	7	7	14
CP 10	175 - 165	Dunărea	4	4	8
Total			269	245	514

Turbidity

Repeated turbidity measurements were carried out at multiple depths along of the sections from which were collected water and sediment samples.

In Annex 5.6.3 are presented bathymetric profiles highlighting water level in the day that turbidity measurements and turbidity measured values were carried out (Campaign 3 and Campaign 4).

Calibration was performed by gravimetric determinations in the laboratory from water and suspended sediment samplings.

For the turbidity determination it was used a HACH Companz – CAM LAB turbidimeter with the following features:

- Reading time – 45 sec
- Read $R = \dfrac{\text{signal at } 90^0 \text{ (nepfelometer)}}{\text{transmitted light + diffuse light}}$
- Wavelength 350 nm and 1100 nm.

3.1.D.1.3 Measurements of flow rates and water flow velocities

In the preconstruction phase they were made water flow velocities and flow rates measurements on several cross sections in the area of the critical points CP 01, CP 02 and CP 10. Thus, hydrometric measurements were performed with a spatial resolution corresponding to the technical specification at each critical point, but on the whole monitoring sector of the Danube, from Călăraşi to Brăila, from 500 to 500 m, and 300 m later, for hydraulic modeling purposes.

The data of the ADCP measurements, repeated 5 times on the same transverse profile were compared and averaged, the result being a report (Discharge Report) containing all the essential data for a hydrometric profile.

Graphical representation of velocity/ discharge data recorded on profile allowed a better understanding of the results for their integration in limnimetrical keys and 3D hydraulic model. The recorded data were exported for processing in ASCII files, according to the technical specifications.

For all monitoring sections were collected during measurements, water level data from hydrometric stations immediately adjacent, for good data processing embodied in the limnimetrical keys, namely: before the beginning of the measurement session and at the end of its.

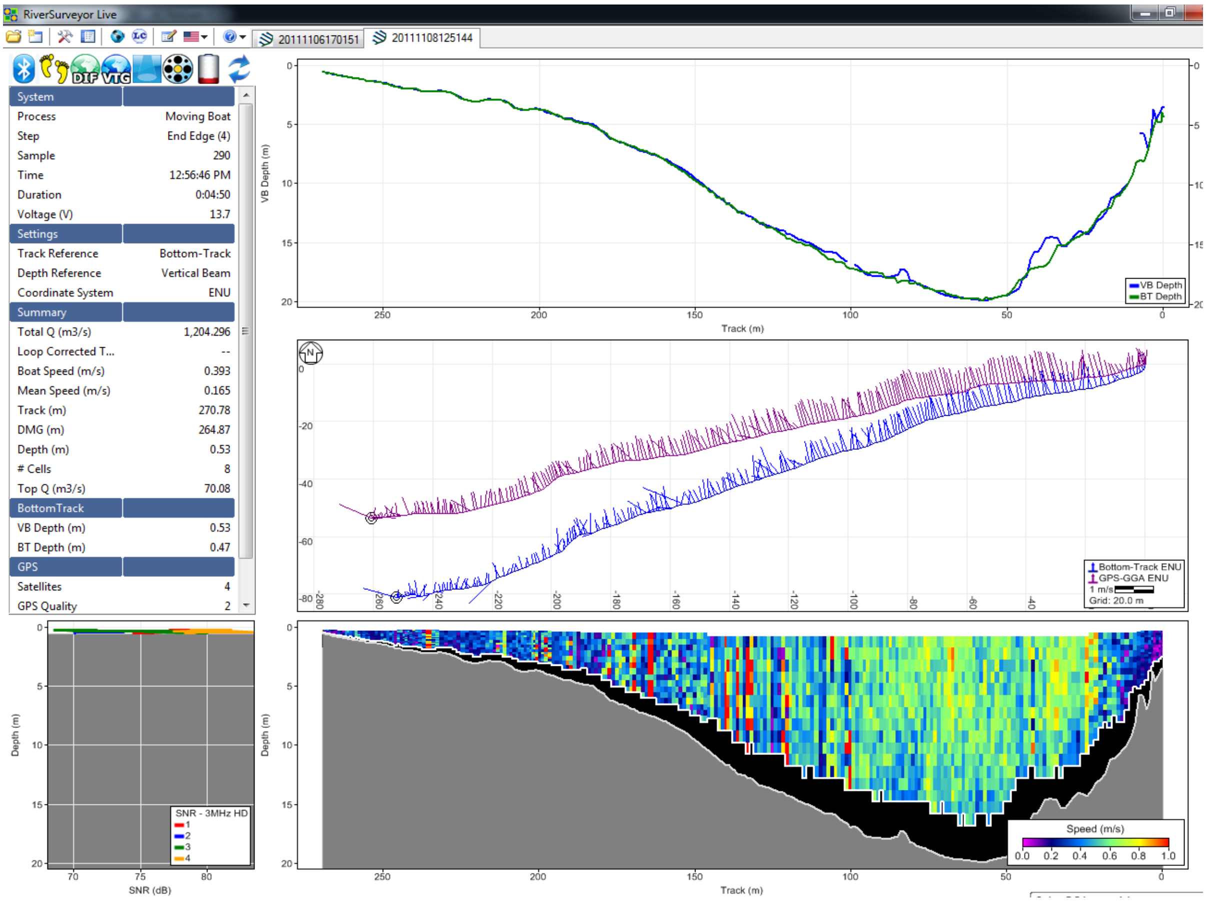


Figure 3.1.D.1.3.1 - ADCP profile processed with River Surveyor Live software

In Annex 5.6.2 these sections are presented indicating the bathymetric profile and water flow velocities in the section at the level of cells.

They have processed the information, calculating the underwater sectional area (as a ratio between the flow rate through the section and the average water flow velocities on the section). The table presents 3.1.D.1.3.1 the flow rates, the water velocities and the geometric indicators on profiles, measured by ADCP technique.

Table 3.1.D.1.3.1 - Flow rates, water velocities and geometric indicators on profiles, measured by ADCP

No	CP	Km	Qt (m^3/s)	Vmed (m/s)	Vmax (m/s)	S (m^2)	Length (m)
1	CP01	348	3375	0.256	2.122	13185	570
2	CP01	374	3933	0.511	1.452	7696	600
4	CP01	BALA	2126	0.888	1.824	2395	220
5	CP01	BALA	2149	0.866	1.940	2482	255
6	CP01	BALA	2091	0.856	1.807	2443	310
7	CP01	BALA	2159	0.432	1.651	4998	362
8	CP01	BALA	2103	0.606	1.663	3470	402
9	CP01	BALA	2097	0.479	1.671	4377	385
10	CP01	BALA	2102	0.700	1.891	3003	378
11	CP01	BALA	2140	0.865	1.569	2474	357
12	CP01	BALA	2086	0.530	1.489	3936	300
13	CP01	BALA	2090	0.536	1.662	3900	265
14	CP01	BALA	2092	0.667	1.564	3136	258
15	CP01	BALA	2111	0.377	1.645	5599	231
16	CP01	BALA	2190	0.750	1.755	2921	222
17	CP01	BALA	2146	0.545	1.574	3938	210
18	CP01	BALA	2153	0.353	1.621	6100	274
19	CP01	BALA	2133	0.569	1.705	3749	217
20	CP01	BALA	2118	0.230	1.619	9210	341
21	CP01	BALA	2114	0.373	1.556	5668	346
22	CP01	BALA	2129	0.366	1.583	5817	293
23	CP01	BALA	2149	0.346	1.654	6210	292
24	CP01	BALA	2155	0.412	1.603	5230	215
25	CP01	BALA	2214	1.085	1.844	2041	179
26	CP01	BALA	2188	0.295	1.773	7416	273
27	CP01	BALA	2081	0.979	1.914	2125	395
28	CP01	BALA	2053	0.465	1.656	4415	490
29	CP01	BALA	2051	0.494	1.581	4152	474
30	CP01	BALA	2073	0.564	1.539	3675	471
31	CP01	BALA	1676	0.415	1.585	4039	269
32	CP01	BALA	1726	0.604	2.106	2857	223
33	CP01	BALA	1695	0.291	1.898	5825	222
34	CP01	BALA	1706	0.323	1.903	5281	212
35	CP01	BORCEA INF	3296	0.317	1.767	10397	312
36	CP01	BORCEA SUP	335	0.111	0.997	3019	167
37	CP01	BORCEA INF	2277	0.289	1.699	7879	296

No	CP	Km	Qt (m^3/s)	Vmed (m/s)	Vmax (m/s)	S (m^2)	Length (m)
38	CP01	BORCEA INF	2205	0.425	1.778	5187	351
39	CP01	348	2356	0.370	1.408	6367	540
40	CP01	348	2243	0.273	1.414	8214	632
41	CP01	348	2301	0.490	1.446	4696	670
42	CP01	347	2246	0.175	1.340	12837	576
43	CP01	347	2309	0.151	1.357	15291	597
44	CP01	347	2022	0.162	1.53	12481	502
45	CP01	346	2273	0.596	1.443	3813	682
46	CP02	334	1252	0.547	1.581	2290	261
47	CP02	341	390	0.368	0.897	1060	285
48	CP02	341	353	0.457	0.919	772	156
49	CP02	341	381	0.584	1.096	653	182
50	CP02	340	403	0.533	1.143	756	143
51	CP02	335	352	0.239	1.147	1471	162
52	CP02	334	344	0.083	1.216	4140	350
53	CP10	169	2431	0.315	1.080	7719	310
54	CP10	171	2488	0.450	1.463	5529	231
55	CP10	173	2659	0.395	1.664	6732	332
56	CP10	CRAVIA	309	0.447	1.138	692	145
57	CP10	175	2081	0.296	1.380	7032	469
58	CP10	179	1826	0.517	1.386	3532	348
59	CP10	180	1919	0.424	1.678	4525	484
60	CP10	180	2251	0.490	1.974	4593	574
61	CP10	181	2083	0.392	1.530	5315	584
62	CP10	182	2192	0.453	1.990	4839	585
63	CP10	183	2241	0.416	1.780	5387	453
64	CP10	185	2209	0.304	1.564	7266	322
65	CP10	186	2548	0.261	1.391	9764	453
66	CP10	CRAVIA	338	0.172	0.957	1967	124
67	CP10	CALEIA	1702	0.685	1.482	2484	227
68	CP10	CALEIA	1703	0.313	1.428	5440	167
69	CP10	DUNARE(SEC19)	835	0.178	0.926	4690	184
70	CP10	DUNARE(SEC19)	792	0.351	1.044	2257	245
71	CP10	DUNARE(SEC19)	697	0.305	1.091	2286	167
72	CP10	DUNARE(SEC19)	773	0.666	2.154	1161	565
73	CP10	DUNARE(SEC19)	789	0.359	1.313	2197	458
74	CP10	DUNARE(SEC19)	789	0.117	0.957	6741	359

No	CP	Km	Qt (m^3/s)	Vmed (m/s)	Vmax (m/s)	S (m^2)	Length (m)
75	CP10	DUNARE(SEC19)	808	0.335	0.893	2413	291
76	CP10	CALEIA	1634	0.632	1.528	2585	316
77	CP10	CALEIA	1629	0.712	1.471	2288	277
78	CP10	196	2008	0.493	1.790	4073	482
79	CP10	199	1971	0.703	1.635	2804	330
80	CP10	200	1914	0.332	1.333	5764	409
81	CP10	201	1993	0.227	2.188	8778	301
82	CP10	206	1976	0.734	1.453	2693	492
83	CP10	208	1936	0.223	1.693	8681	358
84	CP10	209	1957	0.283	2.648	6916	325
85	CP10	212	1803	0.190	1.964	9487	350
86	CP10	213	1939	0.396	1.795	4895	369
87	CP10	ARAPU	741	0.261	1.486	2838	144
88	CP10	MACIN	457	0.211	1.000	2168	123
89	CP01	347	3359	0.696	1.128	4826	683
90	CP02	342	845	0.543	0.831	1557	391
91	CP02	339	802	0.666	1.110	1205	275
92	CP02	334	842	0.552	1.120	1526	389
93	CP01	Bala km 9	2561	0.831	1.166	3082	487
94	CP01	Borcea INF	2755	0.786	1.450	3505	293
95	CP01	Borcea INF	2637	0.791	1.112	3334	323
96	CP01	Borcea INF	2663	0.727	1.120	3663	325
97	CP10	195	1267	0.528	0.972	2400	570
98	CP10	195	1250	0.443	0.898	2821	468
99	CP10	193	1241	0.405	0.739	3063	128
100	CP10	191	1265	0.486	1.259	2603	583
101	CP10	189	1201	0.401	1.127	2995	435
102	CP10	189	1236	0.409	1.105	3022	419
103	CP10	187	1204	0.356	1.093	3383	266
104	CP10	186	1227	0.324	0.636	3787	186
105	CP10	CALEIA km 0	2122	0.699	0.993	3036	305
106	CP10	CALEIA km 1	2101	0.718	1.107	2926	326
107	CP10	MACIN	506	0.465	0.710	1089	217
108	CP10	MACIN	507	0.310	0.499	1635	125
109	CP10	185	2851	0.622	0.999	4584	376
110	CP10	185	2872	0.669	1.042	4293	351

In critical points CP 01 - Bala, CP 02 - Epurașu and CP 10 - Ostrovu Lupu, it was required to be carried out - in June 2011 – water flow velocity measurements through the 3D ADV (Acoustic Doppler Velocity) high frequency technique, with NORTEK VECTOR device NORTEK VECTOR to obtain information about water flow velocity in the vicinity of the river bed and to determine the water turbulence. These measurements and primary data processing were conducted by a BOKU team.

ADCP measurements made at critical points by other project partners, in parallel, are suitable for determining the discharges and the characteristics of the flow profile, but these measurements do not provide information on the bottom of the flow profile. Moreover, the sampling frequency of ADCP is limited and so the technique is not suitable for measuring the values of the turbulence.

After making of the construction works (especially bottom sills), the flow velocities near the riverbed can be changed. To ensure that these changes will not affect fish life, a campaign of ADV measurements is necessary for different cross sections before and after execution of the construction work. In addition, such high frequency measurements of the water velocity are needed to calibrate the 3D numerical hydrodynamic model.

For the critical points CP 01, CP 02, CP 03, CP 07 and CP 10 the project aims to build a large-scale model which will be complemented by a detailed 3D numerical hydrodynamic model on which variables will calculate both hydrodynamics and sediment transport characteristics. In this way, the purposes of the modeling process are:

- Determining the hydrodynamic variables (e.g.: flow velocity – magnitude and direction, water level, turbulence);
- Determining the caracteristics of the sediment transport (e.g.: the amount of sediment carried in suspension, the amount of sediment transported) and its effects on hydromorphology;
- Analysis of the impact of the calculated hydraulic parameters on fish migration.

The 1D and 2D hydrodynamic models are not suitable for a detailed modeling because of the simplifications of the fluid dynamics equations. These simplifications are given in particular by the neglecting of the vertical components and their effects on secondary streams and of the rise effects associated of the water level in the river curves. Therefore, as these phenomena are present at critical points only 3D modeling may produce a reasonable approximation of the flow profile and thus provide a solid basis for sediment transport modeling.

Application of the 3D hydrodynamic model on the river bathymetry before and after implementation of the planned measures provides the opportunity to identify the impact (comparatively) of the construction works.

The ADV 3D measurements of the flow velocity. Campaign of field

The campaign was carried out on the Danube in Romania, between km 348 and km 195 to the CP 01 (Bala), CP 02 (Epuraşu) and CP 10 (Ostrovu Lupu) in June 2011. In the four days of measurement, in 7 different locations and 17 cross sections were made a total of 105 vertical surveys and 840 points for determining the flow velocity (Tab. 3.1.D.1.3.2). On 07.06.2011 and 28.06.2011 the CP 01 and CP 10 measurements were carried out with the ship "Dr. Janos Csoma" belonging to the VITUKI partner. For measurements at CP 01 and CP 02 on 17.06.2011 and 18.06.2011 it was used the Romanian Border Police ship, "Motorboat MAY 3015".

Table 3.1.D.1.3.2 - The summary of the ADV measuring sections - Campaign in June 2011

Year	Date	Sector - Critical Spot		Stream kilometer	Discharge Q [m³s⁻¹]	Water surface [m.a.sl.]	Cross section width [m] **	Cross section Number	Number of verticals	Number of measurement points
2011	07.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	525	CS01-7	8	64
	07.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	305	CS01-6	7	56
	07.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	280	CS01-5	6	48
	07.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	240	CS01-4	6	48
	07.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	235	CS01-2	5	40
	17.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	235	CS01-3	5	40
	17.06.2011	Bala - Izvoarele	Gauge 1	Danube km 348	*	*	565	G1-1	7	56
	17.06.2011	Borcea - Unirea	Gauge 2		*	*	340	G2-1	6	48
	18.06.2011	Bala	CS01 - Sill	Bala km 10 - 9	*	*	210	CS01-1	4	32
	18.06.2011	Epurasu	CS02	Danube km 342.7 - 341.8	*	*	430	CS02-1	6	48
	18.06.2011	Epurasu	CS02	Danube km 342.7 - 341.8	*	*	285	CS02-2	5	40
	18.06.2011	Epurasu	Gauge 3		*	*	435	G3-1	7	56
	28.06.2011	Ostrovu Lupu	CS10 - Sill	Caleia km 10 - 9	*	*	400	CS10-1	6	48
	28.06.2011	Ostrovu Lupu	CS10 - Sill	Caleia km 10 - 9	*	*	395	CS10-2	6	48
	28.06.2011	Ostrovu Lupu	CS10 - Sill	Caleia km 10 - 9	*	*	400	CS10-3	6	48
	28.06.2011	Ostrovu Lupu	CS10 - Sill	Caleia km 10 - 9	*	*	365	CS10-4	6	48
	28.06.2011	Ostrovu Lupu	CS10	Danube km 195.5	*	*	730	CS10-5	9	72
							sum	17	105	840

* discharge and water surface level to be determined by the contractor
** estimated with the Rigel Range Finder - measurement accuracy +/- 2m

At the critical point CP 01 the velocity measurements were performed in 5 cross sections on 07.06.2011, to entry branch Bala (km 10-9) and the other two cross sections in 17.06.2011 and 18.06 0.2011 (Table 3.1.D.1.3.2). The cross section from Izvoarele km 348 and that on the Borcea Branch at Unirea were measured on 17.06.2011 (Table 3.1.D.1.3.2).

CP 02 was monitored on 18.06.2011 (Table 3.1.D.1.3.2) when two cross sections were measured upstream of Ostrovul Epuraşu between km 342.7 and km 341.8 and downstream of the km 335.

The ADV measurements to the CP 10 - Ostrovu Lupu occurred on 28.06.2011 - four cross sections were measured at entry on the Caleia Branch between km 10 and km 9.5 (Caleia), and one on the Danube, at the km 195.5 (Table 3.1.D.1.3.2).

The following figure illustrates the ADV measuring equipment used on the Danube during the campaign in June 2011, and its installation on the ship of the ship "Dr. Janos Csoma".

Figure 3.1.D.1.3.2 - The ADV measuring equipment

Figure 3.1.D.1.3.3 shows the cross section location for CP 01 (Bala). In the interest area, the sections were distributed in such a way as to ensure the collecting of some data as representative as possible (sections marked with red). Another section was made in the Izvoarele area (marked with green).

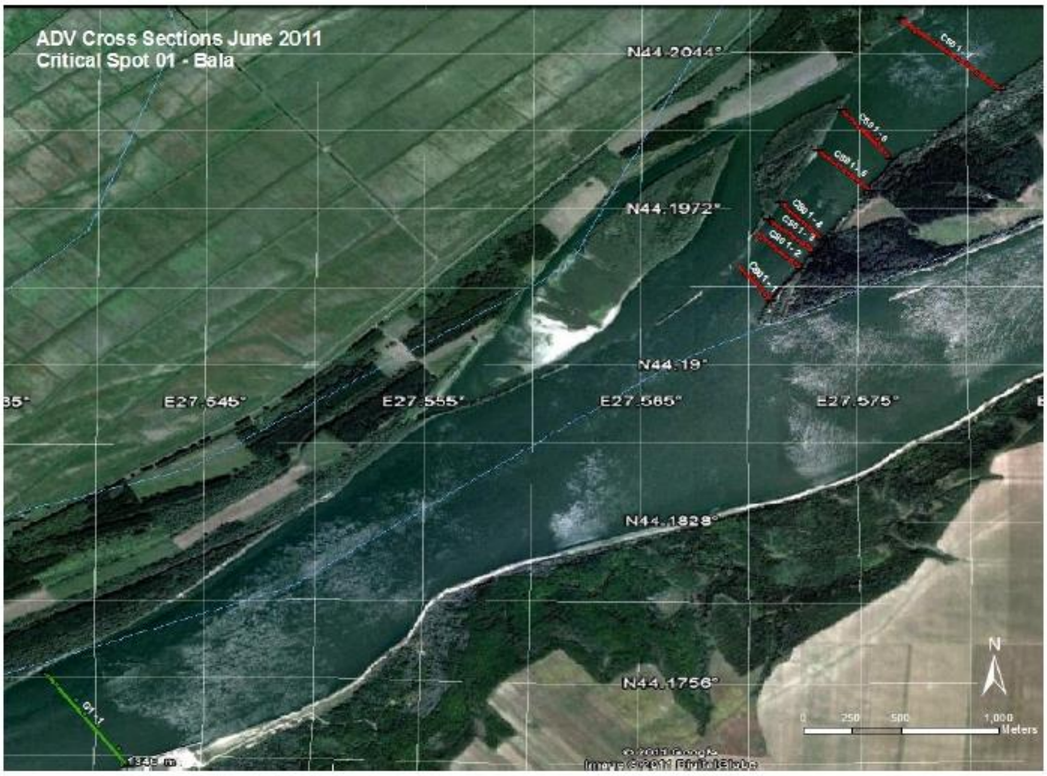


Figure 3.1.D.1.3.3 – The ADV cross sections position –CP 01 Bala and Izvoarele area

The following figures are presented the remaining sections made during the campaign in June 2011.

Figure 3.1.D.1.3.4 - The ADV cross sections position – Unirea area

Figure 3.1.D.1.3.5 - The ADV cross sections position –CP 02 Epuraşu, km 342.7 – 341.8

Figure 3.1.D.1.3.6 - The ADV cross sections position – CP 02 downstream of the Ostrovul Epuraşu

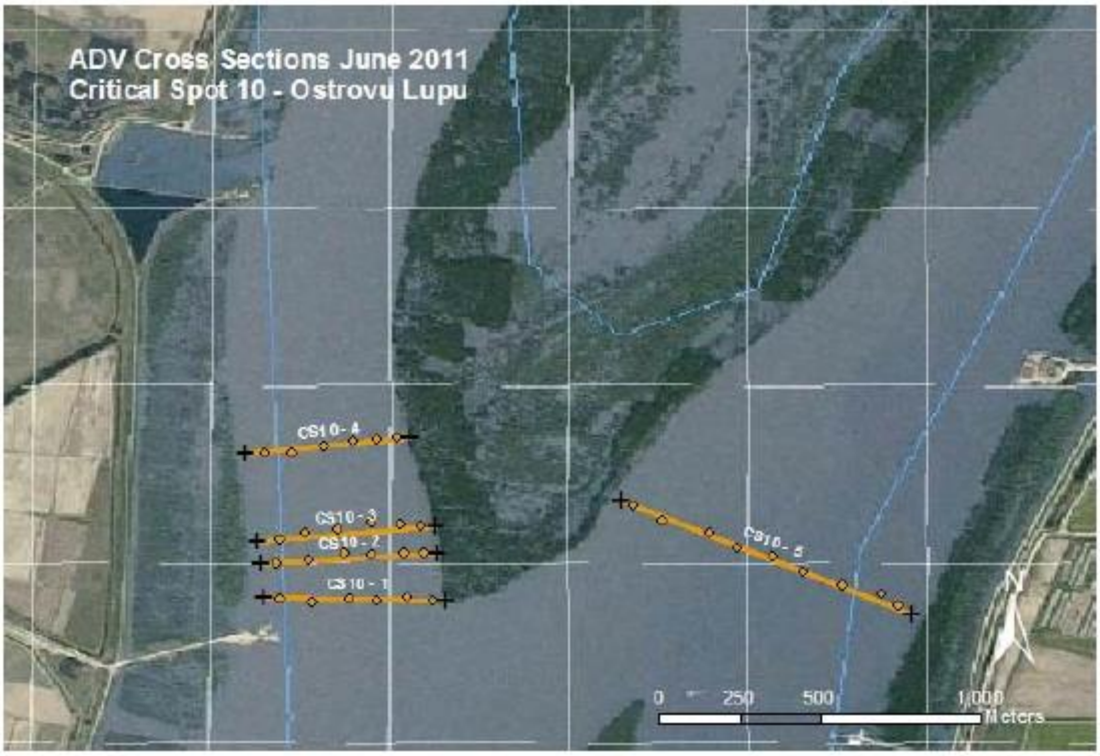


Figure 3.1.D.1.3.7 - The ADV cross sections position – CP 10 km 10 Caleia Branch and km 195.5 Dunube

ADV measurements– preliminary results

In Figures 3.1.D.1.3.8 – 3.1.D.1.3.11 are presented graphically components the components of the resultant total velocity U, namely, the components of the velocity vector on the West (U1), North (U2) and upward (U3) versus time. The red line is the average velocity on each component.

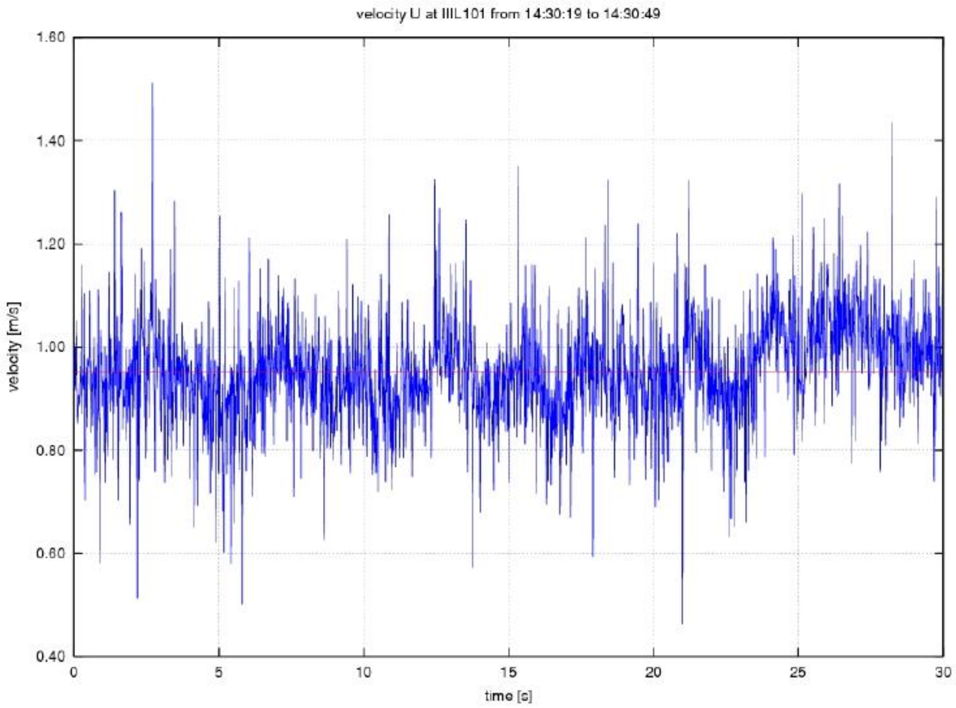


Figure 3.1.D.1.3.8 - The total velocity U in a range of 30 seconds

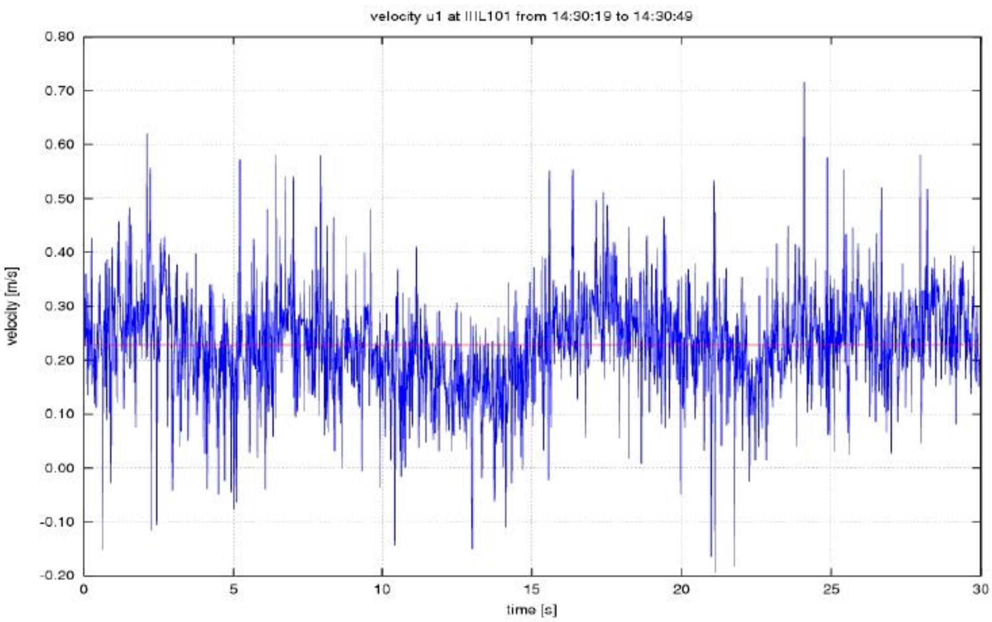


Figure 3.1.D.1.3.9 - U1 component in a range of 30 seconds

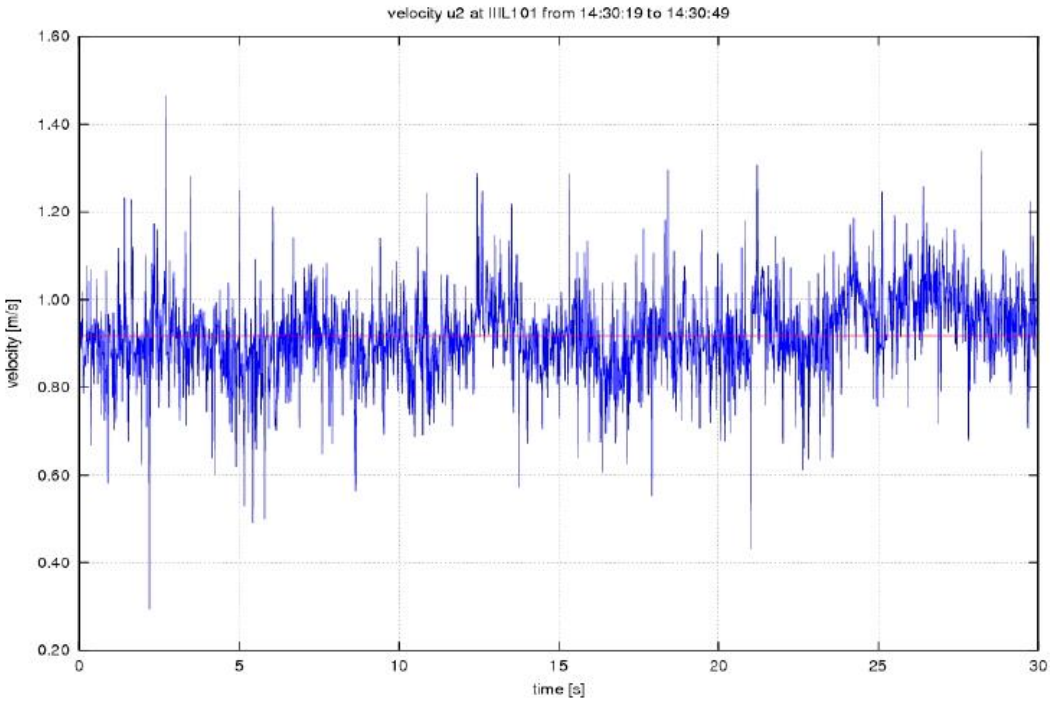


Figure 3.1.D.1.3.10 – U2 component in a range of 30 seconds

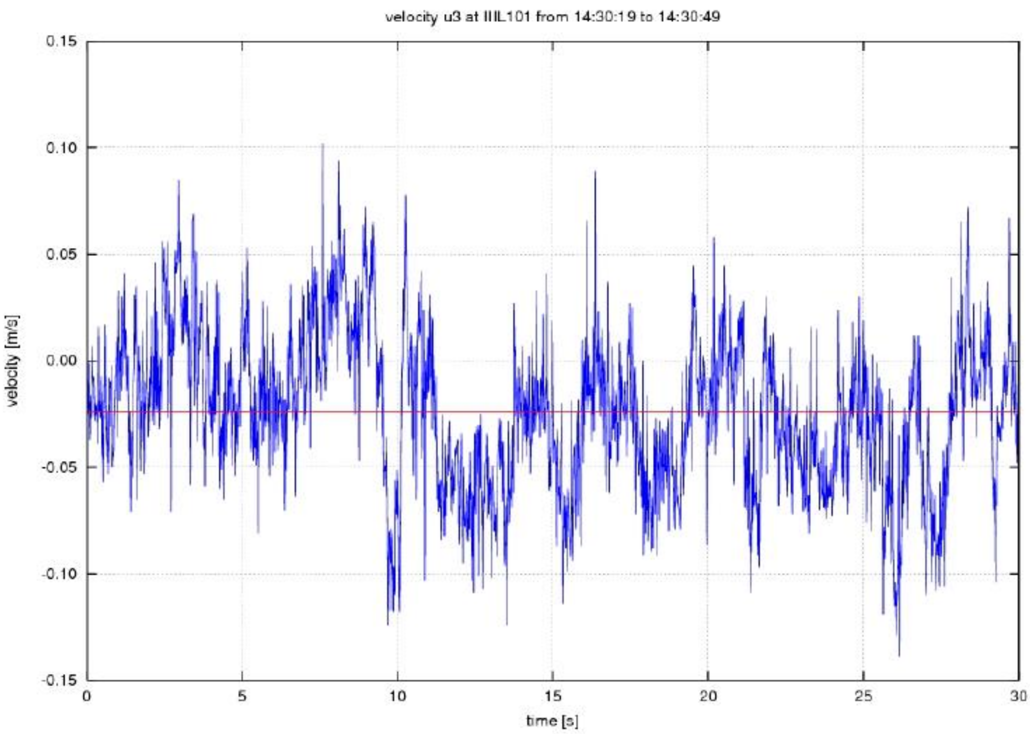


Figure 3.1.D.1.3.11 – U3 component in a range of 30 seconds

The vertical profiles of the velocity components are presented in Figure 3.1.D.1.3.12 and Figure 3.1.D.1.3.13. Can be observed the typical profile, in which the water velocity decreases with increasing depth, the relationship is accelerating with the approach by the riverbed.

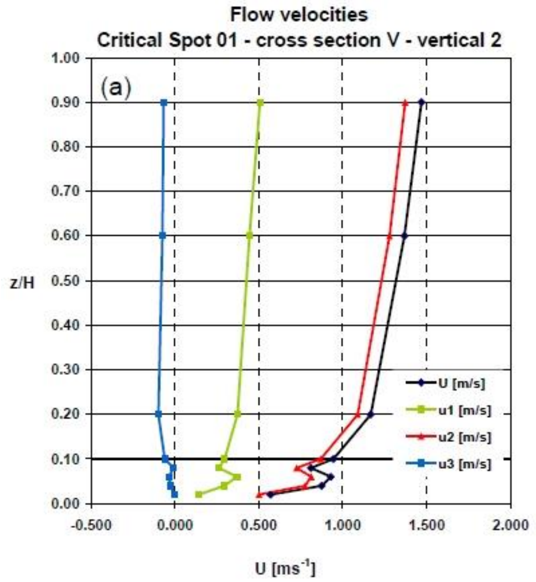


Figure 3.1.D.1.3.12 - Vertical profile of flow velocity in the CP 01

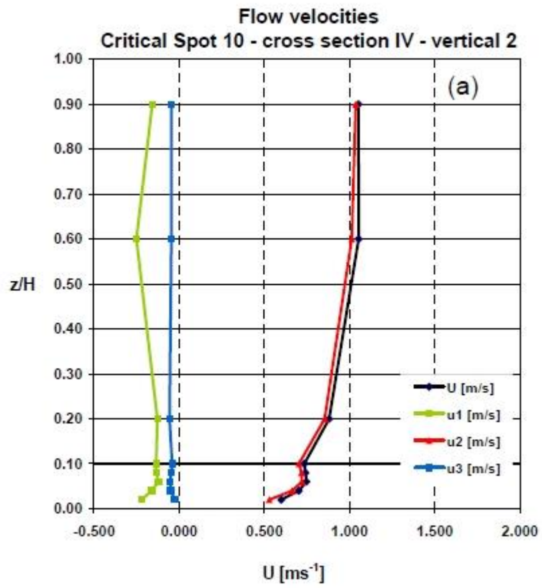


Figure 3.1.D.1.3.13 - Vertical profile of flow velocity in the CP 10

În Figures 3.1.D.1.3.14 – 3.1.D.1.3.18 are shown graphical representations of the velocity values averaged on the water column, for sections that ADV measurements were performed by the BOKU team. In those pictures, are represented as a vector map, flow velocities averaged on the water column (size and direction) overlaid over the morphological map of the Danube thalweg (isolines - M.N.S. absolute levels), obtained from bathymetric measurements using multibeam technology.

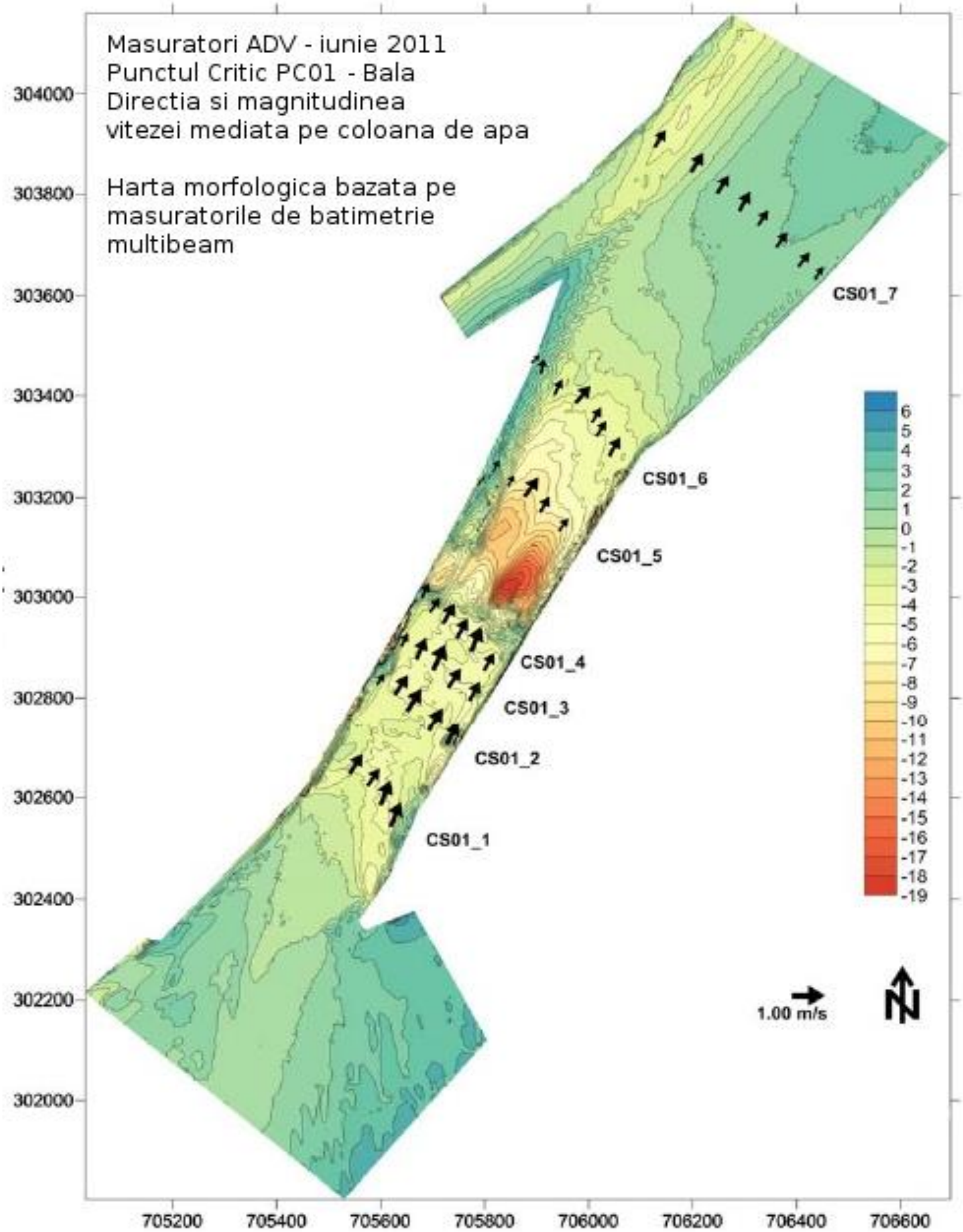


Figure 3.1.D.1.3.14- CP 01 (Bala area) - the velocity values averaged on the water column, for the 7 sections

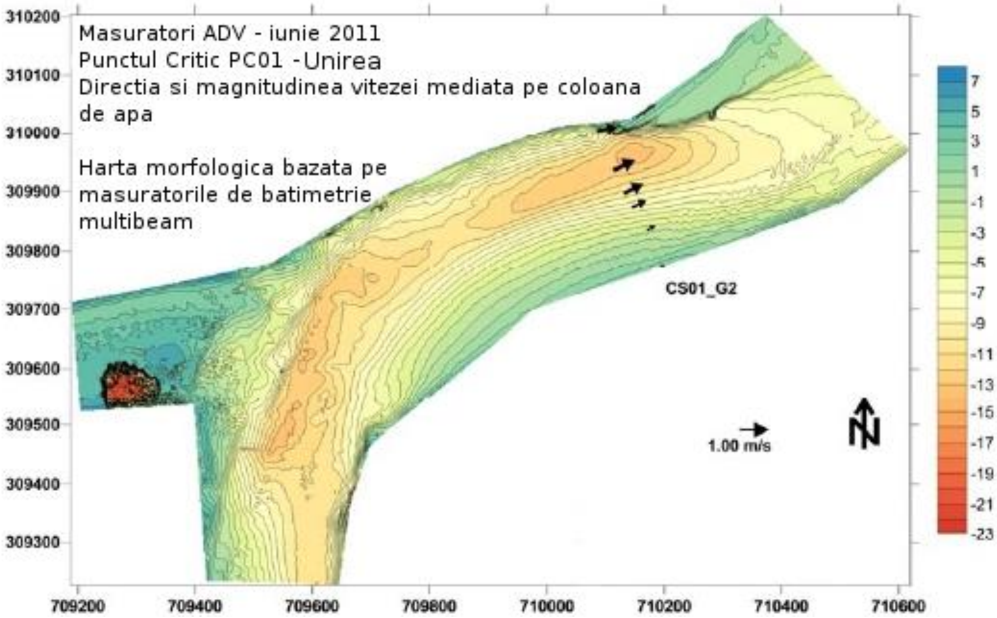


Figure 3.1.D.1.3.15 – CP 01 (Unirea area) - the velocity values averaged on the water column, for 1 section

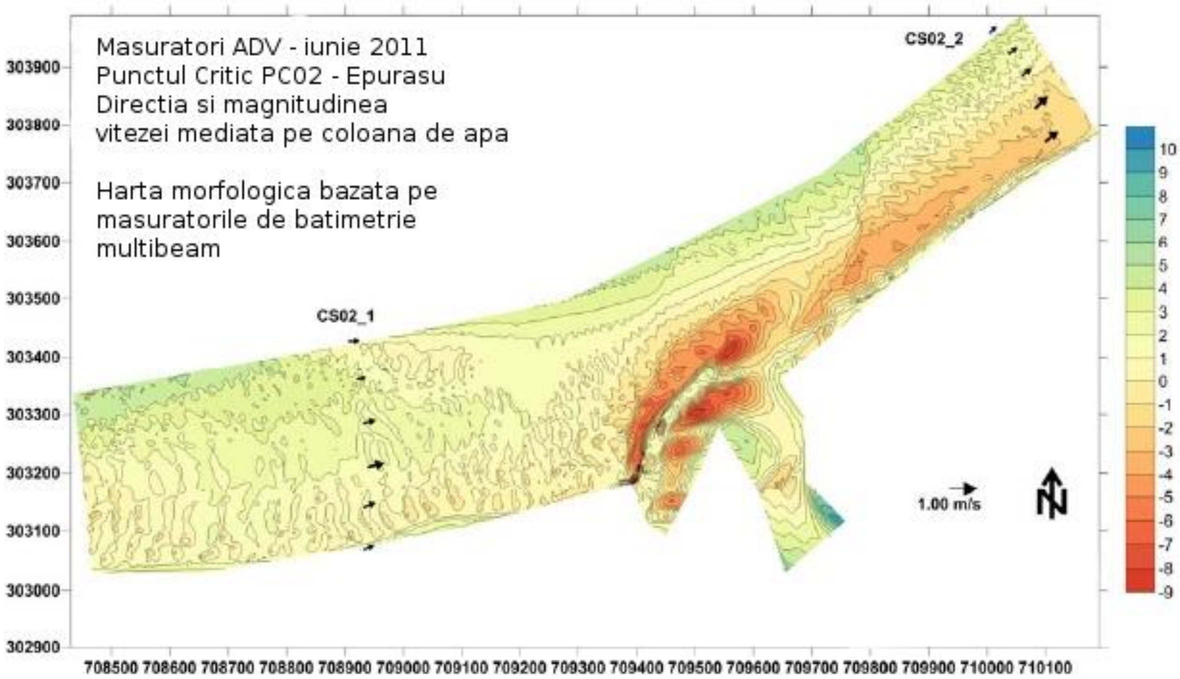


Figure 3.1.D.1.3.16 – CP 02 (beginning area from Epuraşu Branch) - the velocity values averaged on the water column, for 2 sections

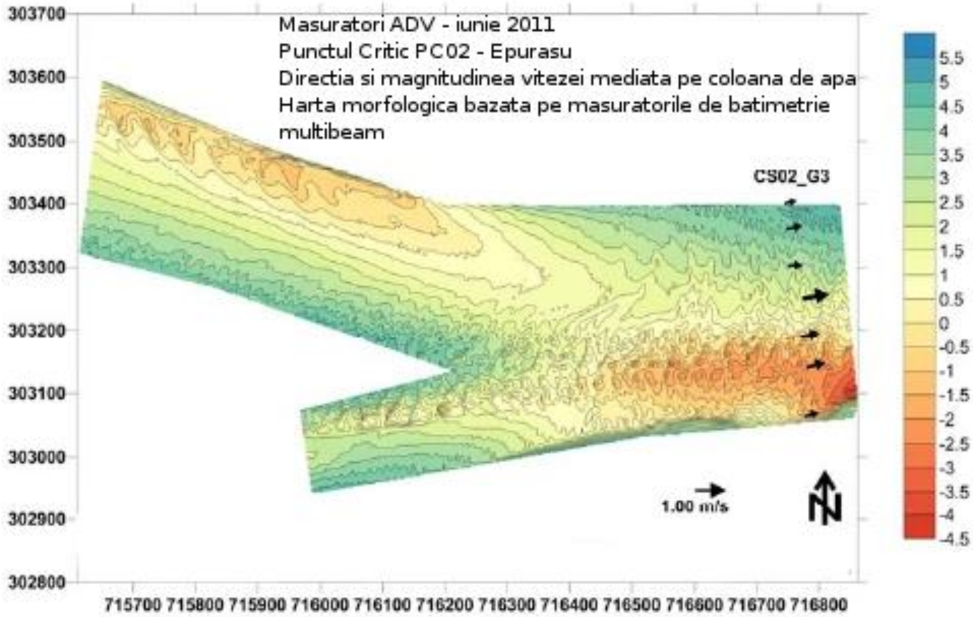


Figure 3.1.D.1.3.17 – CP 02 (ending area from Epuraşu Branch) - the velocity values averaged on the water column, for 1 section

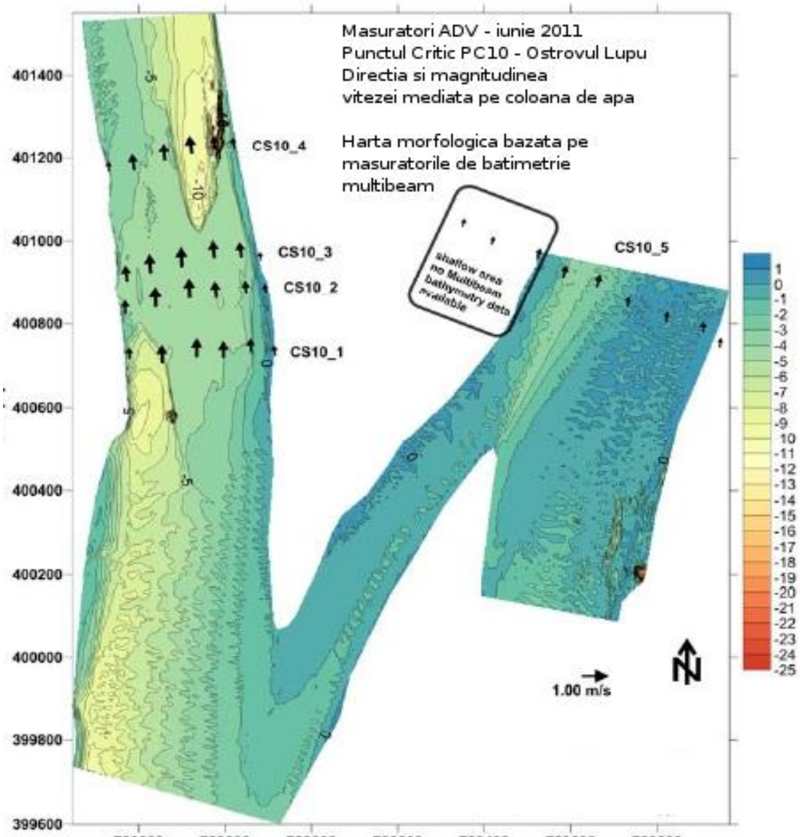


Figure 3.1.D.1.3.18 – CP 10 (Ostrov Lupu area) - the velocity values averaged on the water column, for 5 sections

3.1.D.2. Sediments

Along with pollution associated of the sediments in chemical terms, which is presented in detail in Chapter 3.1.E - Monitoring water quality / sediments, the work carried out during April-August 2011 have pursued characterization of the granulometric composition and mineral composition characterization. There were obtained in this respect the following results:

a) Regarding the granulometric composition, in table 3.1.D.2.1 there are summarized weights of the particle size composition, which results in a differentiation both at the CP level (left bank / right bank) and between the critical points.
   - *(i) The highest weight is for the F_4 fraction (>90 - <500 µm) being of 65.52 %;*
   - *(ii) The F_1 fraction (higher than 2000 µm) it ranks second, respectively 13.7 %;*
   - *(iii) The other factions have relatively similar weights (under 10 %);*
   - *(iv) It is noted the differences in the granulometric composition se remarcă diferenţieri ale compoziţiei granulometrice between the left bank (LB) and right bank (RB), depending on the size fraction considered; Such F1, F2, F3 and F5 are generally higher as weights to the RB as compared to the LB; instead for the F4 fraction the situation is reversed, in terms of percentage, the weight is higher to the LB (approx. 74 %) compared to the RB (about 57 %).*

Table 3.1.D.2.1 - The weights of the granulometric fractions of the sediments

	Critical Point Stalistical Values		% F1 >2000µm	% F2 >1000 - <2000µm	% F3 >500 - <1000µm	% F4 >90 - <500µm	% F5 <90µm
The main critical points	CP 01 MS	ecart	1.6 - 32.5	1.3 - 17.7	0.44 - 12.4	35.1 - 98.5	1.06 - 8.2
		average	12.21	7.28	4.07	71.95	4.5
	CP 01 MD	ecart	1.96 - 24.3	1.39 - 10.28	1.2 - 6.3	50.6 - 91.4	1.94 - 11.5
		average	11.65	5.62	3.95	72.5	6.28
	CP 02 MS	ecart	2.2 - 4.2	2.6 - 3.85	2.1 - 4.8	83.4 - 90.8	2.3 - 5.86
		average	2.97	3.22	3.2	87	3.61
	CP 02 MD	ecart	24.2 - 32.4	7.8 - 13.9	5.7 - 8.9	31.6 - 51.8	5.6 - 21.4
		average	28.1	11.83	7.6	41.1	11.37
	CP 10 MS	ecart	5.1 - 16.9	3.9 - 7.6	3.1 - 4.4	50.8 - 71	9.3 - 20.3
		average	11.57	5.9	3.73	63.3	15.5
	CP 10 MD	ecart	2.1 - 25.4	5.6 - 12.6	4.6 - 6.7	41.5 - 79.9	7 - 16.8
		average	15.7	8.9	5.6	57.3	12.5
Overall average			13.7	7.13	4.69	65.52	8.96

The differences listed briefly above are due to the unequal velocity of the flow water, depending on the banks and the particle size of suspended matter, respectively settling time.

Table 3.1.D.2.2 - The weights of the granulometric fractions of the sediments

Stalistical Values	Bank	% F_1 >2000µm	% F_2 >1000 - <2000µm	% F_3 >500 - <1000µm	% F_4 >90 - <500µm	% F_5 <90µm
Minimum value	MS	1.6 (PC 01)	1.3 (PC 01)	0.44 (PC 01)	35.1 (PC 01)	1.06 (PC 01)
	MD	1.96 (PC 01)	1.39 (PC 01)	1.2 (PC 01)	31.6 (PC 02)	1.94 (PC 01)
Maximum value	MS	32.5 (PC 01)	3.9 (PC 10)	12.4 (PC 01)	98.5 (PC 01)	20.3 (PC 10)
	MD	32.4 (PC 02)	13.9 (PC 02)	8.9 (PC 02)	91.4 (PC 01)	21.4 (PC 02)
Average value	MS	8.58	30.7	3.67	76.81	7.87
	MD	18.49	8.78	5.51	58.17	9.05
average LB/RB		13.4	5.8	4.9	67.4	8.5

For the same critical point, the spreads of % are also differential. Thus, at critical points 01 in terms of grain size have been recorded the following values:

- fraction over 2000µm - 32.5%
- fraction >1000µm – <2000µm - 17.7%
- fraction >500µm – <1000µm - 12.4%
- fraction >90µm – <500µm - 53.1%
- fraction <90µm - 2.3%

b) As regards the characterization of mineral composition, this was achieved by X-ray fluorescence (RX SECVENTIAL – WDXRF - SUPERMINI spectrometer), the data specific to each critical point, being shown in Table 3.1.D.2.3 and Annex 3.1. The following items are drawn from the analysis of those values:

- the main weight is for SiO_2 (mean 63 %), followed by Al_2O_3 (approx. 16 %), CaO (approx. 8.5 %), Fe_2O_3 (4.4 %) and (3.1 %);
- occasionally were recorded and the following oxides NiO, CuO and Ag_2O.

Table 3.1.D.2.3 - The mineral composition of the sediments

Component	Main Critical Points %			Secondary Critical Points %					%	Average composition %	Historical data
	CP 01	CP 02	CP 10	CP 3A	CP 3B	CP 4A	CP 4B	CP 07	Old Danube		
1. Na_2O	1.07	0.828	0.93	1.72	1.82	1.45	1.51	1.42	1.10	1.313	1.21
2. MgO	3.16	2.27	2.21	3.56	3.73	3.38	3.22	3.56	2.73	3.091	2.55
3. Al_2O_3	18.9	19.3	14.7	17.9	15.5	17.0	13.9	14.2	13.9	16.144	15.8
4. SiO_2	58.1	60.7	64.3	62.2	65.0	61.2	62.1	65.3	67.4	62.922	63.0
5. P_2O_5	0.250	0.271	0.302	0.366	0.278	0.341	0.311	0.332	0.314	0.307	0.25
6. SO_3	0.154	0.125	0.197	0.198	0.144	0.304	0.307	0.175	0.254	0.206	-
7. Cl	0.0262	0.0154	0.0132	0.0114	0.0130	0.0120	0.0113	-	0.0148	0.014	-
8. K_2O	2.61	2.57	2.02	2.05	1.81	2.07	1.60	1.46	1.70	1.988	1.91

Component	Main Critical Points %			Secondary Critical Points %					%	Average composition %	Historical data
	CP 01	CP 02	CP 10	CP 3A	CP 3B	CP 4A	CP 4B	CP 07	Old Danube		
9. CaO	8.95	5.96	10.0	6.85	7.36	8.76	11.5	8.36	8.02	8.418	7.24
10. TiO_2	0.751	0.922	0.903	0.784	0.733	0.752	1.23	1.36	0.944	0.931	0.98
11. Cr_2O_3	0.0313	0.0381	-	0.0307	0.0232	0.0309	0.0595	0.0412	-	0.036	-
12. MnO	0.158	0.172	0.101	0.122	0.0926	0.130	0.130	0.118	0.0895	0.124	0.10
13. Fe_2O_3	5.76	6.73	4.26	4.11	3.45	4.57	3.86	3.56	3.45	4.417	5.9
14. NiO	0.0119	0.0175	-	-	-	-	0.0098	-	-	0.013	-
15. ZnO	0.0166	0.0248	0.0097	0.0215	0.0086	0.0167	0.0105	0.0103	-	0.015	-
16. Rb_2O	0.0131	0.0140	0.0086	0.0090	0.0067	0.0088	0.0070	0.0078	0.0056	0.009	-
17. SrO	0.0226	0.0244	0.0275	0.0215	0.0203	0.0214	0.0231	0.0234	0.0239	0.023	-
18. Ag_2O	0.0459	-	-	-	-	0.0406	0.0454	-	-	0.044	-
19. CuO	-	0.0134	-	-	-	0.0087	-	-	-	0.011	-
20. ZrO_2	-	0.0357	0.0763	0.0350	0.0452	-	0.224	0.0588	0.0694	0.078	-

The mineral composition of the sediments depends on the morphology of the hydrographic basin and water movement, these being as effects the continuous erosion of the loess layers and redistribution of the detritus.

It is emphasized that the values determined in 2011 are part of previous data (historical data 1998).

In the Annex are detailed technical elements, respectively spectrums recorded.

3.1.D.3. Suspended matter

- Regarding the monitoring of suspended sediments transported were carried out following specific tasks:
  a) The granulometric characterization of the suspended matter;
  b) The correlation of turbidity data (NTU) quasi-continuously flow, with the suspended matter concentration data (gravimetric determinations in the laboratory);
  c) The measurements of turbidity on five vertical profiles;
  d) The correlation of turbidity values with the granulometry of the resuspendable sediments.
- For the granulometric characterization of the suspended matter were carried out composite samples (about 100 l) obtained in each critical point, obtained by mixing water volumes in equal proportions (LB, RB, CN) and sampled from the different depths (0.5 m, 1.0 m and 1.5 m CN). The composite samples have been left to settle and centrifuged in the laboratory. After these steps,

they were obtained 2-5 g of suspension material (oven-dried at 105^{0}C) which it was sieved according to the procedures applied to the sediments.

From analysis of the values shown in Table 3.1.D.3.1, there are the following observations:

(i) the highest weight (69.1 %) is for 90 - < 500 µm faction while the lowest (10.3 % above 500 µm fraction);

(ii) below 90µm fraction has an average weight of 20.6 %;

(iii) the proportions of the granulometric fractions to suspension vary depending on the critical point, but, they are enroll in the same deviation from the mean values; An exception is the CP 01 where the fractions of more than 500 µm and the one between 90 and 500µm, they have relatively similar weights (42 % and respectively 35 %).

Table 3.1.D.3.1 - Granulometric fractions to the suspended matters

	Critical Points	**%**		
		<90 µm	**90 - <500 µm**	**>500 µm**
Main Critical Points	CP 01	23.0	35.0	42.0
	CP 02	21.4	76.8	1.8
	CP 10	16.5	68.3	15.2
Secondary Critical Points	CP 03A	20.5	78.1	1.4
	CP 03B	18.5	75.8	5.7
	CP 04A	16.8	71.5	11.7
	CP 04B	19.3	69.5	11.2
	CP 07	25.5	72.5	2.0
	Dunărea Veche	24.3	73.8	1.9
	Average	20.6	69.1	10.3

- Related to the calibration in the quasi-continuously flow, in Table 3.1.D.3.2 turbidity values are presented, respectively concentrations of suspensions at the critical points, respectively frequencies stipulated in the technical specification as follows:

  CP 01 – points P_1, P_2, P_4 – weekly

  CP 02 – points P_3, P_5 – monthly

  CP 10 – stations ST_6, ST_7 şi ST_8 – monthly

  CP 03A, 03B, 04A, 04B and 09 twice between April-August 2011.

From the calculation of the ratio between: the concentration of suspension and related turbidity values, it is obtained a coefficient (slope) of approx. 0.8 with a more pronounced dispersion for the domain 0-30 mg/l suspensions.

Table 3.1.D.3.2 - Turbidity calibration (NTU) = ƒ(conc. Suspended matter -mg/l)

weekly	CP 01					
	P_1		P_2		P_4	
	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]
S_1	22.4	15.0	33.6	26.9	32.3	25.0
S_2	25.6	18.0	3.3	24.1	31.8	24.8
S_3	24.8	17.4	30.4	23.4	33.2	25.6
S_4	22.5	15.2	34.5	28.0	35.0	28.0
S_5	25.4	17.0	31.7	25.2	32.0	24.6
S_6	27.3	19.1	32.3	25.8	33.3	25.7
S_7	22.3	15.0	31.2	24.8	30.8	23.7
S_8	24.4	16.8	35.0	28.0	34.0	26.2
S_9	26.0	17.2	34.3	27.8	35.0	28.0
S_{10}	23.8	19.0	32.5	26.1	33.3	25.7
S_{11}	25.5	17.1	31.5	25.3	32.0	24.5
S_{12}	28.0	19.3	28.0	19.6	30.0	24.0
S_{13}	28.6	22.0	29.5	22.7	28.5	22.0
S_{14}	27.3	20.5	32.3	24.9	32.0	24.6
S_{15}	22.3	17.8	31.8	25.7	34.0	26.0
S_{16}	25.5	19.1	30.5	23.5	30.0	25.0
S_{17}	24.0	18.7	35.0	28.0	32.0	25.1

MONTH	CP 02				CP 10					
	P_3		P_5		ST_6		ST_7		ST_8	
	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]
1	31.4	25.1	27.3	24.0	25.8	20.1	40.8	35.9	45.0	40.0
2	41.7	36.3	42.8	34.2	30.5	23.5	37.0	31.4	27.7	24.4
3	39.4	31.5	23.8	20.2	32.8	25.3	30.3	26.4	32.9	29.3
4	31.2	23.4	32.5	27.6	31.8	24.8	26.6	21.3	28.0	22.4

CP 3A		CP 3B		CP 4A		CP 4B		CP 09*	
Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]	Turb. [NTU]	MatS [mg/l]
35.4	28.3	28.7	21.5	25.0	20.0	30.0	23.4	33.2	28.0
33.6	27.6	34.0	26.5	31.5	25.8	32.0	26.2	35.4	29.0

NOTE: MatS = suspended matter

- Regarding sampling of more points and depths, concomitantly with measuring velocities, in Table 3.1.D.3.3 are presented the turbidities determined on five vertical profiles, at depths of 0.2h, 0.6h and 0.8h around Epuraşu Branch.

Table 3.1.D.3.3 - Spectrum of turbidity values measured on five profiles and at different depths

Profile	0.2 h	0.6 h	0.8 h
	NTU		
P_1	27.3	31.4	34.6
P_2	23.8	41.7	31.2
P_3	22.3	37.3	32.0
P_4	24.8	42.8	31.6
P_5	33.6	38.2	31.3
Average	26.4	38.3	32.1

Analyzing the average values appears that to the shallow depths (0.2 h) were recorded the lowest turbidities, while to the average depths (0.6 h) are noted the highest turbidity values, the values decreasing to the depth (0.8 h).

- Regarding the correlation between turbidity values and the sediments granulometry, it is specified the following:
  - the correlation between turbidity and the suspended matter concentrations without be considered the particle size (the granulometry), it is linear type with a slope $DT / DC_S \approx 0.8$ but with a high dispersion of the points mostly on the range C_S 10-40 mg/l; the explanation is derived from the analysis of the correlation Rayleigh relationship between the scattered light (nephelometric turbidity measurements) and the concentration of the suspended matter:

$$I_d = I_0 K \frac{NV^2}{\lambda^4} \qquad (3.1)$$

where: I_d = the luminous intensity of the dispersed beam
K = constant
λ = wavelength
N = the number of the total particles
V = the number of the total particles

From equation (3.1) it is follows that turbidity is dependent on both the number of particles as well as volume. Consequently, the samples with the same concentration of the suspended matter, based on the volume (their granulation) the parameter T will be different. Also, from the same relationship it is follows that the water samples with suspended matter having similar granulation can be established linear correlation curves T = *f* (CS), which up to a certain threshold are linear.

To elucidate this issue in Figures 3.1.D.3.1 and 3.1.D.3.2 are represented calibration curves, conducted at CP 01, separately LB and RB (depth 0.5m) compared to CN (depth 3.0 m). There is a lower dispersion of the points, although the range of the concentrations C_S (Tables 3.1.D.3.5 and 3.1.D.3.6) are between 14.8 mg/l and 76.8 mg/l.

At the same time it is noted that as opposed to LB and RB at CN the suspended matter concentrations are substantially higher. Also, it is found that the slopes of the curve T = *f* (C_S) to CN (3.0m) have a value of 0.93 compared to approximately 0.36 when the determinations are carried out at the banks. However, an average of the two slopes is approx. 0.64, value close to that determined to the composite sample.

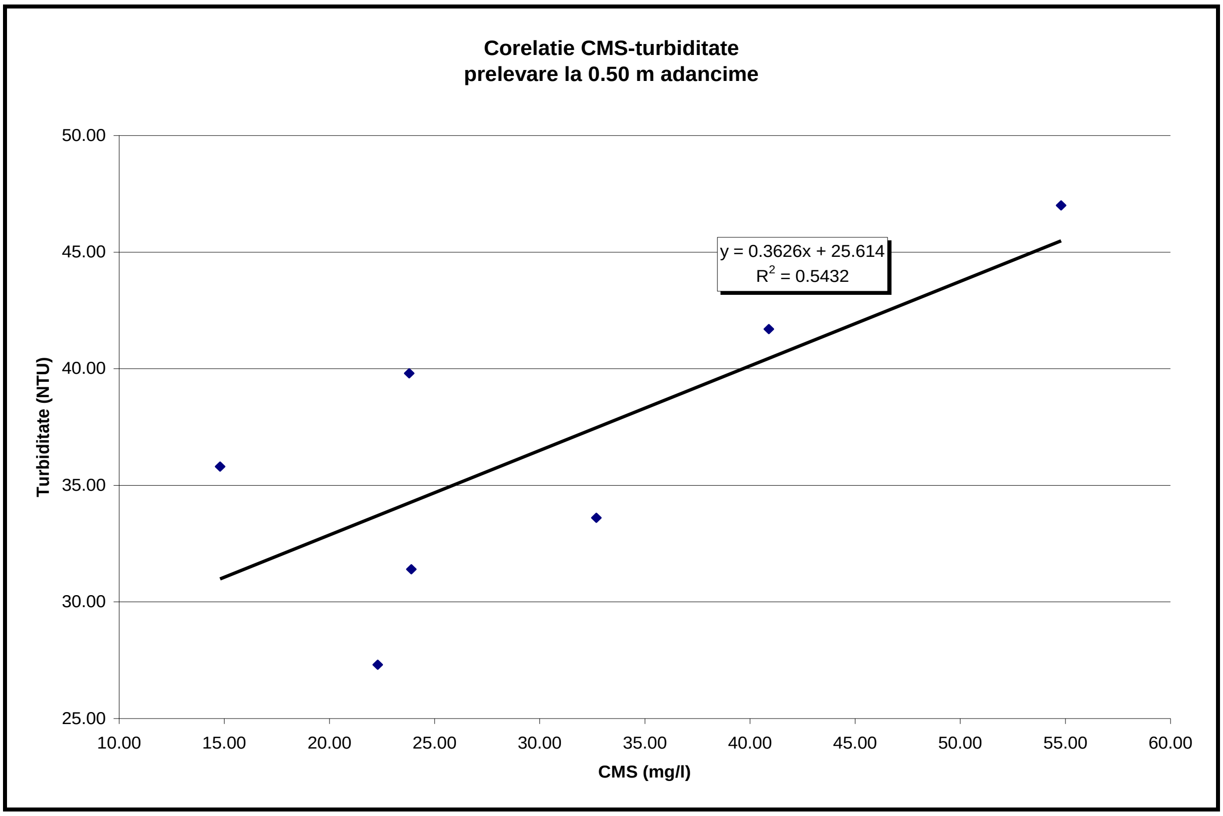


Figure 3.1.D.3.1 - The correlation between concentration of the suspended matter and the turbidity in CP 01 (0,5 m)

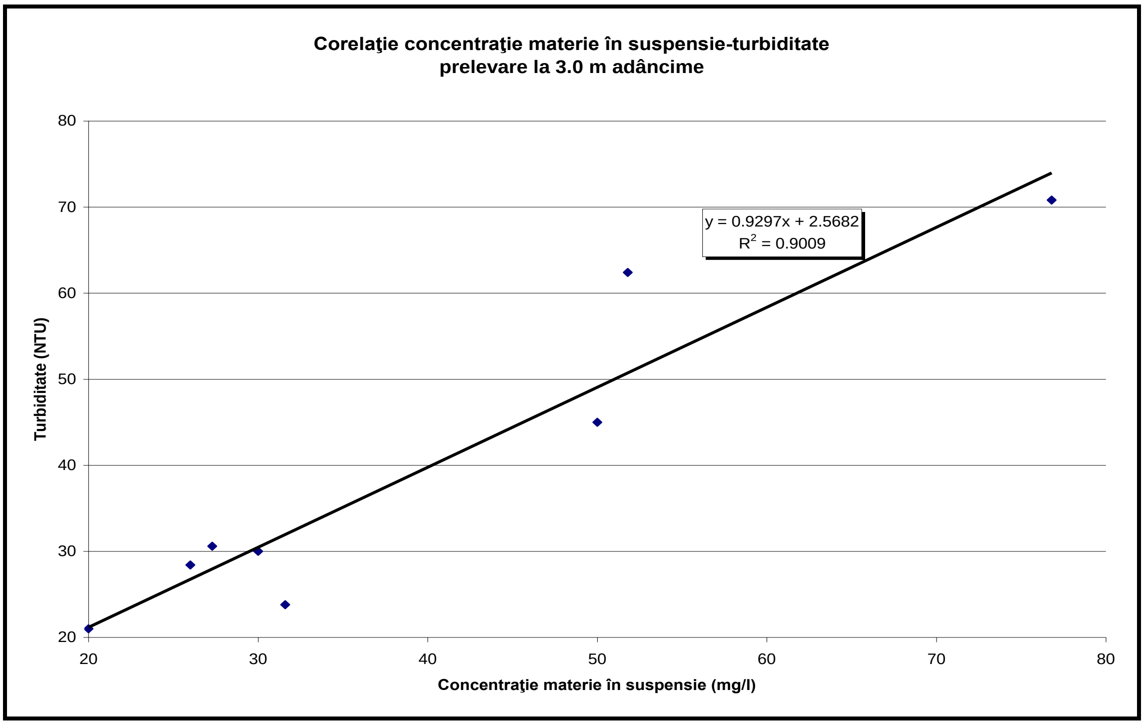


Figure 3.1.D.3.2 - The correlation between concentration of the suspended matter and the turbidity in CP 01 (3 m)

Table 3.1.D.3.4 - Correlation between suspended matter (gravimetric determinations in laboratory) and the turbidity (field measurements - banks)

CP 01	Turbidity (NTU)	Suspended matter (mg/l)
MS 0.5	35.8	14.8
MD 0.5	38.9	23.8
MS 0.5	47.0	54.8
MD 0.5	41.7	40.9
MS 0.5	31.4	23.9
MD 0.5	27.3	22.3
MS 0.5	33.6	32.7

NOTE: MS – left bank
MD – right bank
0.5 – depth from where the water sample was collected, which were determined the turbidity and the suspended matter concentrations

Table 3.1.D.3.5 - Correlation between suspended matter (gravimetric determinations in laboratory) and the turbidity (field measurements - center river)

CP 01	Turbidity (NTU)	Suspended matter (mg/l)
CN 3.0	70.8	76.8
CN 3.0	62.4	51.8
CN 3.0	45.0	50.0
CN 3.0	28.4	26.0
CN 3.0	30.6	27.3
CN 3.0	23.8	31.6
CN 3.0	21.0	20.0
CN 3.0	30.0	30.0

NOTE: CN – center (river)
3,0 – 3.0 depth from where the water sample was collected, which were measured the turbidity and the suspended matter concentrations

For more accurate assessments of the correlation T = *f* (CS) (in statistical terms), based on data obtained from CP 01, CP 02, CP 07, CP 10 and CP 09 were selected and calculated following specific values (Table 3.1.D.3.6):

(i) the arithmetic average for all locations at CN (center) and the banks at the same values C_S (conc. suspended matter)

(ii) the arithmetic average on all locations (CN, banks) at the same values of C_S.

Table 3.1.D.3.6 - Specific values of the turbidity

No.	Turbidity [NTU]			The concentration of suspended matters C_S (mg/l)
	The arithmetic average for all locations at the same conc. C_S	The arithmetic average for all locations at CN for the same conc. C_S	The arithmetic average for banks all locations at the same conc. C_S	
1.	25.4	25.4	28.6	17
2.	32.3	32.2	32.45	25
3.	34.4	33.0	36.6	30
4.	31.7	29.4	35.05	28
5.	30.5	30.1	31.0	26
6.	25.9	25.6	26.4	20
7.	28.0	25.3	32.05	22
8.	33.2	34.5	31.35	28
9.	30.6	32.17	28.15	24
10.	33.1	29.27	38.9	29
11.	34.7	33.6	36.35	31
12.	65.0	-	-	72
Average	33.73	30.05	32.47	29.33

Analyzing the graphs shown in Fig. 3.1.D.3.3 - 3.1.D.3.5, there are the following observations:

- the turbidity corresponding to the conditions (ii), correlated with the C_S, shows a regression coefficient of R^2 = 0.9278, the slope being of approx. 0.71, value very close to the data in the specialty literature;
- for the mean values of the turbidity from the (according to (i)), the dispersion is higher, R^2 being 0.6734, but but with a slope substantially similar to that obtained by (ii), respectively 0.73;
- in the case of turbidity at the center (river), the dispersion is high (R2 = 0.50) with a slope of approx. 0.57.

To establish more precise the logarithm of the correlation between the turbidity (T) and the suspended matter concentration (CMS) have been tested the following functions:

(i) the logarithmic correlation T = f(CMS) for which it was obtained the equation y = 15.437/n – 22.144, with a regression coefficient R^2 = 0.5983

(ii) the power type correlation by the ecuation y = 2.029 x 0.7547, characterized by a regression coefficient of R^2 = 0.7001

(iii) linear type correlations, where, for the range 0-90 mg/l suspended matter the ecuation is of the type y= 0.4705 + 13.031 with R^2 = 0.5284.

It is specified that the characterization of the correlation functions were used the average concentration of the suspended (Figures 3.1.D.3.7 – 3.1.D.3.8).

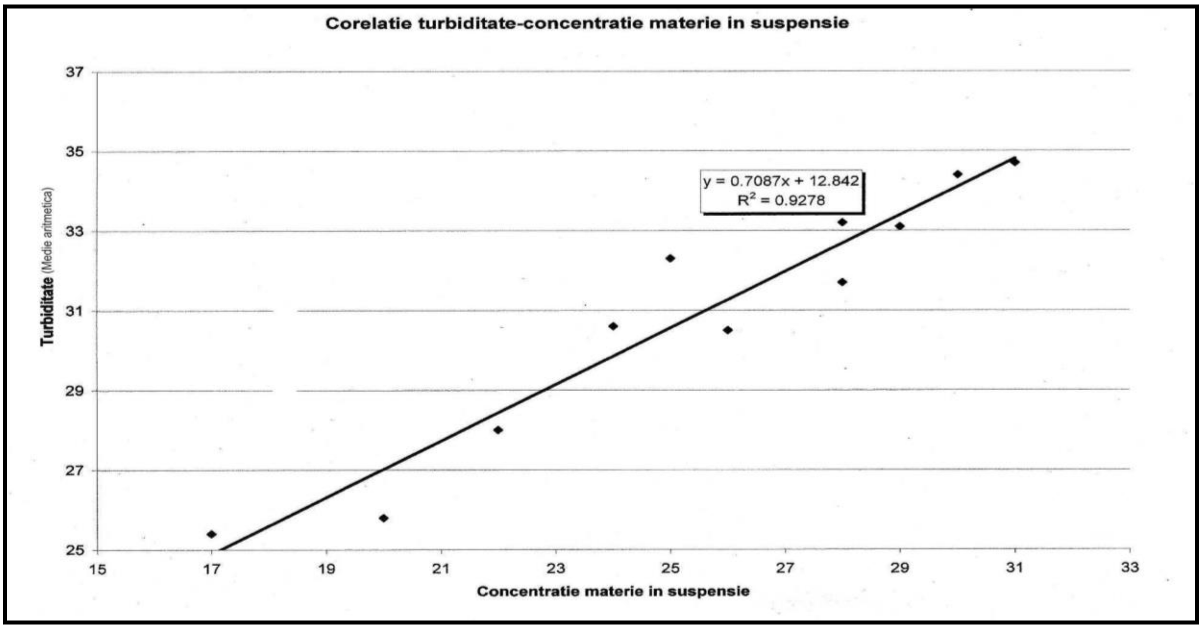


Figure 3.1.D.3.3

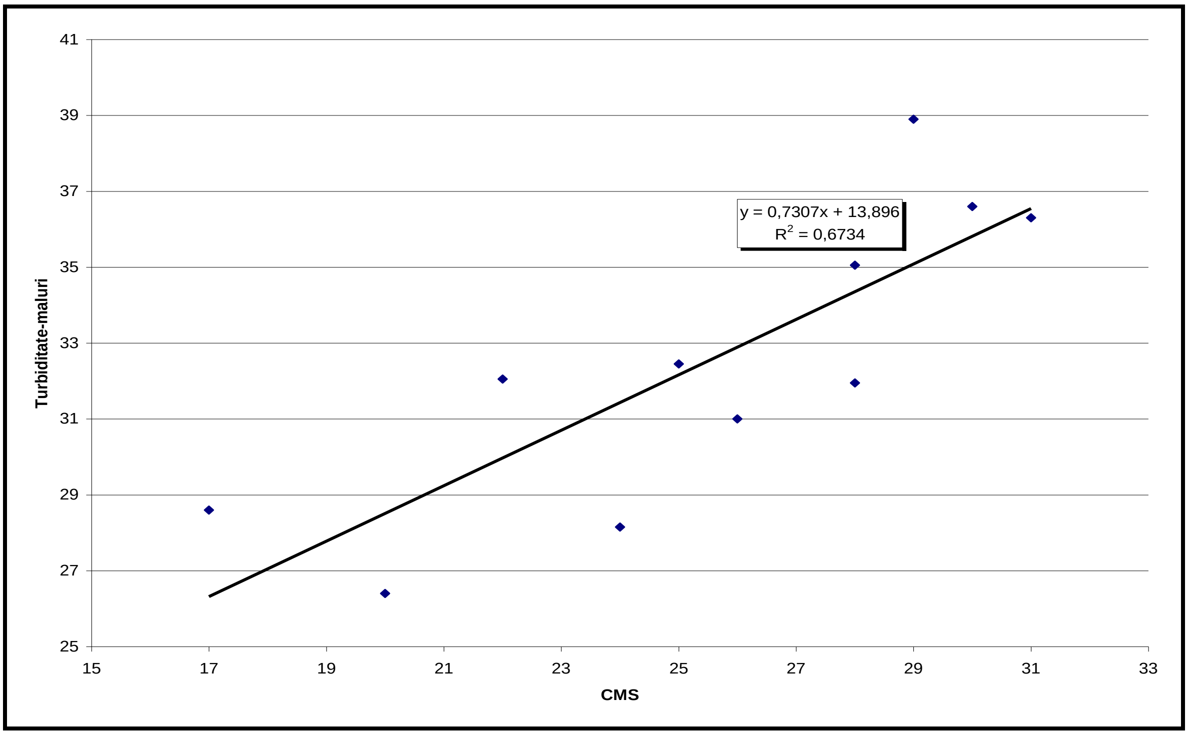


Figure 3.1.D.3.4

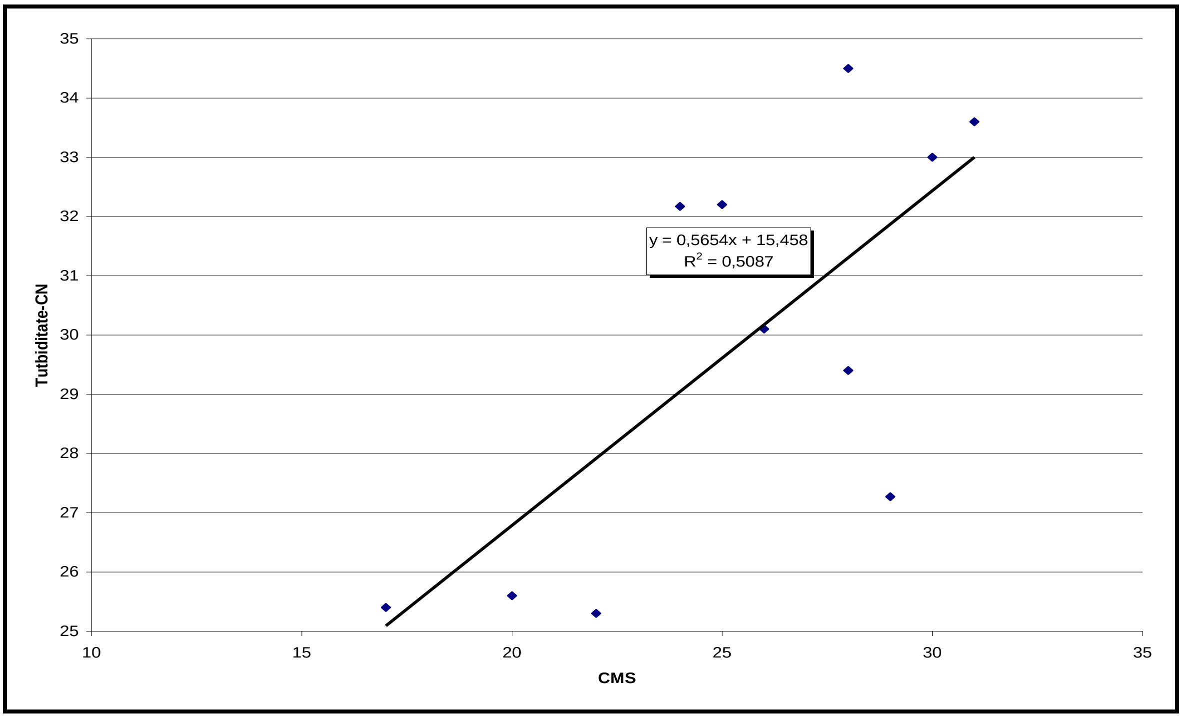


Figure 3.1.D.3.5

It should be noted that if are made calibration curves by using the resuspensioned sediments with the same particles size, diluted with filtered water from Danube, they are obtained linear functions T = *f* (C_S) on the range 0 – 1000 mg/l, with a much lower dispersion of the points (figure 3.1.D.3.6) the slopes of the curves increasing with decreasing of the particles size of the suspended matter (Table 3.1.D.3.7).

Table 3.1.D.3.7 - Correlations between the suspended matter concentrations and the turbidity at the different granulations of the suspended matter

Suspended matter concentrations (mg/l)	Turbidity NTU		
	Fraction <90 µm	Fraction 90 - <500 µm	Fraction >500 µm - <1000 µm
filtered water from Danube	2	1	1
7.81	-	5	2
9.37	4	2	1.8
10	5	3	2
15.62	-	6	4
18.75	8	4	3
23.43	-	10	7
31.25	-	11	8
37.5	14	10	5
50	16	-	-
62.5	19	20	11
75	28	12	11
93.75	-	26	15
100	35	25	14
125	45	30	18
250	90	55	35
375	-	109	38
500	190	123	48
1000	360	-	-

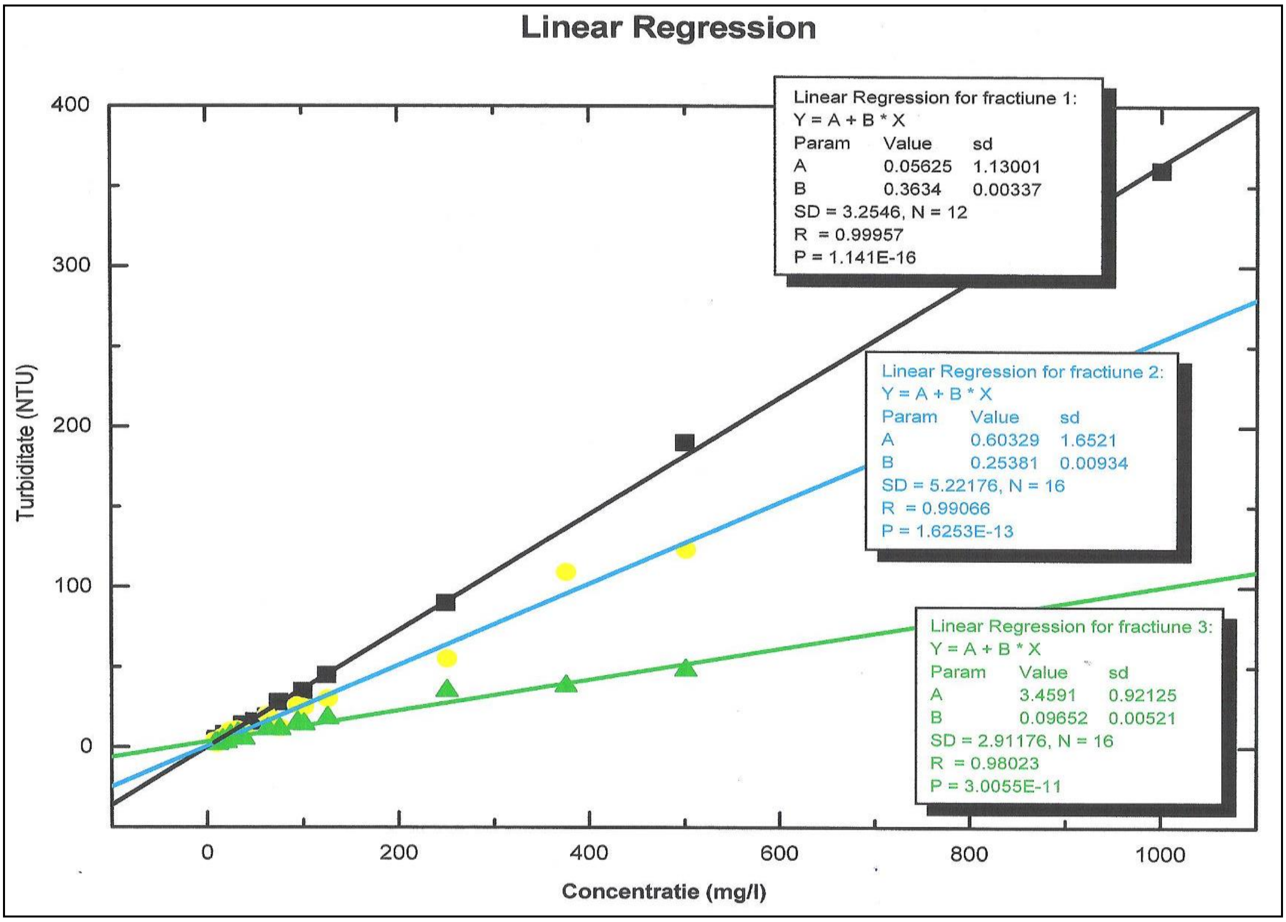


Figure 3.1.D.3.6

To all the above following the conclusive results regarding turbidity sensor calibration:

(i) between turbidity and suspended matter concentration is a linear correlation with a detection limit approx. 10 mg/l and an average slope of 0.78 (ΔC_S / ΔTurb.) for the range of up to 60 mg/l;

(ii) for a higher difference of the suspended matter concentrations, the most appropriate correlation is power type;

(iii) because the turbidity is dependent on the suspended matter volume, it is indicated that, in terms of calibration data, they be carried out differently from the banks (LB and RB) compared to the river (CN);

(iv) whereas granulometric distribution of the suspension matter is dependent on water depth, for more accurate results correlation $T = f\ (C_S)$ is required to establish at 3 depths (0.5 m, 1.5 m and 3.0 m).

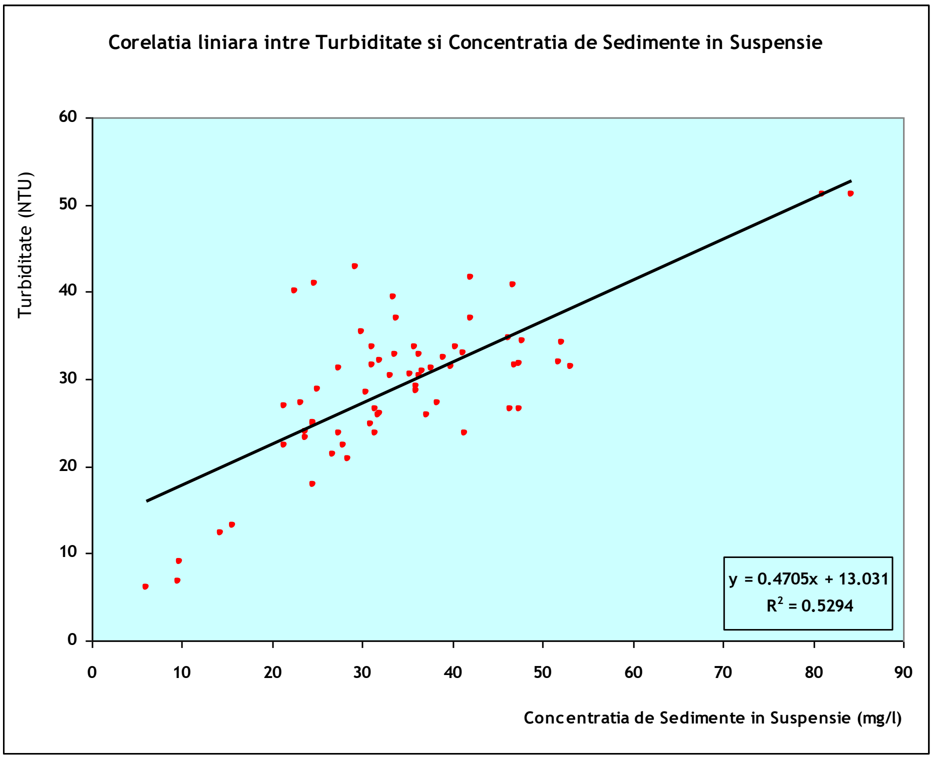


Figure 3.1.D.3.7

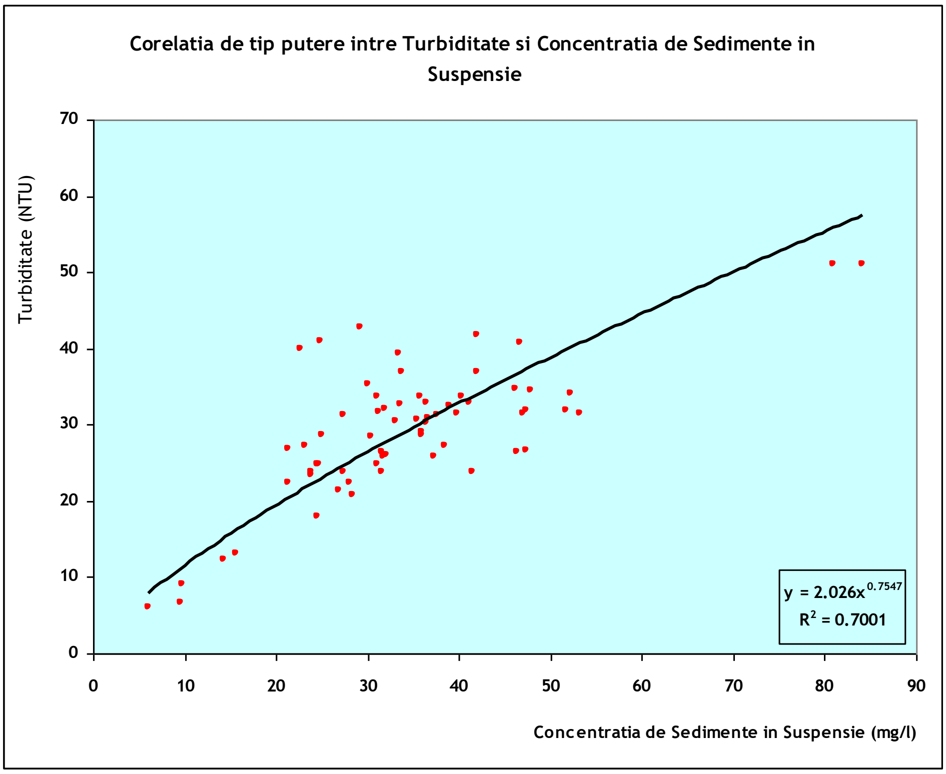


Figure 3.1.D.3.8

3.1.D.4. The assessing and monitoring the flow of the dragged sediments

Generally, transportation of the dragged sediments (G) represents 10-35% the transit of the silt in suspension (R).

For the Danube is characteristic that dragged alluvial flows are low, ranging between 0-40 kg/s and on average represents about 5 % of all alluvial transport.

But above percentage is dependent upon: (i) flow rate and (ii) the nature of the dragged silt which differ depending on the location of the monitoring station. Thus, for the lower Danube are prevalent the large - medium and medium sands (riverbed located in the superficial layer of 20 – 30 cm).

According to data from the specialty literature for the investigation area dragged silt flows have values ranging between 1-3 % of the total quantity of silt.

The Figure 3.1.D.4.1 represents the correlation between dragged flow coefficient of the suspended matter and the water flow for an average of 5 % to approx. 8000 m^3/s.

To assess the dragged sediment flow at Critical-Points level, there were taken water samples at the interface between the water level and bed level with a sampler which provides harvest a volume of 3.0 liters of water, fitted with valves that act depending to followed depth. From the gravimetric determination of the concentration for suspended matters dragged from the riverbed, the dragged sediments flow rate was determined (KT/year or kg/sec) respectively % of this flow compared to overall load of suspended matters from the same monitored sections and the same date.

From the analysis of data presented in Tables 3.1.D.4.1 and 3.1.D.4.2 the following observations can be drawn:

(i) the average percentage of the dragged sediment flow compared to the one corresponding mass loading of the suspension is in the range 1.33 % - 2.05 % with an average of 1.82 %, values which falls within the ones presented in the literature;

(ii) distribution at Critical-Points level reflects basically a similarity for the of dragged sediment flow at CP 01 and CP 10 (average approx. 2 %) but lower for CP 02 (1.33 %).

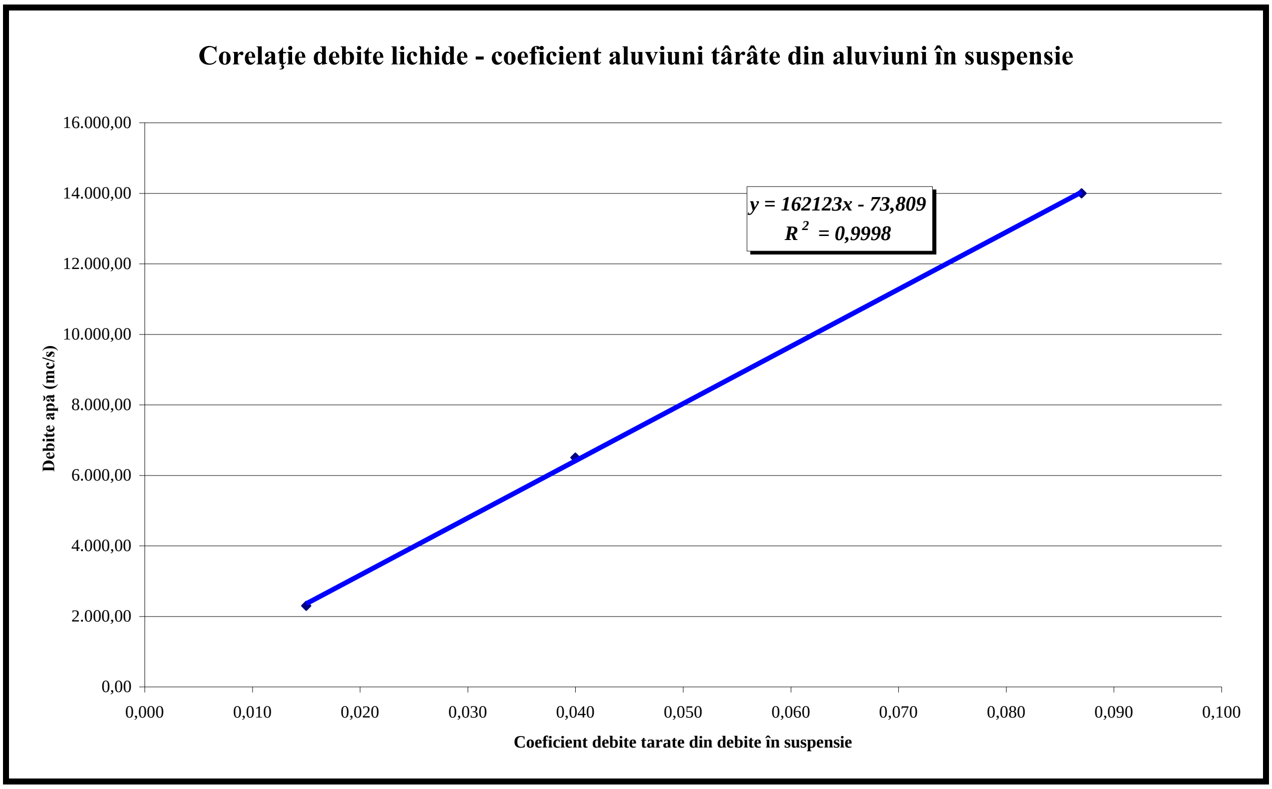


Figure 3.1.D.4.1

Table 3.1.D.4.1 - Basic data for the pre-construction phase to assessing and monitoring of the dragged sediments flow

Critical Point	Km	Section	S H	Flow rate m^3/s	Susspended matter mg/l avarege value	Loading KT/an	Conc. dragged sediments mg/l	Dragged sediments flow KT/an	Dragged sediments flow Kg/s	% Dragged sediments flow toward loading of the suspensions
CP 01	347	Izvoarele	Izvoarele	4510	27.9	4029.4	0.85	109	3.45	2.7
CP 01	Canal Bala (km.0+500)	Bala	Bala	2990	28.3	2707.7	0.57	54.2	1.72	2.0
CP 01	345	-	Cernavodă	1360	35.7	1553.7	0.36	15.5	0.49	1.0
CP 01		-	Vlădeni	3380	36.6	3963	0.92	99.1	3.14	2.5
CP 02	333	-	Putin	3100	30.1	2986	0.63	62.7	1.99	2.1
CP 02	341	-	Cernavodă	1360	39.1	1700	0.39	17	0.54	1.0
CP 02	500 m aval prag Epuraşu	-	Cernavodă Putin	1055	30.1	1015.5	0.27	9.2	0.29	0.9
CP 10	8+500	-	Gropeni parţial	3030	33.6	3258	0.7	65.2	1.98	2.0
CP 10	194+500	-	Palaia + Putin	1260	36.7	1480	0.37	14.8	0.47	1.0
CP 10	186	-	Gropeni + Balaia	4380	36.5	5118.6	1.1	153.6	4.87	3.0
AVERAGE				2642	33.5	2781.4	0.62	60.03	1.90	1.82

Table 3.1.D.4.2 - Primary statistical values of the dragged sediments flow at the primary CPs preconstruction phase (reference state)

Critical Point	Water flow m^3/s	Suspended matter mg/l ecart	Dragged sediments ecart mg/l	Dragged sediments flow average Kg/s	% average toward loading of the suspensions
CP 01	1360-4510	27.9-36.6	0.36-0.92	2.2	2.05
CP 02	1055-3100	30.1-39.1	0.27-0.63	0.94	1.33
CP 10	1260-4380	33.6-36.7	0.37-1.1	20.44	2.00
Average tab.3.1.D.4.1.	2642	33.5	0.62	1.90	1.82

Based on the monitored parameters, listed in the Table 3.1.D.4.1 were characterized following correlation functions (analytical modeling) in the studied section:

(i) $L_i^{Tot} = f(Q_i)$

(ii) $L_i^{dragged} = f(Q_i)$

(iii) $C_{dragged} = f(Q_i)$

where: L_i^{Tot} – is the mass flow associate of suspended matter

$L_i^{dragged}$ – The dragged sediments flow

$C_{dragged}$ – the dragged sediments concentration

Q_i - water flow

From interpretation of the graphs shown in Figures 3.1.D.4.2. – 3.1.D.4.4 were resulted the following specific issues of the dragged sediments:

- For CP 01, CP 02 and CP 10 where water flow was, in April-August 2011, between 1055 m^3/s (minimum CP 02) – 4510 m^3/s (maximum CP 01), the correlation function (i) has a regression coefficient of R^2 = 0.9215 with the provision that for the assessment of the mass loading associated of the suspended matter were used average values of concentrations at the CP level;
- The dragged sediment flow increases linearly with the water flow (the range 1000 – 4500 m^3/s), the regression coefficient being of 0.8999; while the slope coefficient for the range of the recorded flow rates, it is falls in the literature data;
- the suspended matter concentration of the dragged sediments flow, increased linearly with the water flow, the correlation having a regression coefficient of R^2 = 0.8769, but the slope is much less than that one specific of the suspended matter from the water mass; this derives from the fact that in the sediments dragged, as it was mentioned above, are prevailing medium and fine grained sands harder entrained in the water current.

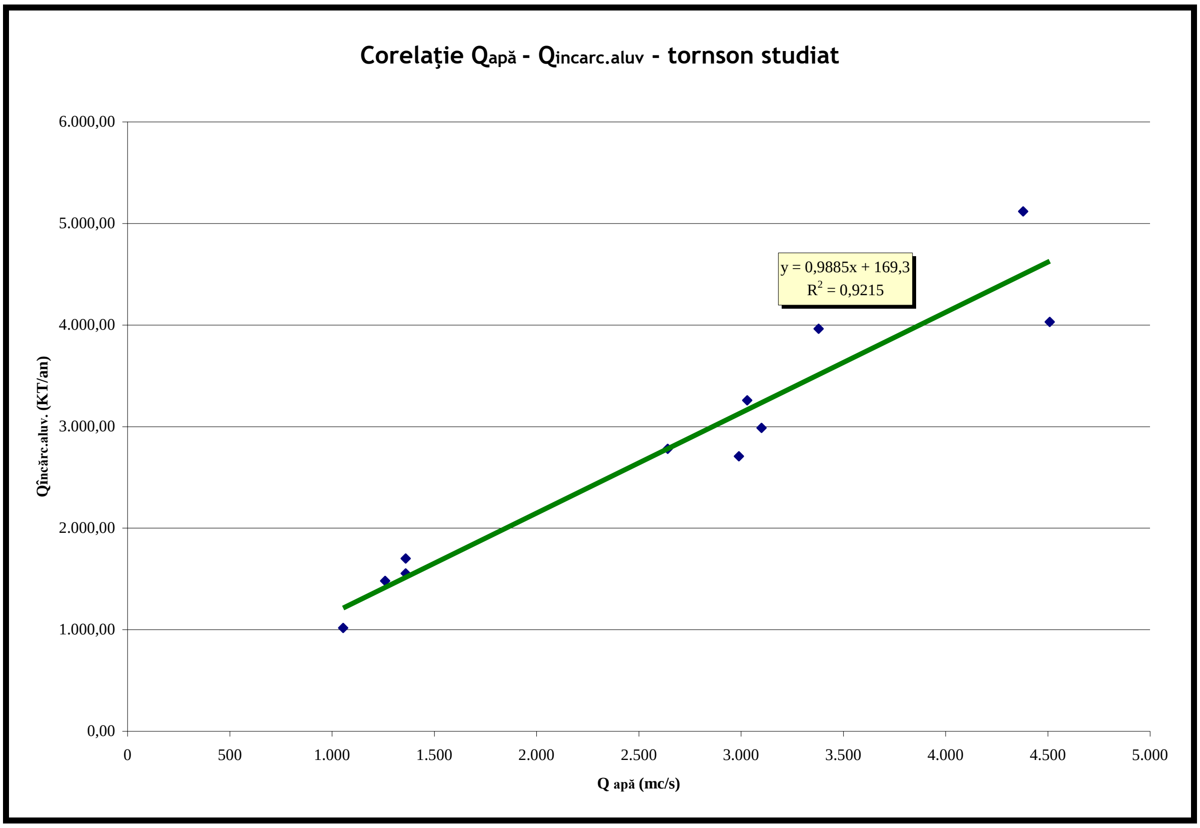


Figure 3.1.D.4.2

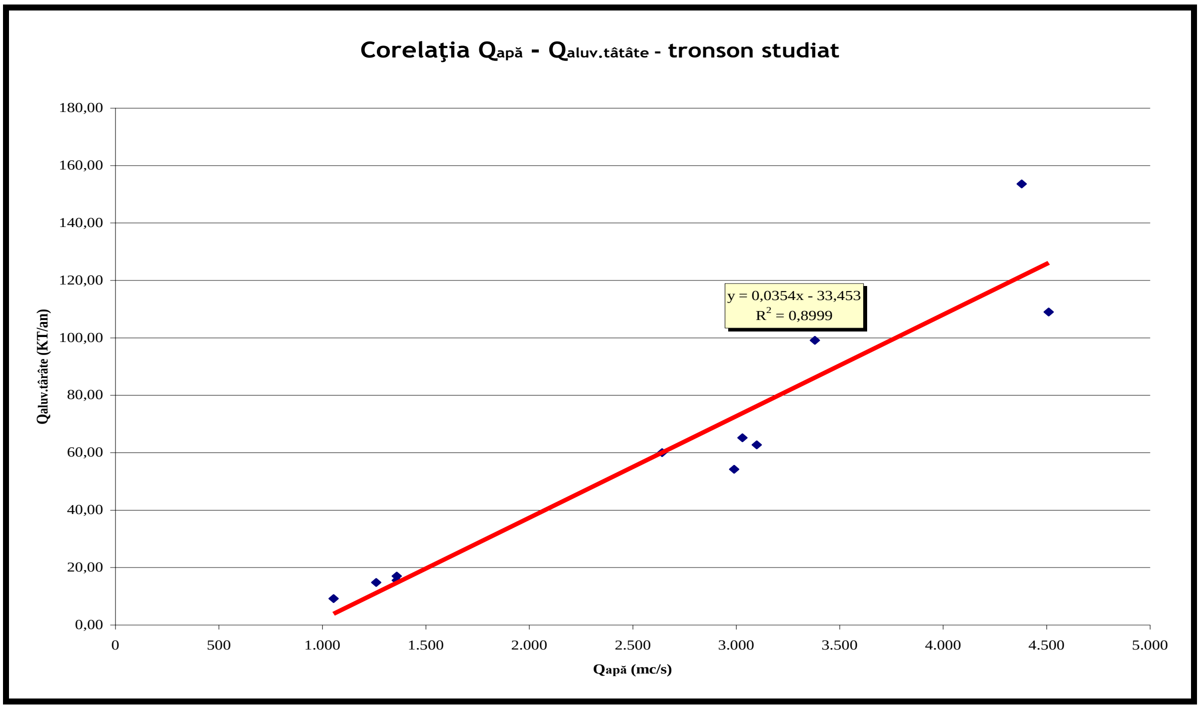


Figure 3.1.D.4.3

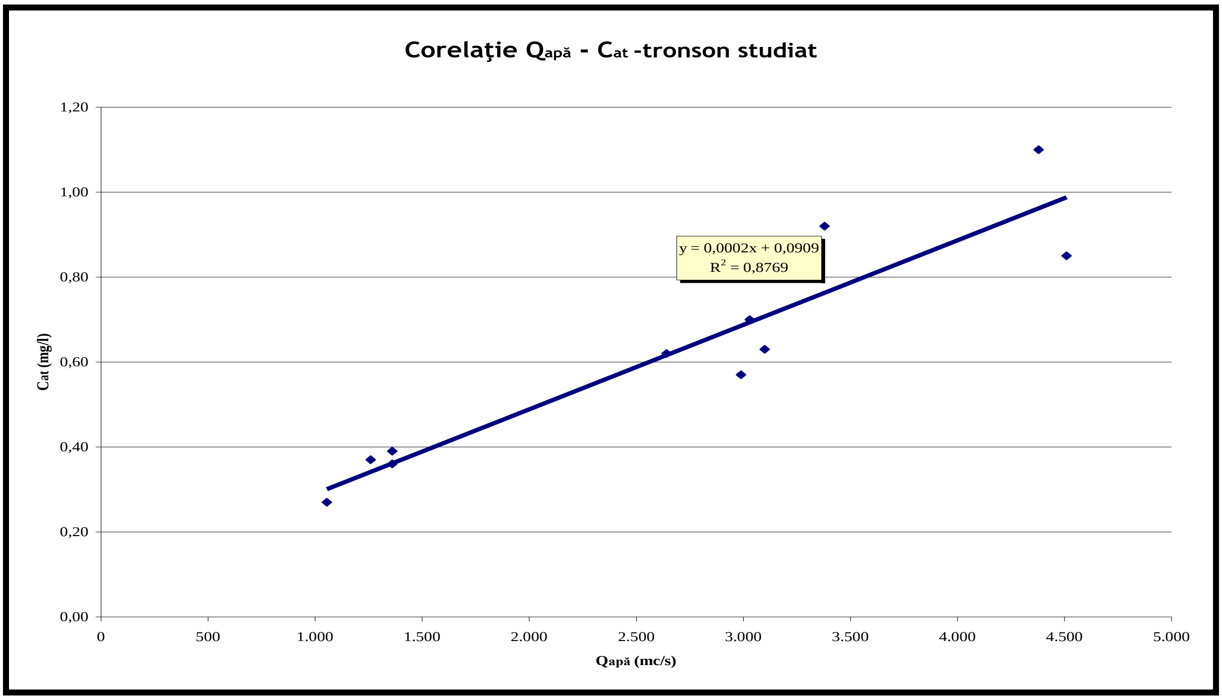


Figure 3.1.D.4.4

3.1.E. Monitoring of water quality

In accordance with the specifications set out in the technical specification were monitored and evaluated from the point of hydrochemical view of water the elements in Table 2 of the Order 161/2006 and respectively the associated pollution of the sediments. At critical points were calculated the primary statistics parameters (minimum, maximum and average values) for each sampling campaign in which average values were established during the monitoring period (April-August 2011). Note that the average values refer to all the specific sections of the same critical point.

3.1.E.1. Chemical and physico-chemical elements monitored at water

Two basic characteristics have resulted in this direction:

A. Ecological status - physico-chemical elements supporting the biological elements
B. Chemical status

A. <u>Ecological status</u>

This was assessed by reporting average values compared to the limits stipulated in Order 161/16.02.2006, issued by the Ministry of Environment and Water Management. According to the Water Framework Directive 60/2000/EC, the assessment of ecological status based on support elements stops at "MODERATE" status: I-very good, II-good and III-moderate. Ecological status given by general physico-chemical elements is obtained by applying the principle "worst-case", i.e. the status given by the sign with the largest value (between good, very good and moderate). In the annex are presented:

(i) the results of analytical determination who was measured on field (pH, water temperature, dissolved oxygen) and those laboratory;

(ii) statistical parameters calculated for each primary Critical Point in each campaign and the overall mean value specifies the indicator physico-chemical pursued at Critical Point. Tables 3.1.E.1 - 3.1.E.3 and charts 3.1.E.1 – 3.1.E.17. presents an overview on the ecological status in terms of physico-chemical elements supporting the biological elements, the following observations resulting in this direction:

a. from the point of view of the thermal regime and the acidification, the quality class is I with mention that, during the monitoring, correlated with the hydrological regime (low waters) were registered average temperatures of water over 20^0C, which has influenced both the oxygen regime and, in particular, that of nutrients.

b. oxygen regime (concentration and saturation) corresponds to the boundaries of class I with the observation that there have been and values above 100 % saturation, item that illustrates a potential biologic eutrophication; organic loading expressed in CBO_5 and CCO-Mn also corresponds to class I-a quality but, for CCO-Cr indicator, the values at the all critical points correspond to class II quality; accordingly, from the point of view of the oxygen regime the quality class is II.

c. the nutrients, reported to the nitrates (NO_3^-) and ammonium (NH_4^+) also fall within class I; but nitrites (NO_2^-) and partly N_T (total nitrogen) present value of quality class II (CP 01, CP 02, CP 10) and quality class III (CP 04A, CP 04B); read in conjunction with observations from (a) and (b), although in terms of the concentration of chlorophyll "a" values correspond to the class I of quality at all critical points, it highlights (in NO_2^-) a denitrification potential reflected especially downstream of the area of study on the trends of water eutrophication; on the whole at the nutrients (with some exceptions to CP 04A, CP 04B) quality class-III.

d. with respect to salinity, overall quality class is II, are not registered the relevant chemical composition differences between PCs. Specific values from chlorides, magnesium and sodium (falling within class II quality) can, however, to derive from the higher natural backdrop for these items.

e. tied to specific toxic pollutants of natural origin, except for CP 03A and CP 03B (quality class II) to other PCs, thanks to the values recorded at cobalt, iron and manganese, the overview quality class is III; as to (d), however, should bear in mind the natural background who may be higher, at least at the iron and manganese, but there are no historical data in this respect.

f. regarding other relevant chemical indicators also the quality class is III, are determinate in this classification the values recorded in phenolic index and AOX.

Integrating all the assessments referred to in (a) .... (f), ecological status in terms of physico-chemical elements support for the biological elements, is contained in the range GOOD to MODERATE, appreciation why enrolls in historical data (T.N.M.N international network – ICPDR).

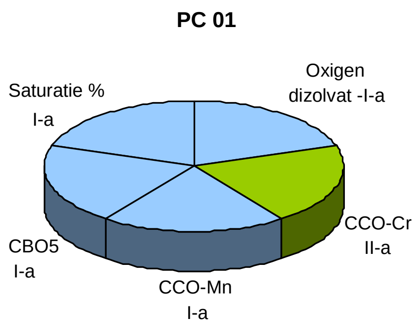
Table 3.1.E.1 - The mean values of the averages for the period April - August 2011

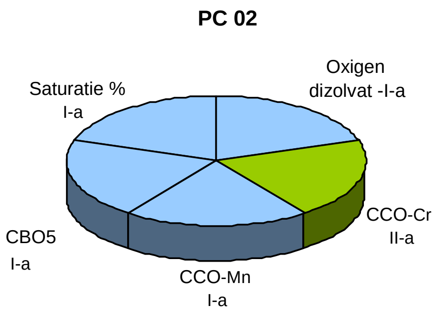
Indicator	Main critical points			Secondary critical points					Old Danube	Historical data
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
THERMAL REGIME AND ACIDIFICATION										
1.Temperature (^{0}C)	21.8	21.9	22.8	18.4	18.7	20.3	19.5	19.6	23.9	13.7
2. pH	8.01	8.20	8.09	7.41	7.92	7.42	7.37	7.88	7.84	7.98
OXYGEN REGIME										
1. Dissolved oxygen	8.16	10.86	8.92	8.66	8.70	8.34	8.58	8.77	7.84	8.94
2. Saturation (%)	95.6	128	105.4	95	96	95	96	98	94.8	80.25
3. CBO_5 (mgO_2/l)	2.7	2.7	2.2	2.2	2.0	1.8	2.2	2.15	2.8	2.05
4. CCO-Mn (mg O_2/l)	3.3	3.3	2.7	2.6	2.5	2.2	2.7	2.6	3.4	3.74
5. CCO-Cr (mg O_2/l)	17.4	16.2	13.6	13.3	12.5	11.2	13.8	13.3	17.2	15.8
NUTRIENTS										
1. $N-NH_4$ (mg/l)	0.56	0.76	0.51	0.18	0.17	0.21	0.18	0.34	0.19	0.35
2. $N-NO_3$ (mg/l)	0.47	0.44	0.73	0.44	0.39	0.45	0.52	0.63	0.59	1.69
3. $N-NO_2$ (mg/l)	0.11	0.12	0.09	0.06	0.08	0.11	0.13	0.03	0.024	0.043
4. N_T (mg/l)	1.43	1.63	1.54	0.75	0.67	0.84	0.87	1.06	0.86	2.12
5. $P-PO_4^{3-}$ (mg/l)	0.03	0.04	0.05	0.02	0.04	0.06	0.02	0.03	0.03	0.03
6. P_T (mg/l)	0.08	0.09	0.12	0.06	0.11	0.16	0.06	0.087	0.09	0.09
7. chloropfyll „a" (µg/l)	17.39	14.06	11.93	11.4	10.4	11.5	13.4	13.34	14.11	10.18
SALINITY										
1. Conductivity (µs/cm)	330	342	382	344	346	361	345	368	379	428
2. Fixed residue (mg/l)	248	257	286	258	250	271	259	276	284	321
3. Cl^- (mg/l)	28.7	27.1	31.2	28.9	28.9	29.0	29.1	28.1	31	33.2
4. SO_4^{2-} (mg/l)	37.1	37.9	39.02	43.83	43.5	43.0	43.2	42.9	40.6	29.05
5. Ca^{2+} (mg/l)	40.6	42	47.5	38.3	37	36	38.2	49.3	50.1	50.47
6. Mg^{2+} (mg/l)	14.9	15.1	16.7	16.3	17.9	20.5	17.6	16.8	17	22.9
7. Na^+ (mg/l)	15.6	12.9	17	27.3	28	20.5	26.2	13.2	16.7	20.5
NATURAL SPECIFIC POLLUTANTS										
1. Cr_{tot} (µg/L)	0.95	0.93	2.47	1.64	1.16	1.28	1.07	1.83	1.50	3.15
2. Cu^{2+} (µg/L)	3.73	3.98	6.8	4.32	4.84	5.37	4.58	4.53	4.15	14.2

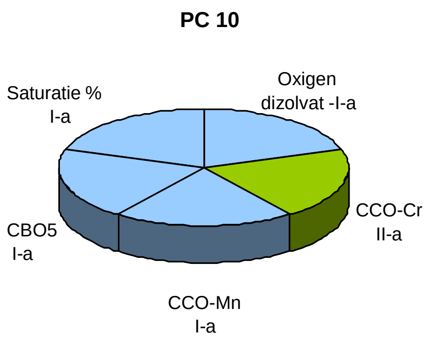
Indicator	Main critical points			Secondary critical points					Old Danube	Historical data
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
3. Zn^{2+} (µg/L)	0.07	0.10	0.29	0.06	0.25	0.26	0.14	0.06	0.06	34.2
4. As (µg/L)	0.79	0.76	0.95	0.83	0.93	0.87	0.88	0.81	0.80	0.82
5. Ba^{2+} (mg/l)	0.044	0.045	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.04
6. Se^{4+} (µg/L)	0.060	0.075	0.077	0.070	0.080	0.070	0.090	0.072	0.080	0.070
7. Co^{3+} (µg/L)	25.85	32.51	27.29	31.73	33.37	23.39	29.52	27.31	46.34	-
8. Pb^{2+} (µg/L)	1.33	2.41	2.12	0.47	4.85	0.90	2.26	2.69	1.62	7.2
9. Cd^{2+} (µg/L)	0.35	0.18	0.18	<0.12	<0.12	0.22	<0.12	0.16	0.93	0.97
10. Fe_{tot} (mg/l)	0.76	0.75	2.62	0.51	0.49	1.68	0.44	1.33	0.78	0.72
11. Hg (µg/L)	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11
12. Mn_{tot} (mg/l)	0.01	0.01	0.04	0.02	0.05	0.05	0.07	<0.002	<0.002	0.12
13. Ni^{2+} (µg/L)	2.95	3.49	5.33	1.95	2.82	2.34	2.32	2.57	1.42	4.94
OTHER INDICATORS										
1. Phenolic index (µg/L)	22.8	12.0	10.8	17.0	15.0	14.5	15.4	13.5	8.2	7.5
2. Anionic detergents (µg/L)	6.65	11.0	20.0	9.1	8.1	9.1	8.1	17.0	12.7	9.4
3. AOX (µg/L)	14.4	17.0	13.5	15.7	16.6	14.8	15.7	15.5	15.8	17.25

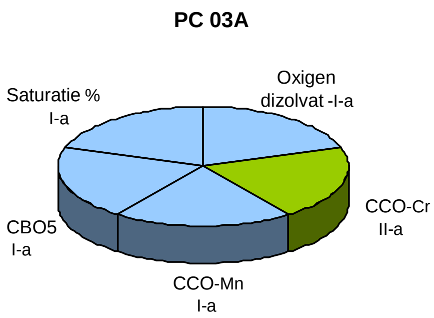
NOTE:
Sld – below detection limit
L.D Hg = 0,01 µg/l
L.D Pb = 0,31 µg/l
L.D Cd = 0,12 µg/l
L.D Zn = 0,058 mg/l
L.D Fe = 0,055 mg/l
L.D Mn = 0,002 mg/l
The historical data refers to the TNMN – ICPDR (2001-2009) average for the sections Chiciu Silistra and Reni.

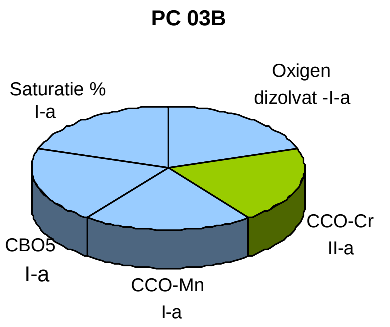
The diagram 3.1.E.1 - Water - Oxygen regime

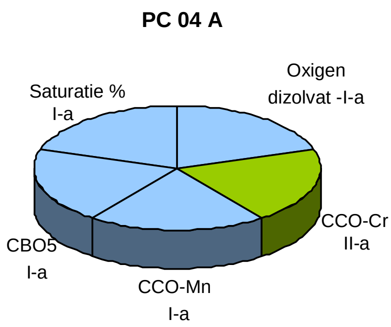


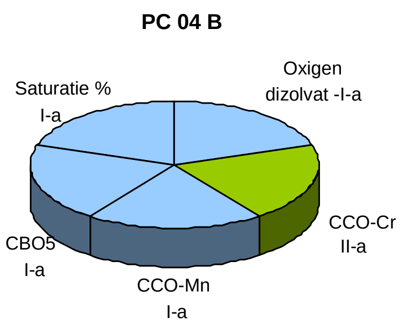


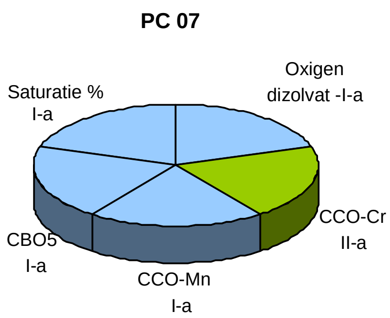

PC 10
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a

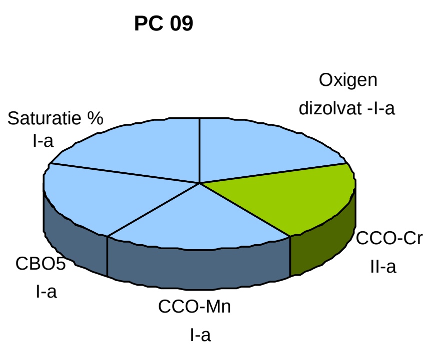

PC 03A
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a


PC 03B
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a


PC 04 A
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a

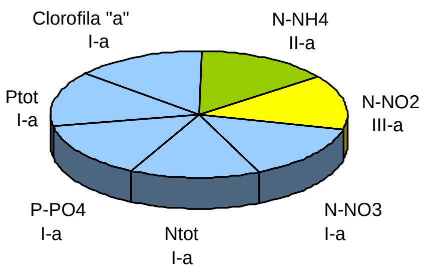

PC 04 B
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a


PC 07
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a

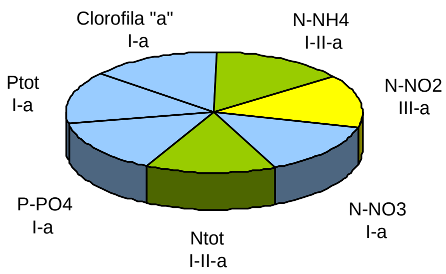

PC 09
Oxigen dizolvat -I-a
CCO-Cr II-a
CCO-Mn I-a
CBO5 I-a
Saturatie % I-a

The diagram 3.1.E.2 - Water - Nutrients

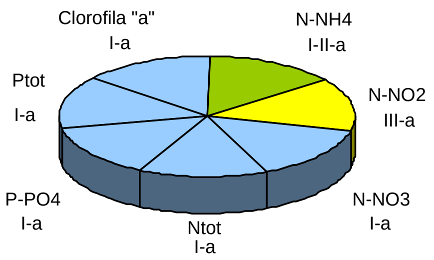
PC 01



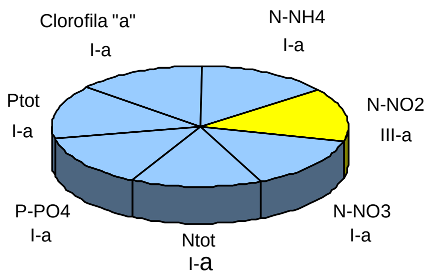
PC 02



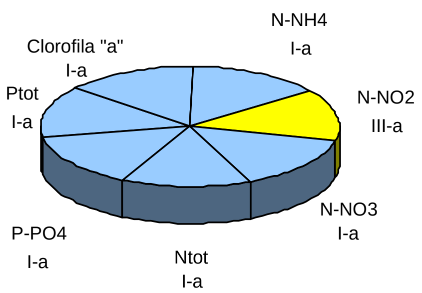
PC 10



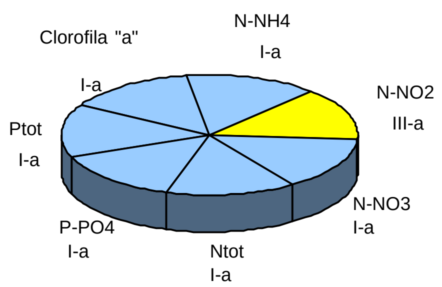
PC 03A

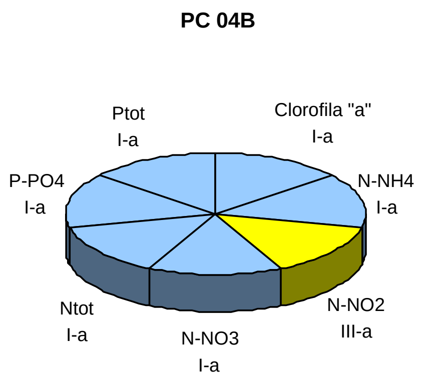


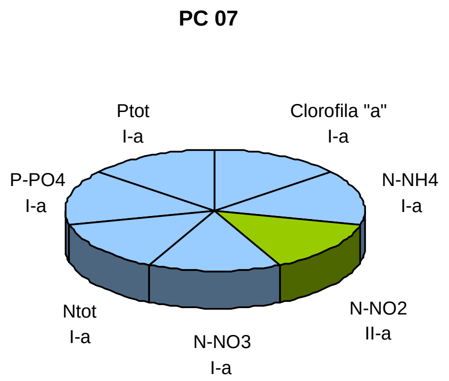
PC 03B

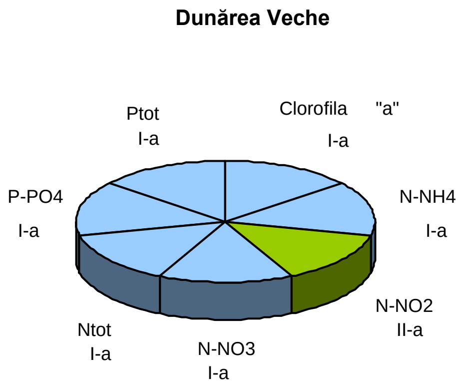


PC 04A



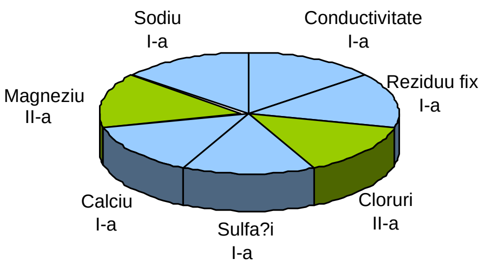

PC 04B
Ptot
I-a
Clorofila "a"
I-a
P-PO4
I-a
N-NH4
I-a
Ntot
I-a
N-NO3
I-a
N-NO2
III-a


PC 07
Ptot
I-a
Clorofila "a"
I-a
P-PO4
I-a
N-NH4
I-a
Ntot
I-a
N-NO3
I-a
N-NO2
II-a

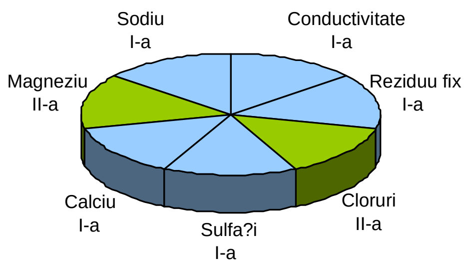

Dunărea Veche
Ptot
I-a
Clorofila "a"
I-a
P-PO4
I-a
N-NH4
I-a
Ntot
I-a
N-NO3
I-a
N-NO2
II-a

The diagram 3.1.E.3 - Water - Salinity

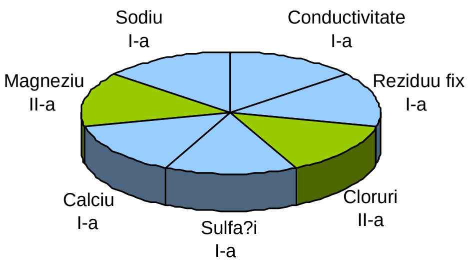
PC 01



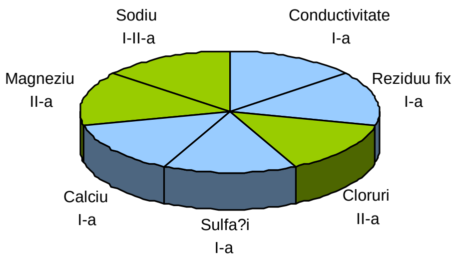
PC 02



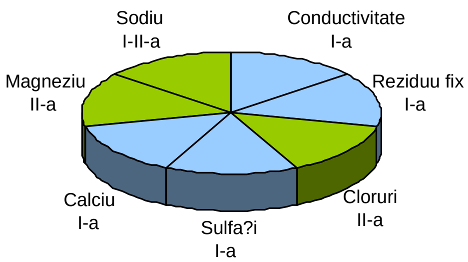
PC 10



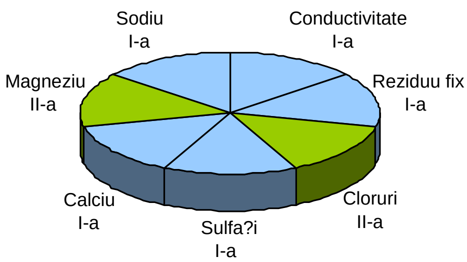
PC 03A

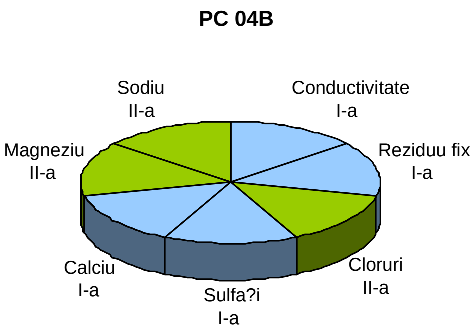


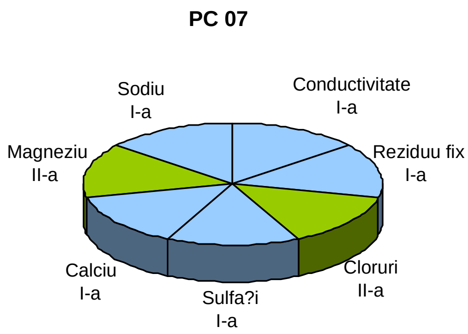
PC 03B

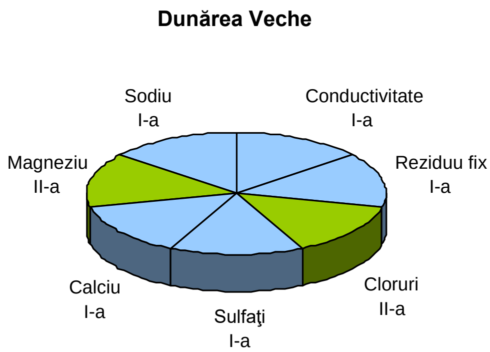


PC 04A



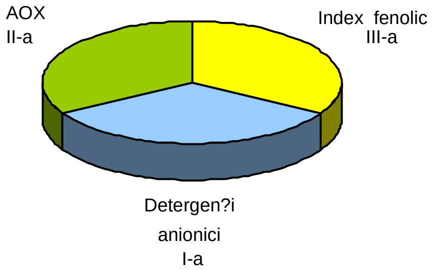

PC 04B
Sodiu
II-a
Conductivitate
I-a
Magneziu
II-a
Reziduu fix
I-a
Calciu
I-a
Cloruri
II-a
Sulfa?i
I-a


PC 07
Sodiu
I-a
Conductivitate
I-a
Magneziu
II-a
Reziduu fix
I-a
Calciu
I-a
Cloruri
II-a
Sulfa?i
I-a

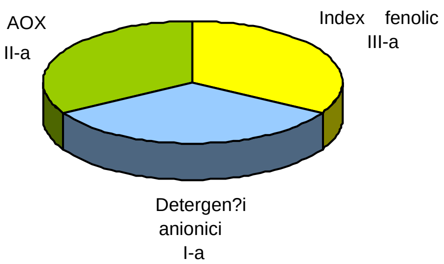

Dunărea Veche
Sodiu
I-a
Conductivitate
I-a
Magneziu
II-a
Reziduu fix
I-a
Calciu
I-a
Cloruri
II-a
Sulfaţi
I-a

The diagram 3.1.E.4 - Water – Other relevant chemical indicators

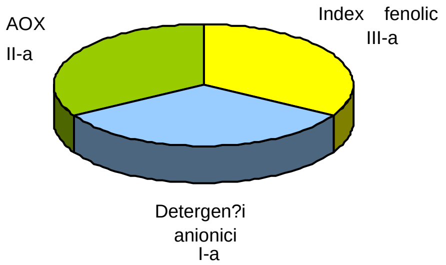
PC 01



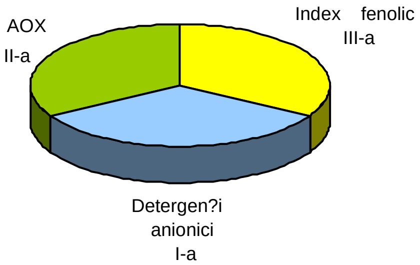
PC 02



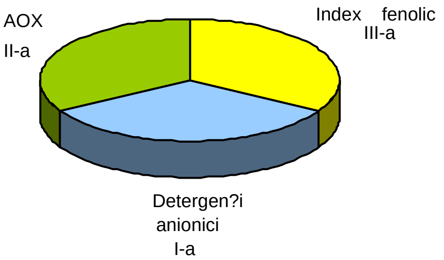
PC 10



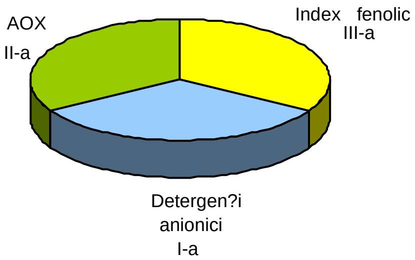
PC 03A

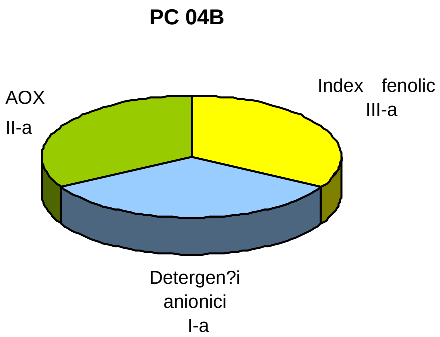


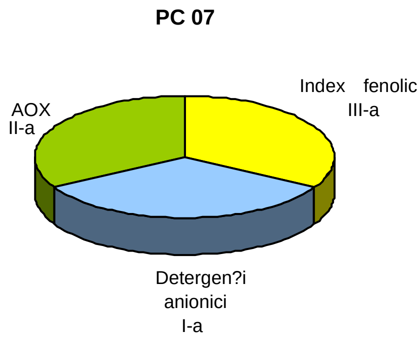
PC 03B



PC 04A







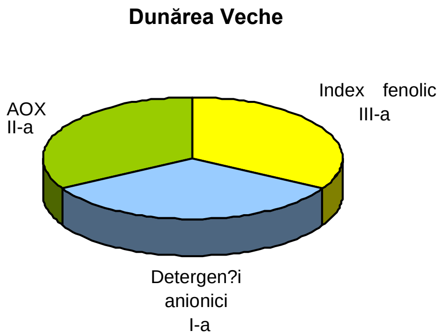
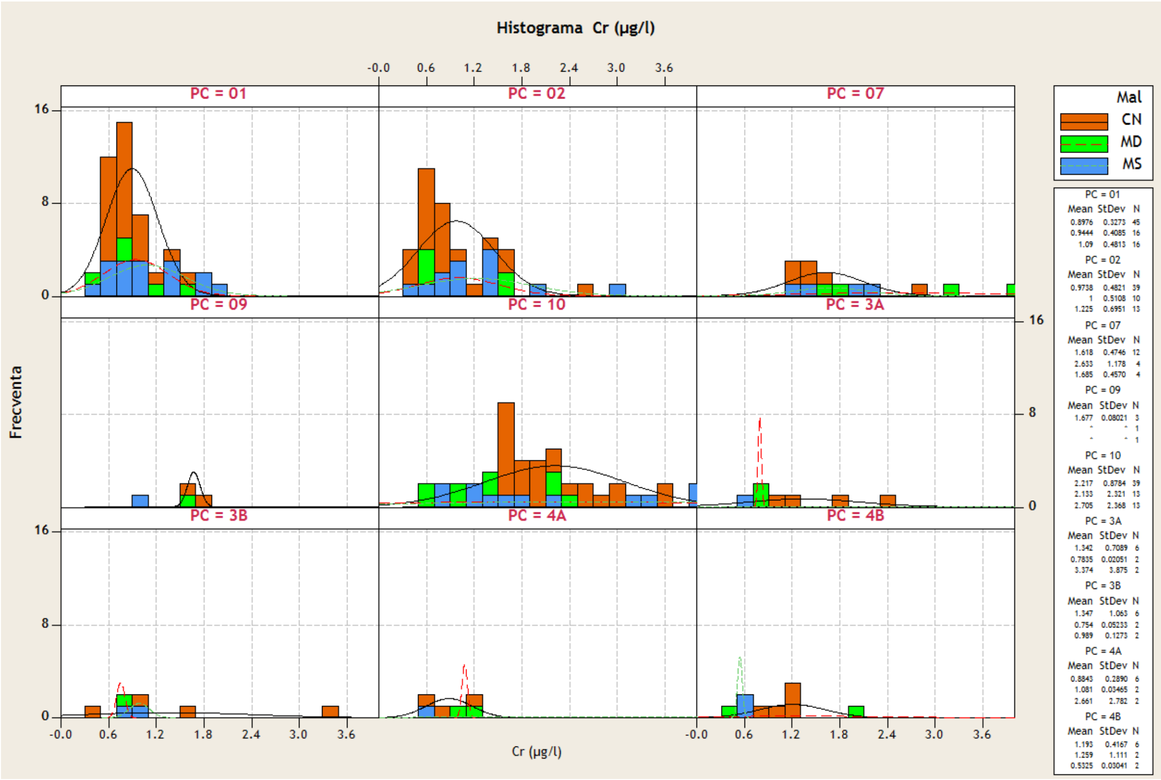


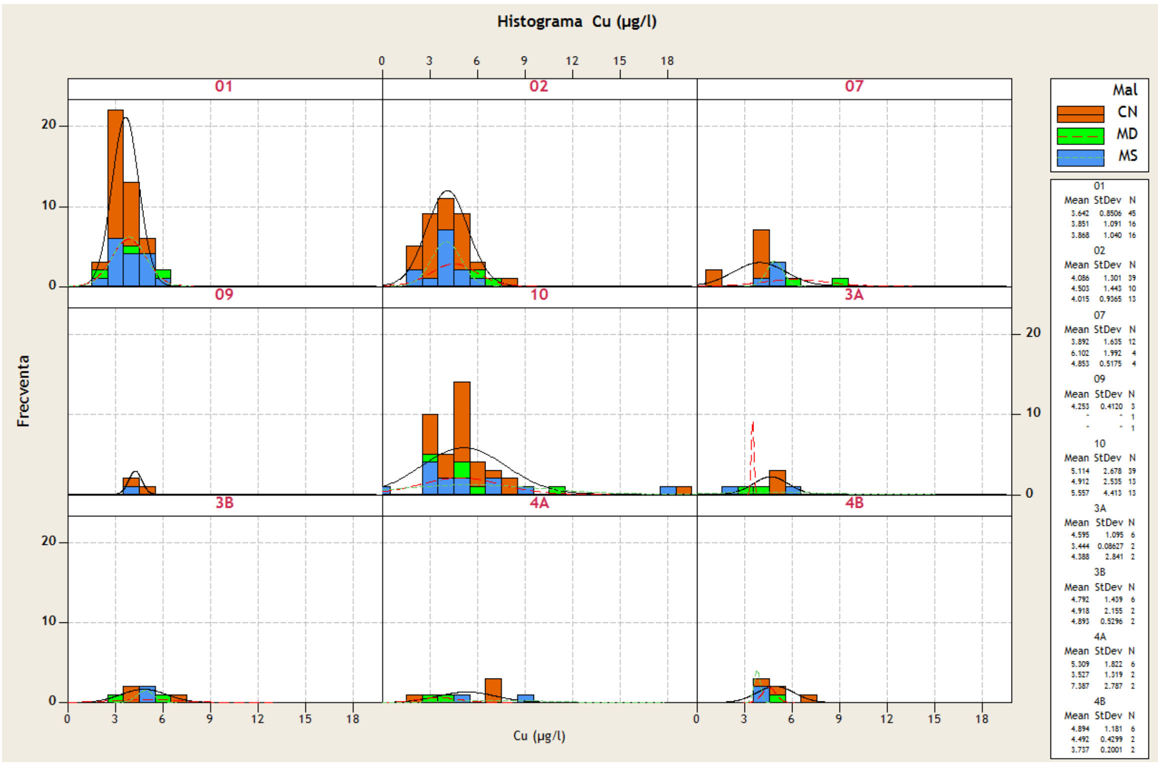
Table 3.1.E.2 - Water – Natural specific pollutants

Pollutants	Main critical points			Secondary critical points					Old Danube
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	
Total Cr	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a
Cu	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a
Zn	I-a	III-a	III-a	I-a	III-a	III-a	III-a	I-a	I-a
As	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a
Ba	I-a	I-a	II-a	I-a	I-a	I-a	I-a	III-a	II-a
Se	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a
Co	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a
Pb	I-a	II-a	II-a	I-a	III-a	I-a	III-a	III-a	I-a
Cd	II-a	II-a	II-a	I-a	I-a	I-a	I-a	III-a	III-a
Fe total	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a	a-III-a
Hg	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a	I-a
Mn total	II-a	II-a	II-a	I-a	III-a	I-a	III-a	I-a	I-a
Ni	I-a	II-a	II-a	I-a	I-a	I-a	I-a	I-a	I-a

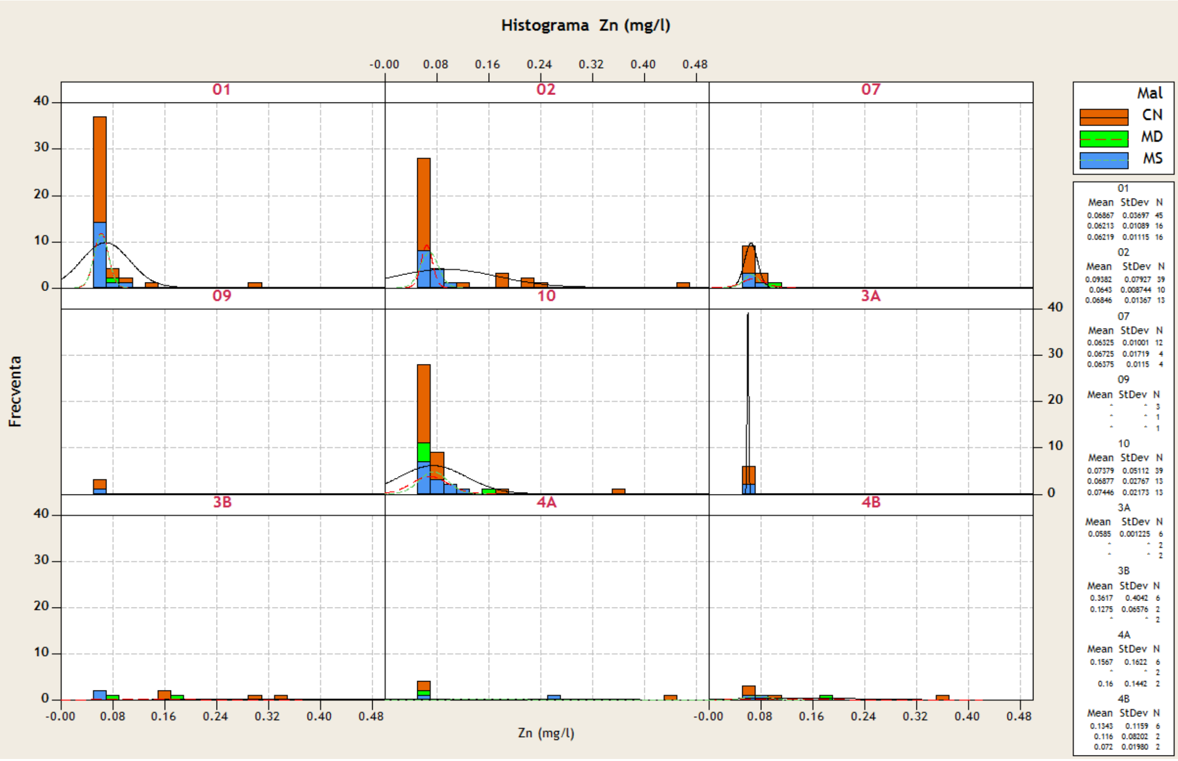
The diagram 3.1.E.5 - Water – Natural specific pollutants - Cr



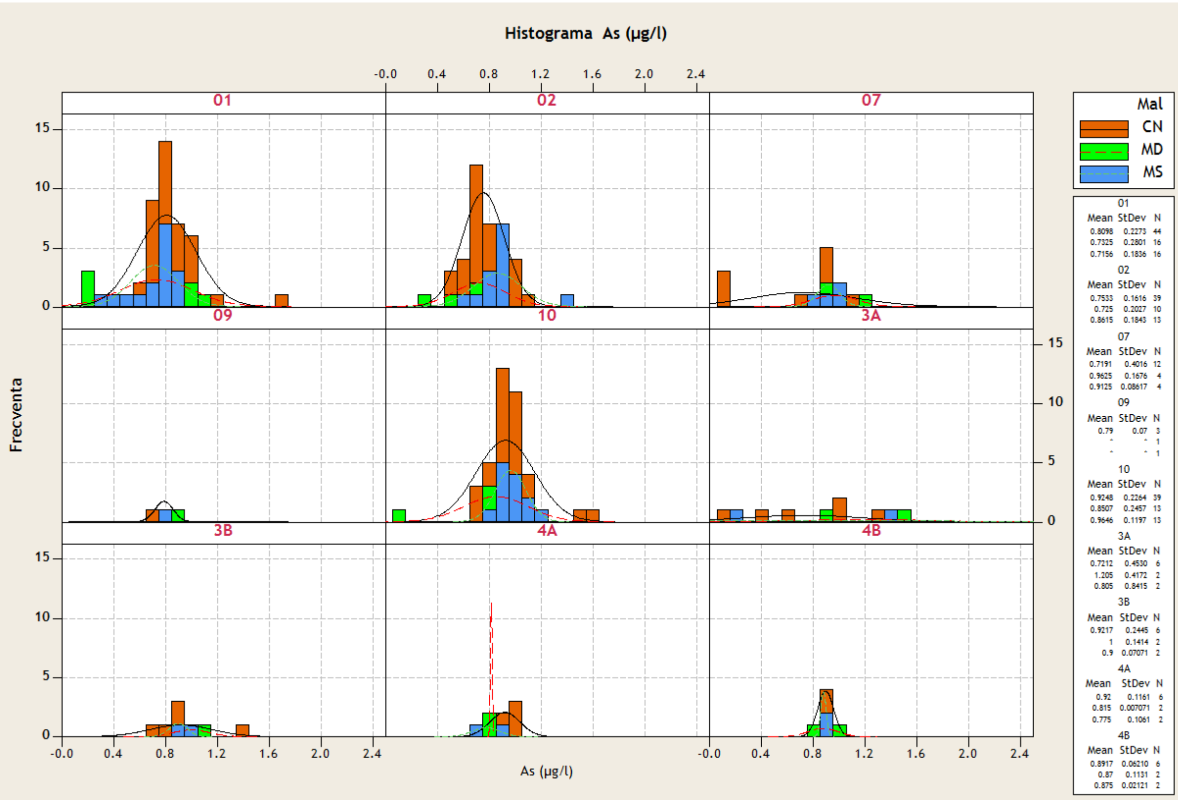
The diagram 3.1.E.6 - Water – Natural specific pollutants - Cu



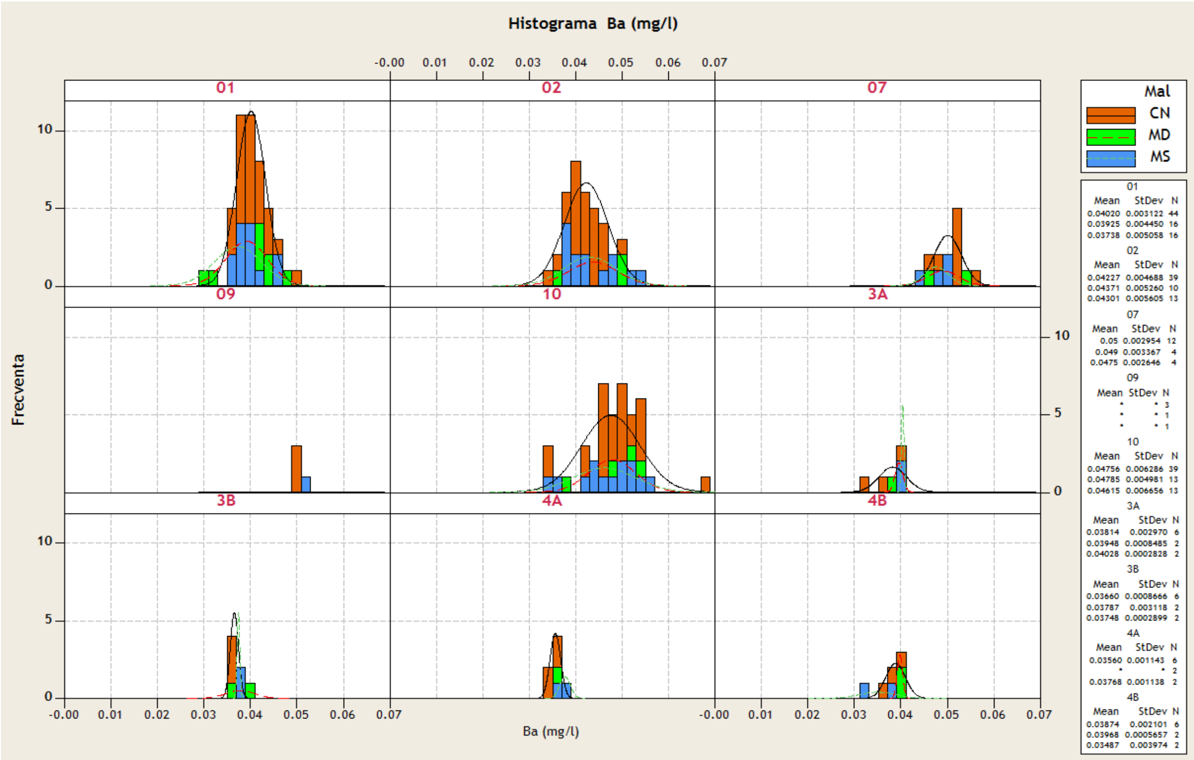
The diagram 3.1.E.7 - Water – Natural specific pollutants – Zn



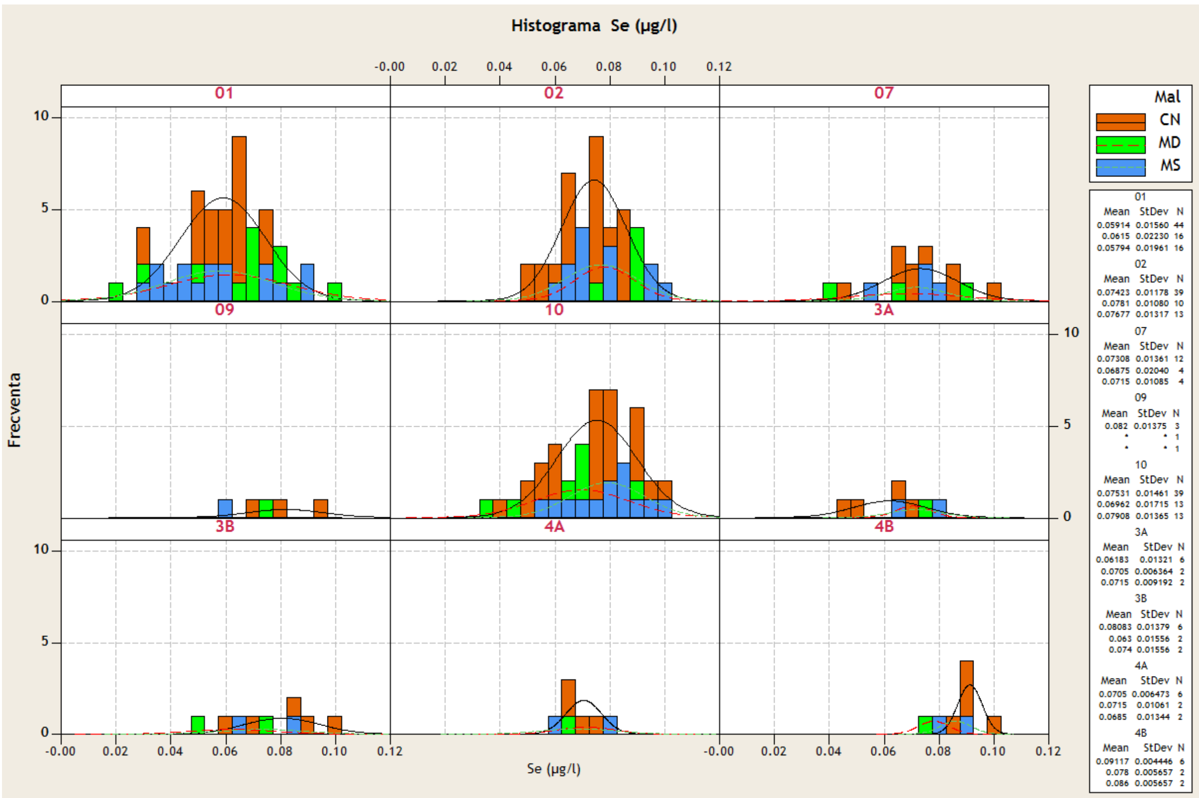
The diagram 3.1.E.8 - Water – Natural specific pollutants – As



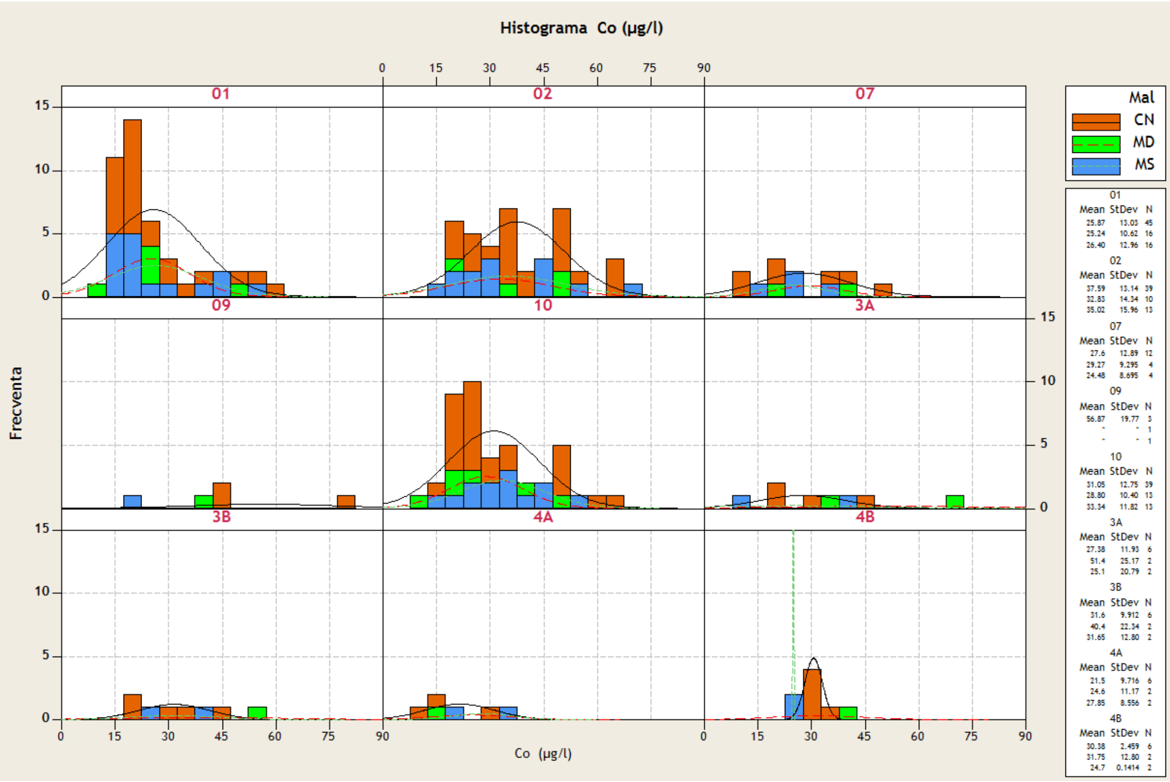
The diagram 3.1.E.9 - Water – Natural specific pollutants - Ba



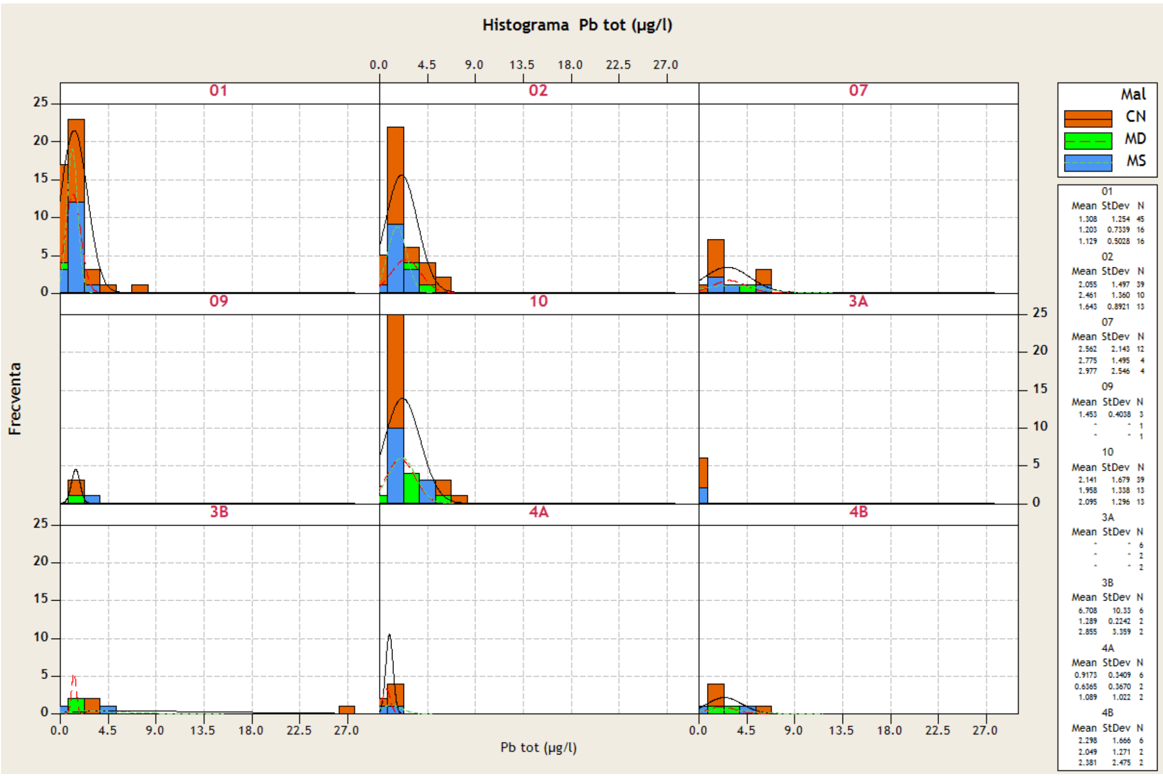
The diagram 3.1.E.10 - Water - Natural specific pollutants - Se



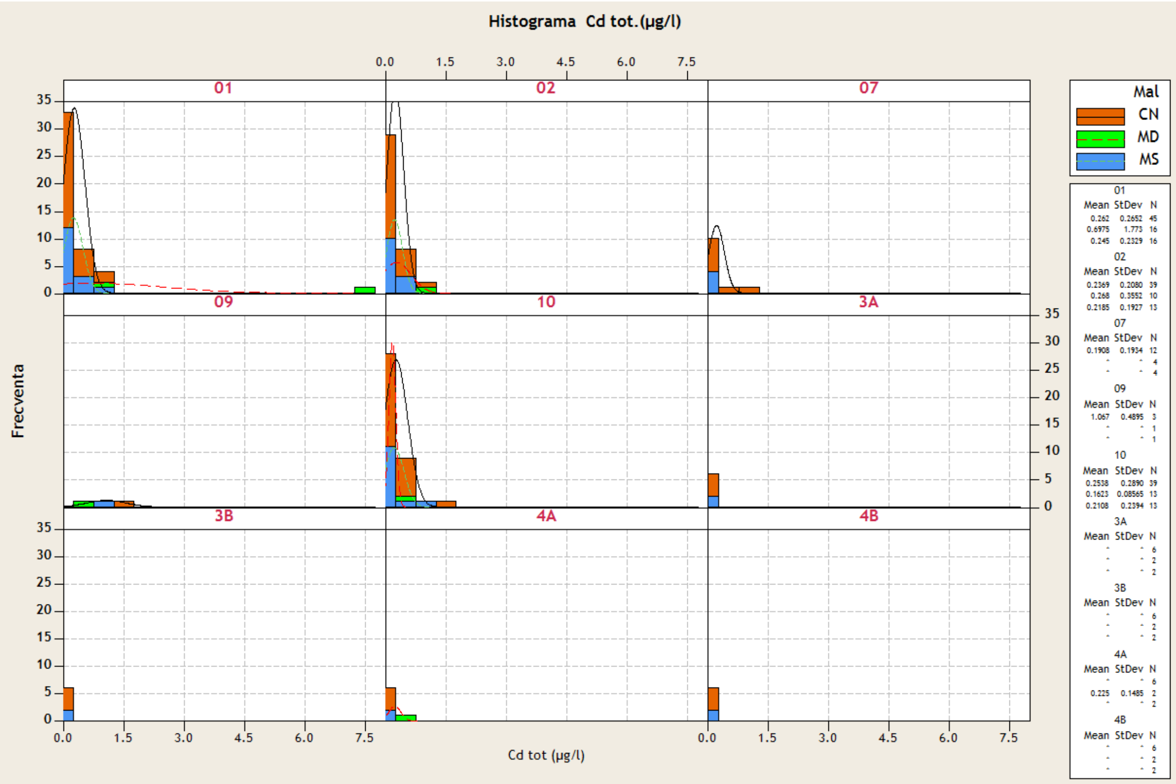
The diagram 3.1.E.11 - Water – Natural specific pollutants - Co



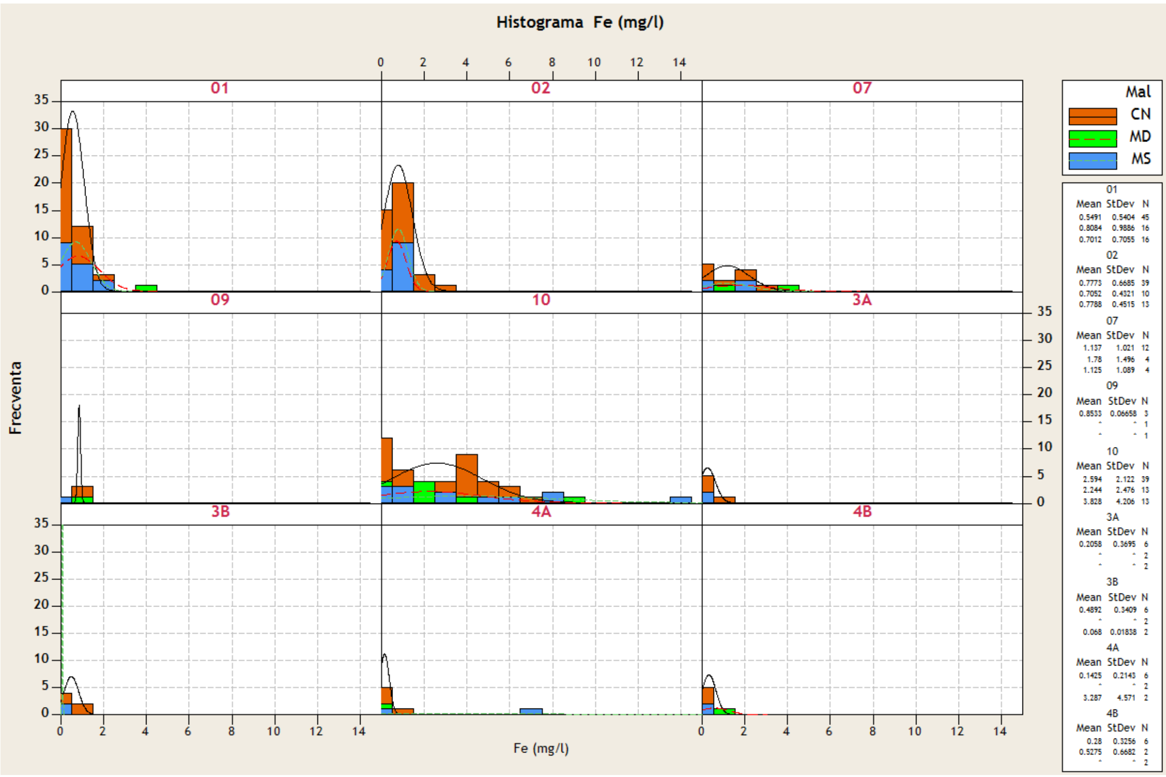
The diagram 3.1.E.12 - Water – Natural specific pollutants - Pb



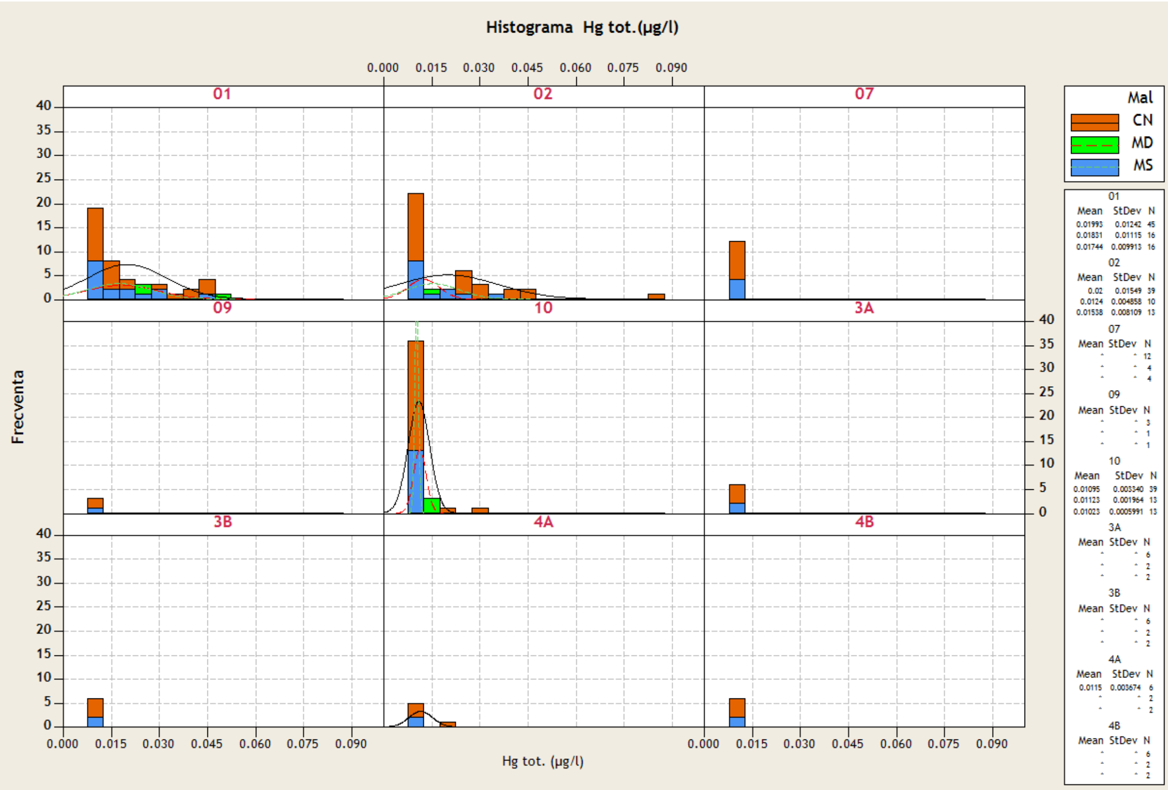
The diagram 3.1.E.13 - Water- Natural specific pollutants - Cd



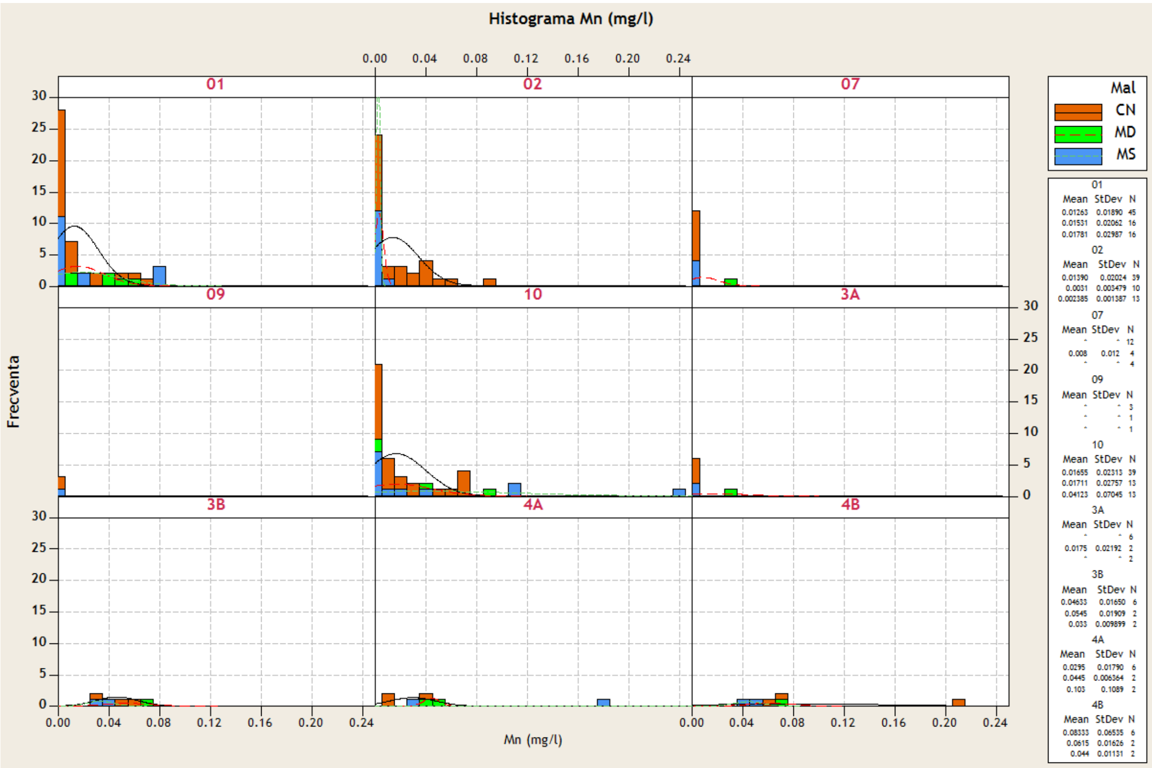
The diagram 3.1.E.14 - Water - Natural specific pollutants - Fe



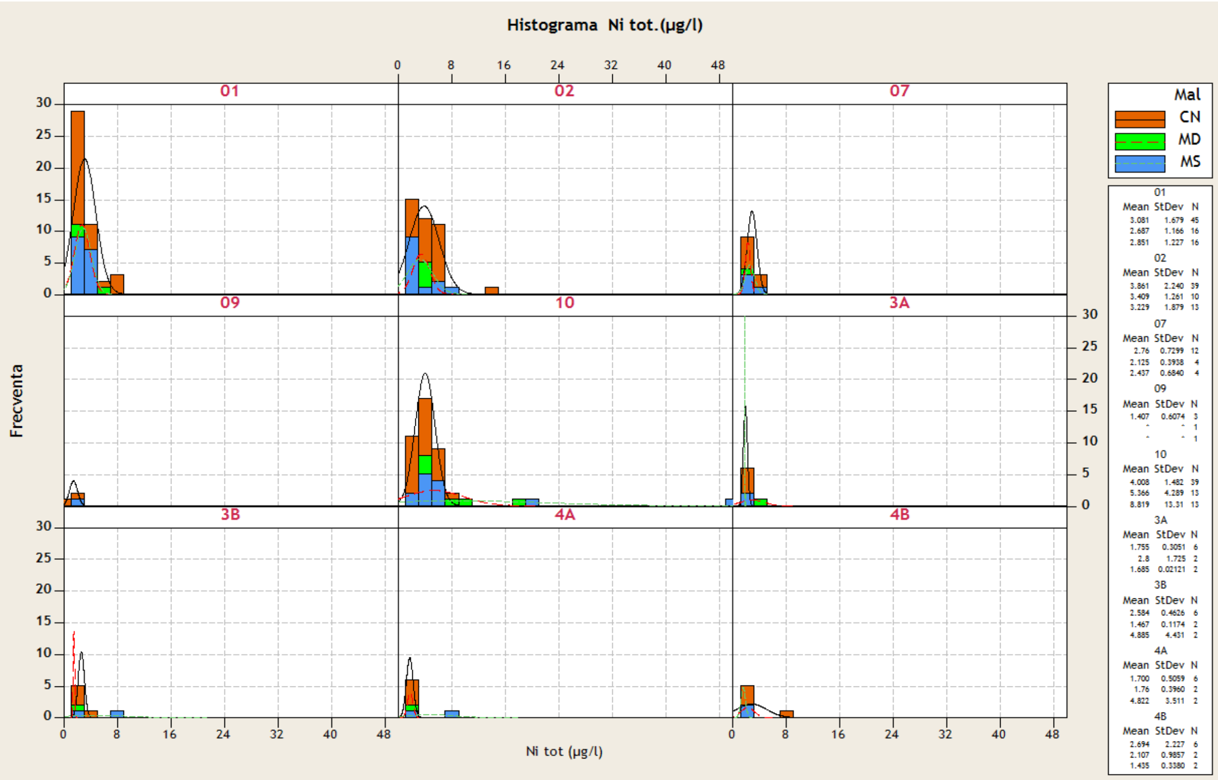
The diagram 3.1.E.15 - Water – Natural specific pollutants - Hg



The diagram 3.1.E.16 - Water – Natural specific pollutants - Mn



The diagram 3.1.E.17 - Water- Natural specific pollutants - Ni



NOTE: 09 is refer to Old Danube

Table 3.1.E.3 - Water - Ecological status- overview (physico-chemical elements support for the biological elements)

Indicator de calitate	Puncte Critice Principale			Puncte Critice Secundare					Dunărea veche	Date istorice
	PC 01	PC 02	PC 10	PC 03A	PC 03B	PC 04A	PC 04B	PC 07		
Regim termi şi acidifiere	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează	Nu se normează
Regimul oxigenului	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)	a-II-a (CCO-Cr)
Nutrienţi	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)	III-a (NH_4, NO_2)
Salinitate	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})	II-a (Cl^{+}, Mg^{2+})
Poluanţi toxici specifici de origine naturală	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})	III-a (Co^{3+})
Alţi indicatori chimici relevanţi	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)	III-a (fenoli, AOX)
Stare de ansamblu	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**	**bună/ moderată**

B. Chemical status

As a result of the provisions of the Government Decision 1038 / December 2010 which transposing Directive 2008/105/EC which amended the Water Framework Directive (2000/60/EC) with regard to chemicals hazardous / dangerous priority during April-August 2011 have been conducted and analyses related to heavy metals dangerous/hazardous priority (Pb, Cd, Hg, Ni). The following clarifications should be made in this direction:

- For the above mentioned metals the chemical status has been established on the basis of the concentration of the dissolved fraction (the average value in the period April-August 2011);
- Maximum allowable Values relate for nickel and lead to annual average, while at Hg and Cd are given both annual average and CMA (maximum permissible concentration); because the monitoring interval refers only to 4 months, in the evaluation were only considered CMA appropriate to arithmetic average;
- For Cd the values are differentiated based on the hardness of the water, in ratings considering the medium hardness of the water of the Danube.
- The chemical status, unlike the ecological state has only two classes: GOOD or BAD, and it highlights a potential short-term ecotoxicological.

In order to establish the chemical status of bodies of water, has been taken into account and Order 161/2006, which lays down quality standards for analysed indicators, but values refer to total concentration, unlike GD 1038/2010 where quality standards refer to the concentration of dissolved substances (for substances priority /priority hazardous).

In the evaluations could not considered the specific natural fund of the Danube, at the metals analysed, because there are no historical data in this respect; it is emphasized, however, that from the point of view of concentration, for other rivers they fall in the range of 10-15 %.

Table 3.1.E.4 - Water - Chemical status - according to HG 1038/2010

Indicator /limit	Main critical points			Secondary critical points					Old Danube	Historical data
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07		
Pb diz/7.2 µg/l	0.58	0.75	0.7	<0.31	0.42	0.45	0.72	0.81	1	1.56
Cd diz /0.15 µg/l (medium hardness)	**0.2**	**0.16**	**0.17**	0.12	0.12	0.12	0.12	0.12	**0.3**	0.24
Hg diz /0.07 µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.052
Ni diz /20 µg/l	1.64	1.87	1.77	1.44	1.5	1.26	1.14	1.44	1.76	2.46
State / CP	**POOR**	**POOR**	**POOR**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**POOR**	**GOOD**
State of ensemble	**POOR**									

Table 3.1.E.5 - Water - Chemical status - according to Order 161/2006

Indicator /limit	Main critical points			Secondary critical points					Old Danube
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	
Cr / 2.5 (µg/l)	0.95	0.93	2.47	1.64	1.16	1.28	1.07	1.83	1.50
Cu / 1.3 (µg/l)	**3.73**	**3.98**	**6.38**	**4.32**	**4.84**	**5.37**	**4.58**	**4.53**	**4.15**
A s / 7.2(µg/l)	0.79	0.76	0.95	0.83	0.93	0.87	0.88	0.81	0.80
Ba/ 0.2 (mg/l)	0.044	0.045	0.05	0.04	0.04	0.04	0.04	0.05	0.05
Se/ 0.07 (µg/l)	0.06	**0.075**	**0.077**	0.070	**0.08**	0.07	**0.09**	**0.072**	**0.08**
Co/ 0.7 (µg/l)	**25.85**	**32.51**	**27.29**	**31.73**	**33.37**	**23.39**	**29.52**	**27.31**	**46.34**
Pb/ 1.7 (µg/l l)	1.33	2.41	2.12	0.47	**4.85**	0.90	**2.26**	**2.69**	1.62
Cd / 1 (µg/l)	0.35	0.18	0.18	<0.12	<0.12	0.22	<0.12	0.16	0.93
Hg / 1 (µg/l)	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ni/ 1.3 (µg/l)	**2.95**	**3.49**	**5.33**	**1.95**	**2.82**	**2.34**	**2.32**	**2.57**	**1.42**
State / CP	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR
State of ensemble	POOR								

Table 3.1.E.4 presents an overview of chemical status (according to GD 1038/2010) of the water, to all PCs, statistical parameters for each CP and for each primary campaign being presented in the annex. The following elements are related with the analysis of data analytical measurements:

a) Regarding the lead the range of average concentrations is less than 0.31 µg/l (sld CP 03A) and 1.00 µg/l (CP 09); the overall chemical status is good;
b) In the case of cadmium for Critical Points 01, 02 ,10 and 09, values observed exceed quality standards obtaining a poor chemical status, while CP-03A, 03B, 04A, 04B the chemical status is good;
c) In the case of mercury the average values of dissolved fraction concentration are below the limit of detection (sld-0.01 µg/l) illustrating a good chemical status in all Critical Points;
d) For nickel the variation range lies within 1.14 µg/l (CP 04B) – 1,87 µg/l (CP 02) being below 20 µg/l, the chemical status being good in all Critical Point;
e) Există o bună concordanţă a valorilor măsurate în perioada aprilie-august 2011 cu cele corespunzătoare datelor istorice (TNMN – ICPDR).

As an overall assessment, the reference state (preconstruction) chemical status it is bad, this being due to the values obtained for Cd.

In Table 3.1.E.5 is presented the chemical status in accordance with Order 161/2006. It is found that the chemical bad condition is mainly caused by overruns constant of quality standards for Co, Cu and Ni. It is noted that for determining the chemical status were considered the values obtained during the period April to August 2011, without taking into account the natural background values (lack of historical data).

3.1.E.2. The monitoring of sediments

Characterization of pollution associated with sediments was carried out for:

A. Metals (Pb, Ni, Zn, Cu, Cr_{tot}, As, Cd, Hg)

B. Organic Pollutants: PAH-uri, PCB-uri and organochlorine pesticides

In accordance with international procedure, chemical laboratory analyses were performed at the fraction of the sediment < 63 µm, quality standards (CMA) are those set out in Order 161 Table B (elements and chemical quality standards for sediments - faction< 63 µm).

A. METALS

Table 3.1.E.6 show average values calculated at the metals analysed resulting the following observations in this direction:

a) For lead the variation range of average concentrations is between 4.99 mg/kg (CP 04B) and 18.3 mg/kg (CP 03A) chemical quality of sediments being good at all Critical Points.
b) In the case of nickel, the average concentration is 35.48 mg/kg (CP 03A) and for this metal the chemical status of sediments is good with small overshoots to CP 03A and CP 04A.
c) For copper all values exceeds threshold of 40 mg/kg illustrating a specific associated pollution this element.
d) For the total chromium were recorded variations between 48.38 mg/kg (CP 03B) and 70.25 mg/kg (CP 03B) all values being below the threshold of 100 mg/kg, showing a good chemical status of sediments in all PCs.
e) Arsenic poses a relatively small range of variation of concentrations 13.19 mg/kg (CP-02) - 16.55 mg/kg (CP 04B), the chemical quality of the sediments in all PCs being good.
f) For the cadmium virtually all values are below the limit of detection (0.41 mg/kg) respectively of the quality standard by Order of 161/2006, the chemical quality being good for all PCs.
g) In the case of mercury, excluding CP 10 (values are below the CMA) to the other CPs were recorded values exceeding 6.6% ... 43% threshold set out in the

Order of 161/2006; consequently like copper for mercury is highlights a associated pollution specific.

h) In accordance with the provisions of the Water Framework Directive, the assessment of chemical status requires at least 12 specific data per year; consequently data at this stage have an indicative character.

i) Hydrological conditions in the period April-August 2011 were reflected through the training flow dragged with higher proportion compared with the contribution of sediment so that the measurements refer to the earlier sediments, and argued that the measured values are close to those obtained in the JDS 1 (2001) versus JDS 2 (2007).

Table 3.1.E.6 - Overall assessment of concentrations of metals in sediments for each monitored critical point

Indicator	Main critical points			Secondary critical points					Old Danube	SC (mg/kg) Order 161/ 2006
	CP01	CP02	CP10	CP03A	CP03B	CP04A	CP04B	CP07		
	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	Vmed (mg/kg)	
Pb	10.76	15.96	10.96	18.31	12.08	9.38	4.99	14.44	7.39	85
Ni	21.03	22.51	19.80	**35.45**	22.75	**35.46**	19.97	22.68	3.15	35
Zn	99.03	104.24	86.87	138.28	101.15	135.98	97.14	95.87	51.87	150
Cu	**113.44**	**128.94**	**91.63**	**254.52**	**200.28**	**258.00**	**171.84**	**206.87**	**116.39**	40
Cr	58.64	50.22	49.76	70.25	48.38	74.32	48.71	51.53	66.52	100
As	14.59	13.19	14.67	15.34	16.42	16.17	16.55	14.30	15.20	29
Cd	sld	0.42	sld	sld	sld	sld	sld	sld	sld	0.8
Hg	**0.34**	**0.35**	0.30	**0.32**	**0.33**	**0.43**	**0.32**	**0.39**	0.27	0.3

NOTE: SC = Chemical status

In terms of metals, chemical status of sediment is poor. The most frequent exceedances of SC were recorded at Cu, Hg, while for Pb, As, Cd all values were lower than the quality standards (Order 161/2006).

From linking with historical data, it is observed only for Pb and Ni a decrease of concentrations (historical data Pb - concentration 125 mg/kg; NI- concentration 175 mg/kg).

It is mentioned that for metals has not been taken into account the natural background concentration. In Figure 3.1.E.1 is presented overall situation to of chemical state of sediments in terms of the concentration of heavy metals for the monitored CPs.

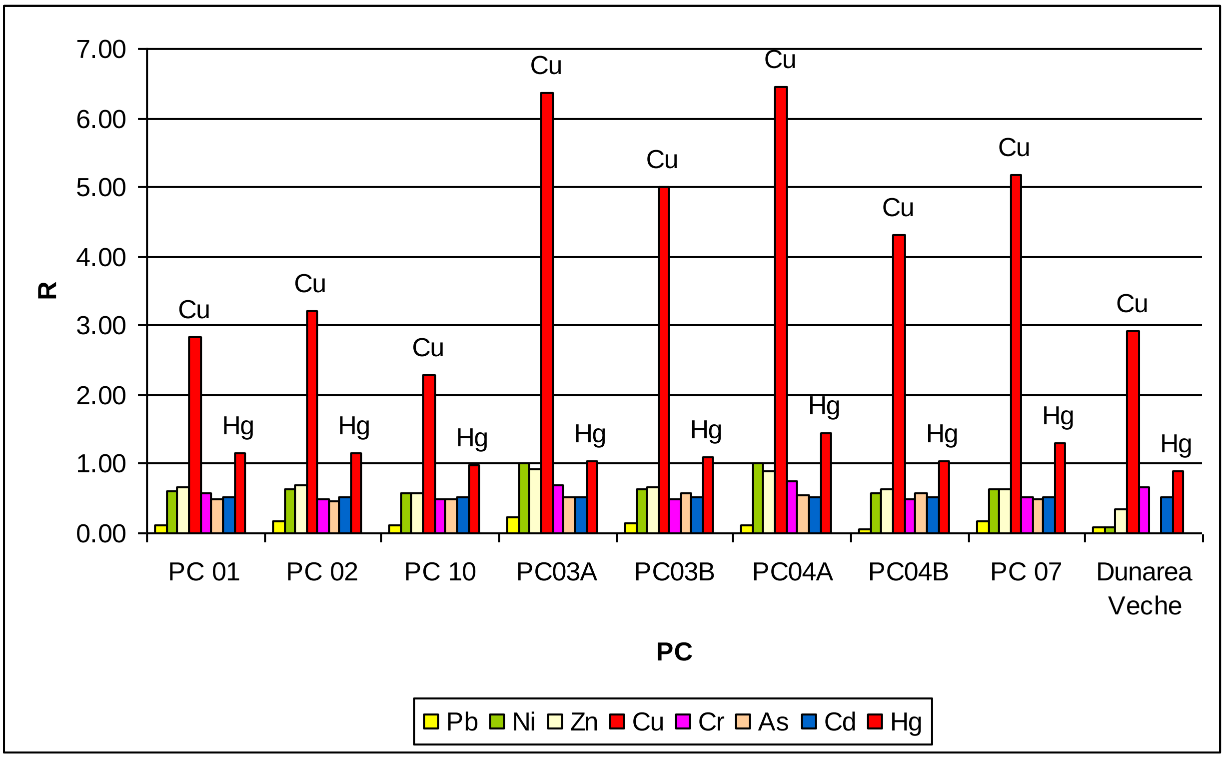


Figure 3.1.E.1 - The chemical state of sediments in terms of heavy metals

NOTE: R – the ratio between determinate concentration and quality standard according to order 161/2006.
R≥1 - indicate an exceedance of the quality standard - poor chemical status, and
R≤1 - a framing in quality standards, respectively a good chemical status.

B. <u>Organic Pollutants</u>

B.1. Table 3.1.E.7 presents the situation of PAH-terms from the point of view of the average concentration values determined at sediment, resulting in the following direction:

- The lowest values were recorded at benzo (a) anthracene and the highest at phenanthrene;
- The distribution of values is relatively homogeneous are not relevant differentiations between the concentrations of PAHS to PCs.
- All CPs are framing in the threshold stated in the Order of 161 so that the evaluated chemical status for the period April-August 2011 for PAHS is good;
- The values determined for the preconstruction phase for PAHs are entered within the range presented by JDS (historical data).

B.2. Regarding **PCBs** from the data presented in Table 3.1.E.8 results the following:

- The predominance belongs to PCB 153, on the second place PCB 138 and PCB 180, the rest of PCBs has no relevance in assessing the pollution associated with sediments.
- Compared with the limit of 20 µg/kg the sum of PCBs, the values determined at CPs are situated in the range thus 27.25 – 31.3, being with 36 - 57% higher, which leads to the conclusion of an pollution of associated sediments in all CPs with this organic micropollutant (poor chemical status).
- As far as PAHs the determined data during April-August 2011 are part of the historical range of measurements (JDS2 –ICPDR).

B.3. Related to **organochlorine pesticides** (Table 3.1.E.9) except the sum α, Δ, β HCH, at all CPs overall chemical status is bad it exceeds the thresholds set out in the Order 161 as follows:

- all CPs for lindane.
- Heptachlor to CP 01, CP 02, CP 10, CP 03A, CP 03B, CP 04A; to CP 04B and CP 07 determined values were below the limit of detection (1.0 µg/kg).
- The DDT sum and the metabolites sum for all.

Table 3.1.E.7 - Average concentrations of PAHs (mg x 10^{-3}/kg) determined in sediments

PAHs	Main critical points			Secondary critical points					Old Danube
	CP 01	CP 02	CP 10	CP 03A	CP 03B	CP 04A	CP 04B	CP 07	
napfthalene	18.5	20.6	19.1	14.5	18	21.5	16	12.25	15.4
phenanthrene	31.5	22.7	25.6	33.5	39.5	36.2	38.7	28	33.6
anthracene	1.9	3.4	2.6	2.75	3.5	3	2.75	3.5	3,5
fluoranthene	17,7	22,1	21,4	19,5	13	16,2	25,5	23,2	18,1
benzo (a) anthracene	sld	sld	sld	sld	sld	sld	sld	sld	sld
chrysene	37,1	22,1	30,2	39	29,7	30,7	42	45	33,8
benzo (k) fluoranthene	8,9	8,5	8,4	9,5	7,75	8,5	7	8	7,9
benzo (a) pyrene	5,1	5,1	4,6	3,5	4,75	4,7	3,75	4,75	4,7
indeno (1,2,3-cd)pyrene	8,7	8,6	8	7,7	8,25	8	9	4,25	7,1
benzo (g, h, i) perylene	2	2.4	2.4	3	3.25	2.75	2.5	2.5	3
sum PAHs	131.9	116	122.8	133.4	128.2	132.1	147.7	131.9	127.6
S.C. Order 161/2006	1000	1000	1000	1000	1000	1000	1000	1000	1000
CHEMICAL STATUS	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**

NOTE:
At the amount of PAHs for sld it was considered the value of 0.5 mg x 10^{-3}/kg.
The historical values are between 65-252 mg x 10^{-3}/kg.
The limit of Order 161/2006 is 1 mg/kg (1000 microg/kg) (the sum of PAHs).

Table 3.1.E.8 - Average concentrations of PCBs (mg x 10^{-3}/kg) determined in sediments

PCBs	Main critical points			Secondary critical points					Old Danube
	CP01	CP02	CP10	CP03A	CP03B	CP04A	CP04B	CP07	
PCB 28	sld	sld	sld	sld	sld	sld	sld	sld	sld
PCB 52	sld	sld	sld	sld	sld	sld	sld	sld	sld
PCB 101	sld	sld	sld	sld	sld	sld	sld	sld	sld
PCB118	sld	sld	sld	sld	sld	sld	sld	sld	sld
PCB 138	5.87	6.12	4	7.25	4	7.25	4	4	7.1
PCB 153	10.12	11.87	12.12	10.5	9	10.5	12.75	12.5	11.7
PCB 180	5.75	4.25	3.5	3.5	7.25	4.5	2.5	3	4.5
Sum PCB (poz 3-9)	**29.74**	**30.24**	**27.62**	**29.25**	**28.25**	**30.25**	**27.25**	**27.5**	**31.3**
CHEMICAL STATUS	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**

NOTE:
The limit of Order 161/2006 at the sum PCBs 20x10^{-3} mg/kg;
Historical data - sum PCB = 14-46 x 10^{-3} mg/kg
For sld was considerate the value 2.0 x 10^{-3} mg/kg

Table 3.1.E.9. Average concentrations of organochlorine pesticides (mg x 10^{-3}/kg) determined in sediment

Organochlorine pesticides	CP01	CP02	CP10	CP03A	CP03B	CP04A	CP04B	CP07	Old Danube
lindan (γHCH)	**4,01**	**6,5**	**4,5**	**5,32**	**3,05**	**2,3**	**3,2**	**4,17**	**4,96**
sum αβΔHCH	sld	sld	sld	sld	sld	sld	sld	sld	sld
heptaclor	**1,49**	**1,3**	**1,5**	**1,12**	**1,2**	**1,52**	**sld**	**sld**	**1,075**
DDT	30,75	29,75	25	26,5	20,75	32,5	26,5	25,2	24,8
DDE	sld	sld	sld	sld	sld	sld	sld	sld	sld
DDD	5,26	5,29	3,05	3,05	2,95	4,25	3,5	3,52	2,83
sum DDT	**37,01**	**36,04**	**29,05**	**30,6**	**24,7**	**37,7**	**31**	**29,7**	**28,63**
CHEMICAL STATUS	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**	**POOR**

NOTE:
Historical data: sum HCH (JDS 2 =0.77 mg x 10^{-3}/kg)
Sum DDT (DDE + DDD) JDS2 =4.4 mg x 10^{-3}/kg)
DDT= 15-38 mg x 10^{-3}/kg
For SLD was considerate the value 1.0
Quality standards are stipulated in Order 161/2006.

Compared to all the above mentioned elements the sediments, at all CPs are characterized from the point of view of evaluation criteria in accordance with the Water Framework Directive - through a poor chemical status - mainly due to PCBs and organo-chlorinated pesticides. In Figure 3.1.E.2 is presented the overall situation of the chemical state of sediments in terms of organic micro-pollutants (PAHs, PCBs and organochlorine pesticides).

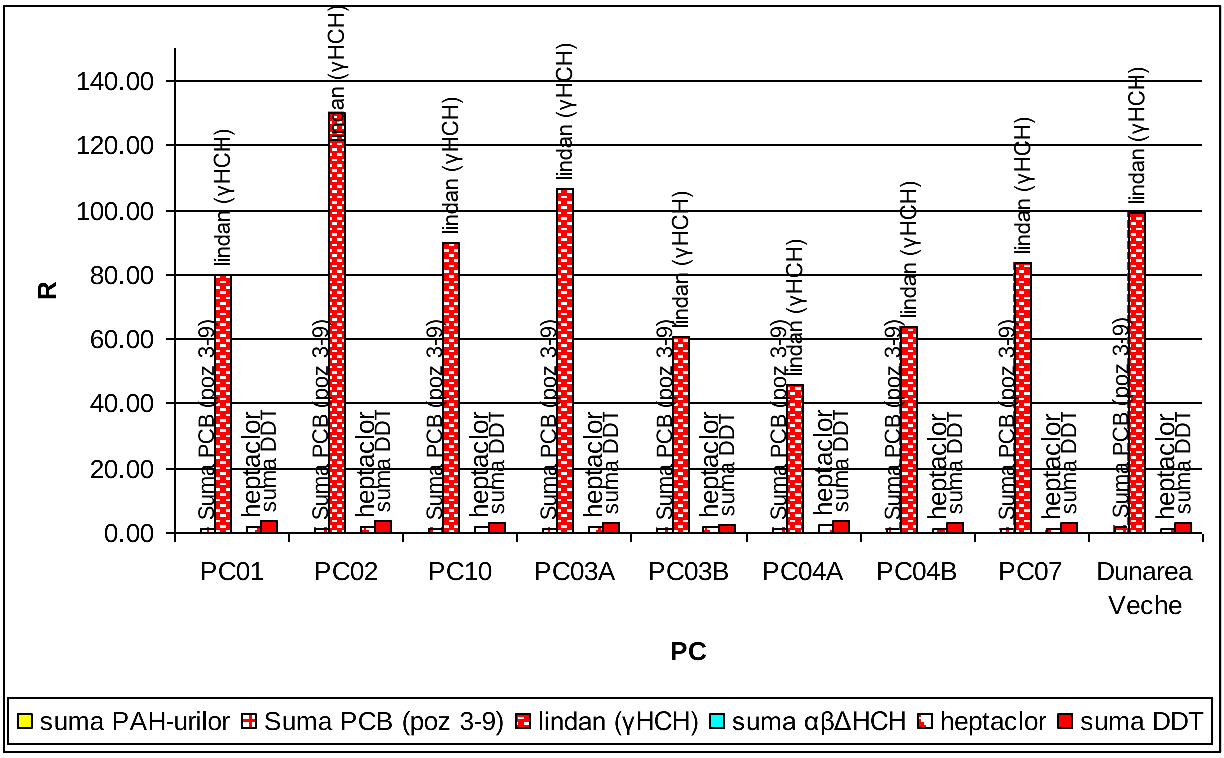


Figure 3.1.E.2 - The chemical state of sediments in terms of organic micro-pollutants

NOTE:

R – the ratio between determinate concentration and quality standard according to Order 161/2006.

R≥1 - indicate an exceedance of the quality standard - poor chemical status, and

R≤1 a framing in quality standards, so a good chemical status.

3.1.F. Monitoring of aquatic flora and fauna

Phytoplankton

Study of qualitative and quantitative structure of phytoplankton sampled from the Danube in order to assess the ecological status of the aquatic ecosystem, took into account determination of the following biological indicators:

- numerical density (ex/l)
- numerical abundance on taxonomic groups
- taxonomic composition, list of taxa with appropriate saprobic valence
- phytoplankton biomass (mg/l)
- numerically dominant and/gravimetric forms
- saprobic index
- Shannon Wiener diversity index.

The results of biological analysis on qualitative and quantitative structure of phytoplankton for critical points/sections analyzed in July 2011 are presented in Tables 3.1.F.1, 3.1.F.2, 3.1.F.3, 3.1.F.4 and 3.1.F.5.

From quantitative point of view, as seen in the Table and Figure 3.1.F.1, total number density values made by phytoplankton algae at the critical points analyzed were not too high, are between 1280000 ind./l and 4580000 ind./l, characteristic situation for rivers.

Table 3.1.F.1 - Quantitative structure of phytoplankton (density: ex/l)

PC/ Secţiunea	Densitatea totală (ex/l)	Densitatea (ex/l)			Indice diversitate Shannon-Wiener	Număr taxoni Cantitativ/ Calitativ
		Cyano-bacteria	Bacillariophyta	Chlorophyta		
01/2	2840000	-	2800000	40000	1,180	7/20
01/3	2440000	-	2420000	20000	1,220	6/12
02/5	1620000	-	1600000	20000	1,208	6/13
02/6	2260000	-	2220000	40000	1,190	8/16
10/18	4580000	-	4540000	40000	1,120	8/11
10/20	3840000	-	3780000	60000	1,041	7/9
3A/9	1280000	-	1260000	20000	1,331	7/8
3B/10	1420000	-	1400000	20000	1,293	6/8
4A/13	1560000	-	1520000	40000	1,413	8/10
4B/15	1540000	-	1520000	20000	1,392	8/9
07/17	2000000	-	1820000	180000	1,598	10/12

Generally taxonomic spectrum of phytoplankton varied from one critical point to another, ranging from 10 taxa (critical point 07/Section 17) and 6 taxa (at critical points: 01/3, 02/5, 3B/10),) numerical share of diatoms.

The number of algal taxa identified in each critical point is less in quantitative terms (6-10 taxa) than the number of taxa qualitative observed (8-20 taxa), as it is normal (Table 3.1.F.1).

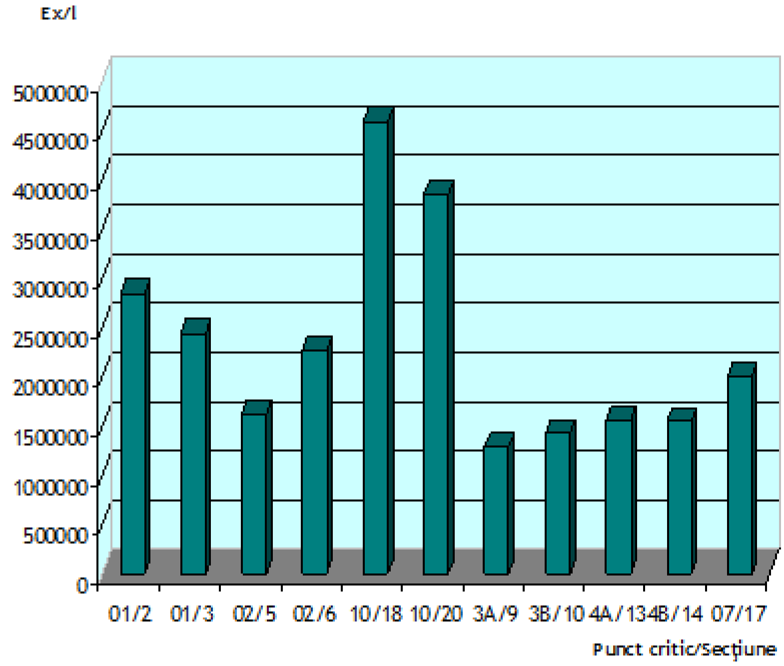


Figure 3.1.F.1 - Phytoplankton density variation at critical points

Regarding Shannon Wiener diversity index (Figure 3.1.F.2) the variation was between 1,041 and 1,413 - which means low levels of species number and uniformity of abundance (number) thereof.

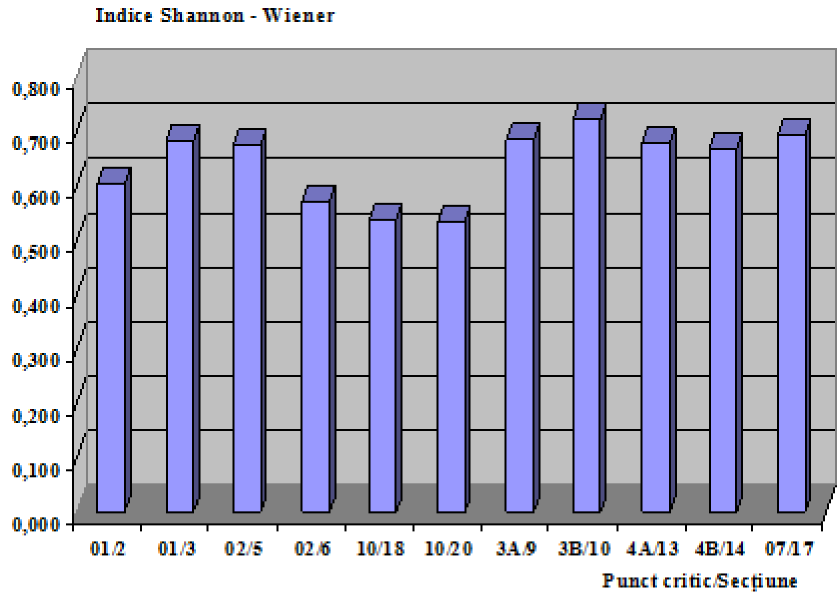


Figure 3.1.F.2 - Shannon Wiener diversity index variation at critical points

Numerical abundance (%) of the systematic group is characterized by the net dominance of diatoms (*Bacillariophyta*), with values ranging between 99.21% and 91%, other groups of algae being represented by a small number of species (Chlorophyta) or being absent (*Cyanophyta, Xantophyta, Euglenophyta, Pyrrophyta*) (Table 3.1.F.2).

Table 3.1.F.2 - Quantitative structure of phytoplankton (density %)

PC/ Secţiunea	Densitatea totală (%)	Abundenţa numerică (%) pe grupe sistematice		
		Cyanobacteria	Bacillariophyta	Chlorophyta
01/2	100	-	98,59	1,41
01/3	100	-	99,20	0,8
02/5	100	-	98,80	1,2
02/6	100	-	98,20	1,8
10/18	100	-	99,10	0,9
10/20	100	-	98,40	1,6
3A/9	100	-	98,40	1,6
3B/10	100	-	98,60	1,4
4A/13	100	-	97,40	2,6
4B/15	100	-	98,70	1,3
07/17	100	-	91,0	9,0

Phytoplankton biomass values were between 1.796 mg/l and 3.964 mg/l for critical points 01, 02, 03, 04 and 07, slightly higher values (5,854 mg/l) were recorded for CP 10 (Table 3.1.F.3 and Figure 3.1.F.3). Phytoplankton from Danube was net dominated by diatoms (*Bacillariophyceae)*, contributing to total biomass value in percentage of over 90%.

Table 3.1.F.3 - Quantitative structure of phytoplankton (biomass: mg/l)

PC/ Secţiunea	Biomasa totală (mg/l)	Grupe sistematice			
		Bacillariophyta		Chlorophyta	
		mg/l	%	mg/l	%
01/2	3,894	3,794	97,43	0,10	2,57
01/3	3,964	3,804	95,96	0,16	4,04
02/5	2,236	2,216	99,10	0,02	0,89
02/6	3,595	3,572	99,36	0,023	0,64
10/18	5,854	5,814	99,32	0,04	0,68
10/20	4,164	4,130	99,18	0,033	0,79
3A/9	1,876	1,796	95,73	0,08	4,26
3B/10	1,796	1,716	95,54	0,08	4,25
4A/13	1,957	1,866	95,35	0,091	4,65
4B/15	1,906	1,826	95,80	0,08	4,20
07/17	2,721	2,456	90,26	0,265	9,74

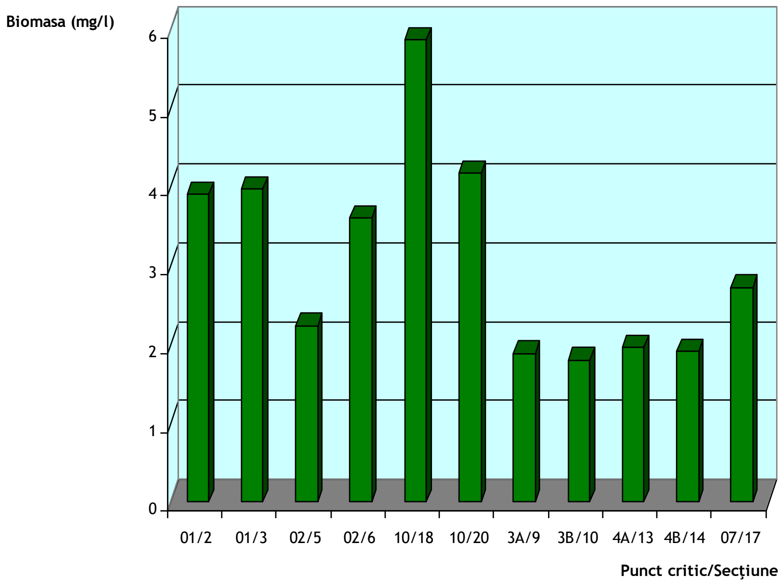


Figure 3.1.F.3 - Changes in phytoplankton biomass at critical points

Taxonomic composition of Danube for each critical point and saprobic valence for each taxon identified are shown in Table 3.1.F.4.

Qualitative composition of phytoplankton was made up of a total of 34 algal taxa belonging to the following systematic groups of algae *Bacillariophyta* - 22 taxa (64.70 %) and *Chlorophyta* - 12 taxa (35,30 %).

In critical points analyzed, commonly were identified algae: *Cyclotella meneghiniana, Aulacoseira (Melosira) granulata, Aulacoseira granulata var. angustissima, Stephanodiscus hantzschii* (diatomee), *Actinastrum hantzschii, Scenedesmus quadricauda* (clorophyte).

Depending on the capacity of different organisms to live in an environment richer or poorer in biodegradable organic substances (saprobic), organic species included saprobity system are grouped into different categories corresponding to different levels or saprobity areas: polysaprobic (p), α-mezasaprobic, β- mezasaprobic, oligosaprobic (o).

As can be seen from the data presented in Table 3.1.F.4 of the total algal taxa identified (34), more than half were forms bio-indicator (25), and of these, 17 belonged oligosaprobic areas, oligo-β-mezosaprobic and β-mezosaprobic, indicating moderate water pollution with *biodegradable organic substances,* so a relatively clean water in terms of quality, situation confirmed by saprobic index values between 1.6 and 2.2 (Figure 3.1.F.5).

Based on the presence of organisms bio-indicator species, bio-indicators of the numerical value of taxa and their absolute frequency (*Pantle – Buck* method), it can be appreciated saprobic area that it falls in overall analysis section, which reflects the level of biodegradable organic matter charging of water.

Table 3.1.F.4 - Qualitative structure of phytoplankton (taxonomic composition)

Grupa sistematica/Taxoni	Valenţa saprobă	Puncte critice/Secţiunea										
		01/2	01/3	02/5	02/6	10/18	10/20	3A/9	3B/10	4A/13	4B/15	07/17
Bacillariophyta												
Asterionella gracillima	o	+	+	+	+							
Amphipleura pellucida	β										+	
Aulacoseira granulata	β	+	+	+	+	+	+	+	+	+	+	+
Aulacoseira granulata var. angustissima		+	+	+	+	+	+	+	+	+	+	+
Cyclotella meneghiniana	α-β	+	+	+	+	+	+	+	+	+	+	+
Cymbella ehrenbergii	o-β					+						
Cymbella lanceolata	β			+								
Cymatopleura elliptica	β						+					
Cymatopleura solea	β-α	+		+								
Fragillaria crotonensis	o-β			+	+							
Meridion circulare	o				+							
Navicula cryptocephala	α	+										
Navicula gracilis	o-β			+	+		+	+	+	+		
Navicula viridula	α					+						
Neidium productum			+		+							
Nitzschia acicularis	α	+	+									
Nitzschia navicularis			+		+							
Nitzschia palea	α					+						
Nitzschia sigmoidea	β	+			+							
Stephanodiscus hantzschii	α	+	+	+	+	+	+	+	+	+	+	+
Synedra acus	β	+			+	+	+	+	+	+	+	+
Synedra ulna	β	+	+	+	+	+		+	+	+	+	+

Grupa sistematica/Taxoni	Valenţa saprobă	Puncte critice/Secţiunea										
		01/2	01/3	02/5	02/6	10/18	10/20	3A/9	3B/10	4A/13	4B/15	07/17
Chlorophyta												
Actinastrum curvata		+										
Actinastrum hantzschii	β						+			+	+	+
Micractinium pussillum												+
Monoraphidium griffithi		+										
Pediastrum simplex		+		+				+	+	+	+	+
Pediastrum duplex	β	+	+	+	+							
Scenedesmus acuminatus	β		+									+
Scenedesmus ovalternus		+				+				+		
Scenedesmus quadricauda	β	+	+	+	+							+
Schroederia setigera												+
Tetraedron caudatum	β	+			+							
Ulotrix zonata	α	+				+	+					

Note: + = prezent taxon

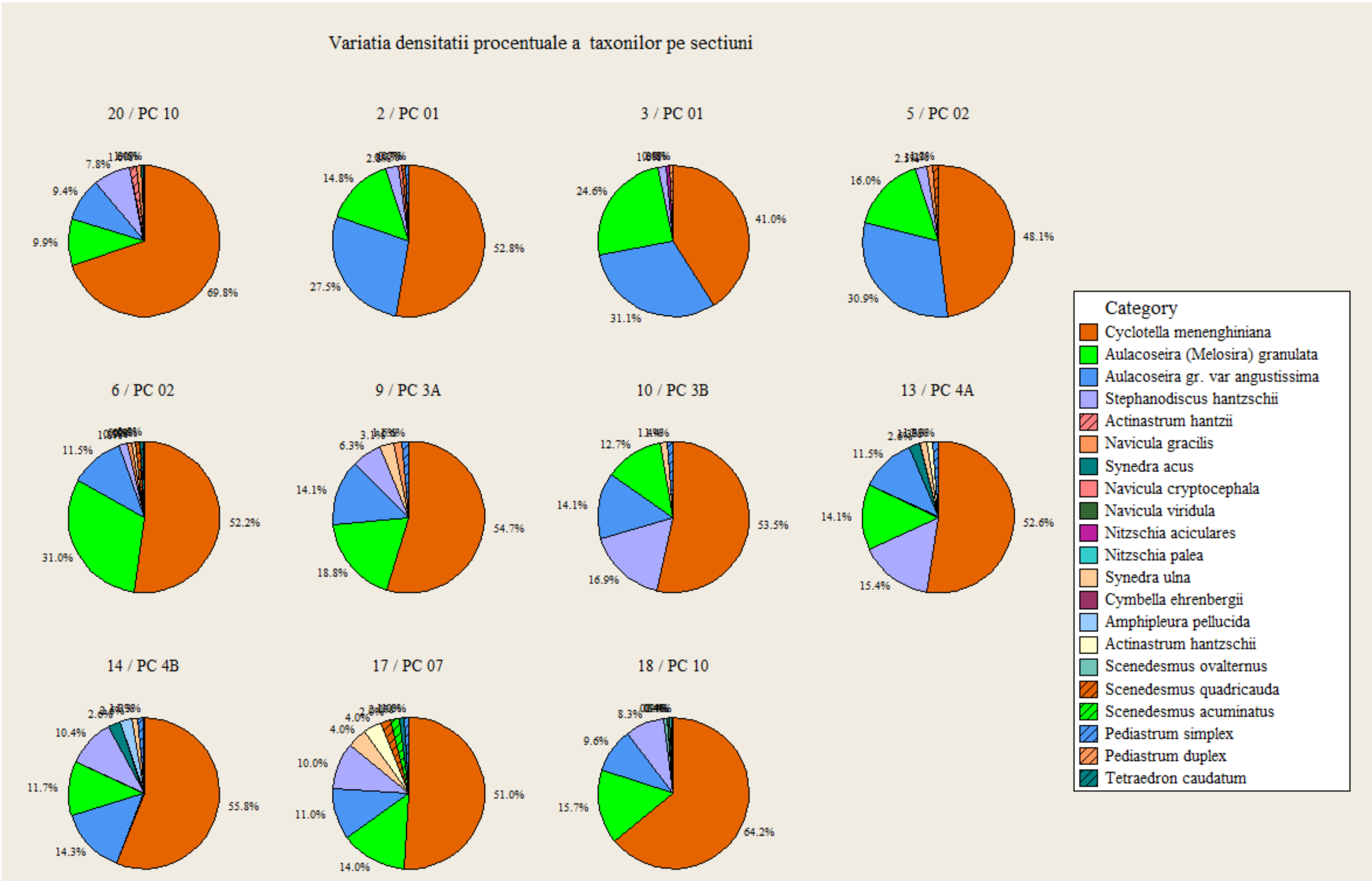


Figure 3.1.F.4 - Density variation of taxa at critical points

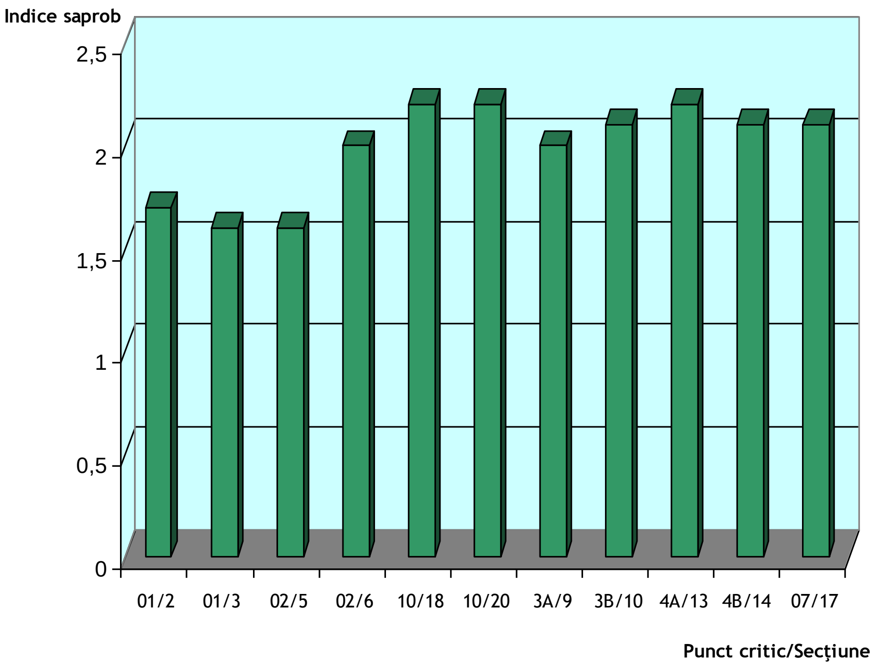


Figure 3.1.F.5 - Saprobic index variation of phytoplankton in the critical points

For critical points/sections analyzed using bio-indicators taxa value (s) and absolute frequency and the number of individuals belonging to each taxon in the sample (h) was calculated saprobic index (S) following formula:

$$S = \frac{\sum (sxh)}{\sum h} \qquad (3.2)$$

Framing of critical points/sections analyzed in saprobic area based on saprobic index value (S) is shown in Table 3.1.F.5.

Table 3.1.F.5 - Saprobic index

PC/ Secţiunea	Indice saprob	Caracterizare
01/2	1,7	- impurificare slabă corespunzătoare zonei oligo-*beta-mezosaprobe*
01/3	1,6	- impurificare slabă corespunzatoare zonei oligo-*beta-mezosaprobe*
02/5	1,6	- impurificare slabă corespunzatoare zonei oligo-*beta-mezosaprobe*
02/6	2,0	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
10/18	2,2	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
10/20	2,2	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
3A/9	2,0	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
3B/10	2,1	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
4A/13	2,2	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
4B/15	2,1	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
07/17	2,1	- impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
Valoare medie puncte critice	1,98	- impurificare potrivită corespunzătoare zonei *beta-mezosaprobe*

Saprobic index values between 1.6 and 2.2, falls water of Danube, in the critical points analyzed, in *mezosaprobic beta oligo* to *β-mezasoprobe* areas, which suggests, in general, water with weak organic charging to moderate.

Taking into account the biological quality elements for assessing the ecological status of water bodies included in the *Order 161/2006* (which is the transposition of Directive 60/2000/EC of European Parliament and Council establishing a framework for Community action in the field of water policy), based on ***quantitative and qualitative ecological indicators for phytoplankton*** can appreciate that, in the analyzed period (July 2011*), the ecological state* of Danube river, in critical points/sections analyzed, has been *very good to good*, corresponding for *class I* of quality to *class II* of quality.

In Table 3.1.F.6 are shown synthesized the main qualitative and quantitative indicators analyzed for critical points.

Table 3.1.F.6 - Synthesis of qualitative and quantitative indicators for phytoplankton

PC/ Secţiunea	Densitatea totală (ex/l)	Biomasa totală (mg/l)	Indice diversitate Shannon-Wiener	Evaluarea calităţii		
				Indice saprob	Clasa de calitate (Ord. 161/2006)	Starea ecologică
01/2	2840000	3,894	1,180	1,7	I	Foarte bună
01/3	2440000	3,964	1,220	1,6	I	Foarte bună
02/5	1620000	2,236	1,208	1,6	I	Foarte bună
02/6	2260000	3,595	1,190	2,0	II	Bună
10/18	4580000	5,854	1,120	2,2	II	Bună
10/20	3840000	4,164	1,041	2,2	II	Bună
3A/9	1280000	1,876	1,331	2,0	II	Bună
3B/10	1420000	1,796	1,293	2,1	II	Bună
4A/13	1560000	1,957	1,413	2,2	II	Bună
4B/15	1540000	1,906	1,392	2,1	II	Bună
07/17	2000000	2,721	1,598	2,1	II	Bună

Figures 3.1.F.6 - 3.1.F.9 shows maps with quantitative structure of phytoplankton in the critical points where monitoring was carried out.

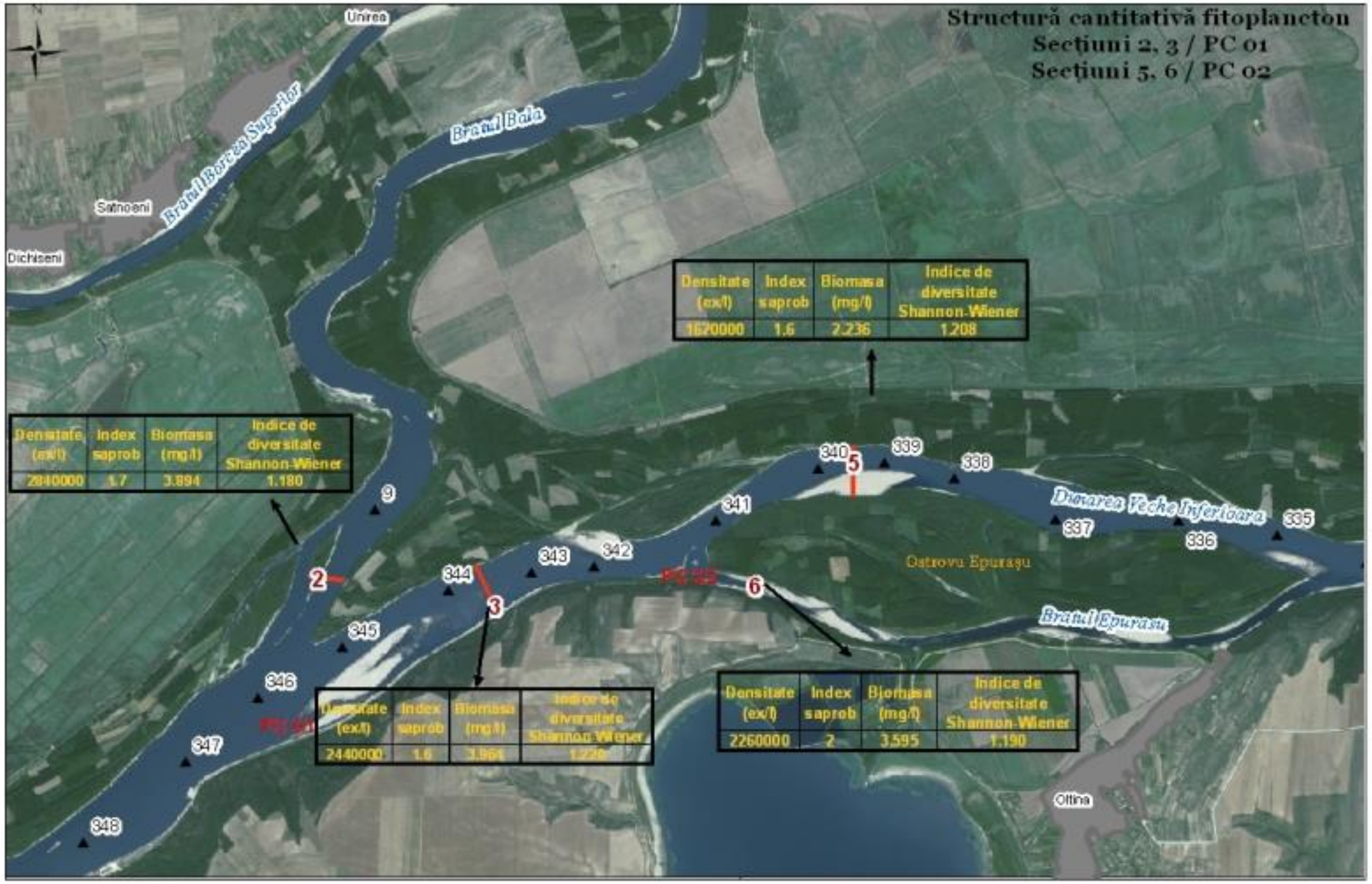


Figure 3.1.F.6 - Quantitative structure of phytoplankton in the critical points 01and 02

Figure 3.1.F.7 – Quantitative structure of phytoplankton in the critical points 3A, 3B, 4A and 4B

Figure 3.1.F.8 - Quantitative structure of phytoplankton in the critical point 07

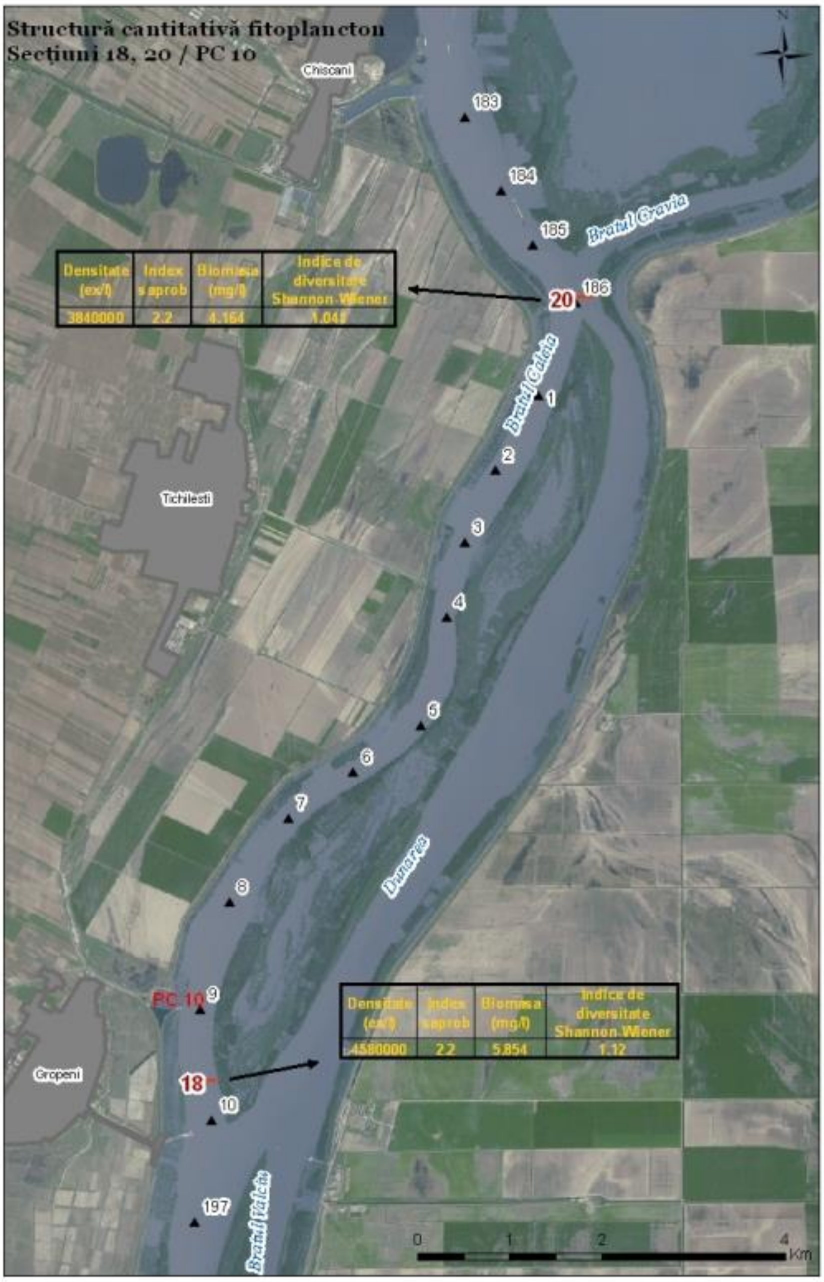


Figure 3.1.F.9 - Quantitative structure of phytoplankton in the critical point 10

Macrophytes

Macrophytobenthos is a permanent component, but not exclusive of the bank area of waters, fixed to the substrate through the roots were strong rhizomes that go through, in most cases, the water column coming into contact with the atmosphere.

Macro seaside vegetation is spread in space depending on water depths there is three cenosis plant with different characteristics, namely: flora harsh, flora emerged, flora submerged.

- *Flora harsh or paludous flora (shore*) is the whole plant with high silicon content that is present on the banks. Most have their roots in the soil and often covered with water and the lower portion of the stem in the water. Harsh flora can be found on permanent moist soil in the vicinity of the bank in the form of vegetal portion composed by elastic plant, resistant to strong wind, that have a role for riverbank protection against the action of winds and waves. Besides the role of bank protection, flora harsh creates the portions that are developing a favorable microclimate, in hot summers or in days with thunderstorms many organisms retreating in these areas cooler and smaller water currents.
- *Flora emerged* is made from plants that have contact with three living environments. The roots or rhizomes are fixed in the substrate, the stems and a part of leaves are the aquatic, and the flowers and part of the stem and leaves are overhead. Flora emerged is found in shallow areas, and after presence or absence of overhead strain emerged there are two types of *flora emerged, flora emerged with overhead leaves and flora emerged with floating leaves.*

  Flora emerged has a positive contribution in the circuit of matter and energy in that emerged leaves rich water in oxygen, and after the vegetative period, dead plant material decomposes by playing back river the minerals assimilated. The aquatic leaves and stems constitute favorable places for periphyton development, and also are favorable areas for reproduction, feeding and shelter for different hydrobionts, particularly for juvenile fish. Biomass plant of flora emerged is used in small part as feed for in small part as food for grazing organisms.
- *Flora submerged or flora soft* is represented by all plants that have all parts of the body in water. This cenosis installs in deeper portions, developing the muddy or sandy bottoms true underwater meadows. Flora submerged is composed of submersed superior plants and as well as macroscopic algae.

  Flora submerged is also called soft because it breaks down completely faster and more completely than the rest of aquatic macrophytes, which determines the release of nutrients in sludge and water, positive thing that enables further biogeochemical cycles. Flora submerged is an important source of oxygen for water because all the oxygen produced by photosynthesis is rendered to water. Flora submerged constitute a living framework for other hydrobionts (biotic biotope) which installs a rich and varied fauna which constitutes a specific cenosis for river called fauna of vegetation. Here fauna found optimal conditions to meet the needs for shelter, feeding and reproduction. And some fish species found here favorable places for feeding, reproduction, shelter.

In contrast with the phytoplankton, represented by small and microscopic plants that are found in the water, macrophytes are defined by superior large plants.

The aquatic and palustre plants represent an important category of primary producers, directly and indirectly involved in the development of the aquatic ecosystem functions, from the ecotop and adjacent areas.

The ecosystem components – vegetation, animals, micro-organisms and biotope structure – are subsystems between which complex and multiple connections are established and which assure the course of energy and matter and the efficiency of self-control mechanisms.

As a rule, the studies of the macrophytes of the aquatic ecosystem involve to establish the fowling issues:

- The surface held by the macrophytes, the degree of coverage the basin. The degree of coverage can be estimated on the entire groups of macrophytes or separate-by every species and it is express in % from the total surface of the considered basin;
- The density and quantitative consistency of the macrophytes.

Because the aquatic macrophytes represent one of the analyzed components of biotic factors monitored, the sampling stations were the same with those for sampling the others components, from the critical points specified in the project. The critical points are presented in Table 3.1.F.7.

Table 3.1.F.7. Sampling points

Critical point	Sector	Km
CP 01	Bala	347-343
CP 02	Epuraşu	342+700 – 341+800
CP 10	Ostrovu Lupu	197 -195
CP 03A and CP 03B	Seica	329 – 325
CP 04A and CP 04B	Ceacaru - Fermecatu	324 – 322
CP 07	Fasolele	291
CP 07*	Atârnaţi	268+ 400 – 266+ 850

CP07*- - adjacent area CP07

The macrophytes gathering was developed from the established station on both bank of the critical point monitored, left (MS) and right bank (MD).

The macrophytes sampling was developed during the maximum evolution process period, June being the warmest month of the year.

For the establishment of the land surface with macrophytes, the degree of coverage the basin, the determination can be done for the entire group of macrophytes or for every specie separate and is expressed in % from the total surface of the considered basin.

For the macrophytes density determination was used a wood quadrant with 1.0 m^2 surface area. The quadrant is submerging with the help of some weights fixed in the corners and all the plants which are inside are ingathered and counted for the density estimation per m^2.

The botanical matter collected from the field was analyzed basis on the literature information and on own research experience, every species being considered, from the systematic point of view, in his gender and family, respecting the actual system of phylogenetic classification of plants.

The type of species and the plant density per m^2 were investigated in the laboratory. The plant samples were samples were weighed to determine weight of plant biomass per m^2.

For the determination of the wet weight the plants were washed to remove foreign objects, and then were dried on filter paper to remove excess water and then were weighed.

For determination of dry biomass, it is applied the procedure used in chemistry for determining the “fixed residue”.

The summary of vascular aquatic flora and paludous has series of useful information, presented as following:

- scientific name of the species and the author
- common name from the literature
- lifetime (annual, biannual perennial)
- biological shape (form of life)
- zonal chorology: the name of the nearest city previously studied in terms of flora, year and authors
- spread of the species in the studied areas with a short description in terms of their frequency (very frequent, frequent, sporadic, rare, very rare)and the position (talus of dike, water surface, river edge)
- floristic element.

Qualitative composition of macrophytes

The presence of the macrophysics was reduced during the study period, July 2011, as a result were identified three species of plants on the Danube banks, in the areas of the critical points established in the project. The presence of the species in the studied critical points is described in Table 3.1.F.8.

All identified species of macrophytes belong to the same class – *Monocotyledoneae*, but are from different type of families, respectively – *Cyperacee*, *Butomaceae* and *Potamogetonaceae*.

Table 3.1.F.8 - Presence of macrophyte species in studied stations

Critical points				Taxon		
				Scirpus maritimus L.	*Butomus umbrellatus* L.	*Potamogeton fluitans* Roth
Main critical points	CP 01	01-1	MS	-	-	-
			MD	-	+ + +	-
		01-2	MS	-	-	-
			MD	-	-	-
		01-3	MS	-	-	-
			MD	-	+	-
		01-4	MS	-	-	-
			MD	-	-	-
	CP 02	02-3	MS	-	-	-
			MD	-	-	-
		02-4	MS	-	-	-
			MD	-	+	+
		02-5	MS	-	-	-
			MD	-	+	+
	CP 10	10-1	MS	-	-	-
			MD	-	-	-
		10-2	MS	-	-	-
			MD	-	-	-
		10-3	MS	-	-	-
			MD	-	-	-
Secondary critical points	CP 03	03A	MS	+ +	-	-
			MD	-	+	-
		03B	MS	-	-	-
			MD	-	-	-
	CP 04	04A	MS	-	-	-
			MD	-	+	-
		04B	MS	-	-	-
			MD	-	-	-
	CP 07	07-1	MS	-	+	-
			MD	-	-	
		07-2	MS	-	-	-
			MD	-	-	-

Legend:
MS - left bank
MD - right bank
+++ - frequent shape
+ + - stray shape
\+ - rare shape
\- - very rare shape (absent)

The distribution of the macro vegetation in the slot is developed as a function of the water depth. The three identified types of plants belonged the following groups of flora:

⇒ Scirpus Genus - flora harsh;
⇒ Butomus Genus - flora emerged with aerial leaves;
⇒ Potamogeton Genus- flora emerged with floating leaves.

The systematic classification of the studied species from the phylogenetic point of view:

Scirpus maritimus **L**

Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Cyperaceae
Genus: Scirpus
Species: Scirpus maritimus
Common name: Seaside Bulrush. Cosmopolitan Bulrush
Synonym: Schoenoplectus maritimus

Description: The plants are common on the edge of the ponds, lakes, wet hay field and also slightly salted water. In those areas are formed clusters of plants which represent food and shelter for fish and good places to breeding. It is a perennial plant, with creeping rhizome and long wearing many tubers, big as walnuts, sought by pigs. The strain is tri accessible edges and foil. The leaves are long, linear. The flowers, hermaphrodite, pedicle or sessile grouped in compact spice and floral wrapper is represented by six bristles (Figure 3.1.F.10).

Figure 3.1.F.10 - Scirpus maritimus L. **specie**

***Butomus umbrellatus* L.**

Class: Monocotyledoneae
Order: Helobiae
Family: Butomaceae
Genus: Butomus
Species: Butomus umbrellatus
Common name: Lily ponds

Description: The plant can be found in lakes, ponds, wetlands places and river bank. The plant is half-submerged with corpulent rhizome, stalk straight up to 150 cm high, cylindrical. Leaf is linear basilar, 60 to 120 cm length, 6-10 mm wide, in three corners, sharp and with shorter strain. Flowers are pink, beautiful, arranged in a large terminal umbrella and flowers develop successively (Figure 3.1.F.11).

Figure 3.1.F.11 - Butomus umbrellatus L. **specie**

***Potamogeton fluitans* Roth.**

Classe: Monocotyledoneae
Order: Helobiae
Family: Potamogetonaceae
Genus: Potamogeton
Species: *Potamogeton fluitans*
Common name: pondweed

Description: Species characteristic of flowing water, but also present in some streams of the Danube Delta (Turkish Channel). Make two kinds of leaf which however, usually do not exist simultaneously, some primary - lanceolate, others appearing later - stretched to oval, petiolated. Petiole of flippers leaves is longer than the limb or its length. The limb is often leather and shiny. The floral spike is very compact. Inflorescence is always present, long spike of 2 to 5.2 cm thick, his tail often thicker that internodes upper stem the fruit is visible on the back edge (Figure 3.1.F.12).

Figure 3.1.F.12 - Potamogeton fluitans Roth. specie(foto original: Vasilean Ion)

Qualitative composition of macrophytes

The macrophytes presence is rare in the analyzed areas, with small exceptions.

From the qualitative point of view, in many stations the macrophytes are missing and in the areas where are present their ***numerical density per m²*** vary from 4 plants – station 03A, lest bank, to 43 plants – station 01-1, right bank.

The macrophytes ***total biomass*** varies between 25.14 g/m² - station 01-3 MD, and 171.90 g/m² – station 03A MD (Table 3.1.F.9).

In Table 3.1.F.9 are presented the stations where the macrophytes are present, in the station unspecified in the table the macrophytes were absent.

Table 3.1.F.9 - Quantitative presence of macrophytes in the stations

Critical points				Taxon					
				Scirpus maritimus L.		*Butomus umbrellatus* L.		*Potamogeton fluitans* Roth.	
				SU (g/m²)	Sum (g/m²)	SU (g/m²)	SUm (g/m²)	SU (g/m²)	Sum (g/m²)
Main critical points	CP 01	01-1	MS	-	-	-	-	-	-
			MD	-	-	38,60	17,95	-	-
		01-3	MS	-	-	-	-	-	-
			MD	-	-	25,14	4,20	-	-
	CP 02	02-4	MS	-	-	-	-	-	-
			MD	-	-	24,68	2,77	25,53	8,44
		02-5	MS	-	-	-	-	-	-
			MD	-	-	11,88	1,78	44,42	5,56
Secondary critical points	CP 03	03A	MS	141,06	30,94	-	-	-	-
			MD	-	-	171,90	15,56	-	-
	CP 04	04A	MS	-	-	-	-	-	-
			MD	-	-	43,05	29,39	-	
	CP 07		MS	-	-	81,68	7,60	-	-
			MD	-	-	-	-	-	-

Legend:
MS - left bank SU - dry substance
MD - right bank SUm - wet substance

The maximum number of species was registered for *Butomus umbrellatus* L., those being in 7 of the 34 sampling stations, where there were found macrophytes.

Of the three species most poorly represented was *Scirpus maritimus L.*, these being found in a single station.

Most macrophytes collected were found on the right bank of the Danube in the critical points established in the project.

The figure illustrates station MD 01-1, with the greatest presence (common shape) of macrophytes, the approximate length of 300 m (Figure 3.1.F.13).

Figure 3.1.F.13 - Macrophytes presence (station 01-1 MD)

Conclusions

- General absence of macrophytobenthos may be due to water stream on the river Danube, which leads to a harder setting, difficult for macrophytes, but also big variations of the water level during one year period, most in the warm season.
- Another reason for the absence of macrophytes may be the clay faces of Danube banks.
- Another explanation for the absence of aquatic macrophytes is due to the abrupt banks of the river.
- The presence of a small number of macrophytes is more frequent on the right bank, because of the profile with a slow slope where macrophytes are fixed much easier, than the left bank with a very abrupt profile.

Zooplankton

The zooplankton represents an important link in food chains from the aquatic ecosystems, being the most valuable food source for fish species in the ecosystems zooplankton ensures the transfer of substances and energy from primary producers to higher order consumers.

The sampling stations are the same with those for other biological monitoring indicators, in the critical points established in the project.

Table 3.1.F.10 - Sampling points

Critical point		Sector	Km
Main critical points	CP 01	Bala area and Caragheorghe sandbank	km 347 - km 343
	CP 02	Zone of Epuraşu Island	km 342+700 - km 341+800
	CP 10	Caleia branch (Ostrovul Lupu)	km 197 - km 195
Secondary critical points	CP 03A and CP 03B	upstream and downstream of Şeica (Mirleanu)	km 329 - km 325
	CP 04A and CP 04B	Inland Ceacâru and Fermecatu	km 324 - km 322
	CP 07	Fasolele Island	km 291
	CP 09	Vărsăturii zone	km 233 - 232

- **Qualitative composition of the zooplankton**

During the study period, July 2011, on the Danube, between Călăraşi and Brăila in the analyzed critical points, were identified the total amount of 16 species of zooplankton (Table 3.1.F.11).

A number of 7 species of rotifers were identified in the studied critical points (CP 01, CP 02, CP 03, CP 04, CP 07, CP 09 and CP 10): *Branchionus calyciflorus* (Figure 3.1.F.14), *Branchionus angularis, Keratella cochlearis, Keratella quadrata* (Figure 3.1.F.15), *Lecane quadridentata, Trichocerca rattus* and *Colurella uncinata*. In all the studied critical points were also present rotifers eggs (Figure 3.1.F.14).

In critical points studied were identified 3 species of copepods: *Paracyclops fimbriatus* (Figure 3.1.F.16), *Cyclops strenuus* (Figure 3.1.F.17) and *Eudiaptomus gracilis* (Figure 3.1.F.18) which were present only in CP 10. The number of individuals in various ontogenetic stages pre adult, in generally, exceed 10-20 times the number of individual adult copepods (Pleşa and Müller, 2002). This situation is characteristic in critical points studied where nauplius (Figures 3.1.F.18, 3.1.F.20) and copepod its (Figure 3.1.F.21) were present in all samples. Because in these developmental stages the taxonomic identification is impossible, they were therefore counted and analyzed.

In addition to rotifers and copepods species were identified and 6 species of cladocerans: *Bosmina longirosris* (Figure 3.1.F.22), *Daphnia cuclata* (Figure 3.1.F.23), *Alonella nana, Alona rectangular, Chydorus shaericus, Ceriodaphnia sp.* In smaller proportion were present gamogenetic females (Figure 3.1.F.24). Have been identified and young cladocerans forms which were noted and analyzed as such.

Table 3.1.F.11 - List of zooplankton species identified on the Danube at the critical points studied in July 2011

Taxoni	PC 01				PC 02			PC 03		PC 04		PC 07		PC 10		
	01-1	01-2	01-3	01-4	02-3	02-4	02-5	03A	03B	04A	04B	07-1	07-2	10-1	10-2	10-3
Încrengătura Rotatoria																
Ordinul Ploimida																
Familia Brachionidae																
Branchionus calyciflorus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Branchionus angularis	+	+	+	+	-	-	-	+	-	-	+	-	-	-	-	+
Keratella cochlearis	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Keratella quadrata	+	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-
Familia Lecanidae																
Lecane quadridentata	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Familia Trichocercidae																
Trichocerca rattus	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Familia Colurellidae																
Colurella uncinata	+	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-
Subclasa Copepoda																
Familia Cyclopidae																
Subfamilia Eucyclopinae																
Paracyclops fimbriatus Claus, 1893	+	+	+	+	-	-	-	-	-	-	-	-	-	-	+	-
Subfamilia Cyclopinae																
Cyclops strenuus Fischer, 1851	+	-	-	+	+	-	+	-	+	-	+	+	-	+	+	+
Familia Calancidae																
Eudiaptomus gracilis Sars, 1863	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Subordinul Cladocera																
Infraordinul Anomopoda																
Familia Bosminidae																
Bosmina longirosris O.F.Müller,1776	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Familia Daphniidae																
Daphnia cuclata Sars, 1862	+	+	-	-	-	-	-	-	-	-	-	+	+	-	-	-
Ceriodaphnia sp Sars, 1862	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+
Familia Eurycercidae																
Alona rectangula Sars, 1862	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Chydorus shaericus O.F.Müller,1776	+	+	-	+	+	-	+	-	-	-	-	+	-	+	+	+
Familia Chydoridae																
Alonella nana Baird, 1850	+	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-

Legend:
+ = present shape;
- = absent shape

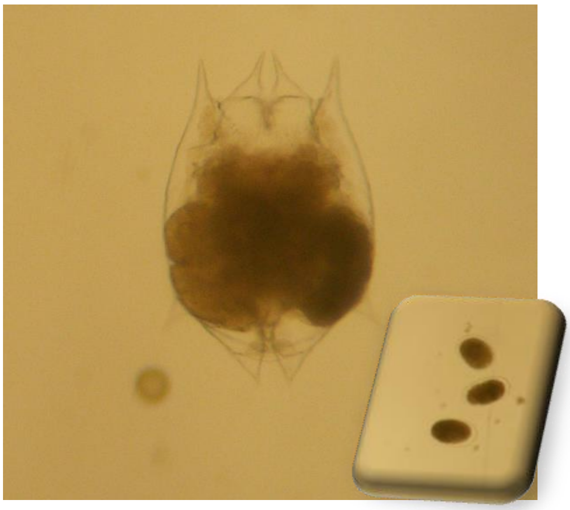


Figure 3.1.F.14 - Branchionus calyciflorus, eggs

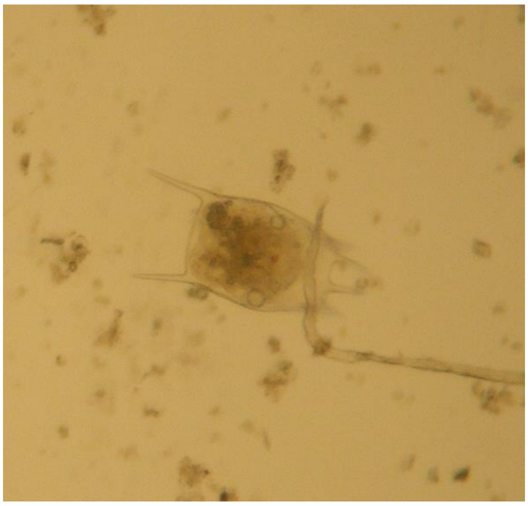


Figure 3.1.F.15 - Keratella quadrata

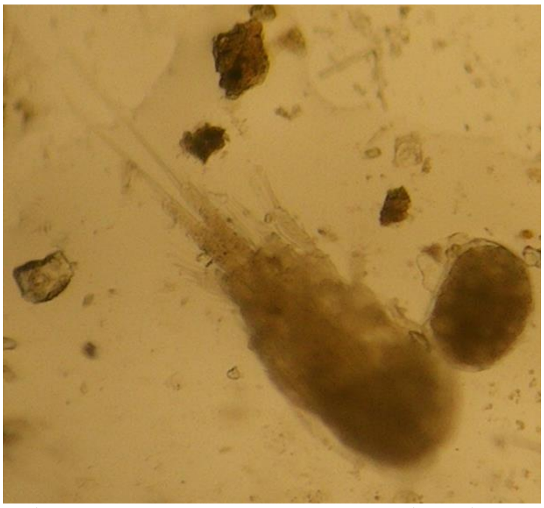


Figure 3.1.F.16 - Paracyclops fimbriatus

Figure 3.1.F.17 - Cyclops strenuous

Figure 3.1.F.18 - Eudiaptomus gracilis

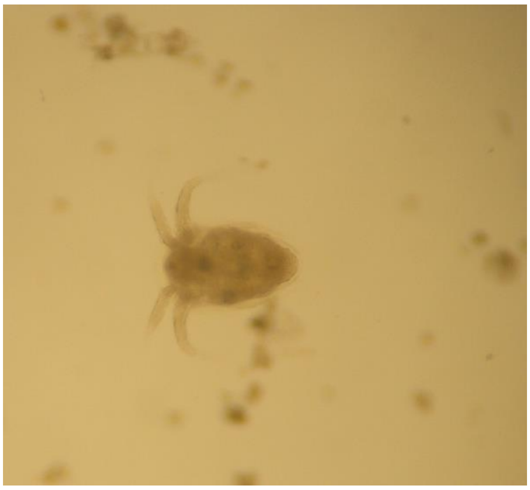


Figure 3.1.F.19 - Naupliu copepod

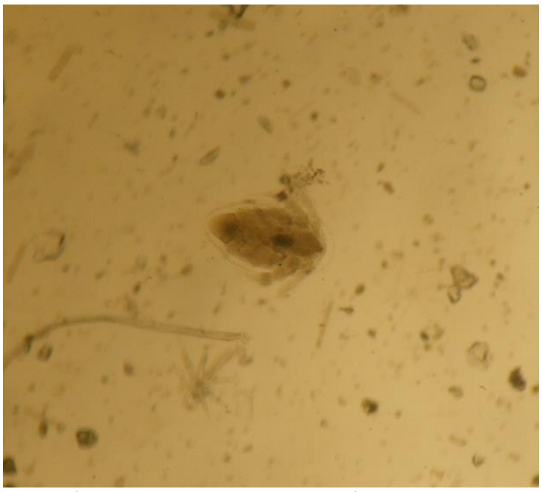


Figure 3.1.F.20 - Naupliu copepod

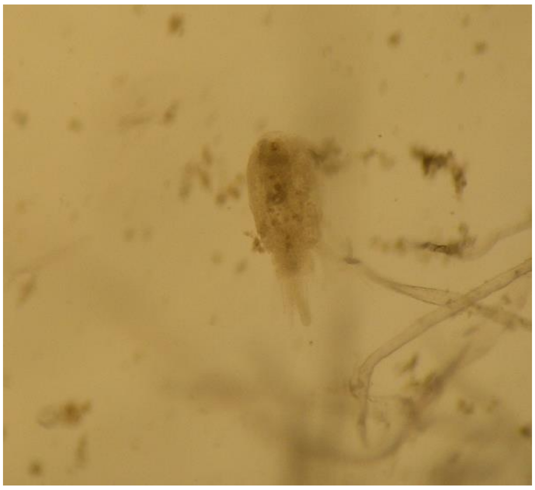


Figure 3.1.F.21 - Copepodit C1

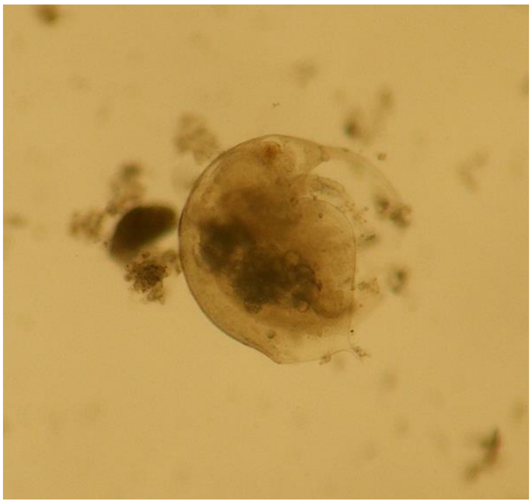


Figure 3.1.F.22 - Bosmina longirosris

Figure 3.1.F.23 - Daphnia cuclata

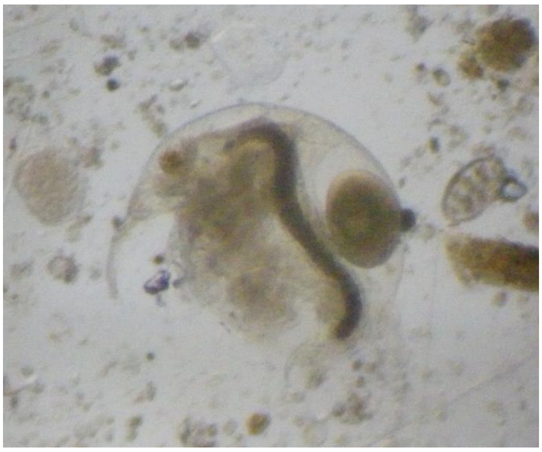


Figure 3.1.F.24 - Bosmina - femală gamogenetică

- **Compoziţia cantitativă a zooplanctonului**

The zooplankton is present in all the analyzed stations, the rotifers being representing the majority.

From the quantitative point of view, the total *numerical density* varies between of 25720 - 128507 ex/l in the analyzed samples and the total biomass of the zooplankton vary between 27581.87 – 176046.27 µg/l (Table 3.1.F.12).

The maximum number of specimens were registered the *Brachionis calyciflorus* species of rotifers.

From the three copepods, *Cyclops sternuus* was the majority both from the density and biomass point of view, in almost all the critical points investigated.

Between the cladocerans *Bosmina longirostris* was the majority both from the density and biomass point of view. The decreasing of population density of *Daphnia* in the samples from July is explained by predator pressure. *Alonella, Ceriodaphnia* and *Bosmina* have smaller dimensions and thus avoid predators more efficiently. Also, it have been observed that the *Daphnia* specimens length decrease with the advance in the summer period just for this reason.

The numerical abundance of the rotifers vary between 94.46 – 99.58 %, of the cladocerans vary between 0.14 – 4.43 % and of the copepods vary between 0.2 – 4.46 % (Table 3.1.F.12). A special mention should be made about the majority presence of rotifers eggs at all stations from all the critical points studied.

Table 3.1.F.12 - Zooplankton composition

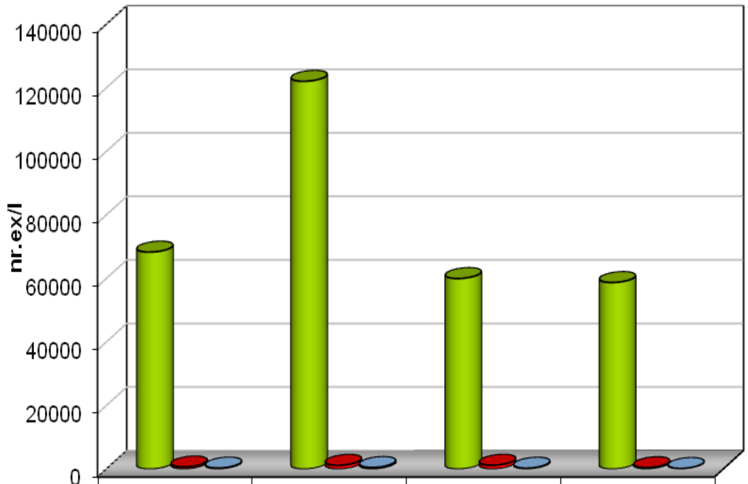
PC		Staţia	Data	Densitatea numerică totală (Nr.ex/l)	Biomasa totală (µg/l)	Abundenta numerica relativa			Specia dominantă
						Rotiferi %	Cladocere %	Copepode %	
Puncte critice principale	PC 01	01-1	26-28 iulie	69306, 67	103830,40	98,45	0,41	1,14	*Brachionis calyciflorus*
		01-2		128507	176046,27	98,69	0,38	0,93	
		01-3		61480	76154,27	99,18	0,42	0,41	
		01-4		59386, 67	95249,87	98,97	0,31	0,72	
	PC 02	02-3		69680	86158,13	99,08	0,60	0,32	
		02-4		34546,67	35759,07	99,42	0,14	0,44	
		02-5		79866,67	123006,00	98,98	0,52	0,40	
	PC 10	10-1		39369,86	45756,27	99,11	0,23	0,66	
		10-2		25720	46523,6	95,82	1,03	3,15	
		10-3		29533,33	62062,93	95,03	0,51	4,46	
Puncte critice secundare	PC 03	03A-aval		68093,33	75776, 7	99,34	0,28	0,39	
		03A-amonte		27253,33	27581,87	99,34	0,16	0,50	
		03B-aval		43106,67	48320	99,58	0,17	0,25	
		03B-amonte		32720	39391,333	99,51	0,29	0,20	
	PC 04	04A-aval		34573,33	43290,4	99,15	0,38	0,46	
		04A-amonte		26973,33	27658,93	99,01	0,20	0,79	
		04B-aval		63680	77640,2	99,11	0,38	0,51	
		04B-amonte		42240	53249,47	98,72	0,70	0,50	
	PC 07	07-1		62587,25	70397,33	94,46	4,43	1,10	
		07-2		57133,33	84031,07	97,77	1,75	0,48	

PC01

- In 01 critical point, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 98.45-99.18 %, in station 01-1-left bank being registered the minimum value of 98.19 % and in station 01-4-left bank the maximum value 99.45 %. Average numerical abundance of copepods varied between 0.41 - 1.14 %, in station 01-3-S being registered the minimum value of 0.31 % and in station 01-1-right bank the maximum value 1.60 %. Average numerical abundance of cladocerans varied between 0.38 - 0.42 %, in station 01-4-left bank being registered the minimum value of 0.09 % and in station 01-3-S the maximum value 0.67 % (figures 3.1.F.25, 3.1.F.26 and 3.1.F.27.)

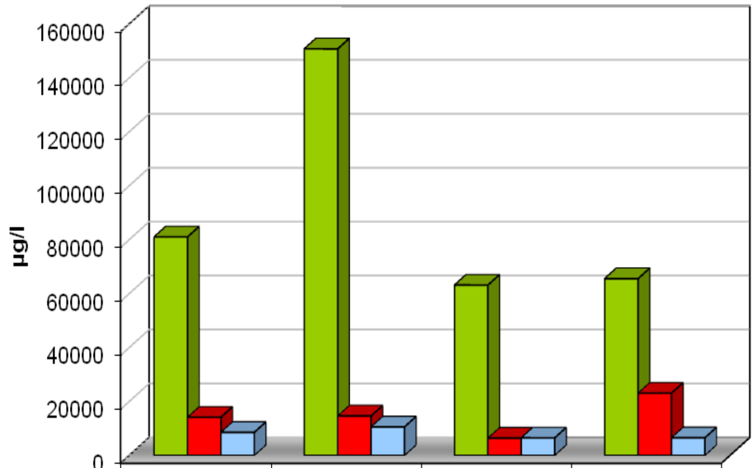
- Samples from July has the ***average numerical density*** of rotifers varied between 58733,33 - 122066,67 ex/l, in station 01-3-right bank being registered the minimum value of 31840 ex/l and in station 01-1-S the maximum value 105320 ex/l. Average numerical density of copepods varied between 453.33 – 1186.67 ex/l, in station 01-1-S being registered the minimum value of 560 ex/l and in station 01-3-left bank the maximum value 1600 ex/l. Average numerical density of cladocerans varied between 200 – 506.67 ex/l, in station 01-1-right bank being registered the minimum value of 40 ex/l and in station 01-1-right bank the maximum value 680 (Figure 3.1.F.28)

- The **average biomass** in 01 critical point of rotifers varied between 63186,53-150791,07 µg/l, in station 01-4-left bank being registered the minimum value of 46412,4 µg/l and in station 01-2-right bank the maximum value 192774.4 µg/l. Average biomass of copepods varied between 6434.4- 23121.20 µg/l, in station 01-4-left bank being registered the minimum value of 1951.6 µg/l and in station 01-1-right bank the maximum value 34446.4 µg/l. Average biomass of cladocerans varied between 6533.33- 10593.33 µg/l, in station 01-3-right bank being registered the minimum value of 560 µg/l and in station 01-1-S the maximum value 20420 µg/l (Figure 3.1.F.29).



	PC01-1	PC01-2	PC01-3	PC01-4
rotiferi	68306.67	122066.70	59986.67	58733.33333
copepode	680	1186.67	1200	453.33
cladocere	320	506.67	293.33	200

Figure 3.1.F.25. Numerical density of zooplankton in the PC 01 of July 2011



	PC01-1	PC01-2	PC01-3	PC01-4
rotiferi	81057.33	150791.07	63186.53	65575.33
copepode	14193.07	14661.87	6434.4	23121.2
cladocere	8580	10593.33	6533.33	6553.33

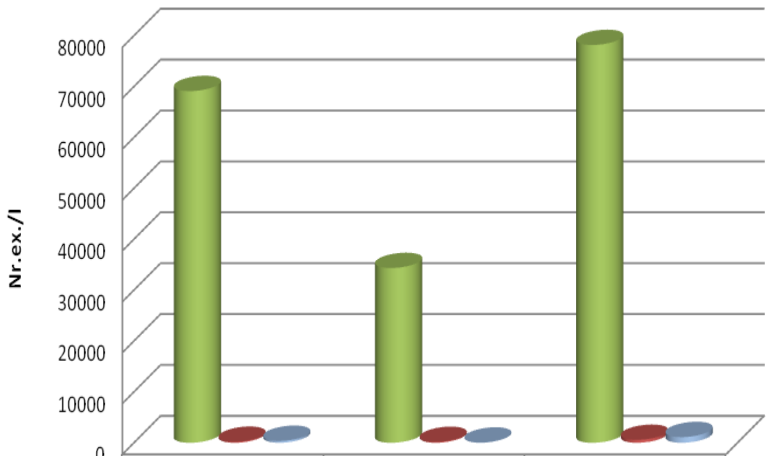
Figure 3.1.F.26 - Zooplankton biomass in the PC 01 July 2011

PC 02

- In CP 02, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 98.98 – 99.42 %, in station 02-3-S and 02-5-MS being registered the minimum value of 98.76 % and in station 02-3-MS the maximum value 99.44 %. Average numerical abundance of copepods varied between 0.32 - 0.44 %, in station 02-3-MS being registered the minimum value of 0.20 % and in station 02-5-MD the maximum value 0.63 %. Average numerical abundance of cladocerans varied between 0.14 – 0.60 %, in station 02-4-MD and 02-5-MD being registered the minimum value of 0.16 % and in station 02-3-MD.

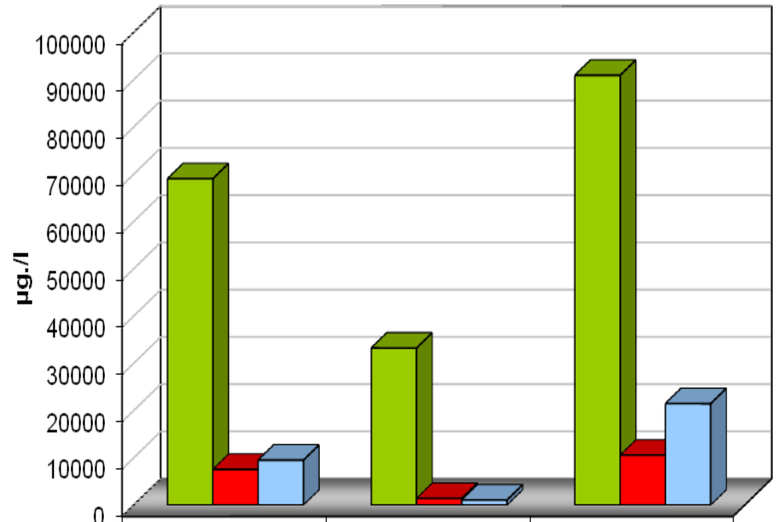
- Samples from July has the ***average numerical density*** of rotifers varied between 34346.67 – 78173.33 ex/l, in station 02-4-S being registered the minimum value of 23280 ex/l and in station 02-5-S the maximum value 102840 ex/l. Average numerical density of copepods varied between 160 - 573.33 ex/l, in station 02-4-S being registered the minimum value of 80 ex/l and in station 02-5-left bank the maximum value 1080 ex/l. Average numerical density of cladocerans varied between 40 - 1120 ex/l, in station 02-4 on right, middle and left bank being registered the minimum value of 40 ex/l and in station 02-5-left bank the maximum value 2520 ind./l (Figure 3.1.F.27).

- The average biomass in 02 critical point of rotifers varied between 33233.20-90948.67 µg/l, in station 02-4-S being registered the minimum value of 21036,4 µg/l and in station 02-5-S the maximum value 117955,6 µg/l. Average biomass of copepods varied between 1432.53- 10577.33 µg/l, in station 02-5-right bank being registered the minimum value of 2060.4 µg/l and in station 02-5-left bank the maximum value 24231,6 µg/l. Average biomass of cladocerans varied between 34546.67 – 79866.67 µg/l, in station 02-4-S being registered the minimum value of 23400 µg/l and in station 02-5-S the maximum value 103920 µg/l (Figure 3.1.F.28).



	PC02-1	PC02-2	PC02-3
rotiferi	69120	34346.67	78173.33
copepode	186.67	160	573.33
cladocere	373.33	40	1120

Figure 3.1.F.27 - Numerical density of zooplankton in the PC 02 in July 2011



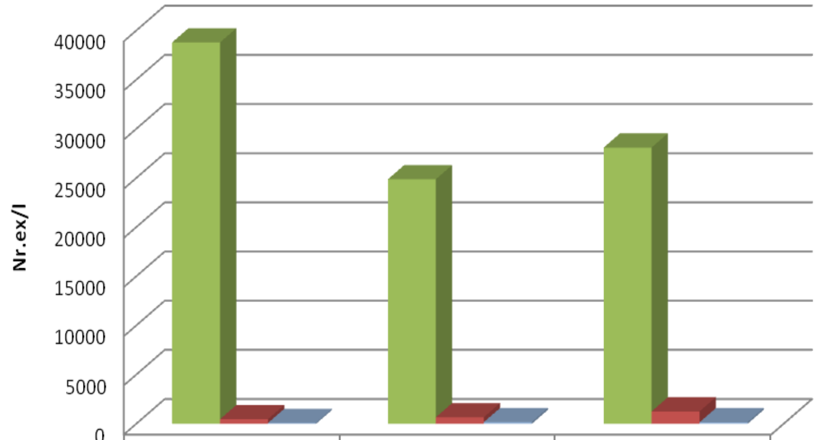
	PC02-1	PC02-2	PC02-3
rotiferi	69067.6	33233.20	90948.67
copepode	7570.53	1432.53	10577.33
cladocere	9520	1093.33	21480

Figure 3.1.F.28 - Zooplankton biomass in PC02 in July 2011

PC 10

- In CP 10, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 95.03 – 99.11 %, in station 10-3-S being registered the minimum value of 94.23 % and in station 10-1-left bank the maximum value 99.31 %. Average numerical abundance of copepods varied between 0.66 – 4.46 %, in station 10-1-left bank being registered the minimum value of 0.52 % and in station 10-2-left bank the maximum value 5.67 %. Average numerical abundance of cladocerans varied between 0.23 – 1.03 %, in station 10-1-right bank being registered the minimum value of 0.14 % and in station 10-3-right bank the maximum value 0,73 %.

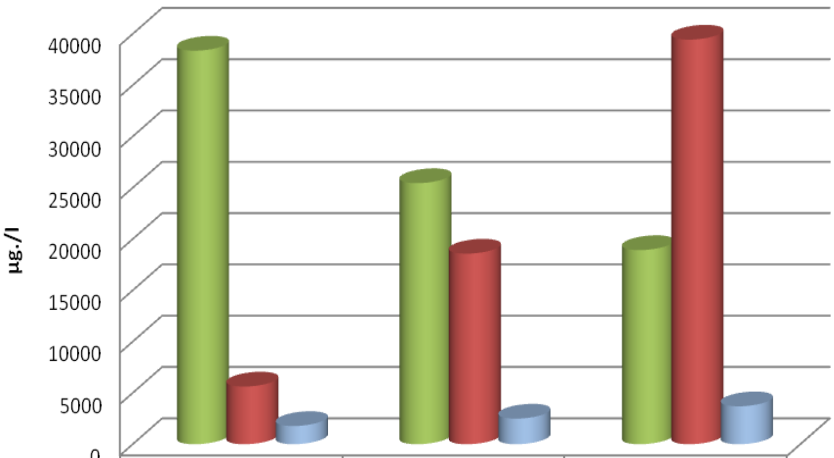
- Following the analysis of samples taken in July, ***average numerical density*** of rotifers varied between 24880 - 38800 ex/l, in station 10-2-left bank being registered the minimum value of 13560 ex/l and in station 10-1-left bank the maximum value 46000 ex/l. Average numerical density of copepods varied between 476.52- 1266.67 ex/l, in station 10-1-MS being registered the minimum value of 240 ex/l and in station 10-3-right bank the maximum value 1400 ex/l. Average numerical density of cladocerans varied between 93.33 - 173.33 ex/l, in station 10-1-right bank and 10-2-S being registered the minimum value of 40 ex/l and in station 10-2-left bank the maximum value 400 ex/l (Figure 3.1.F.29).



	PC10-1	PC10-2	PC10-3
rotifere	38800	24880	28106.67
copepode	476.52	666.67	1266.67
cladocere	93.33	173.33	160

Figure 3.1.F.29 - Numerical density of zooplankton in the PC 10 in July 2011

- Analyzing samples from the critical point 10, ***average biomass*** in 10 critical point of rotifers varied between 18925.60 – 38362.80 µg/l, in station 10-3-S being registered the minimum value of 12783.2 µg/l and in station 10-1-left bank the maximum value 46256 µg/l. Average biomass of copepods varied between 5620.13 - 39444 µg/l, in station 10-1-right bank being registered the minimum value of 2917.2 µg/l and in station 10-3-right bank the maximum value 52597.2 µg/l. Average biomass of cladocerans varied between 1773.33-3693.33 µg/l, in station 07-1-S being registered the minimum value of 560 µg/l and in station 10-3-right bank the maximum value 5200 µg/l (Figure 3.1.F.30).



	PC10-1	PC10-2	PC10-3
rotifere	38362.8	25452	18925.6
copepode	5620.13	18578.27	39444
cladocere	1773.33	2493.33	3693.33

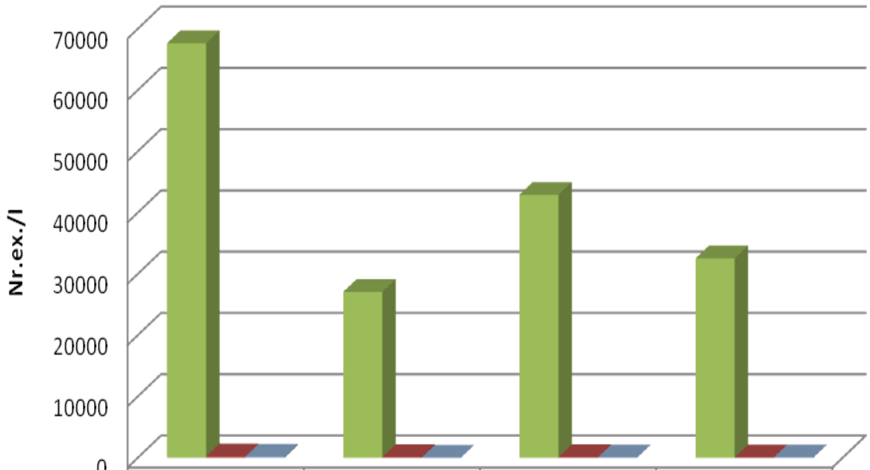
Figure 3.1.F.30 - Zooplankton biomass in the PC 10 in July 2011

PC 03

- In 03 critical point, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 99.34 – 99.58 %, in station 03A-downstream –left bank being registered the minimum value of 99.05 % in station 03B- upstream-S the maximum value 99.65 %. Average numerical abundance of copepods varied between 0.20 – 0.50 %, in station 03B-downstream-right bank being registered the minimum value of 0.13 % and in station 03A-downstream-left bank the maximum value 0.79 %. Average numerical abundance of cladocerans varied between 0.16 – 0.29 %, in station 03A-downstream-right bank being registered the minimum value of 0.00 % and in station 03B-downstream-left bank the maximum value 0.41 %.

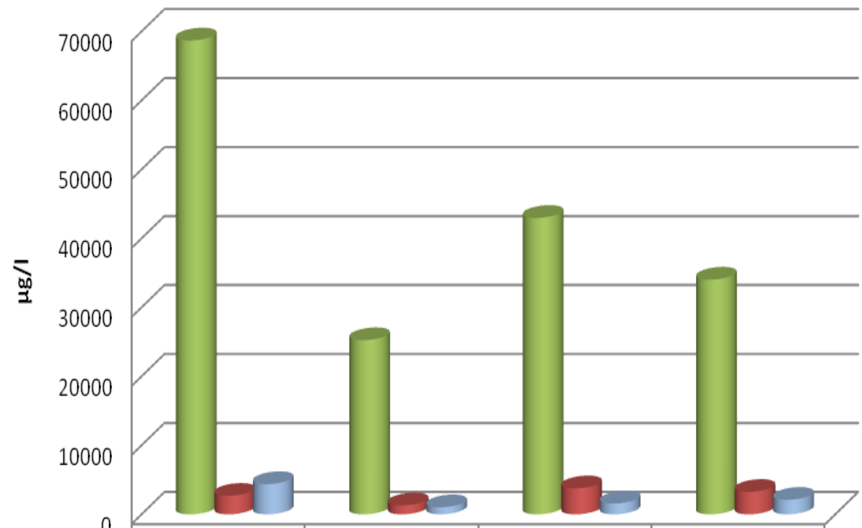
- In July, the ***average numerical density*** of rotifers varied between 27080-67666.67 ex/l, in station 03A-downstream-S being registered the minimum value of 24520 ex/l and in station 03A-upstream-left bank the maximum value 80320 ex/l. Average numerical density of copepods varied between 66.67 – 226.67 ex/l, in station 03B-downstream-right bank being registered the minimum value of 40 ex/l and in station 03A-upstream-S the maximum value 320 ex/l. Average numerical density of cladocerans varied between 40 - 200 ex/l, in station 03A-downstream-right bank being registered the minimum value of 0 ex/l and in station 03A-upstream-MS the maximum value 280 ex/l. (Figure 3.1.F.31).

- The **average biomass** of rotifers in 03 critical point varied between 25254.13 - 68700 µg/l, in station 03A-downstream-left bank being registered the minimum value of 22064 µg/l and in station 03A-upstream-left bank the maximum value 79595.6 µg/l. Average biomass of copepods varied between 1301.07 – 3770.53 µg/l, in station 03B-downstream-right bank being registered the minimum value of 680 µg/l and in station 03B-downstream-S the maximum value 8197.2 µg/l. Average biomass of cladocerans varied between 1026.67 – 4386.67 µg/l, in station 03B-upstream-right bank being registered the minimum value of 220 µg/l and in station 03A-upstream-left bank the maximum value 5320 µg/l. (Figure 3.1.F.32).



	PC03A-amonte	PC03A-aval	PC03B-amonte	PC03B-aval
rotiferi	67666.67	27080	42933.33	32560
copepode	226.67	133.33	106.67	66.67
cladocere	200	40	66.67	93.33

Figure 3.1.F.31 - Numerical density of zooplankton in the PC 03 in July 2011



	PC03A-amonte	PC03A-aval	PC03B-amonte	PC03B-aval
rotiferi	68700	25254.13	42982.8	34033.2
copepode	2690	1301.07	3770.53	3251.47
cladocere	4386.67	1026.67	1566.67	2106.67

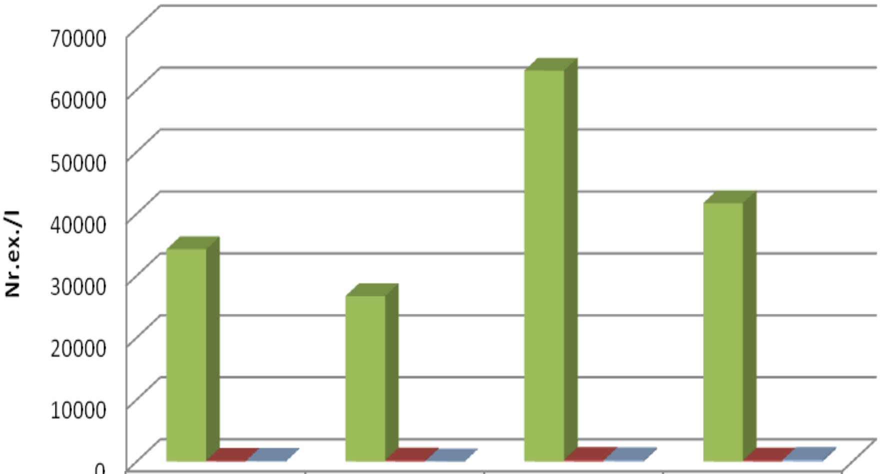
Figure 3.1.F.32 - Numerical biomass of zooplankton in PC 03 in July 2011

PC 04

- In CP 04, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 98.72 – 99.15 %, in station 04B-downstream-right bank being registered the minimum value of 98.30 % and in station 04B-upstream-right bank the maximum value 99.44 %. Average numerical abundance of copepods varied between 0.46 - 0.79 %, in station 04B-upstream-right bank being registered the minimum value of 0.26 % and in station 04A-downstream-S the maximum value 0.80 %. Average numerical abundance of cladocerans varied between 0.20 - 0.70 %, in station 04B-upstream in right bank and in middle being registered the minimum value of 0.31 % and in station 04B-downstream-left bank the maximum value 1.24 %.

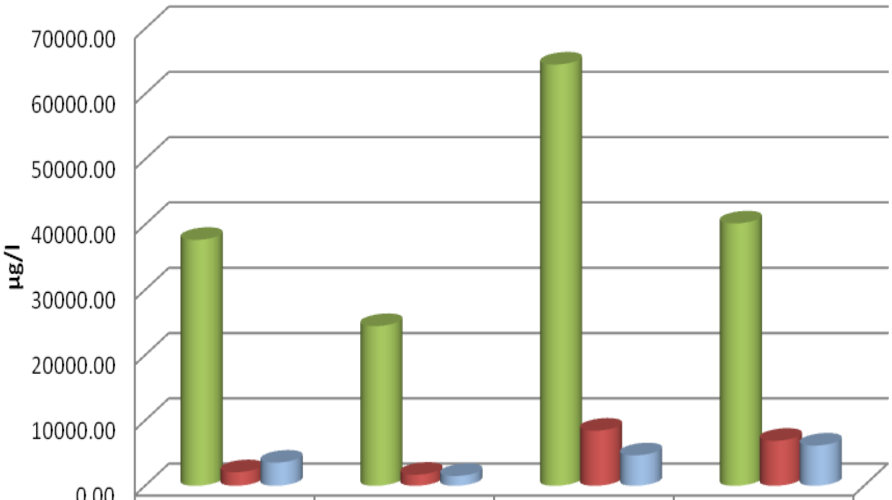
- In July 2011, the ***average numerical density*** of rotifers varied between 26706.67 – 63133.33 ex/l, in station 04A-downstream-S being registered the minimum value of 24600 ex/l and in station 04B-upstream-left bank the maximum value 60320 ex/l. Average numerical density of copepods varied between 160 – 306.67 ex/l, in station 04A-upstream-right bank and 04B-downstream-left bank being registered the minimum value of 120 ex/l and in station 04B-upstream-left bank the maximum value 400 ex/l. Average numerical density of cladocerans varied between 53.33 – 293.33 ex/l, in station 04A-downstream left and right bank being registered the minimum value of 40 ex/l and in station 04B-aval and 04B-upstream the maximum value 320 ex/l (Figure 3.1.F.33)

- The average biomass of rotifers varied between 24470.13 – 64526.53 µg/l, in station 04A-downstream-left bank being registered the minimum value of 22064 µg/l and in station 04B-upstream-right bank the maximum value 76846.4 µg/l. Average biomass of copepods varied between 1695.47 – 8447 µg/l, in station 04A-downstream-S being registered the minimum value of 986 µg/l and in station 04B-upstream-left bank the maximum value 18543.2 µg/l. Average biomass of cladocerans varied between 1493.33 - 4666.67 µg/l, in station 04A-downstream-left bank being registered the minimum value of 280 µg/l and in station 04B-downstream-left bank the maximum value 10080 µg/l (Figure 3.1.F.34)



	PC04A-amonte	PC04A-aval	PC04B-amonte	PC04B-aval
rotiferi	34280	26706.67	63133.33	41733.33
copepode	160	213.33	306.67	213.33
cladocere	133.33	53.33	240	293.33

Figure 3.1.F.33.* Numerical density of zooplankton in the PC 04 in July *2011



	PC04A-amonte	PC04A-aval	PC04B-amonte	PC04B-aval
rotiferi	37667.50	24470.13	64526.5	40192.1
copepode	2076.27	1695.47	8447	6897.33
cladocere	3546.67	1493.33	4666.67	6160

Figure 3.1.F.34 - Numerical biomass of zooplankton in PC 04 in July 2011

PC 07

- In CP 07, from the quantitative point of view, the ***average numerical abundance*** of rotifers varied between 94.46 – 97.77 %, in station 07-1-right bank being registered the minimum value of 85.85 % and in station 07-1-S the maximum value 99.31 %. Average numerical abundance of copepods varied between 0.48 – 1.10 %, in station 07-2-left bank being registered the minimum value of 0.28 % and in station 07-1-right bank the maximum value 1.85 %. Average numerical abundance of cladocerans varied between 1.75 – 4.43 %, in station 07-1-S being registered the minimum value of 0.28 % and in station 07-1-right bank the maximum value 12.31 %.

- Following the analysis of samples taken in July, the ***average numerical density*** of rotifers varied between 29653.333 – 55986.67 ex/l, in station 07-2-right bank being registered the minimum value of 42840 ex/l and in station 07-2-left bank the maximum value 69680 ex/l. Average numerical density of copepods varied between 253.33 – 293.33 ex/l, in station 07-1-S being registered the minimum value of 120 ex/l and in station 07-1-left bank the maximum value 520 ex/l. Average numerical density of cladocerans varied between 680 – 893.33 ex/l, in station 07-1-S being registered the minimum value of 80 ex/l and in station 07-1-right bank the maximum value 1600 ex/l (Figure 3.1.F.35).

- Following the analysis of samples taken in 07 critical point, the average biomass in 07 critical point of rotifers varied between 33233.20 – 90948.67 µg/l, in station 07-1-right bank being registered the minimum value of 15181.2 µg/l and in station 07-2-left bank the maximum value 70974,4 µg/l. Average biomass of copepods varied between 2536.40 – 11662.93 µg/l, in station 07-2-S being registered the minimum value of 1666 µg/l and in station 07-1-left bank the maximum value 7391.6 µg/l. Average biomass of cladocerans varied between 25333.33 – 30506.67 µg/l, in station 07-1-S being registered the minimum value of 2800 µg/l and in station 07-1-right bank the maximum value 56200 µg/l (Figure 3.1.F.36).

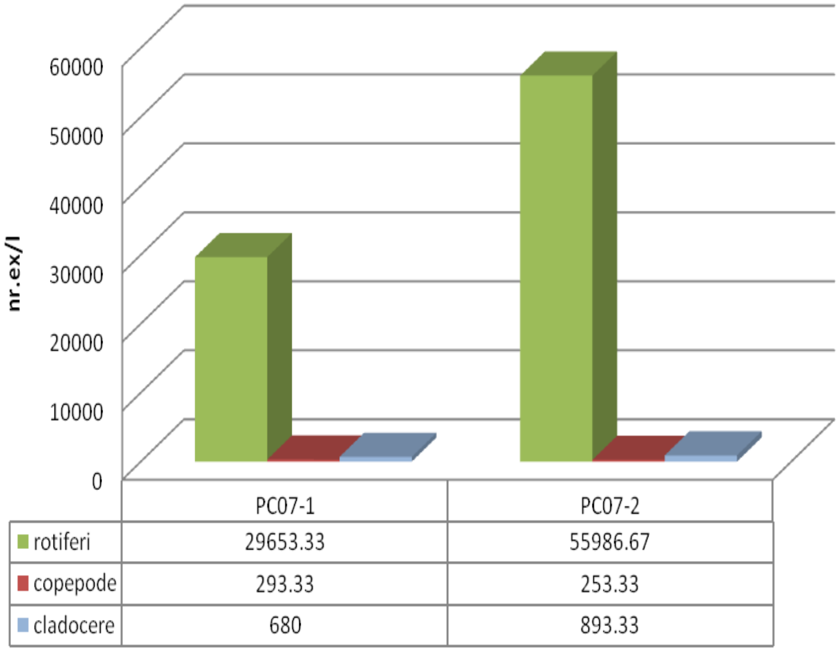


Figure 3.1.F.35 - Numerical density of zooplankton in PC 07 in July 2011

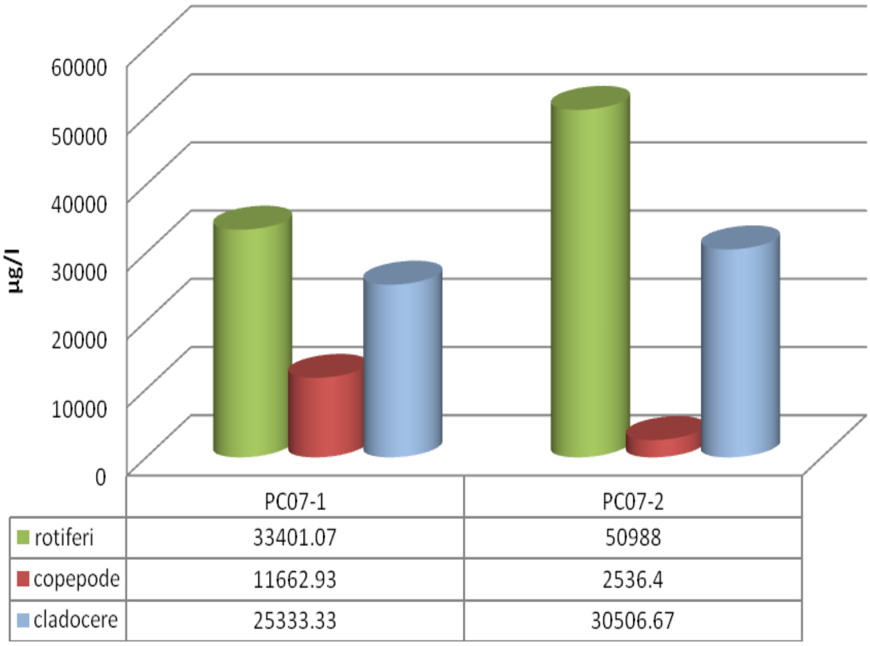


Figure 3.1.F.36 - Biomass of zooplankton in PC 07 in July 2011

➢ Estimation of ecological state

According to Order 161/2006 regarding surface water quality classification for establishment of ecological state of water, the following list with saprobiological indicators of water quality Ttabel 3.1.F.13).

Table 3.1.F.13 - Zooplankton - List of saprobiological indicators of water quality identified in the critical points (July 2011)

Taxoni	Indicatori saprobiologici ai apei din Dunăre (km 375 - km 175)	
Încrengătura Rotatoria		
Ordinul Ploimida		
Familia Brachionidae		
Branchionus calyciflorus	beta-alfa mezosaprob	2,5
Branchionus angularis	beta-alfa mezosaprob	2,5
Keratella cochlearis	0-beta mezosaprob	1,5
Keratella quadrata	0-beta mezosaprob	1,5
Familia Lecanidae		
Lecane quadridentata	0-beta mezosaprob	1,5
Familia Trichocercidae		
Trichocerca rattus	oligosaprob	1
Familia Colurellidae		
Colurella uncinata	Oligosaprob	1
Subclasa Copepoda		
Familia Cyclopidae		
Subfamilia Eucyclopinae		
Paracyclops fimbriatus Claus, 1893	oligosaprob	1
Subfamilia Cyclopinae		
Cyclops strenuus Fischer, 1851	beta-alfa mezosaprob	2,5
Familia Calancidae		
Eudiaptomus gracilis Sars, 1863	oligosaprob	1
Subordinul Cladocera		
Infraordinul Anomopoda		
Familia Bosminidae		
Bosmina longirosris O.F.Müller, 1776	0-beta mezosaprob	1,5
Familia Daphniidae		
Daphnia cuclata Sars, 1862	beta-saprob	2
Ceriodaphnia sp Sars, 1862	0-beta mezosaprob	1,5
Familia Eurycercidae		
Alona rectangula Sars, 1862	0-beta mezosaprob	1,5
Chydorus shaericus O.F.Müller, 1776	oligosaprob	1
Familia Chydoridae		
Alonella nana Baird, 1850	0-beta mezosaprob	1,5

In all analyzed samples, from the quantitative point of view, the bigger numerical density and numerical biomass has the *Branchionus calyciflorus* a species – mezasoprobe alpha beta (2.5) which the water falls in quality class II.

Zooplankton qualitative analysis of aquatic ecosystem Danube (km 375- km 175) has highlighted the presence of three taxonomic groups: rotifers, copepods and cladocerans. Of these, generally, best represented as a number of species and number of copies are rotifers (*Brachionus sp.*, *Keratella sp.* etc.), followed by copepods (*Cyclops sp. etc.*) as adults, copepods, nauplas and the last place as numerical densities are cladocerans (*Daphnia sp.*, *Bosmina sp*. etc.).

Water falls in quality class II.

BENTHIC MACROINVERTEBRATES

Qualitative and quantitative study of the structure of macroinvertebrates samples taken from Danube consisted in determining the following biological indicators:

- taxonomic composition
- numerical abundance on taxonomic groups
- numerical density (no. ex/m^2)
- biomass (g/m^2)
- Shannon Wiener diversity index.

➢ **Qualitative composition of benthic macroinvertebrates**

By qualitative processing of samples taken from the critical points analyzed have been highlighted 7 taxonomic groups namely: *Oligocheta, Gasteropoda, Bivalvia, Ostracoda, Amphipoda, Odonata* and *Diptera*.

15 species of macroinvertebrates have been identified in total (Table 3.1.F.14). *Oligocheta* species (Figure 3.1.F.37), *Tubifex tubifex* was identified in 5 critical points (CP 01, CP 02, CP 04, CP 07 and CP 10). Gastropods (Figure 3.1.F.38) were represented by 7 species, of which *Lithoglyphus naticoides* was present in all sections studied. Of bivalve (two species), *Dreissena polymorpha* (Figure 3.1.F.39) was identified in almost all sections studied, with the exception of CP 04. In addition to species of crustaceans (*Cypris sp., and Gammarus sp.)* have been identified and 3 species of *Insecta* class (*Libellula depressa, Libellula quadrimaculata)* and a *Diptera* species, *Chironomus plumosus* (Figure 3.1.F.40, Figure 3.1.F.41).

Figure 3.1.F.37 - Tubifex sp.

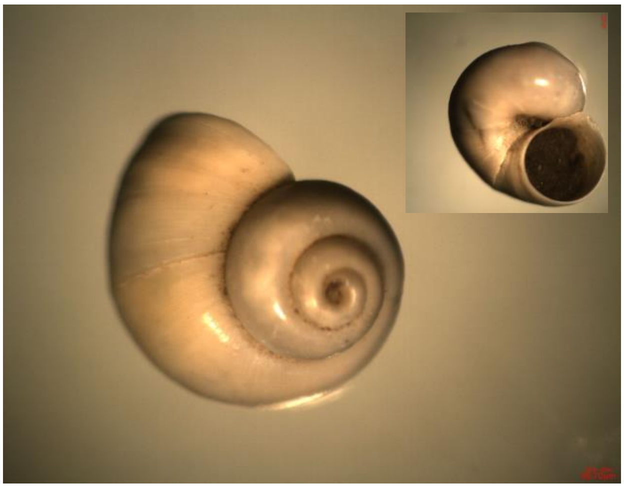
Table 3.1.F.14 - List of macroinvertebrates species identified on the Danube (km 375- km 175)

Taxoni	PC 01				PC 02			PC 03		PC 04		PC 07		PC 10		
	01-1	01-2	01-3	01-4	02-3	02-4	02-5	03A	03B	04A	04B	07-1	07-2	10-1	10-2	10-3
Increngatura ANELIDA																
Suincrengatua Chaetopode																
Clasa Oligocheta																
Tubifex tubifex	+	-	-	-	-	+	-	-	-	+	+	-	+	+	-	+
Increngatura MOLUSCA																
Clasa Gasteropoda																
Ordinul Branchiata																
Familia Bithynidae																
Bithynia tentaculata (Linne, 1758)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Familia Valvatidae																
Valvata piscinalis (O. F. Müller, 1774)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
Familia Viviparidae																
Viviparus acerosus (Bourguignat, 1862)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subclasa Prosobranchia																
Familia Lithoglyhidae																
Lithoglyphus naticoides (C. Pfeiffer, 1828)	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-
Familia Neritidae																
Theodoxus fluviatilis (Linne, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Theodoxus danubialis (C. Pfeiffer, 1828)	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Theodoxus transversalis	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Familia Thiaridae																

Taxoni	PC 01				PC 02			PC 03		PC 04		PC 07		PC 10		
	01-1	01-2	01-3	01-4	02-3	02-4	02-5	03A	03B	04A	04B	07-1	07-2	10-1	10-2	10-3
Esperiana acicularis (Ferussac, 1829)	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Esperiana esperi (Ferussac, 1823)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Subclasa Pulmonata																
Familia Planorbidae																
Planorbis planorbis (Linne, 1756)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planorbarius corneus (Linne, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Familia Physidae																
Physa acuta (Draparnaud, 1805)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clasa Bivalvia																
Subclasa Eulamelibranhiata																
Familia Dreissenidae																
Dreissena polymorpha (Pallas, 1771)	+	+	+	+	-	+	+	+	+	-	-	-	+	-	-	+
Familia Sphaeridae																
Shaerium sp. (Linne, 1758)	-	+	+	-	-	-	-	+	-	-	-	-	+	-	-	-
Familia Unionidae																
Unio pictorum (Linne, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increngatura ARTHROPODA																
Clasa Crustacea																
Ordinul Ostracoda																
Ostracode	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+
Ordinul Amphipoda																

Taxoni	**PC 01**				**PC 02**			**PC 03**		**PC 04**		**PC 07**		**PC 10**		
	01-1	01-2	01-3	01-4	02-3	02-4	02-5	03A	03B	04A	04B	07-1	07-2	10-1	10-2	10-3
Gammarus sp.	-	-	+	-	-	+	-	-	-	+	+	-	+	-	-	-
Clasa Insecta																
Ordinul Odonata																
Libellula depressa	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Libellula quadrimaculata	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Ordinul Trichoptera																
Hydrospyche sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ordinul Diptera																
Chironomus plumosus	+	+	-	-	-	-	-	-	-	+	+	-	+	-	+	-
Culex pipiens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Legend:
+ = present form / - = absent form



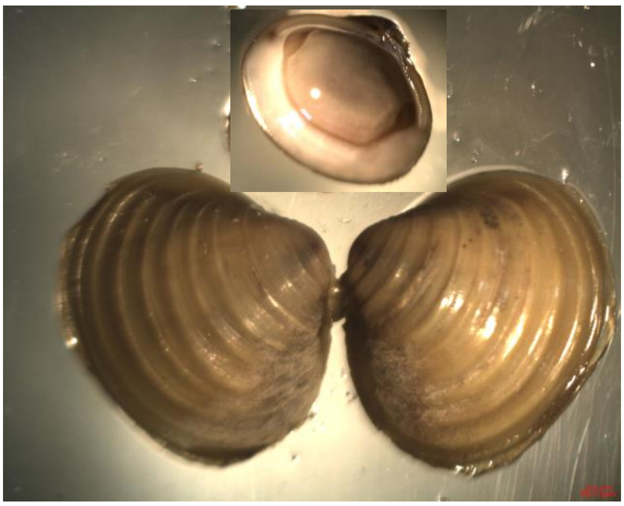
Valvata piscinalis

Lithoglyphus naticoides

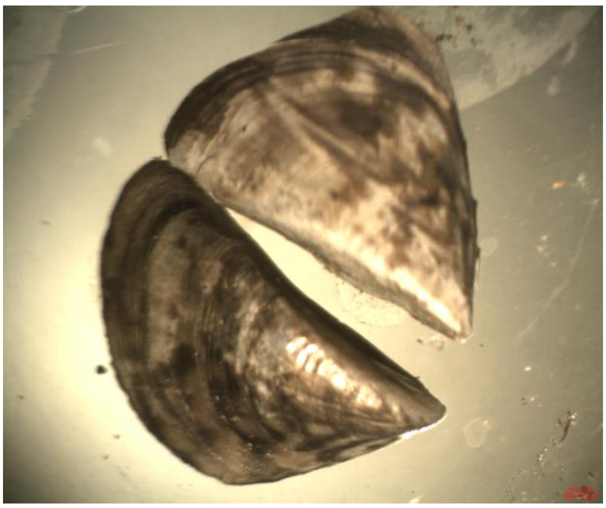
Esperiana acicularis

Esperiana esperi

Figure 3.1.F.38 - Representatives of gastropods



Shaerium sp.



Dreissena polymorpha

Figure 3.1.F.39 - Representatives of bivalves

Gammarus sp.

Gammarus sp.

Figure 3.1.F.40 - Representatives of crustaceans

Chironomus plumosus

Libellula quadrimaculata

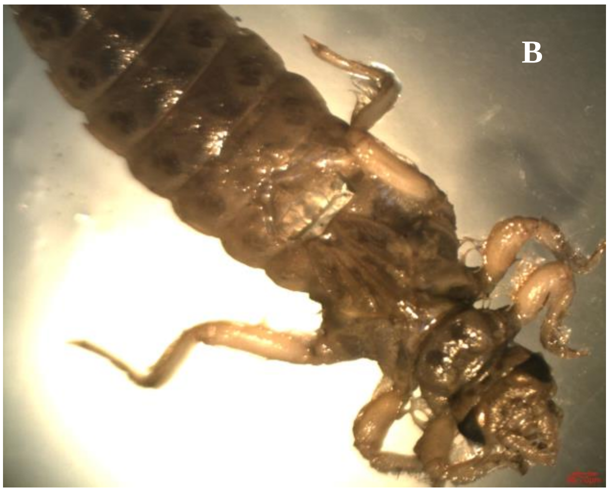


Figure 3.1.F.41 - Representatives of insects

➢ Quantitative composition of macroinvertebrates

- **Abundance (%), number density (no. ind./m^2)**

Abundance on taxonomic groups varied as follows: oligochaete between 0 to 24.14 %, gastropods between 13.79 to 82.69 %, bivalves from 0 to 28.93 %, ostracods from 0 to 1.92 % amphipods between 0- 17.24 %, diptera from 0 to 41.38 % and odonata between 0 to 4.76 % (Table 3.1.F.15).

Gastropods in benthos of the Danube had the highest density in the CP 01 with the value 4024.77 ind./m^2. Also, with high density developed in CP 01 bivalves (2167.18 ind./m^2) and oligochaete (866.87 ind./m^2). Diptera had the highest density in CP 04 - 743.03 ind./m^2, followed by amphipods - 309.60 ind./m^2. Ostracods had the density of 61.29 ind./m^2 in CP 01 and CP 10, and odonate has recorded the density of 61.92 ind./m^2 in CP 04 and CP 07 (Table 3.1.F.15).

Table 3.1.F.15 - Abundance and numerical density of macroinvertebrates groups

Taxoni	PC 01		PC 02		PC 03		PC 04		PC 07		PC 10	
	D Nr.ind/m^2	A %	D Nr.ind/m^2	A %	D Nr.ind/m^2	A %	D Nr.ind/m^2	A %	D Nr.ind/m^2	A %	D Nr.ind/m^2	A %
Oligochete	866, 87	11, 57	433, 44	12, 73	0, 00	0, 00	433, 44	24, 14	0, 00	0, 00	247, 68	7, 69
Gasteropode	4024, 77	53, 72	2414, 86	70, 91	1795,67	76, 32	247, 68	13, 79	804, 95	61, 90	2662, 54	82,69
Bivalve	2167, 18	28, 93	371, 52	10, 91	557, 28	23, 68	0, 00	0, 00	247, 68	19, 05	185, 76	5, 77
Ostracode	61, 92	0, 83	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	61, 92	1, 92
Amfipode	185, 76	2, 48	185, 76	5, 45	0, 00	0, 00	309, 60	17, 24	61, 92	4, 76	0, 00	0, 00
Diptere	185, 76	2, 48	0, 00	0, 00	0, 00	0, 00	743, 03	41, 38	123, 84	9, 52	61, 92	1, 92
Odonate	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	61, 92	3, 45	61, 92	4, 76	0, 00	0, 00
Trichoptere	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00	0, 00

A- numerical abundance, **D**- numerical density

- **Biomass (g/m^2)**

Pe grupe taxonomice biomasa a variat astfel: oligochete între 0-3,653 g/m^2, gasteropode între 0-211,827 g/m^2, crustacee între 0-3,406 g/m^2, diptere între 0-1,734 g/m^2 şi odonate între 0-28,731 g/m^2 (Table 3.1.F.16).

Table 3.1.F.16 - Biomass of macroinvertebrates groups

Taxoni	Puncte critice principale			Puncte critice secundare		
	PC 01	**PC 02**	**PC 10**	**PC 03**	**PC 04**	**PC 07**
	Biomasa (g/m^2)	Biomasa (g/m^2)	Biomasa (g/m^2)	Biomasa (g/m^2)	Biomasa (g/m^2)	Biomasa (g/m^2)
Oligochete	3,653	0,805	0,372	0	0,557	0
Gasteropode	211,827	107,864	2,362	50,155	0	0,607
Bivalve	0	0	0	0	0	0
Crustacei	1,176	1,610	0	0	3,406	1,796
Diptere	0,372	0	0,124	0	0,991	1,734
Odonate	0	0	0	0	0,124	28,731
Trichoptere	0	0	0	0	0	0

- **Shannon Wiener diversity index**

Analyzing benthos biodiversity, quantified by the Shannon-Wiener index (**H'_S**), it is observed that the highest value was registered in CP 01 (2.15), followed by CP 04 (1.401) and CP 07 (1.234). The lowest value for biodiversity index was registered in CP 03 (Table 3.1.F.17).

According to the literature, this index value normally ranges between 1.5 and 3.5, rarely exceed the value 4 (*Washington, H.G., 1984*).

Table 3.1.F.17 - Dynamics of Shannon - Wiener diversity index

Indice	Puncte critice principale			Puncte critice secundare		
	PC 01	**PC 02**	**PC 10**	**PC 03**	**PC 04**	**PC 07**
H'_S	2,15	1,191	0,746	0,63	1,401	1,234
H'_{MAX}	2,639	1,792	1,609	1,099	1,609	1,792
E_H (H_R)	0,815	0,665	0,463	0,573	0,87	0,689

$H_{(S)}$ - *real diversity*; **$H_{(S)MAX}$** - *maximum diversity*; **H_R=E** - relative diversity (equitability

Theoretical maximum values of the Shannon - Wiener index (**H'_{max}**) are situated in the range of 1.099 and 2.639.

Taking into account the values of equitability can see that the critical points with the greatest diversity were: CP 04 - the real diversity 87 % of the theoretical maximum diversity and CP 01 where the real diversity reaches almost 81.5 % of the theoretical maximum diversity.

In Figure 3.1.F.42 is observed the dynamics of Shannon - Wiener index and the maximal diversity of aquatic macroinvertebrates.

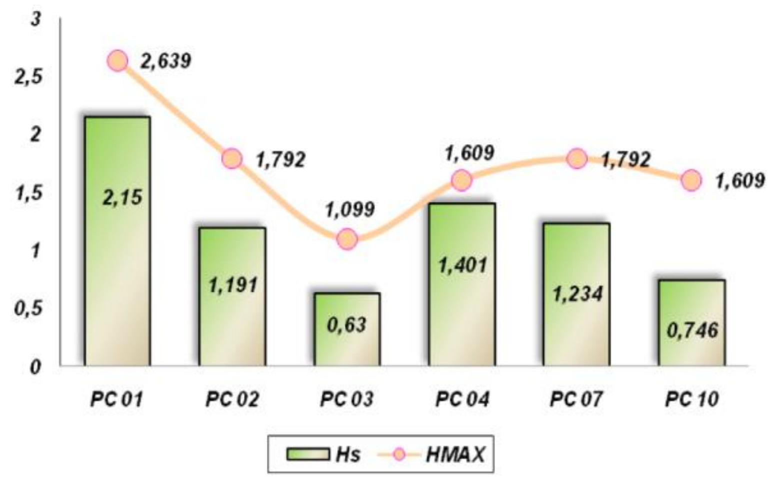


Figure 3.1.F.42 - Variation of Shannon - Wiener Index

➢ Ecological assessment of water quality

On the basis of Order 161/2006 concerning the classification of surface water quality to determine the ecological status of water bodies list was prepared the list of saprobiological indicators of water quality (Table 3.1.F.18)

Table 3.1.F.18 - List of saprobiological indicators of water quality according to Order 161/2006

Taxoni	Indicatori saprobiologici
ANNELIDA	
Oligocheta	
Tubifex tubifex	alfa-para (3,5)
MOLLUSCA	
Gasteropoda	
Valvata piscinalis	beta (2,0)
Lithoglyphus naticoides	beta (2,0)
Bithynia tentaculata	beta (2,0)
Physa fontinalis	orto-beta (1,5)
Theodoxus transversalis	orto-beta (1,5)
Theodoxus danubialis	orto-beta (1,5)
Theodoxus fluvialis	beta (2,0)
Viviparus acerosus	beta (2,0)
Esperiana acicularis	beta (2,0)
Esperiana esperi	beta (2,0)
Planorbis planorbis	beta-alfa (2,5)
Planorbarius corneus	beta (2,0)
Bivalvia	
Unio pictorum	beta (2,0)
Dreissena polymorpha	beta (2,0)
Sherium sp.	beta-alfa (2,5)

Taxoni	Indicatori saprobiologici
CRUSTACEA **Amphipoda** *Gammarus sp.*	 beta (2,0)
INSECTA **Diptera** *Chironomus plumosus* *Culex pipiens* **Odonata** *Libellula depressa* *Libellula quadrimaculata* **Tricoptere** *Hydropsyche sp.*	 alfa-para (3,5) alfa-para (3,5) beta (2,0) beta (2,0) beta (2,0)

Analyzing the data from Table 3.1.F.19, in quantitative terms, it appears that the largest number density is owned by beta mezosaprobic species (2), except CP 04, where the highest numerical density is owned by alpha-para species (3.5).

Table 3.1.F.19 - Biological elements for determining ecological status of water based on the macroinvertebrates

Indicatori de calitate	U/M	Puncte critice principale			Puncte critice secundare		
		PC 01	PC 02	PC 0 10	PC 03	PC 04	PC 07
Bioindicatori alfa-para (3,5)	ex/m^2	1052,63	433,43	247,67	0	1176,47	123,83
Bioindicatori beta-alfa (2,5)	ex/m^2	371,51	0	0	0	0	61,91
Bioindicatori beta (2,0)	ex/m^2	5448,91	2848,29	2848,29	2352,94	619,19	1114,55
Bioindicatori orto-beta (1,5)	ex/m^2	557,27	123, 83	0	0	0	0
Indice saprob (S)		**2, 2**	**2, 17**	**2, 09**	**2, 0**	**3, 06**	**2, 17**

Assessing the water quality using saprobic index (S) calculated for macroinvertebrates, it is observed that the highest value is found in CP 04 (3.06), followed by CP 01 (2.2). For CP 07 and CP 02 was registered the same value (2.17). The lowest saprobic index value is encountered in CP 03 (2.0).

In Figure 3.1.F.43 is observed the dynamics of saprobic index for samples of macroinvertebrates at critical points.

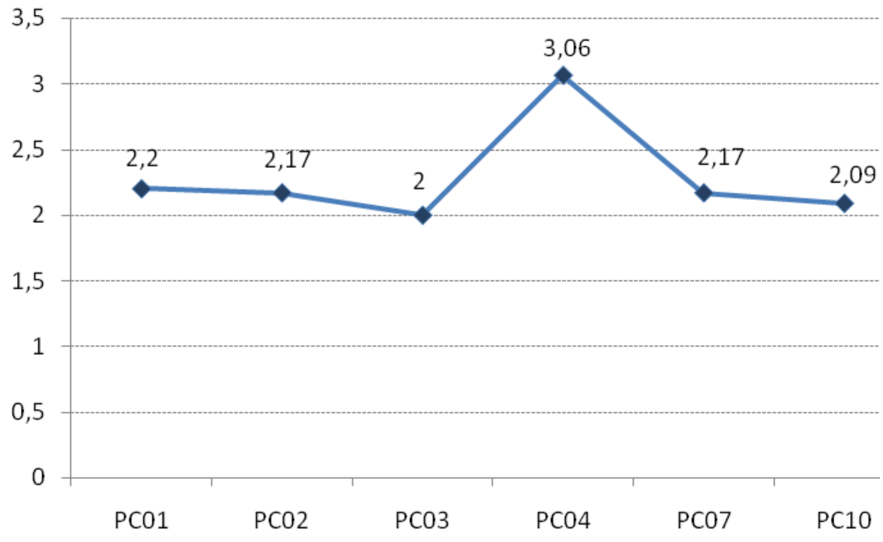


Figure 3.1.F.43 - Saprobic index variation in the critical points

Conclusions

The density and increased abundance of chironomids and in particular of oligochaetes indicate the existence of a larger amount of organic matter in water.

Being very sensitive to any deterioration in water quality, dipteras are indicators of waters where there is no pollution with chemicals.

Amphipods importance consist mainly in their mode of detritivore nutrition (thereby contributing to shredding of alohtone organic matter), and the fact that they are an important food for fish. Were identified with greater frequency in samples taken near the banks, these organisms preferring a slower water velocitie.

Increased density in the analyzed samples of mollusks can represent a potential risk factor for fish, because gastropods may be intermediate hosts for the parasites of fish, in their development stage passes through the body of gastropods.

In the period analyzed, the population status of macroinvertebrates of Danube can be considered good the critical point with the highest diversity of benthic organisms is CP 01, followed by CP 02.

Taking into account the biological quality elements for assessing the ecological status of water bodies included in Order 161/2006, from quantitative terms, the largest numerical density is owned by *beta* - mezosaprobic species (2) excluding CP 04 where the highest numerical density of species is owned by *alfa-para* type (3.5).

Framing of critical points analyzed in saprobic area based on the value of saprobic index (S) calculated for macroinvertebrates, it is shown in Table 3.1.F.20.

Table 3.1.F.20 - Saprobic index

PC	Indice saprob	Caracterizare
PC 01	2,2	impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
PC 02	2,17	impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
PC 03	2,0	impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
PC 04	3,06	impurificare puternică corespunzătoare zonei *alfa-mezosaprobe*
PC 07	2,17	impurificare moderată corespunzătoare zonei *beta-mezosaprobe*
PC 10	2,09	impurificare moderată corespunzătoare zonei *beta-mezosaprobe*

Saprobic index values fall within Danube water at critical points analyzed in the *β-mezasoprobe*, indicating moderate water pollution with biodegradable organic substances.

3.1.F.is. Monitoring migration of sturgeons and barbel

Testing the detection and recording range of ultrasonic transmitters showed that the receiving and decoding radius of the signal transmitted by ultrasonic tags Thelma Biotel ADT MP 16 toward automatic submersible stations VR2W is about 200 m.

Placing the VR2W stations on the fixation transect cable was done so that they can record the passing of sturgeons in areas with water depth greater than 4 m, taking into account the maximum signals recording and decoding distance, of 200 m.

Have been installed 5 systems of steel 012 cable transects protected with PVC, on which are located submersible automatic stations VR2W Vemco, for recording the signals from ultrasonic emitters Thelma Biotel.

Was not installed a submersible automatic station on Old Danube at Km 341 because this stations function has been taken over by all stations installed in CP 10, at 187 Km, on branches Caleia 0.85 Km and Cravia (Table 3.1.F.is.2.), so as to ensure recording of all sturgeons descending downstream carrying ultrasonic emitters, from both CP 01 and CP 10.

It can be considered that the placement of those 10 automatic submersible stations (in Specification are set out just 5 automatic stations) that we were able to install in pre-construction period, has allowed us to answer the main question - if during June - July the sturgeon use Bala and Caleia branches for migration/breeding.

Cable were installed in places that not interfere with the bottom fishing nets and outside of anchoring areas marked on the banks (Table 3.1.F.is.1).

Table 3.1.F.is.1 - Location data for automatic submersible station in CP01 area, Bala branch

Nr. Crt.	Locul de amplasare a capătului de la mal al transectului	Coordonatele capătului transectului	Distanţa de amplasare a VR2 W de la mal [m]	Lăţimea braţului / Dunării în acel loc [m]	Adâncimea de amplasare a statiilor submersibile [m]
1.	Borcea superioară Km 69, mal stâng	N: 44°15,095 E: 27°35,265	80	140	3,9
2.	Bala, km 4, mal stâng	N: 44°14,308 E: 27°35,327	170	340	10,3
3.	Borcea, km 64, mal drept	N: 44°16,205 E: 27°39,635	186	393	8,8
4.	Dunăre, Km 348, mal drept	N: 44°10,254 E: 27°32,394	160	560	10,9
5.	Dunăre, Km 347, mal stâng	N: 44°10,766 E: 27°32,636	70	715	9,2

Figure 3.1.F.is.1 - Station location in CP 01 - Bala area

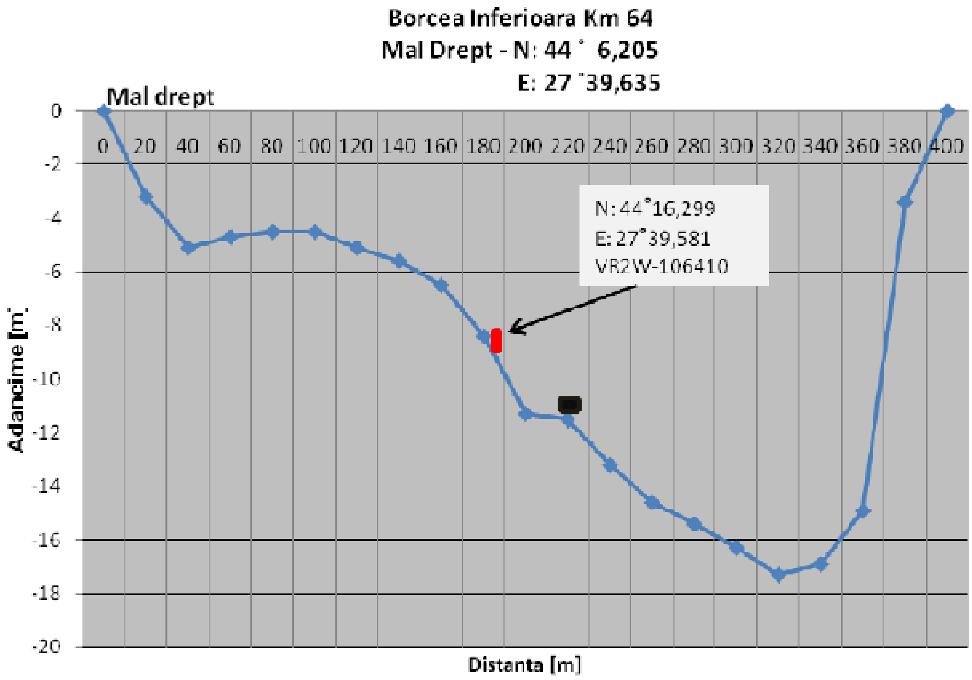


Figure 3.1.F.is.2 - Profile on Borcea branch at km 64

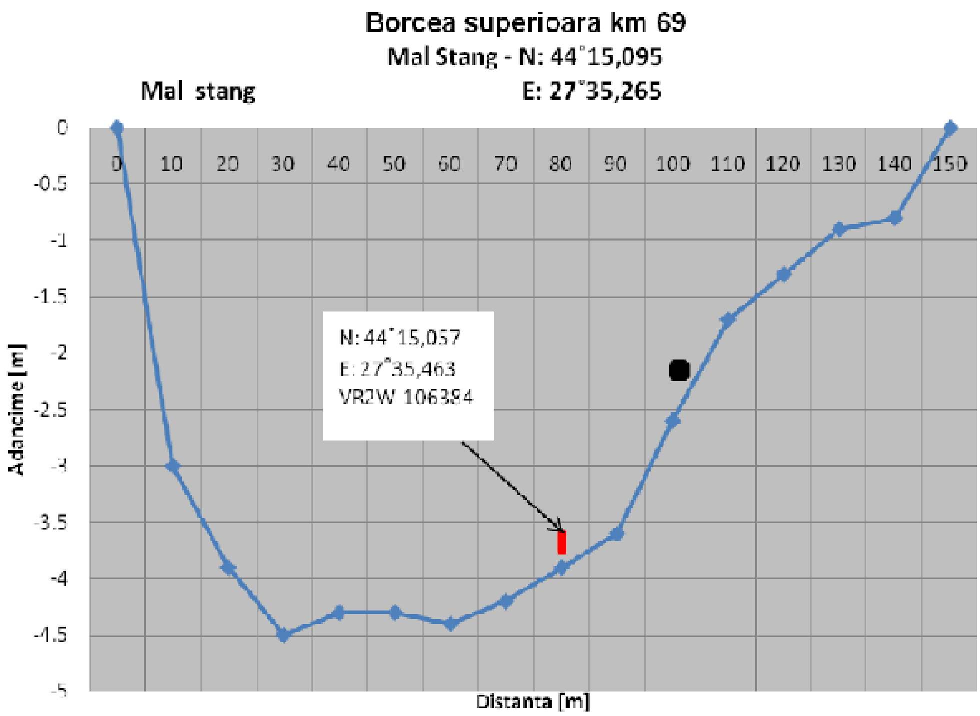


Figure 3.1.F.is.3 - Profile on Borcea branch at km 69

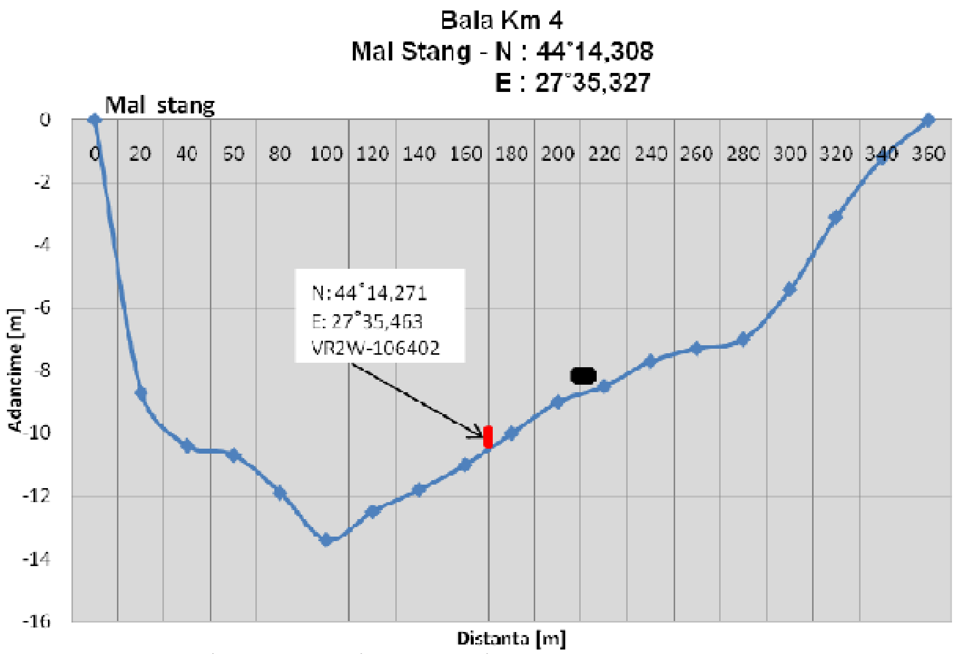


Figure 3.1.F.is.4 - Profile on Bala branch at km 4

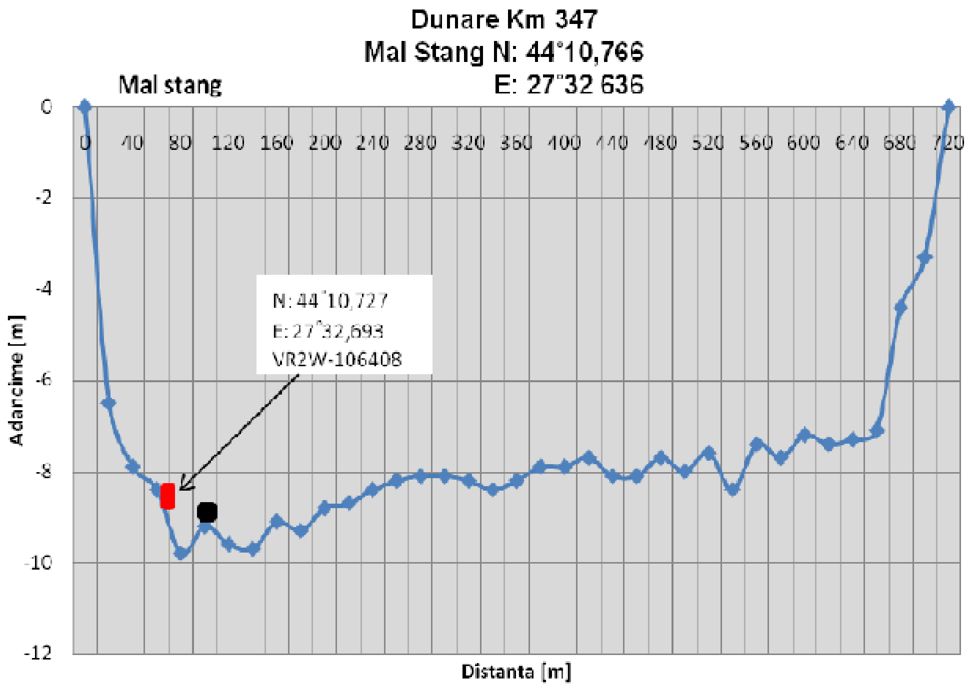


Figure 3.1.F.is.5 - Profile on Danube at km 347

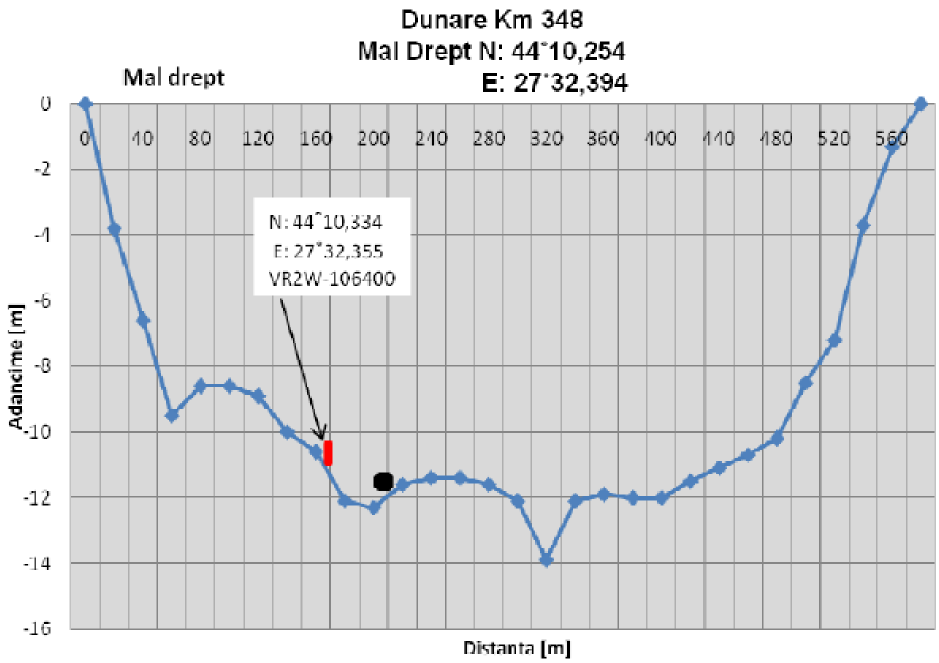


Figure 3.1.F.is.6 - Profile on Danube at km 348

In Caleia branch area were placed 5 submersible automatic stations VR2W (Table 3.1.F.is.2). There have been installed automatic stations for ultrasonic telemetry, VR2 W type, downstream from the confluence of Caleia branch with Old Danube in Km180 area, at 850 m from downstream entry (direction of sturgeons migration) on Caleia branch, at the exit from Cravia branch and on Old Danube at Km 187. These stations have also served for sturgeon registration that would swim upriver on Bala and down river on Old Danube, not being registered by stations at Km 4 Bala and respectively Km 65 Borcea.

Table 3.1.F.is.2 - Location data for automatic submersible stations in CP 10 area, Caleia branch

Nr. Crt.	Locul de amplasare a capătului de la mal al transectului	Coordonatele capătului transectului	Distanţa de amplasare a VR2 W de la mal [m]	Latimea braţului / Dunării în acel loc [m]	Adâncimea de amplasare a staţiilor submersibile [m]
1	Braţ Caleia, (850 m amonte de confluenţa) mal drept	N: 45°08,346 E: 27°57,372	138	330	12,8
2	Braţ Cravia, (650 m aval de confluenţa), mal drept	N: 45°09,248 E: 27°58,032	80	170	12,4
3	Dunăre Km 180,6 mal drept	N: 45°11,544 E: 27°57,098	200	630	4,8
4	Dunăre Km 180,8, mal stang	N: 45°11,451 E: 27°56,541	70	630	8,5
5	Dunăre Km 187, mal drept	N: 45°08,553 E: 27°57,006	65	230	17

Figure 3.1.F.is.7 - Location of VR2 W stations in CP 10 – Caleia

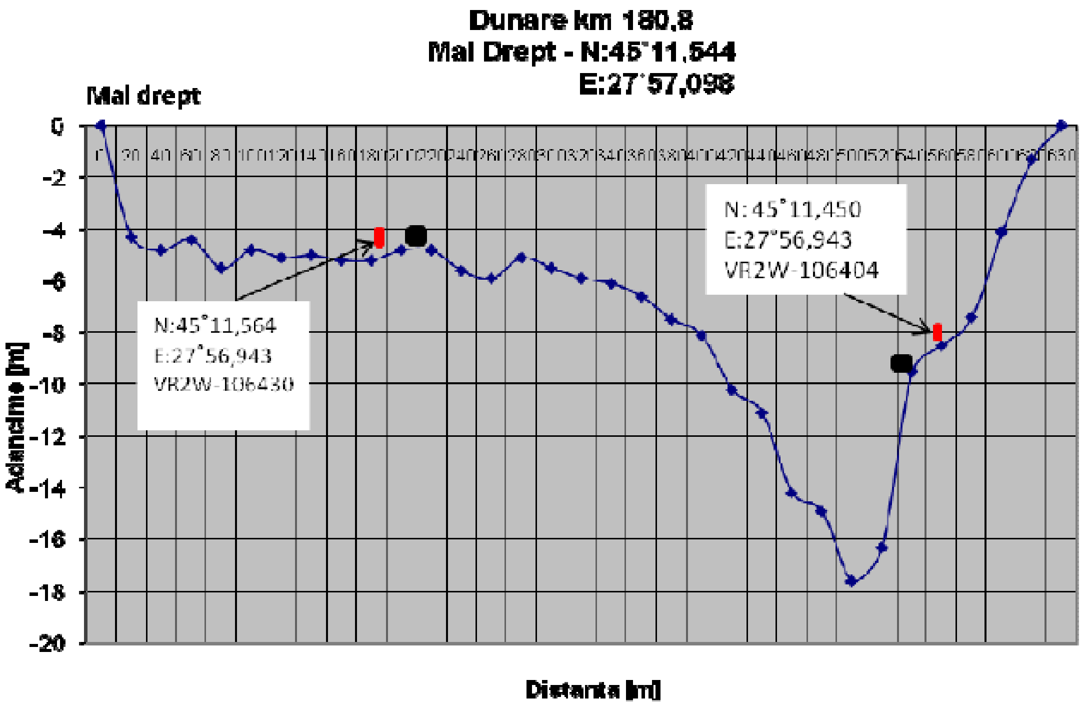


Figure 3.1.F.is.8 - Danube profile at km 180 - 181

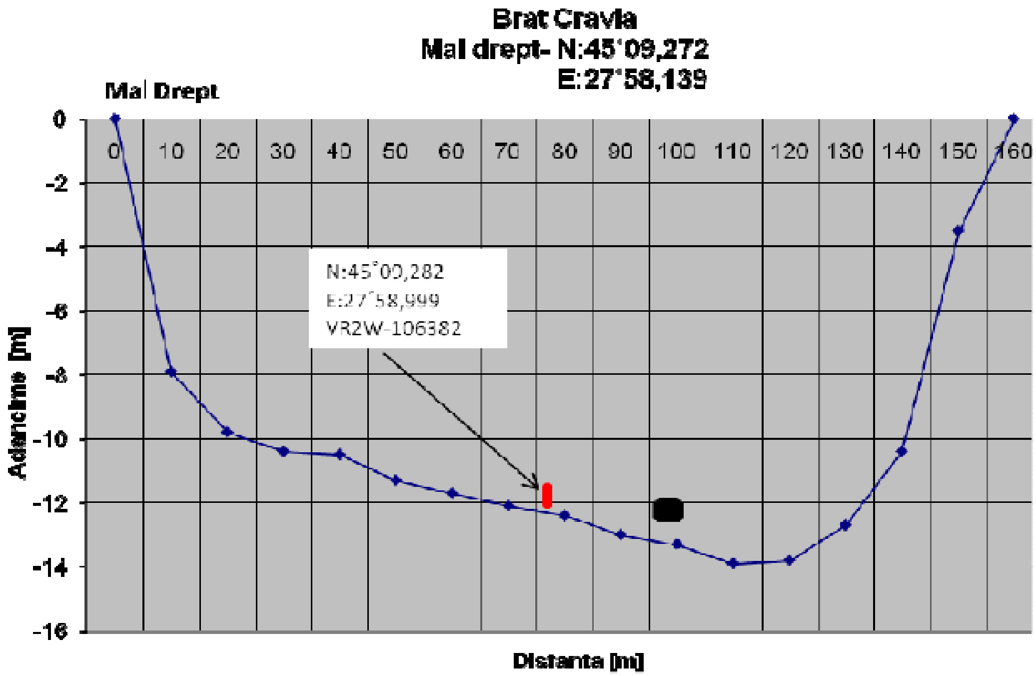


Figure 3.1.F.is.9 - Cravia branch profile at km 4

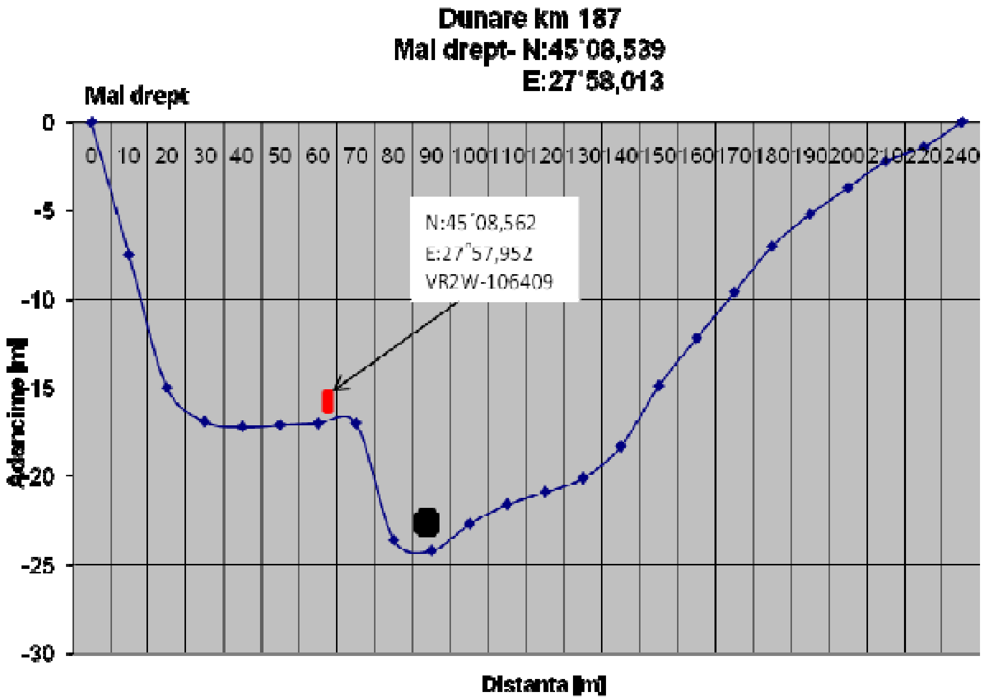


Figure 3.1.F.is.10 - Danube profile at km 187

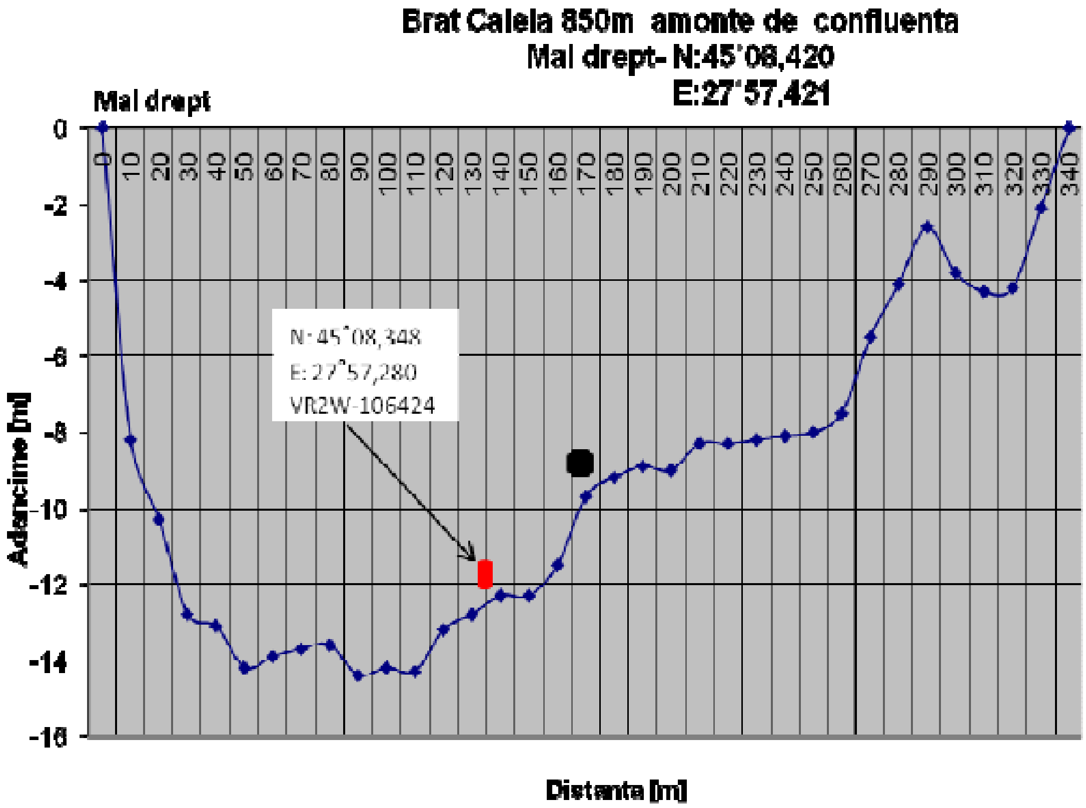


Figure 3.1.F.is.11 - Caleia branch profile at km 1

Tagged sturgeons

Although there have been organized three capture points on each sidearms in CP01 Bala, CP 02, Epuraşu and CP 10 Caleia areas, have been caught sturgeon specimens only in following areas: downstream from CP 01 Bala (on Borcea Km 18 ; km 45-48 and km 55-57), downstream and upstream from Caleia (on Danube at 180.5 km and 200 km).

Out of 10 sturgeon specimens tagged with Thelma Biotel, 7 were captured and released on Borcea branch and 3 on Danube in Chiscani village area (Table 2.1.F.is.3).

Movement of the sturgeons released in CP 01 area

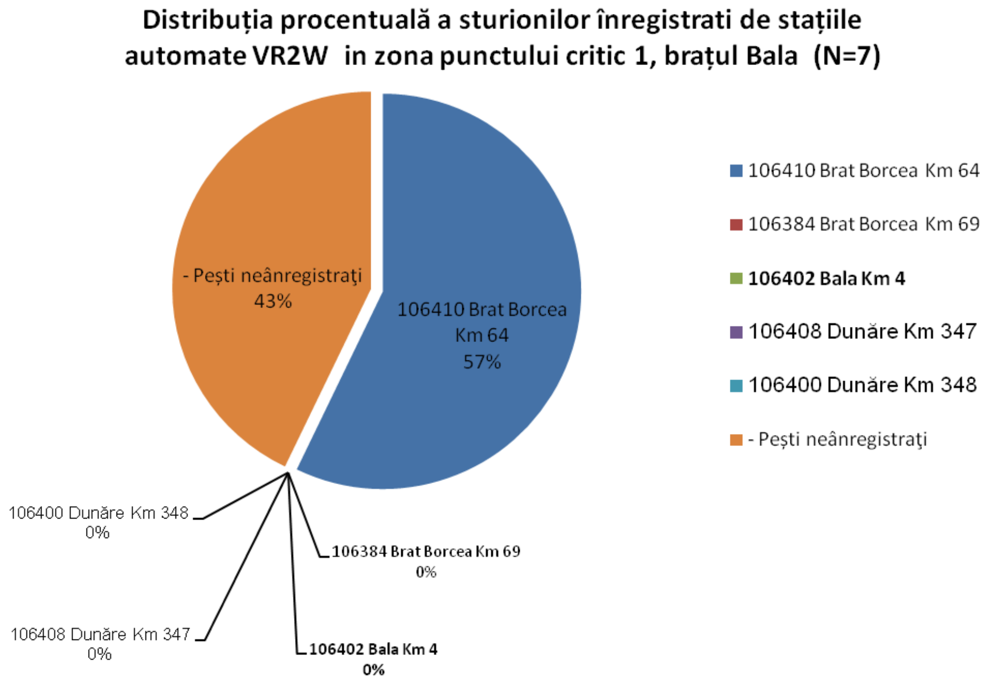


Figure 3.1.F.is.12 - Relative distribution of sturgeons recorded in CP 01 Bala

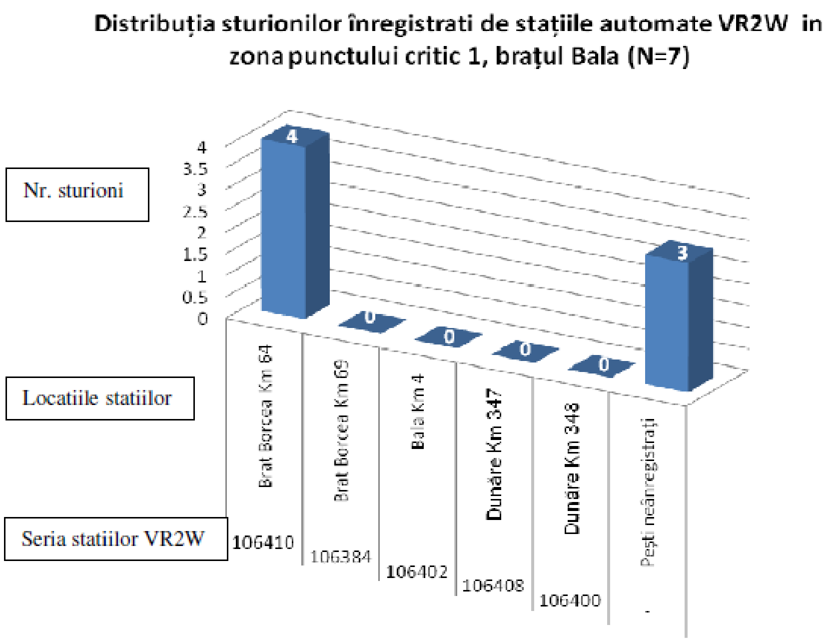


Figure 3.1.F.is.13 - Locations of VR2W stations and number of sturgeons recorded in CP 01 Bala

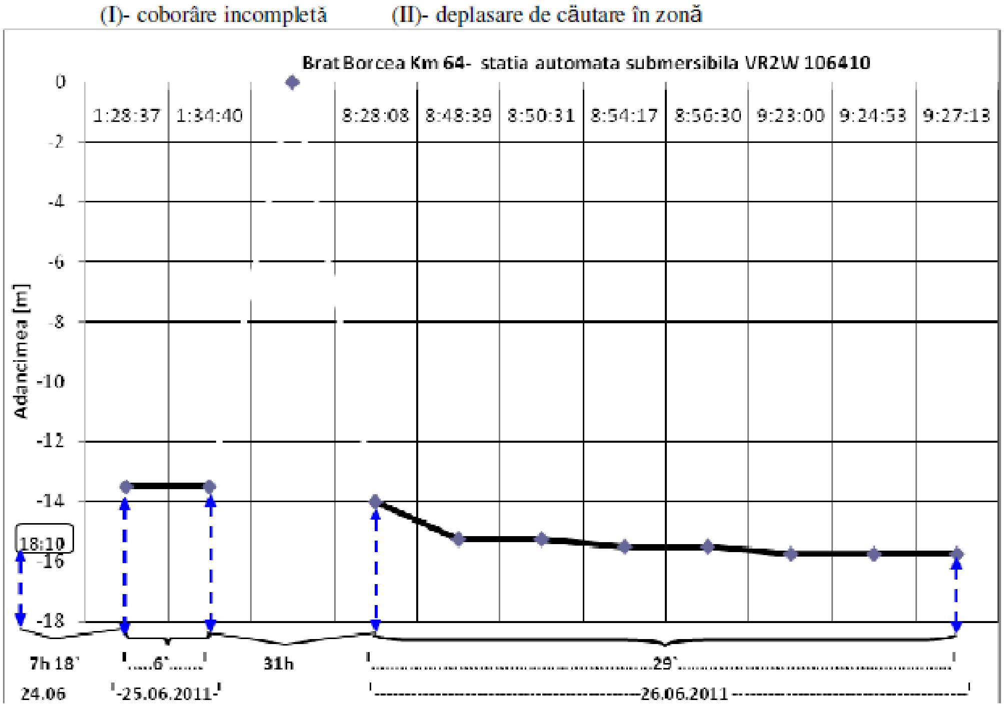


Figure 3.1.F.is.14 - Travel depths for starry sturgeon, code 9 / 10 (11/3/ 7) recorded in station from km 64 - Borcea branch. Descending in phase (I) V=(400m : (6 min x 60) = 1,1 m/sec; after a day and 7 hours downstream phase (II) slow ascending in 29 min V= (400m : (29 min x 60) = 0,22 m/sec

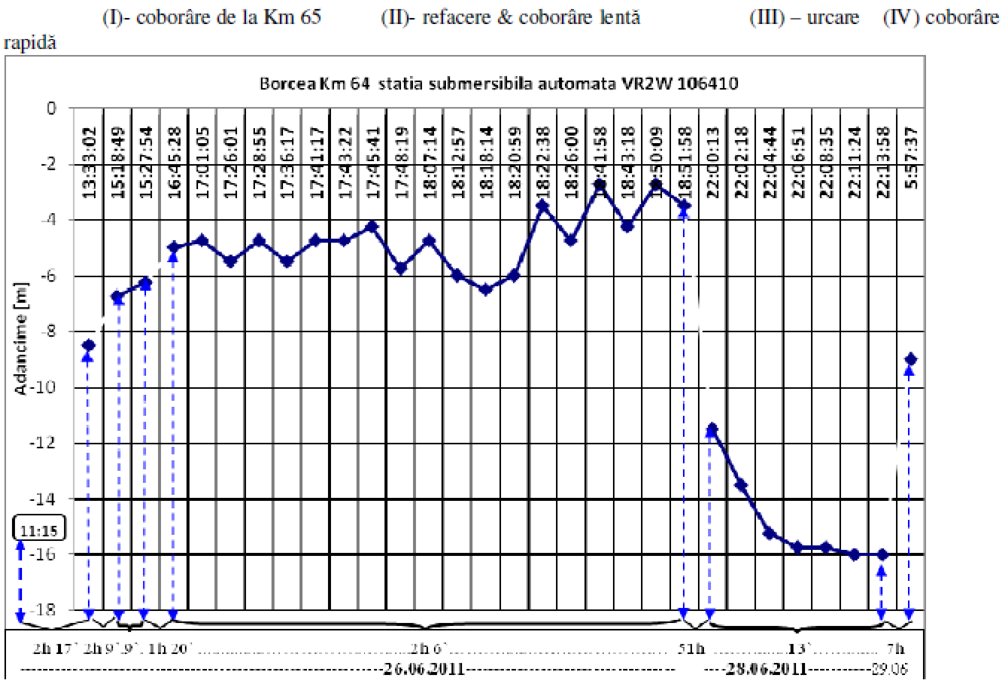


Figure 3.1.F.is.15 - Travel depths for female starry sturgeon, code 17/18 (11/3/9) recorded in station at km 64 Borcea branch. Velocity of slow descending / recuperation in phase (II) (400m : (126 min x 60) = 0,05 m/sec; after 51 hours downstream phase (III) slow ascending in 13 min (400m : (13 min x 60) = 0,46 m/sec; phase (IV) after 7 hours rapid descending in : 400 m: 2 m/sec = 200 sec : 60 = 3,3 min. (a single recording)

(I) – 6 ore si 4 min refacere in amonte de Km 64 pe fundul apei ; (II) – coborâre rapida la 1/3 din adâncime apei

Figure 3.1.F.is.16 - Travel depths for male starry sturgeon, code 25 (11/3/5), recorded in station from km 64 Borcea branch. Just next to the station area, male ascending from water bottom to 1/3 of water depth in the channel, then moving rapidly downstream V=(400 m : (3 min x 60)) = 2,2 m/sec

(I)- coborâre de la Km 65 (II)- refacere & deplasare pe fund timp de 14 min în zona staţiei automate

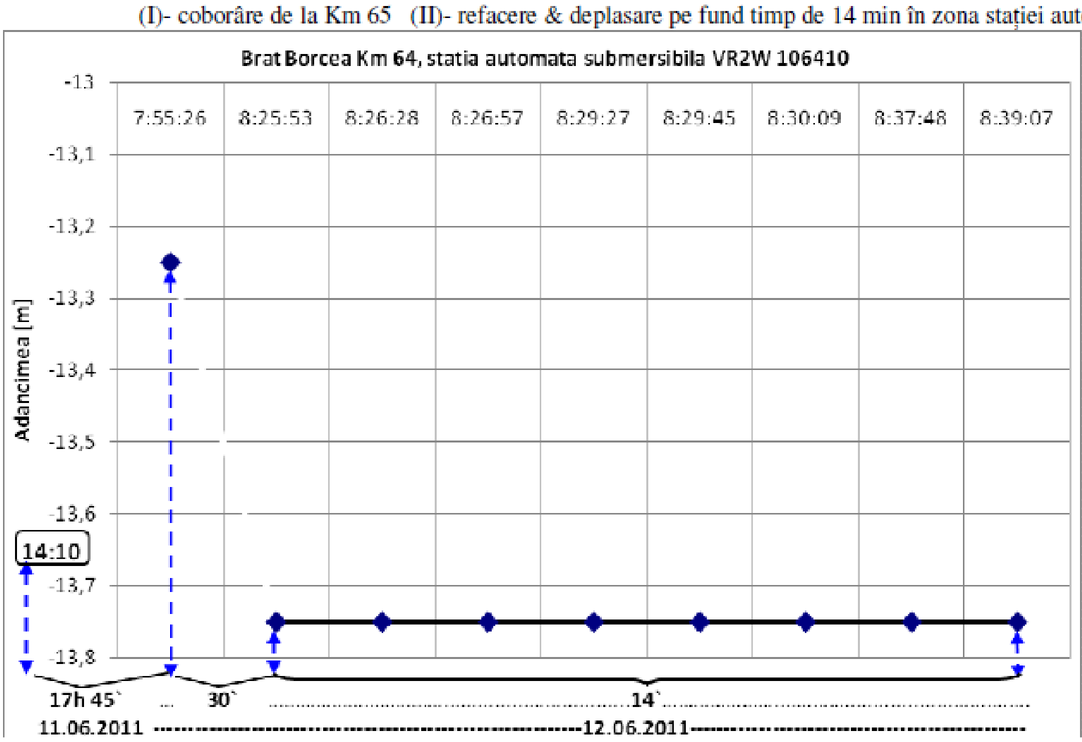


Figure 3.1.F.is.17 - Travel depths for male starry sturgeon, code 22 (11/3/2), recorded in station from km 64 Borcea branch. Velocity of slow descending / recuperation in phase (II) V= (400m : (14 min x 60) = 0,47 m/sec

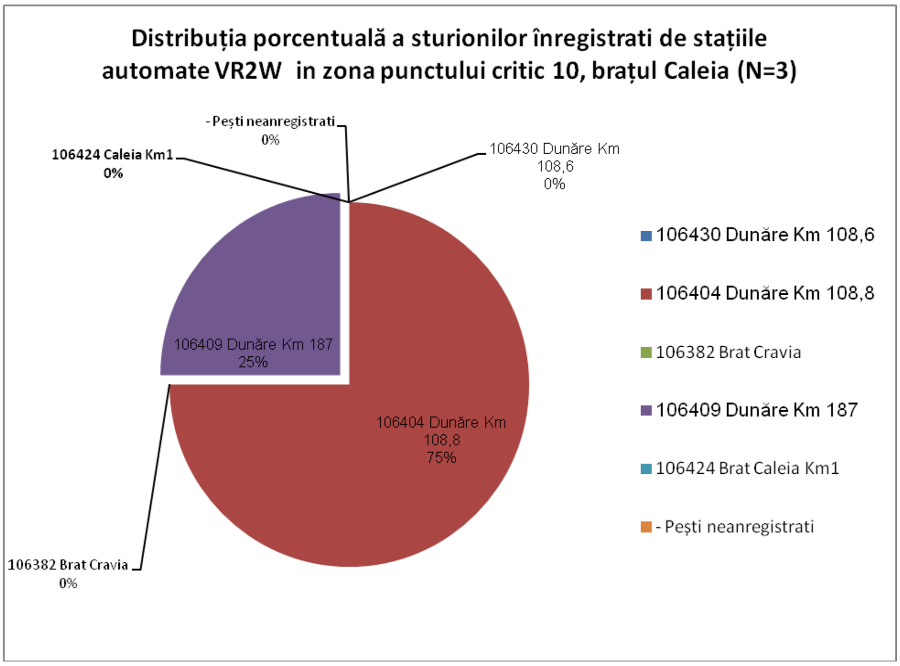


Figure 3.1.F.is.18 - Relative distribution of sturgeons recorded in CP 10 – Caleia area (without considering the data recovered from VR2 W 106430 station, retrieved by fishermen in August)

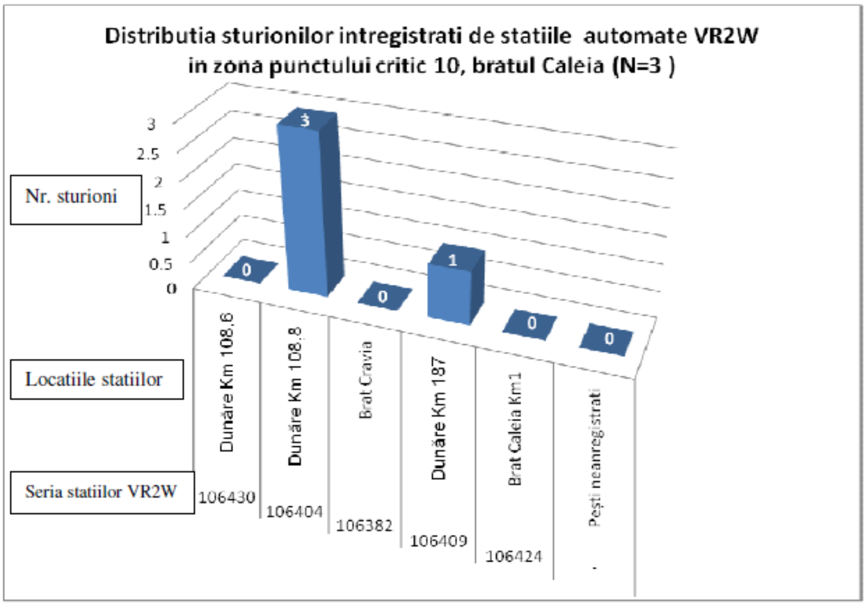


Figure 3.1.F.is.19 - Location of VR2W stations and number of sturgeons recorded in CP 10 - Caleia area

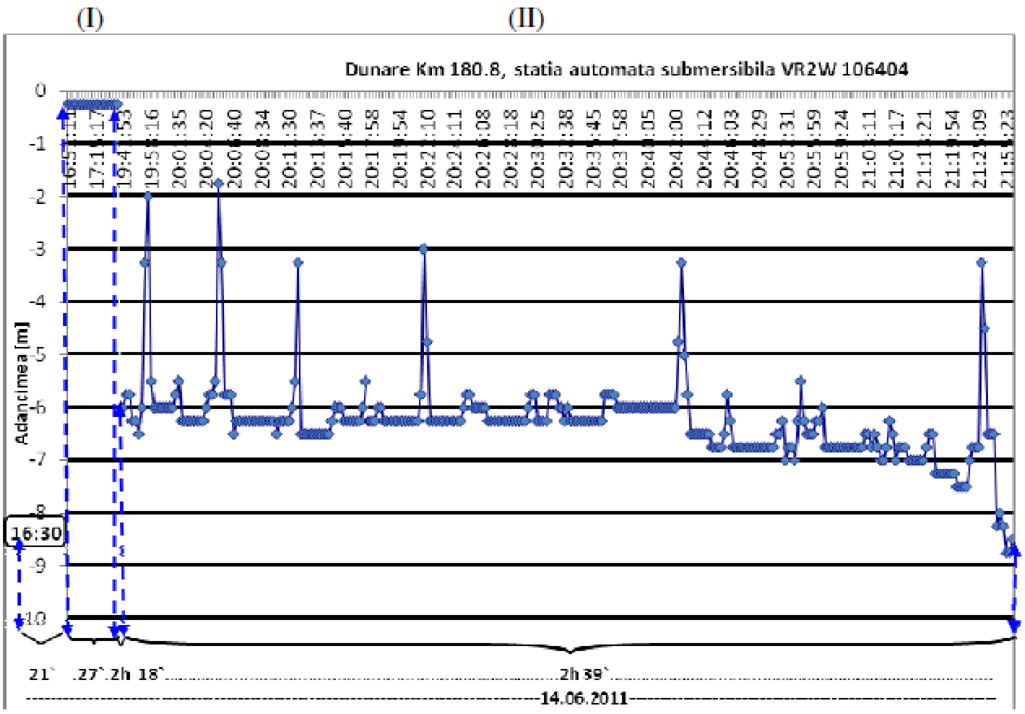


Figure 3.1.F.is.20 - Travel depths for male starry sturgeon, code 23 (11/3/3), recorded in station on Danube at km 180.8. Descending velocity in first phase (I) V=(400m : (27 min x 60) = 0,24 m/sec then (II) search behavior / slow descending V=(400m : (159 min x 60) = 0,04 m/sec

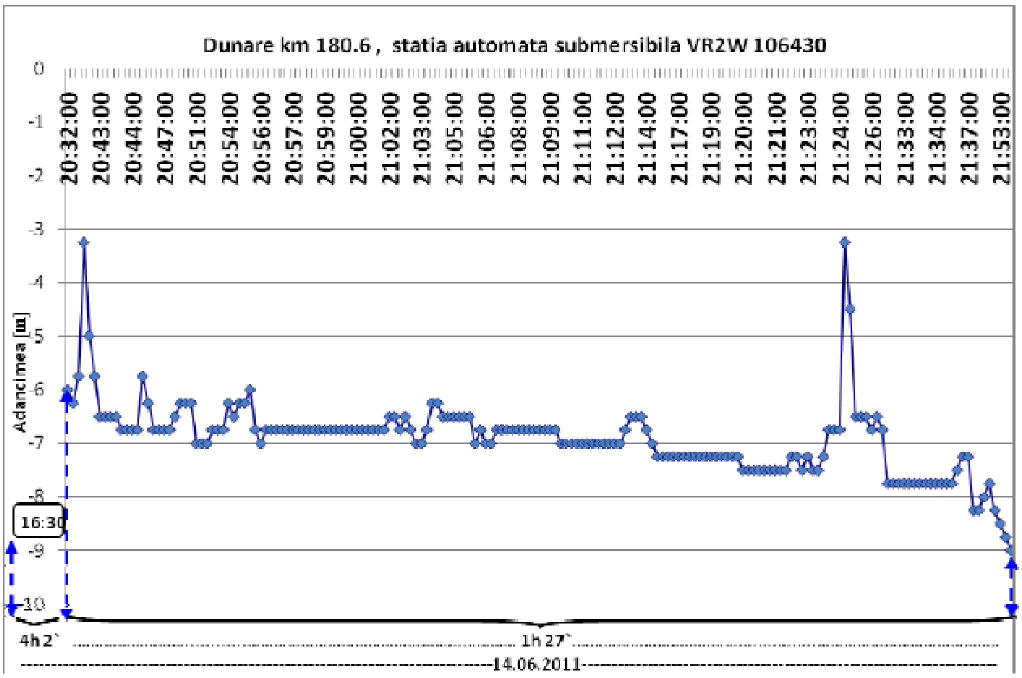


Figure 3.1.F.is.21 - Travel depths for male starry sturgeon, code 23 (11/3/3), recorded in station on Danube at km 180,6. Descending velocity / searching V=(400m: (87 min x 60)) = 0,07 m/sec

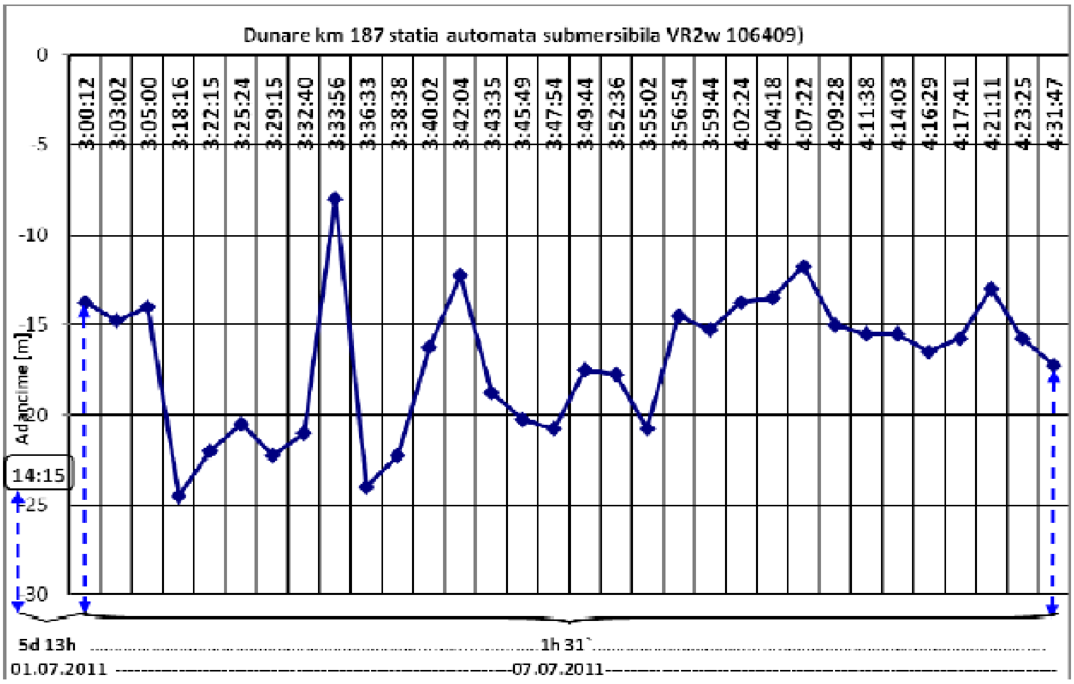


Figure 3.1.F.is.22 - Travel depths for male starry sturgeon, code 11/12 (11/3/12) recorded in station from km 187 / Danube. Average upstream swimming velocity in the area V=(400 m : (91 min x 60) = 0,07 m/sec

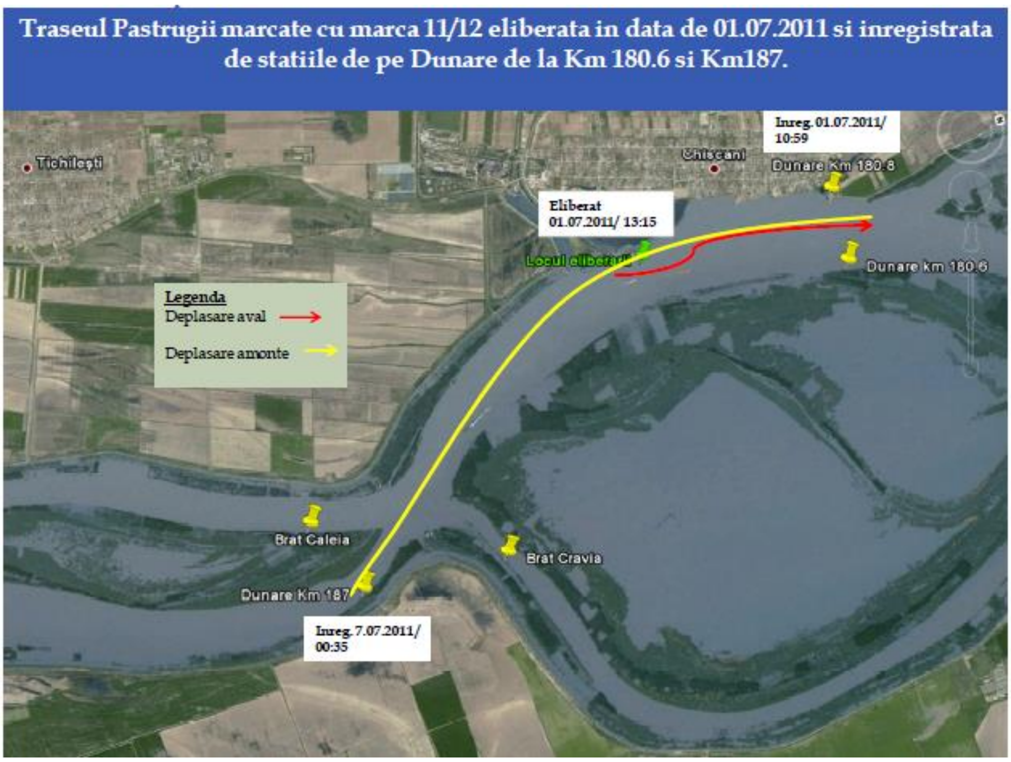


Figure 3.1.F.is.23 - The trail followed by starry sturgeon male captured at Gropeni / Km 200, tagged in 01/07/2011 at Chiscani (Brăila) and released in Danube at Km 183

Presence of sturgeon juveniles in CP 01 and CP 10 areas

After discussions with local fishermen and based on the bathymetric guiding survey points made by us with the sonar from SAM boat, we performed study fishing for sturgeon juveniles capturing on Borcea branch (23 June 2011) at Km 63, being captured 6 specimens of juvenile sterlet sturgeon (Figure 3.1.F.is.24).

Figure 3.1.F.is.24 - Sterlet sturgeon juveniles captured on Borcea branch (Km 63)

In order to identify the presence of juveniles in critical point 10 area, fishing was made with special net on Caleia branch at Km 1. On June 11, 2011 were captured on Caleia branch 7 sturgeon juveniles specimens of which 6 sterlet sturgeon and one starry sturgeon (Figure 3.1.F.is.25).

Figure 3.1.F.is.25 - Sterlet sturgeon juvenile (down) and starry sturgeon (up) captured on Caleia branch (Km 1)

It was also sampled the bottom fauna in the middle area of Bala branch (Table 3.1.F.is.3) used as fishing for subsistence by locals, where they often catch starlet sturgeon and barbel.

Table 3.1.F.is.3 - Qualitative composition of bottom fauna on Bala branch at Km 4 and 7 (Hwater = 8, respectively 10 m)

Nr.	Specia		Ordinul	Data prelevării	Observatii
1	*Corophium nobile*	1	Amphipoda	13.07.11	
2	*Corophium curvispinum*	1	Amphipoda	13.07.11	
3	*Dikerogammarus villosus*	2	Amphipoda	13.07.11	
4	*Pontogammarus moeticus*	2	Amphipoda	13.07.11	
5	*Dikerogammarus heamobaphes*	2	Amphipoda	13.07.11	
6	*Chironomus sp.*	3	Chironomidae	13.07.11	
7	*Hydropsyche bulgaromanorum*	4	Tichoptera	13.07.11	
8	*Corbicula fluminea*	5	Bivalvia	13.07.11	au fost gasite si resturi de cochilii de *Corbicula sp.* si *Dreissena polymorpha*; domina numeric primele

Also, was sampled the bottom fauna (Table 3.1.F.is.4) near the fishing net for study (Km 63) where were captured sterlet sturgeon juveniles hatched in 2011.

Table 3.1.F.is.4 - Qualitative composition of bottom fauna on Borcea branch at Km 63,5 (Hwater=10 m)

Nr.	Specia	Ordinul	Data prelevării
1	*Hydropsyche bulgaromanorum*	Trichoptera	24.06.2011
2	*Dikerogammarus villosus*	Amphipoda	24.06.2011
3	*Pontogammarus crassus*	Amphipoda	24.06.2011
4	*Chironomus sp.*	Chironomidae	24.06.2011

Observations regarding the location of some potential wintering and breeding pits for sturgeons

During travel on the river, during installation of automatic submersible stations transects for sturgeons' tagging and releasing upstream from Feteşti, were conducted observations concerning the location of possible wintering pits in the upper half of Borcea branch, using sonar from SAM boat. Thus was located in the right bank area, at Km 50.9 (N: 44° 19' 14.52" E: 27° 47' 11.15"), a pit of 19,9 m with characteristic sill for wintering areas (Figure 3.1.F.is.26).

After discussions with local fishermen from Borcea branch, was located a potential area with a characteristic rocky bottom (Figure 3.1.F.is.27) in the upper half of Borcea branch, between Km 56.5 - 57 at a depth of 6 - 7 m. In order to study the structure and nature of the substrate consisting of formations such as limestone, observations have been made by DIDSON camera, which confirmed the presence of limestone formations/ structure different from surrounding areas with sandy bottom on Danube riverbed, in the area indicated by fishermen.

Figure 3.1.F.is.26 - Location of potential wintering pit for sturgeons at Km 50.9 on Borcea branch

Figure 3.1.F.is.27 - Location of potential breeding area for sturgeons at Km 56,5 - 57 on Borcea branch. In the upper right: detail with characteristic limestone formations covering the Danube bottom in this area

Weekly measurements of water current velocity at surface and bottom

Because in the pre-construction monitoring period could not be purchased the measuring system for water velocity - ADP River Surveyor M9, weekly reference measurements for water current velocity at the surface and at the bottom in 10 sections/each critical point area, **were postponed and will be conducted during the fall 2011 and spring 2012,** so to constitute the database for comparison with the changed situation after constructions will be carried out in riverbed in these areas.

Tracking the sturgeons movement with Didson camera

During the pre-construction period, neither of tagged sturgeon specimens did not use Bala or Caleia branches, not being necessary to use DIDSON camera to record their presence and behavior. Recording tests were carried out at Km 40 on Borcea branch and at Km 9 on Bala branch (Figure 3.1.F.is.28). Throughout entire working period, DIDSON camera was ready for use at the working base organized in Feteşti.

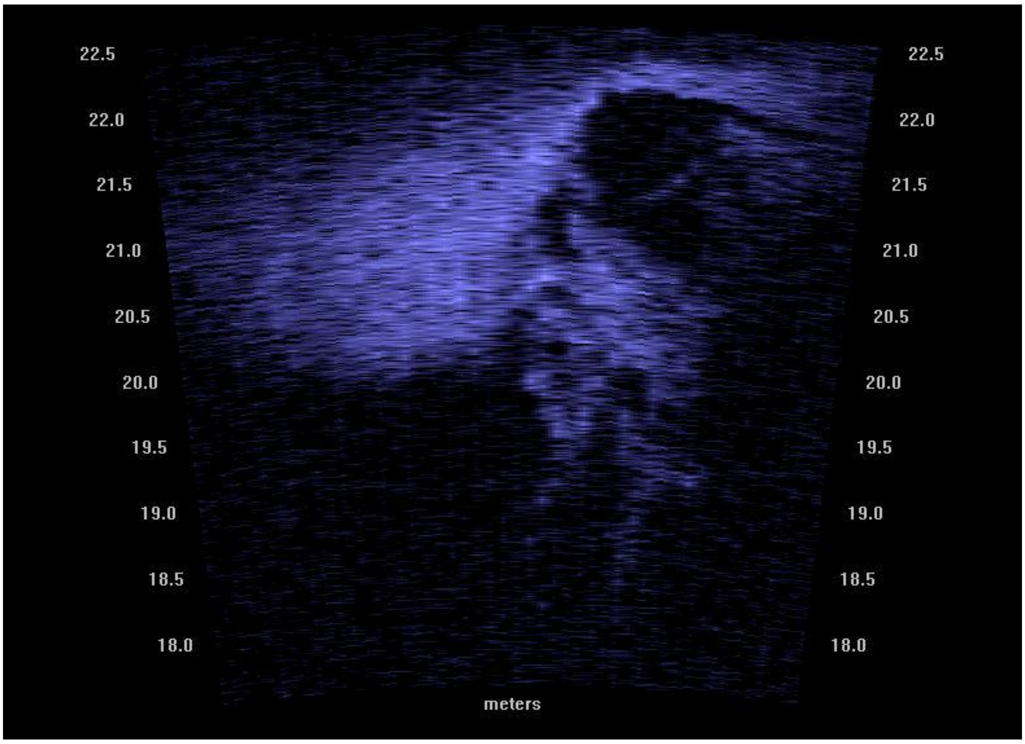


Figure 3.1.F.is.28 - Example of static image recorded with DIDSON on Borcea branch at Km 40

Actually, it should be mentioned that it is not possible an active sturgeons tracking using DIDSON camera, but only their visualization when are located in areas - wintering pits or when passing by a Didson camera installed underwater in a section of interest. In the next period, as the construction works will advance in CP 01 and CP 10 will take into account to place in this area a DIDSON camera to record the presence/passing/behavior of sturgeons in relation to constituent elements of the sills that will be placed in the river.

Observations regarding Danube's white barbel presence (*Barbus barbus*) in CP01 – Bala and CP 10 – Caleia areas

Between 1 - 5 July 2011 were captured by professional fishermen authorized for study fishing, 10 specimens of white barbel, 8 males and two females with weights between 1,5 – 4,5 kg / specimen. Below are presented maps with exact location of capturing and releasing of tagged barbells. We mention that, similar with sturgeons situation, barbell had been captured in locations known by fishermen as sheltering barbell, even if it were different somewhat by those set out in Specifications. In the absence of adequate size ultrasonic taggs for this species, all barbel specimens were tagged externally with Floy T-Barr Tag / Spaghetti brands (Table 2.1.F.is.2). If trying to mark these fish with ultrasonic tags for sturgeon, we are risking barbell's death and loss of tags.

Although it has been fishing **in three locations on each branch from CP 01 Bala and CP 10 Caleia**, have been captured barbel specimens only in fishing nets on Borcea Km 7; Km 35; Km 45; 47 - 48 km (Table 2.1.F.is.2). External tags have an average retention duration of 3 - 4 years, and will provide information on barbells movements on almost throughout the project period.

The adopted working hypothesis is based on tagging – recapture, in this respect the local fishermen being notified that they will receive a reward for returning Spaghetti tags and providing information on the date and place of recapture the tagged fish. Information received from commercial fishermen who had recovered and returned some of Spaghetti tags used for barbells proved that the fish have not moved into the period after marking, remaining in areas where usually stationed, namely with rocky - limestone substrate. This external tagging method has been adopted because the local migration period of barbell is before breeding, so in March - April, before monitoring works started during pre-construction period, not being justified using some ultrasonic telemetry systems. Ultrasonic emitting tags will be purchased in semester 2/2011 and will be used for barbel in Spring 2012.

In 2012, by tagging of new barbell specimens will be identified their possible migration trails. From previous studies it is known that barbell can perform migrations over long distances, entering from Danube on large tributaries for breeding or reproducing, after migrations on short distances in flooded areas near usual feeding places. In studied area there is only one large river where it was reported barbell migration, Ialomita which flows into Danube, upstream of Giurgeni. Next will be detect if barbells in critical points 01, 02 and 10 areas are breeding in the immediate vicinity of feeding areas, or performs migrations over greater distances.

Breeding migration of sturgeons in lower Danube and monitoring period in pre-construction phase

Area downstream from Critical Point 01 - Bala

The presence of starry sturgeon adults on Borcea branch in June was an indication that would take place another breeding for this species (Onara 2011) known as being characterized in lower Danube by multiple breedings, during May - June. This has been confirmed when, at gender controll performed using fiber optic endoscope, the two females captured on June 24 (code 29/30) and 26 June (code 17/18) at Km 55-57 and respectively at Km 18 on Borcea branch, had in abdominal cavity only roe remnants, indication for recently spawning (Table 2.1.F.is.3). Also the starry sturgeon male, code 15/16, captured on Borcea branch Km 55-57 (Table 2.1.F.is.3) lost seminal liquid, this being an indication that was captured near or even in the breeding area. These observations conducted on adult starry sturgeons captured on Borcea branch, are consistent with the potential location of a breeding area for starry sturgeon, based on the existence of the substrate consisting of limestone formations eroded by Danube water. Subsequent behavior and movements of these starry sturgeon specimens, recorded by submersible station **VR2 W 106410**, located on Borcea branch Km 64 at a depth of 8,5 – 9m, also explains that these fish were immediately before or immediately after spawning. So, the male code 22 captured by fishermen on June 11 in area 55-57 km, tagged and released by us at Km 65 (Table 2.1.F.is.3 and Figure 3.1.F.is.17) descending after 17 hours and 45 minutes of recovery after surgical implantation of ultrasonic emitter, to km 64 and then continued to move in automatic station area for 14 minutes, at a depth of 17.5 m, behavior that we interpret as a searching one, characteristic for sturgeon males that come into breeding/spawning places before the females.

During 11 days, male with code 25 captured by fishermen and tagged on 22 June (Table 2.1.F.is.3) traveled downstream from Km 65 (Figure 3.1.F.is.16) after only 6 hours after the release, choosing to use fastest velocity water current, at 6 m depth, meaning 1/3 of the maximum water depth in the fairway (18 m), where has passed with a velocity of about 2.2 m/sec, being recorded by automatic station 106410 for just 3 minutes.

Only one of the females that already spawning, cod 17/18 captured in Km 55-57 area, tagged and released at Km 65, was recorded by submersible automatic station at Km 64 (Figure 3.1.F.is.15).

Female movements in area at Km 65-64 lasted almost two days (June 26 - 28) and were recorded in four distinct phases, alternating slow movements for recovery/downstream, slowly returning upstream, and finally fast leaving the area by swimming on the fairway at a depth of 9 m, with a velocity of 2 m/sec, which led to a single recording during traveling those 400m in the effective detection range of submersible automatic station. This behavior is characteristic for sturgeon females returning to the sea after breeding. This type of downstream movement in area with highest water velocity, provides them the fastest traveling velocity and also the greatest chance of survival, because fishermen do never fishing for sturgeon in fairway and in the first third of water column, but always in the inflection areas of Danube bottom, located on both sides of the fairway and always near the bottom. These are actually the areas that sturgeons use for upstream migration toward breeding areas.

The recorded water temperature has varied during 24-28 June between 25-25.5ºC, above the upper temperature limit for this sturgeon species reproduction mentioned by Antipa (1909 and by Holcik 1989) (23ºC) but within the temperature range mentioned by Vlasenko (1981 and by Holcik 1989) for starry sturgeon in Kuban River/Sea of Azov (17-26ºC).

Existance of breeding areas for starry sturgeon on Borcea branch was until now attributed to spawning on hard clay sills, characteristic for erosion areas, extended to a depth of 5-8 m, on the left bank of this branch (Antipa 1909 and 1933), the existence of which we could also notice in May-June 2011 (Figure 3.1.F.is.29).

Although the initial/preliminary telemetry studies and for breeding habitats distribution undertaken by us during 1998 - 2000 (Kynard, Suciu & Horgan 2002) led to the finding that most of actual sturgeons breeding areas are located upstream from km 500 / Giurgiu - Ruse, we found that Borcea branch probably has several areas where river dug up to basal limestone rock, and water erosion especially the dragged sand, dug into the limestone formations that were detached and constitute in solid structures (detail inserted in Figure 3.1.F.is.29) very suitable for attaching of the eggs spawned by sturgeons and for their shelter, to avoid being damaged by gobies so numerous in all lower Danube sectors (Oţel, 2007).

Figure 3.1.F.is.29 - Sill of hard clay at left bank on Borcea branch, in Km 61 – 62 area (25.05.2011)

During 11 June - 13 July 2011, none of sturgeons (6 starry sturgeons and 1 sterlet sturgeon) tagged in this phase and released to Km 64 on Borcea branch, has not migrated to Bala branch, and has not reached/passed the Critical Point 01 area - future bottom sill at Km 8, not being registered by automatic station that we placed on this branch and neither by one placed on main Danube at km 347. This fact is interpreted as an indication of the absence on Bala branch of delayed spawning areas (June) for starry sturgeon, located on Borcea branch.

Also, none of sturgeons (6 starry sturgeon and 1 sterlet sturgeon) tagged and released at Km 64 on Borcea branch has not chosen to travel during June 11-July 13 upstream on upper Borcea, not being registered by submersible automatic station placed at Km 69 (Table 3.1.F.is.1, Figure 3.1.F.is.1 and Figure 3.1.F.is.3).

Verifying the presence of sturgeons with ultrasonic tags in main and secondary critical points by active monitoring with mobile station VR100, during 16.07. - 15.08.2011, did not identify the presence of any tagged sturgeon.

Area downstream from critical point 10 - Caleia

All three specimens of starry sturgeon captured by fishermen at Km 182 – 180.5 (2 specimens of male starry sturgeon) and at Km 200 (a starry sturgeon male) in CP 10 – Caleia, during 18 June - 1 July 2011 were released after implantation of ultrasonic transmitters at Km 183 at a depth of approx. 7.8 m (Table 2.1.F.is.3). All three were then been recorded by submersible automatic stations at Km 180.6 (two specimens) and at Km 180.8 (three specimens) as moving slowly downstream, already a few hours after releasing (Figure 3.1.F.is.20 and Figure 3.1.F.is.21).

After 7 days after passing downstream from Km 180.8, a single young male, code 11/12 (GT = 3 Kg, LT = 98 cm) was recorded by VR2 W 106409 station in July 7, for 91 minutes, moving upstream on main Danube, at Km 187. Due to characteristic zigzag movement pattern, continuously alternating the swiming depth (Figure 3.1.F.is.22) upstream velocity was only 0.07 m/sec. Significant for upstream migration behavior of this species is that **the traveling depth ranged between 24.5 m and a minimum of 8 m**. The value of minimum swimming depth recorded of 8 m, is characteristic for this sturgeon species and is consistent with the information we had from fishermen and our own observations resulting from fishing with fixed gillnets anchored at known depths, related to the fact that sturgeons always were captured at great depths and always in lower part of the nets. We interpret this behavior as being determined by pronounced negative photo-tactile sense of adult sturgeon and by the fear to climb at the surface / shallow waters, as a defense against potential predators.

None of the sturgeons tagged and released at Km 183, track by automatic stations (Figure 3.1.F.is.7) has not moved during June 18-July 12 on Caleia branch.

Using Borcea branch as sterlet sturgeon breeding area

The presence of sterlet sturgeon juveniles in our captures of fishing study with special net for sturgeon juveniles at Km 63 in 23 June and the high frequency of sterlet captures reported by professional fishermen in area, are clues that are consistent with historical information reported by Antipa (1909) concerning the presence in large number of sterlet on Borcea branch.

We had no opportunity to observe sterlet sturgeon specimens before or immediately after breeding because, from our observations in the period 2004 – 2011, sterlet sturgeon breeds at the same time and in the same places as beluga (Suciu 2004, Onara 2011). In 2011 beluga have been breed in April 1, the first day after the spring maximum water level on Danube (Paraschiv, 2011).

Importance of Borcea, Bala and Caleia branches as feeding areas for marine migratory sturgeons and sterlet sturgeon juveniles

Both great diversity as well as abundance of bottom fauna which constitutes food for juveniles sturgeon (Table 3.1.F.is.3 and Table 3.1.F.is.4) determined by sampling the bottom fauna, and the presence of starry sturgeon and sterlet juveniles determined by study fishing (Chapter "Presence of sturgeon juveniles in CP 01 area" and Chapter "Presence of sturgeon juveniles in CP 10 area" and Figure 3.1.F.is.24. and Figure 3.1.F.is.25) are indicative of the importance of these branches as feeding areas for juveniles sturgeon that are breeding in Danube.

3.1.F.i. Monitoring for other fish species

Results of scientific fishing for shad with driftnets does not have the expected results, as with all fishing effort (12 nets location made in both expeditions, with 1-3 sacks on each net) has not captured any adult shad specimen. Adults of *Alosa immaculata* which were measured and from which were taken biological samples, were obtained from authorized fishermen in areas near Critical Points (in CP 01 from Izvoarele fishermen, in CP 02 from fishermen near Oltina,in CP 10 from Gropeni fishermen).

All fishermen from the 3 critical points are using monofilament gillnets with a net height of 4-6 m and a length of 50-100 m, gillnets which are illegal in Romania although they are the most productive in catches, because on studied Danube segment water has a much higher transparency compared to Danube water and his branches from DDBR, where are used only gill nets and fishing nets.

This is confirmed by INCDPM ichthyology team, Tulcea subunit, that despite all efforts to capture *Alosa immaculata* adult specimens has not succeeded, effort being useless with drifting nets (fishing nets for shad, scientific standardized at 30 m length and 1,8 m height, mesh size 30 mm) both daytime and by night. Thus, shad adults see the nets and bypassing them or continue their migration descending to deep water.

Therefore, only in first expedition were analyzed 55 adult specimens of *Alosa immaculata* in all 3 Critical Points, highlighting the species presence in areas of main Critical Points (CP) CP 01, CP 02 and CP 10 both upstream and downstream from Critical Points and on channels/adjacent branches where will be working to improve navigation.

Alosa immaculata adult specimens are dominated by those of 3 or 4 years, and gender ratio is balanced about 1:1 (female:male 0.55:0.45).

Fullton fattening factor indicates that *Alosa immaculata* adults have much lower values compared with specimens captured from entry on the Danube, which is normal given the distance traveled by adults without feeding.

Also in scientific literature as well as from interviews conducted among authorized fishermen in Critical Points areas CP 01, CP 02 and CP 10 we can state that also the adults from *Alosa tanaica* species reaches up to these areas, entering for breeding even in lakes, backwaters in Danube vicinity with which are connected.

Regarding sampling with Bongo net (net for ichtyoplankton) for sampling the larvae and juvenile from Alosa species (*Alosa immaculata* and *Alosa tanaica*) are not yet known differences between them as juveniles) were made 16 stations of 5 - 10 minutes each station, in 11 sites/stations (in 5 sites were performed sampling in both periods) being present 61 larvae of *Alosa sp.* in a volume of 633 m^3 of filtered water (Table 3.1.F.i.1.).

Table 3.1.F.i.1 - Relative abundance of shad larvae flowing on Danube for studied sector

Data	Punct critic (PC)	Loc	Sit / Staţia	Timp lucru (min)	N1 Index de început	N2 Index la final	Lungime (m)	Volum apă filtrată (m^3)	Larve *Alosa sp.* (ind.)	Larve *Alosa sp.* / 100 m^3	Observaţii
27.04.2011	PC10	PC10Gropeni B1	Dunărea Mică	10	49562	59997	280,420	55,3055	12	21,7	
27.04.2011	PC10	PC10Gropeni B2	Side canal	10	59997	74862	399,468	78,7845	7	8,9	
28.04.2011	PC1	PC1BalaB1	brat Bala	10	74862	87403	337,015	66,4673	3	4,5	
28.04.2011	PC1	PC1BalaB2	Dunărea Mare	10	87403	105731	492,529	97,1384	2	2,1	
28.04.2011	PC2	PC2OltinaB1	Side canal	10	105731	123645	481,403	94,9442	11	11,6	curent f. slab
25.05.2011	PC10	PC10Gropeni B1	Dunăre Mare - mal drept	5	300803	305815	134,688	26,5636	3	11,3	
25.05.2011	PC10	PC10Gropeni B2	Dunăre Mare - mal stâng	5	305815	310005	112,598	22,207	4	18,0	
25.05.2011	PC10	PC10Gropeni B3	Side canal	5	310005	314397	118,026	23,2776	0	0,0	curent f slab
25.05.2011	PC10	PC10Gropeni B4	Dunăre Mică	5	314397	317313	78,362	15,4548	6	38,8	
26.05.2011	PC2	PC2OltinaB1	Side canal	5	317313	321812	120,902	23,8447	3	12,6	curent f slab
26.05.2011	PC2	PC2OltinaB2	Dunăre Mare	5	321812	324187	63,823	12,5875	1	7,9	
26.05.2011	PC2	PC2OltinaB3	Dunăre Navigabila	5	324187	326156	52,913	10,4357	2	19,2	
26.05.2011	PC1	PC1BalaB1	Dunăre Mare	5	326156	330000	103,300	20,3732	5	24,5	
26.05.2011	PC1	PC1BalaB2	brat Bala	5	330000	332999	80,592	15,8947	2	12,6	
26.05.2011	PC1	PC1BalaB3	Dunăre Navigabila	5	332999	339999	188,111	37,1	3	8,1	
26.05.2011	PC1	PC1BalaB4	brat Borcea	5	339999	346259	168,225	33,178	3	9,0	
TOTAL							3212,375	633,557	61	193,7	

Legend:
- N1= beginning index of flowmeter,
- N2= ending index of flowmeter,
- L = distance in meters,
- V = filtered water volume in m^3
- PC= critical point, side channel/branch, Upper Danube = Danube upstream from critical point, Lower Danube/navigable = Danube downstream from critical point.

Sites on each critical point (CP) has been selected so: on Danube upstream from CP (coded Great Danube), on Danube downstream from CP (coded Little Danube or Navigable Danube) and on adjacent branch (coded Side Channel or branch name).

In all sampling stations with Bongo net were found larvae of *Alosa sp.,* except for Lateral Channel (Adjacent) in CP 10, near Gropeni, but also here only in the second expedition, when water current was extremely low and probably *Alosa* larvae followed the Danube current. In this station have been identified larvae of *Alosa sp.* at the end of April (in first expedition) when the water current was much higher.

According to Vladimirov scale (1953), dominant larval stages are those from stage II and especially stage III, and a significant number of stage I, which confirms hypothesis that the Danube segment, Călărași-Brăila is the most important segment for breeding of two species of Alosa genus (Table 3.1.F.i.2.).

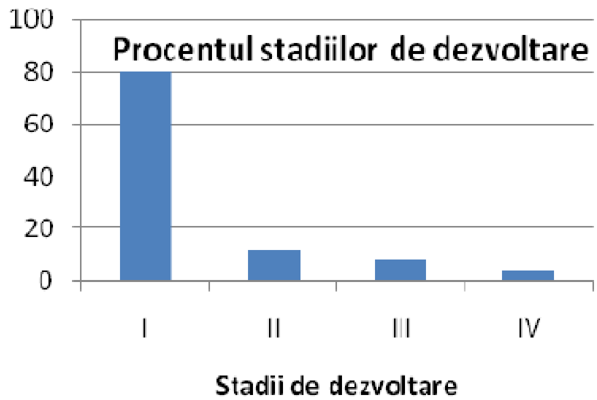


Figure 3.1.F.i.1 - The percentage of Alosa sp. larval stages in critical points areas, studied in this phase

List of fish species and their actual situation in Critical Points

In Danube segment from Călărași to Brăila, literature shows the presence of 63 fish species, mostly freshwater species, but there are also migratory species such as sturgeons and *Clupeidae species* which undertake long upstream migrations for spawning (even this Danube segment is the most important for breeding of *Clupeidae* family as well as sturgeons).

In addition to these species can be accidentally found also species coming from the rivers, probably most often with spring floods, species such as *E. mariae*, *S. cephalus* (the chub). Several species were captured in the past, but currently are not for more than 4 decades (*C. chalcoides, A. nudiventris*) or some are found accidentally in area (eels - *Anguilla A.*, salmon - *Salmo salar*, zander - *S. volgense*) (Table 3.1.F.i.2.).

The most important species for the European Community and for Romania are protected by EU legislation (Habitats Directive) which has been implemented in romanian legislation (Emergency Ordinance 57/2007 completed with Ordinance 154/2008, which replaced and completed by Order 1198 and Law 462/2001).

Red Book - indicates the vertebrate species, in this case only fish species, that are in a situation where populations are declining so that attention must be drawn on further existence of the species in Romania.

Interview among fishermen from Critical Points areas shows that the most commercial species are caught, namely 23 fish species with alimentary and commercial value, predominant in captures being also here *Carassius gibelio* species (Table 3.1.F.i.2.).

Table 3.1.F.i.2 - List of fish species in Danube sector Călăraşi-Brăila

Specii	Denumire comună	Literatura de specialitate	Interviu pescari	Pescuit experimental 2011			Situaţia actuală	Protecţie
		Dunăre Călăraşi-Brăila		PC 01	PC 02	PC 10		
Abramis ballerus	cosac cu bot ascuţit	1					foarte rar	
Abramis brama	plătică	1	1	1			P	
Abramis sapa	cosac cu bot turtit	1					P	
Acipenser guldenstaedtii	nisetru	1	1				P	DH
Acipenser nudiventris	viza	1					neregăsit	DH
Acipenser ruthenus	cega	1	1				P	DH
Acipenser stellatus	păstruga	1	1				P	DH
Alburnus alburnus	oblete	1	1	1	1	1	P	
Alosa immaculata	scrumbie de Dunăre	1	1	1	1	1	P	DH
Alosa tanaica	rizeafca	1	1	1	1	1	P	DH
Anguilla anguilla	anghila	1					Foarte rar	
Aristichthys nobilis	novac	1					P	
Aspius aspius	avat	1	1	1		1	P	DH
Barbus barbus	mreana	1	1				P	DH
Bentophilus stellatus	umflătura	1					P	
Blicca bjoerkna	batca	1	1		1		P	
Carassius carassius	caracuda	1					in declin	CR
Carassius gibelio	caras	1	1			1	P	
Chalcalburnus chalcoides	oblete mare	1					neregăsit	DH, CR
Chondrostoma nasus	scobar	1	1	1		1	P	
Clupeonella cultriventris	gingirica	1					P	
Cobitis sp	zvârlugi	1					P	DH
Ctenopharyngodon idella	cosaş	1					neaclimatizat	
Cyprinus carpio	crap	1	1				P	
Esox lucius	ştiuca	1	1		1		P	
Eudontomyzon mariae	cicar	1					P	DH, CR
Gobio albipinnatus	porcuşor de şes	1					P	DH, CR
Gobio gobio	porcuşor	1					P	DH, CR
Gobio kessleri	porcuşor de nisip	1					P	DH, CR
Gymnocephalus baloni	ghiborţ de Dunăre	1					P	DH, CR
Gymnocephalus cernuus	ghiborţ	1					P	
Gymnocephalus schraetser	răspăr	1					P	DH, CR

Specii	Denumire comună	Literatura de specialitate Dunăre Călărași-Brăila	Interviu pescari	Pescuit experimental 2011 PC 01	PC 02	PC 10	Situația actuală	Protecție
Huso huso	morun	1	1				P	DH
Hypophthalmichthys molitrix	sânger	1	1				P	
Lepomis gibbosus	reginuța	1					P	
Leucaspius delineatus	plevușca	1					P	
Squalius chephalus	clean	1					accidental	
Leuciscus idus	văduvița	1		1	1	1	P	
Lota lota	mihalț	1					P	CR
Misgurnus fossilis	tipar	1					P	DH, CR
Neogobius fluviatilis	guvid	1					P	
Neogobius (Babka) gymnotrachelus	mocănaș	1					P	
Neogobius (Ponticola) kessleri	mitroace	1					P	CR
Neogobius melanostomus	stronghil	1					P	
Pelecus cultratus	sabiță	1					P	DH, CR
Perca fluviatilis	biban	1	1		1		P	
Perccottus glenii	guvid de Amur	1					P	
Proterorhincus marmoratus	moaca de brădiș	1			1		P	
Pseudorasbora parva	murgoi bălțat	1				1	P	
Pungitius platygaster	pălămida de balta	1					in bălți	
Rhodeus amarus	boarța	1				1	P	DH
Rutilus rutilus	babușca	1	1	1	1	1	P	
Sabanejewia bulgarica	dunăriță	1					P	DH, CR
Salmo solar	păstrăv de mare	1					accidental	DH, CR
Sander lucioperca	șalău	1	1		1		P	
Sander volgensis	șalău vărgat	1					accidental	CR
Scardinius erythrophthalmus	roșioara	1	1			1	P	
Silurus glanis	somn	1	1				P	
Syngnathus abaster	undrea	1					P	
Tinca tinca	lin	1	1				P	
Vimba vimba	morunaș	1	1				P	
Zingel streber	fusar	1					P	DH, CR
Zingel zingel	pietrar	1					P	DH, CR
TOTAL		63	23	8	10	11		

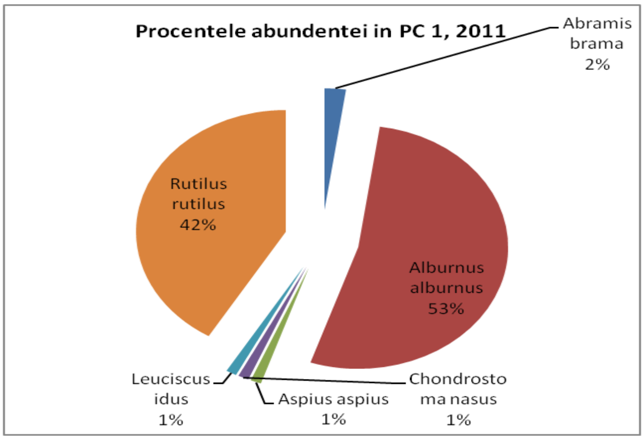
With shore electrical fishing on 5 stations in 2011, have been captured 15 fish species in the 3 studied Critical points, 6 species in CP 01, 8 species in CP 02 and 9 in CP 10 (Table 3.1.F.i.3.), from which is noted that in CP 02, due to stone damming can be found stagnant water species as *B. bjoerkna*, *E. lucius*, *P. fluviatilis* or *P. marmoratus*, but also a lack of rheophile species as *C. nasus*, *A. aspius* (Table 3.1.F.i.2.).

Table 3.1.F.i.3 - Species richness for shore electrical fishing in the 5 station in 2011

Specia	PC 01			PC 02	PC 10			TOTAL
	E1	E2	Total	E1	E1	E2	Total	
Abramis brama		1	1					1
Alburnus alburnus	1	1	1	1	1	1	1	1
Aspius aspius		1	1		1	1	1	1
Blicca bjoerkna				1				1
Carassius gibelio						1	1	1
Chondrostoma nasus	1		1		1	1	1	1
Esox lucius				1				1
Leuciscus idus	1		1	1	1	1	1	1
Perca fluviatilis				1				1
Proterorhinus marmoratus				1				1
Pseudorasbora parva						1	1	1
Rhodeus amarus						1	1	1
Rutilus rutilus		1	1	1		1	1	1
Sander lucioperca				1				1
Scardinius erythrophthalmus					1		1	1
TOTAL	3	5	**6**	**8**	5	8	**9**	**15**

At the 15 species captured in all 3 Critical Points need to be added *Alosa species* (*A. immaculata* and *A. tanaica*), which migrate from the sea into Danube for spawning and, as we have seen, reaches the 3 Critical Points and on side channels, both as adults or juveniles, completing the list of species up to 17 species, respectively 8 in CP 01, 10 in CP 02, 11 in CP 10 (Table 3.1.F.i.2.).

In CP 01 highest percentages of abundance have *A. alburnus* and *R. rutilus*, and for biomass dominates by far *R. rutilus* (Figure 3.1.F.i.3.). In CP 02 dominate the species *A. alburnus* in abundance, and for biomass are *S. lucioperca* and *E. lucius* (Figure 3.1.F.i.2). In CP 10 also *A. alburnus* is the dominant species, and for biomass dominates *L. idus*, rheophile species typical for Danube (Figure 3.1.F.i.3).



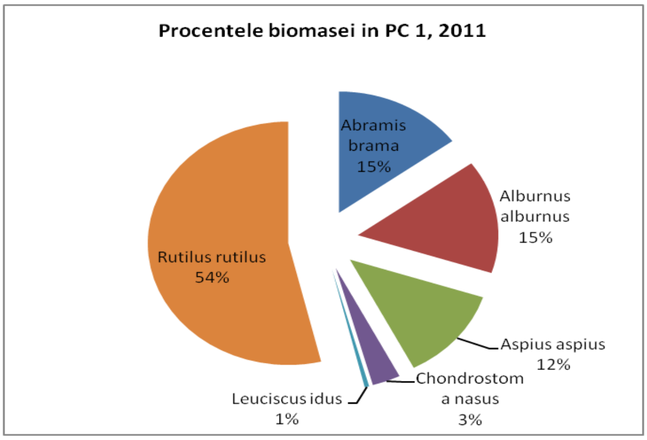


Figure 3.1.F.i.2 - Abundance (left) and biomass (right) in percentages for shore electrical fishing in CP1

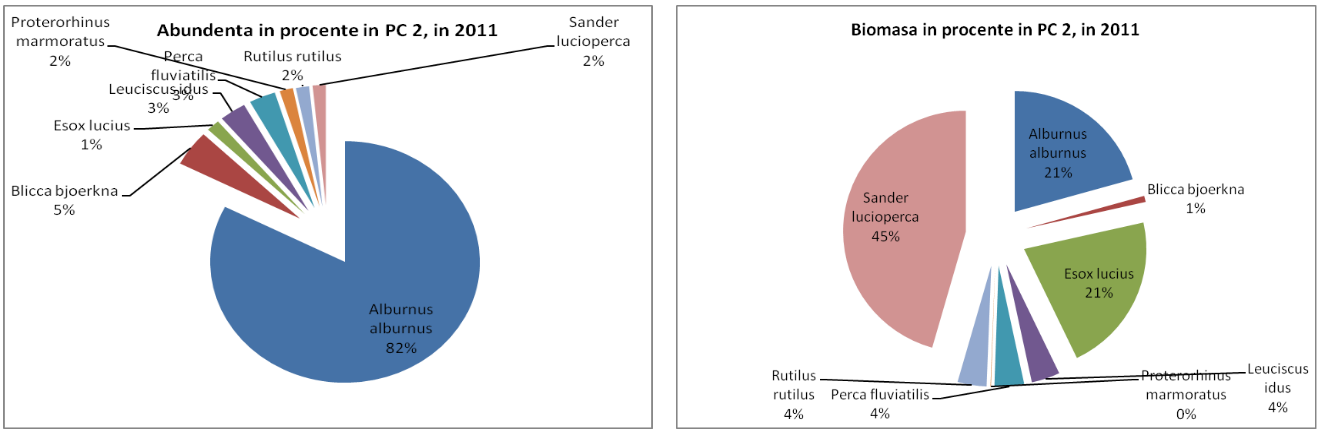


Figure 3.1.F.i.3 - Abundance (left) and biomass (right) in percentages for shore electrical fishing in CP2

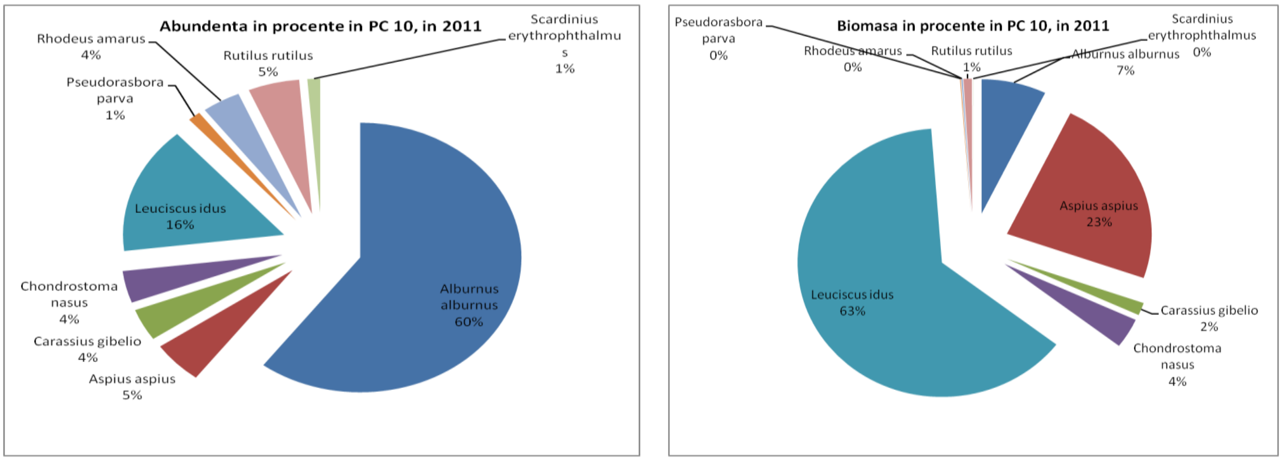


Figure 3.1.F.i.4 - Abundance (left) and biomass (right) in percentages for shore electrical fishing in CP10

Results of sampling by deep water electrical fishing are presented in Table 3.1.F.i.4, grouped in 3 categories, corresponding to 3 critical areas.

Table 3.1.F.i.4 - Fish species captured

Nr. Crt	PC 10, zona Gropeni km 197-198 (21 specii capturate)	PC 01 si PC 02 (16 specii capturate)	Braţul Bala (22 specii capturate)
	Specia	Specia	Specia
1.	*Abramis brama*	*Abramis brama*	*Abramis brama*
2.	*Abramis sapa*	*Abramis sapa*	*Abramis sapa*
3.	*Alburnus alburnus*	*Alburnus alburnus*	*Acipenser nudiventris*
4.	*Barbus barbus*	*Alburnus alburnus*	*Alosa tanaica*
5.	*Benthophilus stellatus*	*Alosa tanaica*	*Babka gymnotrachelus*
6.	*Blicca bjoerkna*	*Barbus barbus*	*Barbus barbus*
7.	*Cobitis taenia*	*Barbus barbus*	*Benthophilus stellatus*
8.	*Cyprinus carpio*	*Benthophilus stellatus*	*Blicca bjoerkna*
9.	*Eudontomyzon mariae*	*Benthophilus stellatus*	*Cobitis taenia*
10.	*Gymnocephalus baloni*	*Blicca bjoerkna*	*Eudontomyzon mariae*
11.	*Gymnocephalus schraetser*	*Blicca bjoerkna*	*Gobio albipinnatus*
12.	*Lota lota*	*Gobio albipinnatus*	*Gymnocephalus baloni*
13.	*Neogobius melanostomus*	*Gymnocephalus schraetser*	*Gymnocephalus schraetser*
14.	*Ponticola kessleri*	*Neogobius fluviatilis*	*Neogobius fluviatilis*
15.	*Romanogobio albipinnatus*	*Neogobius melanostomus*	*Neogobius melanostomus*
16.	*Rutilus rutilus*	*Sabanejewia aurata*	*Ponticola kessleri*
17.	*Sabanejewia balcanica*	-	*Sabanejewia balcanica*
18.	*Sander lucioperca*	-	*Sander lucioperca*
19.	*Silurus glanis*	-	*Syngnathus abaster*
20	*Zingel streber*	-	*Vimba vimba*
21.	*Zingel zingel*	-	*Zingel streber*
22.	-	-	*Zingel zingel*
	Total exemplare capturate: 572	Total exemplare capturate: 269	Total exemplare capturate: 657

Electrical deep water fishing took place on 10 transects, each of 500 m in length, daytime, 7 of which were fished in June 2011 at km 344, and 3 in July 2011 between km 386-387. The 269 captured specimens belong to 16 fish species. The dominant species of benthic habitats is *Neogobius melanostomus* (32 %) of ponto-caspian origin. A similar representation had *Gobio albipinnatus* species (29 %), which is a Community interest species, Natura 2000. The two species represent more than 50 % of the capture. A significant presence had also the species *Zingel streber* (12 %), which is also a Natura 2000 species, and *Gymnocephalus schraetzer* (7 %) (Figure 3.1.F.i.6, Table 3.1.F.i.5).

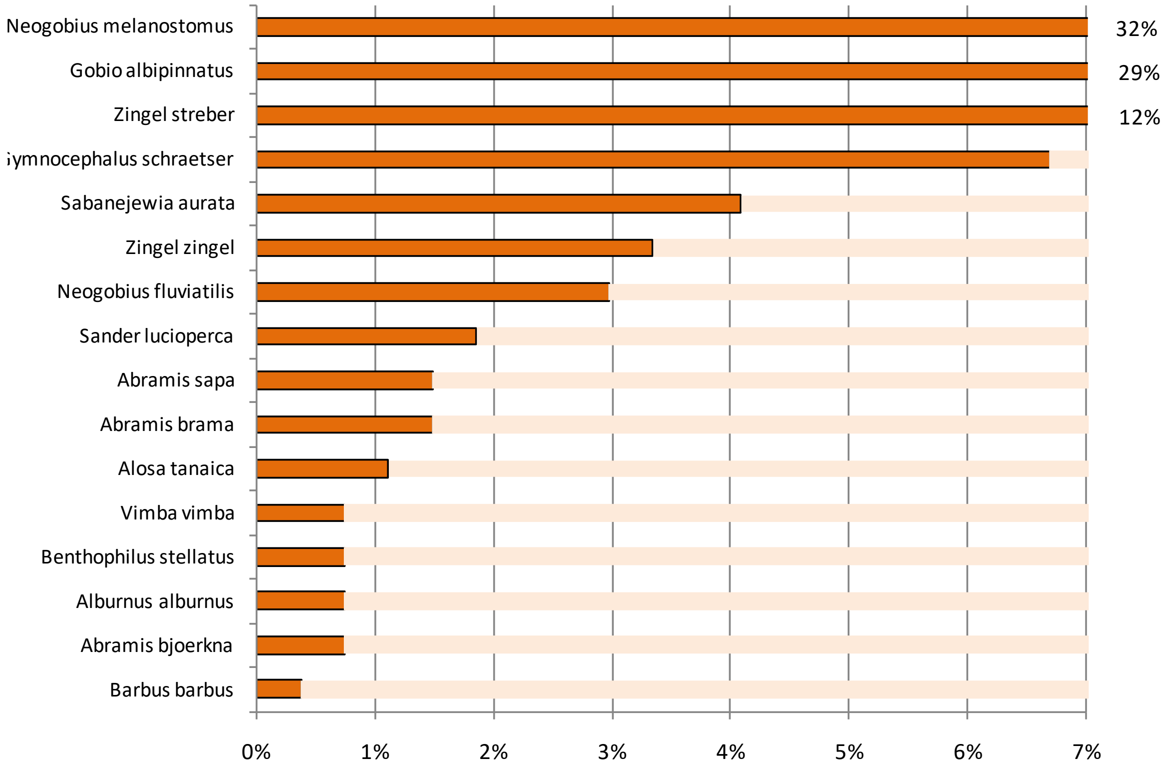


Figure 3.1.F.i.5 - Statistical results of deep water scientific fishing with captured species and their relative abundance (%) in Călăraşi (Izvoarele) area

Table 3.1.F.i.5 - Statistical results of scientific fishing with electrical trawl in Călăraşi (Izvoarele) area: matching species in environmental protections norms, relative abundance

TAXON	Abund. rel.	rvf	fvf	HD II.	HD IV.	HD V.	Nat.2000
Barbus barbus	0.37					■	
Abramis bjoerkna	0.74						
Alburnus alburnus	0.74						
Benthophilus stellatus	0.74						
Vimba vimba	0.74						
Alosa tanaica	1.12			■		■	■
Abramis brama	1.49						
Abramis sapa	1.49						
Sander lucioperca	1.86						
Neogobius fluviatilis	2.97						
Zingel zingel	3.35	■		■		■	■
Sabanejewia aurata	4.09			■			
Gymnocephalus schraetser	6.69	■		■		■	■
Zingel streber	11.90	■		■			■

TAXON	Abund. rel.	rvf	fvf	HD II.	HD IV.	HD V.	Nat.2000
Gobio albipinnatus	29.37			■			■
Neogobius melanostomus	32.34						
Total nr. indivizi	269	59	0	152	0	31	141
Total nr. specii	16	3	0	6	0	4	5

Near Gropeni, between km 197-198, in June were captured 572 specimens, from 21 species, in 8 transects of 500 m each. Most frequent two species, partial protected and of Natura 2000 interest were *Zingel streber* (19 %) and *Ponticola kessleri* (17 %). A similar presence had also species *Sabanejewia balcanica* (14%), and a species with a wide spreading, mostly in big rivers and stagnant waters, *Abramis bjoerkna* (13 %) and species of interest Natura 2000, *Gobio albipinnatus*. These species are followed by *Zingel zingel* (8%), a Natura 2000 species of interest, partial protected (Figure 3.1.F.i.7, Table 3.1.F.i.6).

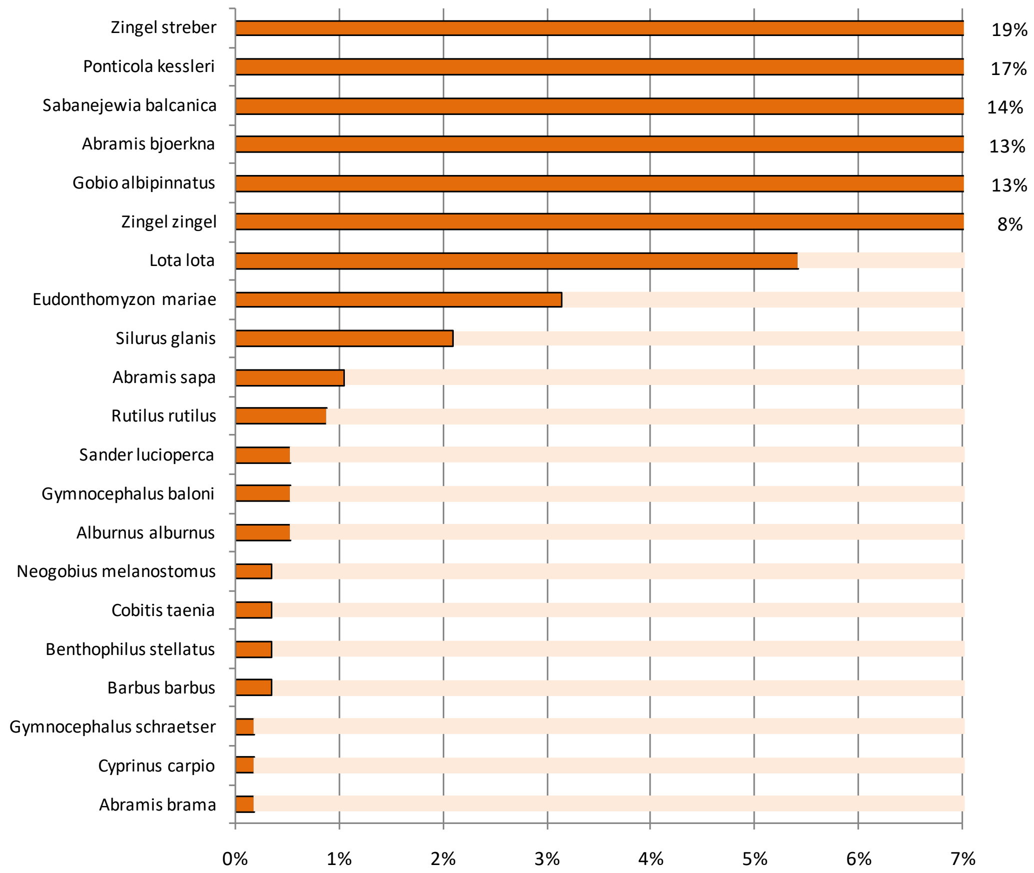


Figure 3.1.F.i.6 - Statistical results for deep water scientific fishing, with captured species and their relative abundance (%) in Gropeni area

Table 3.1.F.i.6 - Statistical results of scientific fishing with electrical trawl in Gropeni area: matching species in environmental protections norms, relative abundance

TAXON	Abund. Rel.	rvf	fvf	HD II	HD IV	HD V	Nat.2000
Abramis brama	7.08						
Cyprinus carpio	1.60						
Gymnocephalus schraetser	3.40	■		■		■	■
Barbus barbus	0.07					■	
Benthophilus stellatus	0.33						
Cobitis taenia	0.27			■			■
Neogobius melanostomus	1.67						
Alburnus alburnus	0.40						
Gymnocephalus baloni	0.13			■	■		■
Sander lucioperca	0.27						
Rutilus rutilus	0.13						
Abramis sapa	0.07						
Silurus glanis	0.40						
Eudonthomyzon mariae	12.42			■			
Lota lota	5.07						
Zingel zingel	2.07	■		■		■	■
Gobio albipinnatus	0.07			■			■
Abramis bjoerkna	3.40						
Sabanejewia balcanica	0.53			■			
Ponticola kessleri	0.27						
Zingel streber	13.62	■		■			■
Total nr. indivizi	572	156	0	331	3	47	235
Total nr. Specii	21	3	0	8	1	3	5

At the same time with scientific fishing with electrical trawl on Bala branch, took place fishing in transects of 500 m each, daytime, of which 7 in June 2011 at km 344, and 1 transect at km 345 in July, 3 between km 347-348. In total have been captured 22 fish species, 657 specimens. The dominant species of the capture has proved to be here also *Zingel streber* species (43%). A similar abundance had the species *Gobio albipinnatus* (14%) and *Sabanejewia Balkan* (12%) (Figure 3.1.F.i.7, Table 3.1.F.i.7).

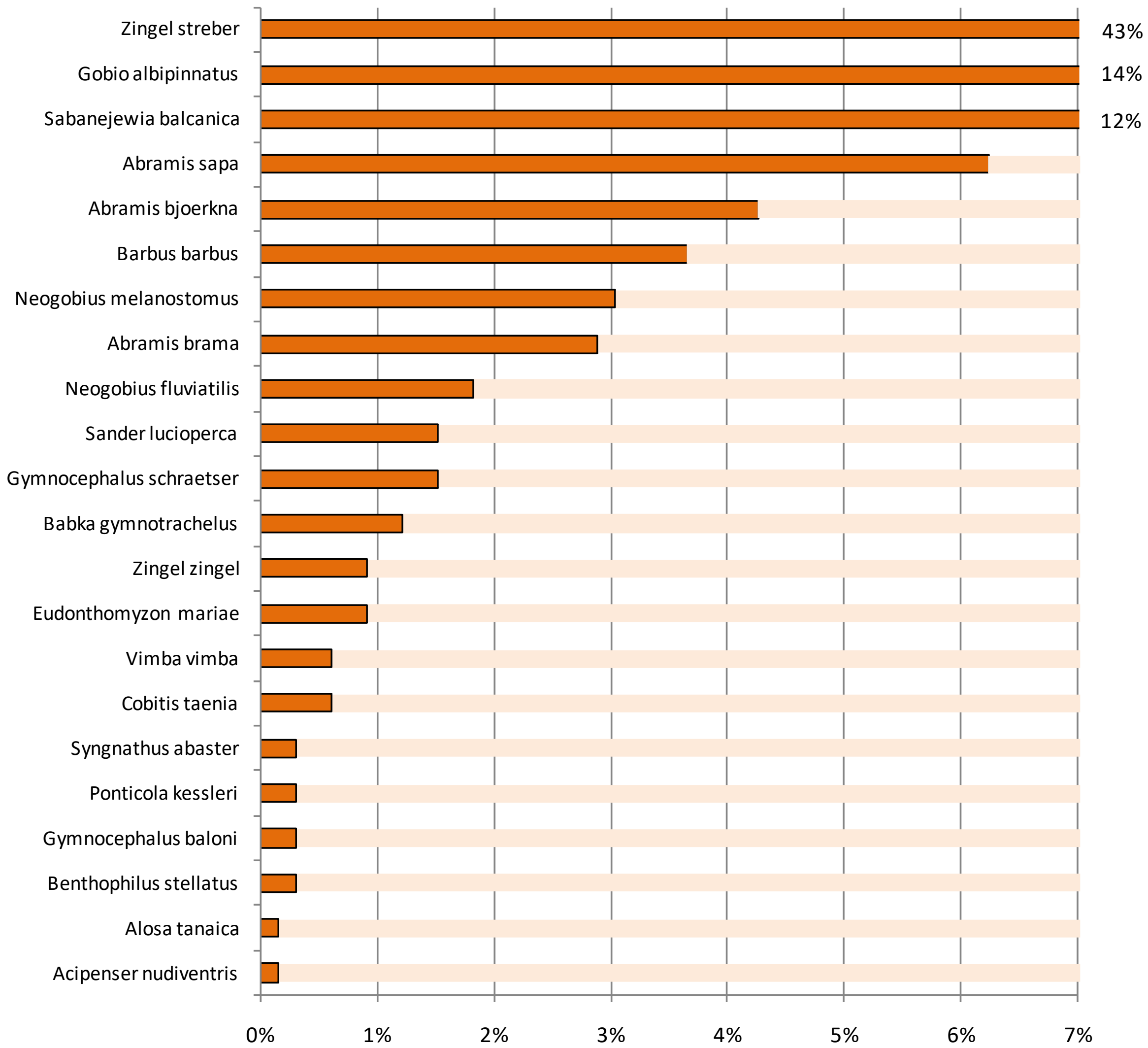


Figure 3.1.F.i.7 - Statistical results for deep water scientific fishing, with captured species and their relative abundance (%) on Bala branch

Table 3.1.F.i.7 - Statistical results of scientific fishing with electrical trawl in Bala branch area: matching species in environmental protections norms, relative abundance

TAXON	Abund rel.	rvf	fvf	HD II	HD IV	HD V	Nat.2000
Acipenser nudiventris	0.15					■	
Alosa tanaica	0.15			■		■	■
Benthophilus stellatus	0.30						
Gymnocephalus baloni	0.30			■	■		■
Ponticola kessleri	0.30						
Syngnathus abaster	0.30						
Cobitis taenia	0.61			■			■
Vimba vimba	0.61						
Eudonthomyzon mariae	0.91			■			
Zingel zingel	0.91	■		■		■	■
Babka gymnotrachelus	1.22						
Gymnocephalus schraetser	1.52	■		■		■	■
Sander lucioperca	1.52						
Neogobius fluviatilis	1.83						
Abramis brama	2.89						
Neogobius melanostomus	3.04						
Barbus barbus	3.65					■	
Abramis bjoerkna	4.26						
Abramis sapa	6.24						
Sabanejewia balcanica	12.33			■			
Gobio albipinnatus	13.55			■			■
Zingel streber	43.38	■		■			■
Sum nr. indivizi	657	518	0	964	76	120	788
Sum nr. Specii	22	3	0	9	1	5	5

Assessment

Sampling sections are located in 3 different areas. Statistical analysis has been performed in order to verify if that fish communities are different depending on location. As statistical analysis we used variance and discriminance test. The two statistical methods revealed that the fish fauna is not significantly different in the three studied locations, which indicates similarities in habitat and abiotic parameters in all three locations. This enables unitary assessment of data from different sites.

Based on statistical results, which demonstrates that does not have significant differences between data from different locations, we checked the efficiency of fishing effort based on aggregated data. For this purpose we followed the link between increase in fishing effort (increase of sampling units number) and changes in fish species number captured, by *rarefaction* analysis (Figure 3.1.F.i.9). According to chart, after a number of 6-7 transects of 500 m length, increasing in number of capture species starts to attenuate. With the increasing number of sections over this value increases number of captured species but with lower intensity. In evaluation it can be seen that, for the maximum number of 23 transects made in our samplings, number of captured species is still increasing, but with low intensity. In this sector of Danube capturing of all species would be possible only with a great fishing effort, due to rare species. Based on the chart, we can say that the fishing effort applied within this program gives a real and significant image regarding fish communities from benthic habitats on the Danube.

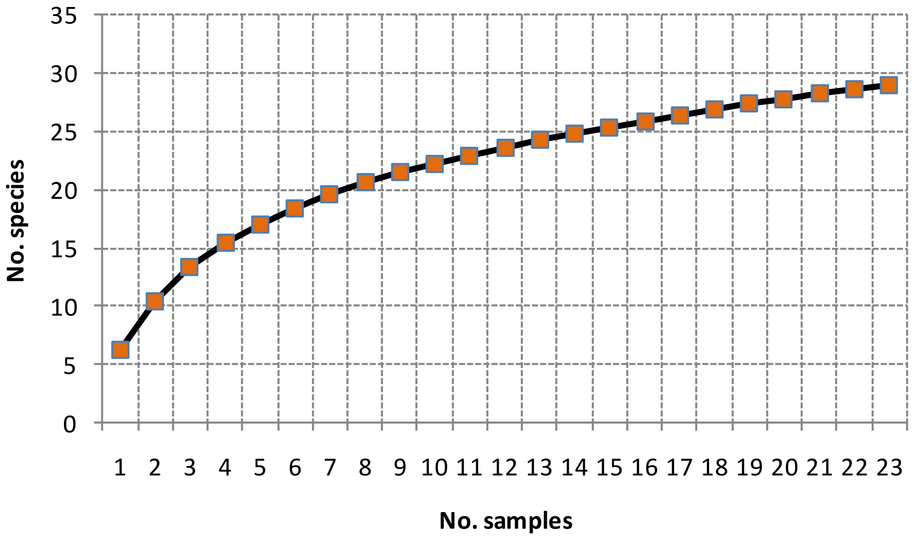


Figure 3.1.F.i.8 - Evolution of species number correlated with the fishing effort

Number of species which have been captured in small number and in fewer sections is higher. *Gobio albipinnatus* and *Zingel streber* were species captured in the largest number and from the most of the transects. *Zingel zingel* and *Balkan Sabanejewia* may also be considered frequent species. The fact that all four common species from this area present a value in terms of environmental protection considerations, highlights the areal value as regards of species conservation (Figure 3.1.F.i.10). In addition to above mentioned species can be considered as common species *Neogobius fluviatilis* and *Abramis bjoerkna.*

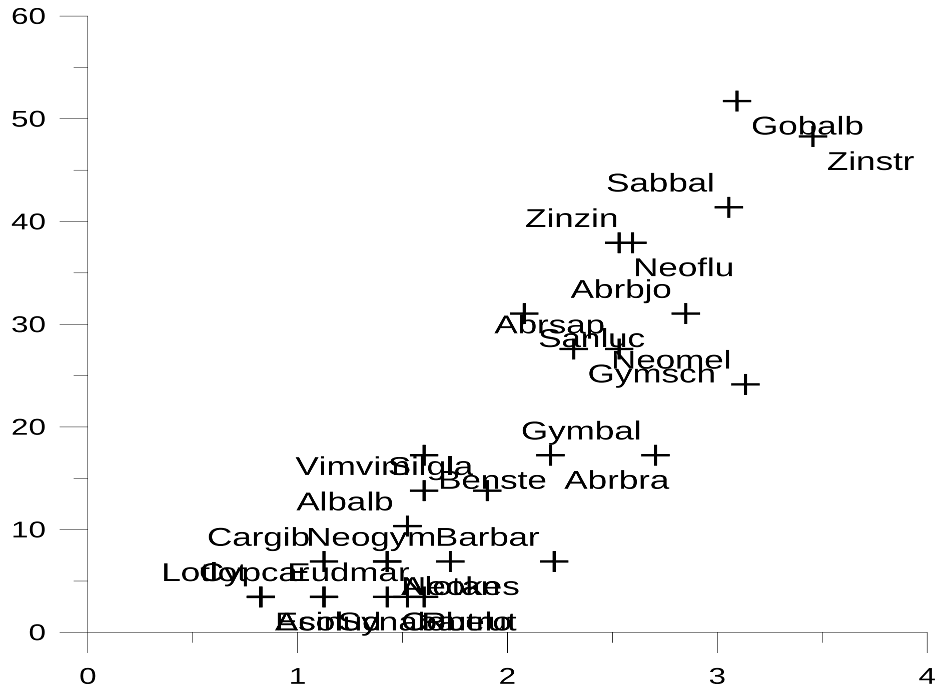


Figure 3.1.F.i.9 - Relative abundance (axis x) and absolute (axis y) of captured species

Based on data analysis, the assessed habitats show a significant value for environmental impact assessment (Figure 3.1.F.i.10). In this figure we can see three different classifications in this regard. In all three classifications, the concerned habitats have a significant number of valuable species in terms of environmental protection. Particularly frequent are species of Natura 2000 community interest.

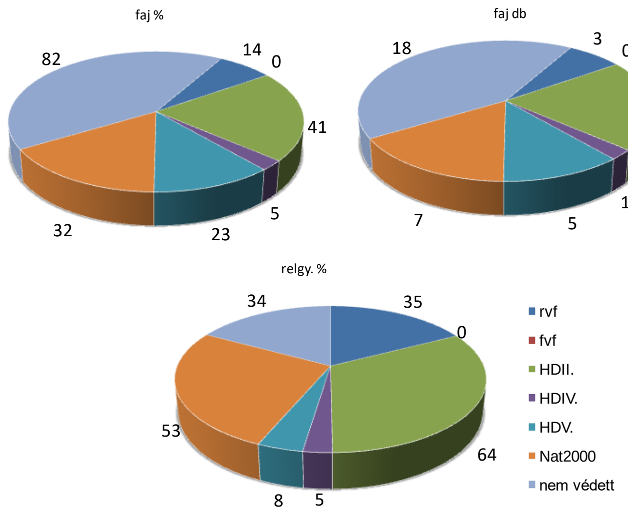


Figure 3.1.F.i.10 - Species status based on environmental protection considerations in studied areas: a) percentage repartition of species in different classes b) repartition of species number, in percentages for different classes; c) repartition of individuals number, in percentages for different classes

Should be taken into account that some species belonging simultaneously to several classes, which explains that the percentages summed by classes is over 100%, respectively maximum number of species (29). Abbreviations used: rvf - partially protected species, fvf - strictly protected species, HD II - species listed in Habitats Directive II, HD IV - species listed in Habitats Directive IV, Nat2000 - Natura 2000 species.

Monitoring of river habitats

Score of main critical points

Habitats assessment for the main three critical points (01, 02 and 10) was done according to Specification by field method for River habitats monitoring (River Habitat Survey - RHS) (Great Britain Environmental Agency, 1997). This method is a systematic collection of data associated with the physical structure of water courses based on a standard length of 500 m river unit.

The characterization of each zone using RHS forms gives a score, Habitat Modification Score (HMS). This score expresses the degree of artificial modification of the physical structure of the channel. Subsequently areas must be classified according to the 6 HMS categories used in Great Britain (Raven et al., 1998), according to the table below.

Habitat Modification Score (HMS)

0	nemodified
1 - 2	semi-natural
3 - 8	rather unmodified
9 -20	obviously modified
21 - 44	serious modified
≥ 45	highly modified

Analysis of main critical points based on RHS forms produced the score of habitats modifications - Habitat Modification Score (HMS) for each critical points:

Critical Point	**Score of habitats modification (HMS)**	
CP 01	8	rather unmodified
CP 02	0	nemodified
CP 10	3	rather unmodified

Model for River Habitats Assessment form (RHS) and RHS forms completed in field for CP01, CP 02, CP 10 are found in Annex 5.10.

The connectivity degree of aquatic habitats

River dry land length is an indicator of lateral connectivity. The longer is the bank, the greater is the interaction between water and land. In addition, dry land length is positively correlated with the diversity of young fish species, or the number of shorebirds breeding pairs.

In the following table is presented, separately for CP 01 – CP 02 respectively for CP 10, the lengths on water (measured on the center of navigable channel) and respectively lengths on land - summed on the 2 banks on outer perimeter - located on the water – for islands and islets located in critical points area.

The degree of lateral connectivity

PC	Denumire braţ	Km	Lungime mal drept (m)	Lungime mal stâng (m)	Insule-Ostroave	Lungime râu (m)	Lungime totală uscat (m)	Raport uscat/apă
PC 01 - PC 02	Dunărea (amonte Bala)	349 - 345	2870,4	3185,8	0	1031,0	6056,2	5,87
PC 01 - PC 02	Dunărea (aval Bala)	346 - 332	13476,5	14117,4	3434,8 (Ostrov la Km 341)	13909,6	48687,3	3,50
					4269,5 (Ostrov la Km 337)			
					13389,09 (Insula Epurasu)			
PC 01 - PC 02	Bala	9 -1	10946	11037,5	2483,7 (Ostrov 1 Km 9)	11074,0	26138	2,36
					1670,8 (Ostrov 2 Km 9)			
PC 01 - PC 02	Total					26014,6	80881,5	3,11
PC 10	Dunărea	197 - 186	10069,3	10831,6	0	10482,0	20900,9	1,99
PC 10	Braţ Caleia	10 - 1	10570,6	11725,2	0	10570,6	22295,8	2,11
PC 10	Total					21052,6	43196,7	2,05

As can be noted for CP 01 – CP 02, ratio between land and water lenght is 3.11, while for CP 10 this ratio has a value close to 2 – value characteristic for a regularized riverbed. Mentioned that the land lenght was determined for the situation with average flow rate on these sectors – about 6000 mc/s.

3.1.G. Monitoring of the terrestrial flora and fauna

3.1.G.1. Terrestrial flora

Types of habitats present within the project area

a) Canadian poplar plantations *(Populus x canadensis).* This type of habitat is fully anthropogenic. Fast growing (allochthonous) poplar monocultures are widespread within the project area, the wood material being used for export (furniture wood). These monocultures are characterized by tree layers of 5-7 m height and same age, they are organised in rows and they represent 60-75 % of the covering. Occasionally, ash (*Frasinus excelsior*) is present. The tree layer is scanty (up to 15 % covering) and it consists of allochthonous invasive species (*Amorpha fruticosa*) and willow (*Salix alba*) or poplar (*Populus* x *canadensis*, *Populus alba*) saplings. The herbaceous layer is scanty also; however it has a better covering (of 30-40 %). This layer consists of common or ruderal species, resistant to perturbances (*Agropyron repens, Rubus caesius, Arctium lappa, Aristolochia clematitis, Chenopodium album, Xanthium strumarium, Echinochloa crus-galli*). It should be noted the widespread of three invasive allochthonous species: *Amorpha fruticosa, Echinocystis lobata, Xanthium strumarium*.

Figure 3.1.G.1.1 - Canadian poplar plantation

b) R4407 Danubian forests of white willow (*Salix alba*) and *Rubus caesius* (Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries). This type of habitat is widespread in the southern part of the country, on the riverside. The tree layer consists almost totally of white willow (*Salix alba*) and occasionally of white or black poplar (*Populus alba, P. nigra*) or alder (*Alnus glutinosa*). In the case of sallow saplings, the tree layer can get up to 100 %, while for old ones it decreases at 60-80 %. In the herbaceous layer the following species are present: *Rubus caesius* (that may attain a 100 % covering, forming a dense vegetation, difficult to penetrate), *Galium aparine, Gratiola officinalis, Lycopus europaeus, Lysimachia nummularia, Lysimachia vulgaris, Bidens tripartita, Agrostis stolonifera, Solanum dulcamara, Polygonum hydropiper* and *Stahys palustris*.

Figure 3.1.G.1.2 - Danubian forests of white willow (Salix alba) and Rubus caesius

c) R4406 Danubian-Pannonian forests of white poplar (*Populus alba*) and *Rubus caesius* (Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries). This is a type of habitat frequently found on riversides and plains, especially on levees. The tree layer is dominated by the poplar (*Populus alba, P. nigra*), howver willow (*Salix alba*), elm (*Ulmus laevis*) or ash (*Fraxinus angustifolius*), mulberry tree (*Morus alba, M. nigra*) are also present with a 70-90 % covering. The tree layer comprises *Crataegus monogyna, Rosa canina, Prunus spinosa, Sambucus nigra* and allochthonous species such as *Amorpha* *fruticosa*. Within herbaceous-bush layer *Rubus caesius* is abundant, but lianas such as *Humulus lupulus, Vitis sylvestris* and *Clematis vitalba* are also frequent.

d) <u>R8703 Anthropic communities with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra*</u>. This type of habitat is represented by ruderal communities, grown on alluvial soils, in uncultivated areas. The vegetation is dominated by *Agropyron repens* and the total vegetation covering is 75-80%. The height of the layer is 30-40 cm and nitrophilous or ruderal species such as *Datura stramonium, Cirsium arvense, Malva sylvestris, Capsella bursa-pastoris, Leonurus cardiac* are present. Thus the settlement of shorter species (*Polygonum aviculare, Lepidium draba*) is less possible.

e) <u>R5312 Pontic-danubian communities with *Bidens tripartita*, *Echinochloa crus-galli and Polygonum hydropiper* (Natura2000 code: 3270 Rivers with muddy banks with *Chenopodiumrubri pp* and *Bidention* vegetation).</u> This type of habitat is usually found on the bank of aquatic basins and it is characterised by swamp weeds. Signs of this habitat are present within the project area, the sandy shores being colonized mostly by *Xanthium strumarium* and only few species characteristic for these communities being present. Thus, the sandy shore is almost deserted, with the vegetation covering fewer than 5%. Besides *Xanthium strumarium*, remote specimens of *Ranunculus sceleratus, Chenopodium botrys, Polygonum hydropiper, Rorippa sylvestris, Echinochloa crus-gallis* and *Bidens frondosa* are present. Considering this, this type of habitat matches the habitat with almost deserted sandy areas, temporarily flooded.

Figure 3.1.G.1.3 - Almost deserted sandy shore

f) R8704 Anthropic communities with *Polygonum aviculare, Lolium perenne, Schlerochloa dura* and *Plantago major*. This type of vegetation may be present on vacant lands, roadsides and paths. The significant species are the short and sheepfold-resistant species. The vegetation covering is 80-90 % and the dominant species are *Lolium perenne, Plantago major, Polygonum aviculare, Poa annua* and *Digitaria sanguinalis*. A higher layer consists of few specimens of *Centaurea calcitrapa, Centaurea solstitialis, Carduus nutans* and other ruderal species.

Figure 3.1.G.1.4 - The areas of the island shore: Willow galleries in the form of thin strips, most of the inland being covered with Canadian poplar plantations

THE CHARACTERISATION OF THE CRITICAL POINTS FROM THE POINT OF VIEW OF THE VEGETATION

- **CP 01 – The Bala branch and the Turcescu Island**

Along the riverbank, within a few meter-long strip, degraded groups of danubian forests of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries) may be found. These are present only within the riparian area which is periodically flooded. In the remote areas and inside the Turcescu Island, poplar plantations are present, in places with open areas, covered with anthropic communities with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703). Along the riverside, degraded and overgrazed sheep pastures are present, their vegetation being represented by anthropic communities with *Polygonum aviculare, Lolium perenne*, *Schlerochloa dura* and *Plantago major* (R8704). In patches, the sandy riverbank is almost without vegetation.

- **CP 02 – The Epurașu Island**

Most part of the island is covered by danubian-pontic forests of white poplar (*Populus alba*) with *Rubus caesius* (R4406, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries) and danubian forests of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries). These types of habitats are present also along the riverbank in narrow strips. These communities show some degree of degradation. Also the presence of invasive allochtonous species (*Amorpha fruticosa, Erigeron canadensis*) is noted. In the riparian area, deserted sandy areas are present, with scanty vegetation represented by few specimens of *Xanthium strumarium*. In the middle of the island, on a relatively small area, an almost deserted temporary lake is present (on the lakeshore few specimens of *Alisma plantago-aquatica*, *Eleocharis* sp. are present and *Potamogeton pectinatus* is present in water).

Figure 3.1.G.1.5 - Well preserved old sallow

- **CP 03 A – Upstream Șeica**

Both the island and the riverbank are covered with poplar plantations, except for the riparian area, where a few meter-wide strip, a practically deserted temporarily flooded sandy area is present (only few specimens of *Xanthium strumarium* and other ruderal species are present), followed by a few meter-narrow strip of danubian communities of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries).

- **CP 03 B – Downstream Șeica**

This area is similar to the area upstream Șeica, same vegetation type being present. The riverbank is covered with poplar plantations and in the riparian area, narrow strips of danubian communities of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries) are present).

- **CP 04 A – The Ceacâru Island**

The Ceacâru Island has a 1-2 m steep riverbank, with no sallow present within the riparian area. The entire surface of the island is covered with poplar plantations.

- **CP 04 B – The Fermecatu Island**

The riparian area with wide sandy surfaces, temporarily flooded (with scanty vegetation) is followed by a narrow strip with sallow, danubian communities with white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura2000 code: 92A0 *Salix alba* and *Populus alba* galleries) and most of the island is covered with poplar plantations.

Figure 3.1.G.1.6 - The sallow galleries and the sandy riverbank

- **CP 07 – The Fasolele Island**

Similar to the previously described islands, most of this island is covered with poplar plantations, the sallow from the riparian area representing a narrow strip. Amid the plantations, anthropic communities with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703) are present.

- **CP 07- adjacent area – the Atârnați area**

Similar to the previously described islands, most of this island is covered with poplar plantations, the sallow from the riparian area representing a narrow strip. Amid the plantations, anthropic communities with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703) are present. The riverbank is varied, in some places steep and in others with deserted sandy areas.

- **CP 10 – The Caleia Arm and the Lupu Island**

These areas are also characterised by poplar plantations and sallow within the riparian area, represented by danubian forests of white willow (*Salix alba*) with *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries). Amid the poplar plantations, anthropic communities with *Agropyron repens, Arctium lappa, Artemisia annua* and *Ballota nigra* (R8703) are present.

Figure 3.1.G.1.7 - Amorpha fruticosa, widespread allochtonous invasive species

Figure 3.1.G.1.8 - Sandy riverbank with Xanthium strumarium

Table 3.1.G.1 shows the types of habitats, their approximate area and their percentage within each critical point.

Table 3.1.G.1 - Types of habitats within each CP

		Suprafaţă	**% din zona PC**
	PC 01		
Braţul Bala	Plantaţie de plop canadian	8,23 kmp	**69,4%**
	R8704 Comunitati antropice cu *Polygonum aviculare, Lolium perenne, Schlerochloa dura %i Plantago major*	2 kmp	**16,8%**
	Suprafaţă nisipoasă temporar inundată	54332 mp	**4,5%**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	216118 mp	**1,8%**
Ostrovul Turcescu	Plantaţie de plop canadian	1,06 kmp	**8,9%**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	59541 mp	**0,5%**
	R8703 Comunitati antropice cu *Agropyron repens, Arctium lappa, Artemisia annua* şi *Ballota nigra*	0,23 kmp	**1,9%**
	PC 02		
Ostrovul Epuraşu	Suprafaţă nisipoasă temporar inundată	177521 mp	**29%**
	Lac temporar fără vegetaţie	43439 mp	**0,7%**
	R4406 Păduri danubien-pontice de plop alb (*Populus alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	5,42 kmp	**88,5%**
malul Dunării	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,48 kmp	**7,8%**

		Suprafaţă	% din zona PC
	PC10		
malul Braţului Caleia	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	860165 mp	**10,9%**
	Plantaţie de plop canadian amestecat cu salcie albă (*Salix alba*)	0,63 kmp	**8%**
Ostrovul Lupu	Plantaţie de plop canadian	6,37 kmp	**81%**
	R8703 Comunitati antropice cu *Agropyron repens*, *Arctium lappa*, *Artemisia annua* şi *Ballota nigra*	pâlcuri de diferite dimensiuni, intercalate în plantaţii	
	PC 03A		
amonte Şeica	Plantaţie de plop canadian	0,84 kmp	**63,5%**
	Suprafaţă nisipoasă temporar inundată	0,43 kmp	**32,5%**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	51349 mp	**3,8%**
	PC 03B		
aval Şeica	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	50042 mp	**8,6%**
	Suprafaţă nisipoasă temporar inundată	15350 mp	**2,6%**
	Plantaţie de plop canadian	0,51 kmp	**88,6%**
	PC 04A		
Insula Ceacâru	Plantaţie de plop canadian	0,77 kmp	**practic 100%**
malul Dunării	Plantaţie de plop canadian	0,35 kmp	**practic 100%**
	PC 04B		
Ostrovul Fermecatu	Plantaţie de plop canadian	2,69 kmp	
	Suprafaţă nisipoasă temporar inundată	0,6 kmp	
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	267720 mp	
	PC 07		
Insula Fasolele	Plantaţie de plop canadian	1,52 kmp	**practic 100%**
	PC 07*		
Zona Atârnaţi	Plantaţie de plop canadian	0,64 kmp	**practic 100%**
	PC 09		
Zona Vărsături	Plantaţie de plop canadian şi frasin	0,16 kmp	**practic 100%**
	Zonă cu influenţe puternice antropice - apărare de mal din beton şi comunitati ruderale	88,3 mp	

* CP07*-area adjacent to CP 07

3.1.G.2. The avifauna

The general diversity of aquatic avifauna on different sections of the Danube

The following table shows the bird species and flocks observed during the boat trip on 05 – 07.05.2011.

Table 3.1.G.2.1 - Comparison between the Danube sections based on the data collected during the boat trip in May. (*length* – the length of the section where the birds were observed; *ex* – specimen; *H'* – Shannon diversity index; * - species partially on spring migration during the census) (data shown in the "TOTAL" column refers to the Danube section with the length of 348 km, not to the sum of the other data shown in the table)

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC04	PC07	PC 07*	PC 09		
lungime segment (km)		348	13	7,4	9,578	3,2	7,81	4,21	3,5	2,7	66,9	36
păsări total (ex)		9840	691	133	343	61	124	531	7	111	1722	495
H' (Shannon div.)		**2,277**	**1,961**	**1,978**	**0,969**	**0,759**	**2,241**	**1,94**	**1,154**	**0,498**	**2,01**	**1,929**
Specie		**TOTAL**										
Corcodel mare	*Podiceps cristatus*	4									1	
C. cu gât negru	*Podiceps nigricollis*	4				4						
C. cu gât roşu	*Podiceps grisegena*	1										
Pelican creţ	*Pelecanus crispus*	29			28							
Pelican comun	*P. onocrotalus*	19					19					
Cormoran mare	*Phalacrocorax carbo*	140	4	2		3	2	21		2	19	21
Cormoran mic	*P. pygmaeus*	170	14	6			38	6			24	
Stârc de noapte	*Nyctycorax nyctycorax*	34	2	1						2	19	
Stârc galben	*Ardeola ralloides*	13									10	
Egretă mică	*Egretta garzetta*	173	2		3		3	6	1	2	10	14
Egretă mare	*Ardea alba*	3			1		1					
Stârc cenuşiu	*Ardea cinerea*	36	1				2	2	1		7	4
Stârc roşu	*Ardea purpurea*	1										
Barză albă	*Ciconia ciconia**	248	42		2						3	190
Barză neagră	*Ciconia nigra**	48	1		3	1						1
Barză sp.	*Ciconia sp.*	3										
Ţigănuş	*Plegadis falcinellus*	62						7				
Lopătar	*Platalea leucorodia*	14							1		6	
Lebădă de vară	*Cygnus olor*	8										
Gârliţă mare	*Anser albifrons*	4										
Călifar alb	*Tadorna tadorna*	3										
Călifar roşu	*Tadorna ferruginea*	18					2	4	4			5
Raţă mare	*Anas platyrhynchos*	157	4	5	5		9	21			13	12
Raţă pestriţă	*Anas strepera*	11	2									

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC04	PC07	PC 07*	PC 09		
Rață cârâitoare	*Anas querquedula*	2						2				
Rata roşie	*Aythya nyroca*	3						3				
Codalb	*Haliaetus albicilla*	2			1		1					
Uligan pescar	*Pandion haliaetus*	1			1							
Acvilă țipătoare mică	*Aquila pomarina*	16	3		2						1	1
Gaie neagră	*Milvus migrans*	6			1						5	
Erete de stuf	*Circus aeruginosus*	15	3		3		1					2
Erete sur	*Circus pygargus*	1									1	
Erete alb	*Circus macrourus*	1									1	
Erete sp.	*Circus pygargus/macrourus*	3			1							1
Şorecar comun	*Buteo buteo*	19	3		1		1				8	3
Şorecar comun ssp. vulpinus	*Buteo buteo vulpinus*	3	1								1	
Şorecar mare	*Buteo rufinus*	3	2				1					
Şorecar sp.	*Buteo sp.*	1										
Şorecar sp./Viespar	*Buteo sp./Pernis apivorus*	2										2
Viespar	*Pernis apivorus**	23	1	1	2	1	2				2	6
Uliu păsărar	*Accipiter nisus*	4			1						1	1
Uliu cu picioare scurte	*Accipiter brevipes*	2			1	1						
Uliu sp.	*Accipiter brevipes/ nisus*	3	1									
Vânturel roşu	*Falco tinnunculus*	25		1				2				5
Şoimul rândunelelor	*Falco subbuteo*	60	3	5	3		3				3	3
Vânturel de seară	*Falco vespertinus**	44	9		1					2	12	
Şoim călător	*Falco peregrinus*	1			1							
Scoicar	*Haematopus ostralegus*	3									1	
Piciorong	*Himantopus himantopus*	1						1				
Ciovlică ruginie	*Glareola pratincola*	1										
Nagâț	*Vanellus vanellus*	2									1	1
Fluierar cu picioare verzi	*Tringa nebularia*	19			1		10	4			1	
Fluierar de munte	*Actitis hypoleucos*	21			1							9
Bătăuș	*Phylomacus pugnax**	90										

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC04	PC07	PC 07*	PC 09		
Culic mic	*Numenius phaeopus**	2						1				
Pescăruş râzător	*Larus ridibundus*	162	1				2					
Pescăruş. mic	*L. minutus*	26	1								2	
P. cu cap negru	*L. melanocephalus*	2										
Pescăruş pontic	*L. cachinnans*	14		3								
Pescăruş mediteran	*L. michahellis*	4									1	1
Pescăruş sp.	*L.arus michahellis/cahinnans*	219	22	2		1	2	46			32	28
Chiră de baltă	*Sterna hirundo**	55	9	6							5	3
Pescăriţă râzătoare	*Sterna nilotica*	3		3								
Chirghiţă neagră	*Chlidonias niger**	583	31					42			112	
Ch. cu aripi albe	*C. leucopterus**	164	5								113	
Ch. cu obraz alb	*C. hybridus*	1005	84	6				28			470	17
Chirighiţă sp.	*Chlidonias sp.*	35									35	
Porumbel gulerat	*Columba palumbus*	7	3					2		1		1
Porumbel de scorbură	*Columba oenas*	2										
Cuc	*Cuculus canourus*	6	1								1	2
Drepnea neagră	*Apus apus*	6						1		2		
Pescăraş albastru	*Alcedo atthis*	6						1				1
Pupăză	*Upupa epos*	2										
Prigorie	*Merops apiaster*	13			10							3
Ghionoaie sură	*Picus canus*	1										
Ciocănitoare neagră	*Dryocopus martius*	2	1					1				
Lăstun de mal	*Riparia riparia**	2117	225	37			5	200		0	598	
Rândunică	*Hirundo rustica**	3688	210	265	60	50	20	130		100	173	153
Lăstun de casă	*Delichon urbica**	101										
Codobatură albă	*Motacilla alba*	5										5
Codobatură galbenă	*Motacilla flava*	30									30	

CP07*+area adjacent to CP 07

The following table shows the calculated densities for each section:

Table 3.1.G.2.2 - Birds densities on different Danube sections (*length* - the length of the section where the birds were observed; *density - specimen/km*; * - species partially on spring migration during the census) (data shown in the "TOTAL" column refers to the Danube section with the length of 348 km, not to the sum of the other data shown in the table)

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09		
lungime segment (km)		348	13	7,4	9,578	3,2	7,81	4,21	3,5	2,7	66,9	36
densitate (ex/km)		28,29	53,15	17,97	35,81	19,06	15,88	126,13	2,00	41,11	25,74	13,75
Specie		TOTAL										
Corcodel mare	*Podiceps cristatus*	0,012									0,01	
C. cu gât negru	*P. nigricollis*	0,012				1,25						
C. cu gât roşu	*P. grisegena*	0,003										
Pelican creţ	*Pelecanus crispus*	0,083			3,78							
P. comun	*P. onocrotalus*	0,055					2,43					
Cormoran mare	*Phalacrocorax carbo*	0,403	0,31	0,21		0,94	0,26	4,99		0,74	0,28	0,58
Cormoran mic	*P. pygmaeus*	0,489	1,08	0,63			4,87	1,43			0,36	
Stârc de noapte	*Nyctycorax nyctycorax*	0,098	0,15	0,10						0,74	0,28	
Stârc galben	*Ardeola ralloides*	0,037									0,15	
Egretă mică	*Egretta garzetta*	0,497	0,15		0,41		0,38	1,43	0,29	0,74	0,15	0,39
Egretă mare	*Ardea alba*	0,009			0,14		0,13					
Stârc cenuşiu	*Ardea cinerea*	0,104	0,08				0,26	0,48	0,29		0,10	0,11
Stârc roşu	*Ardea purpurea*	0,003										
Barză albă	*Ciconia ciconia**	0,713	3,23		0,27						0,04	5,28
Barză neagră	*Ciconia nigra**	0,138	0,08		0,41	0,31						0,03
Barză sp.	*Ciconia sp.*	0,009										
Ţigănuş	*Plegadis falcinellus*	0,178						1,66				
Lopătar	*Platalea leucorodia*	0,040							0,29		0,09	
Lebădă de vară	*Cygnus olor*	0,023										
Gârliţă mare	*Anser albifrons*	0,012										
Călifar alb	*Tadorna tadorna*	0,009										
Călifar roşu	*Tadorna ferruginea*	0,052					0,26	0,95	1,14			0,14

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09		
Raţă mare	*Anas platyrhynchos*	0,451	0,31	0,52	0,68		1,15	4,99			0,19	0,33
Raţă pestriţă	*Anas strepera*	0,032	0,15									
Raţă cârâitoare	*Anas querquedula*	0,006						0,48				
Rata roşie	*Aythya nyroca*	0,009						0,71				
Codalb	*Haliaetus albicilla*	0,006			0,14		0,13					
Uligan pescar	*Pandion haliaetus*	0,003			0,14							
Acvilă ţipătoare mică	*Aquila pomarina*	0,046	0,23		0,27						0,01	0,03
Gaie neagră	*Milvus migrans*	0,017			0,14						0,07	
Erete de stuf	*Circus aeruginosus*	0,043	0,23		0,41		0,13					0,06
Erete sur	*Circus pygargus*	0,003									0,01	
Erete alb	*Circus macrourus*	0,003									0,01	
Erete sp.	*Circus pygargus/macrourus*	0,009			0,14							0,03
Şorecar comun	*Buteo buteo*	0,055	0,23		0,14		0,13				0,12	0,08
Şorecar comun ssp. vulpinus	*Buteo buteo vulpinus*	0,009	0,08								0,01	
Şorecar mare	*Buteo rufinus*	0,009	0,15				0,13					
Şorecar sp.	*Buteo sp.*	0,003										
Şorecar sp./Viespar	*Buteo /Pernis*	0,006										0,06
Viespar	*Pernis apivorus**	0,066	0,08	0,10	0,27	0,31	0,26				0,03	0,17
Uliu păsărar	*Accipiter nisus*	0,012			0,14						0,01	0,03
Uliu cu picioare scurte	*Accipiter brevipes*	0,006			0,14	0,31					0,00	0,00
Uliu sp.	*A. brevipes/ nisus*	0,009	0,08								0,00	0,00
Vânturel roşu	*Falco tinnunculus*	0,072		0,10				0,48			0,00	0,14
Şoimul rândunelelor	*Falco subbuteo*	0,173	0,23	0,52	0,41		0,38				0,04	0,08
Vânturel de seară	*Falco vespertinus**	0,127	0,69		0,14					0,74	0,18	
Şoim călător	*Falco peregrinus*	0,003			0,14							
Scoicar	*Haematopus ostralegus*	0,009									0,01	
Piciorong	*Himantopus himantopus*	0,003						0,24				
Ciovlică ruginie	*Glareola pratincola*	0,003										
Nagâţ	*Vanellus vanellus*	0,006									0,01	0,03
Fluierar cu picioare verzi	*Tringa nebularia*	0,055			0,14		1,28	0,95			0,01	

		TOTAL	Puncte critice principale			Puncte critice secundare					Borcea	Măcin
			PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09		
Fluierar de munte	*Actitis hypoleucos*	0,060			0,14							0,25
Bătăuş	*Phylomacus pugnax**	0,259										
Culic mic	*Numenius phaeopus**	0,006						0,24				
Pescăruş râzător	*Larus ridibundus*	0,466	0,08				0,26					
Pescăruş. mic	*L. minutus*	0,075	0,08								0,03	
P. cu cap negru	*L. melanocephalus*	0,006										
Pescăruş pontic	*L. cachinnans*	0,040		0,31								
Pescăruş mediteran	*L. michahellis*	0,012									0,01	0,03
Pescăruş sp.	*L.arus michahellis/cahinnans*	0,630	1,69	0,21		0,31	0,26	10,93			0,48	0,78
Chiră de baltă	*Sterna hirundo**	0,158	0,69	0,63							0,07	0,08
Pescăriţă râzătoare	*Sterna nilotica*	0,009		0,31								
Chirghiţă neagră	*Chlidonias niger**	1,676	2,38					9,98			1,67	
Ch. cu aripi albe	*C. leucopterus**	0,472	0,38								1,69	
Ch. cu obraz alb	*C. hybridus*	2,890	6,46	0,63				6,65			7,03	0,47
Chirighiţă sp.	*Chlidonias sp.*	0,101									0,52	
Porumbel gulerat	*Columba palumbus*	0,020	0,23					0,48		0,37		0,03
Porumbel de scorbură	*Columba oenas*	0,006										
Cuc	*Cuculus canourus*	0,017	0,08								0,01	0,06
Drepnea neagră	*Apus apus*	0,017						0,24		0,74		
Pescăraş albastru	*Alcedo atthis*	0,017						0,24				0,03
Pupăză	*Upupa epos*	0,006										
Prigorie	*Merops apiaster*	0,037			1,35							0,08
Ghionoaie sură	*Picus canus*	0,003										
Ciocănitoare neagră	*Dryocopus martius*	0,006	0,08					0,24				
Lăstun de mal	*Riparia riparia**	6,087	17,31	3,86			0,64	47,51			8,94	
Rândunică	*Hirundo rustica**	10,604	16,15	27,67	8,11	15,63	2,56	30,88		37,04	2,59	4,25
Lăstun de casă	*Delichon urbica**	0,290										
Codobatură albă	*Motacilla alba*	0,014										0,14
Codobatură galbenă	*Motacilla flava*	0,086									0,45	

CP 07*+area adjacent to CP 07

The comparison of species distribution on different sections of the Danube with the Mann-Whitney U-test did not result in significant differences, which proves that no critical point nor other studied area distinguish from the point of view of avifauna diversity.

THE EVALUATION OF THE TERRESTRIAL AVIFAUNA

Further we show the summary of the results derived from *the point count* and *the evaluation of linear routes*. The results of night records are shown within the "*The count of the results derived from different methods*" subchapter.

Evaluation on critical points in different habitats was performed. From these results, bird density in three dominant habitats was calculated: *danubian forests of white willow (Salix alba) with Rubus caesius; poplar plantations; open habitats* (including meadows, slashing and sapling plantations).

Based on the densities, on the areas of the critical points and on the areas of different habitats present in the critical points (Table 3.1.G.2.2), the flocks likely to be present in each critical point were calculated. For calculating these flocks, the method that provides more comprehensive data was chosen between the estimation based on the results of the evaluation for each critical point and the estimation based on the habitats areas.

It should be noted that in order to obtain statistically reliable results, a sufficient number of observed specimens is required. From this reason, using the Distance software, reliable densities were obtained only in the case of most common species. However, using the simultaneous examination of Shannon diversity indices calculated for each total list of species, the number of species and of the observed specimens and the densities of the common species, the accurate long-term monitoring of the avifauna diversity becomes possible.

The species and the flocks present in the main habitats

Tables 3.1.G.2.3, 3.1.G.2.4 and 3.1.G.2.5 show the estimated densities for the species for which the results provided by the Distance software were conclusive. The total list of species on which these results were calculated is shown in Annex 5.7.1, 5.7.2 and 5.7.3.

Table 3.1.G.2.3 - Species and densities within the danubian forests of white willow (*Salix alba*) with *Rubus caesius*

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de confidenţă	
Măcăleandru	*Erithacus rubecula*	489,66	140,08	28,6	265,77	902,16
Cinteză	*Fringilla coelebs*	3724,1	560,69	15,0	2759,1	5026,6
Frunzăriţă galbenă	*Hippolais icterina*	605	136,38	22,5	370,64	987,56
Privighetoare	*Luscinia megarynchos*	1285,6	384,63	29,9	693,18	2384,5
Grangur	*Oriolus oriolus*	262,4	85,284	32,	129,51	531,63
Piţigoi albastru	*Parus caeruleus*	5020,9	1513,9	30,1	2640,3	9547,8
Piţigoi mare	*Parus major*	2053,9	264,08	12,8	1582,3	2665,9
Silvie cu cap negru	*Sylvia atricapilla*	791,64	174,54	22,0	498,82	1256,3
TOTAL		14593	1021,4	7	12713	16751

The Shannon diversity index (H') for the danubian forests with white willow (*Salix alba*) with Rubus caesius: **3.05.**

Table 3.1.G.2.4 - Species and densities within *the poplar plantations*

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de confidenţă	
Cinteză	***Fringilla coelebs***	1460	265,57	18,19	1008,3	2114,1
Frunzăriţă galbenă	***Hippolais icterina***	2068,4	385,59	18,64	1361,6	3142,1
Privighetoare	***Luscinia luscinia***	2554,2	618,96	24,23	1546,3	4219,0
Privighetoare	***Luscinia***	864,53	244,35	28,26	477,04	1566,8
Grangur	***Oriolus oriolus***	576,3	134,25	23,3	342,61	969,39
Piţigoi mare	***Parus major***	1409,4	324,16	23	859,38	2311,4
Silvie cu cap negru	***Sylvia atricapilla***	999,01	237,66	23,79	599,18	1665,6
Mierlă	***Turdus merula***	749,26	191,7	25,58	432,88	1296,9
TOTAL		22759	1523,9	6,7	19952	25961

The Shannon diversity index (H') for the poplar plantations: **2.837**

Due to the small number of open habitats from the Danube islands and, respectively, to the reduced flocks, in the case of this habitat, no conclusive results were obtained, except for the total number of specimens/ km^2.

Tablel 3.1.G.2.5 - Species and densities within *the open habitats* (including meadows, slashings, sapling plantations)

	Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de confidenţă	
TOTAL	11016	1349,9	12,25	8623,8	14073

The Shannon diversity index (H') within the open habitats (including meadows, slashings, sapling plantations): ***2.789***.

- **CP 01 – The Bala Arm and the Turcescu Island**

Species density and the calculated flocks:

Table3.1.G.2.6 - Densities and flocks of common species of *Passeriforme* within CP 01

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de confidenţă		Efectivele estimate
Cinteză	***Fringilla coelebs***	1769,6	273,59	15,46	1294	2420,1	20969
Frunzăriţă	***Hippolais icterina***	2496,7	437,11	17,51	1730,4	3602,2	29585
Privighetoare	***Luscinia luscinia***	2041,7	487,88	23,9	1246,8	3343,5	24194
Privighetoare	***Luscinia***	1092,1	231,78	21,22	698,19	1708,3	12941
Piţigoi mare	***Parus major***	1541,2	286,65	18,6	1049	2264,2	18263
Silvie cu cap	***Sylvia atricapilla***	1313,9	286,47	21,8	827,58	2085,9	15569
Mierlă	***Turdus merula***	554,17	146,67	26,47	312,56	982,55	6566

The diversity index (H'): **3.006**

- **CP 02 – The Epuraşu Island**

Species density and calculated flocks:

Table 3.1.G.2.7 - Densities and flocks of common species of *Passeriforme* within CP 02 (including the habitats within the Danube riverbank in the area of the critical point)

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de confidenţă		Efectivele estimate
Măcăleandru	***Erithacus rubecula***	1019,8	262,69	25,76	583,8	1781,6	6242
Cinteză	***Fringilla coelebs***	4667,3	895,49	19,19	3172,7	6865,9	28568
Privighetoare	***Luscinia***	843,45	219,03	25,97	473,24	1503,3	5162
Piţigoi mare	***Parus major***	2197,9	375,36	17,08	1541,3	3134,2	13453
Mierlă	***Turdus merula***	520,29	160,49	30,85	263,06	1029,1	3184
TOTAL		21192	1727,5	8,15	18043	24890	129715

The diversity index (H'): **2.611**

- **CP 03 - The Șeica Island**

Species density and the calculated flocks:

Table 3.1.G.2.8 - Densities and flocks of common species of *Passeriforme* within CP 03

Specie		Efective
Măcăleandru	***Erithacus rubecula***	2467
Cinteză	***Fringilla coelebs***	6568
Frunzăriță galbenă	***Hippolais icterina***	4061
Privighetoare roșiatică	***Luscinia megarynchos***	2470
Piţigoi albastru	***Parus caeruleus***	6993
Piţigoi mare	***Parus major***	3431
Silvie cu cap negru	***Sylvia atricapilla***	1814
TOTAL		45520

The diversity index (H'): **2.888**

- **CP 04 – The Ceacâru Island and the Fermecatu Island**

Species density and the calculated flocks:

Table 3.1.G.2.9 - Densities and flocks of common species of *Passiforme* within CP 04 (including the habitats within the Danube riverbank in the area of the critical point)

Specie		Efective
Măcăleandru	***Erithacus rubecula***	5693
Cinteză	***Fringilla coelebs***	8877
Frunzăriță galbenă	***Hippolais icterina***	9893
Privighetoare roșiatică	***Luscinia megarynchos***	3638
Piţigoi albastru	***Parus caeruleus***	6714
Piţigoi mare	***Parus major***	4356
Silvie cu cap negru	***Sylvia atricapilla***	3066
TOTAL		90619

The diversity index (H'): **2.916**

- **CP 07 – The Fasolele Island**

Species density and the calculated flocks:

Table 3.1.G.2.10 - Densities and flocks of common species of *Passiforme* within CP 07

Specie		Efective
Măcăleandru	*Erithacus rubecula*	2219
Cinteză	*Fringilla coelebs*	3143
Frunzăriţă galbenă	*Hippolais icterina*	3882
Privighetoare roşiatică	*Luscinia megarynchos*	1314
Piţigoi albastru	*Parus caeruleus*	2142
Piţigoi mare	*Parus major*	1518
Silvie cu cap negru	*Sylvia atricapilla*	1138
TOTAL		34593

The diversity index (H'): **2.426**

- **CP 07 - adjacent area – the Atârnaţi area**

Species density and the calculated flocks:

Table 3.1.G.2.11 - Densities and flocks of common species of *Passiforme* within CP 07*

Specie		Efective
Măcăleandru	*Erithacus rubecula*	934
Cinteză	*Fringilla coelebs*	1323
Frunzăriţă galbenă	*Hippolais icterina*	1634
Privighetoare roşiatică	*Luscinia megarynchos*	553
Grangur	*Oriolus oriolus*	368
Piţigoi albastru	*Parus caeruleus*	902
Piţigoi mare	*Parus major*	639
Silvie cu cap negru	*Sylvia atricapilla*	479
TOTAL		14565

PC 07*+zonă adiacentă PC 07
Indicele de diversitate (H'): **2.126**

- **CP 10 – The Caleia Arm and the Lupu Island**

Species density and the calculated flocks:

Table 3.1.G.2.12 - Densities and flocks of common species of *Passiforme* within CP 10 (including the habitats within the Danube riverbank in the area of the critical point)

Specie		Efective	
		Mal Dunăre	Ostrov
Măcăleandru	*Erithacus rubecula*	1340,988394	9300
Cinteză	*Fringilla coelebs*	4506,432477	13175
Frunzăriţă galbenă	*Hippolais icterina*	2129,545825	16270
Privighetoare roşiatică	*Luscinia megarynchos*	1650,482024	5507
Piţigoi albastru	*Parus caeruleus*	5206,724449	8977
Piţigoi mare	*Parus major*	2396,069194	6363
Silvie cu cap negru	*Sylvia atricapilla*	1152,974821	4772
TOTAL		26890,5578	144974

The diversity index (H'): **2.631**

Direct evaluation from elevated observation points

The following table shows the predatory birds (the *Falconiformes* order) observed using this method. Together with the data obtained using this method, the birds observed during evaluation using other methods are also shown.

Table 3.1.G.2.13 - Predatory species observed and their flocks (specimens) (data shown in the "TOTAL" column refer to the Danube section with a length of 348 km, not to the sum of the other data shown from the table)

SPECIE (ex)		Puncte critice principale			Puncte critice secundare					Total PC	TOTAL
		PC 01	PC 02	PC 10	PC 03	PC 04 1	PC 07	PC 07*	PC 09		
Codalb	*Haliaetus albicilla*									4	4
Uligan pescar	*Pandion haliaetus**			1						1	1
Acvilă ţipătoare mică	*Aquila pomarina**	4		2						6	16
Acvilă pitică	*Aquila pennata*			1						1	1
Gaie neagră	*Milvus migrans*			1						1	6
Erete de stuf	*Circus aeruginosus**	3		3		1				7	15
Erete sur	*Circus pygargus**										1
Erete alb	*Circus macrourus*	1								1	1
Erete sp.	*Circus*			1						1	3

SPECIE (ex)		Puncte critice principale			Puncte critice secundare					Total PC	TOTAL
		PC 01	PC 02	PC 10	PC 03	PC 04 1	PC 07	PC 07*	PC 09		
	*pygargus/macrourus**										
Şorecar comun	*Buteo buteo*	3	2	1		1	2	1		10	24
Şorecar comun ssp. vulpinus	*Buteo buteo vulpinus*	1								1	3
Şorecar mare	*Buteo rufinus*	2				1				3	3
Viespar	*Pernis apivorus**	1	1	2	1	2				7	23
Uliu păsărar	*Accipiter nisus*			1			1			2	5
Uliu porumbar	*Accipiter gentilis*				1					1	1
U. cu picioare scurte	*Accipiter brevipes*			1	1					2	2
Uliu sp.	*A. brevipes/nisus*	1								1	1
Vânturel roşu	*Falco tinnunculus*	1	1				2	1	2	7	25
Şoimul rândunelelor	*Falco subbuteo*	3	6	3		3	1			16	61
Vânturel de seară	*Falco vespertinus**	1	1				2	1	2	7	25
Şoim călător	*Falco peregrinus*	3	6	3		3	1			16	61

(*-species observed since the spring migration; *Total CP* - total flocks observed in the critical points; **TOTAL** - flocks observed along the whole length of the Danube section (348km))
CP 07*+area adjacent to C07

Colonies of sand martin (Riparia riparia), bee-eater (Merops apiaster) and territories of river kingfisher (Alcedo atthis)

- **Sand martin (*Riparia riparia*)**

Few areas of the Danube riverbank are suitable for sand martin colonies. Most of the riverbank is not high enough to allow colonies to be above the water level in the case of high water levels. For most of the islands, the riverbank consists of sand and has a small slope, so that the settlement of colonies is impossible. From these reasons, some colonies settle close to the rivershore near the landslides of the Dobrogea hills. The shore of the Bala branch is suitable for colony formation and in this zone were identified six colonies of the sand martin.

The following table shows the colonies and the specimens observed during field evaluations.

Table 3.1.G.2.14 - Number of colonies and specimens of sand martin observed in the area of the critical points (TOTAL - colonies and flocks observed along the whole Danube section (348 km))

Monitorizare	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09	TOTAL
exemplare	~ 1100		37	10	13	~ 500			3097
colonii	6		1						21

CP 07*+area adjacent to CP 07

- **Bee-eater (*Merops apiaster*)**

The bee-eater is not a species linked to the aquatic habitats and it does not form colonies in the riparian areas. From this reason, fewer colonies were identified and at longer distances from the Danube compared to the sand martin. Table 3.1.G.2.15 shows the specimens and the colonies found during the census.

Tablel 3.1.G.2.15 - The number of colonies and specimens of bee-eater observed in the area of the critical points (TOTAL - colonies and flocks observed along the Danube sector (348 km))

Monitorizare	Puncte critice principale			Puncte critice secundare					TOTAL
	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09	
exemplare		10		5					18
colonii						1	1		5

CP 07*+area adjacent to CP 07

- **River kingfisher (*Alcedo atthis*)**

The number of river kingfishers observed is shown in Table 3.1.G.2.16. In case only one specimen was observed, a nesting pair may be counted. In case more specimens were observed, the number of nesting pairs is unknown, since the male and the female cannot be distinguished based on their plumage.

Table 3.1.G.2.16 - Number of river kingfishers observed in the area of the critical points (TOTAL - flocks (nesting pairs) observed along the Danube sector (348 km))

Monitorizare	Puncte critice principale			Puncte critice secundare					TOTAL
	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 07	PC 09	
exemplare	6	5	3	1	1	1	1		22

CP 07*+area adjacent to CP 07

The ringing method

This method will be used for the evaluation of bird populations that use the Danube as the migration route. The ringing will be performed in September and the results will be shown in the next report.

The winter waterbird count method

The results of the winter census of the aquatic birds will be presented in the report regarding the activities conducted during winter.

The mapping of the Ciconiiformes colonies

On the Epurașu island, an abandoned colony was found. According to the fishermen statements, it was a mixed colony of herons and cormorants. However it has been abandoned for years, since the Oltina lake was privatized and the fish farms are empty.

No colony of herons or cormorants was identified in other critical points. However, it should be mentioned that the detectability is lower during the vernal season compared to the winter due to the leafage. The search of the colonies will be conducted also during the winter and the corresponding results will be presented in the respective report.

Based on the present results, it is unlikely to identify new colonies of *Ciconiiformes* or cormorants, since during the field evaluations, no sign indicating the presence of such colonies was noticed (significant agglomerations of these species, the flying of several specimens in the same direction towards a specific area from the forest, the noise characteristic for these colonies, etc.).

The sum of the results obtained with different methods

Table 3.1.G.2.17 shows the sum of the species observed within the critical points, except for the common small size singing birds closely linked to the terrestrial habitats.

Table 3.1.G.2.17 - Species and flocks found in the critical points - the sum of the results obtained with different methods used for evaluation of the avifauna (except for the common small size singing birds closely linked to the terrestrial habitats) – H' Shannon diversity index

		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09
		Bala	Turcescu	Total							
Exemplare		1400	423	1823	212	430	292	228	2081	13	121
H' (Shannon div.)		1,546	1,355	1,709	2,697	1,656	1,931	2,276	1,675	2,138	0,871
Specie/nr. specii		44	12	48	35	29	254	24	27	13	12
Corcodel cu gât negru	*Podiceps nigricollis*										
Pelican creţ	*Pelecanus crispus*		17	17		28	16				
Pelican comun	*Pelecanus onocrotalus*							19			
Cormoran mare	*Phalacrocorax carbo*	6	24	30	2		3	3	21		2
Cormoran mic	*P. pygmaeus*	14		14	10			38	6		2
Stârc de noapte	*Nyctycorax nyctycorax*	7	1	8	1	5					2
Stârc galben	*Ardeola ralloides*						1				
Egretă mică	*Egretta garzetta*	4		4	3	4	1	7	6	1	2
Egretă mare	*Ardea alba*					1		2	0		
Stârc cenuşiu	*Ardea cinerea*	1	1	2	2	5	1	2	2	1	
Barză albă	*Ciconia ciconia*	42		42		3	1				
Barză neagră	*Ciconia nigra*	2		2	35	3	1				2
Ţigănuş	*Plegadis falcinellus*								7	1	
Lopătar	*Platalea leucorodia*	3		3		5				1	
Lebădă de vară	*Cygnus olor*				2	8	1		1		
Gâscă sp.	*Anser sp.*				2						
Călifar alb	*Tadorna tadorna*	16		16	1						
Călifar roşu	*Tadorna ferruginea*		2	2		2		8	45	4	
Raţă mare	*Anas platyrhynchos*	6	110	116	18	5	129	80	21		
Raţă pestriţă	*Anas strepera*	2		2			3				
Raţă cârâitoare	*Anas querquedula*								2		
Raţă cu cap castaniu	*Aythya ferina*					2	1				
Rata roşie	*Aythya nyroca*						2		3		

		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09
		Bala	Turcescu	Total							
Rață cu ciuf	*Netta rufina*						2				
Codalb	*Haliaetus albicilla*					3		1			
Uligan pescar	*Pandion haliaetus*					1					
Acvilă țipătoare mică	*Aquila pomarina*	4		4		2					
Acvilă pitică	*Aquila pennata*					1					
Gaie neagră	*Milvus migrans*					1					
Erete de stuf	*Circus aeruginosus*	3		3	1	3		1			
Erete alb	*Circus macrourus*	1		1							
Erete sp.	*Circus pygargus/macrourus*					1					
Șorecar comun	*Buteo buteo*	3		3	2	1		1	2	1	
Șorecar comun ssp. Vulpinus	*Buteo buteo vulpinus*	1		1							
Șorecar mare	*Buteo rufinus*	2		2				1			
Viespar	*Pernis apivorus*	1		1	1	2	1	2			
Uliu păsărar	*Accipiter nisus*					1			1		
Uliu porumbar	*Accipiter gentilis*						1				
Uliu cu picioare scurte	*Acipiter brevipes*					1	1				
Uliu sp.	*Acc brevipes/nisus*	1		1							
Vânturel roșu	*Falco tinnunculus*	1		1	1				2	1	2
Șoimul rândunelelor	*Falco subbuteo*	3		3	6	3		3	1		
Vânturel de seară	*Falco vespertinus*	9		9	1	1					2
Șoim călător	*Falco peregrinus*					1					
Piciorong	*Himantopus himantopus*								1		
Prundăraș gulerat mic	*Charadrius dubius*						4	5			
Fluierar cu picioare verzi	*Tringa nebularia*	2		2		1		10	4		
Fluierar de zăvoi	*Tringa ochropus*					18	2				
Fluierar de munte	*Actitis hypoleucos*				1	1		2		1	
Culic mare	*Numenius arquata*					1					
Culic mic	*Numenius phaeopus*								1		

		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 07*	PC 09
		Bala	Turcescu	Total							
Pescăruş râzător	*Larus ridibundus*	1	30	31	11			2	750		3
Pescăruş mic	*Larus minutus*	1	2	3							
Pescăruş cu cap negru	*Larus melanocephalus*										
Pescăruş cu picioare galbene	*Larus cachinnans*	2		2	3						
Pescăruş sp.	*Larus michahellis/cachinnans*	22		22	3		40	3	500		
Chiră de baltă	*Sterna hirundo*	9		9	6			2			
Pescăriţă răzătoare	*Sterna nilotica*				3						
Chiră de mare	*Sterna sandvicensis*		9	9							
Chirighiţă neagră	*Chlidonias niger*	31		31					42		
Ch. cu aripi albe	*Ch. leucopterus*	5		5							
Ch. cu obraz alb	*Ch. hybridus*	84		84	6	21	11		28		
Porumbel gulerat	*Columba palumbus*	3		3					2		1
Cuc	*Cuculus canourus*	1		1							
Drepnea neagră	*Apus apus*								1		2
Pescăraş albastru	*Alcedo atthis*	5	1	6	3	5	1	1	1	1	
Prigorie	*Merops apiaster*	1		1		10	5				
Ciuş	*Otus scops*		1	1	1						
Huhurez mic	*Srix aluco*	1		1		2		2			
Ghionoaie sură	*Picus canus*	2		2							
Ciocănitoare de grădini	*Dendrocopos syriacus*	1		1							
Ciocănitoare neagră	*Dryocopus martius*	2		2	1				1		
Lăstun de mal	*Riparia riparia*	875	225	1100	37		10	13	500		
Rândunică	*Hirundo rustica*	210		210	265	60	50	20	130		100
Sfrâncioc roşiatic	*Lanius collurio*	6		6							
Sfr. cu frunte neagră	*Lanius minor*	3		3	2						1
Corb	*Corvus corax*	1		1							
Pietrar negru	*Oenanthe pleschanka*									1	

CP 07*+area adjacent to CP 07

HERPETOFAUNA, AMPHIBIANS

Linear routes with an approximate total length of 10.7 km were covered in different types of habitats (pastures, meadows, plantations, sallow etc.). Despite these efforts, the number of species and specimens is reduced, so the statistical interpretation of the data is impossible. The reason for the reduced number may be the hot and droughty weather during the evaluation period. The observed species were: *Natrix natrix, Lacerta agilis, Lacerta viridis, Bufo bufo, Rana esculenta.*

3.1.H. Monitoring Natura 2000 sites

Works to improve navigation conditions on the Danube between Călăraşi and Brăila is carried out on an area that overlaps both sites belonging to the Natura 2000 Network (RO SCI 0006, RO SCI 0022, RO SPA 0039, RO SPA 0017 and RO SPA 0005). The sites of Community Importance (SCI) designated under the Habitats Directive and Special Protection Areas (SPAs) and established under the Birds Directive, forming part of the Natura 2000 ecological network.

Distribution of NATURA 2000 areas in the perimeter where hydrotechnical works will take place on every critical point is shown in Table 3.1.H.1.

Table 3.1.H.1 - Distribution of NATURA 2000 sites on each critical point

Arii NATURA 2000	Puncte critice principale			Puncte critice secundare						
	PC 01	PC 02	PC 10	PC 03A	PC 03B	PC 04A	PC 04B	PC 07	PC 08	PC 09*
RO SCI 0006			X							X
RO SCI 0022	X	X		X	X	X	X	X	X	
RO SPA 0005			X							X
RO SPA 0039	X	X		X	X	X	X			
RO SPA 0017										-

*NOTE – ROSPA 0017 can be found at km 9.2 on Borcea branch and km 261.4 on the Danube up to km 237.9 on the Danube, in its perimeter is not found none of the critical points; closest to this area is PC 09, being approximately 3 km from it

Also, for a better assessment of the reference state prior to the commencement of the hydrotechnical works were monitored other areas from Natura 2000 sites in the pre-construction phase and are shown in Table 3.1.H.2.

Table 3.1.H.2 - Other sites analysed

Arii NATURA 2000	Puncte critice principale			Puncte criticesecundare						
	PC 01	PC 02	PC 10	PC 03A	PC 03B	PC 04A	PC 04B	PC 07	PC 08	PC 09
RO SCI 0071						~	~			
RO SCI 0172		~		~	~					
RO SCI 0012			-							
RO SCI 0149	-									
RO SPA 0007							~			
RO SPA 0012	~									
RO SPA 0053	-									
RO SPA 0056		~								
RO SPA 0054				~	~					
RO SPA 0002									x	x
RO SPA 0017										-
RO SPA 0040									-	-

NOTE

~ critical points which are found in the vicinity of protected areas

- critical points that are closest to the protected area

X critical points which overlap the perimeter of the protected areas

Monitoring of flora and habitats from the Natura 2000 protected areas

The assessment of flora and habitats from Natura 2000 areas that overlap with different segments of the Danube was carried out simultaneously with the assessment of the critical points flora and bird censuses on the Danube (in May-June 2011). Habitats and flora from Natura 2000 sites which are outside the direct impacts of the project (the areas which contain no segments of the Danube) were assessed after identifying biodiversity of the directly affected area (in June-August 2011). Their assessment was carried out by following shore areas for those lakes or by crossing routes in the case of the terrestrial habitats in the vicinity of those lakes. The species identified in the field were listed.

Most critical points (placed in the protected areas) are to be found within the ROSCI0022 site (PC 01, 02, 03A, 03B, 04A, 04B, 07 and 08).

In terms of habitat, the natural protected area may be characterized by several types like semi-natural and anthropogenic ones. This can be notice by the large surfaces occupied by the Canadian poplar plantations (*Populus x canadensis*) both on the Danube's islands and isles. The natural and semi-natural habitat types are alluvial forests of willow (*Salix alba*) and white poplar (*Populus alba*), meadows of *Agrostis stolonifera*, which often are in advanced stages of decay (marked by great abundance of invasive alohtone species). The most significant value of this area is the alluvial forests, which have become greatly reduced due to forestry activities; rarely is found one old alluvial wooded area and in good state of preservation.

Table 3.1.H.3 presents the habitat types, their approximate surface and the percentage occupied within each critical point.

Table 3.1.H.3 - Habitat types in the area of each PC from ROSCI0022

Zona	Tipuri de habitate	Suprafaţă (kmp)	% din zona PC
	PC 01		
Braţul Bala	Plantaţie de plop canadian	8,23	**69,6**
	R8704 Comunitati antropice cu *Polygonum aviculare, Lolium perenne, Schlerochloa dura %i Plantago major*	2	**16,8**
	Suprafaţă nisipoasă temporar inundată	0,05	**0,5**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,21	**1,8**
Ostrovul Turcescu	Plantaţie de plop canadian	1,06	**8,9**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,05	**0,5**
	R8703 Comunitati antropice cu *Agropyron repens, Arctium lappa, Artemisia annua* şi *Ballota nigra*	0,23	**1,9**
	PC 02		
Ostrovul Epuraşu	Suprafaţă nisipoasă temporar inundată	0,17	**2,9**
	Lac temporar fără vegetaţie	0,04	**0,7**
	R4406 Păduri danubien-pontice de plop alb (*Populus alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	5,42	**88,6**
Malul Dunării	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,48	**7,8**
	PC 03A		
Amonte Şeica	Plantaţie de plop canadian	0,84	**63,5**
	Suprafaţă nisipoasă temporar inundată	0,43	**32,5**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,05	**4**
	PC 03B		
Aval Şeica	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,05	**8,8**
	Suprafaţă nisipoasă temporar inundată	0,01	**2,6**
	Plantaţie de plop canadian	0,51	**88,6**
	PC 04A		
Insula Ceacâru	Plantaţie de plop canadian	0,77	**100**
malul Dunării	Plantaţie de plop canadian	0,35	**100**
	PC 04B		
Ostrovul Fermecatu	Plantaţie de plop canadian	2,69	**75,7**
	Suprafaţă nisipoasă temporar inundată	0,6	**16,9**
	R4407 Păduri danubiene de salcie albă (*Salix alba*) cu *Rubus caesius* (92A0 *Salix alba* and *Populus alba* galleries)	0,26	**7,4**
	PC 07		
Insula Fasolele	Plantaţie de plop canadian	1,52	**100**
	PC 08		
Zona Atârnaţi	Plantaţie de plop canadian	0,64	**100**

Characterization of critical points in terms of vegetation in ROSCI0022

CP 01 – Bala Branch) and Ostrovu Turcescu (Turcescu Islet)

Along the shore on a strip of a few meters can be found degraded clumps within Danubian forests of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*). These, however, are only present in the riparian area which is regularly flooded. In more remote areas and inside the Ostrovu Turcescu poplar plantations are found on some sites with open areas covered by anthropogenic communities with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703). On riverside there are areas used as pasture for sheep, degraded and overgrazed. Their vegetation is represented by anthropogenic communities with *Polygonum aviculare, Lolium perenne*, *Schlerochloa dura* and *Plantago major* (R8704). In patches, the sandy shore is almost entirely devoid of vegetation.

CP 02 – Ostrovul Epuraşu (Epuraşu Islet)

Most of the island is forested by Danubian-Pontic white poplar (*Populus alba*) with *Rubus caesius* (R4406, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*) and by Danube white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*). All those habitat types are also found along the shore in narrow strips. These communities, in the case of Ostrovu Epuraşu, present a certain level of degradation. Thus, is notable the presence of alohtone species with invasive character (*Amorpha fruticosa, Erigeron canadensis*). In the riparian area are present empty sandy area, the vegetation is very poor being represented by several specimens of *Xanthium strumarium*. In the middle of the island, on a relatively small area it is a temporary lake, almost devoid of vegetation (on shore are present a few copies of *Alisma plantago-aquatica*, *Eleocharis sp*. and *Potamogeton pectinatus* in water).

CP 03 A – Şeica upstream

Both the island and the rivershore are covered outside the riparian area with poplar plantations, where there is an wide area of a few meters, sometimes even wider, with a sandy surface temporarily flooded, practically devoid of vegetation (only a few specimens of *Xanthium strumarium* and other ruderal species), followed by a strip of a few meters from the Danube community of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*).

Figure 3.1.H.1 - Old salicet in good state of conservation

CP 03 B – Şeica downstream

This area is similar to the upstream Şeica area, where there are the same types of vegetation. The rivershore is covered with poplar plantations and in the riparian area are found narrow strips of willow Danube communities (*Salix alba*) with *Rubus caesius* (R4407, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*).

CP 04 A – Insula Ceacâru (Ceacâru Island)

The Ceacâru island has steep shores between 1 m and 2 m, without salicet from the riparian area. The total area of the island is covered by the poplar plantation.

CP 04 B – Ostrovul Fermecatu (Fermecatu Islet)

The riparian with large sandy and temporarily flooded area (with very low vegetation) is followed by a narrow strip of salicet, Danube communities of white willow (*Salix alba*) with *Rubus caesius* (R4407, Natura 2000 code: 92A0 *Salix alba* and *Populus alba galleries*) and most of the islet is covered with poplar plantations.

Figure 3.1.H.2 - Salicet galleries and sandy shores

CP 07 – Insula Fasolele (Fasolele Island)

Like previous islands, most of this island is covered with poplar plantations, the salicet from the riparian area forming a very narrow strip. In patches, can be found anthropogenic communities interspersed in plantations with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703).

CP 08 –Atârnaţi area

Like previous islands, most of this island is covered with poplar plantations, the salicet from the riparian area forming a very narrow strip. In patches, can be found anthropogenic communities interspersed in plantations with *Agropyron repens*, *Arctium lappa*, *Artemisia annua* and *Ballota nigra* (R8703). The rivershore area is varied, so in patches is steep and in other places are found empty sandy surfaces.

CP 09 – CP 10

In the Ostrovu Lupu (Lupu islet) are found Canadian poplar plantations (Populus x canadensis) and in the riparian in the form of a strip up to tens of meters are found alluvial forests of white willow (*Salix alba*) – in patches with white poplar (*Populus alba*) and in the herbaceous layer *Rubus caesius* is predominant (in the case of Canadian poplar plantations the *Agropyron repens*). In these alluvial forests, the abundance of invasive alohtone species (especially *Amorpha fruticosa*) can be noted.

Table 3.1.H.4 presents the habitat types, the approximatively surface and the percentage occupied in the area of each critical point.

Table 3.1.H.4 - Habitat types in the area of each PC from ROSCI0006

<table>
<tr><th>PC</th><th>Zona</th><th>Tipuri de habitate</th><th>Suprafaţă kmp</th><th>% din zona PC</th></tr>
<tr><td>PC 09</td><td>Zona Vărsături</td><td>Plantaţie de plop canadian şi frasin</td><td>0,16</td><td>100</td></tr>
<tr><td rowspan="4">PC 10</td><td rowspan="2">Malul Braţului Caleia</td><td>R4407 Păduri danubiene de salcie albă (Salix alba) cu Rubus caesius (92A0 Salix alba and Populus alba galleries)</td><td>0,86</td><td>11</td></tr>
<tr><td>Plantaţie de plop canadian amestecat cu salcie albă (Salix alba)</td><td>0,63</td><td>8</td></tr>
<tr><td rowspan="2">Ostrovul Lupu</td><td>Plantaţie de plop canadian</td><td>6,37</td><td>81</td></tr>
<tr><td>R8703 Comunitati antropice cu Agropyron repens, Arctium lappa, Artemisia annua şi Ballota nigra</td><td colspan="2">pâlcuri de diferite dimensiuni, intercalate în plantaţii</td></tr>
</table>

Characterization of critical points in terms of existing vegetation in ROSCI0006

These areas are characterized by poplar plantations and salicet from the riparian area represented by Danubian forests of white willow (*Salix alba*) with *Rubus caesius* (92A0 *Salix alba* and *Populus alba galleries*). In interspersed patches between poplars plantations are found anthropogenic communities with Agropyron repens, Arctium lappa, Artemisia annua and *Ballota nigra* (R8703).

Figure 3.1.H.3 - Amorpha fruticosa, alohton species with invasive character and widespread in large number

Figure 3.1.H.4 - Sandy shore with Xanthium strumarium

Monitoring of aquatic flora and fauna, including the ichthyofauna from Natura 2000 protected areas

ROSCI0022 „Canaralele Dunării"

There are no macrophyte species, algae or invertebrate that could make the subject of the annexes of Directive habitats.

None of the 14 habitats of the "Balta Mică a Brăilei" Natural Park are not negatively affected in a significant way, because of two reasons: the tiny surface affected by the site organization and the work itself (0.083 % of the total surface of natural protected area) and by that none of the critical points (PC) located in the area are not nearly to any strictly protected areas or integral protection areas.

The protected natural area "Canaralele Dunării" (site of Community importance) includes the course of the Danube and is in a vital area for sturgeon migration and reproduction.

Of the 13th protected fish species under the Habitats Directive of Natura 2000 Network have been highlighted a number of 9 species.

Table 3.1.H.5 - Species of Community importance under RO SCI 0006

Specii de importanţă comunitară	
Enumerate în anexa I-a Directivei Consiliului 79/409/CEE	**Grad de vulnerabilitate faţă de lucrările şantierului**
Alosa pontica	-
Gobio albipinnatus	scăzută
Rhodeus sericeus amarus	-
Cobitis taenia	medie
Zingel zingel	medie
Zingel streber	medie
Pelecus cultratus	-
Aspius aspius	scăzută
Gymnocephalus schraetzer	scăzută
Gobio kessleri	scăzută
Alosa tanaica	scăzută
Gymnocephalus baloni	scăzută
Misgurnus fossilis	-

ROSCI0006 „Balta Mică a Brăilei"

Are described 32 species of superior aquatic plants that belonging to 15 orders (*Hydrocharitales, Nympheales, Najadales, Typhales, Myrtales, etc*). Being a wetland, the phytocoenosis of ponds are particularly rich in inferior aquatic plants of which algae are dominant. Green, blue and siliceous algae are common. There are no species of macrophyte, algae or invertebrates that could make the subject of the annexes of Directive habitats.

None of the 18 habitats of the "Balta Mică a Brăilei" Natural Park are not negatively affected in a significant way, because of two reasons: the tiny surface affected by the site organization and the work itself (0.018 % of the total surface of Natural Park) and by that none of the critical points (PC9 and PC10) located in the area are not nearly to any strictly protected areas or integral protection areas.

Of the 12th protected fish species under the Habitats Directive of Natura 2000 Network have been highlighted a number of 9 species:

Table 3.1.H.6 - Species of Community importance under RO SCI 0006

Specii de importanţă comunitară	
Enumerate în anexa I-a Directivei Consiliului 79/409/CEE	**Grad de vulnerabilitate faţă de lucrările şantierului**
Alosa pontica	scăzută
Gobio albipinnatus	scăzută
Rhodeus sericeus amarus	scăzută
Cobitis taenia	medie
Zingel zingel	medie
Pelecus cultratus	-
Aspius aspius	scăzută
Gymnocephalus schraetzer	scăzută
Gobio kessleri	-
Alosa tanaica	scăzută
Gymnocephalus baloni	scăzută
Misgurnus fossilis	-

ROSCI0071 „Dumbrăveni - Valea Urluia - Lacul Vederoasa"

It is paleontological and ornithological reservation. Vederoasa Lake belongs to the meadow lakes category with a high degree of meandering. Over 80% of the lake surface is covered with reeds which is a bird-friendly habitat. Natural ichthyofauna is underrepresented and consisting of *Aspius aspius*, *Rhodeus sericeus amarus*, *Misgurnus fossilis*, *Cobitis taenia*, which add the carp, crucian carp and asian cyprinids populated by the concessionaire pond. It is not affected by the work itself.

ROSCI0172 „Pădurea şi Valea Canaraua Fetii - Iortmac"

Reserve with extensive wetlands, reed-covered and with pools of water. Large lakes are exploited under aquaculture (Dunăreni, Oltina). The ichthyofauna protected by the Habitats Directive of the Natura 2000 Network is consisting of: *Gobio albipinnatus*, *Aspius aspius, Rhodeus sericeus amarus* and *Misgurnus fossilis*. It is not affected by the construction works.

ROSCI0012 „Braţul Măcin”

The reserve includes the Danube („Braţul Măcin”) and surrounding landscaped lakes in fisheries (e.g. Igliţa Lake). The fisheries population protected by the Habitats Directive Natura 2000 Network is the same as the one identified in the PC 10 which add the *Romanogobio kesslerii* (pietroc). It is not affected by the construction works.

ROSCI0149 „Pădurea Eseschioi - Lacul Bugeac”

The Bugeac Lake is exploited under aquaculture. The fisheries population protected by the Habitats Directive the Natura 2000 Network consists of: *Gobio albipinnatus, Aspius aspius, Rhodeus sericeus amarus* and *Cobitis taenia*. It is not affected by the construction works.

<u>Monitoring the amphibian species</u>

Bombina bombina

The *Bombina bombina* species has been reported in both Natura 2000 sites in the implementation area of the project ISPA 1 (both the "Canaralele Dunării" - ROSCI0022 and the "Brăila Lake" - ROSCI0006). The size of the local populations of these sites is between 2 % and 15 % (for each site individually) from the actual number of species.

Specific habitats, important for *Bombina bombina*, had before the commencement of execution works of infrastructures provided in project ISPA 1 with a <u>good</u> conservation degree. From this point of view, from all sites of Balta Mică a Brăilei (ROSCI0006) and Canaralele Dunării (ROSCI0022), the *Bombina bombina* species has a <u>good</u> conservation status.

In terms of isolation, the populations of the *Bombina bombina* species fall into the C category (non-isolated population by population from other areas) in both cases: the site Balta Mică a Brăilei (ROSCI0006) and in the Canaralele Dunării site (ROSCI0022).

The global conservation status of the *Bombina bombina* species in the Balta Mică a Brăilei (ROSCI0006) site perimeter was qualified as <u>excellent</u> and the Canaralele Dunării (ROSCI0022) site perimeter may be considered as having <u>good</u> value.

Triturus dobrogicus

The *Triturus dobrogicus* species was nominated only in standard documentation (related to ”Balta Mică a Brăilei” site - ROSCI0006), namely in the annex to the Order of the Minister of Environment and Sustainable Development no. 1964/2007, but it is present within both Natura 2000 sites declared in 2007 in the implementation area of ISPA 1 project.

The size of local populations of *Triturus dobrogicus* of these sites is between 2 % and 15 % of the actual number of species in the case of the ”Balta Mică a Brăilei” site (ROSCI0006) and is less than 2 % of the actual number of species in the case of the “Canaralele Dunării” site (ROSCI0022).

The specific habitats, important for *Triturus dobrogicus*, had before the commencement of execution works of infrastructures provided in project ISPA 1 with a <u>good</u> conservation degree. From this point of view, from all sites of Balta Mică a Brăilei (ROSCI0006) and the Canaralele Dunării (ROSCI0022), the *Triturus dobrogicus* species has a <u>good</u> conservation status.

We believe that in terms of isolation, the populations of the *Triturus dobrogicus* species fall into the C category (non-isolated population by population from other areas) in the case of both Natura 2000 sites even if the Natura 2000 standard sheets (corresponding to the Order of the Minister of Environment and Sustainable Development no. 1964/2007) is considered that the population of the Balta Mică a Brăilei site (ROSCI0006) would fall into the B category ("non-isolated populations, but at the area limit of distribution").

The global conservation status of *Triturus dobrogicus* species in the perimeter of Balta Mică a Brăilei (ROSCI0006) and “Canaralele Dunării” sites (ROSCI0022) fits into the <u>good</u> category.

Recommendation: we consider that in the case of *Triturus dobrogicus* species is necessary to carry out monitoring activities in the period between March and June during the years of the execution works, types of living environments that are targeted by these investigations being the stagnant shallow waters (including those that dries up temporarily) and other types of wet habitats along the Danube natural shores and on the islands, especially in the area of 04 and 09 critical points.

<u>Monitoring species of reptiles</u>

Emys orbicularis

The *Emys orbicularis* species was nominated in the standard sheets of both Natura 2000 sites (corresponding to the Order of the Minister of Environment and Sustainable Development no. 1964/2007) in the implementation area of the ISPA 1 project, but during April - August of 2011 we have not observed specimens of *Emys orbicularis* in the perimeter of neither of the two Natura 2000 sites.

According to the official documentation relating to the species situation in the two sites:

- the size of local populations of *Emys orbicularis* is between 2% and 15% of the actual number of species in the case of the ”Balta Mică a Brăilei” site

(ROSCI0006), respectively is less than 2% of the actual number of species in the case of the "Canaralele Dunării" site (ROSCI0022);

- the global conservation status of the *Emys orbicularis* species in the Balta Mică a Brăilei (ROSCI0006) and Canaralele Dunării (ROSCI0022) fits into the good category.

In terms of isolation, populations belonging to the *Emys orbicularis* species fall into the C category (non-isolated population by population from other areas) both in the case of the Balta Mică a Brăilei site (ROSCI0006) and the Canaralele Dunării site (ROSCI0022).

Recommendation: we consider that in the case of *Emys orbicularis* species it is necessary to carry out the monitoring activities in the period between April and July during the years of the execution works provided in the ISPA 1 project, types of living environments to be targeted by these investigations being poorly flowing waters and the stagnant ones located on the Danube's natural shores, especially in the area of five critical points namely 02, 03, 04, 09 and 10.

Testudo graeca

The *Testudo graeca* species was not nominated in any of the standard documentation related to those two Natura 2000 sites declared in 2007 in the area of ISPA 1 project implementation, but specimens of *Testudo graeca* have been identified on the right shore of the Danube, on the edge of steep cliffs in several places in the perimeter of the "Canaralele Dunării" (ROSCI0022) site.

We believe that the size of the local *Testudo graeca* populations from the "Canaralele Dunării" (ROSCI0022) site is probably less than 2% of the actual number of species. The specific habitats, important for *Testudo graeca*, had before the commencement of execution of infrastructure works of ISPA 1 project with a good conservation degree. From this point of view, from all of "Canaralele Dunării" (ROSCI0022) site, this species has a good conservation status (category B).

In terms of isolation, the *Testudo graeca* populations from the "Canaralele Dunării" (ROSCI0022) site fall into the category of "non-isolated population, with an area of extensive spread" (category C).

The global conservation status of *Testudo graeca* species in the perimeter of the "Canaralele Dunării" (ROSCI0022) site fall into the category: good.

Mammal species monitoring

Lutra lutra

Lutra Lutra species was nominated in standard sheets of both Natura 2000 sites (related Order of the Minister of Environment and Sustainable Development no. 1964/2007) of the ISPA 1 project implementation area, but during April-August 2011 we did not noticed Lutra Lutra specimens in either of the two perimeters Natura 2000 sites. Presence of this species has been observed in the lakes area Oltina, Dunăreni (Mârleanu) and Vederoasa.

According to the official documentation (annexes to Order of the Minister of Environment and Sustainable Development no. 1964/2007) regarding the situation of the species in the "Balta Mică a Brăilei" site (ROSCI0006):

- local population size of Lutra Lutra ranges between 2 % and 15 % of the total national number of the species;
- the overall status of the Lutra Lutra species conservation in the perimeter of the "Balta Mică a Brăilei" (ROSCI0006) site is considered to fall in the good category.

According to the official documentation (annexes to Order of the Minister of Environment and Sustainable Development no. 1964/2007) regarding the situation of the species in the "Canaralele Dunării" site (ROSCI0022) it is mentioned that the presence of the species Lutra Lutra is uncertain at this Natura 2000 site.

From the isolating point of view, *Lutra Lutra* populations from the lower Danube meadow fall into the C category (non-isolated populations of populations from the other areas).

Recommendation: we consider that for the *Lutra Lutra* species it is necessary to develop (during the execution years of the work under the ISPA 1 project) the monitoring activities in the nearby zone of the river shore which is near Critical Points 02, 03 and 04.

Avifauna monitoring in Natura 2000 sites

Avifauna monitoring for aquatic and terrestrial ecosystems depends on the ecological requirements of the species of identified birds. The collected data represents estimations of the populations tendencies and species distribution of aquatic and terrestrial birds during nesting periods, during the spring and autumn migration, agglomerations during the winter, species distribution depending on the noise level and the disturbance caused by human activities, species distribution and abundance depending on the vegetation type, by the natural factors influence (fluctuations of water level) at the nesting success of the aquatic bird species.

For direct observation activities mobile towers for observing and monitoring bird behaviour have been installed. The distribution of areas SPA 0005, SPA 0039 and SPA 0017 is presented in Table 3.1.H.1.

The observation period includes three periods in a year:

- *first period*: spring (April - June) covers the spring migration and nesting season;
- *second period* (September - October) covers autumn migration;
- *third period* (January) covers the wintering species; counts will be made in January when water species counting takes place at European level.

Considering that the pre-construction phase occurred between April to August, in the phase report only results regarding the spring migration and nesting season are presented.

The results synthesis from *the count in the points* and *linear routes evaluation* is presented below.

The species identified on field in RO SPA 0005 during the pre-construction phase protected by Council Directive 79/409/EEC are shown in Table 3.1.H.6. The Table 3.1.H.7 contains other species types identified on field.

Table 3.1.H.6 - Community importance species in RO SPA 0005

Specii de importanţă comunitară	
Enumerate în anexa I-a Directivei Consiliului 79/409/CEE	**Identificate pe teren nr. exemplare**
Ardeola ralloides	1
Egretta garzetta	60
Ardea purpurea	1
*Ciconia ciconia**	4
*Ciconia nigra**	40
Plegadis falcinellus	21
Platalea leucorodia	7
Aquila pomarina	6
Circus aeruginosus	4
*Falco vespertinus**	30
*Sterna hirundo**	26
Chlidonias hybridus	291
Alcedo atthis	3
Aythya nyroca	-
Botaurus stellaris	-
Branta ruficollis	-
Coracias garrulus	-
Crex crex	-
Egretta alba	-
Grus grus	-
Haliaeetus albicilla	-
Ixobrychus minutus	-
Milvus migrans	-
Nycticorax nycticorax	-
Phalacrocorax pygmeus	-

The following table contains other species identified on the field.

Table 3.1.H.7 - Other species in the RO SPA 0005, which are not found in Annex I at the Council Directive 79/409/EEC

Specia	Nr. exemplare
Podiceps cristatus	1
Podiceps grisegena	1
Phalacrocorax carbo	58
Phalacrocorax pygmaeus	54
Nyctycorax nyctycorax	9
Ardea cinerea	9
Tadorna tadorna	1
Falco tinnunculus	9
Falco subbuteo	35
Actitis hypoleucos	9
Phylomacus pugnax*	50
Larus michahellis	2
Larus michahellis/cahinnans	28
Chlidonias leucopterus*	49
Cuculus canourus	2
Apus apus	2
Upupa epos	2
Riparia riparia*	387
Hirundo rustica*	2545
Delichon urbica*	6
Pelecanus crispus	1
Cygnus olor	2
Anser albifrons	4
Anas platyrhynchos	48
Anas strepera	9
Circus macrourus/pygarsus	1
Pernis apivorus*	3
Accipiter nisus granti/brevipes	2
Haematopus ostralegus	1
Larus ridibundus	64
Larus minutus	2
Larus cachinnans	3
Sterna nilotica	3
Chlidonias niger*	348
Columba oenas	2
Picus canus	1
Columba palumbus	1

The protected species by the Council Directive 79/409/EEC, identified on field in RO SPA 0039 during the preconstruction phase, are shown in Table 3.1.H.8.

Table 3.1.H.8 - Community importance species in ROSPA0039

Specii de importanţă comunitară	
Enumerate în anexa I-a Directivei Consiliului 79/409/CEE	**Identificate pe teren nr. exemplare**
Ardeola ralloides	-
Egretta garzetta	15
Ardea purpurea	-
Plegadis falcinellus	7
Milvus migrans	1
Circus aeruginosus	7
Accipiter brevipes	2
*Falco vespertinus**	10
Himantopus himantopus	1
*Sterna hirundo**	15
Alcedo atthis	1
Picus canus	-
Dryocopus martius	2
Acrocephalus melanopogon	-
Branta ruficollis	-
Caprimulgus europaeus	-
Chlidonias hybridus	-
Chlidonias niger	-
Ciconia ciconia	-
Ciconia nigra	-
Haliaeetus albicilla	-
Coracias garrulus	-
Emberiza hortulana	-
Ixobrychus minutus	-
Lanius collurio	-
Lanius minor	-
Larus minutus	-
Nycticorax nycticorax	-
Pandion haliaetus	-
Pelecanus onocrotalus	-
Phalacrocorax pygmeus	-
Platalea leucorodia	-
Porzana parva	-
Recurvirostra avosetta	-
Sterna albifrons	-
Sylvia nisoria	-
Tringa glareola	-

The following table contains other species identified on the field.

Table 3.1.H.9 - Other species in the ROSPA0039, which are not found in Annex I at the Council Directive 79/409/EEC

Specia	Nr. exemplare
Pelecanus crispus	28
Podiceps nigricollis	4
P. onocrotalus	19
Phalacrocorax carbo	32
P. pygmaeus	64
Nyctycorax nyctycorax	3
Ardea cinerea	6
Ciconia ciconia*	44
Ciconia nigra*	5
Ardea alba	2
Haliaetus albicilla	2
Platalea leucorodia	1
Circus pygargus/macrourus	1
Buteo buteo	5
Buteo buteo vulpinus	1
Falco tinnunculus	3
Falco subbuteo	14
Actitis hypoleucos	1
Tadorna ferruginea	10
Anas platyrhynchos	44
L.arus michahellis/cahinnans	73
C. leucopterus*	5
Cuculus canourus	1
Apus apus	1
Anas strepera	2
Merops apiaster	10
Riparia riparia*	467
Hirundo rustica*	735
Anas querquedula	2
Aythya nyroca	3
Pandion haliaetus	1
Aquila pomarina	5
Buteo rufinus	3

Specia	Nr. exemplare
Pernis apivorus*	7
Accipiter nisus	1
Accipiter brevipes/ nisus	1
Falco peregrinus	1
Tringa nebularia	15
Numenius phaeopus*	1
Larus ridibundus	3
L. minutus	1
L. cachinnans	3
Columba palumbus	5
C. hybridus	118
Sterna nilotica	3
Chlidonias Niger	73

Evaluations were carried in the critical points of different habitats. From these results, the bird density was calculated on three dominant habitats: *danubian forests of White willow (Salix alba)* with *Rubus caesius; poplar tree plantations; open habitats* (including meadows, shaving cuts, very young plantations).

Based on the densities resulted on the critical points surfaces and on the surfaces of the various habitats present in the critical point, likely herds present on each critical point were calculated. To calculating these herds, between estimation based on the assessments resulting for the respectively critical point and forecasting based on habitat areas, we chose the second method, from more reliable data have been obtained.

It must be mentioned that for reliable results in statistical terms, a high number of observed specimens is required. For this reason, by using the Distance software, reliable densities resulted only for the most common species. But with simultaneous examination of the Shannon diversity indices computed for each total list of species, with the number of species and specimens observed and with the common species densities, an exact monitoring of long-term of the avifauna diversity becomes possible.

Species and flocks present in the main habitats

In the tables 3.1.H.10, 3.1.H.11 and 3.1.H.12 estimated densities for species where the results from Distance software were conclusive are presented. The total species list which is calculated based on these results is presented in the Annexes 5.7.1, 5.7.2 and 5.7.3.

Table 3.1.H.10 - Species and densities in the danubian forests of White willow (Salix alba) with Rubus caesius

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de incredere	
Măcăleandru	*Erithacus rubecula*	489,66	140,08	28,61	265,77	902,16
Cinteză	*Fringilla coelebs*	3724,1	560,69	15,06	2759,1	5026,6
Frunzăriţă galbenă	*Hippolais icterina*	605	136,38	22,54	370,64	987,56
Privighetoare	*Luscinia megarynchos*	1285,6	384,63	29,92	693,18	2384,5
Grangur	*Oriolus oriolus*	262,4	85,284	32,5	129,51	531,63
Piţigoi albastru	*Parus caeruleus*	5020,9	1513,9	30,15	2640,3	9547,8
Piţigoi mare	*Parus major*	2053,9	264,08	12,86	1582,3	2665,9
Silvie cu cap negru	*Sylvia atricapilla*	791,64	174,54	22,05	498,82	1256,3
TOTAL		14593	1021,4	7	12713	16751

Shannon diversity index (H') in the danubian forests of White willow *(Salix alba)* with Rubus caesius: **3.05**

Table 3.1.H.11 - Species and densities in poplar tree plantations

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de incredere	
Cinteză	***Fringilla coelebs***	1460	265,57	18,19	1008,3	2114,1
Frunzăriţă galbenă	***Hippolais icterina***	2068,4	385,59	18,64	1361,6	3142,1
Privighetoare	***Luscinia luscinia***	2554,2	618,96	24,23	1546,3	4219,0
Privighetoare roşiatică	***Luscinia megarynchos***	864,53	244,35	28,26	477,04	1566,8
Grangur	***Oriolus oriolus***	576,3	134,25	23,3	342,61	969,39
Piţigoi mare	***Parus major***	1409,4	324,16	23	859,38	2311,4
Silvie cu cap negru	***Sylvia atricapilla***	999,01	237,66	23,79	599,18	1665,6
Mierlă	***Turdus merula***	749,26	191,7	25,58	432,88	1296,9
TOTAL		22759	1523,9	6,7	19952	25961

Shannon diversity index (H ') in the poplar tree plantations: **2.837**

Because of the very low number of open habitats on the Danube islet, respectively for the reason of reduced flocks in these areas, in this type of habitat we have not obtained any conclusive results except for the total number of the specimens/square kilometre.

Table 3.1.H.12 - Species and densities in *open habitats* (including meadows, shaving cuts, very young plantations)

	Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de incredere	
TOTAL	11016	1349,9	12,25	8623,8	14073

Shannon diversity index (H') in the open habitats (including meadows, shaving cuts, very young plantations): **2.789**

Avifauna characterization on critical points

CP 01 – Bala Branch) and Ostrov Turcescu (Turcescu Islet)

Species density and flocks calculated:

Table 3.1.H.13 - The densities and flocks of common species of *Passeriforme* on CP 01

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de incredere		Efectivele estimate
Cinteză	***Fringilla coelebs***	1769,6	273,59	15,46	1294	2420,1	20969
Frunzăriţă	***Hippolais***	2496,7	437,11	17,51	1730,4	3602,2	29585
Privighetoare	***Luscinia luscinia***	2041,7	487,88	23,9	1246,8	3343,5	24194
Privighetoare	***Luscinia***	1092,1	231,78	21,22	698,19	1708,3	12941
Piţigoi mare	***Parus major***	1541,2	286,65	18,6	1049	2264,2	18263
Silvie cu cap	***Sylvia***	1313,9	286,47	21,8	827,58	2085,9	15569
Mierlă	***Turdus merula***	554,17	146,67	26,47	312,56	982,55	6566
TOTAL		17378	809,5	4,66	15854	19047	205929

Diversity index (H'): **3.006**

CP 02 – Ostrovul Epuraşu (Epuraşu Islet)

Species density and flocks calculated:

Table 3.1.H.14 - The densities and flocks of common species of *Passeriforme* on CP 02 (including habitats along the Danube shore from the critical point area)

Specie		Densitate (ex/kmp)	Eroare Standard	% coeficient de variaţie	95% Interval de incredere		Efectivele estimate
Măcăleandru	***Erithacus***	1019,8	262,69	25,76	583,8	1781,6	6242
Cinteză	***Fringilla coelebs***	4667,3	895,49	19,19	3172,7	6865,9	28568
Privighetoare	***Luscinia***	843,45	219,03	25,97	473,24	1503,3	5162
Piţigoi mare	***Parus major***	2197,9	375,36	17,08	1541,3	3134,2	13453
Mierlă	***Turdus merula***	520,29	160,49	30,85	263,06	1029,1	3184
TOTAL		21192	1727,5	8,15	18043	24890	129715

Diversity index (H'): **2.611**

CP 03 - Șeica islet

Species density and flocks calculated:

Table 3.1.H.15 - The densities and flocks of common species of *Passeriforme* on CP 03

Specie		Efective
Măcăleandru	***Erithacus rubecula***	2467
Cinteză	***Fringilla coelebs***	6568
Frunzăriță galbenă	***Hippolais icterina***	4061
Privighetoare roșiatică	***Luscinia megarynchos***	2470
Piţigoi albastru	***Parus caeruleus***	6993
Piţigoi mare	***Parus major***	3431
Silvie cu cap negru	***Sylvia atricapilla***	1814
TOTAL		45520

Diversity index (H’): **2.888**

CP 04 – Insula Ceacâru (Ceacâru Island) and Ostrov Fermecatu (Fermecatu Islet)

Species density and flocks calculated:

Table 3.1.H.16 - The densities and flocks of common species of *Passeriforme* on CP 04 (including habitats along the Danube shore from the critical point area)

Specie		Efective
Măcăleandru	***Erithacus rubecula***	5693
Cinteză	***Fringilla coelebs***	8877
Frunzăriță galbenă	***Hippolais icterina***	9893
Privighetoare roșiatică	***Luscinia megarynchos***	3638
Piţigoi albastru	***Parus caeruleus***	6714
Piţigoi mare	***Parus major***	4356
Silvie cu cap negru	***Sylvia atricapilla***	3066
TOTAL		90618

Diversity index (H’): **2.916**

CP 07 – Insula Fasolele (Fasolele Island)

Species density and flocks calculated:

Table 3.1.H.17 - The densities and flocks of common species of *Passeriforme* on CP 07

Specie		Efective
Măcăleandru	*Erithacus rubecula*	2219
Cinteză	*Fringilla coelebs*	3143
Frunzăriță galbenă	*Hippolais icterina*	3882
Privighetoare roșiatică	*Luscinia megarynchos*	1314
Piţigoi albastru	*Parus caeruleus*	2142
Piţigoi mare	*Parus major*	1518
Silvie cu cap negru	*Sylvia atricapilla*	1138
TOTAL		34593

Diversity index (H'): **2.426**

CP 08- Atârnaţi area

Species density and flocks calculated:

Table 3.1.H.18 - The densities and flocks of common species of *Passeriforme* on CP 08

Specie		Efective
Măcăleandru	*Erithacus rubecula*	934
Cinteză	*Fringilla coelebs*	1323
Frunzăriță galbenă	*Hippolais icterina*	1634
Privighetoare roșiatică	*Luscinia megarynchos*	553
Grangur	*Oriolus oriolus*	368
Piţigoi albastru	*Parus caeruleus*	902
Piţigoi mare	*Parus major*	639
Silvie cu cap negru	*Sylvia atricapilla*	479
TOTAL		14565

Diversity index (H'): **2.126**

CP 10 – Caleia Branch and Ostrov Lupu (Lupu Islet)

Species density and flocks calculated:

Table 3.1.H.19 - The densities and flocks common species of *Passeriforme* on PC 10 (including habitats along the Danube shore from the critical point area)

Specie		Efective	
		Mal Dunăre	Ostrov
Măcăleandru	*Erithacus rubecula*	1340	9300
Cinteză	*Fringilla coelebs*	4506	13175
Frunzăriță galbenă	*Hippolais icterina*	2129	16270
Privighetoare roșiatică	*Luscinia megarynchos*	1650	5507
Pițigoi albastru	*Parus caeruleus*	5206	8977
Pițigoi mare	*Parus major*	2396	6363
Silvie cu cap negru	*Sylvia atricapilla*	1152	4772
TOTAL		26890	144974

Diversity index (H'): **2.631**

Direct assessment from elevated observation points

In the next table the raptors (order *Falconiformes*) are presented, observed by this method. In addition to data obtained using this method, the birds observed during evaluations by other methods are included.

Table 3.1.H.20 - Raptor species observed and their flocks (data presented in the column "TOTAL" refers to the Danube segment with the length of 348 km, not the sum of the other data presented in table)

SPECIE (ex)		Puncte critice principale			Puncte critice secundare					Total PC	TOTAL
		PC 01	PC 02	PC 10	PC 03	PC 04 1	PC 07	PC 08	PC 09		
Codalb	*Haliaetus albicilla*									0	4
Uligan pescar	*Pandion haliaetus**			1						1	1
Acvilă țipătoare mică	*Aquila pomarina**	4		2						6	16
Acvilă pitică	*Aquila pennata*			1						1	1
Gaie neagră	*Milvus migrans*			1						1	6
Erete de stuf	*Circus aeruginosus**	3		3		1				7	15
Erete sur	*Circus pygargus**										1
Erete alb	*Circus macrourus*	1								1	1
Erete sp.	*Circus pygargus/macrourus**			1						1	3

SPECIE (ex)		Puncte critice principale			Puncte critice secundare					Total PC	TOTAL
		PC 01	PC 02	PC 10	PC 03	PC 04 1	PC 07	PC 08	PC 09		
Şorecar comun	*Buteo buteo*	3	2	1		1	2	1		10	24
Şorecar comun ssp. vulpinus	*Buteo buteo vulpinus*	1								1	3
Şorecar mare	*Buteo rufinus*	2				1				3	3
Viespar	*Pernis apivorus**	1	1	2	1	2				7	23
Uliu păsărar	*Accipiter nisus*			1			1			2	5
Uliu porumbar	*Accipiter gentilis*				1					1	1
U. cu picioare scurte	*Accipiter brevipes*			1	1					2	2
Uliu sp.	*A. brevipes/nisus*	1								1	1
Vânturel roşu	*Falco tinnunculus*	1	1				2	1	2	7	25
Şoimul rândunelelor	*Falco subbuteo*	3	6	3		3	1			16	61
Vânturel de seară	*Falco vespertinus**	1	1				2	1	2	7	25
Şoim călător	*Falco peregrinus*	3	6	3		3	1			16	61

(*- specii observate încă în migraţia de primăvară; *Total PC* - efective totale observate în zona punctelor critice; **TOTAL** - efective observate pe toată lungimea sectorului parcurs pe Dunăre (348 km))

Sand Martin colonies (Riparia riparia), prigoria (Merops apiaster) and common kingfisher (Alcedo atthis)

Sand Martin (*Riparia riparia*)

The Danube shore in a few areas is suitable for the formation of martin shore colonies. Generally, the shore is not height enough for the formation of colonies in order to remain out of the water in case of high rates. In most cases, the shores islets consist of sand and have low gradients, making the formation of colonies in these shores impossible. The Bala branch shore is suitable for colony formation; in this area 6 sand martin colonies have been identifiedde mal.

In the below table the colonies found and specimens observed during field assessment are presented.

Table 3.1.H.21 - The number of colonies and Sand Martin species observed in the critical point area (Total - colonies and flocks observed on the entire sector length of route on Danube (348 km))

Monitorizare	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09	TOTAL
exemplare	~ 1100		37	10	13	~ 500			~3097
colonii	6		1						21

Prigoria (*Merops apiaster*)

The prigoria is a species related to aquatic habitats that does not form breeding colonies in the riparian zone of the rivers. For this reason, fewer colonies were identified and these were at greater distances of Danube shore than in Sand Martin case. In the Table 3.2.H.22 specimens and colonies found during the censuses are presented.

Table 3.1.H.22 - Number of colonies and prigoria species observed in the critical point area (TOTAL - colonies and flocks observed on the entire sector length of route on Danube (348 km))

Monitorizare	Puncte critice principale			Puncte critice secundare					TOTAL
	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09	
exemplare		10		5					18
colonii						1	1		5

Common kingfisher (*Alcedo atthis*)

The number of observed common kingfishers is presented in the Table 3.1.H.23. In the cases where only one specimen was noticed, we consider it as a nesting pair. In the cases where more specimens were seen, the number of the nesting pairs remains unknown because based on feathering the male and female can be indistinguishable.

Table 3.1.H.23 - The number of colonies and prigoria species observed in the critical point area (TOTAL - colonies and flocks observed on the entire sector length of route on Danube (348 km))

Monitorizare	Puncte critice principale			Puncte critice secundare					TOTAL
	PC 01	PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09	
exemplare	6	5	3	1	1	1	1		22

Ciconiiformes colonies mapping

On the Epurașu island one abandoned colony was found. According to local fishermen, there was a mixed colony of herons and cormorants, but it has been abandoned for years since the Oltina Lake was privatized and the fisheries are no longer active.

In other critical points no herons and cormorants colonies were identified, but it should be mentioned that their detectability is lower in the vernal season due to foliage than in winter. Also, during the winter, colonies will still be searched, and those results will be presented in the respectively report.

Based on the present data, the probability to identify new colonies of *Ciconiiformes* or cormorants is low, because during field assessments, signs that would indicate the presence of nearby colonies have not been seen (clusters of the same species, specimen's flights in the same direction to a certain forest area, noise of the colonies etc.).

Herpetofauna, amphibians

Linear routes of total length of about 10.7 km in different habitats types (pasture, grassland, plantation, salicete etc.) have been covered. Despite these efforts, the species and specimens found number is very low, thus statistical interpretation of these data is impossible. The reason may be the hot and dry weather during evaluation period. The observed species were: *Natrix natrix, Lacerta agilis, Lacerta viridis, Bufo bufo, Rana esculenta*.

Total results from different methods

The number of total species observed in the critical points excepting the common songbirds with small size closely related to terrestrial habitats is presented in the table 3.1.H.24.

Tablel 3.1.H.24 - Species and flocks present in the critical points - results totalization of the different methods used in the avifauna assessment (excepting the common songbirds with small size closely related to terrestrial habitats) - H' Shannon diversity index

		Puncte critice principale					Puncte critice secundare				
		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09
		Bala	Turcescu	Total							
Exemplare		1400	423	1823	212	430	292	228	2081	13	121
H' (Shannon div.)		1,546	1,355	1,709	2,697	1,656	1,931	2,276	1,675	2,138	0,871
Specie/nr. specii		44	12	48	35	29	254	24	27	13	12
Corcodel cu gât negru	*Podiceps nigricollis*										
Pelican creţ	*Pelecanus crispus*		17	17		28	16				
Pelican comun	*Pelecanus onocrotalus*							19			
Cormoran mare	*Phalacrocorax carbo*	6	24	30	2		3	3	21		2
Cormoran mic	*P. pygmaeus*	14		14	10			38	6		2
Stârc de noapte	*Nyctycorax nyctycorax*	7	1	8	1	5					2
Stârc galben	*Ardeola ralloides*						1				
Egretă mică	*Egretta garzetta*	4		4	3	4	1	7	6	1	2
Egretă mare	*Ardea alba*					1		2	0		
Stârc cenuşiu	*Ardea cinerea*	1	1	2	2	5	1	2	2	1	
Barză albă	*Ciconia ciconia*	42		42		3	1				
Barză neagră	*Ciconia nigra*	2		2	35	3	1				2
Ţigănuş	*Plegadis falcinellus*								7	1	
Lopătar	*Platalea leucorodia*	3		3		5				1	

		Puncte critice principale					Puncte critice secundare				
		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09
		Bala	Turcescu	Total							
Lebădă de vară	*Cygnus olor*				2	8	1		1		
Gâscă sp.	*Anser sp.*				2						
Călifar alb	*Tadorna tadorna*	16		16	1						
Călifar roşu	*Tadorna ferruginea*		2	2		2		8	45	4	
Rață mare	*Anas platyrhynchos*	6	110	116	18	5	129	80	21		
Rață pestriță	*Anas strepera*	2		2			3				
Rață cârâitoare	*Anas querquedula*								2		
Rață cu cap castaniu	*Aythya ferina*					2	1				
Rață roşie	*Aythya nyroca*						2		3		
Rață cu ciuf	*Netta rufina*						2				
Codalb	*Haliaetus albicilla*					3		1			
Uligan pescar	*Pandion haliaetus*					1					
Acvilă țipătoare mică	*Aquila pomarina*	4		4		2					
Acvilă pitică	*Aquila pennata*					1					
Gaie neagră	*Milvus migrans*					1					
Erete de stuf	*Circus aeruginosus*	3		3	1	3		1			
Erete alb	*Circus macrourus*	1		1							
Erete sp.	*Circus pygargus/macrourus*					1					
Şorecar comun	*Buteo buteo*	3		3	2	1		1	2	1	
Şorecar comun ssp. Vulpinus	*Buteo buteo vulpinus*	1		1							
Şorecar mare	*Buteo rufinus*	2		2				1			
Viespar	*Pernis apivorus*	1		1	1	2	1	2			
Uliu păsărar	*Accipiter nisus*					1			1		
Uliu porumbar	*Accipiter gentilis*						1				
Uliu cu picioare scurte	*Acipiter brevipes*					1	1				
Uliu sp.	*Acc brevipes/nisus*	1		1							
Vânturel roşu	*Falco tinnunculus*	1		1	1				2	1	2
Şoimul rândunelelor	*Falco subbuteo*	3		3	6	3		3	1		
Vânturel de seară	*Falco vespertinus*	9		9	1	1					2
Şoim călător	*Falco peregrinus*					1					
Piciorong	*Himantopus himantopus*								1		
Prundăraş gulerat mic	*Charadrius dubius*						4	5			
Fluierar cu	*Tringa nebularia*	2		2		1		10	4		

		Puncte critice principale					Puncte critice secundare				
		PC 01			PC 02	PC 10	PC 03	PC 04	PC 07	PC 08	PC 09
		Bala	Turcescu	Total							
picioare verzi											
Fluierar de zăvoi	*Tringa ochropus*					18	2				
Fluierar de munte	*Actitis hypoleucos*				1	1		2		1	
Culic mare	*Numenius arquata*					1					
Culic mic	*Numenius phaeopus*								1		
Pescăruş râzător	*Larus ridibundus*	1	30	31	11			2	750		3
Pescăruş mic	*Larus minutus*	1	2	3							
Pescăruş cu cap negru	*Larus melanocephalus*										
Pescăruş cu picioare galbene	*Larus cachinnans*	2		2	3						
Pescăruş sp.	*Larus michahellis/cachinnans*	22		22	3		40	3	500		
Chiră de baltă	*Sterna hirundo*	9		9	6			2			
Pescăriţă râzătoare	*Sterna nilotica*				3						
Chiră de mare	*Sterna sandvicensis*		9	9							
Chirighiţă neagră	*Chlidonias niger*	31		31					42		
Ch. cu aripi albe	*Ch. leucopterus*	5		5							
Ch. cu obraz alb	*Ch. hybridus*	84		84	6	21	11		28		
Porumbel gulerat	*Columba palumbus*	3		3					2		1
Cuc	*Cuculus canourus*	1		1							
Drepnea neagră	*Apus apus*								1		2
Pescăraş albastru	*Alcedo atthis*	5	1	6	3	5	1	1	1	1	
Prigorie	*Merops apiaster*	1		1		10	5				
Ciuş	*Otus scops*		1	1	1						
Huhurez mic	*Srix aluco*	1		1		2		2			
Ghionoaie sură	*Picus canus*	2		2							
Ciocănitoare de grădini	*Dendrocopos syriacus*	1		1							
Ciocănitoare neagră	*Dryocopus martius*	2		2	1				1		
Lăstun de mal	*Riparia riparia*	875	225	1100	37		10	13	500		
Rândunică	*Hirundo rustica*	210		210	265	60	50	20	130		100
Sfrâncioc roşiatic	*Lanius collurio*	6		6							
Sfr. cu frunte neagră	*Lanius minor*	3		3	2						1
Corb	*Corvus corax*	1		1							
Pietrar negru	*Oenanthe pleschanka*									1	

3.1.I. Monitoring construction site activities

Description of the location. Utilities

During the preconstruction period, the main works considered for analysing environmental impact were those relating to organizing the construction site. Were made visits at the site organization in the area of CP01, CP02, and CP 10.

Observations (data collection) were performed on the occasion of sampling of water, air, soil, etc.

Execution of construction work is carried out by an association of companies having as leading SC Interconstruct SRL Constanţa.

Critical Point 01

The site organization is located 1 km upstream of the CP 01 Bala - sandbank Caragheorghe (km 347 - km 343), near the commune Izvoarele, in the right 347.5 km on the right bank of the Danube. The precinct site organization is bounded as follows: on the North, flooded meadow and forest selvage; to the East, the natural limit provided by small terrace slope, with the edge of the same forest; to the south is the beach and flooded meadow of the Danube; to the west, the Danube riverbank, where in the central zone is a pier on that is installed a workstation of the Border Police.

The location is surrounded to the North (continuous) and South (partial) with metallic fence reaching down to the water, to close the whole perimeter. The said fences are fitted with gates for access from both directions.

The land from the location is relatively flat in the middle part, on longitudinal axis parallel to the waterfront, but the whole area tilts sensitive from the East to the West.

The objects of the site organization, in the period under review, April-August 2011 are:

- two construction type "shack" in which the execution staff must to be accommodated (Figures 3.1.I.1 and 3.1.I.2)
- a platform for storage of building materials
- a platform for storage the waste.

During the period of observation are not performed movements of machinery in the respective location, except an excavator AKERMAN H10 and a bulldozer S100.

The constructions are ground type and are provided with necessary utilities to produce no significant environmental impact.

Figure 3.1.I.1 - The site organization from km 346

Figure 3.1.I.2 - The detail of the main construction building within the organization from km 346

Access to the location of the site organization is carried out on land, on a road of exploitation carried out by the association of companies that performing the work having as leading SC Interconstruct SRL Constanţa and on water (Figures 3.1.I.3 and 3.1.I.4).

Figure 3.1.I.3 - The road to the location of the site organization from km 346 (to locality Izvoarele)

Figure 3.1.I.4 - Mooring at the location of the site organization from km 346

The fencing the site organization is made of woven wire placed on steel poles (Figure 3.1.I.5).

Figure 3.1.I.5 - Fencing the location of the site organization from km 346

Staff employed until the date of the last comments was 12 people, and in emplacement, on the visit date were 4 people. The location is guarded by four guards.

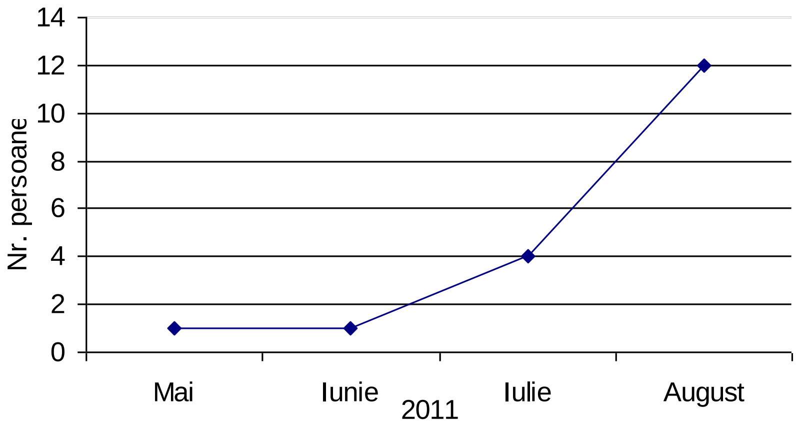


Figure 3.1.I.6 - Variation of the number of people in the period of preconstruction at the site organization in CP 01

Water supply to the construction site is achieved by capturing a natural spring that download free a flow of 0.2 l/s, enough for the needs of the staff.

In the cold season period the heating of buildings will ensure with stoves using biomass.

Critical Point 02

In CP 02 – area of Epuraşu Island, km 342.7 - km 341.8 the site organization is located on the right bank of the Danube and is in conservation, with no activity and no guards.

Critical Point 10

In CP 10 –Caleia Arm (Ostrovu Lupu), km 197-195, in Gropeni, Brăila County there is a site organization in conservation without any activity and without guards. The location is on the left bank of the Caleia arm.

This area is included in the Insula Mică a Brăilei Natural Park and in protected areas ROSCI 0006 Balta Mica a Brăilei and ROSPA 0005 Balta Mica a Brăilei, forming part of the Natura 2000 Network community.

The location of the site organization falls as follows: to the North, the station of potabilization/treatment-chlorination of water (captured through an underground pipeline from the Danube bank) for centralized supply of rural communities in the area. Also in the vicinity of it lies the outlet channel with floating pumping station Gropeni, which provide power to adduction channel CA I- meadow and terrace, in the irrigation system Terasa Brăilei; to the East, the small beach development of the Caleia arm and consolidated local shore with stone; to the South, the meadow floodplains covered with forest vegetation between the shore and the defence pier for big waters; to the West, the longitudinal pier defence.

The location dispose of continues enclosure with metallic fence only on the South and West sides. To the north, the natural border is covered by vegetation which bordered the drinkable water station, located at an elevation superior to the floodplain.

Inside the domain related with site organization (relatively flat terrain) is suspended a barrack above the ground, built and closed completely in the present with laminated chipboard panels. There are not other facilities (toilet outside, fittings, waste collection containers, etc.), and any stored materials, which are intended for preparatory works or those of construction site. Also, there are not loading equipment, land modelling, transport etc.

Arboreal vegetation with low density is represented mostly by willow, followed by poplar and to a lesser extent of acacia.

In the area of the site organization on the left bank there not appear traces of removing existing vegetation.

Critical Point 01

Estimating the impact in the preconstruction phase. Investigations conducted

Impact on water

The wastewater is collected in a septic tank having a volume of 1 mc. Periodically, the septic tank is cleaned, and the sludge and wastewater are transported at urban wastewater treatment plant. Therefore the impact of wastewater discharge on the natural course of water at the location of the site organization is null.

Impact on soil

During the period of observation were not performed movements of equipment in the respectively location, with the exception of an excavator AKERMAN H10 and a bulldozer S100. There have not observed leaks of lubricants or other substances peculiar to their use and maintenance.

Domestic wastes and similar-about 2-3 kg/day (7-8 dm^3/day) are temporarily stored in containers that are shipped regularly to the municipal landfill of waste.

There have not observed the excavations works or storage of other material on the platform of the site organization.

On a surface of about 165 m^2 were deposited the fascines (16 pieces of mattresses) that were to be used in the defence work (Figure 3.1.I.7). Subsequently, the solution of the designer has changed. Fascines were replacement with synthetic materials (geotextiles) which were deposited over an area of about 20 m^2. Storage of both the fascines and the geotextile has not been carried out properly on an emplacement. The constructor did not present the technical sheet of the geotextile that to be used. As a result, given the inadequate storage conditions, we consider necessary to perform chemical analysis to determine if the material is impregnated with persistent organic pollutants.

Figure 3.1.I.7 - Fascine mattresses temporarily stored for the purpose of water transport to another location

For setting the level of pollution of the soil in the area of the site organization at CP 01 were taken 6 soil samples at two depths (5 cm to 30 cm) from the limit of enclosure. The samples were analyzed in the laboratory, the results obtained are presented centralized in Table 3.1.I.1.

Table 3.1.I.1 - The minimum, average and maximum values of indicators concentrations analysed from samples of soil taken from the location of the construction site CP 01

No.	Indicator	U.M.	min.	med.	max.
1.	pH	unit. pH	7,12	7,47	7,77
2.	Conductivity	µS/cm	209	247,5	311
3.	Antimony	mg/kg dm	<0,35*	<0,35*	<0,35*
4.	Silver	mg/kg dm	<0,5*	<0,5*	<0,5*
5.	Arsenic	mg/kg dm	<0,1*	<0,1*	<0,1*
6.	Barium	mg/kg dm	<1*	<1*	<1*
7.	Beryllium	mg/kg dm	<1*	<1*	<1*
8.	Soluble boron	mg/kg dm	<0,01*	<0,01*	<0,01*
9.	Cadmium	mg/kg dm	0,036	0,063	0,116
10.	Cobalt	mg/kg dm	<0,5*	<0,5*	<0,5*
11.	Total chromium	mg/kg dm	4,25	5,97	7,05
12.	Hexavalent chromium	mg/kg dm	<0,01*	<0,01*	<0,01*
13.	Copper	mg/kg dm	9,58	12,34	16,31
14.	Manganese	mg/kg dm	255,9	342,7	404,5
15.	Mercury	mg/kg dm	<0,1*	<0,1*	<0,1*
16.	Molybdenum	mg/kg dm	<0,1*	<0,1*	<0,1*
17.	Nickel	mg/kg dm	2,06	2,74	3,45
18.	Lead	mg/kg dm	2,05	4,96	6,52
19.	Selenium	mg/kg dm	<0,2*	<0,2*	<0,2*
20.	Tin	mg/kg dm	<0,5*	<0,5*	<0,5*
21.	Thallioum	mg/kg dm	<0,01*	<0,01*	<0,01*
22.	Vanadium	mg/kg dm	<0,1*	<0,1*	<0,1*
23.	Zinc	mg/kg dm	39,4	51,85	70,3
24.	Cyanide (free)	mg/kg dm	<0,1*	<0,1*	<0,1*
25.	Cyanide (complex)	mg/kg dm	<0,25*	<0,25*	<0,25*
26.	Sulpfocyanides	mg/kg dm	<0,01*	<0,01*	<0,01*
27.	Fluorine	mg/kg dm	<1*	<1*	<1*
28.	Bromine	mg/kg dm	<1*	<1*	<1*
29.	Sulfur (elemental)	mg/kg dm	absent	absent	absent
30.	Sulfides	mg/kg dm	<1,5*	<1,5*	<1,5*
31.	Sulpfates	mg/kg dm	218,9	298,6	345,2
32.	Calcium	mg/kg dm	174,5	216,7	266,2
33.	Magnesium	mg/kg dm	30,6	37.9	44,3
34.	Humus	%	4,87	7,14	9,03
35.	Organic carbon	%	8,40	12,32	15.58

The impact on air

During the period of observation, both within the site organization and in the area of the execution of the work there has been activity, the identified equipment in the location in question was an excavator AKERMAN H10 and a bulldozer S100. There were not other sources of air pollution; stoves used for heating buildings works only in cold period of the year.

For the determination of the degree of pollution and establish reference levels were collected ambient air samples at a single point and analysed in the laboratory. The results are presented in Table 3.1.I.2.

The obtained values for the monitored indicators are below the maximum permitted concentrations, in accordance with the standards in force.

Table 3.1.I.2 - The obtained values of concentrations analysed indicators at sample of the atmospheric emissions collected on location of site organization CP 01

Poluant	Valoare
oxizi de azot ($\mu g/m^3$)	1,92
monoxid de carbon (mg/m^3)	0,22
particule în suspensie (mg/m^3)	<0,012
oxizi de plumb (ng/m^3)	<2,1
dioxid de carbon (% vol)	0,04

The determination of noise level

Were made determinations of the noise level at the boundary of site organization, and the results obtained are presented in Table 3.1.I.3.

Table 3.1.I.3 - The minimum, average and maximum values for noise level of the location of site organization CP 01

	LZeq (dB)		
Condiţii trafic	**Mediu**	**Maxim**	**Minim**
Trafic naval "0"	41,2	57,6	25,3
Trafic naval	42,3	59,7	26,6

The impact on biodiversity

Arboreal vegetation on site is missing, were met the specific plant associations of the natural spontaneous eco-systems and anthropized on the banks of the river and river islands. The monitored site is included in the protected areas of ROSPA-0039 Dunăre-Ostroave and ROSCI 0022 Canaralele Dunării, part of the Community Network Natura 2000.

Because the location of the site organization is located in an area where it was not necessary to cutting of trees, vegetation is the ordinary vegetation of the Danube, not having a particular value. The birds are not affected by the two temporary constructions or the presence of those few people who temporarily living in the area, even more so that the equipment identified on the spot have not worked. Itineraries and places of migratory stopover for avifauna do not intersect with the location of the site organization.

<u>The landscape impact</u>

Location area of site organization being very weak anthropic, we consider that from the point of view of landscape can indicate a significant impact. The analysis of visual impact has been carried out and with the help of some photomontage. Comparison of Visual images containing site organizing with those of existing landscape give a significant measure of the impact of landscape given by the respective works. Figures 3.1.I.8 - 3.1.I.10 are relevant in this respect. Consider it necessary that at the end of construction works, the location of the construction site to be restored to its original state.

Figure 3.1.I.8 - The location of the site organization at km 346 – Landscape

Figure 3.1.I.9 - The location of the site organization at km 346 – Landscape

Figure 3.1.I.10 - The location of the site organization at km 346 – Landscape

Critical Point 10

The construction relating to the site organization is in conservation and in the area of works is no activity; as a result there were no identified sources of pollution of the environment factors.

Recommendations and mitigation measures of the impact

Avoid uncontrolled use and storage of building materials. Also, the equipment used will have to be checked periodically to avoid technical failures leading to loss of petroleum products.

The constructor has not submitted technical sheet of the geotextile before to be used. As a result, given the inadequate storage conditions, we consider necessary to perform the chemical analysis which to determine if the material is impregnated with persistent organic pollutants.

To reduce the impact it is necessary to be taken the following measures:

- coverage the deposits of raw materials in order to reduce the action of the wind
- periodic verification of the equipment of technically
- the use of the recent generation machines, equipped with advanced systems for minimizing and retention of pollutants in the atmosphere
- regular watering of roads used by construction equipment, especially in the warm season
- the use of liquid fuels needed to the machinery and trucks that respect the rules in force on pollution
- must take into account the possibility of periodic verification of the integrity of the network of wastewater evacuation.

Parameters that will be followed especially during the course of construction:

Nr.Crt	Parametru	Indicator/Mod de evaluare
1.	calitatea aerului în zona lucrărilor	particulele în suspensie, oxizii de azot, oxizii de plumb, monoxid şi dioxid de carbon.
2.	nivelul de zgomot din zona lucrărilor	LZeq (dB)
3.	modul de colectare, depozitare şi evacuare a deşeurilor	fotografii/filmări
4.	modul de depozitare a produselor petroliere	fotografii/filmări
5.	modul de depozitare al materialelor de construcţii	fotografii/filmări
6.	respectarea planului de intervenţie în caz de poluări accidentale	Recoltari de probe, fotografii/filmări
7.	peisajul	fotografii/filmări
8.	situaţia numărului de personal	organigrama, fotografii/filmări
9.	situaţia numărului de utilaje folosite în cadrul lucrărilor	fotografii/filmări

Encountered difficulties

On the duration of monitoring during the period of preconstruction phase the Provider had not the plan on prevention and combat of accidental pollution, the Execution Plan and Gantt chart with execution works, which are necessary to be able to more effectively correlate activity monitoring. Also in discussions with the local people identified 2 barges belonging to the manufacturer, one sitting on the right and another at approximately 700 m on upstream of the construction site, at the trestle.

To date no plan was not sent, although were requested to the contractor and AFDJ.

3.1.J. Numerical Modeling

The need to assess the impact on surface water populations has led to the development of several habitat modeling techniques. The applicability of these ecological and climatological models at the level of the various regions has not yet been demonstrated and therefore need to be validated.

The purpose of such modeling is to provide decision makers with information regarding biological changes and the impact of these changes, so that the decisions are taken by considering the potential ecological effects.

The habitat modeling techniques are generally based on hydrological, morphological and hydraulic parameters because they influence the distribution and abundance of aquatic organisms.

- The morphological characteristics: substrate distribution, type, shape, stability, geometry - local elevation of the cross-section, bottom roughness, sediments porosity, bathymetry, particle shape, cross-sectional profile, channels or banks stability, river tortuosity, presence of obstacles, nearby land use, permeability layers, geomorphology, elevation etc.
- The hydraulic characteristics: laminar/turbulence flow, local velocity, flooding perimeter, vertical hydraulic gradient, turbulence, velocity in cross-section, water depth, spatial velocity.
- The hydrological characteristics: base discharge, maximum and minimum, duration, dry periods, daily, seasonal, inter-annual discharge variations, flood and drought system, frequency, magnitude, discharges spatial variation, seasonal variability, continuity of the flow, precipitation, average, maximum and minimum temperature.
- The size of the area to assess: pico-habitat, micro, mezzo and macro habitat or habitat to region level.
- Other factors: water temperature, light, water quality (oxygen regime, pH, conductivity, toxic substances, nutrients), type and amount of suspended solids.

The modeling results and its limitations:

- Integration of data in indexes
- Temporal analysis
- Spatial distribution of habitat quality.

Among the limiting factors of modeling can include:

- Costs and time required for data collection
- Insufficient or insufficiently precise data
- Biological interactions cannot be modeled, for example interaction with terrestrial ecosystems
- Direct or indirect human impact (e.g. fishing).

The most important parameters:

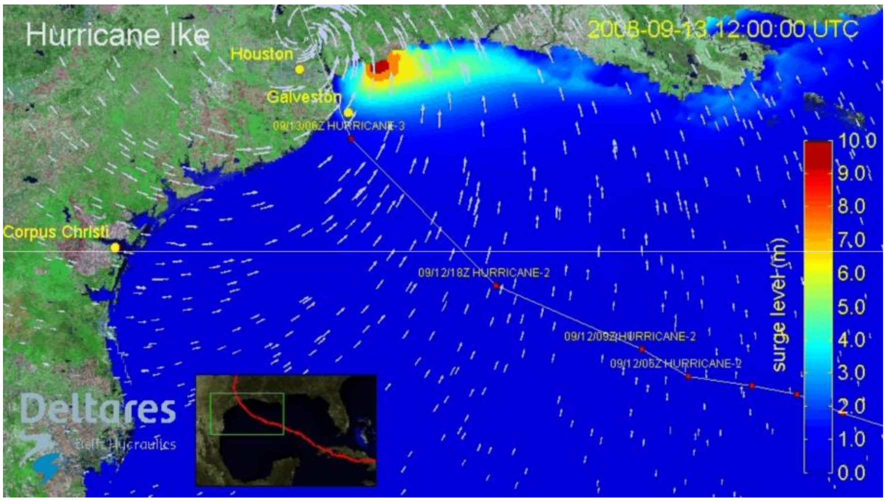
- Water velocity - is the most important parameter. The development of new equipment makes possible the simultaneous collection of more data (location, depth, velocity).
- Shear (tangential stress) the water movement determines in certain areas of their involvement bottom or banks. It depends on the density of water, gravity, hydraulic gradient.
- Adâncimea apei.
- Flow rate - the water volumes that pass through a particular section in a unit time.
- Suspended materials and sediments flow per unit time through a section
- The substrate particle size.

Types of programs for the assessment of habitats:

- MIKE habitat module
- PHABSIM (physical habitat simulation; Bovee 1982; Milhous et al. 1989)
- RHABSIM (river habitat simulation) used in the United States of America
- RHYHABSIM (river hydraulic habitat simulation; Jowett 1989) used in New Zealand
- EVHA (evaluation of habitat; Ginot 1998) in France
- CASIMIR in Germany (Jorde 1997)
- RSS (river simulation system; Killingtviet & Harby 1994) in Norway
- FLUENT
- FIDAP
- STAR CD
- 3D CFX

- FLOW 3D
- COCIRM
- CH3D
- TABS
- TELEMAC
- SSIIM is acronym for Sediment Simulation in Intakes with Multiblock.

Deltares has developed a software of modelling called Delft3D. This is a flexible integrated model that simulates in 2 and 3 dimensions the flow, sediment transport and morphology, water quality and ecology and can integrate these three processes. The system is designed for both experts and non-experts, consultants, engineers, to government.



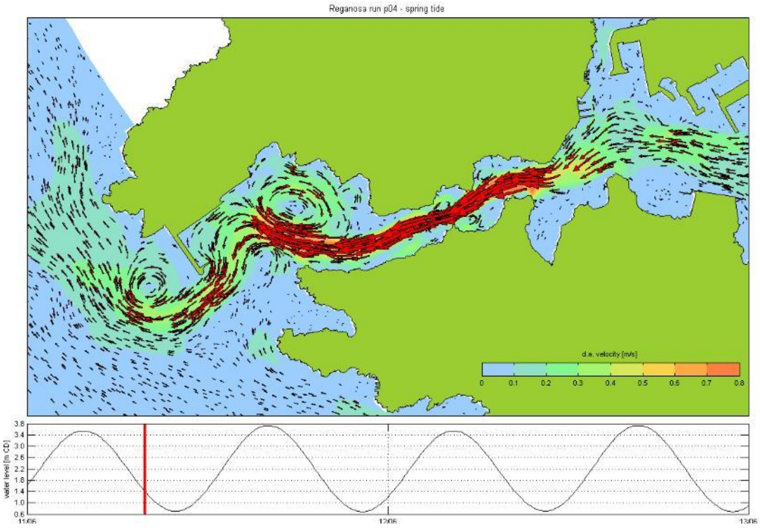
<u>Components</u>

Delft3D allows the simulation of the interaction between water, sediment, water quality and ecology in time and space. The package is used for modeling the natural phenomena, but also the artificial ones. The package consists in three components tested and validated.

FLOW (Hydrodynamics)

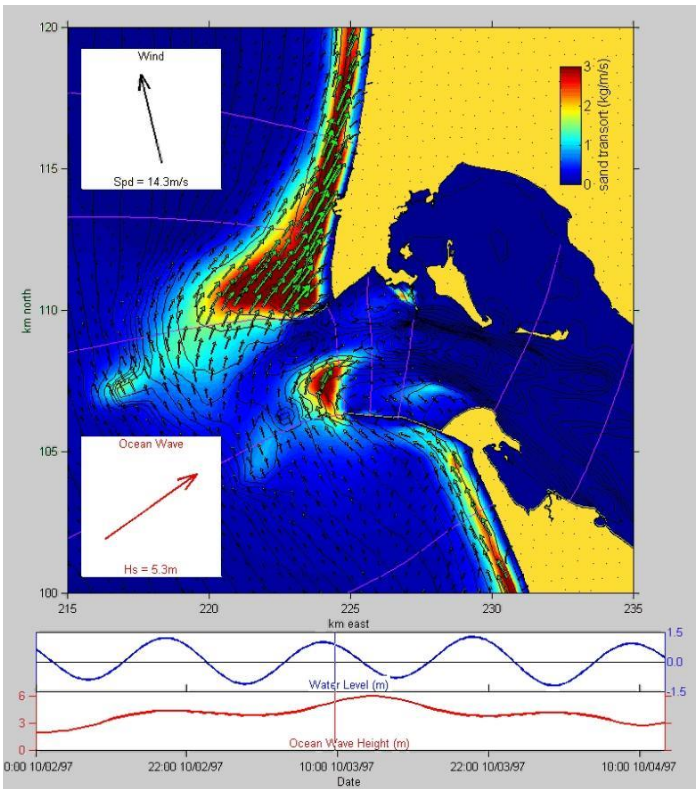
This component simulates flows in relatively shallow waters. It incorporates the effect of waves, wind, atmospheric pressure, density (salinity and temperature), turbulence, drought and flood. The module's outputs are used in the other Delft3D components.

The standard part is 2D but it expands easily to 3D, through 3D modeling of the discharge, turbulence, spherical grids and structures.



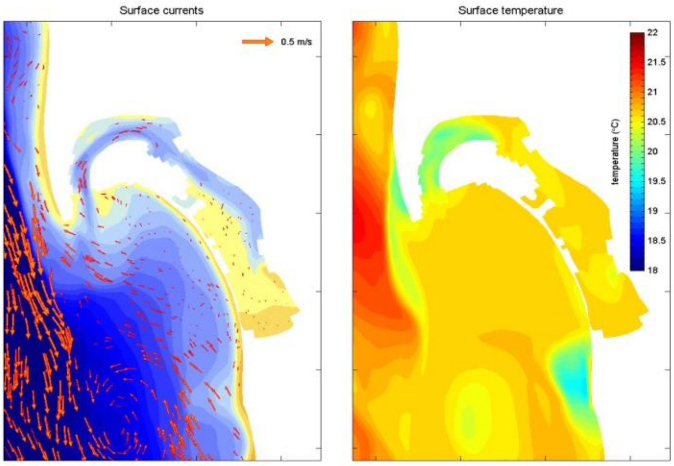
MOR (Morphology)

This component is used for modeling the sediment transport (suspended and total) and the morphological changes. It shall take into account the effects of density. This component has direct feedback with FLOW and WAVE components, which allows adjusting the flow rates and waves at local bathymetry and allows the simulation for any period of time.



WAVE

It calculates the dynamic propagation of small waves over a bottom sill, taking into account wind and energy dissipation, breaking waves, refraction (due to bottom topography). This component is based on SWAN spectral model.



WAQ (Water quality)

This component simulates water and sediment quality as a result of transportation processes. It can be appreciated the CBO and nitrification decrease, the exchange of substances with the atmosphere, contaminants adsorption and desorption, deposited or resuspension of particles. The program includes a database.

SED (Sediment transport)

This module simulates the transport, erosion, deposition of suspended matter or sediments. The component includes several standard formulas concerning the transport and considers various independent fractions. It doesn't take into account the bottom morphology modification and therefore assesses only the short-term transport.

ECO (Ecology)

The component describes the processes that govern ecosystems and the interaction between them. The component includes a relevant database used for the eutrophication process.

PART (Particle tracking)

This component estimates the short-term spatial and dynamic distribution of the particle concentrations.

The preliminary analysis and the construction of the mesh network

In the first two months we preliminary analyzed the mesh topology model of the area to be 3D modeled. To this end, the model was divided into multiple subdomains, each characteristic for each branch of the Danube. The borders of these subdomains are located in various bifurcation points on the branches. The meshing cells that we studied were polyhedral type with quadrilateral faces.

We analyzed the preliminary requirements thus generated networks/grids, the requirements necessary to achieve hydrodynamic calculations correct, namely:

- Orthogonality
- Rate of change of size and direction: smoothness, curvature
- The ratio between the mesh on different directions.

The DELFT3D software developers indicates that for the grid quality analysis are important especially orthogonality and moderate gradual modification of the network (smoothness). The angles between the lines of the network should be very close by 90 degrees (cosine angle value less than 0.02).

The ratio between the sizes of network's neighboring cells should be below 1.2 and for those located further under 1.4. The meshing on different directions should be within an aspect ratio that does not exceed 2, but the ratio may be higher where the flow is directed along a line of the network. The application of these general criteria is limited by the allowable size of the network, which determines the duration of the calculation.

The orthogonality requirement stipulates that all 4 angles of quadrilaterals have not a deviation greater than 5° to an angle of 90°.

Following the preliminary analyzes and tests it resulted that the smoothness need involve the difference between successive cell dimensions of a network of less than 10 % for the main channel and less than 25 % for floodplain.

In an area with various orientations of tidal - longitudinal and transverse, the ratio between the two dimensions of cells should not differ greatly from the unit, by allowing, however, that this report does not exceed 4 over the branches (for not having cells/finite elements too sharp).

For this purpose, the informational volumes have been analyzed and were made mesh networks simulations and also were made simulation of the elements/cells size for the first two subdomains:

- Bala branch
- Upper Danube between Izvoarele and Bala branch entrance.

On the basis of the held information, preliminary tests have been done at the other critical points.

The grid used was that of DELFT3D software package.

For Bala branch it was tested, in the pre-construction second month, a preliminary mesh network with 25000 cells to cover the main channel/minor riverbed and 46000 cells for major riverbed (excluding the main course already coveredt).

After some preliminary tests, it was succeeded - in a proportion of 96% - to be covered the 3 criteria required for a conformal mesh network, which gives us real hope of being able to complete the mesh geometry model with a high trust level in accordance with the work plan agreed with the 3D modeling experts from Boku, Vituki and Deltares. The biggest problems have occurred in areas where Bala branch has a curvature (inflection) very pronounced, area where we had to test a model using small finite cell/elements. We used cells of comparable size for modeling the area where will be achieved the bottom sill.

On the basis on analyzed informational volumes in the 3rd month within the pre-construction period it was continued the mesh network pre-development for the Upper Danube sector between Călărași and Bala branch bifurcation entrance. Also, were made previous tests at critical points.

This area has a size at least double that the one modeled in step one. For example, after some preliminary tests, for this subdomain we managed also the meshing on a network with about 42000 cells to cover major riverbed and one with 67000 cells to cover these adjacent area - floodplain until the defense dams, such data being informative, but useful for building 3D models.

After a few preliminary tests, it was succeeded as for this subdomain - in a proportion of 93 % - to be met the three imposed criteria on consistent mesh networks, which confirms the correctness of the developed work plan.

Another operation that began in the third month of the pre-construction period, consisted in designing - by using GIS techniques – of all the relevant hydraulic and morphologic characteristics over grids created thereby. These primarily included: Danube riverbed topography, its composition, hydraulic roughness coefficients, which for floodplain area were based on CLC data - Corine Land Cover (vegetation land cover), and hydraulic structures - especially longitudinal defense dams. This operation was achieved by automatic correlation between analytical centers elements (cells) coordinates of the interpolation networks and spatially referenced information, in the same coordinate system, regarding the hydraulic and morphological characteristics set out.

An operation that required a large amount of laborious calculations and analysis has been the design/the overlay of bathymetry data over the grid cells.

The bathymetry data obtained by using the two techniques multi-beam and single-beam, were interpolated into several successive stages, so that it can finally attach an absolute value to each cell of the bottom riverbed share network - in Stereo 70 MNS.

All these elements of configuration and implementation of the 3D model for the two considered subdomains have been carried out in close collaboration with modeling experts form Boku, Vituki and Deltares. All data were transmitted between partners via FTP created especially for the transmission of real-time information between partners.

The results of these tests and constructions create the premises for the complete achieving of 3D modeling network in accordance with the Technical Offer.

Because the minor and major Danube riverbed has complex configurations, the network is built in several steps, by successive operations to include specific requirements that determine the flow structure in different areas.

First, some elements for the river sector and for studied situations are taken into account:

- Range of flow rates
- The flow of water
- Main branches with their ramifications and confluences
- Particular elements on the branches
- Configuration riverbed.

The figures below are examples of the particular elements of the flow domain which is taken into account in the building of the network.

At the same time, is presented an example of a calculation network that follows the path of a river branch (Bala branch).

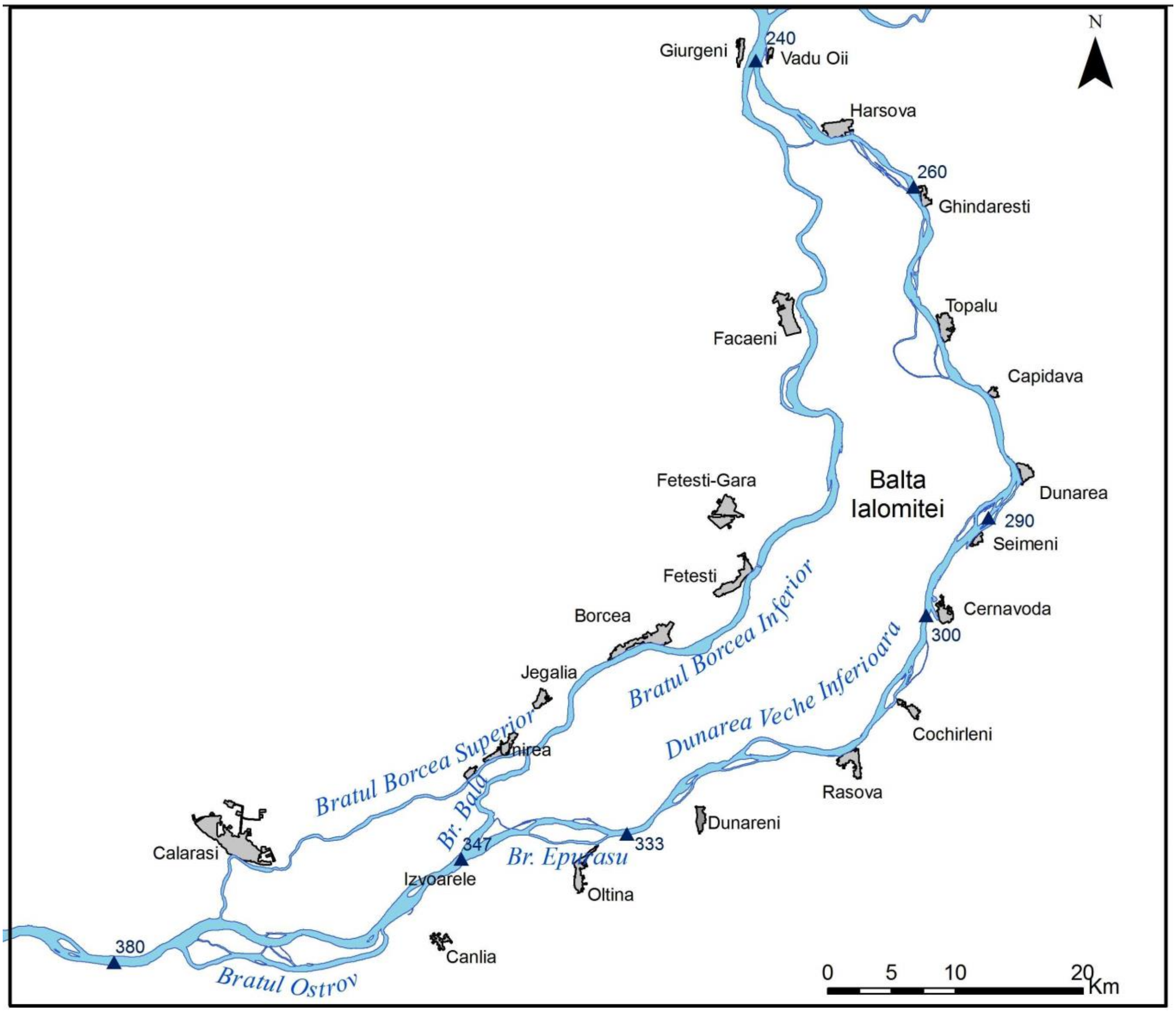


Figure 3.1.J.1 - Particulars elements of configuration on Danube branches - between Călărași and Hârșova - which will take into account for building the computing network

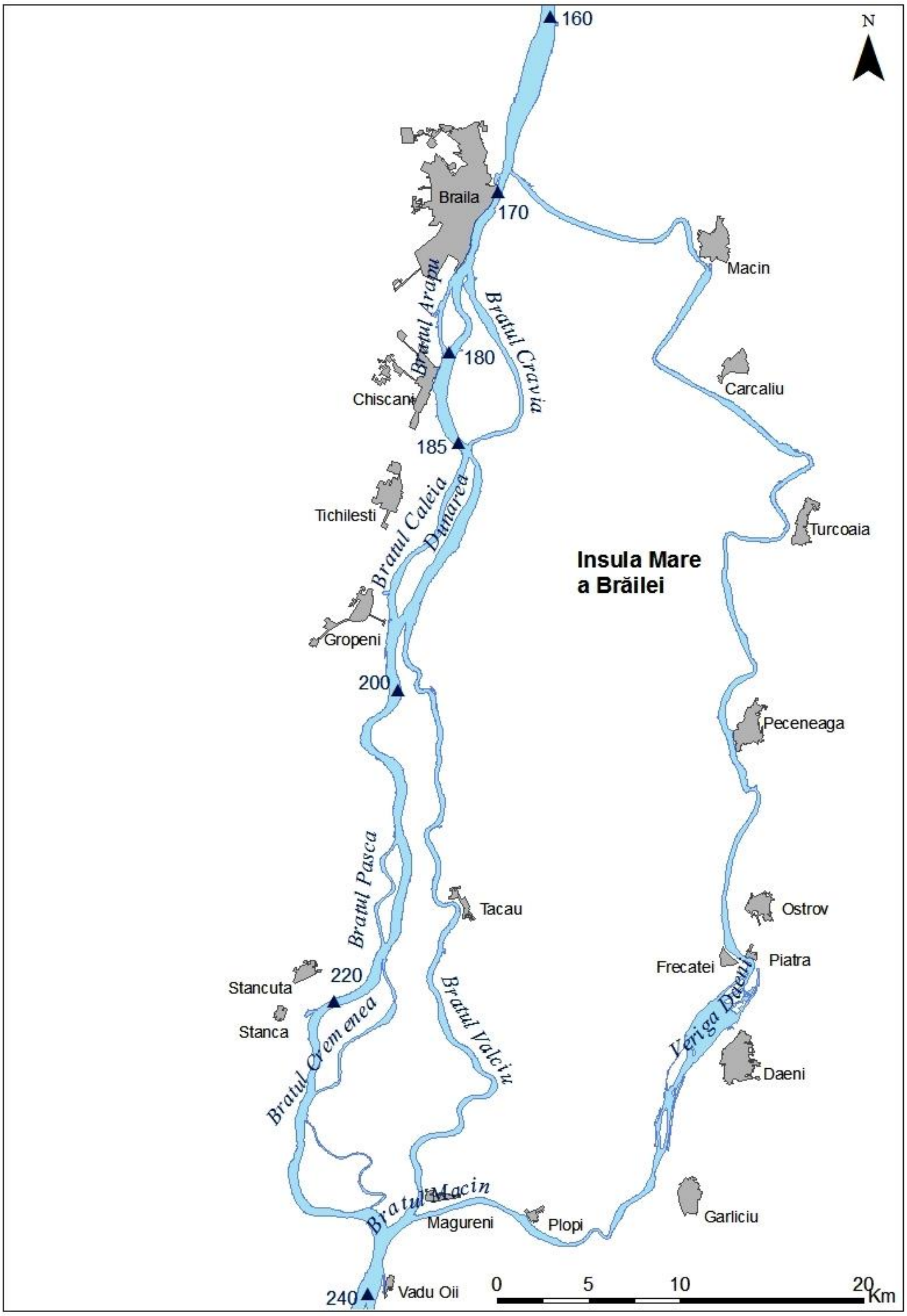


Figure 3.1.J.2 - Particulars elements of configuration for building the computing network on Danube branches - between Hârşova and Brăila

Figure 3.1.J.3 - Particulars elements of configuration on Bala area for building the computing network

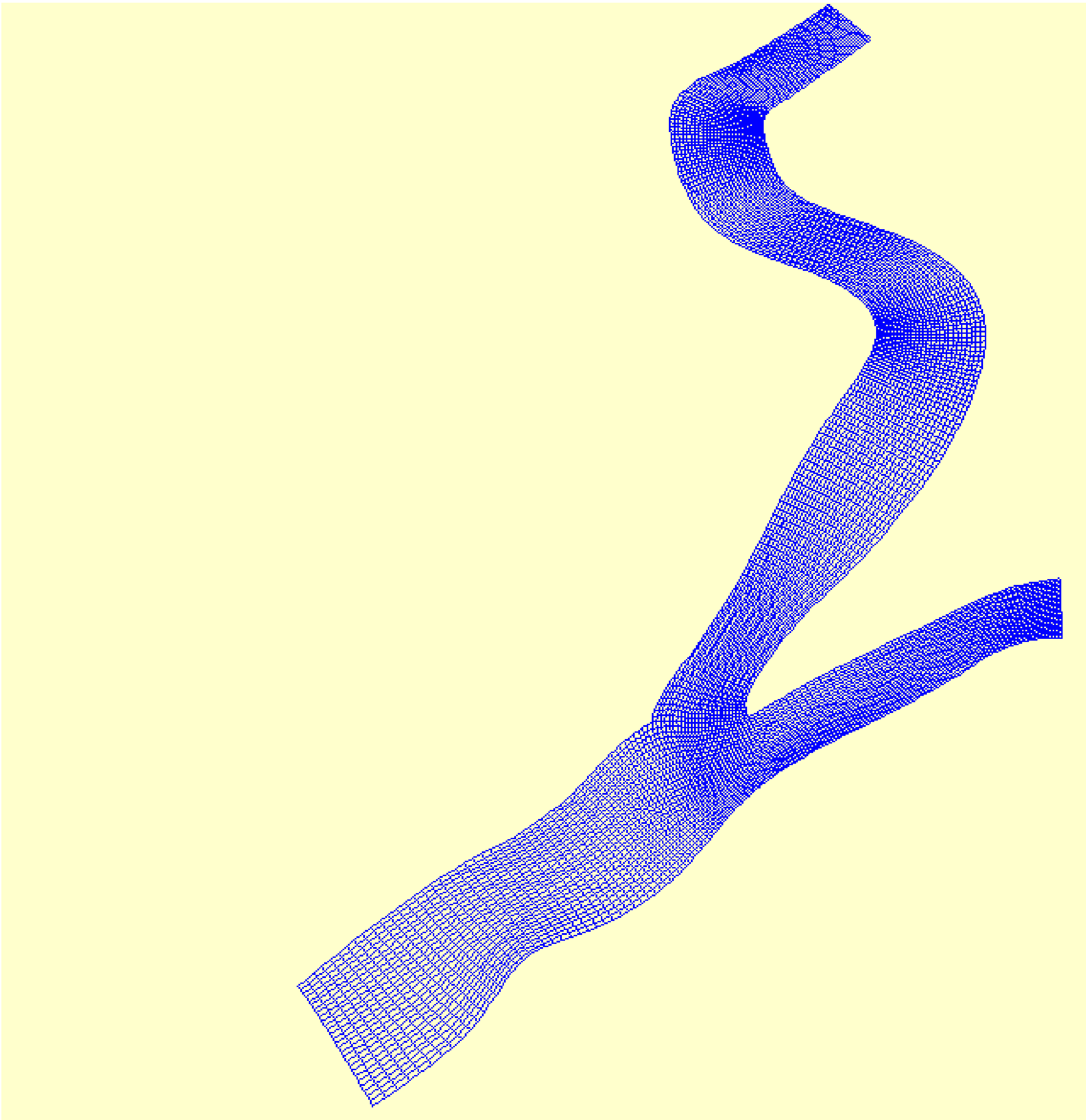


Figure 3.1.J.4 - Computing network on Bala area

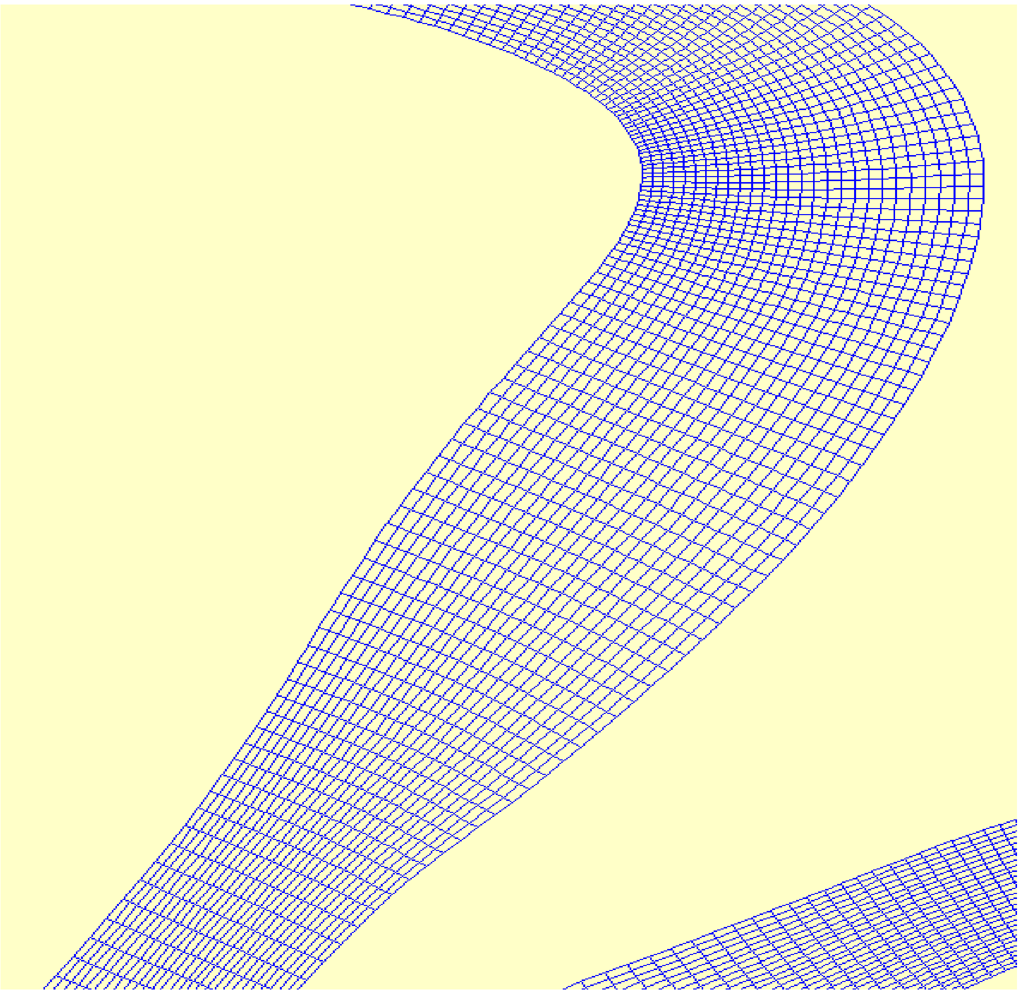


Figure 3.1.J.5 - Computing network on Bala area - detail view

To adapt the configuration of computing network to the riverbed and flow domain, a balanced treatment is needed, taking into account different aspects:

- The flow structure is influenced by the configuration of minor and major riverbed
- A computing network should include items of interest to study
- The software results depends on the computing network
- A very dense computing network greatly increases the calculation duration
- The uneven configuration of the natural Danube riverbed requires a dense computing network
- The branches and some local elements must be included in the calculation.

In the following figures are presented examples of computing network characteristics. The analysis of these features, using Delft3D software package tools, allows successive improvement of the network in some areas considered critical in terms of geometric configuration.

The changing operations of the computing network can lead to different results. Therefore, it takes great care to preserve as far as possible the improvements achieved by the earlier refining network operations.

Using the built computing network, are inserted into calculation the data concerning the entry and the out conditions on studied sector and are obtained results in different intermediary areas. Therefore, the computing network must include sections or points required for specifying the input data and to obtain the necessary results for the study.

Another stage of network improvement will be based on the calculations results, which will show the areas where are needed detailed configuration of the network and data. The software developers indicate that for areas with special hydrodynamic features which are important for the study should be a local network for at least 1/5 or 1/10 of the size at which this phenomenon occurs. For such modifications and adaptations of the network will be contemplated the ramifications and areas where the calculations will indicate the phenomena of complex water circulation.

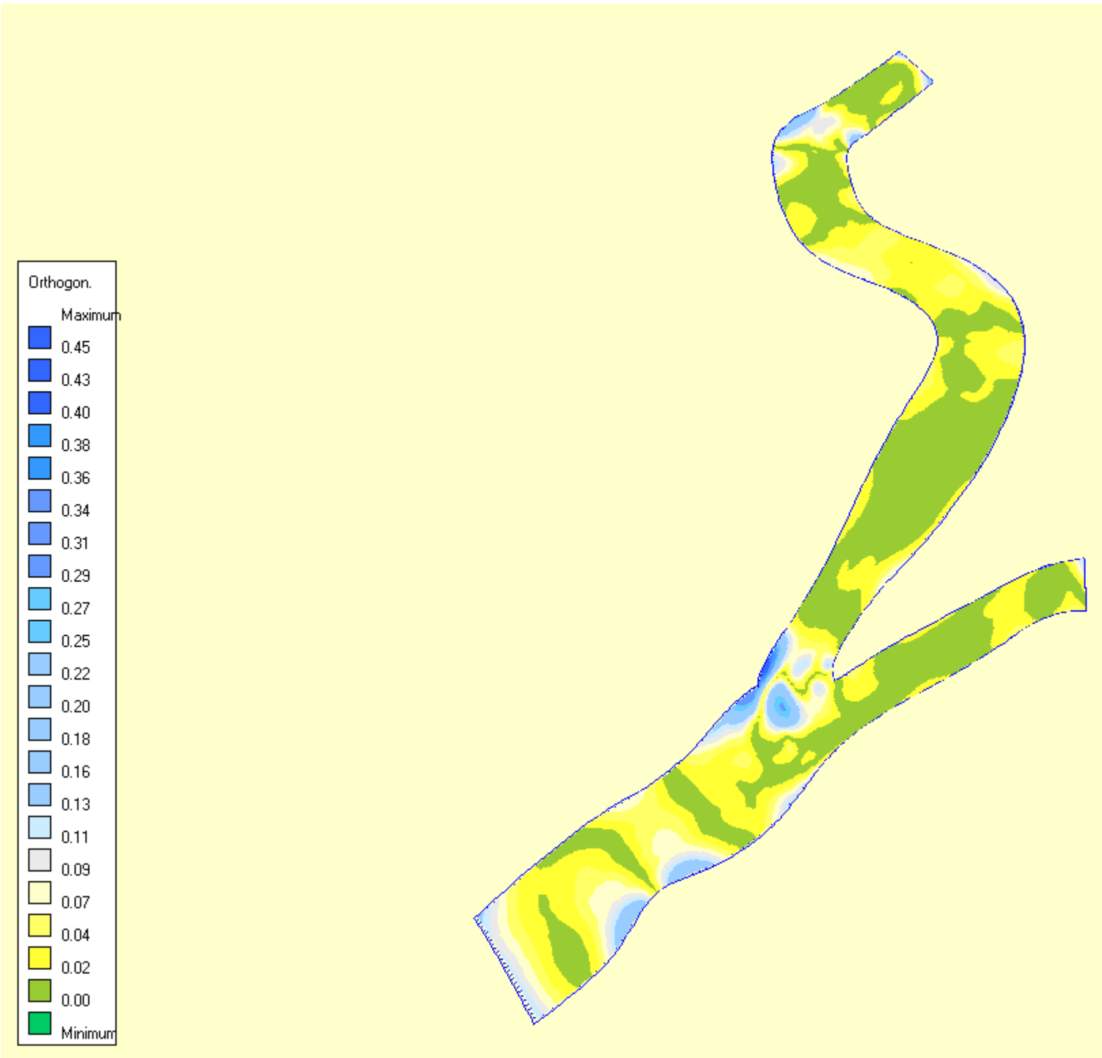


Figure 3.1.J.6 - Orthogonality analysis for computing network on Bala area

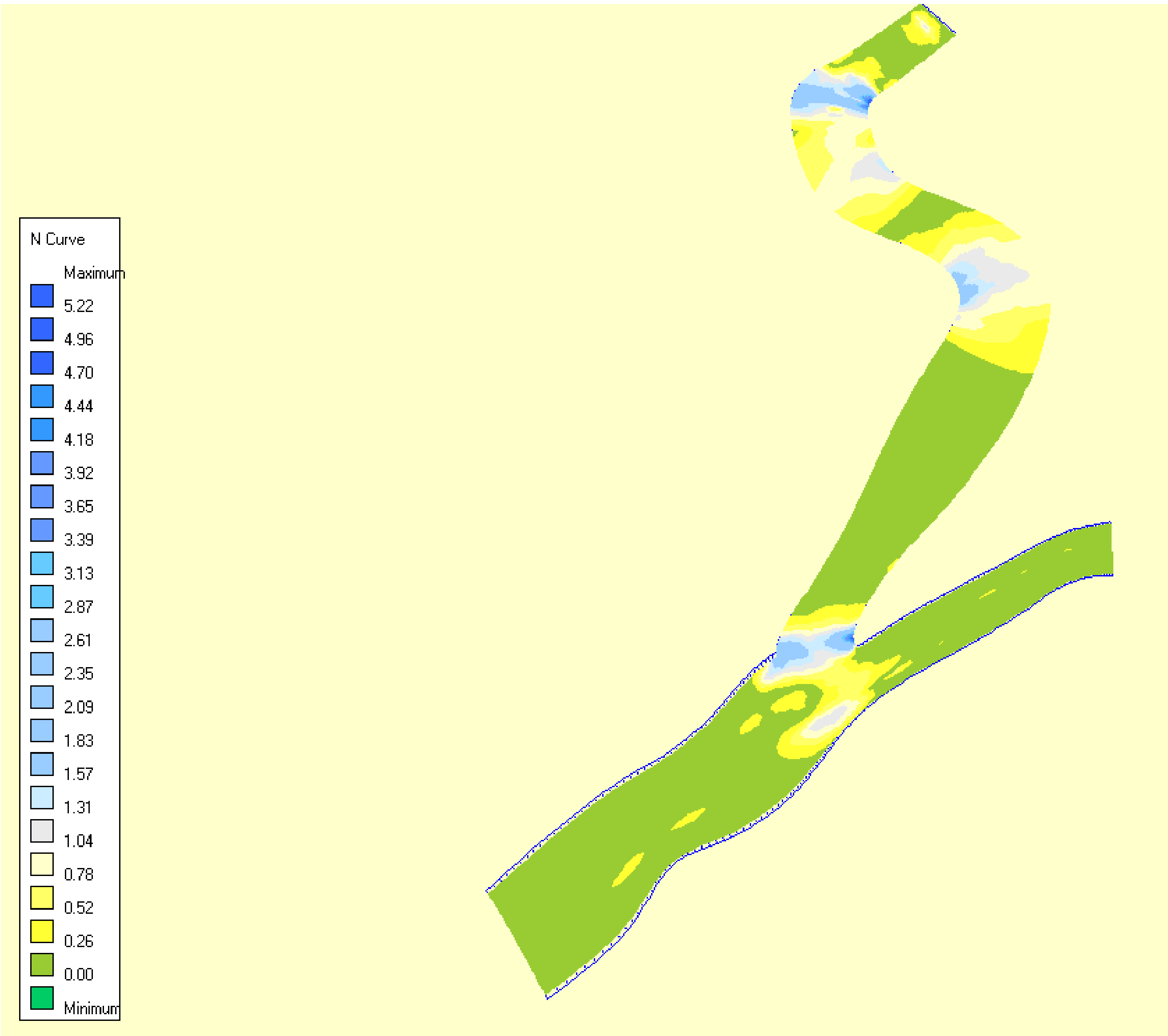


Figure 3.1.J.7 - Curvature analysis for computing network on Bala area

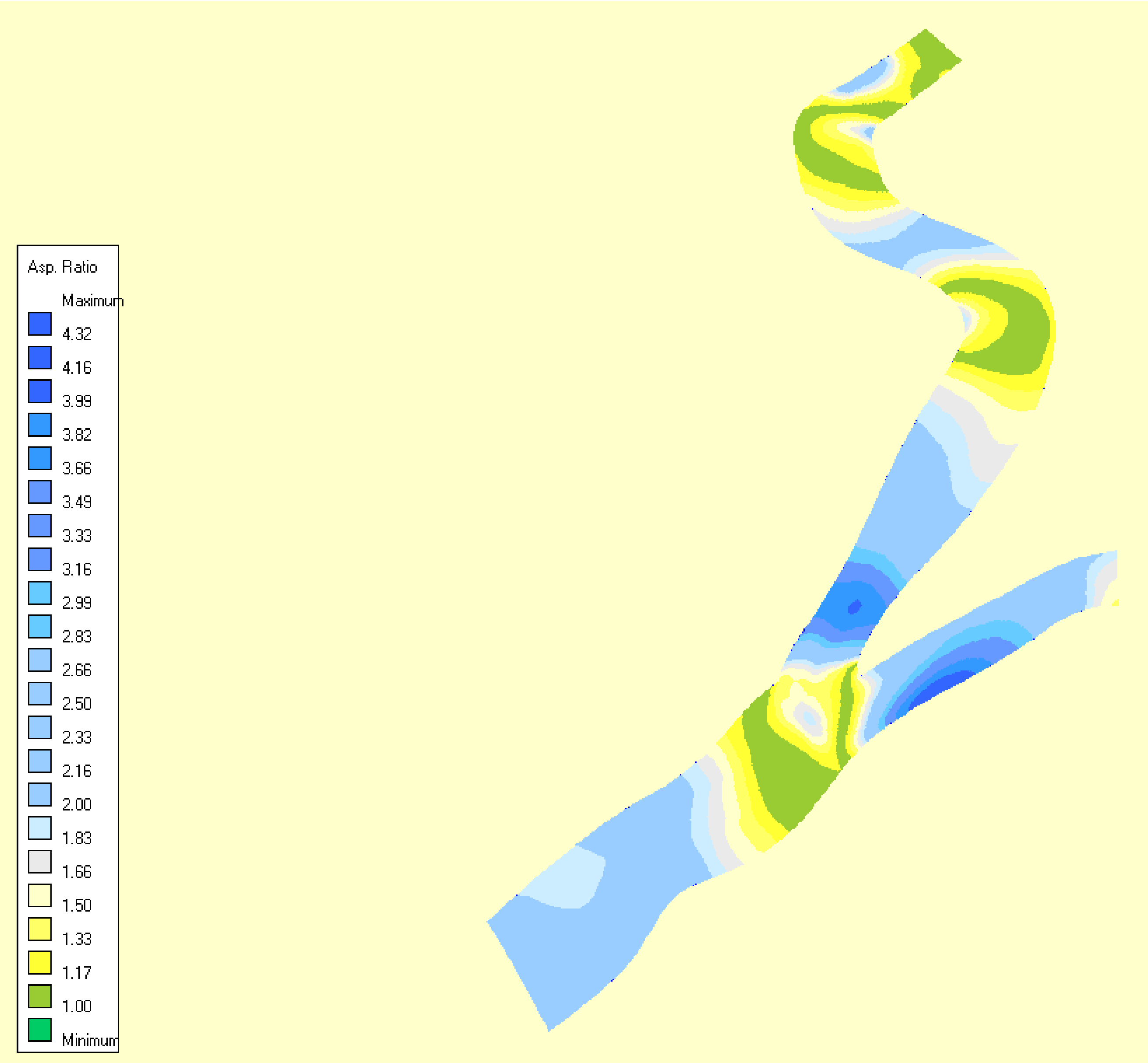


Figure 3.1.J.8 - Aspect ratio analysis for computing network on Bala area

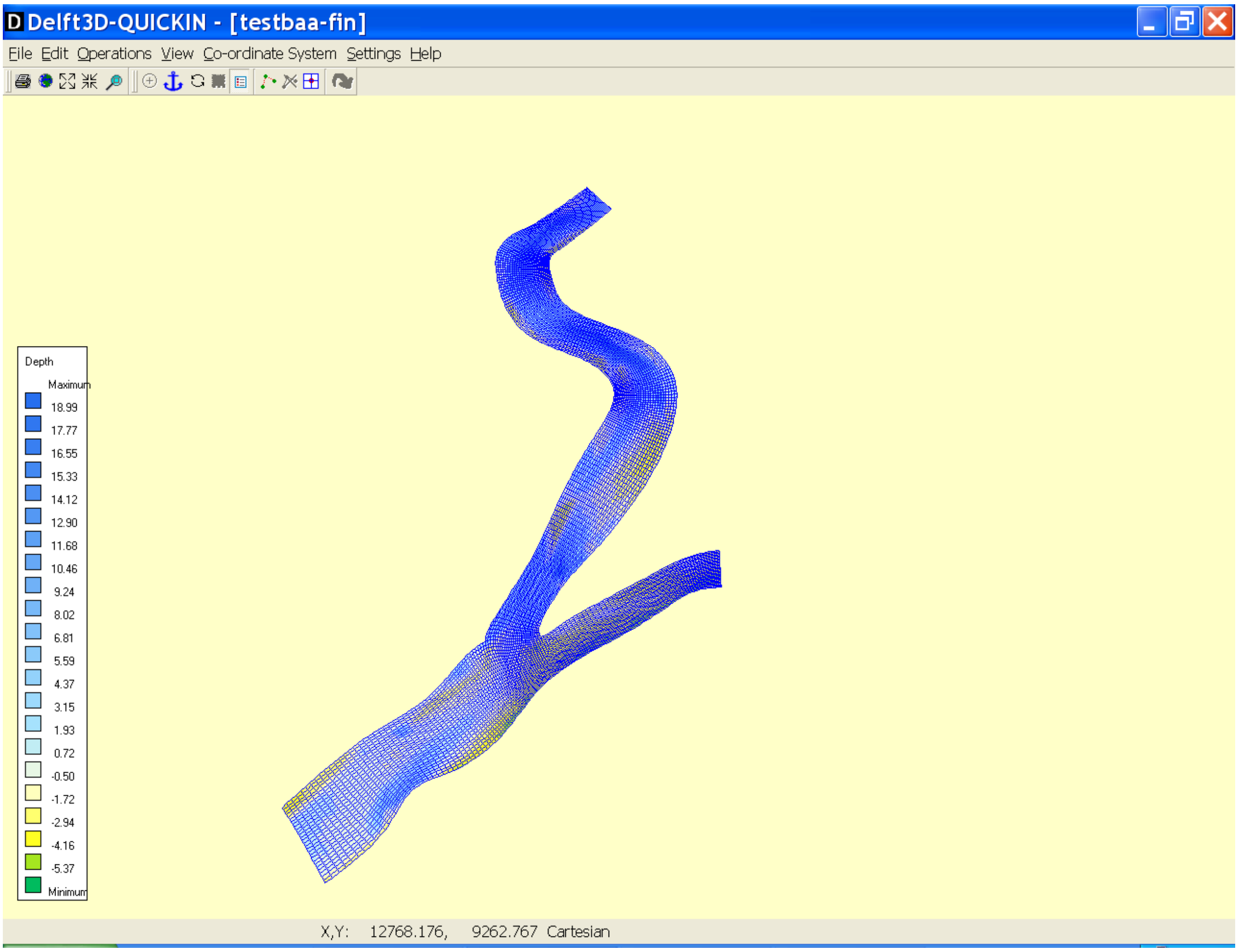


Figure 3.1.J.9 - Computing network with bathymetric on Bala area

We note that in the above figure, as well as in the legend, the significance of the variable "depth" is not that deep, but absolute altitude (reported at MNS-Black Sea Sulina quote) of the Danube riverbed - bathymetric values obtained by interpolation from the respective cells.

<u>The 3D model building</u> is based on bathymetric data of the Danube branches:

- Historical data available concerning the cross-sections of Danube and its branches, on the entire sector
- Bathymetric data obtained within the project in the critical points areas, with high density.

They contribute to the representation of the geometry of the Danube and its branches.

The entering of flow rates and water levels values in the model, the startup and preliminary calibration begin from the data from Danube and its branches hydrometric stations:

- Multiannual limnimetric keys at hydrometric stations;
- Levels series recorded at hydrometric station over a period of several years, including also the years with the lowest and those with very high recorded levels;
- Data concerning the discharge distribution on branches.

To be possible to obtain a model that reflects the existing conditions of water flow on the Danube and the main branches, these data are required from hydrometric stations from upstream, downstream and the middle sector and also from the main branches.

For the proper calibration of the current situation and for validating the model for this situation, we use recent data from the hydrometric stations and from critical points areas:

- The flow rates measured in the last year at hydrometric stations, on the entire sector
- The flow rates measured from the vicinity of critical points
- The water levels series measured at the hydrometric stations.

Because the water levels recorded in 2011 were mostly in the area of low values and even extremely low, these data are very useful, but does not provide enough information on a timeframe for the model. It is necessary to be added the data that will be measured in 2012, to cover the normal ranges of water levels on the Danube.

The general existing 3D models have features determined by the issues for which it was constructed and developed. They are further improved and supplemented with new modules by the teams that created them, but they are far from completely cover the categories of water bodies problems.

On the other hand, the Danube studied sector has a very complex configuration and includes many branches, and the existing hydrometric network is at the minimum required.

For these reasons, the building of a 3D model is first a scientific problem of conceptual modeling within reasonable limits of the areas studied, taking into account the knowledge and current possibilities.

Then, it is a problem of effective constructing the model, using appropriate software, with representative data for different parts of the sector and with the estimated parameters based on data and knowledge.

During the project, it is possible to find that the necessary elements of the study may be provided more appropriate software packages that deals better with one category of problems, based on the data which will be measured.

Collection and analysis of data

For the development of the 3D model it must be built a hydrodynamic and a sediment transport model.

The hydrodynamic model will be used to assess the influence that various scenarios have on the main hydrodynamic parameters such as water levels and depths, velocities and discharges and for the extraction of the design parameters of the structures that will be implemented.

The sediment transport model uses the hydrodynamic model results and will be used to estimate the influence of measures on sediment transport and morphological changes on the Danube.

The following sections describe the data that has been prepared and will be used on the development, calibration and running the 3D model. Some of these data are presented in Annex 5.6.1.

1. Data required for typical behavior of the Danube.
    - Limnimetric key (flow-level relation) for a hydrometric station located at the downstream extremity of the modeled area, which will be used to define the boundary condition of the model downstream extremity. This limnimetric key will be built for a historical period of 40 years.
    - Historical discharges for a station located at the upstream extremity of the modeled area, data that will be used to define the boundary condition of the model upstream extremity. Historical discharges correspond to the hydrometric station Chiciu-Silistra Călărași and cover the 1970-2011 period.
    - Historical percentage distribution between the Danube different branches, depending on the total flow.
    - Historical data set regarding the riverbed topography, data that will be used to define Danube morphology trends.
    - Information about the transport of the sediments at different flow rates of water outflow.
    - Information about the dredged volumes, the areas on which were executed dredging works and the dredged material storage areas.

2. Recent data - necessary for the hydrodynamic calibration of model (the entire year 2011 - necessary expansion whereas during the pre-construction period - 4 months - there have been recorded low flow rates on Danube).
    - Flow rates in a hydrometric station located upstream extremity of the modeled area – Chiciu-Silistra Calarași hydrometric station.
    - Water level – appropriate for these discharges - measured in hydrometric station of the downstream extremity of the modeled area.

- Water level at available hydrometric station located along the main course and the side Danube branches.
- Percentage distribution corresponding to the analyzed period between the different branches of the Danube by the total flow of the upstream station - Chiciu-Silistra Calaraşi.

3. The data set for validation (hydrodynamic), similar to calibration data set, but different in relation to time.
4. The calibration data set (morphology) will be deduced by analyzing the riverbed level trend.
5. Polygons representing the type of vegetation: polygon shapefiles that identifies different types of vegetation on the major riverbed. These data will be used to determine the roughness coefficients of the major riverbed.
6. Information about the composition of sediments from the riverbed.
7. Information about the riverbed fixed layer (non-erodible).
8. Information about the existing protections banks, obstacles, hydraulic structures etc.
9. Information about flow rates falling or leaving the modeled area.
10. Water quality data; these data are not strictly necessary at the beginning of the project, but are needed after the start of the setting water quality model.
11. Information about the water quality monitoring: temperature, suspended sediment, dissolved oxygen, nitrogen and phosphorus.
12. Information about water quality monitoring regarding to the upstream limit concentrations.
13. Quantitative information related to wastewater flow - volume and loading.
14. Information about the water quality monitoring in the study area, for purposes of model validation and calibration.
15. Information about the habitat sustainability – these data is not strictly necessary at the beginning of the project, but necessary after setting the habitat model.
16. Calculation rules for all ecological variables relevant to the area of study.
17. Information obtained through the monitoring of all ecological variables related to validate the computing rules implemented in the Habitat model.
18. The relation between environmental variables and Habitat Sustainability Index (HIS); it must be calculated on a scale from 0 to 1, before implementation in the 3D model.

Distribution on the Danube branches

On the main branches of the hydrographic systems Balta Ialomiței and Balta Brăilei, the water outflow evolution over time, is different from how it occurs on the Danube. Thus, a number of branches have a tendency of natural aging and so decrease the transportation capacity (Borcea branch upstream junction Bala branch, Old Danube branch, downstream Bala branch, Măcin branch bifurcation), while others are active branches, where prevailing transport phenomena (Bala branch, Borcea branch downstream confluence Bala branch).

In order to properly assess the variation in time of the outflow on branches, this must be based on the water flow rate from upstream of the hydrometric station on the unique Danube (Chiciu – Silistra station).

It is defined as the flow distribution coefficient of a specific branch, the ratio of the amount of flow on that branch and the unique Danube flow.

For the Balta Ialomiței hydrographic system branches the distribution coefficients are determined based on the unique Danube flow rates at Chiciu-Călărași. For Balta Brăilei hydrographic system the distribution coefficients are determined based on the unique Danube flow rates at Vadu Oii.

These data are inputs for 3D numerical model, both for defining the typical behavior of the Danube's flow and calibration of the model.

In Table 3.1.J.1 are shown the values of flow rates distribution coefficients of the Danube, at Chiciu-Călărași, on Balta Ialomiței branches system.

Table 3.1.J.2 includes the values of the discharges distribution coefficients in Vadul Oii on the Balta Brăilei branches system.

In both tables are present the distribution coefficients for the 1977-1987; 1998-2003 periods compared to January-August 2011.

We note that in these tables we used historical data on which we had access - 1977-1987 and 1998-2003 periods (data used in Studies of Environmental Impact Evaluation - 2005 and 2006) and at the 2011 - data processed by us. From analysis of the data presented in the following tables we assume that there are no significant variations of these distribution coefficients during the past 35 years, and consequently for the 3D modeling values presented it can be considered acceptable - without any problem - for the period of the past 10 years.

Table 3.1.J.1 - Percentage distribution of the flow rate between the branches (balta Ialomiţei)

Secţiune	Perioada	Debit la Silistra - Calaraşi (m^3/s) - km 380														
		(m^3/s)	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000
Dunărea Veche Superioară	1977-1987	%	98,5	95,7	94,0	92,4	91,3	90,3	89,4	88,7	88,0	87,5	87,0	86,7	86,4	86,1
	1998-2003	%	98,7	96,0	94,1	92,6	91,4	90,4	89,5	88,7	88,0	87,4	86,8	86,2	85,7	85,3
	ian-aug 2011	%	99,2	97,6	96,0	94,4	92,8	91,2	89,6	88,0	86,4	84,8	83,2	81,6	80,0	78,4
Braţul Borcea Superior	1977-1987	%	1,5	4,3	6,0	7,6	8,7	9,7	10,6	11,3	12,0	12,5	13,0	13,3	13,6	13,9
	1998-2003	%	1,3	4,0	5,9	7,4	8,6	9,6	10,5	11,3	12,0	12,7	13,2	13,8	14,3	14,7
	ian-aug 2011	%	0,8	2.4	4.0	5.6	7.2	8.8	10.4	12.0	13.6	15.2	16.8	18.4	20.0	21.6
Braţul BALA	1977-1987	%	77,5	68,3	62,8	57,6	53,8	51,0	48,8	47,0	45,5	44,6	43,2	42,5	41,8	41,1
	1998-2003	%	82,3	71,8	65,2	60,5	56,9	54,0	51,6	49,6	47,9	46,4	45,1	43,9	42,8	41,8
	ian-aug 2011	%	76,6	70,0	65,7	62,6	60,1	58,1	56,4	54,9	53,7	52,6	51,6	50,7	49,8	49,1
Dunărea Veche Inferioară	1977-1987	%	21,0	27,3	31,2	34,8	37,5	39,3	40,6	41,7	42,5	42,9	43,8	44,2	44,6	45,0
	1998-2003	%	16,4	24,2	28,9	32,1	34,5	36,3	37,8	39,0	40,1	40,9	41,7	42,4	43,0	43,5
	ian-aug 2011	%	23,4	30,0	34,3	37,4	39,9	41,9	43,6	45,1	46,3	47,4	48,4	49,3	50,2	50,9

Date interpolate - debite neînregistrate în 2011 până în luna august

Table 3.1.J.2 - Percentage distribution of the flow rates between the branches (balta Brăilei)

Secţiune	Perioada	Debit la Vadu-Oii (m^3/s) - km 237														
		(m^3/s)	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000
Braţul CREMENEA	1977-1987	%	80,0	73,3	70,0	68,4	67,0	66,4	65,9	65,6	65,0	64,6	64,3	64,2	64,1	64,0
	1998-2003	%	77,0	74,0	71,3	69,2	67,3	65,9	64,9	64,2	64,0	63,8	63,6	63,4	63,2	63,0
	ian-aug. 2011	%	82,6	79,6	75,7	70,8	67,5	65,6	65,0	64,6	64,4	64,3	64,2	64,1	64,0	63,9
Braţul VALCIU	1977-1987	%	17,5	20,3	21,5	21,4	21,7	21,4	21,2	21,2	21,2	21,2	21,1	21,0	20,9	20,8
	1998-2003	%	19,5	20,3	20,9	21,3	21,7	22,1	22,2	22,2	22,4	22,4	22,4	22,4	22,4	22,4
	ian-aug. 2011	%	12,5	13,3	15,6	19,3	21,6	22,6	22,5	22,2	21,8	21,4	21,0	20,7	20,4	20,1
Braţul MACIN	1977-1987	%	2,5	6,4	8,5	10,2	11,3	12,2	12,9	13,2	13,8	14,2	14,6	14,8	15,0	15,2
	1998-2003	%	3,5	5,7	7,8	9,5	11,0	12,0	12,9	13,6	13,6	13,8	14,0	14,2	14,4	14,6
	ian-aug. 2011	%	4,9	7,1	8,7	9,9	10,9	11,8	12,5	13,2	13,8	14,3	14,8	15,2	15,6	16,0

Date interpolate - debite neînregistrate în 2011 până în luna august

Analyzing the data submitted in the two tables we can conclude:

1. **For Balta Ialomiței system**
   - Flow rates distribution coefficients between the Upper Old Danube and Borcea branch have not undergone major changes over the last 35 years, regardless of the flow rate at the sector entrance - Călărași-Silistra hydrometric station
   - For flow rates average values in the input entrance section in the modeled sector between 4000 m^3/s and 8000 m^3/s more than 90% of the water quantity is distributed on the Upper Old Danube
   - Flow rates distribution coefficients between the Lower Old Danube and Bala branch has changed over the last 35 years for all the flow rates values at the sector entrance - Călărași-Silistra hydrometric station, observing an increase of the water volume passing Bala branch
   - For flow rates values in the entrance section on the modeled sector between 4000 m^3/s and 10000 m^3/s - specific to the January - August 2011 period - the water amount that has leaked on the Bala branch accounted values between 54 % and 66 %.

2. **For Balta Brăilei system**
   - Flow rates partition coefficient between the 3 branches - Cremenea, Vâlciu and Măcin shows no significant differences between the historical reference period 1977-2003 and the first 8 months of 2011, regardless of the flow rate at the entrance sector - Vadu Oii hydrometric station
   - For flow rates average values in the entrance section in the modeled sector between 4000 m^3/s and 8000 m^3/s, over 65 % of the water is distributed on the Cremenea branch, while the amount of water overrun on Măcin branch is between 9 % and 12 %.

Bathymetry

For implementing the model, it was processed bathymetric data collected by Consortium specialized teams. There were made several bathymetry measurements:

Multi-beam topographic-bathymetric measurements

1. Measurements in the critical points CP 01- CP 02

Measurements made by VITUKI team were located as follows:

- **Main navigable course** Km 347-334 (13 km length - measured by the team using a multi-beam bathymetric technology)
- **Epurașu secondary branch** - entire length of 8 km of secondary branch has been measured (2.5 km measured using multi-beam 3D bathymetric technology, 5.5 km using a small vessel, measuring rod, GPS positioning on the banks)
- **Bala secondary branch**, the entire length of 11 km of secondary branch has been measured using multi-beam bathymetric technology
- **Borcea secondary branch**, over a distance of 2 km from the confluence with the Bala branch (km 69-68, measured by single-beam 2D bathymetric technology)

Total length 35.0 km

2.0 km single-beam

5.5 km small vessel

26.5 km multibeam

3. Measurements in the critical point CP 10

The accomplished measurements were located as follows:

- **Main course**/Km 198-193 navigable course
- **Caleia secondary branch**/ km 11-6 navigable course
- **Vâlciu secondary branch**, 2 km at downstream of the confluence.

Overall length measured using the 3D bathymetric technology (multibeam) – 12 km.

Overview measurements taken:

55.5 km in total, of which:

2.0 km single-beam

5.5 km small vessel

48.0 km multi-beam.

Figure 3.1.J.10 - Measurements in critical points PC 01 – PC 02

Figure 3.1.J.11 - Measurements in the critical point PC 10

Multi-beam bathymetry measurements were processed as follows:

- The points coordinates where it was determined the water depth were trans calculate of the geographical coordinates system into the STEREO 70 projection for X and Y
- Depth data were interpolated into a regular grid with a step of 2 m
- There were made the level corrections using the water levels measured during geodetic measurements made from banks
- The bathymetry data validation has been made where the case was.

Finally it was obtained X, Y, Z text files - Z representing absolute quota reported at the Black Sea – Sulina quota.

These data will allow the transfer of bathymetric information with a very high resolution by 3D modeling program.

In figure 3.1.J.12 - 3.1.J.25 are presented 3D graphics with details of the investigated areas using 3D bathymetric technology (multibeam).

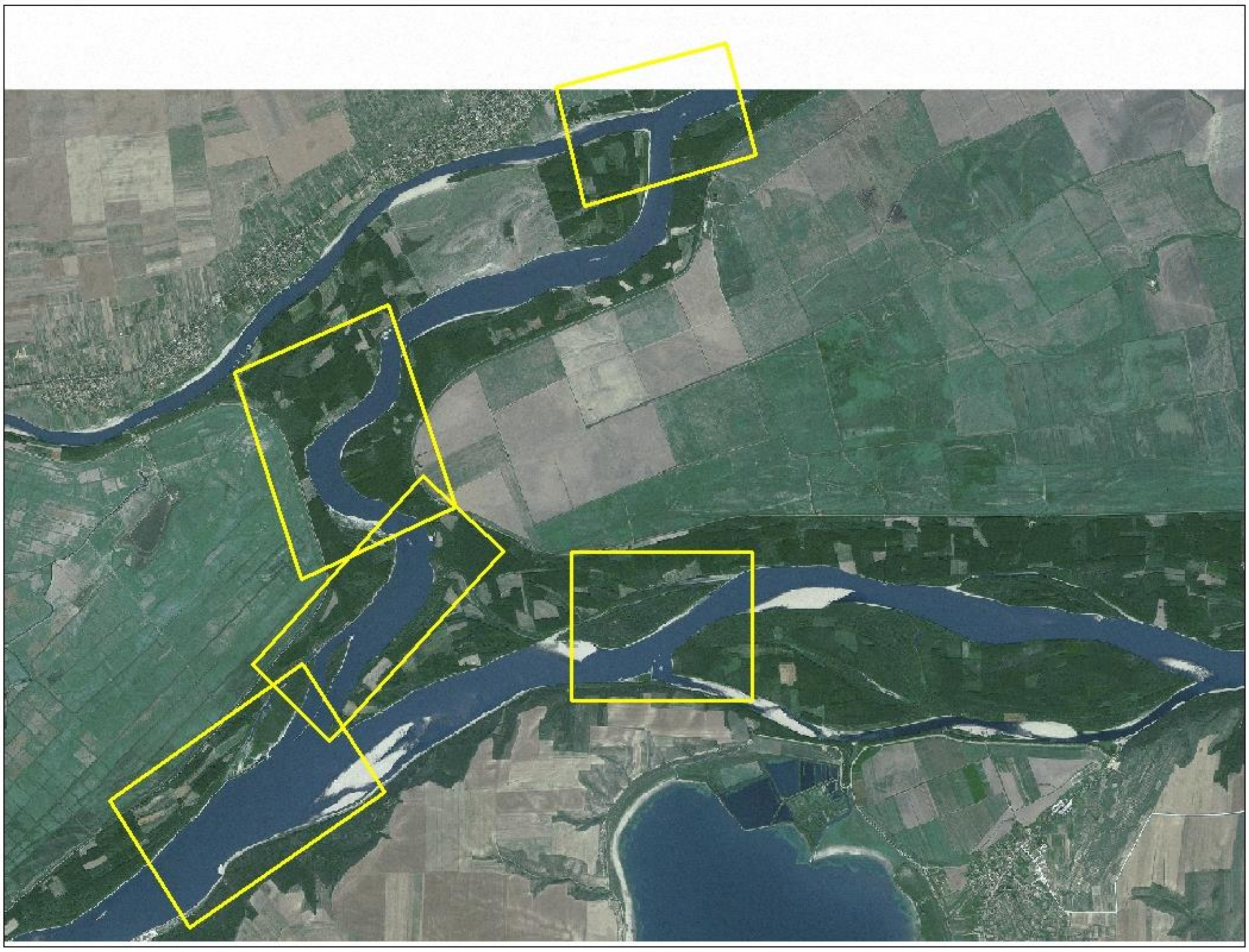


Figure 3.1.J.12 - Location of the 3D scenes at CP 01 - CP 02

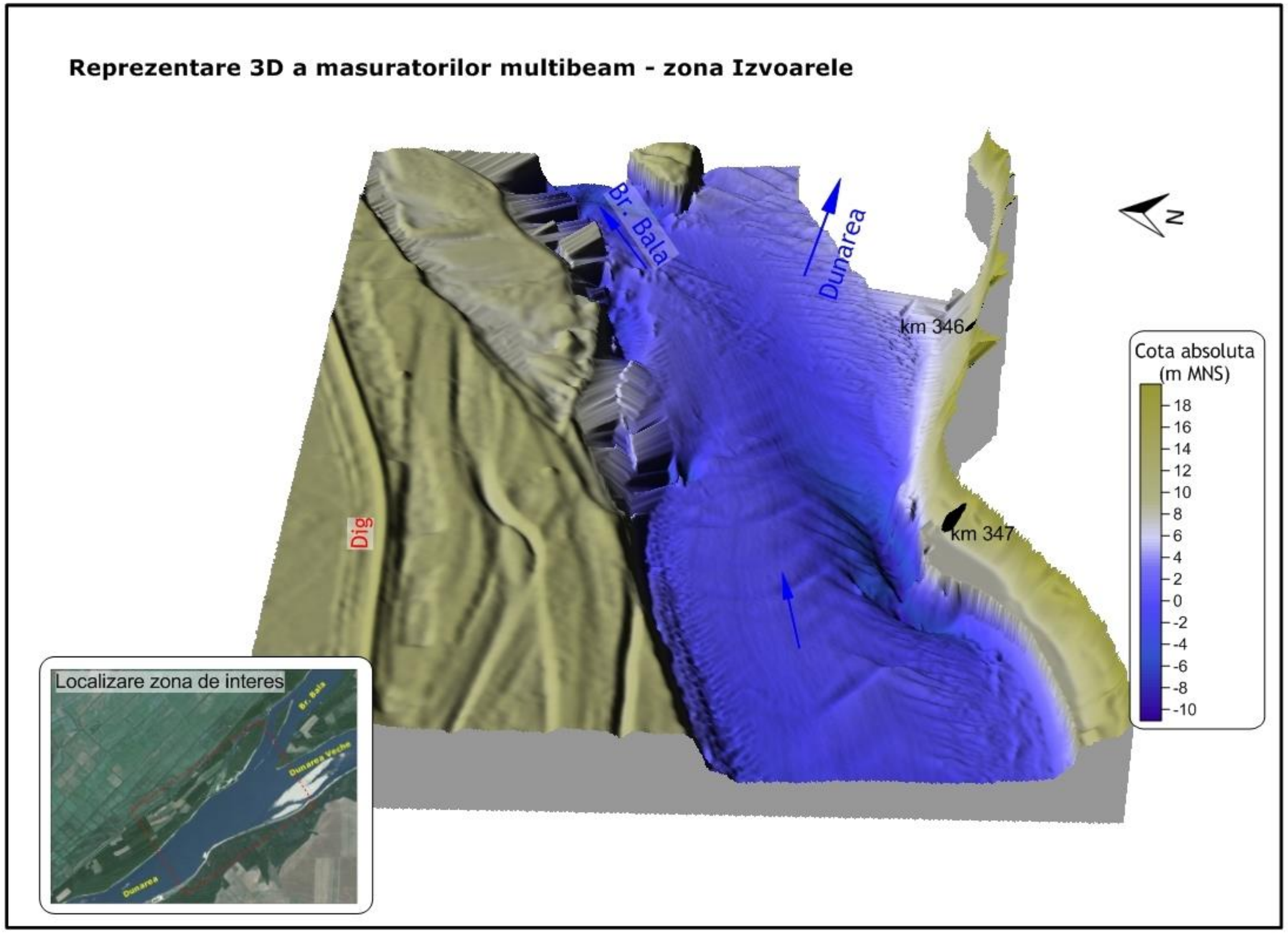


Figure 3.1.J.13

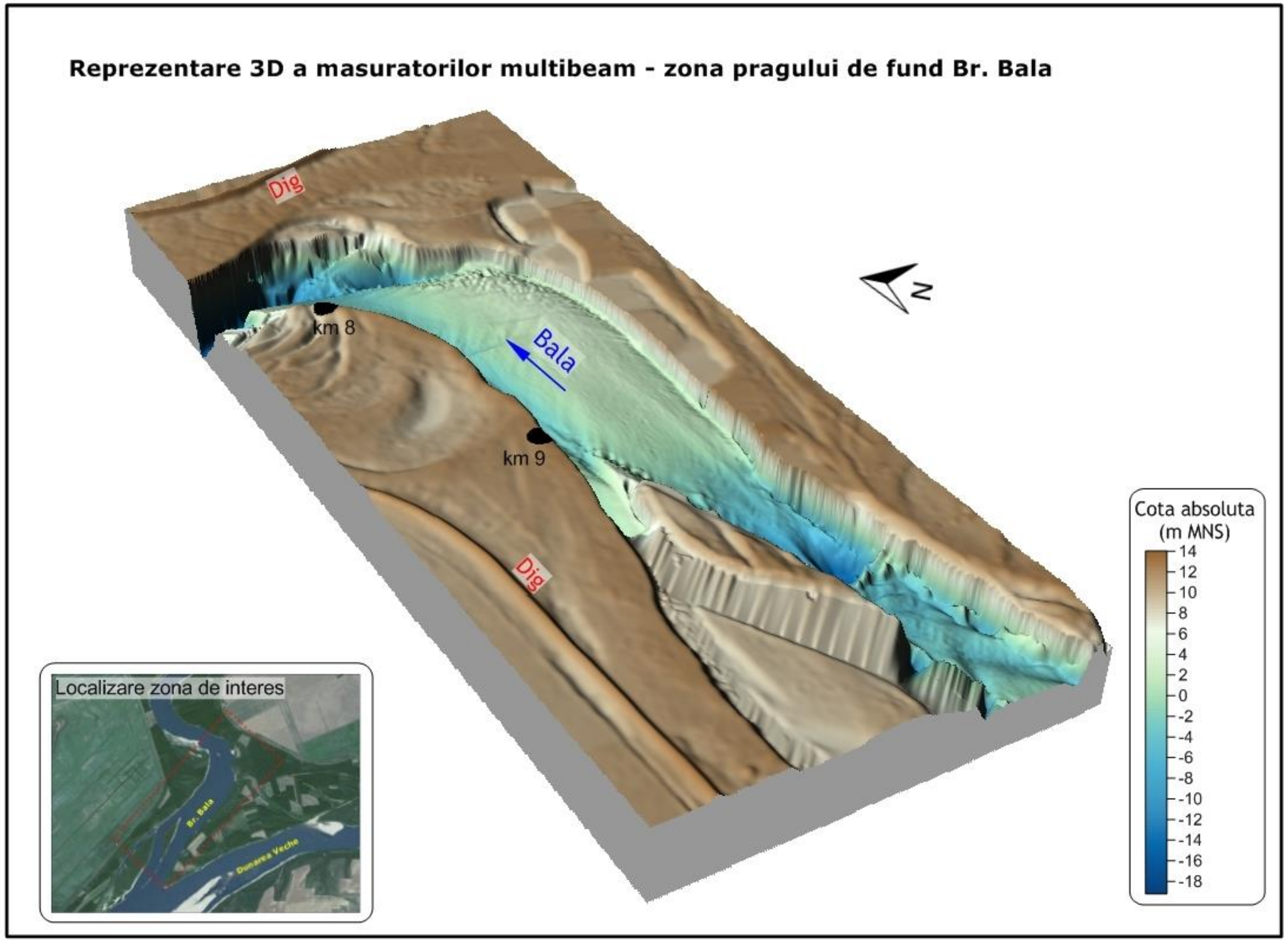


Figure 3.1.J.14

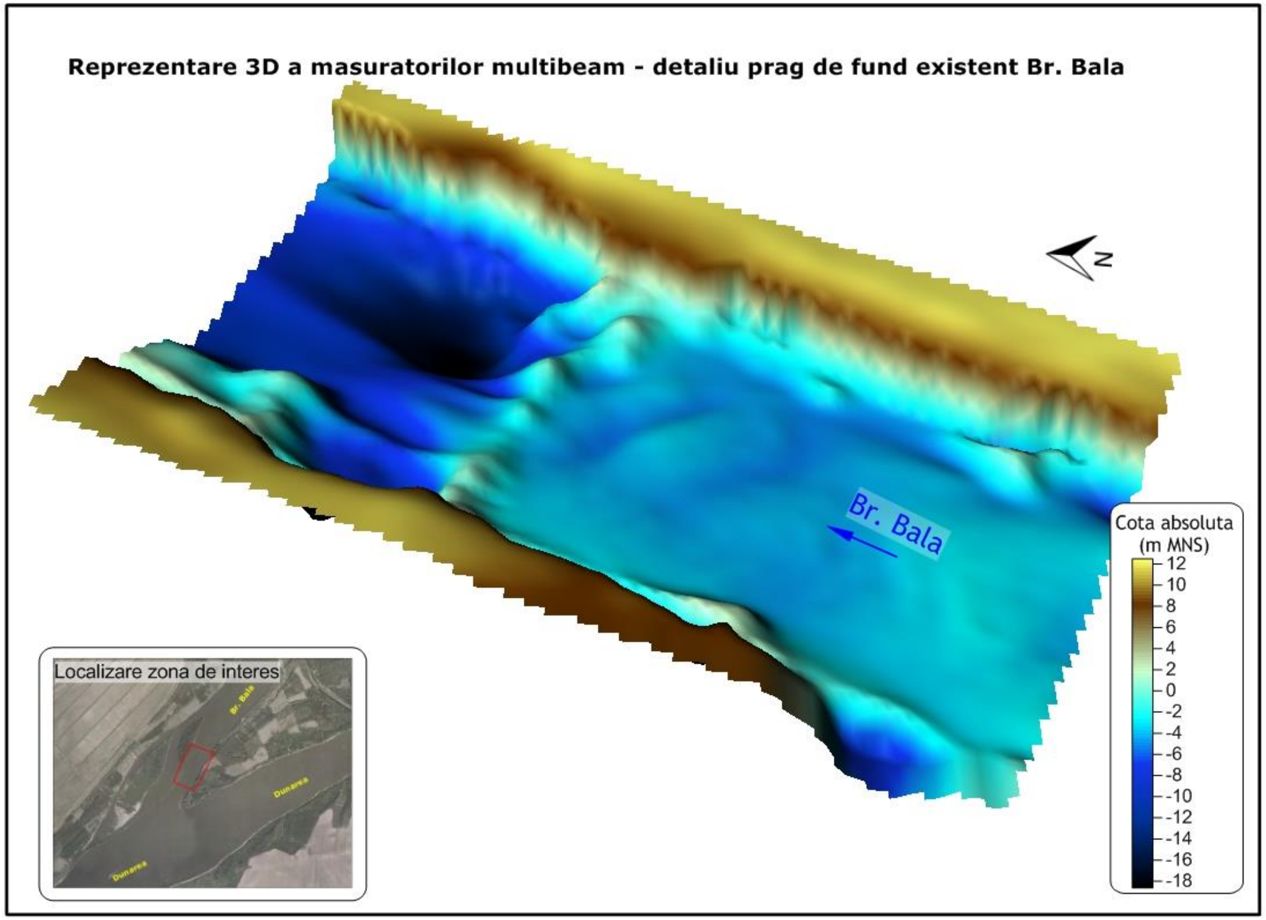


Figure 3.1.J.15

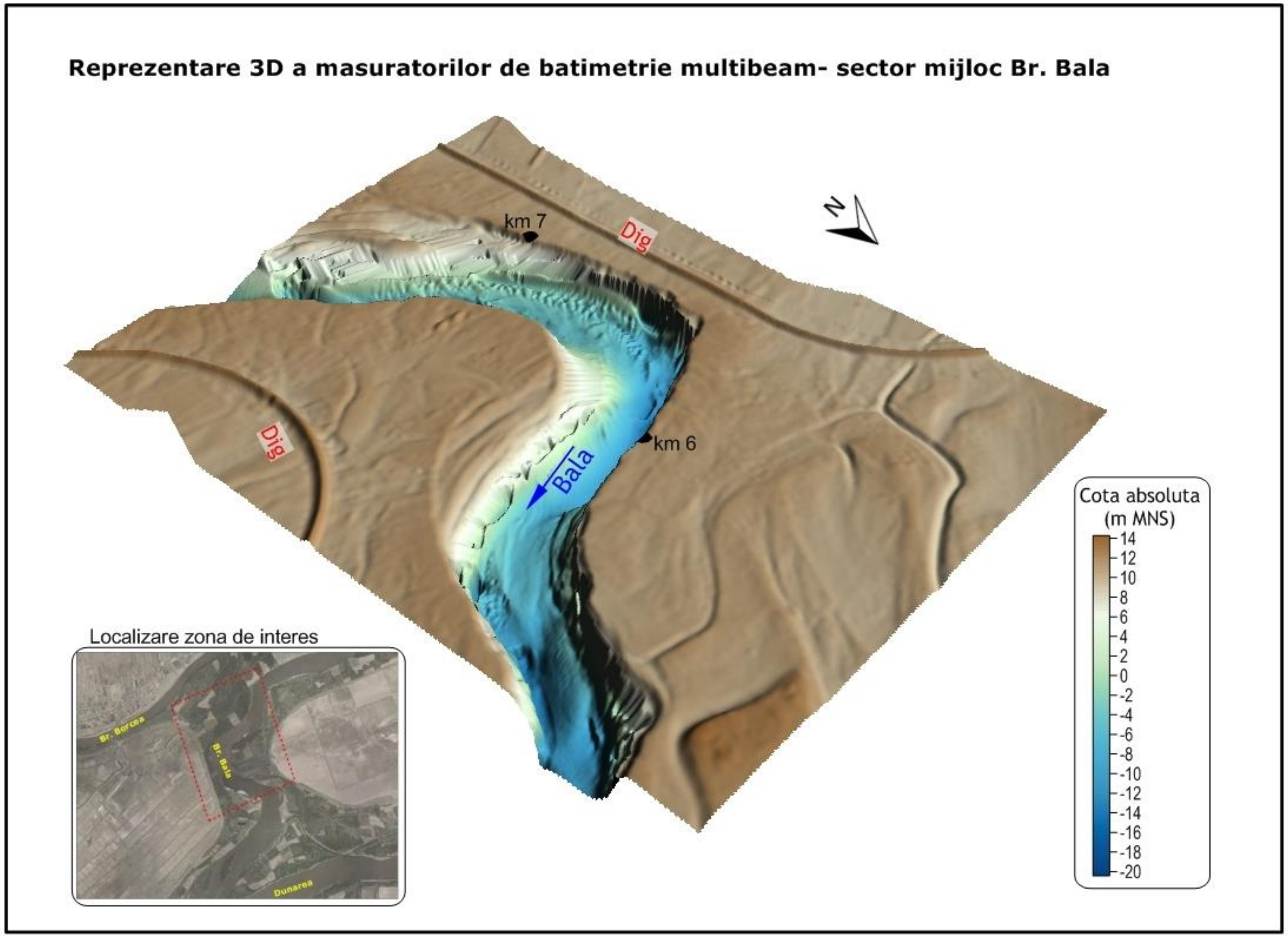


Figure 3.1.J.16

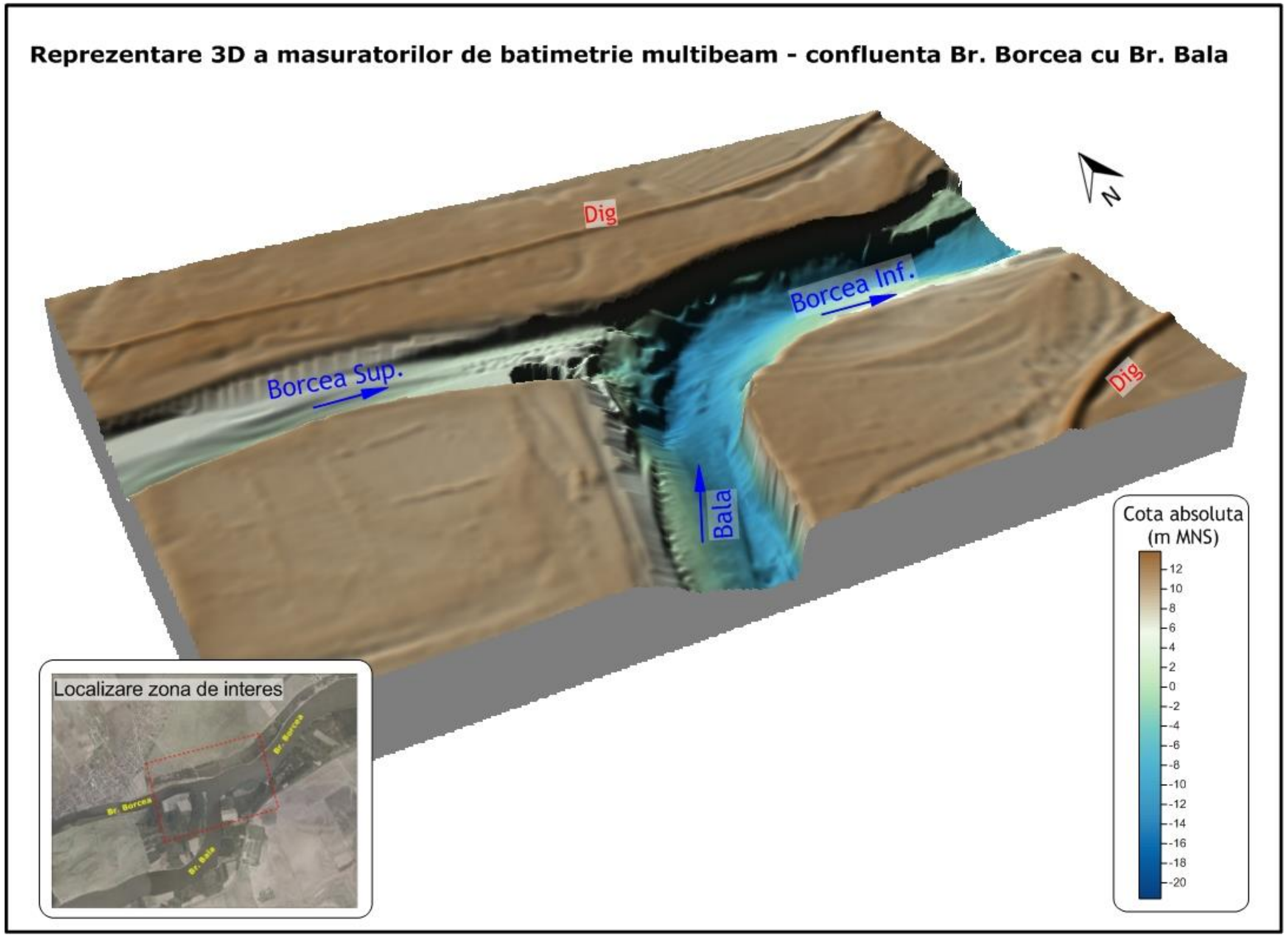


Figure 3.1.J.17

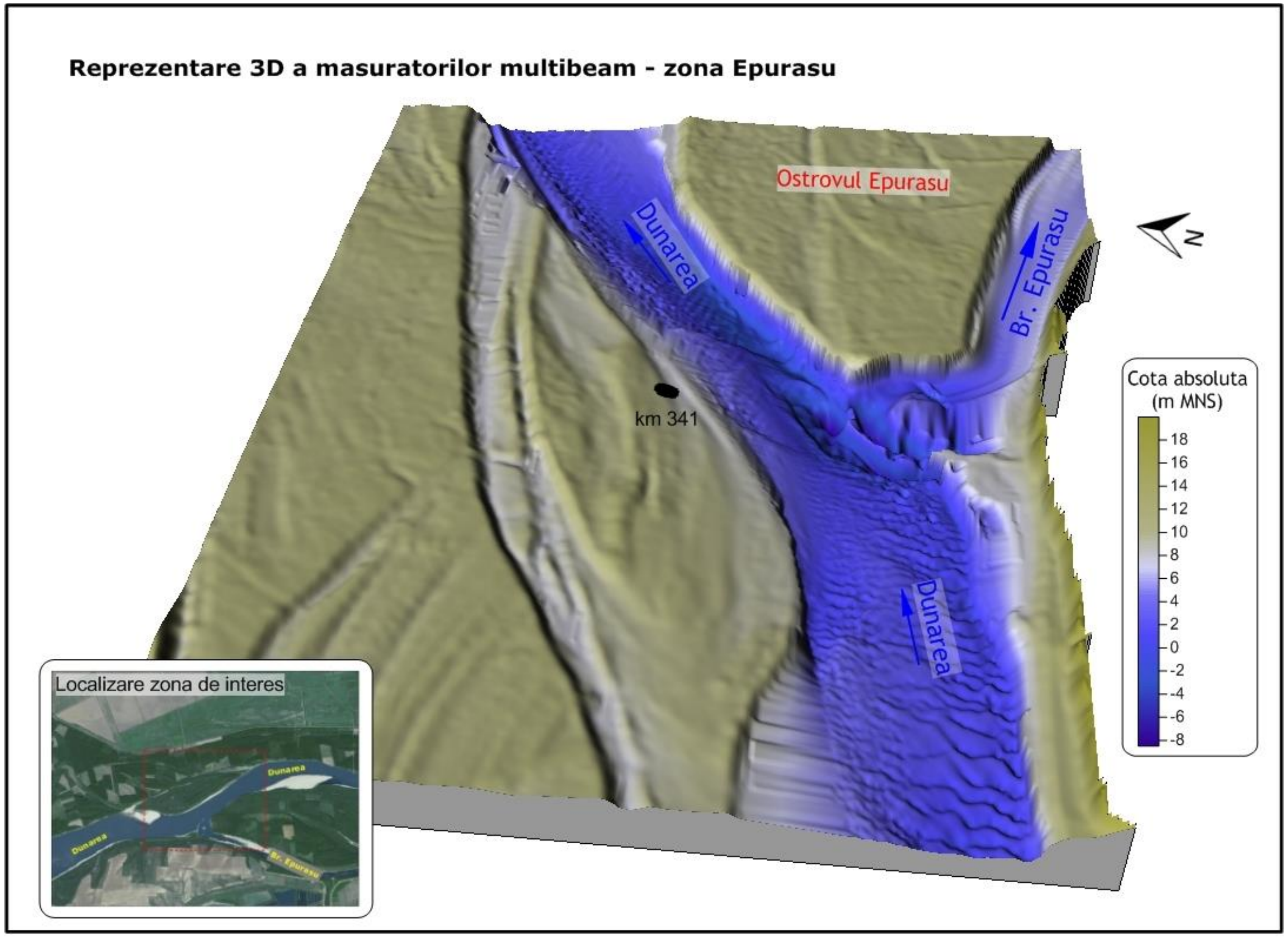


Figure 3.1.J.18

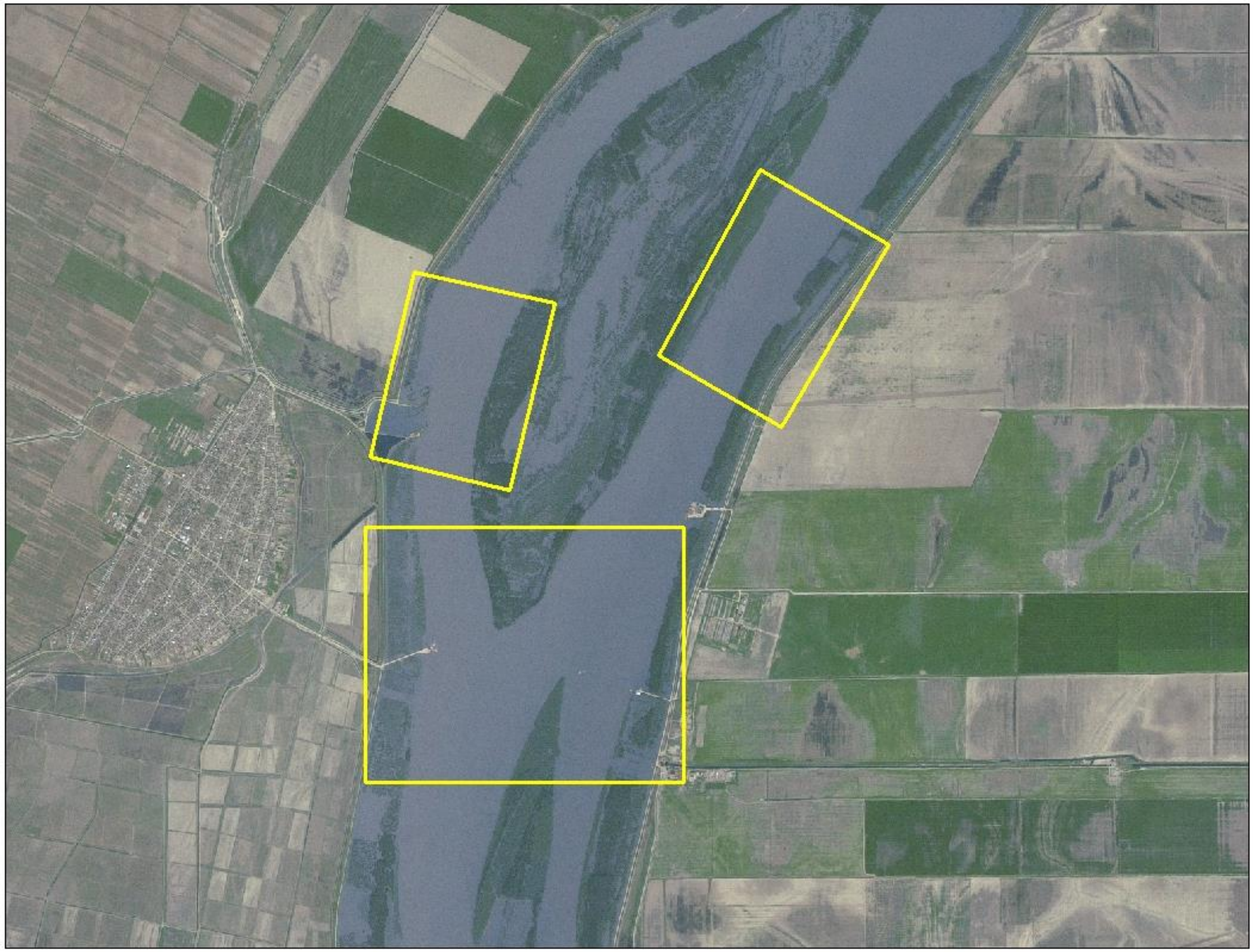


Figure 3.1.J.19 - Location of the 3D scenes at CP10

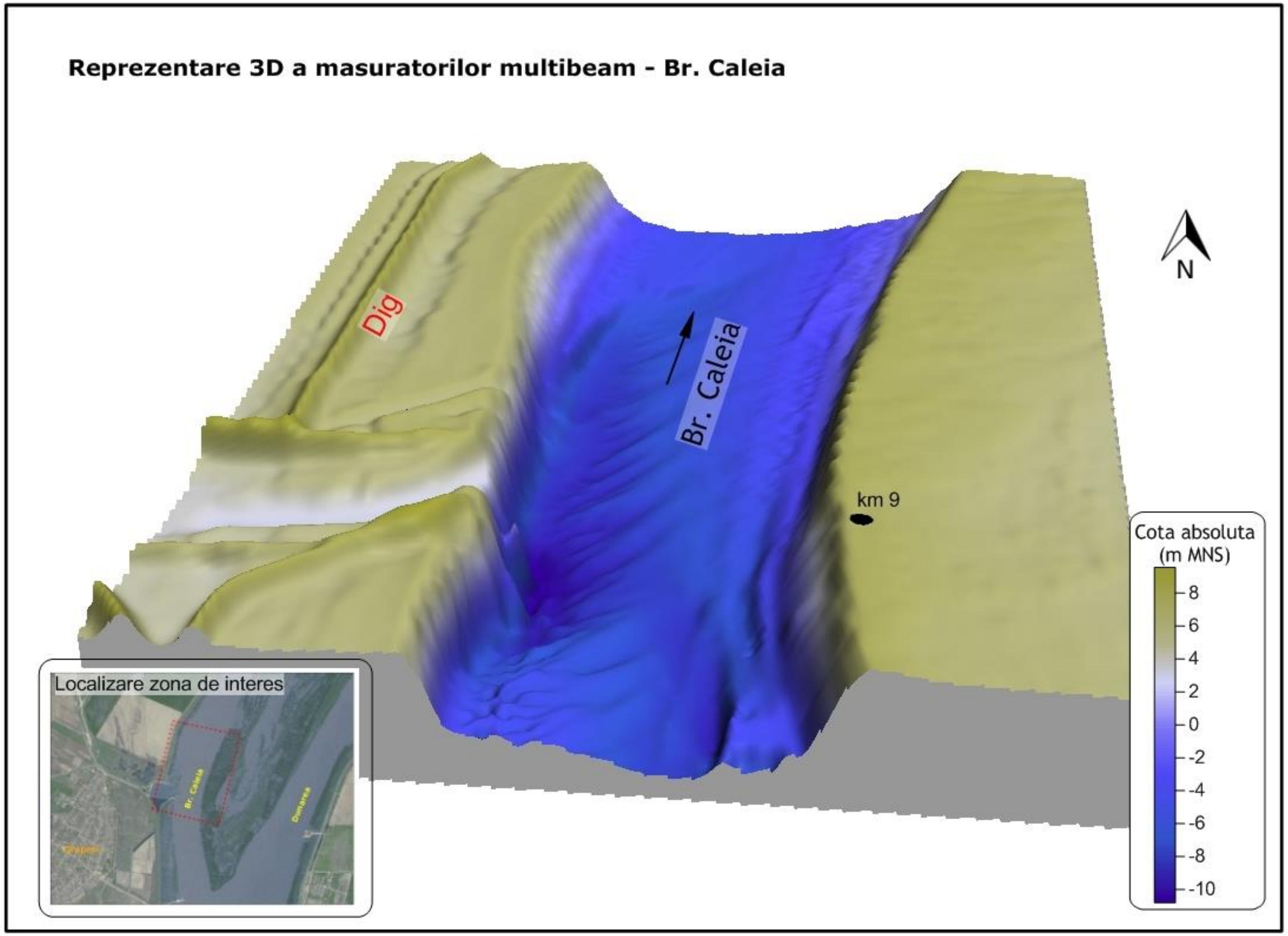


Figure 3.1.J.20

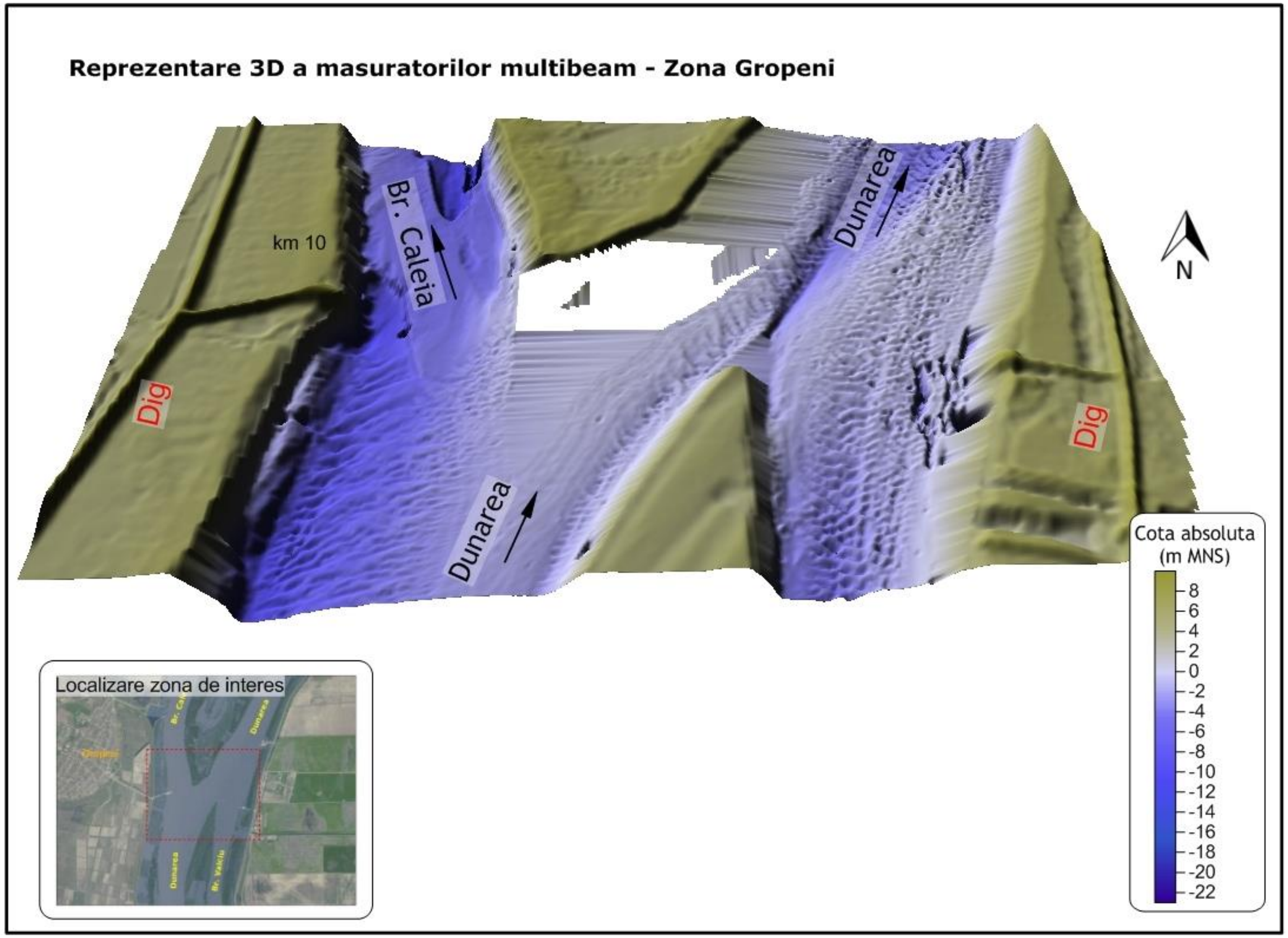


Figure 3.1.J.21

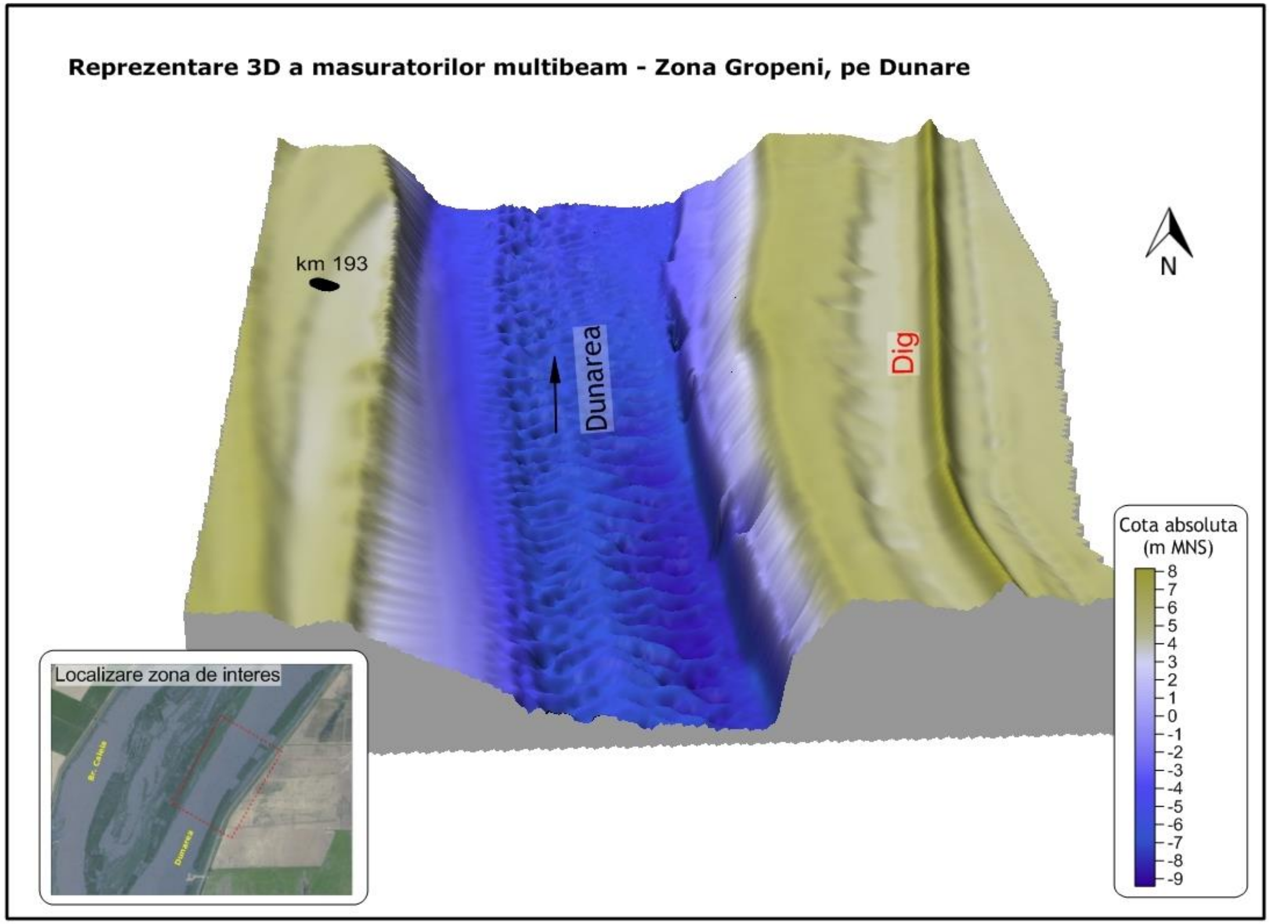


Figure 3.1.J.22

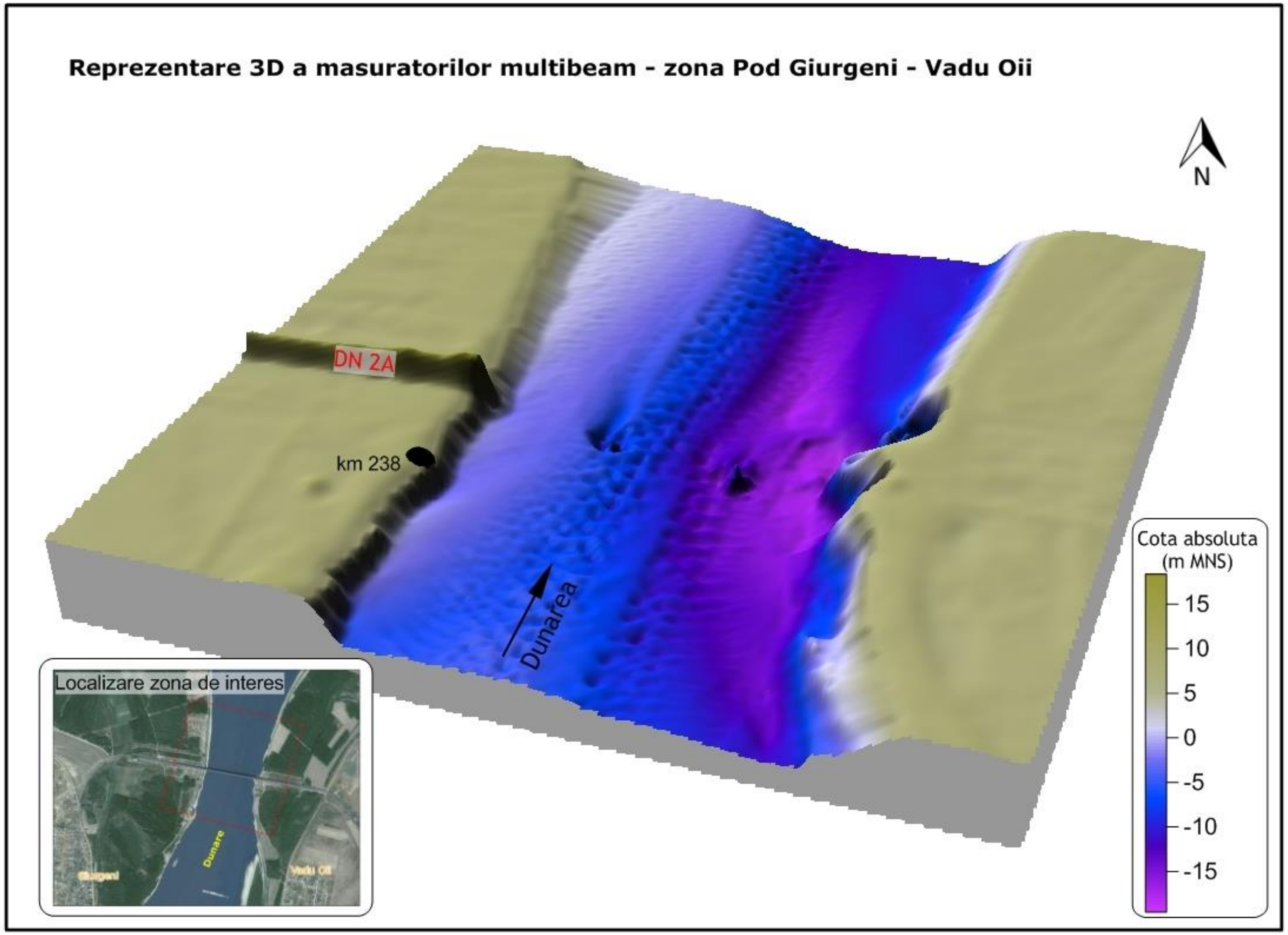


Figure 3.1.J.23

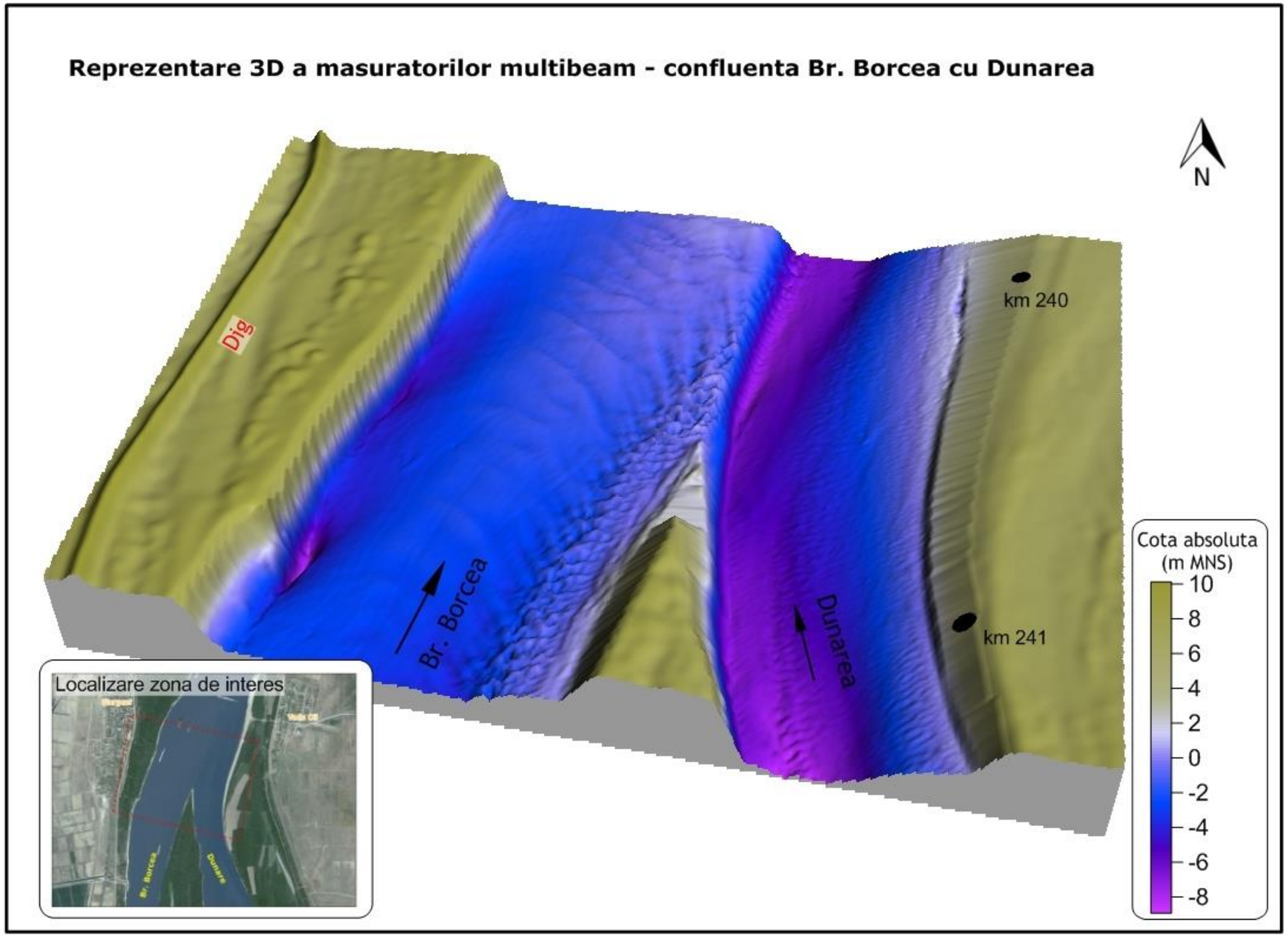


Figure 3.1.J.24

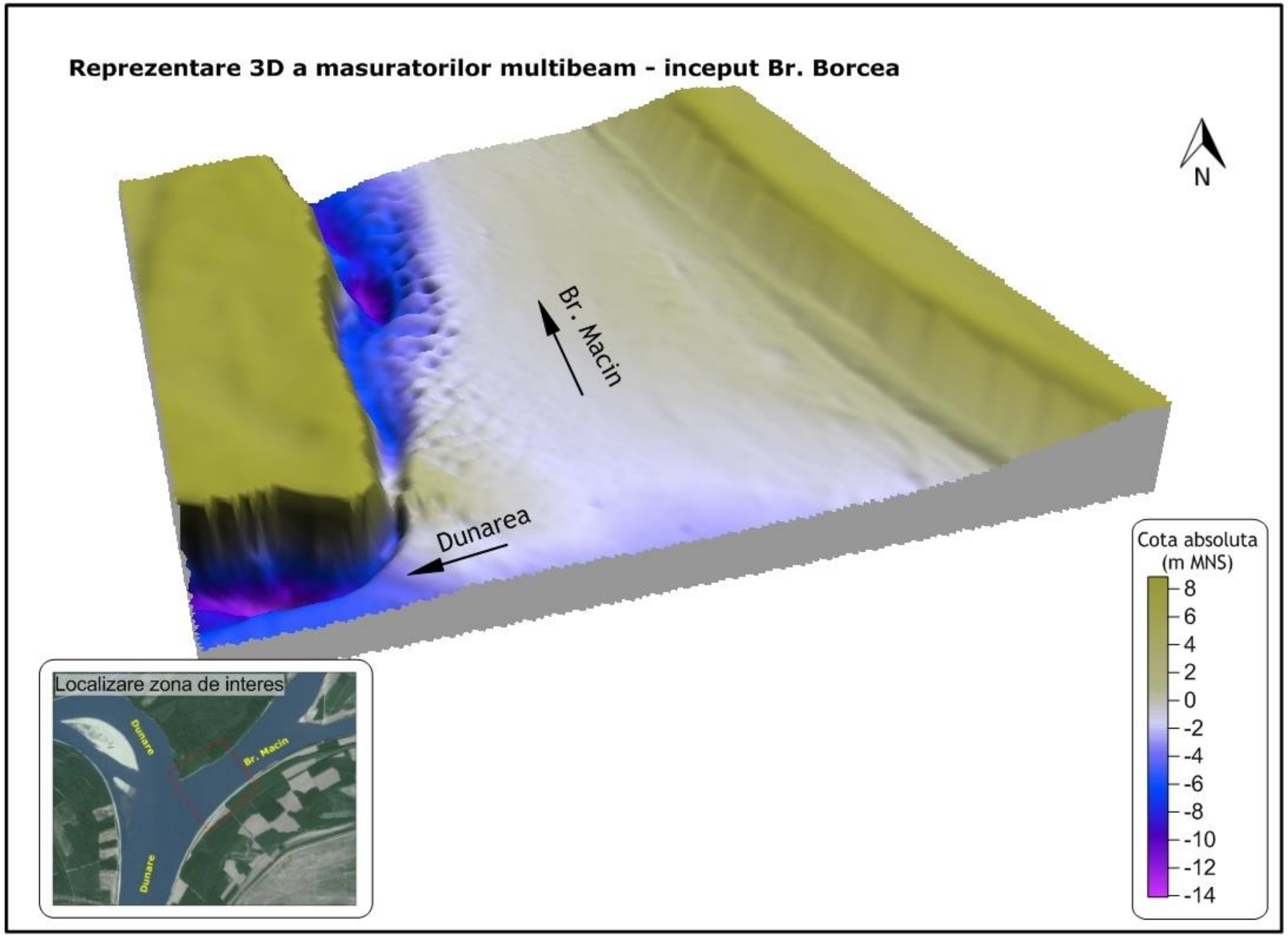


Figure 3.1.J.25

Single-beam topographic-bathymetric measurements

Were executed more than 550 single-beam bathymetry measurements on the cross-sections on the Danube. Their density was - according to the conditions of contract - greater in areas where works will be executed - the areas of the critical points CP 01, CP 02 and CP 10 - areas where the distance between 2 profiles in a row was 100 m.

Figure 3.1.J.26 and Figure 3.1.J.27 presents the location of these single-beam bathymetry profiles.

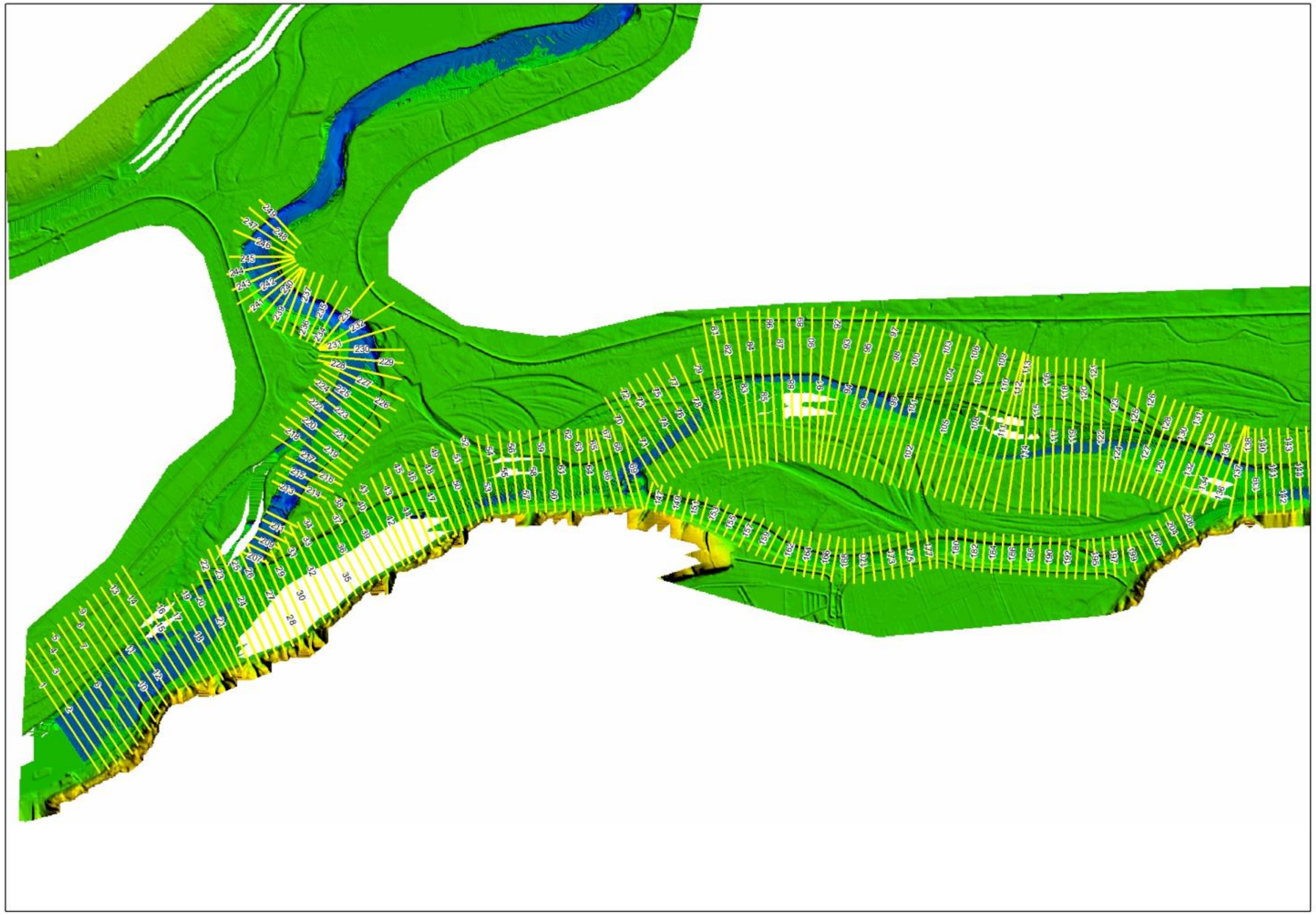


Figure 3.1.J.26 - Location of 2D profiles (single- beam) – CP 01 and CP 02

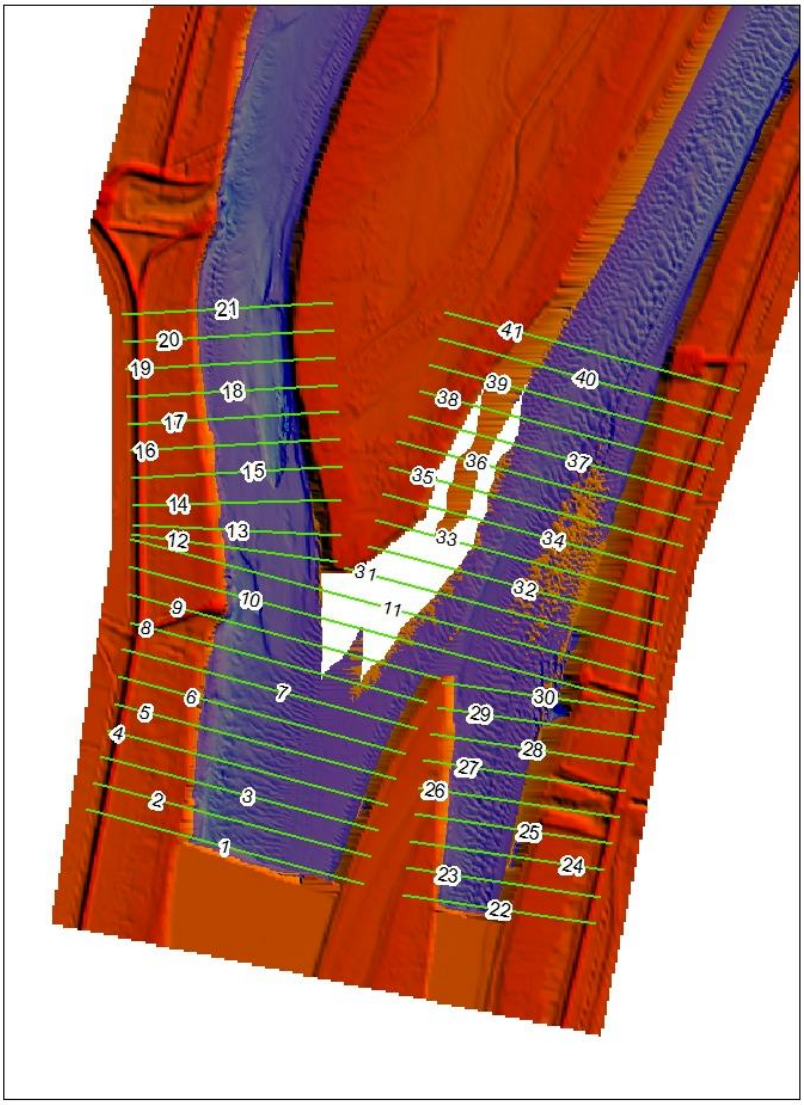


Figure 3.1.J.27 - Location of 2D profiles (single-beam) – CP 10

These bathymetric profiles are presented in annexes 5.4 and 5.9.

For cross-sections from CP 01, CP 02 and CP 10, on which they have collected water and sediments samples, in Figures 3.1.J.28 – 3.1.J.36 are presented charts with additional information on:

- The fairway location and width - information taken by digitizing electronic navigational charts - only sections for which we had provided information on the fairway
- The minimum and maximum water levels during pre-construction period, calculated according to the levels recorded in this 4 months period from the hydrometric stations located close to those bathymetric sections
- Fairway minimum and maximum depths for the same period (depths relatively calculated on the point having absolute maximum quota on the valley floor) - only sections for which we had provided information regarding the fairway.

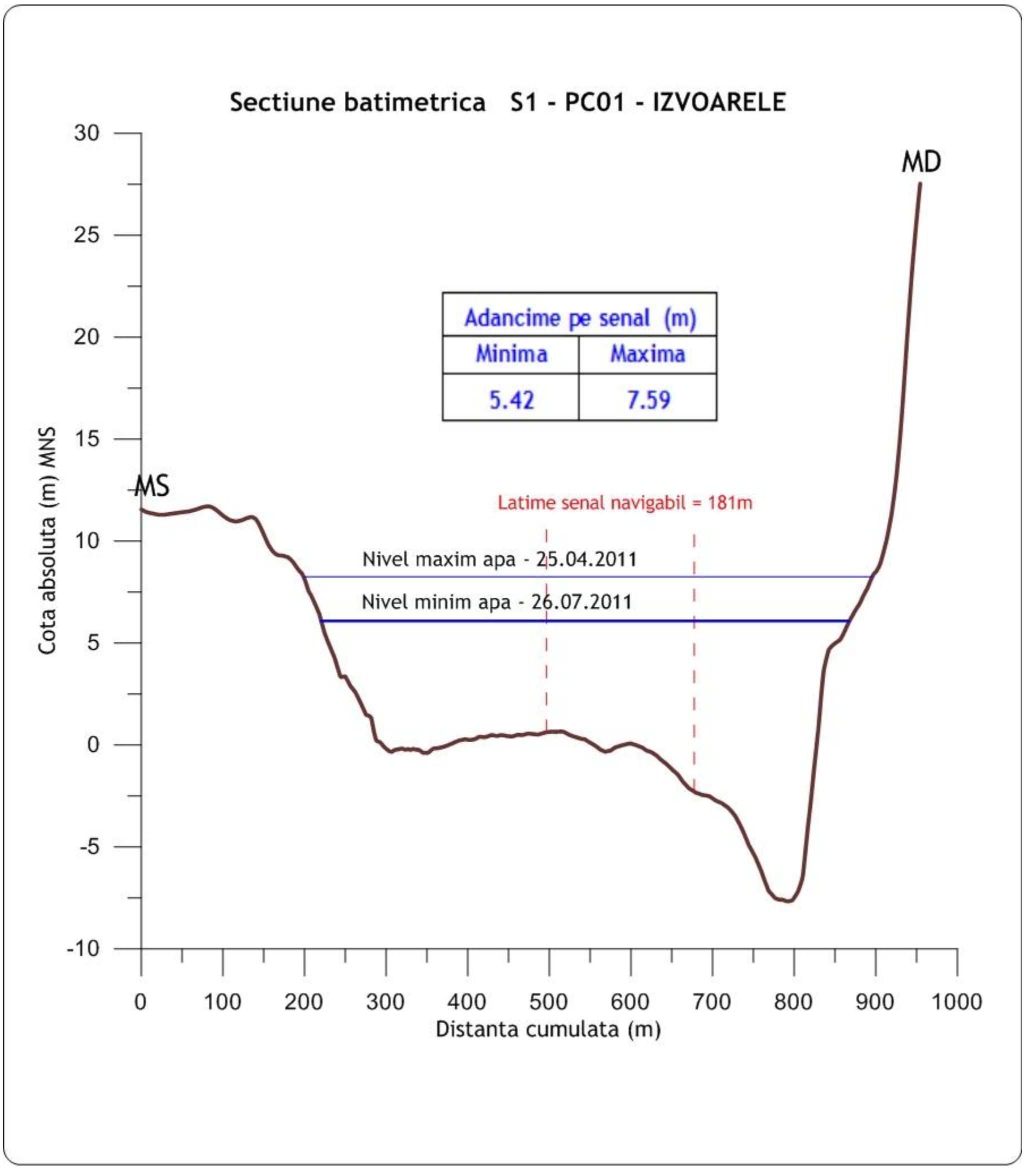


Figure 3.1.J.28

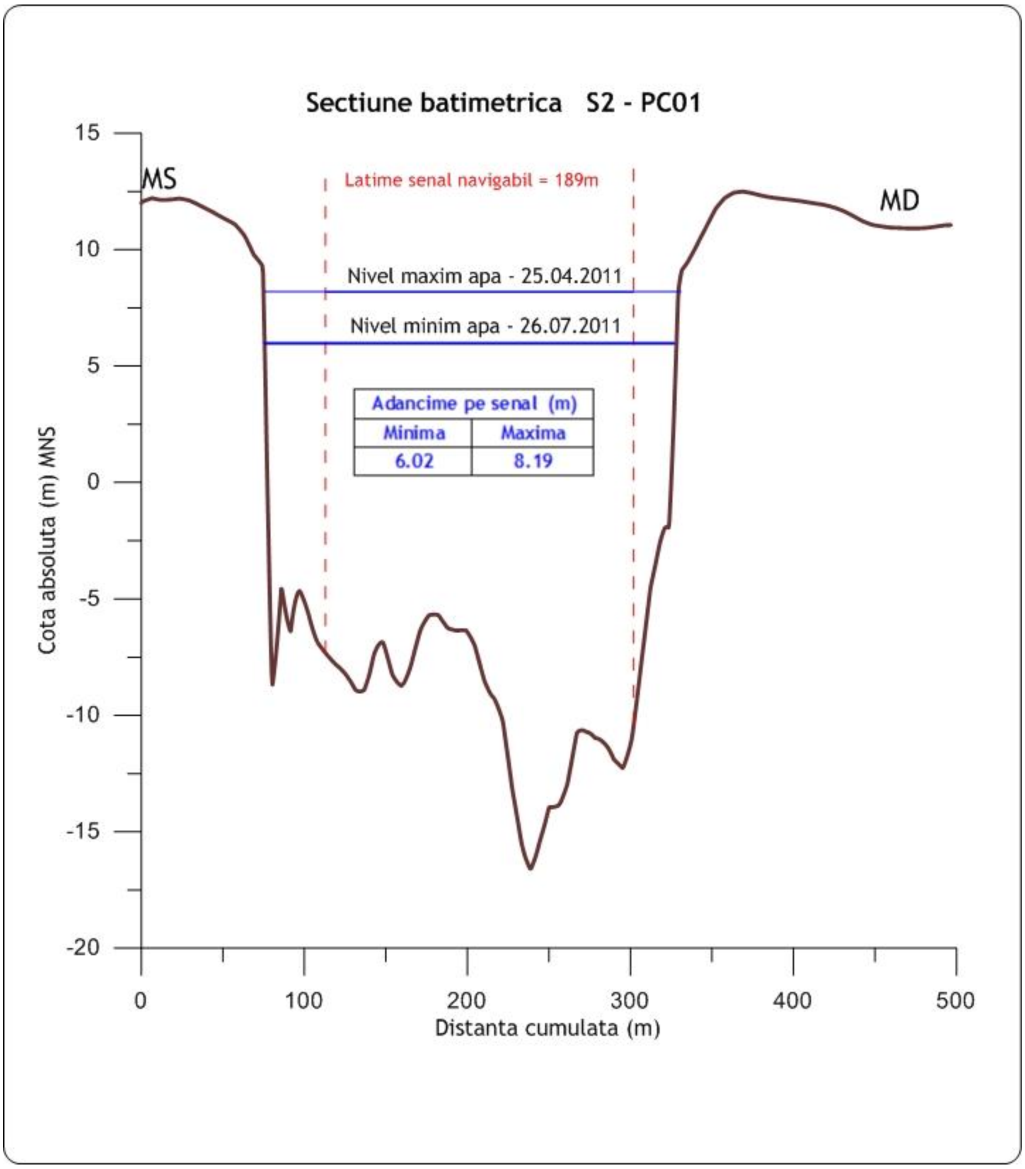


Figure 3.1.J.29

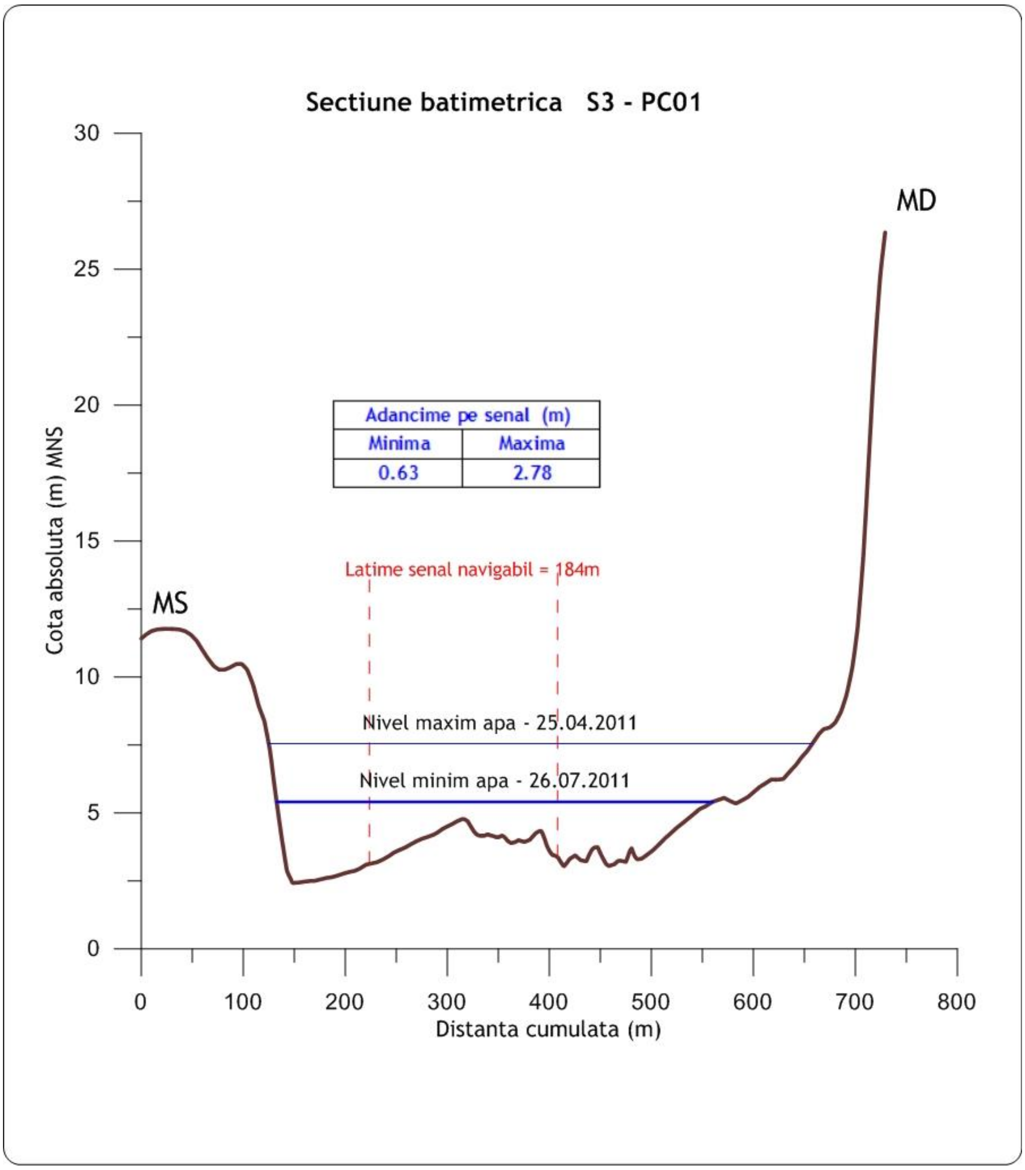


Figure 3.1.J.30

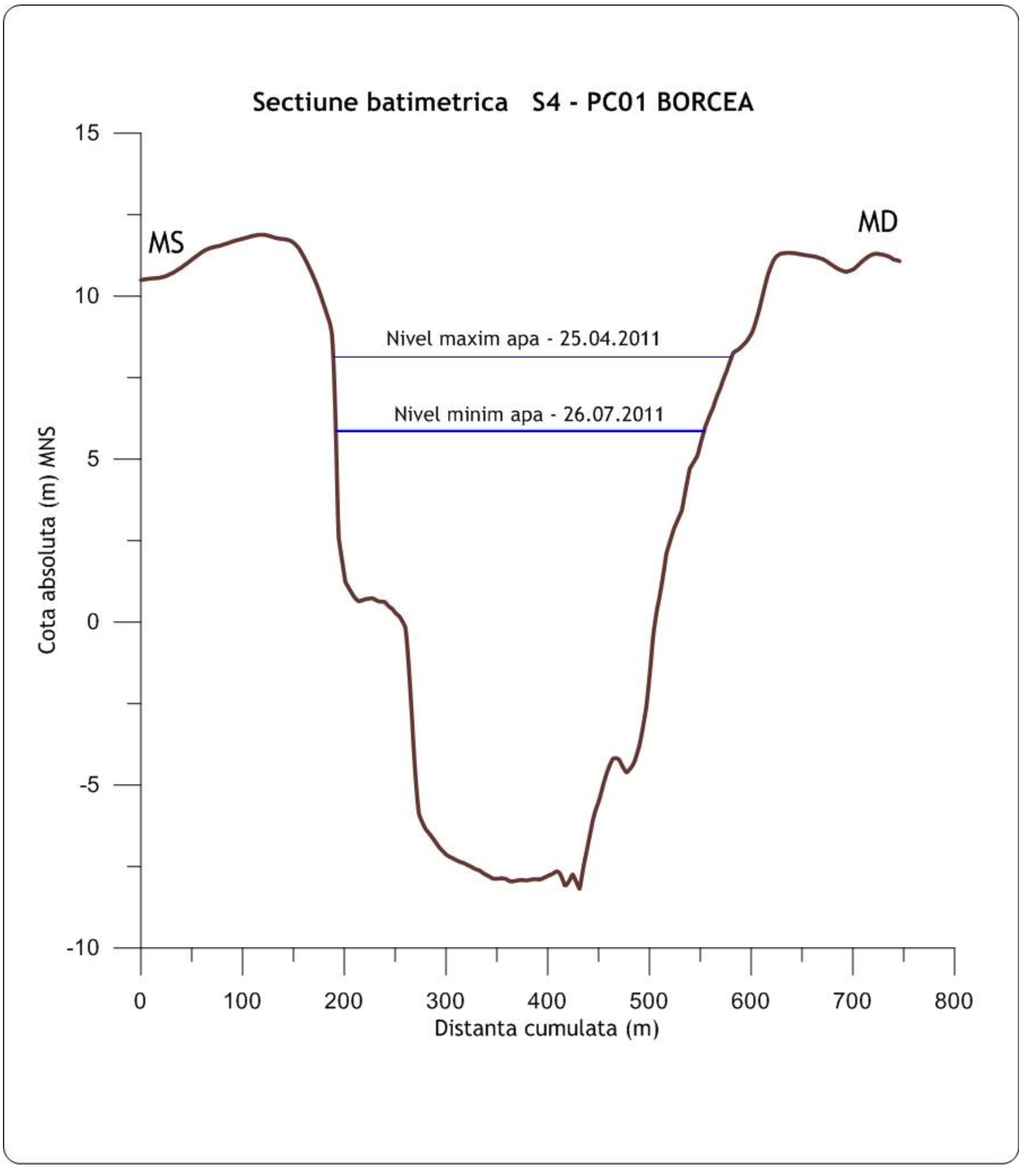


Figure 3.1.J.31

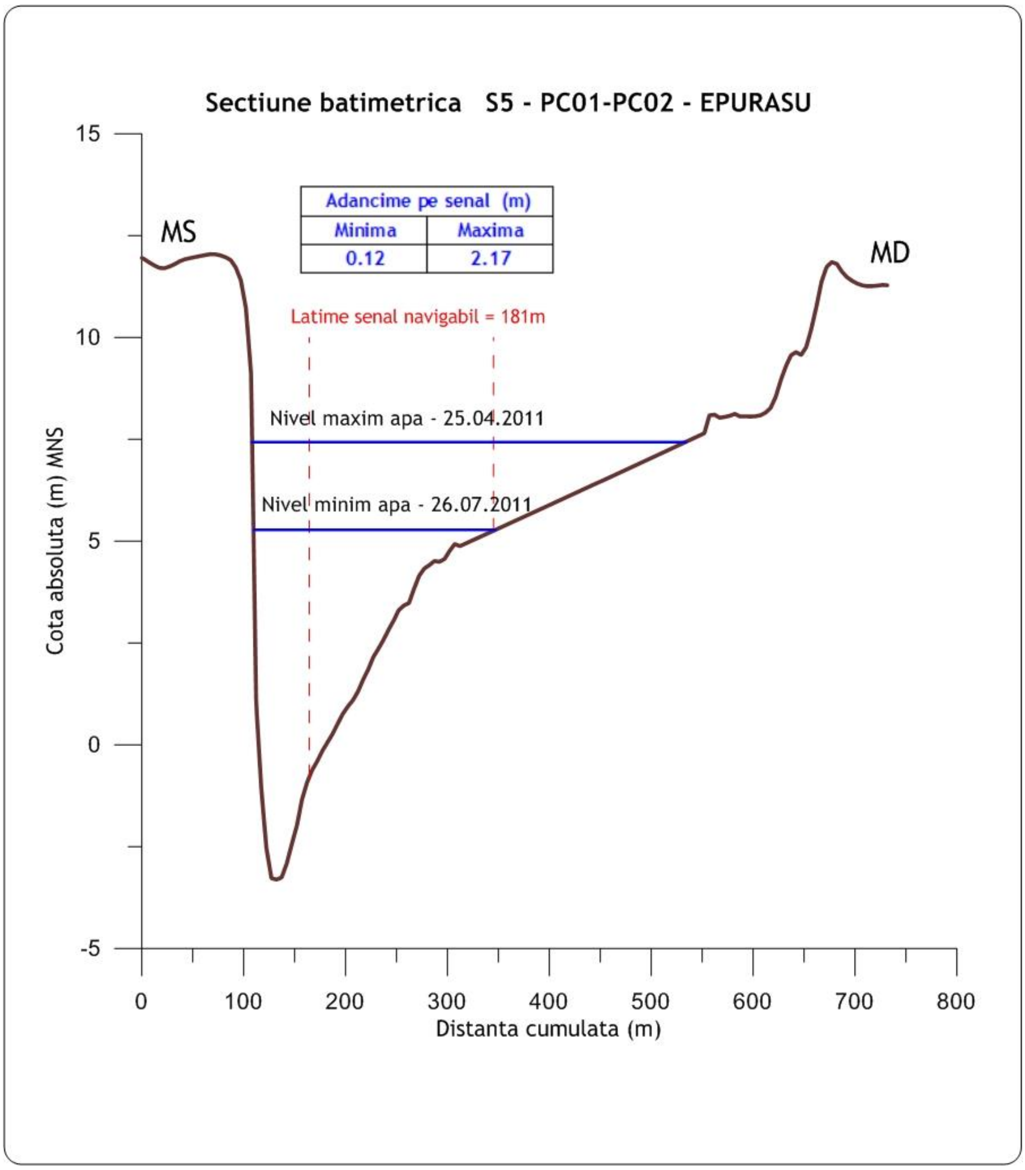


Figure 3.1.J.32

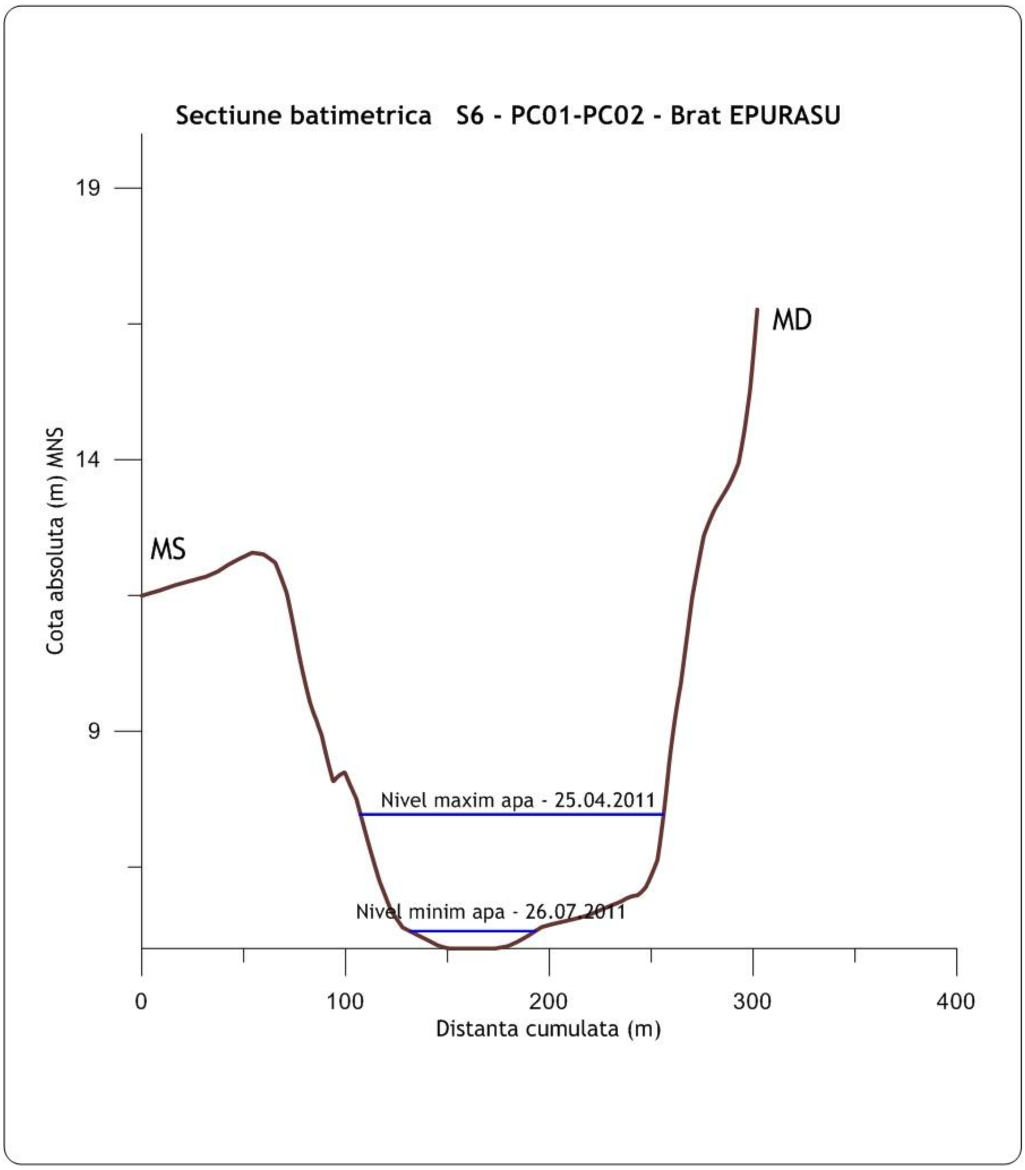


Figure 3.1.J.33

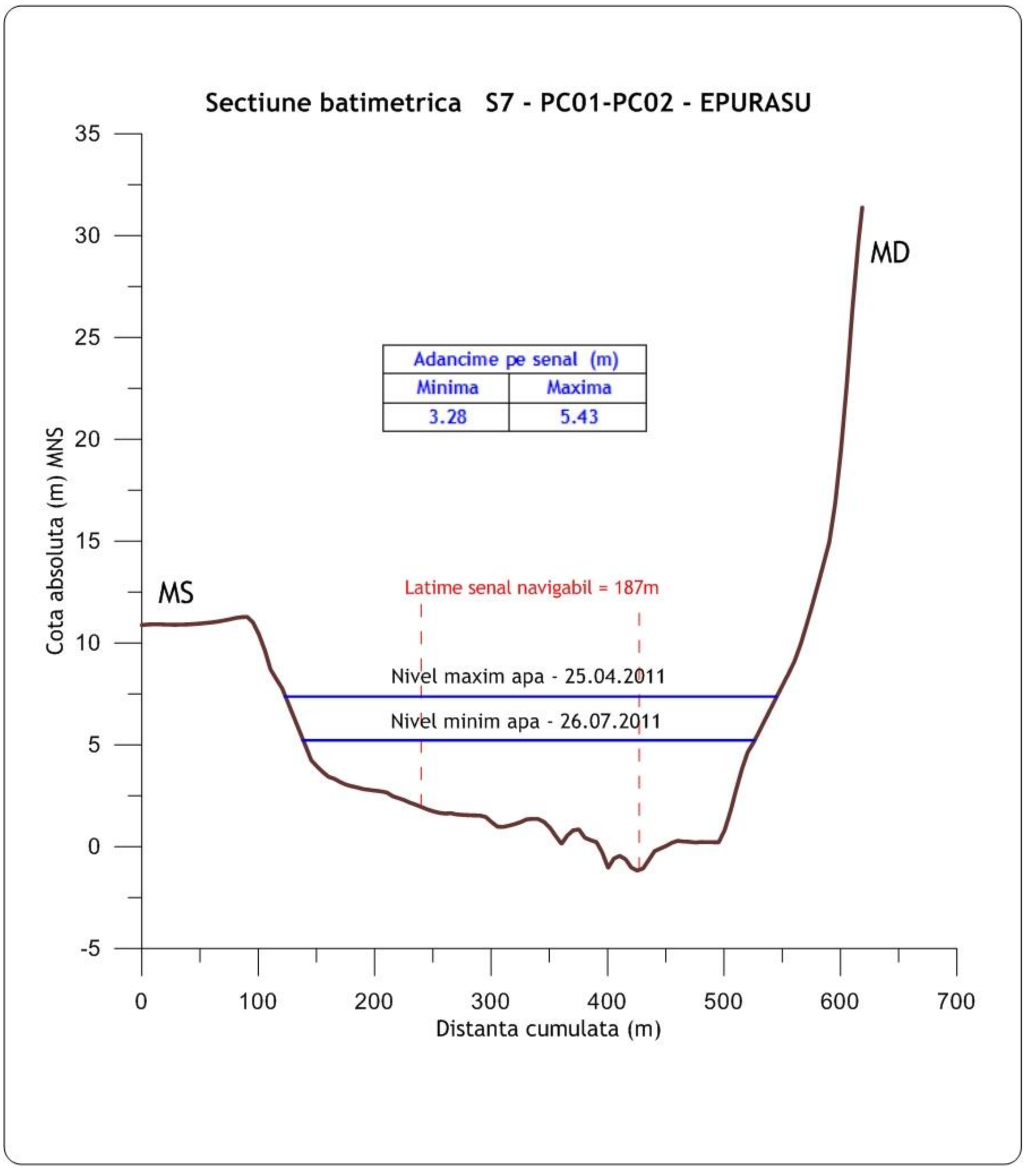


Figure 3.1.J.34

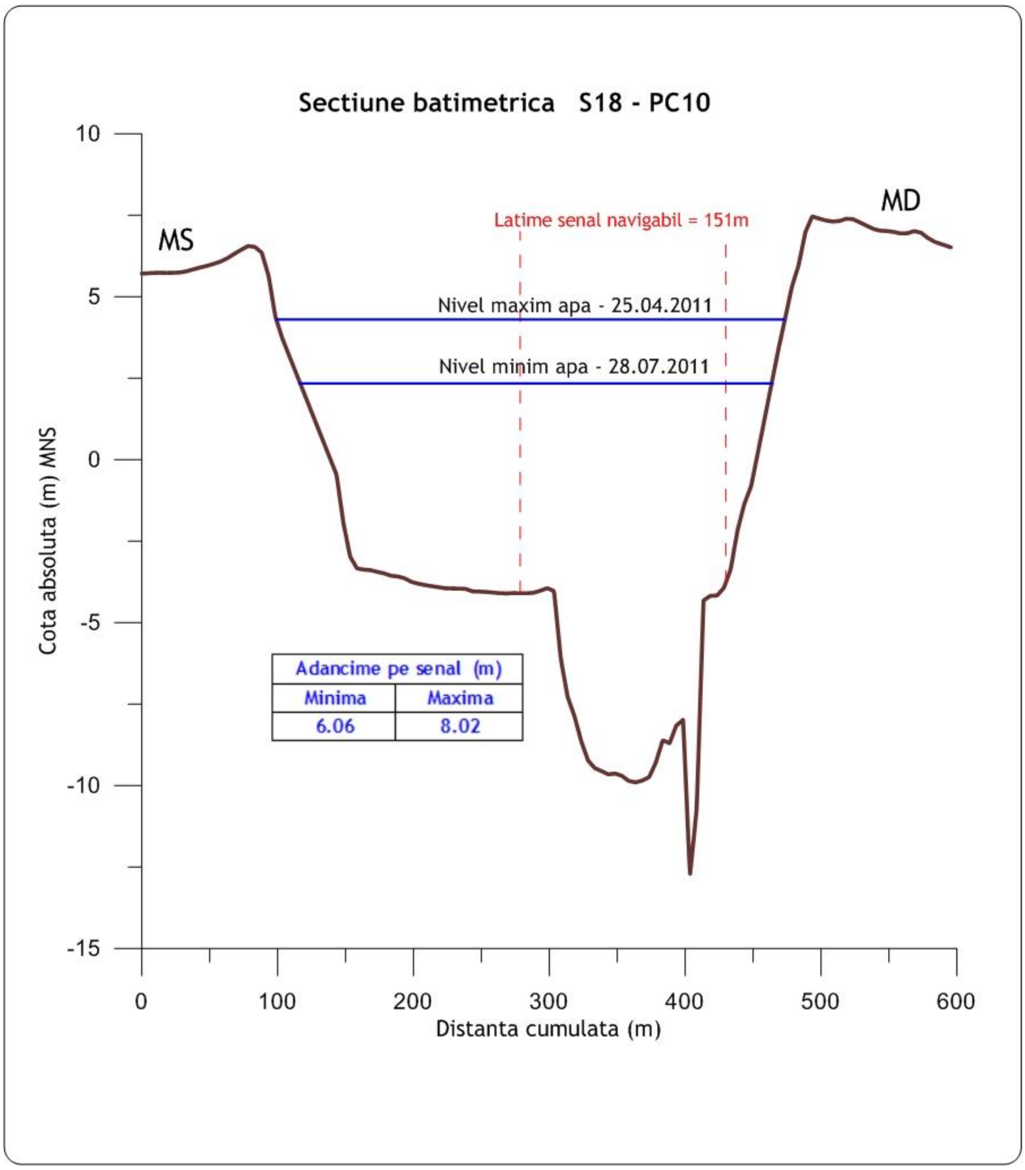


Figure 3.1.J.35

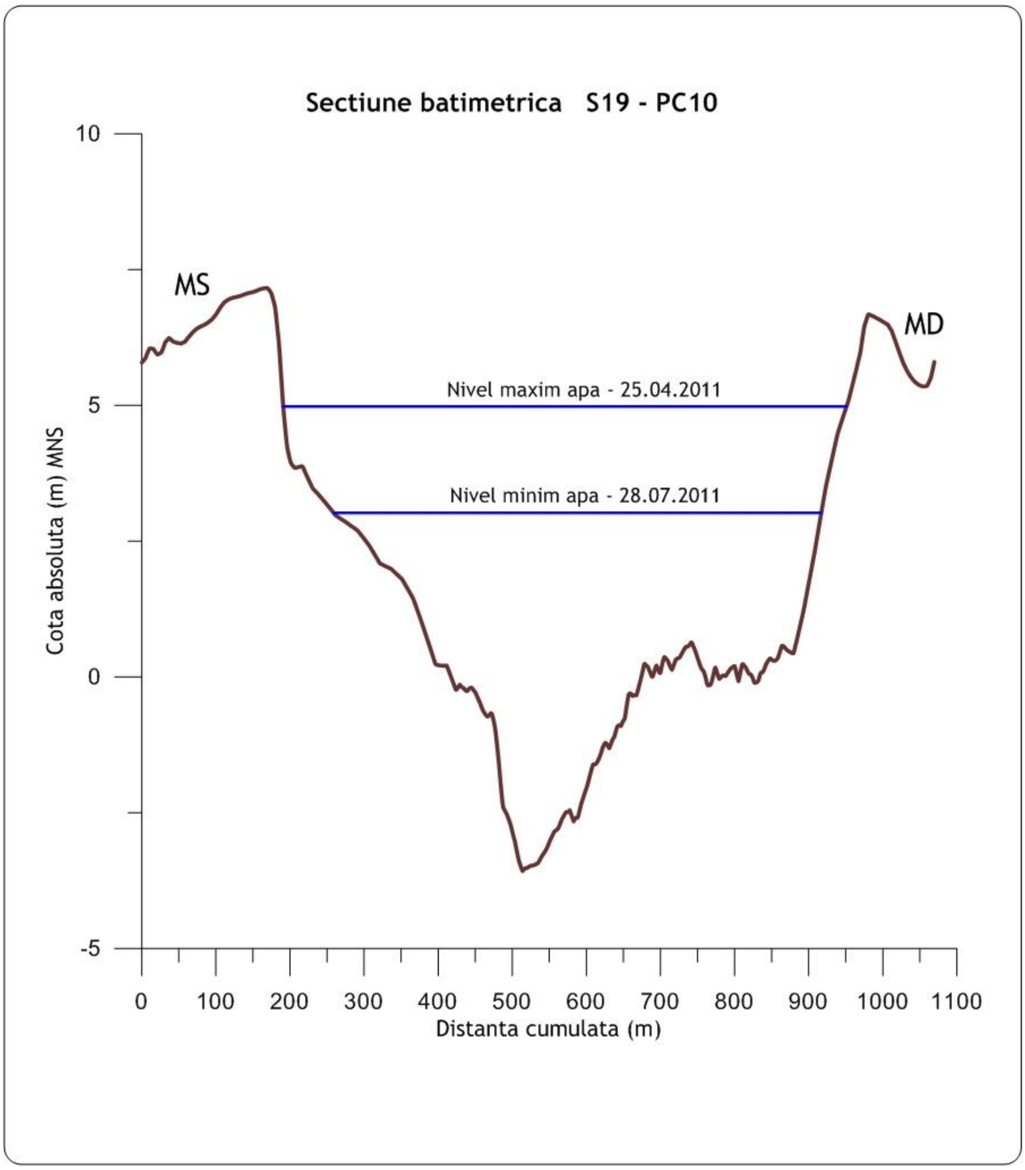


Figure 3.1.J.36

3.2. Reference Database

Monitoring locations (measuring/probing/sampling) and measurements/samples codification

Complex monitoring areas = Critical Points (CP 01, CP 02, CP 3A, CP 3B, CP 4A, CP 4B, CP 07 and CP 10).

Table 3.2.1 - Monitored components codification

Nr. crt.	Componenţa monitorizată	Cod componenţă
1.	Apa	**APA**
2.	Sedimente	**SED**
3.	Sol	**SOL**
4.	Aer	**AER**
5.	Zgomot	**ZGM**
6.	Flora terestra	**FLT**
7.	Fauna terestra	**FAT**
8.	Fitoplancton	**FIT**
9.	Flora acvatica	**FLA**
10.	Fauna acvatica	**FAA**

Monitored components codification

A number of restrictions imposed by the land condition which are going to be change from one campaign to another have been previously identified, namely:

- **Dynamics of the Danube** (some islands/islets will be partially flooded or completely covered by water during certain periods) – for this reason in some locations, monitoring points - it will be impossible to work on field;
- **Condiţiile meteo potrivnice** (de ex. valurile mari produse de vântul puternic) vor împiedica apropierea ambarcaţiunii de maluri pentru a lua probe de sediment, sau chiar debarcarea pe uscat;
- **The impossibility of field marking** and/or impossibility of an accurate localization of probing/samplig locations from previous campaigns.

All these risks require the following codification strategy, differentiated by monitored component.

For **monitoring/sampling carried out from the ground** (air, noise, soil, terrestrial flora and fauna terrestrial) for each "critical point" – according to the requirements of Terms of References - subareas have been defined on each river banks respectively island in order to be covered by a network having a specified density. This network could be different from one campaign to another, as number of points and/or locations. For **monitoring/sampling carried out from the ground** (air, noise, soil, terrestrial flora and fauna terrestrial) for each "critical point" – according to the requirements of Terms of References - subareas have been defined on each river banks respectively island in order to be covered by a network having a specified density. This network could be different from one campaign to another, as number of points and/or locations.

For **monitoring/sampling carried out from the water** (water and sediments samples, mainly) 20 cross sections along the Danube river are established. This sections will not be change from one campaign to another. For this reason, locations and water and sediment samples codification is complete and definitive already at this stage. The sections are localized by centers coordinates (generally in the middle of the navigation channel) and by the description and specification of the milestone which is situated nearest from the river bank.

As a general codification principle, to each location is assigned a unique alphanumeric code - obtained by concatenation - based on which the following informations can be obtained:

- Monitored component (APA, SED, SOL, AER, ZGM, FLT, FAT, FIT, FLA, FAA)
- Monitoring area – “critical point”
- Position (left river bank, right river bank, island/islet)
- Cross section (only for samples APA, SED, FLA, FAA);
- Depth (only for samples APA, SOL).

Codification of sampling/measuring points locations

As a general codification principle - under the imposed restrictions – the subareas, locations and samples have been codified, in the case of multiple samples in the same location (for example, soil and water samples which will be sampled from various depths).

A unitary codification of all the monitoring/measuring campaigns has been carried out.

Therefore, for each monitoring campaign was assigns a unique code on the type ***Cxx***.

Recognition campaign from 5 to 7 May 2011 has the code C00 and the campaign from 12 to 17 may has the code C01.

Numbering of campaigns is incrementally, without taking into account the monitoring/sampling type to be carried out in the campaign. This campaign code, consisting of 3 characters, will be automatically added at the end of codes specified in the codification forms, in order to allow the selection of the monitoring dates in a certain campaign from the established database.

1. Codification of sampling/measuring locations for AER

Codification of these locations (subareas) is shown in Table 3.2.2. Alphanumeric codes assigned to these locations have 7 characters, highlighting the composition of the monitored component, critical point and river bank/subarea-island or islet - as the case.

Table 3.2.2 - Locations codification (subareas) for AIR samples

Component	Critical point PC (XX)	River bank (YY)	Location code (subarea)	Observations
AER	01	MS	AER01MS	
AER	01	MD	AER01MD	
AER	01	OT	AER01OT	OT=OSTROVUL TURCESCU
AER	02	MS	AER02MS	
AER	02	MD	AER02MD	
AER	02	IE	AER02IE	IE=INSULA EPURASU
AER	3A	MS	AER3AMS	
AER	3A	MD	AER3AMD	
AER	3A	IS	AER3AIS	IS=INSULA SEICA
AER	3B	MS	AER3BMS	
AER	3B	MD	AER3BMD	
AER	4A	MS	AER4AMS	
AER	4A	MD	AER4AMD	
AER	4A	IC	AER4AIC	IC=INSULA CEACARU
AER	4B	MS	AER4BMS	
AER	4B	MD	AER4BMD	
AER	4B	IR	AER4BIR	IR=INSULA FERMECATU
AER	07	MS	AER07MS	
AER	07	MD	AER07MD	
AER	07	IF	AER07IF	IF=INSULA FASOLELE
AER	09	MS	AER09MS	
AER	09	MD	AER09MD	
AER	10	MS	AER10MS	
AER	10	MD	AER10MD	

Location (subarea) code are formed according to the rule below (first 7 characters). To these are added the sampling/measurement point code of the respective subarea (DD), alphanumeric character "C" that campaign code (NN).

1	2	3	4	5	6	7	8	9	10	11	12
A	E	R	X	X	Y	Y	Z	Z	C	N	N
Location code											

Similar codification rules have been used for the others monitored components with major differences in case of water samples taken from cross-sections at several depths and soil samples collected at two depths - 5 cm and 30 cm – from each samopling location.

Each component codification is exemplified in the following.

Measurements/samples codification – exemplifications

- **Air measurements/samples codification**

To the subarea code, specified in the form, the location code will be incrementally added - 2 digits - then the campaign code.

For example, a air sample code **AER01OT04C09** will be unique and will contain the following informations: AIR monitoring, along Ostrov Turcescu from PC 01 critical point area, in the location no 4 of this subarea, in monitored campaign no 9. The expert which will perform the measurements will fill this code with information regarding the monitored pollutant (measured or sampled).

- **Water samples codification**

To the sample code, specified in the form, the campaign code will be finally added as – Cxx.

For example, a water sample code A**PA3AS09CN30C02** is unique and contain the following informations: water sample, sampling along section 09, situated in PC 03A critical point area (upstream Seica), on the Danube middle, to a 3 m depth, in campaign C02.

- **Sediments samples codification**

To the sample code, specified in the form, the campaign code will be finally added as – Cxx.

For example, a sample code **SED4AS13MDC12** is unique and contain the following informations: sediment sample, sampling along section 13, in critical point 04A (Ceacaru island), on the right river bank, in campaign C12.

- **Noise measurements codification**

To the subarea code, specified in the form, the location code will be incrementally added - 2 digits - then the monitoring campaign code.

For example, a sample code **ZGM4AMD11C03** will be unique and will contain the following informations: measuring noise, on the right river bank, in PC 04A critical point area, in the location no 11 on the right river bank, in the campaign C03.

- **Soil samples codification**

To the subarea code, specified in the form, the location code will be incrementally added - 2 digits - then probing depth code – **A05** for sample taken from a depth of 5 cm, respectively **A30** for sample taken from a depth of 30 cm and finally the campaign code. For example, a sample code **SOL4BMD04A05C13** will be unique and will contain the following informations: soil sample taken from the right river bank, in PC 04B critical point area, location no 04, to a depth of 5 cm, in campaign C13.

All measured/sampled data have been georeferenced in Stereo'70 projection system, and then introduced – from the sampling/measuring sheets/forms - in a standardized format files. Laboratory test results have been introduced in these files.

Finally, a database was accomplished - which will form **the baseline** for the preconstruction campaign. The database contains all the information relative to all monitored components in the 4 months – 15 April 2011-15 August 2011.

3.3. Integrated analysis and the evaluation of monitoring results

3.3.1. Aquatic ecosystems

The Table 3.3.1 presents a syntetic matrix analysis of conditional and interdependencies between abiotic and biotic parameters at ecosystem level for the studied area, the next observations were accustomed through corroboration with the results of monitoring between April and August 2011.

(i) *The interdependency between the identified ecologic state (good to moderate) and the water chemical state was analyzed in correlation with the historical data, because the 3-4 months segment is insufficient in this manner; as such through the parallel utilisation of the historical data (specially TNMN – ICPDR) resulted a good answer between the two states, with the mention that at the level of Cd, Pb, Ni şi Hg metals, the disolved fraction concentration did not influenced directly the saprobic index,the eutrophication potential or the development of phytoplankton, but is reflected on the ecotoxicological potential, respectivelly on the metal bioaccumulation at flora and fauna level; the historical data (JDS_1 and JDS_2) did not put into light the relevant elements form ecotoxicological point of view, as a result of the relative low concentrations of hazardous metals/ priritary hazardous from the Danube water, at the studied section level.*

(ii) *The oxigen regime, mainly the biodegradable organic load, is directly reflected not only on ecological state in general, but also mainly on the saprobic index, the growth of CBO_5 leading directly to a growth in index value, respectively to the devaluation of water quality; the first and secons class identified at critical points from point of view of the organic loading is corroborating with the saprobic index evaluation index (ß mezosaprob);*

Table 3.3.1 - The matrix analysis of the corroboration of monitoring abiotic and biotic parameters for the aquatic ecosystems

Parametri/ Indicatori	Stare ecologică	Index saporbic	Potenţial de eutrofizare	Flora şi fauna acvatică			
				Dezvoltare fitoplancton	Potenţial ecotoxicologic	Bioacumulare în ecosistem acvatic	Toxicitate
Stare chimică	X	-	-	-	X	X	X
Încărcare organică biodegra-dabilă / regim oxigen	X	X	+/-	+/-	-	-	-
Regim nutrienţi N_T / P_T clorofila „a”	X	X	X	X	-	-	-
Poluanţi specifici de origine naturală	X	-	-	-	pe termen lung X	X	X
Concentraţia dizolvată metale periculoase C_D C_D/C_T	X	-	-	-	pe termen scurt X	X	X
Sedimente poluare asociată	X	-	-	-	pe termen mediu X	X fitobentos zoobentos (macronever-tebrate)	X
Modificări hidro-morfologice	X ihtiologie	-	-	-	+/	+/-	+/

NOTE: X direct interconditionalities
+/- potential correlations

(iii) The nutrients regime influences directly both the ecological state on the whole, the saprobic index, and specially the eutrophication potential (the algae development at phitoplancton level); althought for Danube river, including the researched area, no eutrophication porcesses were observed, the high temperatures, the low water flow led to a high value of nitrites registration, lower than of the nitrates and orthophosphates and for saturations in disolved oxigen ilustrating a denitrification potential; for the elucidation of this aspect in Table 3.3.2. the N_T / P_T reports are presented with the mention of a higher value of 14 of this report highlights a growth in eutrophication potential (Reedfeld relation of chlorophyll formation through photosynthesis); it can be seing R>14 s was registered at CP 01 and CP 02, where a saturation of dissolved oxigen and a pH growth (alkalinity) was in fact noted as a result of algae respiration (night CO_2 emissions, daily O_2 emissions); althought the values of „a" chlorophyll concentrations are not high as a whole, it can be seing that in mentioned hydrologic conditions and at high water temperatures, the existence of an eutrophication potential with an impact on downstream areas (particularyy in Danube Delta).

Table 3.3.2 - The N_T / P_T ratio corelation with the eutrophication potential growth

Parametrii	Puncte critice principale			Puncte critice secundare					
	PC 01	PC 02	PC 10	PC 3A	PC 3B	PC 4A	PC 4B	PC 07	PC 09
N_T (mg/l)	1,43	1,63	1,54	0,75	0,67	0,84	0,87	1,06	0,86
P_T(mg/l)	0,08	0,09	0,12	0,06	0,11	0,16	0,062	0,087	0,086
R = N_T / P_T	17,9	18,1	12,8	12,5	6,1	5,25	4,03	12,2	10
Clorofila „a" (µg/l)	17,39	14,06	11,93	11,4	10,4	11,5	13,4	13,34	14,11

(iv) The natural specific pollutans are corroborating with the ecotoxicological potential on the long-term (being about the total concentration parameter) respectively bioacummulation processes in vegetal and animal tisues and aquatic toxicity, with the mention that the natural backgroung has an important role in the evaluation; for hte researched area no relevant problems at this pollutants class has being revealed.

(v) Heavy metals dissolved concentration, particulary the hazardous ones (Ni, Pb) and prioritality hazardous (Cd, Hg) it highlights the direct ecotoxicological potential in short-term periods (acute toxicity) that is directly reflected on the ecological state and ecotoxicological processes; enphasized the fact that C_{diz} is depended on the matter in suspention content according to the relation:

$$\frac{C_{diz}}{C_{total}} = \frac{1}{1-K_p[conc.suspensii]} \qquad (3.3.)$$

where K_p is the partitition constant; it can be noticed that a higher values of suspention concentration % C_{diz} drops and vice versa. In this regard, the Tables 3.3.3 and 3.3.4 are presenting a comparitive view between C_{diz}/C_{total} reports at the Chiciu - Silistra and Reni (historical data TNMN – ICPDR) monitoring stations and the ones registered at critical points between April – August 2011; it can be seen that the CP determined reports values (althought for a short research period of 4 months) are sensibly higher than those measured between 2001 – 2006 given the low suspention concentration (Danube's low flow).

Table 3.3.3 - C_D / C_T reports Chiciu Silistra (S_1) and Reni (S_2) sections – TNMN – ICPDR data (annual averages)

Metal/conc.	Staţia	2001	2002	2003	2004	2005	2006	Media	Medie PC-uri 2011
Pb	S_1	-	0,23	0,25	0,15	0,22	-	0,212	0,43
	S_2	-	0,32	0,12	0,54	0,26	0,63	0,374	
Cd	S_1	0,18	0,28	0,11	0,27	0,12	-	0,192	0,52
	S_2	0,12	0,32	0,43	0,34	0,14	0,20	0,258	
Hg	S_1	-	-	-	-	-	-	-	0,40
	S_2	-	-	-	-	-	-	-	
Ni	S_1	0,18	0,30	-	0,37	0,24	-	0,272	0,61
	S_2	0,29	0,28	0,27	-	0,28	-	0,280	
Q (m^3/s)	S_1	5919,4	6100,1	4571	-	-	7370	5990,1	3000
	S_2	6304,3	6837,1	5021	-	-	8428	6647,6	

Table 3.3.4 - C_D / C_T reports Critical Points 2011 (averages)

	PC 01	PC 02	PC 10	PC 03A	PC 03B	PC 04A	PC 04B	PC 07	PC 09
Pb	0,56	0,45	0,58	<0,31	<0,31	0,43	0,31	0,27	0,65
Cd	<0,06	<1,0	0,73	<1,0	<1,0	<1,0	<1,0	0,42	0,72
Hg	<0,42	<0,38	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
Ni	0,89	0,66	0,38	0,74	0,53	0,54	0,5	0,58	0,69

Because the C_{diz}/C_{tot} report is dependent on the matter suspention regime at critical points (CP) level it can be distinguished a differentiation between the concentrations (metals) from the left bank(LB)/right bank (RB) and the center (CN); In this regard, in the Annexe 5.5 the distribution histograms both at total concentration (Cr, Cu, Zn, As, Ba, Se, Co, Fe, Mn) and at C_T/C_D fractions (Pb, Cd, Hg, Ni) are presented; in this line, the following observations are being underligned (water column):

- In general the main tranzit wight (histograms) goes to CN
- For dissolved forms, the wights are higher in areas of higher suspention concentration and vice versa (Cd, Pb, Hg, Ni).

(vi) The pollution associated with sediments is reflected upon the ecological state of body water through an ecotoxicological potential in a mid-channel, driving directly to bioaccumulation and toxicity processes for phytobenthos and zoobenthos (mainly macroinvertebrates); this particular aspect is not under contract but, as reference data, with the JDS_1, JDS_2, the Cousteau Report (1993) can also be used where the elements regarding the PCB accumulations on the Danube lower section at microinvertebrates level, are being presented.

In conformity with CIS 2003 Guide, for the evaluation ecological state and the ecological potentian basis must be considered: (i) the quality biological elements, (ii) hydromorphological conditions, (iii) physico-chemical conditions and the specific pollutants. For the Danube river, the relevant biologic elements are fish, invertebrates benthic fauna, phitoplanktonul and macrophytes / phytobenthos. The ecological state for every BQE (Quality Biologic Elements) 5 classes can be distinguished: high (the first), good (second), moderate (third), poor (fourth) and bad (fifth).

From the monitoring data obtained in April – August 2011 and from the corroborated with the historical data (ICPDR – TNMN, JDS_1 şi JDS_2) in this regard, the following observations are being underligned:

(i) Saprobic index (SI) indicates a ß-mezosaprobic water quality, respectively a „good” ecologic state, with some pressures derived from organic pollution (to be seen CCO-Cr)

(ii) Althought the determined values for „a” clorophyll are not high (first class, accordingly to Order 162) some dissolved oxigen saturation values were registered (CP 01 şi CP 02), which ilustrates a eutrophication potential, correlating with the phytobenthos

(iii) Hydromorphological alterations at Danube lower section level is reflected at inchthyofauna migration level

(iv) General physico-chemical parameteres (including nutrients) fall into the border between „good” and „moderate” state

(v) For the specific pollutants some exceedings in copper, zinc and other metals were identified, but these observations can not be generalized due to the non-existent informations about the natural content at the studied area level

(vi) The Table 3.3.5 presents a comparitative view between BQE and the physico-chemical parameters (JDS_2 historical data) that are concordant with the determined ones from the contract, for the preconstruction phase (the reference state); it can be observed that the results about fish and phytobenthos have a very bad outcome; for the evaluated ecological state of phytobenthos indicates that the nutrients impact and the hydrologic characteristic changes (flowmeters) from the hydromorphological alterations; to be noted that the phytobenthos oftenly indicates a moderate or bad ecological state althought the nutrient level does not crossover the quality standard; beacause of the phytobenthos is a long-term indicator meanwhile the chemical results shows the momentary situations.

By corroborating the monitoring data from the campagnes from Aprilie-August 2011 with the historical data results that on a whole, the ecological state is fitted between good to moderate.

Table 3.3.5 - Ecological state on the Danube lower section (ICPDR - JDS_2 - 2007)

Secţiune monitorizată	Indicaţii asupra stării ecologice pentru elementele de calitate biologică					Parametrii fizici şi chimici generali
	Nevertebrate bentice	Fitoplancton	Fitobentos	Macrofite	Peşti	
Chiciu - Silistra	3	1	1	2	4	1
Amonte Cernavodă	2	2	3	2	3	1
Brăila	2	2	3	2	3	1
Reni	2	1	3	2	-	1

Notes regarding the ecological state indications: 1-high, 2-good, 3-moderate, 4-poor, 5-bad

In contrast to the ecological state, the chemical state is evaluating on the basis of two classes: (a) good or (b) bad (inadequate), in this regard, elements being neccesary for highlighting the following:

(i) For the hazardous chemical/prioritaryly hazardous substances through Directive 2008/205/EC of amendment of Water Framework Directive (2000/60/EEC) transposed in Romania through Hotărârea de Guvern 1038/2010, is provided, according to the chemical component, annual averages sills and regarding the maximum admissible concentrations; consequently, for an objective evaluation it is neccesary at least 12 values (monthly monitoring)

(ii) The monitoring parameters refers to the dissolved fraction concentrations (Hg, Cd, Pb, Ni) and to the total concentration (other chemical substances)

(iii) For cadmium, the admisible limits are depended by the water hardness this limits growing with the hardening measures

(iv) The componenets that can be discovered in natural content (metals) no reference values are provided; no evaluations of the natural content of metals on the Danube river has being made so far(content values)

(v) In the situation of sediments both for the metals specified above and the organic micropollutants (PAHs, PCBs, organochlorine pesticides) the Directive 105, respectively the HG 1038 does not present specific environmental standards, consequently, referentialy, Order 161 was used

(vi) The chemical state for other metals (Cu, Zn, Mn, Co etc) was evaluated conformly with the specifications from Order 161, with the mention that the natural content was not considered for these elements, due to the fact that it is not reference data.

The corroboration of chemical state with the ecological one is not direct to the natural elements (metals) because, depending on the natural content the aquatic ecosystems have adapted to this, the overcrossing of the carrying capacity (the supportability degree) could't be evaluated, exclusively, on the basis of limits of admissibility. In consequence, even though the example for Cu, Fe, Mn or another elements the overcrossing of admissibility limits leads to the evaluation of chemical state as bad and this evaluation must not be equivalent with a directly reflection of the ecological state.

A reference element is the corelation of the hydromorphological order with the ecological state of the body water, particularly with the fish migration,the following aspects must be pointed out:

(i) Hydromorphological alterations (namely the ones that will be generated by the bottom sills) wil be reflected by the directly affecting both for the inchthyofauna migration as well for the conectivity modifications, in general (in principal the longitudinal ones); this fact wil be blazing forth upon the nutrition habitats and on the fish reproduction.

(ii) The same hydromorphological order alterations will modify the suspention material tranzit from upstram to downstram, due to bottom sills.

Together with the corroboration of abiotic and biotic data at ecosystem level results, it was also revealed the corelations between water quality indicators and the water flow and also the interparametrics (hydrochemical data).

For the first category the proximation ecuation of concentration (at non-persistent water quality indicators) must be considered, respectively:

$$C_i = C_{beK} + C_{pct} + (\alpha - \beta)Q \qquad (3.4.)$$

unde: C_i – reprezintă concentraţia (valori de imisi)

C_{beK} – concentraţia de fond

C_{pct} – concentraţia ce reflectă sursele punctiforme

α – creşterea concentraţiei elementului urmărit prin poluarea difuză (ea mărindu-se cu debitul)

β - efectul diluţiei (el crescând cu debitul)

Depending on the wight of α with β the curbe inclination $C_i = f(Q)$ may be positive (proponderent diffuse pollution) or negative (dilution is preponderent).

Beside the interdependency function $C_i = f(Q)$ it is practised the correlations between mass flow associated L_i with the flow and respectively between C_i and L_i.

In this regard, the corelations between water flow, suspention material concentrations and the mass flows tranzited by Danube river on the Chiciu – Silistra – Reni section (historical data) were followed.

In the Table 3.3.6 are presented the flow values, suspention concentrations mass associated loads, for the 1998 (Bucureşti Declaration), 2001 – 2009 (TNMN – ICDR network) period – the following mentions are neccesary for highlighting in this direction:

a. For the gravimetric determination of suspention concentrations water sampling was made, at both monitoring sections of the CP at a depth of 1,0 m; if more samples were collected in the same section (LB, RB CN) a medium value was used;
b. Average monthly concentrations have being calculated accordingly to the relation:

$$C_M(mg/l) = \frac{\sum_{i=m} C_i(mg/l) \bullet Q_i(m^3/s)}{\sum_{i=m} Q_i(m^3/s)} \qquad (3.5.)$$

where C_M = average monthly concentrations (average wight with flow)
C_i = concentration in sampling days of every month
Q_j = the flows from the sampling days of the month

c. Monthly inputs were determined by using the formula

$$L_m(tone) = C_m\ (mg/l) \cdot Q_m\ (m^3/s) \cdot days\ (m) \cdot 0.08464 \qquad (3.6.)$$

where Q_m = average monthly concentrations

d. Monthly inputs were determined from the amount of monthly uploads

$$L_a(tone) = \sum_{m=1}^{12} L_m(tone) \qquad (3.7.)$$

e. If the flows are available only for the sampling days Q_m was calculated from these data;for the months without measurements the C_m Q_m procedures will be used from the daily sampling months.

The Figures 3.3.1. and 3.3.2. presents in this regard, the results obtained at the two monitoring sections. It can be observed that the both curves are of liniar type, without any differences between the inclinations at Chiciu - Silistra, respectively Reni. The dispertion points, especially in the below 30mg/l area, is relatively high, mainly beacause of the specific errors to the gravimetric of materials in suspention in low concentrations determinations.

Also, in the Figures 3.3.3. – 3.3.8. other interparametric corelations are shown that were established for this regard.

This type of curve (analytical modelling) can put into light the influence of bottom sills on the materials in suspention in tranzit, in the area where the hydrotechnical works will be made. Also, the data can be used as basic information (abiotic data) for the 3D modelling.

Table 3.3.6 - Average water flow values, suspention material concentrations and of suspention quantity tranzited by the Danube -
data from Bucureşti Declaration(1998) and TNMN - ICPDR 2001-2009 data

Staţia de montoring	1998	2001	2002	2003	2006	2007	2008	2009
Chiciu Silistra (km 375) Q(m^3/s)	5610	5919,4	6100,1	4571	7370	5195	5358	5990
Suspensii (mg/l)	29	15	14	13	41,44	26,97	19,5	2183
KT/an suspensii	5206	2700	2600	2122	11151	4801	3584	4547
Reni (km 132) Q(m^3/s)	6310	6304,3	6837,1	5021	8428	5626	5909	6492
Suspensii (mg/l)	25	19	23	15	48,01	36,05	33,9	42,26
KT/an suspensii	5048	3700	5100	2615	13994	6953	6247	8172

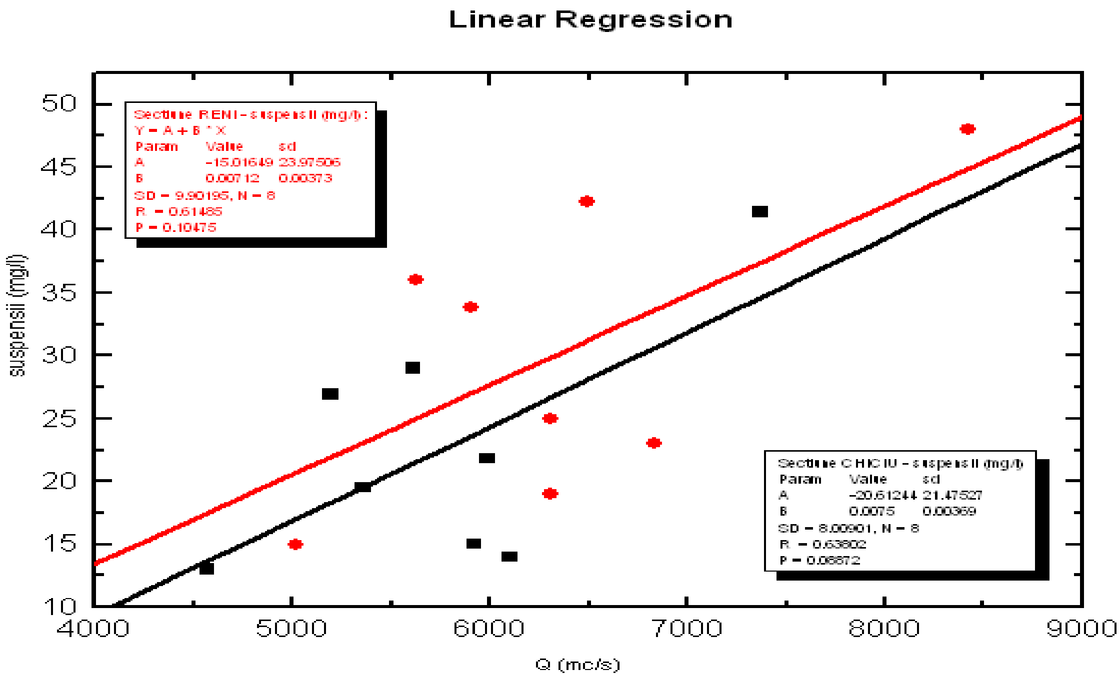


Figure 3.3.1 - C_{susp} = f(Q m^3/s) correlation at Chiciu - Silistra and Reni sections (1998 - 2009 period)

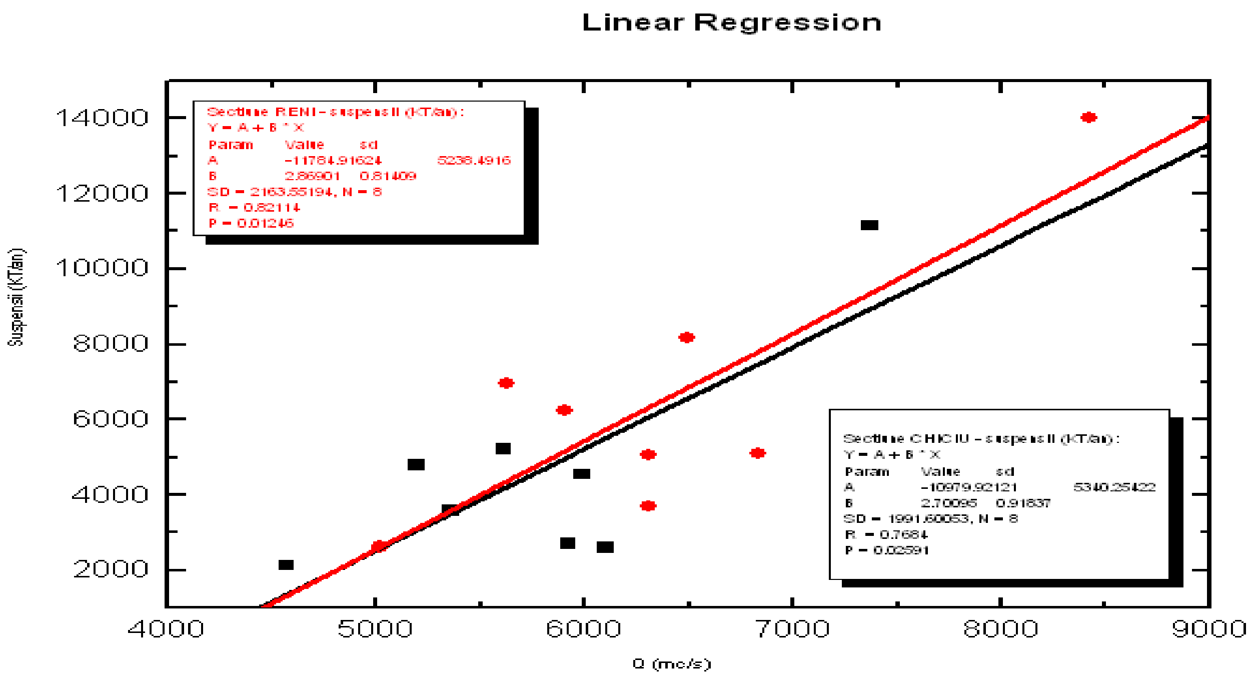


Figure 3.3.2 - $K_{T\ suspensii}$ = f(Q m^3/s) correlation at Chiciu - Silistra şi Reni monitoring stations (1998 - 2009 period)

Beside the data shown earlier, the following general elements about the evaluation of monitoring aquatic ecosystems results:

(i) *The data and informational set about the hydromorphological monitoring, the water quality, the aquatic fauna and flora and the inchthyofauna monitoring, covers the requirements from the Specifications allowing the obtaining of basic data for the evaluation of preconstruction state (reference state);*

(ii) *It is distinguished a good concordance between the hydrochemical and the hydrobiological evaluations, between the chemical state and the water ecological state;*

(iii) *Based on of the obtain data from April - August 2011 and the corroboration with historical data (where appropiate) a series of corelations between water quality physico-chemical indicators and water flow were revealed and also interparametric type was distinguished, a detailed of the last ones was provided for the finalisation report for the preconstruction phase;*

(iv) *A good congruence between the parameter values determined at the preconstruction phase level with the historical ones exists.*

In concequence, it can be stated that the basic data obtained at this phase assures the necessary conditions for reference state evaluation and through this, a evaluation of further necessities (construction and post-construction state)

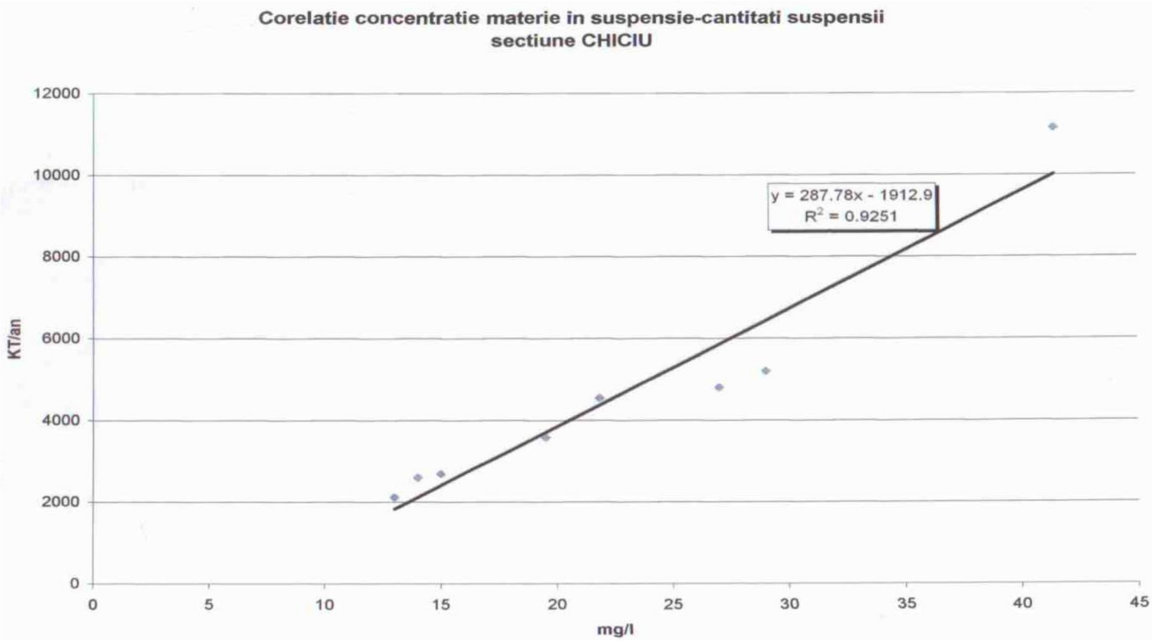


Figure 3.3.3

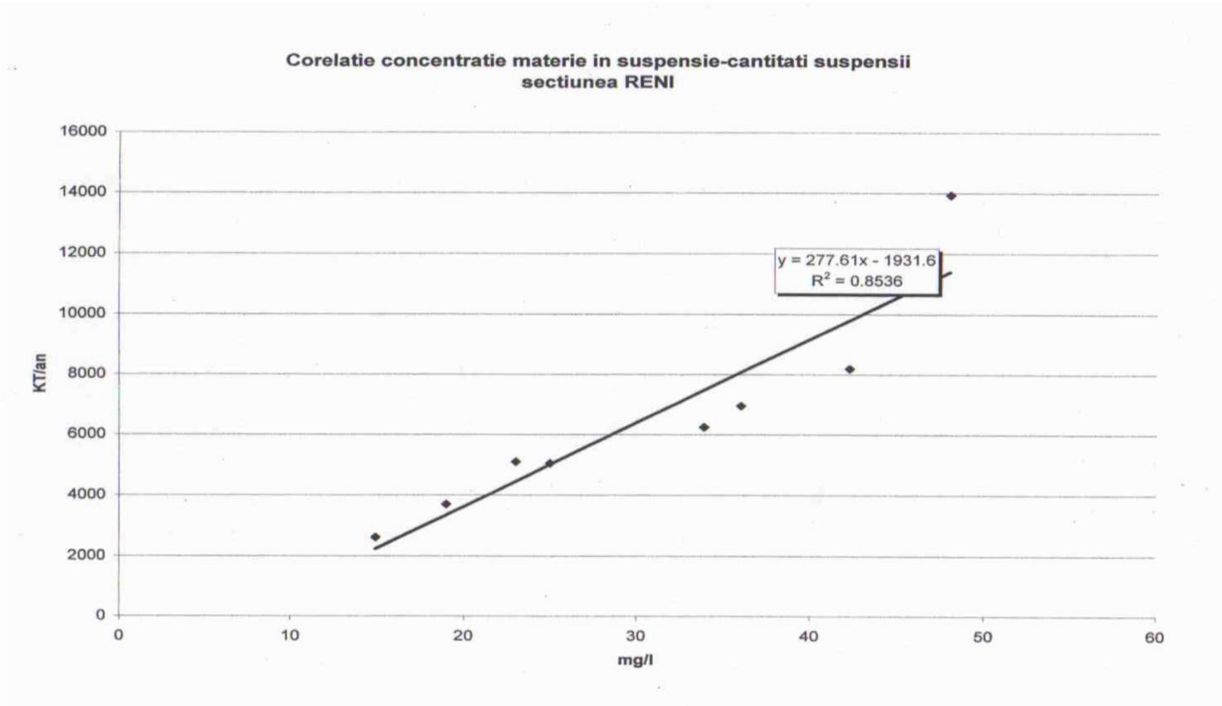


Figure 3.3.4

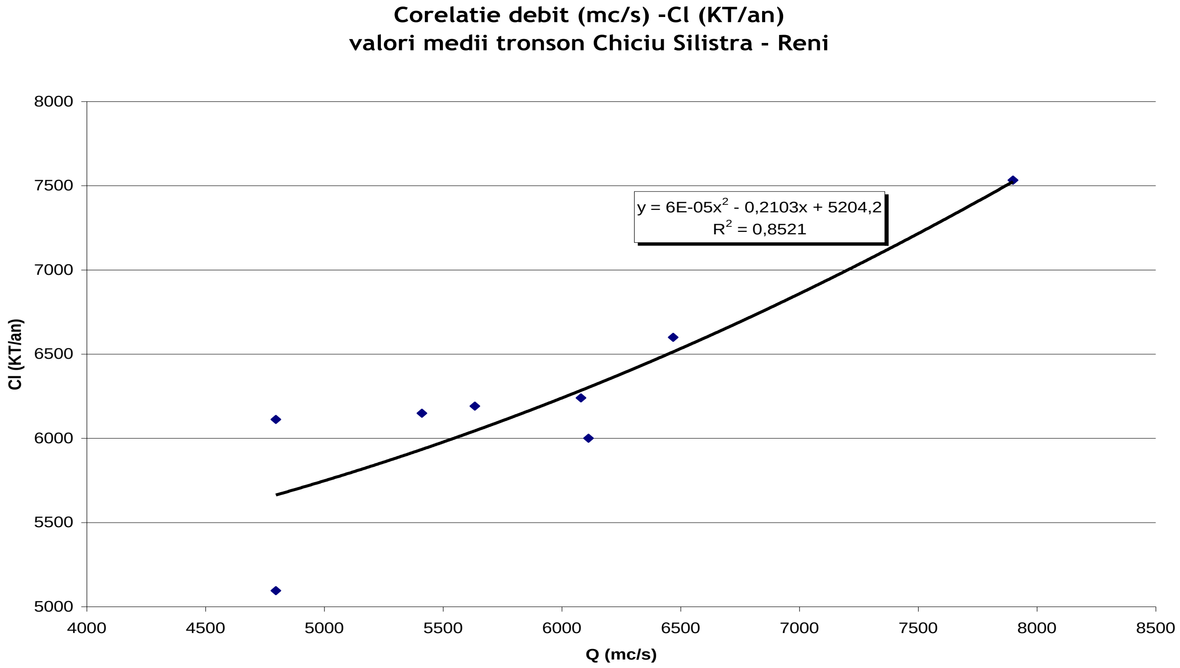


Figure 3.3.5

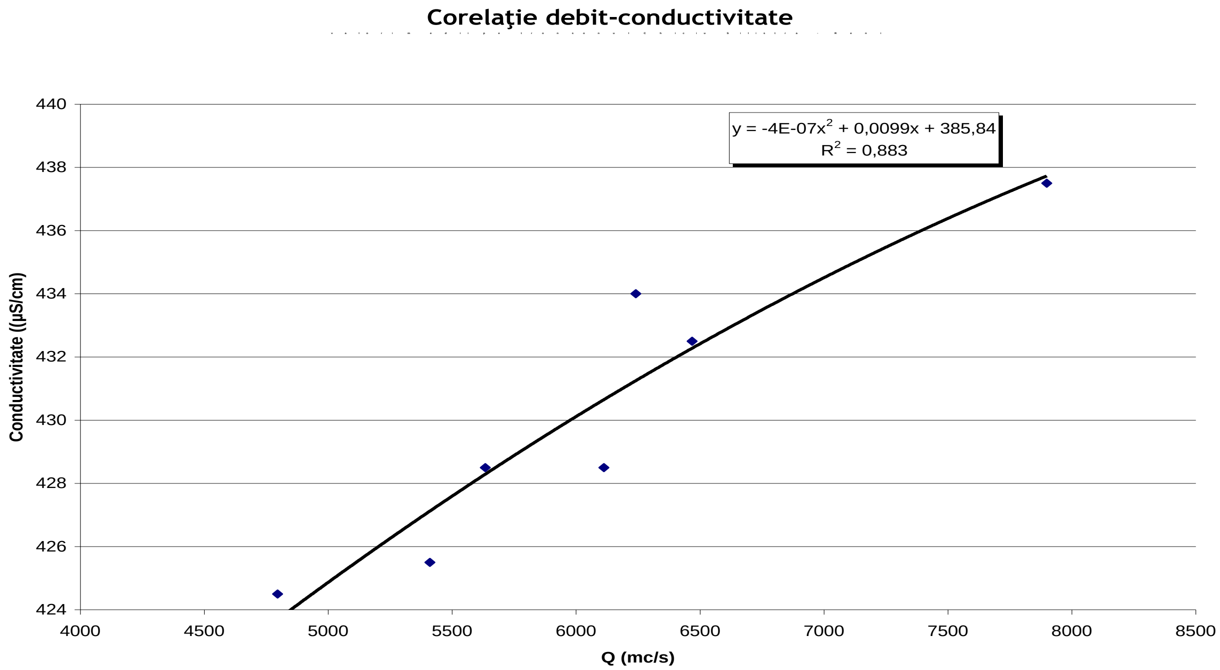


Figure 3.3.6

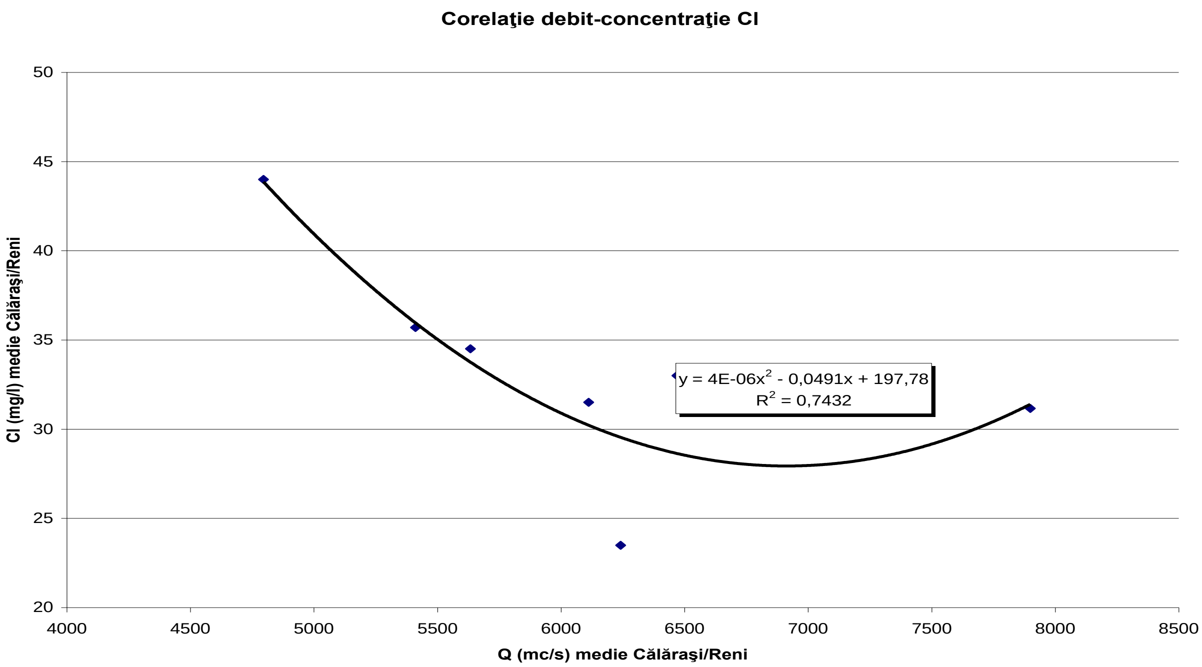


Figure 3.3.7

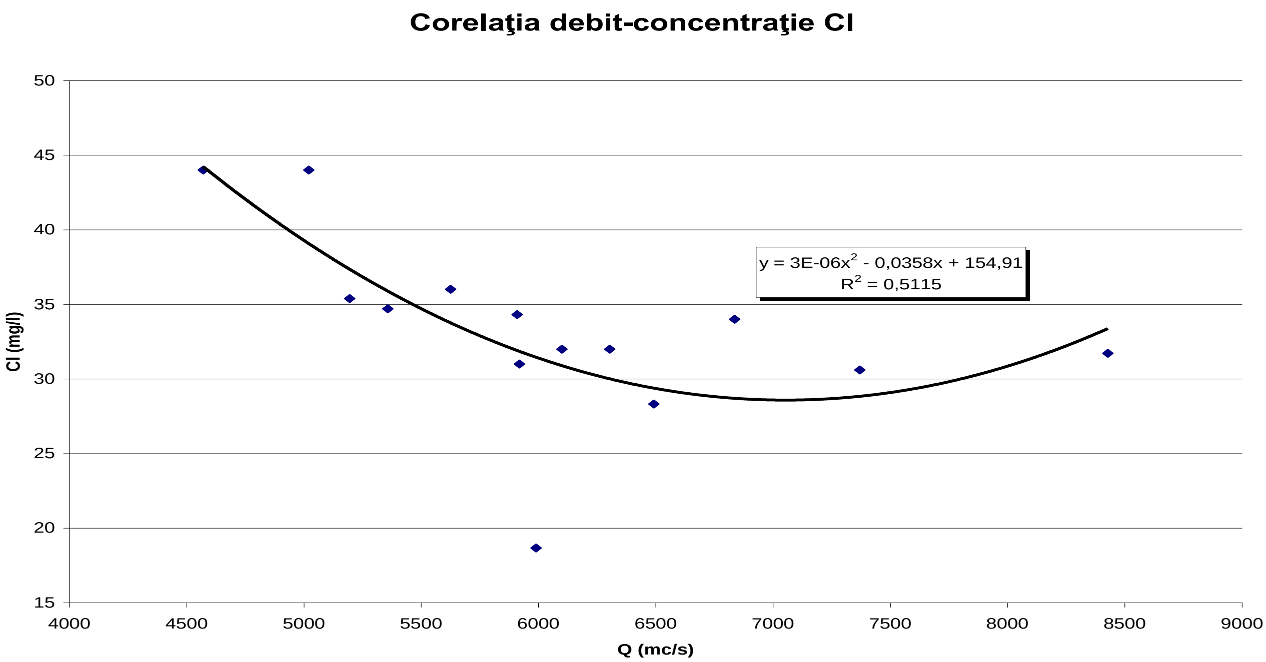


Figure 3.3.8

Flowing waters are liniar systems which are modifing its relatively predictable flow, the water temperatures, sublayer rugosity and the riverbed size in different sections. Thus, the water flow and velocity, the depths and the turbidity have a great influence on the rheophile communities. In this regard, the geomorphological and the hydrological characteristics of the river, such as the fairway morphology establishes the larger part of the spacial scales that affects the rheophile communities.

Migratory sturgeons are not permanent residents of the Danube, this species migrating from the sea, during late autumn, when they position themselves in wintering pits and are waiting the hot season, or during early spring, when they gather in aggregation areas for the further movement to breeding areas.

The previous studies have specify that the sturgeon breeding begins immediately after the Danube flow's begins to decrees, after a period of floods, that are washing away the sediments that could asfixiate the embryonic spawns in the hard sublayer, at water temperatures between 6° and 15°C.

Table 3.3.7 - Breeding characteristics for sturgeon species that spawn in the Danube (sourse INCDDD)

Specia	Temperatura apei [°C]	Perioada de reproducere	Adâncimea apei [m]	Viteza apei [m/s]
A. ruthenus	12 – 17	primăvara	10	1,5 – 5
A. stellatus	15 -26	primăvara - vara	2 – 14	1,2 – 1,5
A. gueldenstaedti	15	primăvara	4 – 10	1 – 1,5
H. huso	8 -12	primăvara	4 -20	1,1 – 1,9

The recruitment from the natural breeding of sturgeons in the Danube variated in the last decade, depending on how many breeders have managed to arrive in the breeding areas. The most favorable years for breeding were 2000, 2005 and 2010, when COEU (captures on effort units) had reached values between 7 and 10. It appears that this thing was due to a powerfull generation, prior to 1990, that in regular scale intervals (5 years) had produced generations characterized by a large number of juvenals. Another explanation is that in 2005 the sea waters during spring made difficult to capture the breeders, so they were able to breed at a large scale.

Table 3.3.8 - Captures on effort units (COEU) in 2000 - 2010 period (sourse INCDDD)

Anul	Specia				
	Huso huso	*A. gueldenstaedti*	*A. stellatus*	*A. ruthenus*	Total
2000	**7,375**	**0,750**	**1,375**	**3,125**	**12,625**
2001	1,625	0,167	0,208	0,208	2,208
2002	1,744	0,302	0,046	1,279	3,372
2003	0,143	0,000	0,086	1,743	1.971
2004	1,683	0,073	0,122	2,244	4,122
2005	**10,000**	**0,091**	**1,273**	**13,182**	**24,545**
2006	0,51	0	0	0	0,51
2007	0,659	0,024	0	0,366	1,049
2008	2,846	0,000	0,308	0,115	3,269
2009	0,160	0,00	0,19	12,77	13,13
2010	**8,700**	**0,029**	**0,210**	**16,000**	**24,940**

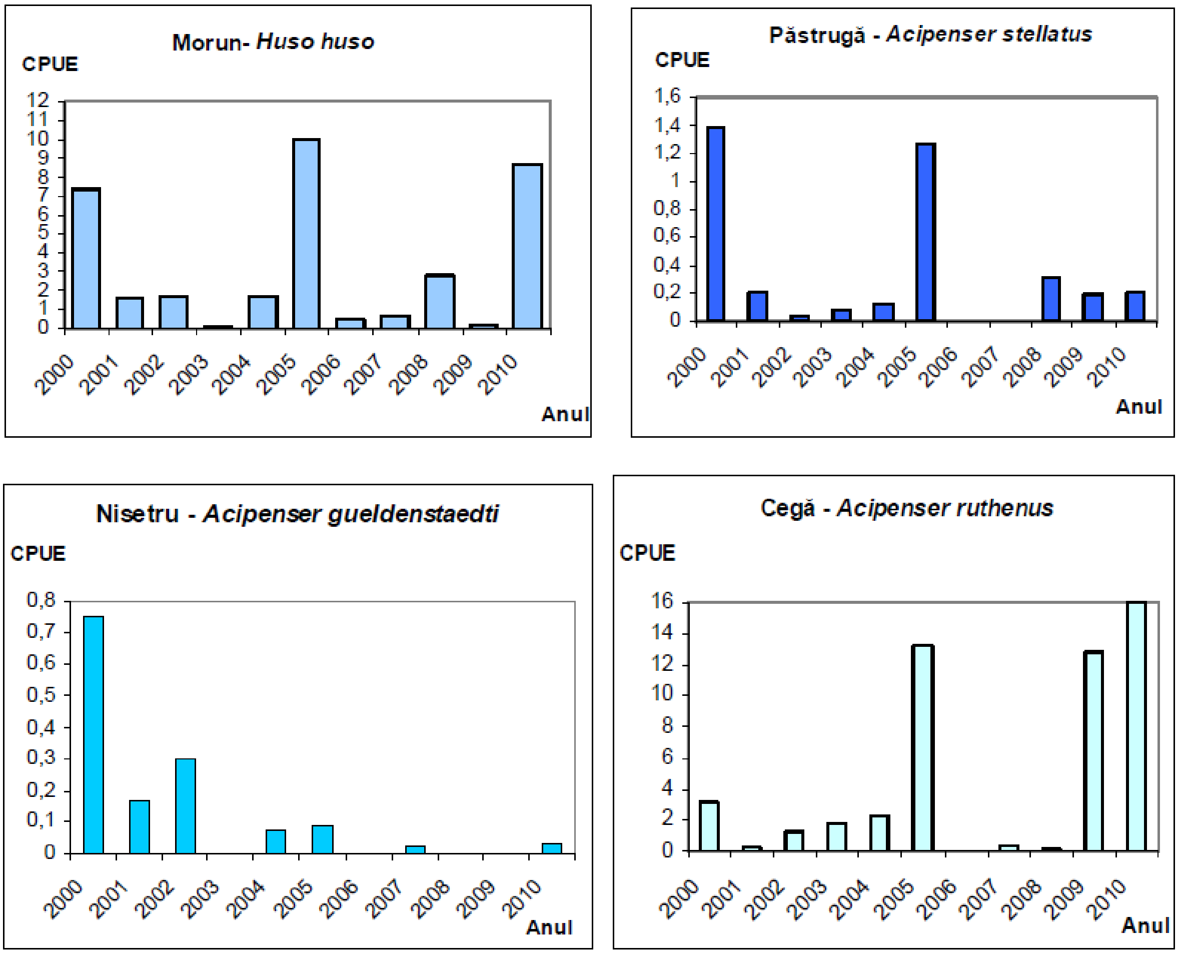


Figure 3.3.9 - COEU evolution for sturgeon species that are breeding in the Danube (source INCDDD)

Regarding to the breeding areas of sturgeon species, these were detected on Borcea branch, represented by areas with sublayer made by eroded limestone formationes, in Borcea setlement area, and on the Old Danube, in Piatra Roşie area (Rasova). The collected data from fishermen sugestes that the upstram migration is developed specially on Borcea with a passing in the Old Danube through Bala branch.

It is noteworthy that in June – July period c.y. no captured and marked sturgeon on Bala branch (starry sturgeon and sterlet) have migrated on Bala branch, which means that on this branch and upstream there are no late breeding areas for starry sturgeon. Also, the captured and marked sturgeon analysis in the 200 – 180 km area has shown that non of the specimen have moved on Caleia branch for the upstream migration.

Thus, on Borcea, Bala and Caleia branches are showing its importance as a feeding area for infant sturgeons, the Bala and Borcea branches representing the main migratory route for upstream breeding.

Considering the fact that the migratoy behavior of adult and infant sturgeons is obvious the fact that the realization of sills with the water of Danube from Bala branch towards Old Danube deviation role, respectively Caleia branch to Old Danube, in low flow conditions, may affect the migration to the breeding areas from upstream, and the infants migration downstream, to the sea, because these movements are taking place near the sublayer, in high depth areas. But these things wil not affect the return of sturgeon in the sea, after breeding, because in these situations it was observed that the sturgeons usually swim much more rapidly, in the third superior layer of the water, where the current is maximum, for the maximization of their velocity movement.

The captured migratory sturgeons analysis on the Danube (from the previous period of sturgeon fishing banning) reveals that, at least for the russian sturgeon and the starry sturgeon, the autumn migration seems to be much more important than the spring migration, due to the bigger captures made in this particular period. It is also possible that the spring floods might influence the fishing of breeders and so the data of the captures may not reflect the migration dynamic of these species. In the scientific domain an opinion is circulating that stipulates that the beluga,in autum migrates all the medium specimens, the big specimens migrates during late winter and at the begining of spring and the small breeders migrates at the end spring.

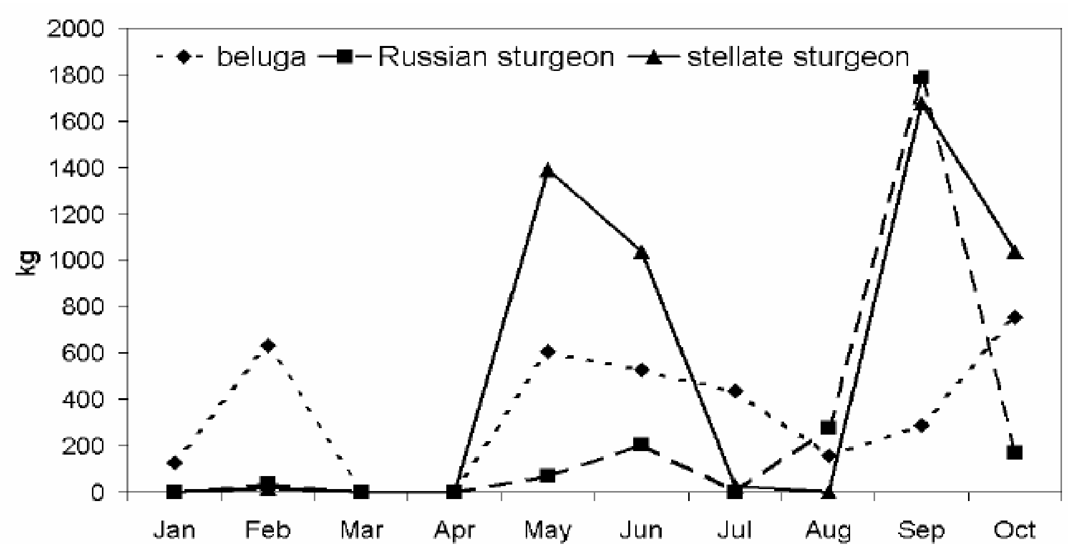


Figure 3.3.10 - The sturgeon capture dynamic in Danubian romanian sector (sourse A. Ciolac, 2004)

The migratory sturgeons from the Danube river are not breeding annualy, but at intervals between 2 and 8 years, depending on the species and on their size.

Table 3.3.9 - Time intervals between two succesive breeeding in years at different sturgeon species (after 2001)

Specia	Răspândire	Mascul	Femelă	Autori
A. baeri	Siberia	1 – 2	3 – 4	Kozhin, 1964
		2 – 4	3 – 6	Sokolov, 1965
A. brevirostrum	USA	3 – 8	3 – 8	Taubert, 1980 Dadswell şi colab., 1980
A. fulvescens	Quebec	2 – 3	4 – 6	Magnin, 1966
	Lacul St. Louis	9 – 10	9 – 10	Goyette şi colab., 1987
A. gueldenstaedti	Dunăre	-	> 6	Valsenko şi colab., 1989
	Volga	2 – 3	5	Valsenko şi colab., 1989
A. oxyrhynchus	USA	1 – 5	3 – 5	Smith, 1988
A. ruthenus	Dunăre	1	1	Manea, 1966
		-	1 – 2	Jankovic, 1958
A. stellatus	M. Caspică	3 – 4	3 – 4	Shubina şi colab., 1989
A. transmontanus	Columbia	-	2 – 11	Cochnauer şi colab., 1985
	Fraser	4 – 11	6 – 8	Cochnauer şi colab., 1985
H. huso	M. Neagră şi M. Caspică	3 – 4	3 – 4	Eladnize şi colab., 1970
	M. de Azov	4 – 5	5 – 5,5	Makarov, 1970
P. kaufamanni	Amu – Darya		3 – 4	Makeeva şi colab., 1964

The drastic reduction of migratory strugeon effectives is due to multiple causes. The cumulated effects of invensive fishing and dam building at Porţile de Fier I and II (that have reduced almost half of the breeding area of strugeons on Danube), are esential, which made a drastic drop of beluga captures in Romania (Figure 3.3.11).

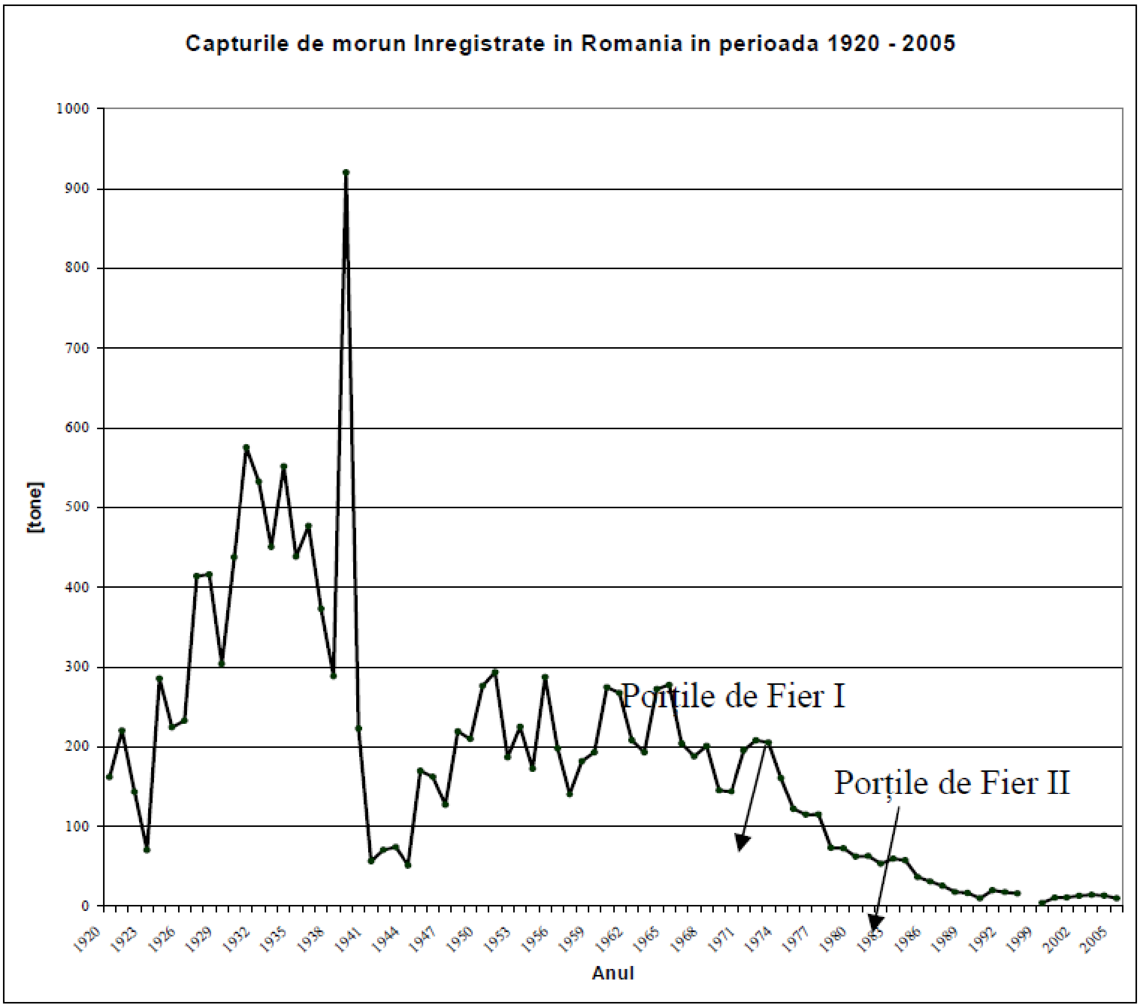


Figure 3.3.11 - Beluga captures registered in Romania during 1920 – 2005 (sourse INCDDD)

Because of the short period from the start of this project and until its preconstruction phase will be completed, it is imposible to obtained complete data about thesturgeon movement, their wintering areas, concentration and breeeding areas, we are forced to use the scientific publications and the fishermen observation to sketch a more completly image of sturgeons favorite habitats in breeding migrations on Danube.

The **Suitability Index**(SI) and also the **Habitat suitability index** (HSI) models are heavily relying on the obtained informations from the scientific publications, regarding the habitat necessities of these species. The HSI models and SI graphics are therby realised to produce an index between 0 (unfitted habitat) and 1 –optimal habitat. Using the SI and HSI models is the starting point for the developing of further own models, such that the general favorable habitats of species can adapt to the local constraints and particular habitat conditions. It must be understood that the HSI şi SI models are hypotheses of the species-habitat relations.

The exact behavoir of sturgeons in migration and their requests for habitats differs accordingly to the migration period, because of the two form of it: a late autumn migration with the remains in wintering pits in the Danube until spring (when the breeeding takes place), and another one that migrates form sea in early spring, it concentrates in different areas situated near traditional breeding areas. So, this migrations manifest different traits and different habitat utilisation patterns,although it belongs to the same species.It is considered that the specimens that migrates in autumn, are making a longer traits upstream of river, in contrast to the specimens that migrates during spring, which chooses to breed downstream.

The water velocity, the depth, the temperature are esential characteristics for migratory strugeons as well as the sublayer, depth and velocity flow are esential characteristics for their breeding areas choises.

The migratori sturgeons on Danube HSI model consists in two components: C_m migration and C_r. breeding. Every component contains variable habitats that can be measured on field.

The relation system between the habitat variables included in HSI model for rheophyle habitats is ilustrated in Figure 3.3.12.

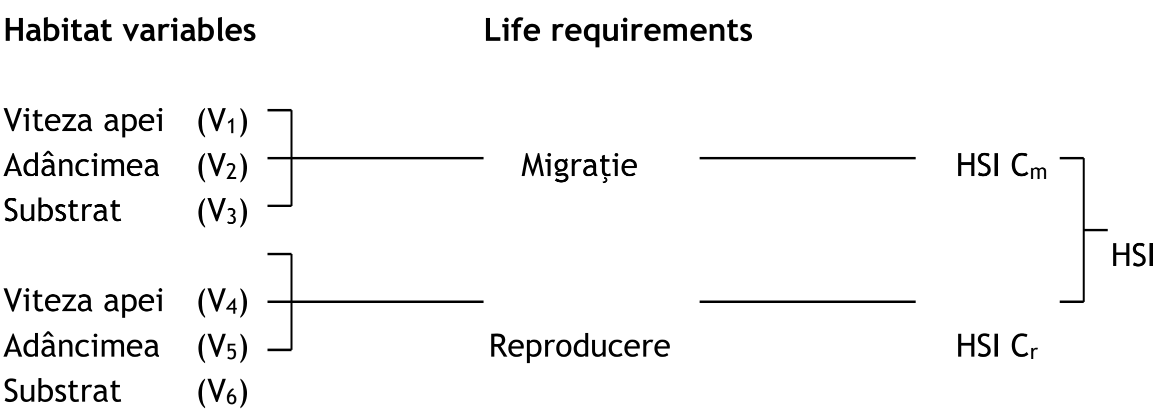


Figure 3.3.12 - The relations between habitat variables and life requirements of migratory sturgeons on Danubein the HSI rheophile model (lotic)

Migration component

The water velocity (V_1), the depth (V_2) and the flow (V_3) were chosen as indicators for the choosing of the adequate migration trait for Danube migratory sturgeons. The sturgeon breeders migration begins at the dropping of flows. The sturgeon migratory traits are characterized by the fairway depth area.

Breeding component

The water velocity (V_4), the depth (V_5) and the sublayer (V_6) are selected as indicators for picking breeding areas. Generally, the spawing takes place at water temperatures of 8-15ºC, and the incubation period shortens with the rise of temperature. The breeding places are characterized by great depths (15 – 20 m for beluga), with a sublayer of gravel and boulders, with an ideal rugosity for catching the sublayer spawns. The water velocity and flow are considered crucial for spawing, incubation success and larvae survival. An ideal combination of environmental conditions takes place only 4-5 days per year. The adults can postpone the breeding if the period and magnitude of flood does not meet the fish requirements.

Suitability index (SI) graphics forselected variables

The SI graphics for V_1 – V_6 variables were relised converting the avalaible informations about the Danube migratory strugeons in an maching index that varies between 0 (unfitted) and 1 (optimum). The arguments for the maching index development for the utilized variables of the HSI model for the two components are presented in Table 3.3.10.

Table 3.3.10 - Variable type and the arguments of its choosing

Variabilă	Explicaţie
V_1	**Viteza de curgere a apei** pe traseul de migraţie permite peştelui o deplasare rapidă, în condiţii de siguranţă, ţinând cont de faptul că peştele se deplasează în apropierea substratului, la adâncime mare, pe şenal sau în imediata vecinătate.
V_2	**Adâncimea apei** pe traseul de migraţie se menţine mare, maximă chiar, la morun, întrucât peştele se deplasează în imediata vecinătate a substratului. Adâncimea maximă asigură peştelui protecţie împotriva eventualilor prădători şi are legătură cu fototactismul pronunţat al sturionilor adulţi.
V_3	**Tipul substratului** pe traseul de migraţie variază de la mâl la piatră, funcţie de zona prin care peştele trece.
V_4	**Viteza de curgere a apei** este esenţială la reproducere, întrucât peştii aleg acele zone cu o viteză suficient de mare, astfel încât locul de reproducere să fie curăţat de către curentul apei, astfel încât sedimentele să fie îndepărtate pentru a nu asfixia icrele şi embrionii imobili.
V_5	**Adâncimea apei** în locurile de reproducere este importantă, morunul alegând ca locuri de reproducere cele mai adânci gropi, pentru protecţia icrelor şi puietului
V_6	**Tipul substratului,** rugozitatea sa este esenţială pentru capacitatea icrelor de a se prinde de substrat. De asemenea crevasele dintre pietre sau fragmentările din stratul de argilă asigură o bună protecţie a icrelor şi larvelor imobile împotriva diferiţilor prădători.

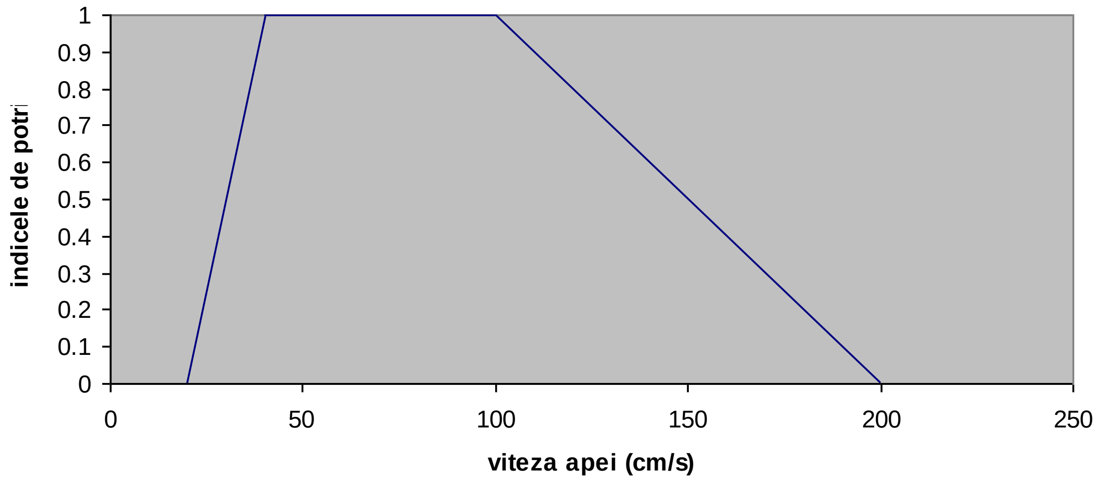


Figure 3.3.13 - Average water velocity on migratory trait

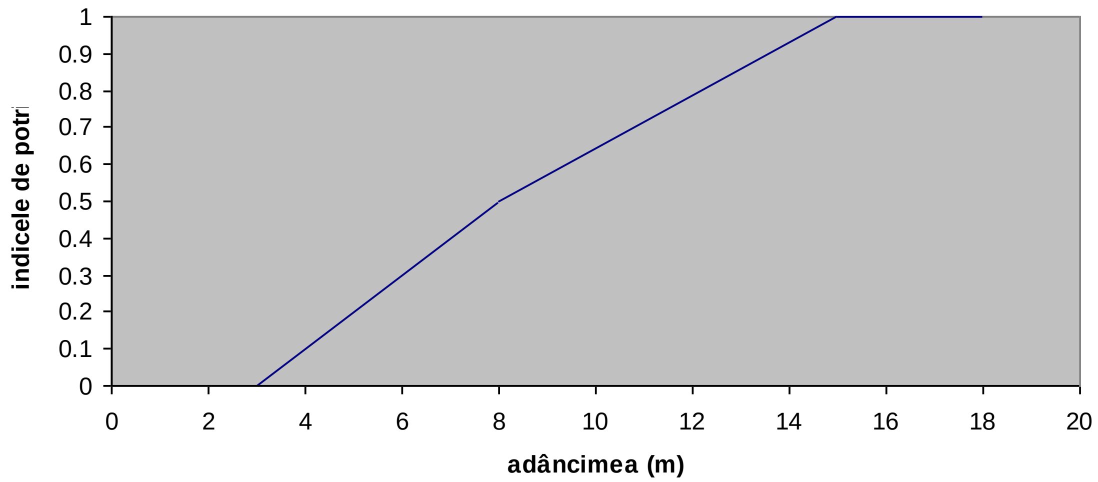


Figure 3.3.14 - Average water depth on migratory trait

Sublayer code:

1- macrophytes
2- ooze
3- clay
4- sand
5- gravel
6- boulders
7- cliffs

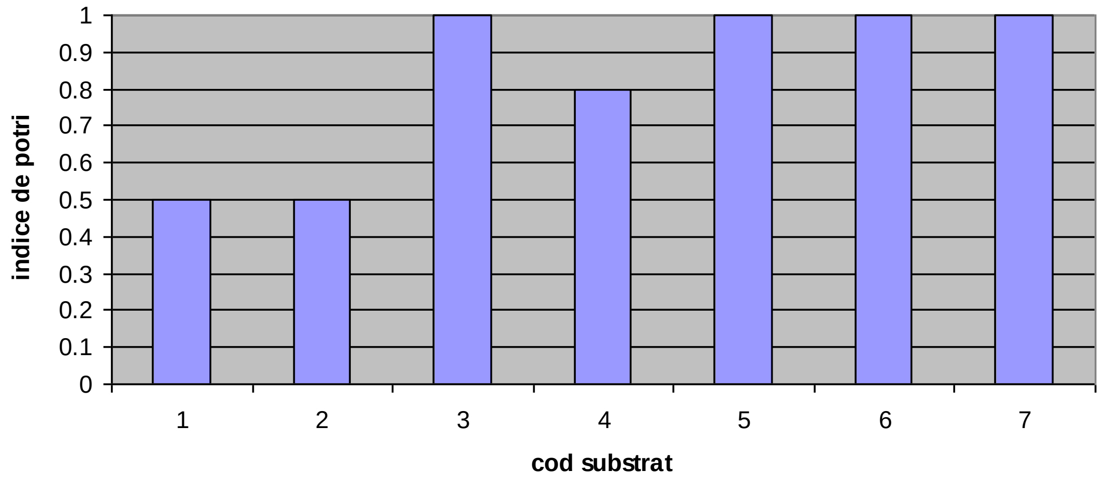


Figure 3.3.15 - Prevalent type of sublayer used during migratory period

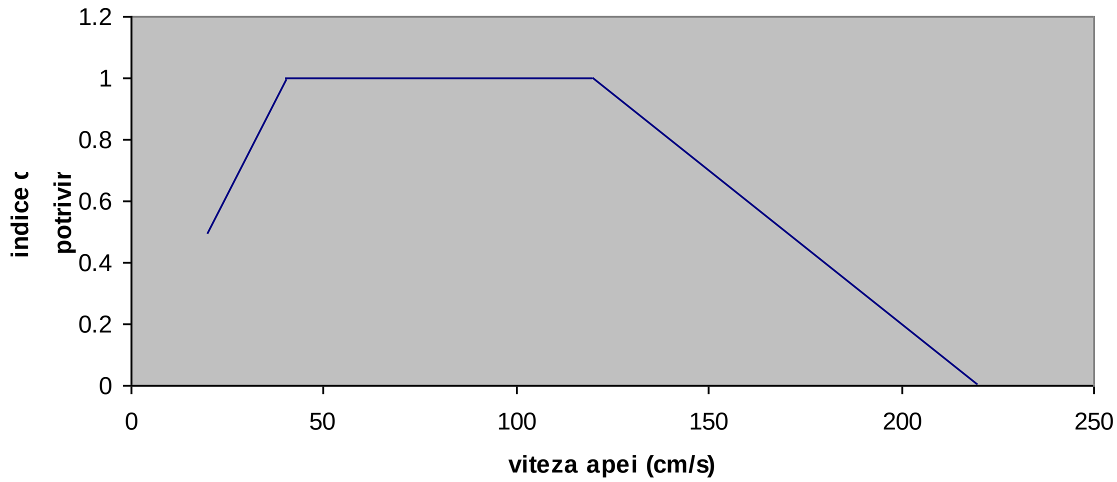


Figure 3.3.16 - Average water velocity in breeding area

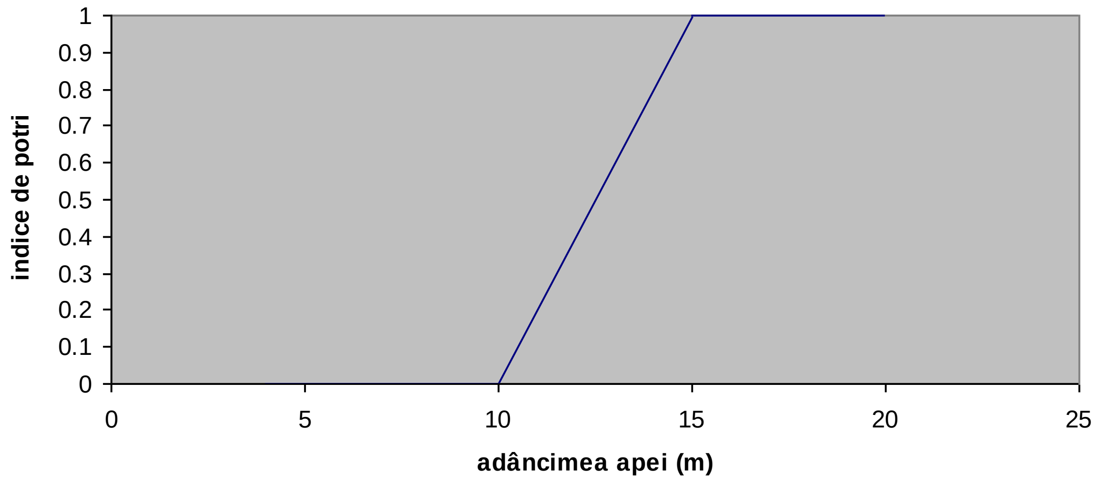


Figure 3.3.17 - Average water depth on migratory traits at breeding area

Sublayer code:

1. macrophytes
2. ooze
3. clay
4. sand
5. gravel
6. boulders
7. cliffs

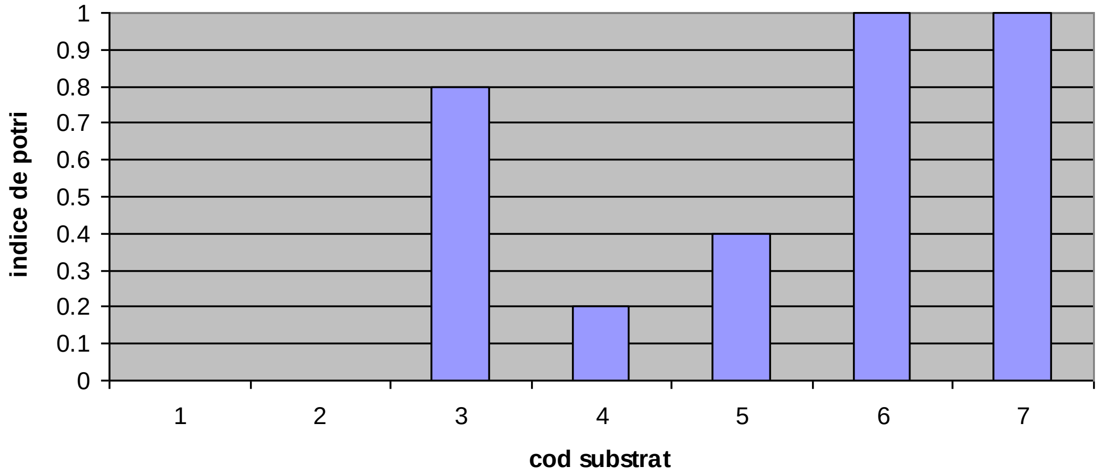


Figure 3.3.18 - Prevalent type of sublayer used at the breeeding area

HSI determination

The Table 3.3.11 presents the data obtained from scientific publications for the calculation of SI scores for every model component.The theoretical data are considered to represent logical combinations of Danube migratory strugeon habitat conditions. We assume that wathever variables utilized at any of the two components of this model, C_m and C_r may prevent the appearance of the maximum favorable conditions for sturgeons, no matter the value of the other habitat variable. Thus, the variables with the lowest suitability index (SI) assumes that it defines the maximum potential limit for danube migratory strugeons, in the evaluated habitat.

HSI C_m = minimum SI of V_1, V_2 şi V_3 variables.

HSI C_r = minimum SI of V_4, V_5 şi V_6 varaibles.

HSI total = minimum SI for C_m or C_r

Table 3.3.11 - The ipothetical data set used for suitability indices results presentation, for Danube migratory sturgeon habitat variables

Model component	Setul 1		Setul 2		Setul 3	
	data	**SI**	**data**	**SI**	**data**	**SI**
V1	135 cm/s	1,0	180 cm/s	0,2	280 cm/s	0,0
V2	17	1,0	12	0,3	4	0,1
V3	argilă	1,0	nisip	0,8	argilă	1,0
V4	150 cm/s	1,0	100 cm/s	0,5	35 cm/s	0,1
V5	18	1,0	12	0,4	16	1,0
V6	argilă	0,8	pietriș	1,0	piatră	1,0
HSI $C_{(m)}$		1,0		0,2		0,0
HSI $C_{(r)}$		0,8		0,4		0,1
HSI total		0,8		0,4		0,0

Model results interpretation

This type of models are not expected to predict the breeding succes beacause not only the habitat conditions determined the Danube migratory sturgeon population survival and success. The model can be useful for the preliminary evaluation of discussed sites, such as the potential habitats for Danube migratory strugeons. The model indicates the matching level of Danube migratory strugeons.This can be: excelent (SI = 0,8 – 1,0), good (SI = 0,7 – 0,8), moderate (SI = 0,5 – 0,6), poor (SI = 0,1 – 0,4) or bad (SI = 0).The model was not yet applied on field, because of its following testing for the determination of its accuracy as a descriptor of strugeon habitat quality. The model must be evaluated through field measurements, in the proposed practice area for the determinaton of which variable model is important and can be measured or estimated. A HSI = 0 for a specific habitat that is evaluated does not signify the absence of sturgeons in that area. It means that the habitat is poor in one or more variables and the presence of sturgeons may be reduced or null. If the model is properly structured, than the HSI high score may indicate the optimal habitat conditions for sturgeons, regardin to the variables included in the model.

The SI graphics and the HSI models allows the utilisation of IFIM method (Instream Flow Incremental Methodology) that is used for the quantification of habitat number that are available to different species or different fish life stages (or invertebratetes) at different flows. The IFIM methodology consists in some autonomous modeles, combined by users when required. A IFIM component is PHABSIM (Physical Habitat Simulation System). The results obtained outlines the physical micro-habitats availability, according to the riverbed flow and structure for every set of habitat disponibility criteria (SI graphics) from the model.

PHABSIM uses the Suitability index (SI) graphics that describes the habitat variables disponibility, the most important are the river hydraulics and the riverbed structure (flow velocity, depth, sublayer temperature) for every fish species life stage (spawing, larvar stage, juvenile and adult).

Depending on the ichthyofaunal ecological zoning namely the abiotic environmental characteristics are more important than others. Thus, some benthonic species, are esential for the riverbed characteristics (depths, riverbed discontinuities, sublayer rugosity and type), meanwhile for the pelagic species esential are the water column characteristics (curent velocity, flow, turbidity).

The analysis of the benthonic fish population (other than sturgeons and barbel) in areas of interest highlights the similar habitat conditions in the three analized locations (CP 01 and 02, CP 10 and Bala branch). The similar habitat conditions and trophic resourses makes the fish populations not to differ significantly from the three studied locations. Ca diferences are distinguished in the relative abundance a wight higher than of the adapted species at a average flow with a sandy and rocky sublayer in CP 01 and 02 (Izvoarele – Ostrov Iepuraşu, km 347 – 342 area). It is about *Neogobius melanostomus* and *Gobio albipinatus* which together represented, in this area, 61% of relative abundance of captured species. Instead, in the Bala breanch area, where the fairway depths are greater and the water velocity much more stronger dominantes the species, predominanlty rhophiles,such as *Zingel streber* (43% relative abundance).

It can be distinguished a lack or the reduced percentage of commercial value of species (carp, wels catfish, zander) that are affected by excessive commercial fishing and the drastic reduction, through draining of the floodplains of Danube, in the 6th and 7th decades of the last century, which were the favorite breeding and growing areas for juvenals of this species. The reduction of commercial value species percentage has determined the upstream advancing of many freshwater gobies species,that in other times were stationed at the Danube river mouth, nowadays being in an active process of colonising the Danube river, some species arriving upstream, near Vienna. The growing percentage of gobies species (7 species in the Danube river) may have negative effects on the hatching rate of strugeon spawns and on the juvenals survival in the first stages of life, because gobies consumes the spawns and juvnals of other species.

The benchic fish fauna is represented by 29 captured species, with a total efectiv of 1498 specimens.

The captured sea fish population in electric shore fishing analysis, outlines a number of 15 species in the three critical points, to which is added two species of mackerel (*Alosa immaculata* and *Alosa tanaica*), which, during spring, migrates from the sea to Danube for laying spawns. The maximum abundance in all of the three locations is owned by common bleak (*Alburnus alburnus*), and regarding the biomass, in CP 01 the common roach (*Rutilus rutilus*) dominated, in CP 02 the zander (*Stizostedion lucioperca*) and the pike (*Esox lucius*), and in CP 03 the ide (Leuciscus idus). It must be noted that in CP 02, the electrical fishing was made in a channel closed with a stone dam, that reduced the flow action, thus a larger precentage of species of low flow were reported, such as the pike (*Esox lucius*) and the bream (*Abramis bjoerkna*). Form the larvae and mackerel juvenals (*Alosa immaculata* şi *Alosa tanaica*) samples it is confirming the hypothes that in the Danube Călăraşi – Brăila segment is the most important for the breeding of the two species form the *Alosa* genum.

The number of species in this area is much more bigger, the completed questionnaire by local fishermen, form the three critical points, revealing the constant presence of a number of 44 species, from which 23 have a commercial value, the Gibel carp (*Carassius gibelio*) being the most predominant. To this a number of 4 species is added, with a accidental presence in the area.

On the basis of the obtained results analysis one can confirm that in this Danube section presents a higher value for the point of view of environmental conservation and the conservation of Danube indigenous species.

The obtained data from benthic and sea electrical fishing, were sorted and processed for the highlighting of fish species grouping, found in the critical points, regarding the habitat condition similarities. The habitat conditions were characterized on the basis of three characteristics: the water depth (great, average and shallow), sublayer type (without sublayer – sea, sand, ooze, clay, gravel, aquatic vegetation, boulders and compact rocks species), the flow velocities (high, avearage and low). The chosen variables encodes with 0 and 1 (0 - absent, 1 present) and is rolling with AHC – Agglomerative Hierarhical Clustering (Figure 3.3.19). A dendogram is obtained, which groups the fish species present in the critical points regarding the esential abiotic characteristics: water depth, sublayer type and the water flow velocity.

Table 3.3.12 - Inchthyofaunal Abreviation list

	Specii	**Abreviere**
1	*Abramis bjoerkna*	Abrbjo
2	*Abramis brama*	Abrbra
3	*Abramis sapa*	Abrsap
4	*Acipenser nudiventris*	Acinud
5	*Alburnus alburnus*	Albalb
6	*Alosa tanaica*	Alotan
7	*Barbus barbus*	Barbar
8	*Benthophilus stellatus*	Benste
9	*Carassius gibelio*	Cargib
10	*Cobitis elongatoides*	Cobelo
11	*Cyprinus carpio*	Cypcar
12	*Esox lucius*	Esoluc
13	*Eudontomyzon mariae*	Eudmar
14	*Gobio albipinnatus*	Gobalb
15	*Gymnocephalus baloni*	Gymbal
16	*Gymnocephalus schraetser*	Gymsch
17	*Lota lota*	Lotlot
18	*Neogobius fluviatilis*	Neoflu
19	*Neogobius gymnotrachelus*	Neogym
20	*Neogobius kessleri*	Neokes
21	*Neogobius melanostomus*	Neomel

	Specii	**Abreviere**
22	*Rutilus rutilus*	Rutrut
23	*Sabanejewia balcanica*	Sabbal
24	*Sander lucioperca*	Sanluc
25	*Silurus glanis*	Silgla
26	*Syngnathus abaster*	Synaba
27	*Vimba vimba*	Vimvim
28	*Zingel streber*	Zinstr
29	*Zingel zingel*	Zinzin
30	*Leuciscus idus*	Leuidu
31	*Scardinius erythrophthalmus*	Scaery
32	*Aspius aspius*	Aspasp
33	*Chondrostoma nasus*	Chonas
34	*Rhodeus sericeus*	Rhoama
35	*Pseudorasbora parva*	Psepar
36	*Perca fluviatilis*	Perflu
37	*Proterorhinus marmoratus*	Promar

Another inchthyofauna group graphic representation (fig. 3.3.20) in critical points, regarding the essential abiotic characteristics (water depth, sublayer type and the water flow velocity) are obtained by rolling MCA – Multiple Correspondence Analysis (Analiza de corespondenţă multiplă). It is noted it the graphic th association between different species with specific abiotic conditions.

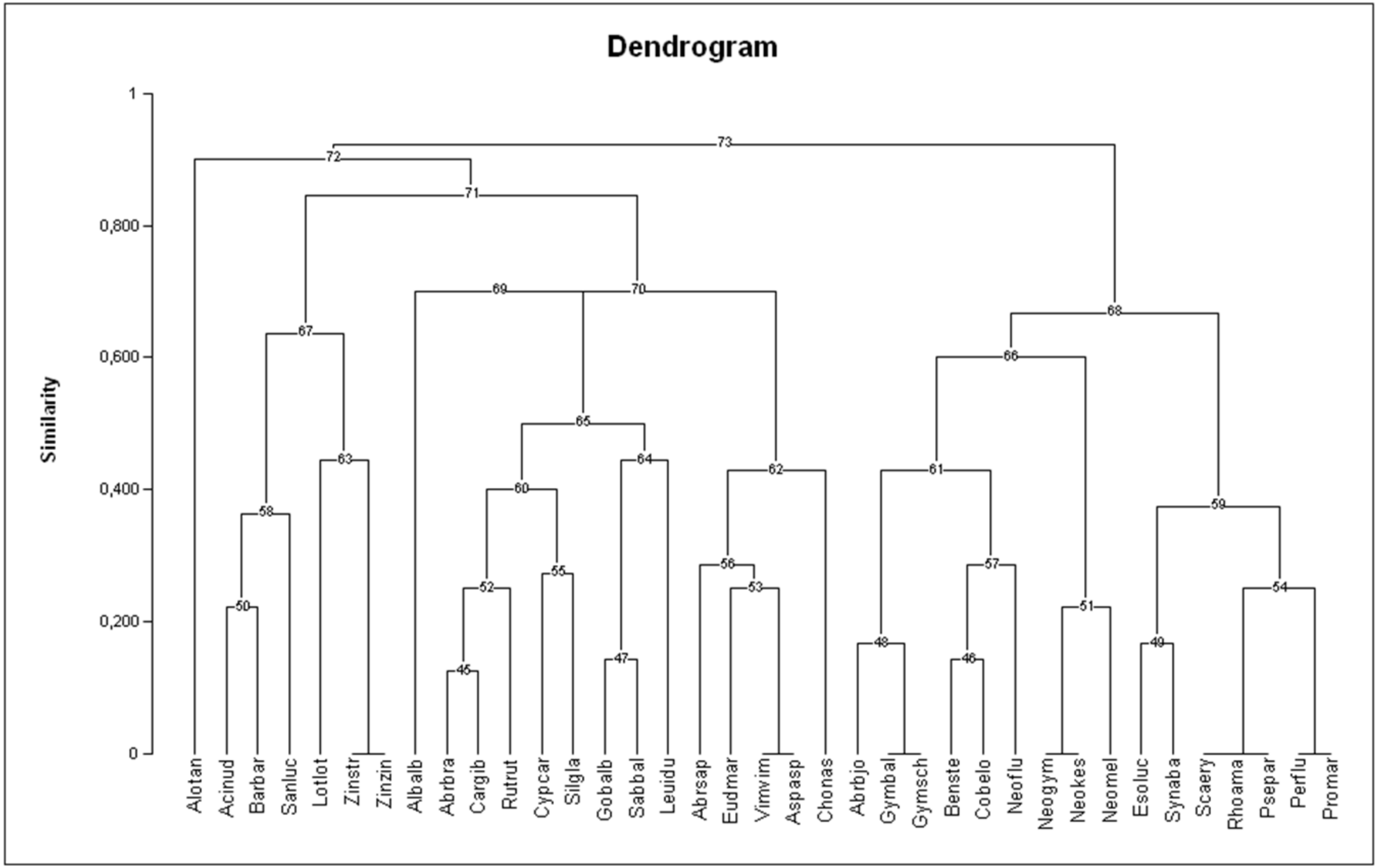


Figure 3.3.19 - Habitat similarities between fish species present in critical points resulted from the AHC analysis dendogram

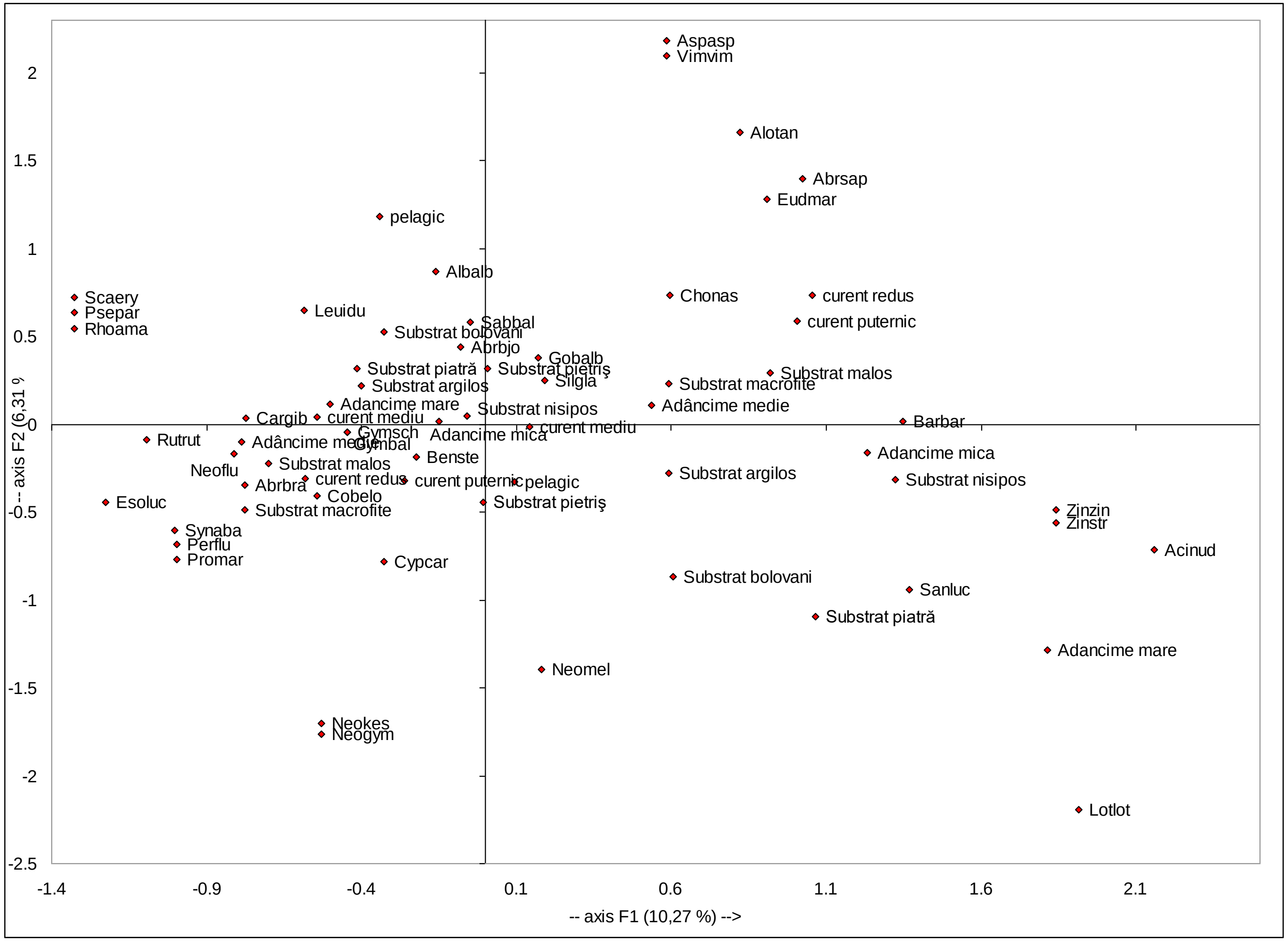


Figure 3.3.20 - Graphic of habitat similarities between fish species present in critical points rezulted from MCA analysis

3.3.2. Terrestrial ecosystems

- **Terrestrial ecosystems**

Lumbricides have adapted to three different soil environments- life styles in soil,being distinguished three ecophisiological categories:

- Epigenous lumbricides
  - Its lives on the surface of soil, in the leaf layer – e.g. *Lumbricus castaneus*
  - Prefers forests
  - Some live in compost – e.g. *Eisenia foetida*
- Endogenous lumbricides
  - its live in predominantly organic soils form the superficial layer (0-20 cm) – e.g. *Allolobophora chlorotica*
  - it digs temporarily horizontal tunnels
  - it prefers agricultural soils and meadows
  - it contribuits to the stabilization of organic matter in soil
- Anecic lumbricides
  - It digs permanent horizontal tunnels, in deeper soil layer (it can reach to about 3 min depth) – ex. *Lumbricus terrestris*
  - Contribuites to the evolution of soil structure.

The lumbricide populations varies depending on the seson,species and the local characteristics (soil conditions, food disponibility). Also, the species varies through time and space, reaching to 10 to thousands of individuals per m^2. Usually, in cultivates plots the lumbricides density doesn't reach 200 individuals/m^2. Instead, in meadows, it can reach up to 500 individuals/m^2. The lumbricides presence and activity is controlled by climatic conditions (rains, air temperatures), by plant species and microbial populations from soil, physical and chemical soil characteristics (texture, pH, organic material) and human activities (agriculture).

The factors that affect lumbricides in soil distribution are:

- soil humidity – lumbricides prefer humid soils; the excess water harms due to water lack of air in soil
- soil temperature –the optimal temperatures for lumbricides are 10-20^{0}C; the lumbricides are sensitive to light and low temperatures (there are few species that tolerate temperatures under 0^{0}C); and high temperatures (25-35^{0}C) are lethal
- soil properties
  - texture/ granulometric structure – the medium texture soils are much more favorable for lumbricides than sandy or clayey texture

  - soil aeration degree
  - soil pH– lumbricide populations are often absent in acid soils with a lower pH than 3,5 and very few at 3,5 and 4,5 pH; the majority of earthworms prefer neutral or mildly alkaline reactions and its live in soils with a pH of 5,0 and 8,3, with an optimal between 7,0 and 7,8
  - the quality and quantity of organic material in soil influence the lumbricide abundance and distribution
- soil disturbances
  - the lumbricide populations are much more numerous in undisturbed soils.
  - the size population depends on the soil disturbance rate and the frequences.
  - the populations are recovering after a few years of undisturbed soil.
  - lumbricide populations are larger in untilled soils.
  - the lumbricides populations are affected by pesticide utilisation by droping.

Lumbricides dominate the edaphic fauna, in biomass as well as in activity. Their main benefit is improvement soil fertilisation.

The study of the relation between the chemical results of soil and the presence of lubricides in soil was made by analysing the relation between lubricides and some soil characteristics: humidity, pH, organic carbon and humus.

Table 3.3.13 - Lumbricides-Soil relation

Punct Critic		Densitate medie Lumbricide	Umiditate	pH	Carbon organic	Humus
		(indivizi/m^2)	(%)	(unit pH)	(%)	(%)
01	Mal Drept	283	29,3	7,58	7,29	21,77
	Mal Stâng	200	24,55	7,49	5,49	9,48
	Ostrovul Turcescu	245	27,1	7,44	7,02	12,12
02	Mal Drept	283	28,5	7,57	10,93	18,85
	Mal Stâng	245	27,7	7,64	8,7	15
	Insula Epuraşu	245	21,75	7,62	2,64	14,17
10	Mal Drept	224	26,45	7,66	5,47	9,44
	Mal Stâng	200	21,95	7,76	4,87	8,41
03A	Mal Drept	245	26,17	7,72	3,48	9,66
	Mal Stâng	283	24,32	8,0	10,48	18,08
03B	Mal Drept	245	20,28	7,72	5,67	9,6
	Mal Stâng	283	28,09	8,07	10,09	17,4
04A	Mal Drept	200	21,33	7,5	3,16	8,71
	Mal Stâng	224	25,2	7,5	8,8	15,18
04B	Mal Drept	173	19,67	7,77	1,51	6,07
	Mal Stâng	283	26,21	8,1	11,9	20,53
07	Mal Drept	141	14,51	7,63	1,86	7,02
	Mal Stâng	173	17,39	7,58	4,67	8,06

As a result, it has been found that the lumbricide populations were not very numerous because:

- the soil humidity in some areas did not exceed 29.3 %
- the organic C (average) procentage droped to 11.9 %
- humus - max 21.77 %.

The alluvial soil from CP area, predominantly sandy, is poor in organic C and humus.

The lumbricide populations are too numerous when the organic C and humus procentage grows, e.g. in CP 01, right bank – 283 individuals/m^2.

The lumbricide effects on soil are:

- the physical point of view, the lumbricides immprove the soil strucutre through:
  - the creation of numerous tunnels allows a better water aeriation and drenage in soil
  - the soil layer mixture through transport in feeding process
  - diminishies the surface leaks
  - reduces the soil erosion process
  - grows the water retention capacity in soil
  - grows the water infiltration degree in soil
  - grows the soil aggregation
- the chemical point of view, the lumbricides grows the soil fertility through:
  - the changes in soil chemical composition through the decomposition of organic matter and nutrients, that are transported in accesible layer for plants
  - grows the soil nutrients – the lumbricides excrements are 5 times richer in N, 7 times richer in P and 11 times richer in K than the 15 cm surface layer; in humus rich soils, a earthworm may produce 4-5 kg of excrements per year
  - the formation of humus (partial decomposed organic matter) allows the formation of nutrients for plants and grows the soil ability to retain water
  - grows the soil pH-ului as a result of lumbricides activity
- the biological point of view, through the humus formation, lumbricides:
  - grows the soil microbial activity
  - grows the soil enzyme activity
  - facilitates the roots growth and development
  - transports nutrients, making them accesible to plants
  - recycles the organic matter from soil layers
  - grows the soil fertility (the plant productivity grows with 25 %).

In comparision with the aquatic ecosystems, the abiotic and biotic parameters corroboration at terrestiral ecosystem level is much more difficult, at least from the following considerations:

(i) *the historical data set is very limited and even if the informations exist, they do not refer to the interest area, or some specific exclusively elements are aproached, without the corelation evaluations*

(ii) *the monitoring period (preconstruction phase) about 4 months does not allow a quantitative evaluation of inter-conditioning potentials between the monitored parameters.*

In this regard, the Table 3.3.14 presents a matrix analysis of interdependencie potencials at terrestrial ecosystems level for monitored CP.

Table 3.3.14 - The matrix analisys of interdependencies at terrestrial ecosystems level

	Floră şi vegetaţie terestră	**Faună terestră**	**Avifaună**	**Natura 2000**
Calitate aer	X	+/-	+/-	X
Zgomot	-	X	X	X
Caracteristici sol	X	X (lumbricide)	-	+/-
Activitate şantier	+/-	+/-	X	X

NOTE: X - direct interdependences;
+/- potential inter-conditioning

- *The air quality may affect – depending on the pollutants nature and concentrations – the terrestrial flora and fauna including at Natura 2000 sites; giving the worksite nature, this thing is not anticipated*
- *The noise affects the avifauna including the avifauna from Natura 2000 sites; depending on the noise intensity and frequencies made by hydrotechnical works machineries,it can be made a more precise corelation in this directions*
- *The soil characteristics (composition, pollution degree, granulometric texture) directly influences the terrestrial flora and vegetation and at fauna the presence or absence of lumbricides*
- *The site activity, without calling into question the accidental pollution potential, wil be reflected by especially the stress on avifauna*

After the air quality, noise and soil, terrestrial fauna and flora (including Natura 2000 sites and avifauana) monitoring, a set of consistent data and information was obtained under which was made the preconstructed state characterisation at every monitored objective, specified above, in this way ensuring, with the fulfillment of contractual obligations for this phase, the indespensable conditions for further evaluations.

Corelation between the lumbricide number and some soil properties

Based on the collected data in the preconstruction phase the data were processed and presented graphically for the corelaton evidentiation between the soil properties and the lumbricide number in critical points.

The corelations are available for the concentrations from this domain in which the analyzes were made.

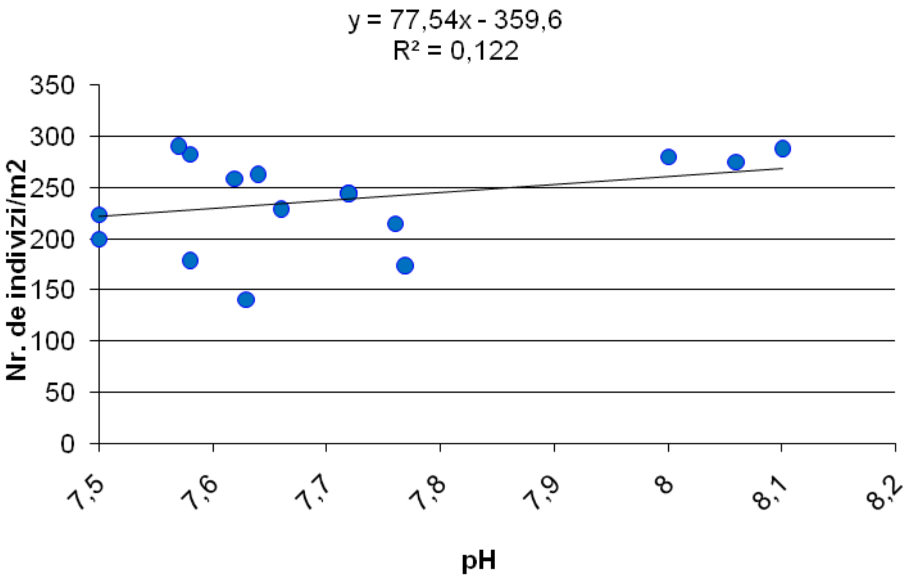


Figure 3.3.21 - The corelation between the soil pH and the lumbricide number

In Figure 3.3.21 for the porcessed data resulted that in the majority of critical points where the analyzes were made, the soil has a pH favorable for the development of lumbricides, between 7.5 – 8.2. Most of the individuals were identified in samples where the soil pH-had values between 7,5 -7,8; optimal values for the development of lumbricides according to the scientific publications. According to data, pH no present great variations that it to fit the soil in strongly acid or alkaline, therefore in the studied area in terms of this parameter, the habitat is proper the lumbricides development.

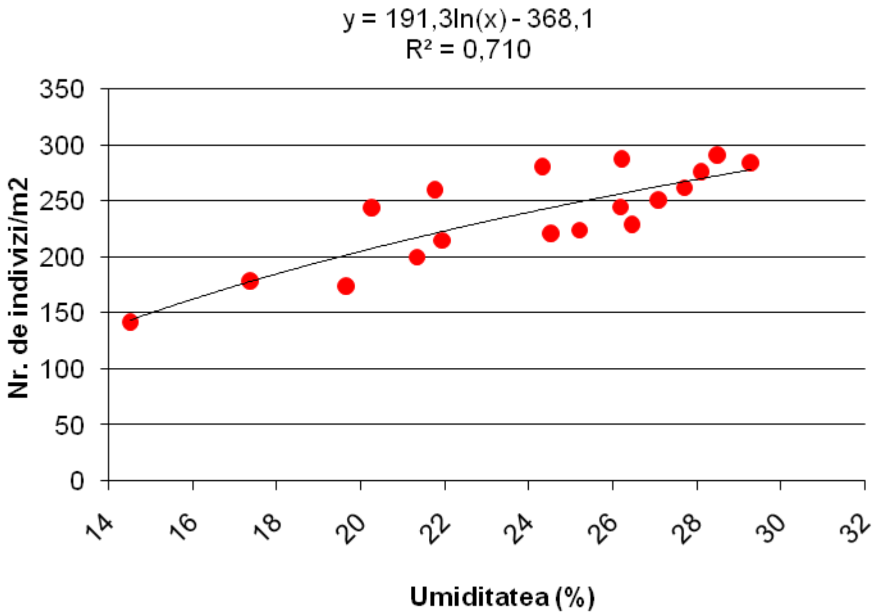


Figure 3.3.22 - The corelation between soil humidity and the number of lumbricides

In Figure 3.3.22 after the data processing, it can be observed that a positive corelation exists between humidity and the number of individuals. At a humidity concentration growth in the analysed set limits made on field the number of individuals grows according to the logarithmic curve. The correlation coefficient value of 0.71 indicate a pretty intense correlation between the lubricide density and humidity.

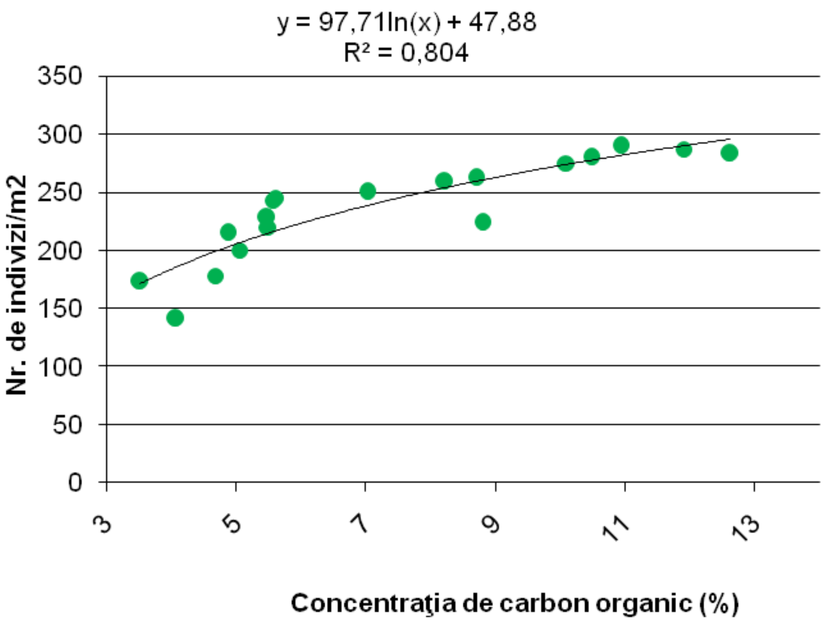


Figure 3.3.23 - The correlation between soil organic carbon concentration and lumbricide number

Based on the proccesd data derived form the field analyzes for the domain of this analyzes it can be observed in Figure 3.3.23, as in the case of carbon there is a positive and relative strong correlation (the coeficient is over 0.8). The lumbricides density exceeds the 250 ind/m^2 value for the organic carbon concentrations superior to 9 % value.

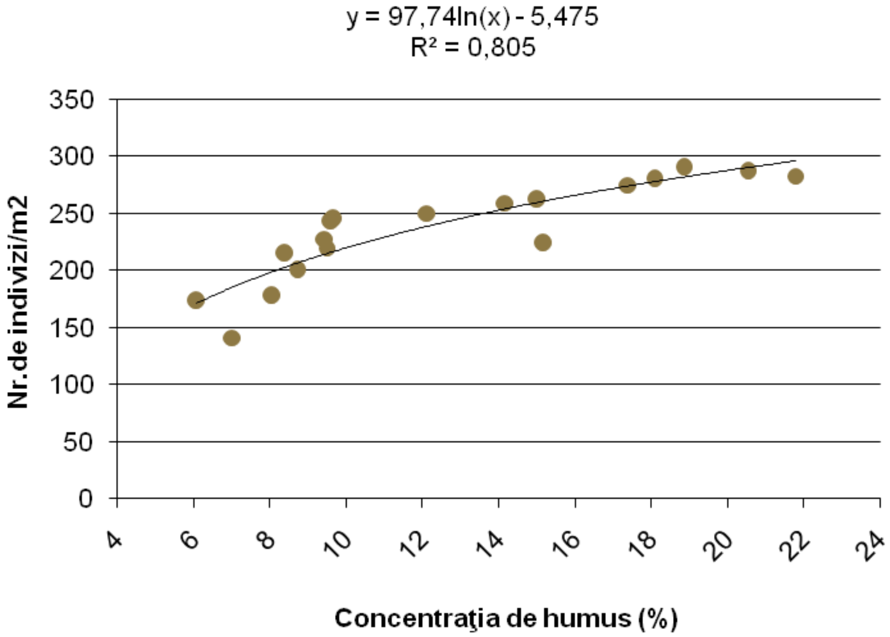


Figure 3.3.24 - The correlation between soil humus and the lumbricide number

In Figure 3.3.24 it can be observed a positive and relative strong correlation between humus concentration and the lumbricide number; the corelation coefficient being over 0.8. The lumbricide density exeeds the 250 ind/m^2 value for humus concentrations superior to 12 % value.

The correlation between the avifaunal species and the type of habitats

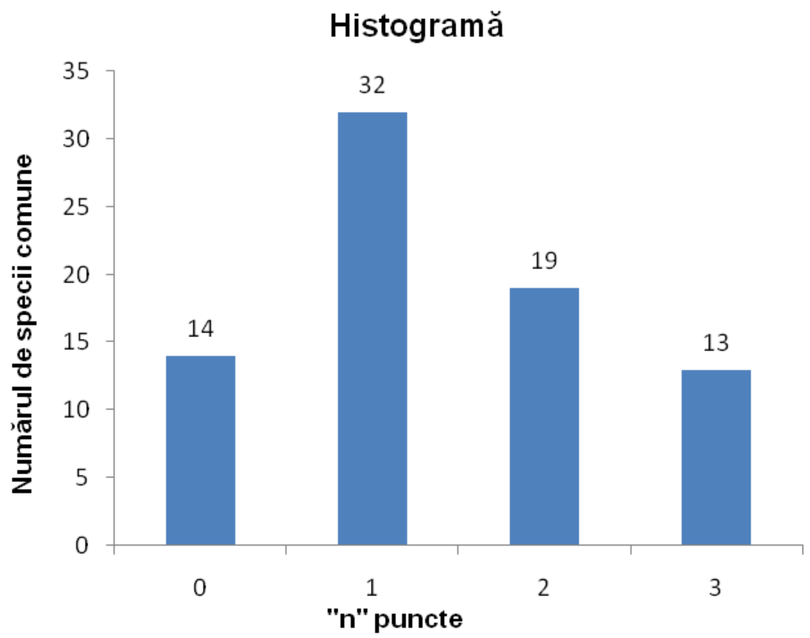


Figure 3.3.25 - The frequencies histogram for avifaunal species in CP01-CP02-CP10 points

The histogram presented in Figure 3.3.25 shows that the diversity of avifaunal species is higher in the main points (critical) in comparision to the secondary points. From the total of 78 avifaunal species monitored in critical points in April-July, 64 species appear in at least one of the main points CP 01-CP 02-CP 10. Of these, 32 species appears in one critical point, 19 species are common in two critical points, meanwhile 13 species appears in all three points.

According to the percentage, it can be indicate that from the terrestrail avifaunal inventory during April-July, 18 % from total avifaunal species were not found in none of the critical points CP 01-CP 02-CP 10. It can be observed that most of the species, 41 %, were reported in one critical point. The avifaunal species that were observed in all the three critical points represent 16,66 % of total species, and 25 % of species were common only in two of the three critical points.

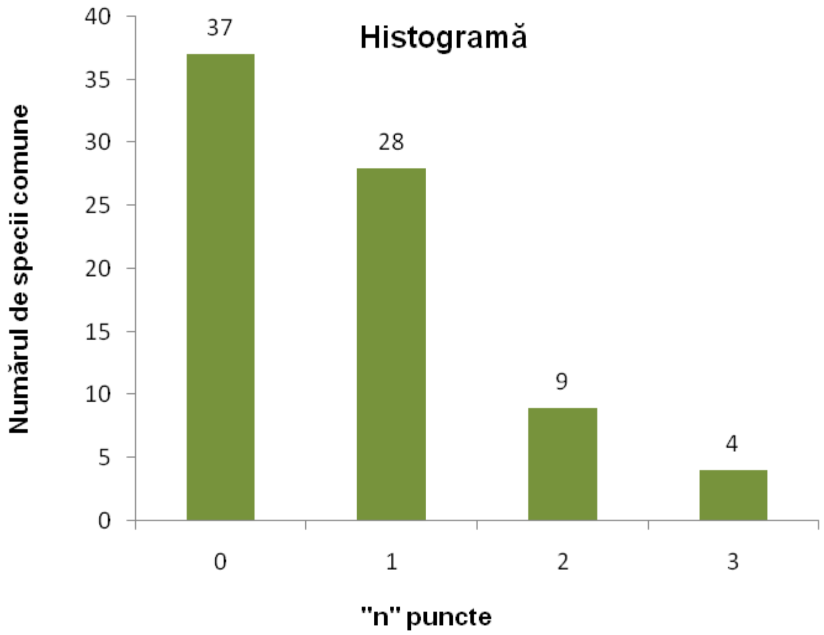


Figure 3.3.26 - The frequencies histogram for avifaunal species in critical CP 03-CP 04-CP 07- adjacent area PC 07*

In Figure 3.3.26, from total 78 avifaunal species monitored in critical points CP 03, CP 04, the adjacent area CP 07, 41 species appears in at least one of the main points CP 03-CP 04-adjacent area CP 07. Of these, 28 species appears in one critical point, 9 species are common in two critical points, and 4 species appears in all three points. The correlations are available for the concentrations in the domain in which analyzes were made.

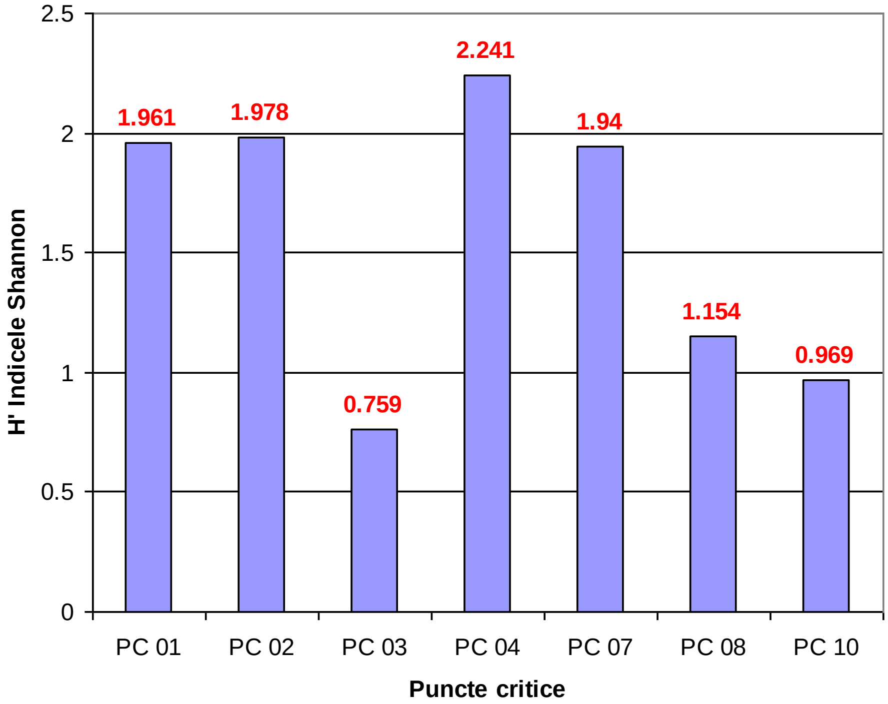


Figure 3.3.27 - Shannon diversity index value in critical points for avifaunal species

The avifaunal diversity point of view on the basis of field observations regarding avifaunal species the Shannon diversity index was calculated in seven critical points (fig 3.3.27). The purpose of the index calculation is the highlighting of bird diversity in critical points and the relation biotic-abiotic, respectively the birds-habitat type relation.

The highest diversity was registered in the critical point CP 04 due to the habitat form in which a *poplar plantation and stripes of white willow danubian.The habitat is not fragmented by anthropoic communities.* The points CP 01, CP 02, CP 07, appropriate to habitats, danubian *forests of white willow, danubian pontic forests and poplar plantations*, also a less higher diversity index was reported in comparision with CP 04, through the analysis made on field, it was observed a lower vegetation, and in some places it can be found some anthropic communities.

The smalest Shannon diversity index value was reached in the critical points CP 03, the adjacent area CP 07, CP10, having the *poplar plantations and danubian forests of white willow* as type of habitat, but it is not found on the whole critical point surface, due to the anthropic communities, of temporarily flooded sandy areas and the lack of vegetation.

4. CONCLUSIONS, RECOMMENDATIONS, WARNINGS

4.1. General conclusions

4.1.1. The Pre-construction Phase Report on the “***Monitoring the environmental impact of the works regarding the improvement of the navigation conditions on the Danube River between Călăraşi and Brăila, km 375 to km 175***” project regards the April to August 2011 period and is based on integrating the results for each monitoring objective, presented in terms of activities in the Monthly Reports. At the same time, as outlined in the Specifications, there was processed and considered, alongside the specific pre-construction monitoring results, the historical data (the reference framework) for more precise assessment of the reference state.

For all the Critical Points there were established the geographic coordinates and the alphanumeric codes related to the monitoring targets or the specified monitored locations in the Specifications.

4.1.2. Regarding the status of the activities, the following conclusive elements emerge the:

For the pre-construction phase there were carried out, at the air, soil, water (Hydrochemistry and Hydrobiology) monitoring level the harvesting 2256 samples followed by a number of 56940 physico-chemical and biological analysis, fact that illustrates, along with the complexity of the integrated monitoring activity, the Provider’s effort to fulfill the obligations arising out of the Specifications for this phase; at the above mentioned directly quantifiable figures, there are added the observations and measurements at the hydromorphological, ichthyologic monitored objectives, the terrestrial flora and fauna, and the work site activities.

Overall, we can say that, for the pre-construction phase, the Provider has complied with the work schedule as stipulated in the Technical specifications.

4.1.3. In terms of results and observations on the pre-construction phase (reference state) the following conclusions arise:

4.1.3.A. Air quality monitoring

4.1.3.A.1. In terms of nitrogen oxides pollutant the maximum, minimum and average concentrations values are below the limit value (200 µg/m^3), below the upper assessment threshold, the lower assessment threshold, the vegetation protection alert threshold and the protection vegetation critical level.

4.1.3.A.2. The determined concentrations values for carbon monoxide pollutant did not exceed the limit value (10 mg/m^3). Also, the pollutant concentrations are below the upper assessment threshold (7 mg/m^3) and below the lower assessment threshold (5 mg/m^3).

4.1.3.A.3. For the particulate matter, lead oxides and carbon dioxide pollutants, the concentrations determined from measurements are below the limits set by regulations for the protection of human health and vegetation protection.

4.1.3.A.4. The general condition for all critical points investigated in terms of air quality for pollutants nitrogen oxides, carbon monoxide, particulate matter, lead oxides and carbon dioxide can be characterized as good, the determined concentration values were below the limits imposed by legislation.

4.1.3.B Noise monitoring

4.1.3.B.1. As a general conclusion of these measurements we can say that, with zero traffic conditions, overlaid with medium background noise (without the presence of birds in proximity) to all critical points, the maximum intensity L_{zeq} has a value of up to 50 dB; in conditions of high background noise, the value does not exceed 60 dB, regardless of traffic conditions.

The above findings are based on the monitoring period, which corresponded to the spring's end and basically the entire summer.

4.1.3.C Soil quality monitoring

4.1.3.C.1. Lumbricides presence and activity is controlled by climatic factors (precipitation, air temperature), the plant species and soil microbial populations, physical and chemical soil characteristics (texture, pH and organic matter).

The study of the link between results of chemical analysis of the soil and the lumbricides presence in soil was done by analyzing the relationship between lumbricides and some soil characteristics: moisture, pH, organic carbon and humus.

It has been found that the lumbricide populations are not numerous because:

- soil moisture in those areas did not exceed - 29.3%
- the percentage of organic carbon (average value) is low - 11.9%
- humus – max. 21.77 %.

The alluvial soil of the critical points, predominantly sandy, is poor in organic carbon and humus.

Lumbricide populations are more numerous if the percentage of organic carbon and humus increases, e.g. at the CP 01 right bank - 283 individuals /m^2.

4.1.3.C.2. Concerning the determinations on physicochemical indicators included in Annex 2 of Order 756/1997, the following conclusions can be drawn:

- *heavy metal content is below normal value in soils, being well below the thresholds for alert and intervention for sensitive use types imposed by the MAPM Order 756/1997*
- *pollutants concentration*: cyanides, sulfo-cyanites, fluorine, bromine, sulfur and sulphide are *below normal* levels in soil
- concentration indicator "sulfate" is *below the alert threshold* for sensitive types of land use, imposed by the MAPM Order 756/1997
- humus content values range from <1% very poor in humus soils (sandy soils) up to 8% higher values characteristic humus rich soils (sandy loam soils).

4.1.3.C.3. The physico-chemical properties of the soil samples consisted in determining the texture, porosity and moisture of the soil. The results for soil samples taken from the critical points CP 01, CP 02, CP 10, CP 03 (A + B), CP 04 (A + B) and CP 07 revealed the texture of the soil from sandy coarse to medium sandy-loamy coarse.

4.1.3.D Hydromorphology

4.1.3.D.1. In terms of grain size, the most important share in sediments refers to the >90 - <500 µm fraction, the percentage being 67.4 %; the > 2000 µm fraction has a share of 13.4 %, the remaining fractions percentage values being below 10 %; it was noted that the granulometric composition was different between the left (LB) and right (RB) of the Danube, the F_1, F_2, F_3 and F_5 fraction values have higher percentages on the RB compared to the LB; for the F_4 fraction, the situation is reverse, having a share of approx. 77 % for the LB.

4.1.3.D.2. The sediment mineral composition illustrates the prevalence of SiO_2 (average of 63 %), followed by Al_2O_3 (approx. 16 %), CaO (approx. 8.5 %), Fe_2O_3 (4.4 %) and MgO (3.1 %); the mineralogical data determined in 2011 are part of the prior information (historical data) ecart.

4.1.3.D.3. Regarding the suspended particles that virtually form the superficial dragged sediment layer, which is characterized by a major share of the faction 90 - <500 µm (69.1 %); the granulometric suspended fraction proportions varies depending on the critical point, but generally fall into the same ecart from the mean values, except CP 01 where 90-500 µm and over 500 µm fractions, have close shares (42 % and 35 %).

4.1.3.D.4. The correlation function of turbidity (NTU) and the concentration of suspended solids (C.S) are linear with a slope of approx. 0.8 and a limit of linearity at about 15-20 mg /l (C.S). Given that the dependence of turbidity, measured by nephelometry, of both the number and the volume of particles, laboratory tests carried out on sediments with differentiated resuspended granulometries, revealed that the turbidity / CS calibration slopes are different, those being even higher as the particle size is lower.

4.1.3.D.5. The evaluated and monitored average percentage of dragged sediment flow is approx. 1.82% of the total suspension, higher values being recorded at CP 01 and CP 10 (average 2%) compared to the CP 02 (1.33%). The dragged sediment flow increases linearly with the flow of water, for the 1000 - 4500 m^3/s recorded during the monitoring phase of preconstruction, the regression coefficient being 0.89; the evaluated dragged flow values are within the historical data range.

4.1.3.E. Water quality monitoring

Based on the water column and sediment monitoring, the following conclusions can be drawn:

4.1.3.E.1. The ecological status, in terms of the physico-chemical elements supporting the biological elements, is between the 2nd and the 3rd class, good to moderate respectively, the determinant indicators that influence the class inclusion is COD-Cr, ammonia, nitrates and Co^{3+}, total Fe phenols and AOX; the ecological status assessment based on the hydro-chemical data fall data presented by ICPDR - TNMN (historical data from 2001 to 2009).

- *water chemical* status determined based on HG 1038/2010 (dissolved concentrations of priority hazardous substances), is bad (exceeding of EQS for Cd).

- *water chemical* status determined on the basis of Order 161/2006 (total concentrations of specific toxic pollutants of natural origin) is bad. It is noted that this disrepair refers to values obtained during the period April to August 2011, when there were constant overruns of quality standards especially for indicators Co, Ni and Cu.

4.1.3.E.2. For sediments, in accordance with the provisions of the Water Framework Directive, for the Cu, Hg and Ni indicators, the chemical status is bad; to notice that for the assessment, the natural background was not considered, no data for the Danube river being recorded; for other water bodies, the natural background ecart for heavy metals is 5 - 15%; for the PAHs, the water's chemical quality is good, while for the PCBs (in this case 138, 153 and 180) and organochlorine pesticides, the water's chemical quality is bad. In this assessment, it should be considered that the hydrological conditions during April-August 2011 (very low flow of the Danube) lead to the fact that the dragged sediment flow was predominant compared to that resulting from the intake of silt; consequently, there has been driven sediment from depths greater than 2-5 cm (previous sediments), observation made valid by the fact that the increased values are closer to those obtained in JDS_1 (2002) compared to JDS_2 (2007).

4.1.3.F. Regarding aquatic flora and fauna

4.1.3.F.1. Based on *quantitative and qualitative biological indicators* analyzed for phytoplankton, *the ecological status* of the Danube's water for critical points / sections analyzed, it was *very good* to *good*, saprobic index values ranged between 1.6 and 2.2, calculated using the method Pantle-Buck, including the water in the *oligo-β-mezasoprobe* to *β-mezasoprobe* area. The index saprobic evaluation is so correlated with the values obtained for the critical points analyzed in terms of organic load, corresponding to *the 1st to 2nd quality class*, which suggests, in general, a weak to moderate organic loaded water.

4.1.3.F.2. As to the specific *ichthyologic* elements, the cable transects used to fix /locate the submerged automatic stations on the River Danube have been shown to have a high potential to be hung by objects stalled on the river bottom and professional fishermen nets.

4.1.3.F.3. It was proved the importance of using ultrasonic transmitters with depth sensors for monitoring fish migrations.

4.1.3.F.4. Regarding the ultrasonic telemetry tracking of the presence and movement of sterlet and starry sturgeon adults there were drawn the following conclusions: (i) these two species of sturgeon migrate on the Borcea and Bala branches for reproduction and (ii) their offspring find here food in abundance.

4.1.3.F.5. Ultrasonic telemetry measurements of thee sturgeon movement in the area upstream of km 180.6 conducted in June and July, did not reveal that on the Caleia branch would be found starry sturgeon breeding areas, or that starry sturgeon adults migrate upstream on this branch. The importance of this branch as feeding area for sterlet and starry sturgeon young was determined by capturing them by research-fishing in June, 2011.

4.1.3.G. Terrestrial flora and fauna

4.1.3.G.1. In the studied areas of the Danube dominates plantings of Canadian poplar, semi natural habitats (which in these areas are floodplain forests with white willow and poplar predominant) that are limited to narrow strips in the temporarily flooded riparian areas and are in poor condition with many invasive alien species. Because of the relatively small area and the abundance of invasive species these habitats have low conservation value. Also the forestry work in progress, not only promotes the degradation of habitats but also the spread of invasive species. Sometimes, the abundance of these species is so significant that native species are represented in only a few specimens.

Of all the critical points, the CP 02 – Ostrov Epurașu is the most important in terms of biodiversity. Here the Danube floodplain forests of willow and poplar are present in relatively good state of preservation. The forests of this island present more or less the characteristics of these floodplain forests, even though the area is not without invasive species. It also notes the existence of a temporary lake inland, which represents a potential habitat for several species hydrophilic (their absence could be explained by the dry summer).

In terms of diversity of aquatic fauna and other species of birds outside the *Passeriforms* closely linked to forest or semi-forest habitats, Ostrov Epurașu tops the critical points. *The Passeriforms* have the highest diversity present in the CP 01 area, probably due to the large surface area. Bala branch is characterized by sand martin colonies (*Riparia riparia*) with a total effective over 1,000 nesting pairs.

Terrestrial flora and fauna assessments carried out in pre-construction phase indicate the state of the natural environment still unaffected by the planned works. In the coming years, the biodiversity changes in the potentially affected area will be compared with these states. No one can predict with great accuracy the impact of the anticipated works, but from the current state of the environment, namely the nature and the extent of the planned work, it can be made a rough estimate of the impact in the future.

4.1.3.G.2. The anticipated impact of the work on terrestrial flora

Considering that the works will be carried out in the water and on the banks, we can say that they will not adversely affect terrestrial flora. The vegetation will be disturbed only in certain segments of the riparian zone and adjacent areas. Due to the degraded state of the habitats and also to the powerful anthropogenic impact in the potentially affected area, the planned work will not affect the conservation status of habitats of high conservation value of protected natural areas.

It is recommended to avoid the unjustified deforestation by reducing to the minimum size the required worksites. After the works completion, it is recommended the renaturalising of the affected areas by the site works (by deforestation) by planting trees. It should be avoided the planting of alien species. In the works of renaturalization is recommended to be included an expert biologist /ecologist.

4.1.3.G.3. The anticipated impact of the works on avifauna

The construction works will have the greatest impact on terrestrial avifauna. The aquatic birds will predictably withdraw from the water areas affected by the works close to them and will seek food in areas unaffected by the project. Terrestrial birds, whose territories are located in or near the riparian area, where works of bank protection will be carried out, may be adversely affected by the works. This impact can be significant in the short term, if the works will be performed during the breeding season (April 1 to July 10). Planned works will affect predominantly forest habitats, where the fauna is composed of relatively common species, so we do not anticipate significant negative impact on the state of conservation of species designated by Special Protection Areas (SPAs). After completing the works, nature will likely soon return to the current state, so, on the long-term, the works will not significantly affect the fauna in these areas.

It is recommended that the works to be carried out outside of the breeding birds (before 01 April and after 10 July) so it will be possible to significantly mitigate the impact of short-term work. In this case, it is also recommended that the affected areas to be renaturalised as shown above.

4.1.3.H. Natura 2000 sites monitoring

Although several sites of those listed do not overlap with the project, nor are in the clear direct impact area of it, to maintain the valuable habitats within them in a good state of preservation it is essential to favor the (partial) regeneration of the degraded habitats or possibly even remove them (after the works are completed), as they serve as a source of propagation. Thus, the species composition of the natural habitats can favor the characteristic and indigenous species colonization. It is important to note, however, that there is strong pressure in the area from invasive alien species.

ROSCI0006 „Balta Mică a Brăilei”

It contains the critical points CP 09 and CP 10 and it is therefore possible damage to these areas by the proposed work. It is recommended extra caution while carrying out construction and monitoring activities.

ROSCI0022 „Canaralele Dunării”

This protected area covers most critical points (CP 01 - Ostrov Turcescu, CP 02, CP 03A, CP 03B, CP 04A, CP 04B, CP 07 respectively adjacent to the CP 07). Thus, the project will likely have the biggest impact on this protected area (together with the overlapping "Ostroave Danube" SPA). It is recommended special care in carrying out the construction and monitoring activities.

ROSPA0005 „Balta Mică a Brăilei”

This Special Protection Area (SPA) overlaps with the Site of Community Importance (SCI) „Balta Mică a Brăilei”. It includes the CP 10 critical point and it is therefore possible damage to these areas by the proposed works. It is recommended extra caution while carrying out construction and monitoring activities.

ROSPA0039 „Dunăre Ostroave”

This SPA overlaps with SCI *„Canaralele Dunării”*. Therefore, it includes most critical points (CP 01 - Ostrov Turcescu, CP 02, CP 03A, CP 03B, CP 04A, CP 04B, CP 07 respectively adjacent to the CP 07). Thus the project will likely have the biggest impact on these two protected areas. It is recommended special care in carrying out the construction and monitoring activities.

ROSPA0017 „Canaralele de la Hârşova”

In this segment of the Danube there would be no works carried out, however, it is possible the emergence of impacts on biodiversity caused by flow changes in the various branches of the Danube.

4.1.3.I. Regarding the monitoring of activities

Before the works execution and the compliance with the plan in case of accidental pollution, in the interval April-August 2011, there were not recorded relevant elements leading to warnings.

From observations on the work site organization from km 346, in the activities monitoring process at the Bala work site – the Caragheorghe sandbank (CP 01), it was showed that the environmental impacts are insignificant in the preconstruction phase.

4.1.4. Regarding the integrated analysis and monitoring results evaluation there can be drawn the following conclusive elements:

4.1.4.1. On the aquatic ecosystems level, the interdependence of the identified ecological status (good to moderate) and the water chemical status results a congruence of the two states, fact illustrated also by the corroboration of the hydro-chemical and hydro-biological data:

- it was highlighted, for the period of status of reference monitoring (preconstruction), a eutrophication potential of the Danube waters (both from the hydro-chemical and hydro-biological data) due to: (i) low water flow, (ii) high temperatures (iii) ratio N_T/P_T of over 14 at CP 01, CP 02 and Old Danube, although in terms of "a" chlorophyll values were within 1st quality class range (Order 161); the assessment is based on highlighting the oxygen over-saturation, increase of the alkalinity (pH) and of the nitrite concentrations, which are indicators for denitrification processes
- in terms of specific pollutants of natural origin, although there is no reference data regarding the natural background, for the hazardous /priority dangerous heavy metals as a result of Danube low-flow and of the suspended solids concentration, the dissolved fraction share is higher, without exceeding the alarm eco-toxicological thresholds; therefore, it can be stated that the bioaccumulation /toxicity effects in the water column aquatic ecosystems are not relevant
- as for the sediments associated pollution, registered in the period of April-August 2011,it stands to notice the PCBs and organochlorine pesticides; but the heavy metals issue is questionable, no data related to natural background level and no bioaccumulation at phyto and zoobentos level is to be found
- the inter-correlations of physico-chemical indicators of water quality and the water flow highlights, according to the share of diffuse pollution, an increase in the suspensions concentration, respectively the load (historical data) with the water flow, reference element for assessing the impact of hydraulic works when, through the bottom sills, suspension mass transfer is anticipated to be affected; other correlations of

chlorides, e.g. with the water flow, not being dependent of the suspensions regime (identified in historical data) will also serve for the impact and post-impact state assessment.

4.1.4.2. At the terrestrial ecosystems level, there can be drawn the following conclusive elements:

- lumbricides, through their drill into the soil, produce changes in the morphology of internal soil by creating wide pores, with a particularly important role in the processes of water and air moving and the development of the root system of plants. At the same time, by their movement into the ground, they swallow large quantities of soil then they eliminate it in a state of advanced humification and in a mixture of mineral and organic fine particles united in quality natural structural micro-aggregate called coprolite. Their multiplication and movement in the soil is conditioned by the need to oxygen, water and food. Therefore, the indirect physical and chemical degradation processes that lead to the deterioration of these conditions obviously have a negative impact on their lives
- it was not revealed an influence of noise on avifauna, regardless of shipping traffic
- monitored air quality in the areas falls within the specific standards, reflected by a terrestrial flora and vegetation un-affectation.

4.1.5. Besides to all the above, the following recommendations are made:

4.1.5.1. The continuation of the analytical modelling activities of the monitoring data, namely of those hydrochemical and hydrobiological, in order to support the "3D" numerical modelling.

4.1.5.2. The feasibility analysis of developing conceptual models, at the aquatic and terrestrial ecosystems level, of "Fuzzy cognitive maps" specific systems to assess the interdependencies of components both at biotic/abiotic level and between them.

4.1.5.3. The analysis of opportunities for integrated view of states of monitoring (reference / impact / post impact) in an accessible form of comparison (spidergrams).

4.1.5.4. Regarding ichthyology is proposed:

During autumn migration from September to November 2011 we will be able to perform the following categories of works by monitoring the movement of sturgeon in the Bala CP 01 and CP 10 - Caleia areas and the distribution of essential habitats for breeding and wintering.

4.1.5.4.1. Testing a new placing system for the submersible automatic stations using Hall anchors, floats and mounting weights without the need for cable transects fixed to the bank. It is hoped that this system will decrease the rate of loss / displacement of transmitters recorded by the system adopted in the first phase.

4.1.5.4.2. Installing a number of other 5 VR2 W/Vemco automatic submersible stations on the Old Danube, Bala and Borcea branches.

4.1.5.4.3. Marking a number of up to 50 specimens of sturgeons (beluga, russian sturgeon, stellate sturgeon, sterlet sturgeon), respectively minimum of 30 specimens and of up to 50 specimens of barbel.

4.1.5.4.4. Mapping of the wintering holes on the Borcea branch by using the sonar located on the SAM boat and the GPS Garmin. Measurement of flow velocity profiles in the potential wintering holes.

4.1.5.4.5. The use of the VR 100/Vemco mobile station for active telemetry in December 2011 and January 2012 to locate the sturgeons in possible wintering areas from the Bala, Borcea and Caleia branches.

4.1.5.4.6. Choosing 1-2 holes where there will be placed submersible automatic stations to monitor/record the presence/standing of sturgeon with ultrasonic transmitters in these areas and the water temperature at which the sturgeons leave these areas.

4.1.5.4.7. Observating and recording of ultrasonic marked sturgeons observation and recording located in wintering holes.

4.1.5.4.8. Sampling fauna from the wintering holes bottom, which are used as feeding areas for sturgeons which wintering in these areas.

4.1.5.4.9. Preliminary mapping of potential breeding areas, that having rocky substrate of calcareous nature on the Borcea branch in order to be sampled / confirmed in the breeding season from 2012.

4.1.5.4.10. Analysis fulfillment in November 2011 of PCR - RFLP analysis of mtDNA D-loop region in all samples collected from sturgeon in the first and second monitoring stage in 2011. This was not possible in August due to the small samples number which could not justify the very expensive consumption of reagents needed for the extraction of DNA, agarose gel electrophoresis separation and enzymatic digestion, in particular, only if would be working with at least 24 samples.

4.2. Conclusions on Critical Points

4.2.1. Bala branch CP 01 critical point area and the Caragheorghe sand strip

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 1.88 µg/m^3 and 8.13 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.19 µg/m^3 and 0.3 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 01 ranged from 200 individuals/m^2 (left bank) and 283 individuals/m^2 (right bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below the *alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 9.48 % (left bank) and 21.76 % (right bank), sandy-loam soils characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is bad (exceeding the quality standard just for Cd).

Water chemical status established under Order 161/2006 is bad (exceeding the standard quality for Cu and Co).

Chemical status of sediment according to the Order 161/2006 is bad, it is caused by exceeding quality standards for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton*, *the saprobic index* averaged a value of 1.65, falling Danube water quality in 1st quality class, corresponding to a *very good ecological status.*

From observations on the work site organization from km 346, the monitoring of activities at the site of Bala - sandbank Caragheorghe (Critical Point 01) showed that the environmental impacts are insignificant in the preconstruction phase.

4.2.2. CP 02 critical point Epurașu Island area (Lebada)

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.24 µg/m^3 and 9.23 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.24 µg/m^3 and 0.29 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 02 ranged from 245 individuals/m^2 (left bank/Epurașu Island) and 283 individuals/m^2 (right bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below the *alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 14.17 % (left bank) and 18.85 % (right bank), sandy-loam soils characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is bad (exceeding the quality standard just for Cd).

Water chemical status established under Order 161/2006 is bad (exceeding the standard quality for Cu, Se, CO and Pb).

Chemical status of sediment according to the Order 161/2006 is bad, it is caused by exceeding quality standards for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount DDT.

From the point of view of ecological status for *phytoplankton*, *the saprobic index* averaged a value of 1.80, falling Danube water quality in the 1st quality class, corresponding to a *very good ecological status*.

4.2.3. CP 10 critical point, Caleia branch (Ostrovu-Lupu)

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.3 µg/m^3 and 9.92 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.21 µg/m^3 and 0.35 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 10 ranged from 200 individuals/m^2 (left bank) and 224 individuals/m^2 (right bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below the *alert threshold and the intervention threshold* for sensitive use types by Order 756/1997

- humus content ranges from between 2.11 % (Lupu Island) and 9.43 % (right bank), from sandy texture to sandy-loam texture characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is bad (exceeding the quality standard just for Cd).

Water chemical status established under Order 161/2006 is bad (high values for Cu, Se, CO and Pb.

Chemical status of sediment according to the Order 161/2006 is bad, R>1 was obtained for Cu, PCB sum (PCB 153), lindane, heptachlor, DDT amount, where R is the ratio between the obtained value and the quality standard value.

From the point of view of ecological status for *phytoplankton*, *the saprobic index* averaged a value of 2.20, falling Danube water quality in the 2nd quality class, corresponding to a *good ecological status*.

4.2.4. CP 03-09 critical points

4.2.4.1. CP 03A critical point, upstream Seica

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.07 μg/m^3 and 6.05 μg/m^3, values below the limit of 200 μg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.21 μg/m^3 and 0.31 μg/m^3, values below the limit value of 10 μg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 μg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 03A ranged from 245 individuals/m^2 (right bank) and 283 individuals/m^2 (left bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below *the alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 9.66% (right bank) and 18.07% (left bank), sandy-loam soils characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is good.

Water chemical status established under Order 161/2006 is bad (exceeding the standard quality for Cu and CO).

Chemical status of sediment according to the Order 161/2006 is bad; it is caused by high values for Ni, Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton, the saprobic index* averaged a value of 2.00, falling Danube water quality in the 2nd quality class, corresponding to a *good ecological status*.

4.2.4.2. CP 03B critical point, downstream Seica

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.42 µg/m^3 and 5.68 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.23 µg/m^3 and 0.35 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 03B ranged from 245 individuals/m^2 (right bank) and 283 individuals/m^2 (left bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below *the alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 9.6% (right bank) and 17.39% (left bank), sandy-loam soils characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is good.

Water chemical status established under Order 161/2006 is bad (exceeding the standard quality for Cu, Se, CO and Pb).

Chemical status of sediment is bad, R>1 for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton*, *the saprobic index* averaged a value of 2.1, falling Danube water quality in the 2nd quality class, corresponding to a *good ecological status*.

4.2.4.3. CP 04A critical point, Ceacâru

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.21 µg/m^3 and 6.39 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.23 µg/m^3 and 0.32 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 04A ranged from 200 individuals/m^2 (right bank) and 224 individuals/m^2 (left bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below *the alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 8.71 % (right bank) and 15.18 % (left bank), sandy-loam soils characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is good.

Water chemical status established under Order 161/2006 is bad, high values for Cu and CO.

Chemical status of sediment is bad, R>1 for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton, the saprobic index* averaged a value of 2.2, falling Danube water quality in the 2nd quality class, corresponding to a *good ecological status*.

4.2.4.4. CP 04B critical point, Fermecatu

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 3.21 µg/m^3 and 7.17 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.21 µg/m^3 and 0.34 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 04B ranged from 173 individuals/m^2 (right bank) and 283 individuals/m^2 (left bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below *the alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 6.71% (right bank) and 20.52% (left bank), from sandy texture to sandy-loam texture characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is good.

Water chemical status established under Order 161/2006 is bad, exceeding the standard quality for Cu, Se, CO and Pb.

Chemical status of sediment is bad; it is caused by high values for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton, the saprobic index* averaged a value of 2.1, falling Danube water quality in the 2nd quality class, corresponding to *a good ecological status*.

4.2.4.5. CP 07 critical point, Fasolele

Air quality monitoring in the preconstruction stage, revealed the following:

- concentration of the pollutant *nitrogen oxides* is between 1.96 µg/m^3 and 10.97 µg/m^3, values below the limit of 200 µg/m^3 imposed by Law 104/2011, respectively below the upper assessment threshold, lower assessment threshold, alert threshold for vegetation protection and critical level for vegetation protection
- determined pollutant concentrations for *carbon monoxide* is between 0.20 µg/m^3 and 0.31 µg/m^3, values below the limit value of 10 µg/m^3 imposed by Law 104/2011, below the upper assessment threshold (7 µg/m^3) and the lower threshold of evaluation (5 mg/m^3)
- concentrations of pollutants: particulate matter, lead oxides and carbon dioxide are below the limits imposed by Law 104/2011 and STAS 12574/1987, protective of human health and vegetation protection.

Soil quality monitoring in the preconstruction stage, revealed the following:

- lumbricide populations are not very numerous, the average density of the number of individuals/m^2 in CP 07 ranged from 141 individuals/m^2 (right bank) and 173 individuals/m^2 (left bank)
- physico-chemical indicators concentrations are *below the normal value* in soils, much below *the alert threshold and the intervention threshold* for sensitive use types by Order 756/1997
- humus content ranges from between 7.01 % (right bank) and 8.06 % (left bank), from sandy texture to sandy-loam texture characteristic values.

Water quality monitoring

From the point of view of *ecological status*, it was determined as a 3rd quality class which corresponds to a moderate ecological status, which is caused by higher values recorded for NH_4, NO_2, CO, phenols, AOX.

Chemical status of water, determined by following the HG 1038/2010 is good.

Water chemical status established under Order 161/2006 is bad, high values for Cu, Se, CO and Pb.

Chemical status of sediment is bad, R>1 for Cu, Hg, PCB sum (PCB 153), lindane, heptachlor, DDT amount.

From the point of view of ecological status for *phytoplankton, the saprobic index* averaged a value of 2.1, falling Danube water quality in the 2nd quality class, corresponding to a *good ecological status*.

5. Annexes

Annex 5.1	Maps with the distributions of pollutant concentrations in the air
Annex 5.2	Maps with the noise intensity distributions
Annex 5.3.1	Tables with the concentrations of the indicators analized for soil
Annex 5.3.2	Maps with the distributions of chemical elements concentrations in soil
Annex 5.4	Bathymetric cross sections - single beam technique
Annex 5.5	Maps with characterization of the chemical status of water on sections
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Annex 5.7.1	The list of species based on which the densities of Passeriformes were estimated in the forests of white willow (*Salix alba*)
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Annex 5.7.3	The list of species based on which the densities of Passeriformes were estimated in open habitats (including meadows, slashings, sapling plantations)
Annex 5.7.4	Natura 2000 maps (SCI and SPA)
Annex 5.8	Images from the laboratory activity
Annex 5.9	Completion single-beam bathymetry
Annex 5.10	Model of Form for the Evaluation of River Habitats (RHS) and RHS Forms completed for CP 01, CP 02 and CP 10