



Environmental Monitoring
in the Black Sea



*Empowered lives.
Resilient nations.*

National Pilot Monitoring Studies and Joint Open Sea Surveys in Georgia, Russian Federation and Ukraine, 2016

Final Scientific Report - ANNEXES

DECEMBER 2017

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Annex 1: Chemical Inercomparisons

Results of chemical inter-comparison exercises

The main objective of these exercises was to collect samples bottom sediments and biota (mussels tissues) for chemical parameters by the EMBLAS partners, following their routine methodology of sampling and analysis for assessment of the comparability of data collected during the NPMS-UA. These exercises are expected to produce valuable results for making recommendations for further improvement and harmonization of research (monitoring) methodology in the Black Sea.

1. Sampling

Two of the shelf stations from Ukrainian waters (NPMS UA 05 and NPMS UA 13) were chosen for inter-comparison exercises for contaminants in mussels. Another inter-comparison station (NPMS UA 06) was select for inter-comparison exercises for contaminants in sediments.

Station	Lat, °N	Long, °E	Bottom depth, m	Date
NPMS UA 05	45 ° 30,969'	29 ° 51,728'	20	18.05.16
NPMS UA 13	46 ° 27,722'	31 ° 20.618'	13	21.05.16
NPMS UA 06	45 ° 18,676'	29 ° 51,200'	22	18.05.16



St. No 5



St. No 13



St. No 6

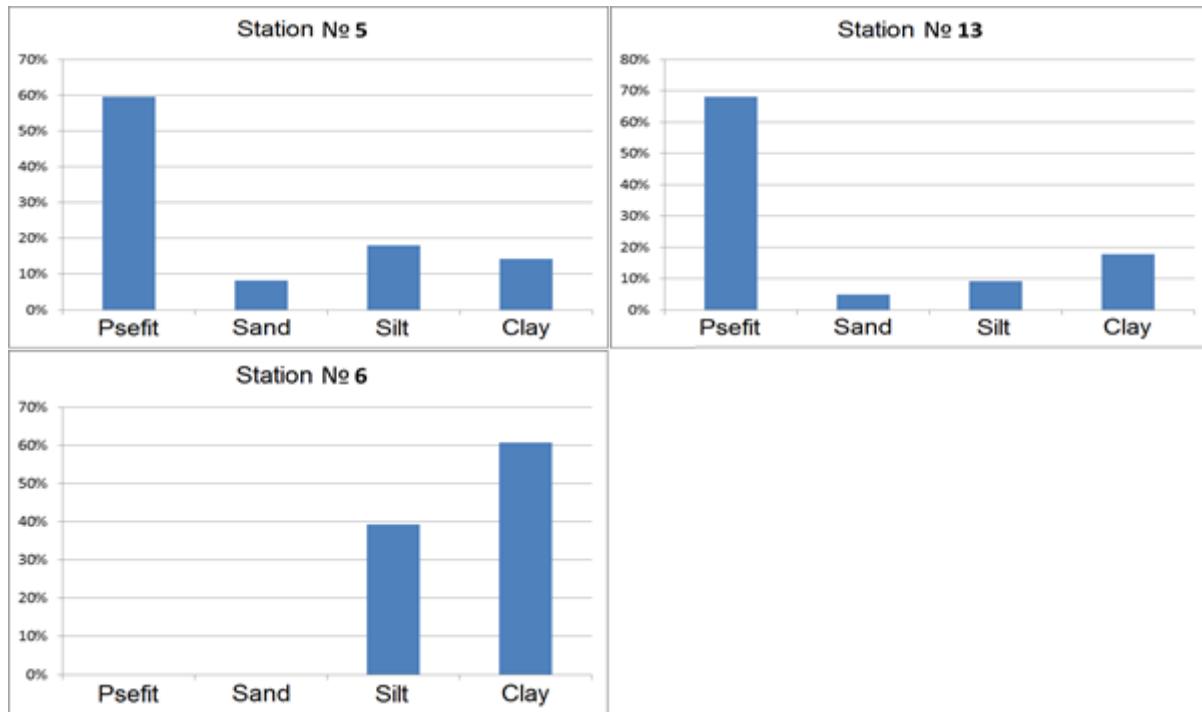


Figure 1 - Distribution of sediment fractions in the samples selected for the intercalibration

2. Preparation of samples

Biota samples

At stations No 5 and No 13 divers of a research vessel "Mare Nigrum" were carried the sampling of 173 (St. 5) and 127 (St. 13) shellfish (*Mutilus Galoprovincialis*). Mussels were collected in one size (45-55 mm). On the board of vessel mussels were dissected and soft tissues were collected in a bag and placed in the freezer (- 20-24°C). In the laboratory of UkrSCES integrated sample was freeze-dried and well homogenized (for 3 weeks). For homogeneity control was carried out analysis of some metals and organic pollutants. If the sample homogeneity is achieved, it will be divided into the necessary quantitative portions for transmission to laboratories that will participate in the inter-calibration (analysis of metals and organics).

Bottom sediments samples

One big volume sediment sample (about 3 kg) was collected on station No 6 using a Van Veen grab sampler. The undisturbed surface layer was carefully collected with a spatula, mixed and homogenized on board. This sample was frozen on the ship (- 20-24°C) and after the end of the expedition was delivered to the laboratory UkrSCES. In the laboratory, the sample was freeze-dried, by dry sieving the fraction of 63 microns has been allocated and well homogenized (for 3 weeks). For homogeneity control was carried out analysis of some metals and organic pollutants. If the sample homogeneity is achieved, it will be divided into the necessary quantitative portions for transmission to laboratories that will participate in the inter-calibration (analysis of metals and organics).

3. Analyses of samples

The samples were analyzed subsequently in the participant laboratories:

Tbilisi State University (TSU), Scientific Research firm “GAMMA”	1
State Oceanographic Institute (SOI), Russia	2
Ukrainian Scientific Centre of the Ecology of Sea (UkrSCES)	4
National and Kapodistrian University of Athens (UoA)	5
TÜBİTAK Marmara Research Center Environment and Cleaner Production Institute	6
Department of Laboratory, Measurement and Monitoring/Ministry of Environment and Urbanization/TURKEY	8

Trace metals

Table 1 - Inventory of analytical methods for Trace Me analysis reported by the laboratories

	Code of the laboratories					
	1	2	4	5	6	8
Drying procedure	Drying 105°C/24h	Drying 105°C/24h	Drying 105°C/24h	Drying 105°C/24h	Drying 105°C/24h	Drying 105°C/2h
Digestion technique	Wet mineralisation Acids used: HCl+HNO ₃ +HF+H ₃ BO ₃ ; open vessels	Wet mineralisation Acids used: HCl+HNO ₃ +HF+H ₃ BO ₃ ; closed vessels /microwave oven: power 100%, PSI – 20, Time – 20 min TAP – 20	Wet mineralisation Acids used: HCl+HNO ₃ +HF+H ₃ BO ₃ ; closed vessels /microwave oven: power 100%, PSI – 20, Time – 20 min TAP – 20	Wet mineralisation Acids used: HNO ₃ closed vessels /microwave oven 175°C	Wet mineralisation Acids used: HCl+HNO ₃ +HF+H ₃ BO ₃ ; closed vessels /microwave oven 120°C	Wet mineralisation Acids used: 3 mL HCl + 9 mL HNO ₃ ; closed vessels /microwave oven 190°C
Instrumental techniques	Atomic absorption spectrometry (AAS) for Al, As, Cd, Co, Cu, Fe, Mn, Ni, Pb, Zn	Atomic absorption spectrometry (AAS) for Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, V	Atomic absorption spectrometry (AAS) for Al, As, Cd, Co, Cr, Cu, Ni, Fe, Mn, Mo, Pb, ZN, V Cold vapour technique for Hg	Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) for Al, As, Cd, Co, Cr, Cu, Fe, Hg, Li, Mn, Ni, Pb, Sn, Sr, V, Zn Mercury Analyzer (DMA-80) for Hg	Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) for Al, As, Cd, Co, Cr, Cu, Fe, Li, Mn, Mo, Ni, Pb, V, Zn, Mercury Analyzer (DMA-80) for Hg	Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) for Al, As, Cd, Co, Cr, Cu, Fe, Li, Mn, Mo, Ni, Pb, V, Zn, Hg, Be, B, P, Se, Sr, Ag, Sn, Sb, Ba, Tl
Quality control procedure	CRM	CRM	CRM	CRM	CRM	CRM

Participants determined metals concentration in sediment samples in three replicate. In Table 2 for each laboratory gives the average values.

Table 2 - Results of analyses of the trace metals in sediment sample

Laboratory code numbers		1	2	4	5	6	8	Average value	Confidence range
Compounds	Units	value							
Al	g/kg	60,4	64,6	65,8	30,1	68,0	29,2	52,83	±16,53
As	mg/kg	10,7	17,9	12,6	13,1	12,4	11,7	13,06	±2,30
Cd	mg/kg	<2,0	0,41	0,46	0,505	0,447	0,384	0,44	±0,04
Cr	mg/kg		111	118	67,1	97,8	61,15	91,02	±22,99
Co	mg/kg	16,2	11,7	9,40	11,2	14,0	8,336	11,79	±2,64
Cu	mg/kg	49,5	55,3	55,2	48,4	51,0	33,4	48,79	±7,36
Fe	g/kg	38,2	37,3	41,6	25,7	39,2	21,63	33,94	±7,48
Mn	mg/kg	781	669	774	573	712	487,8	666,23	±106,07
Ni	mg/kg	68,2	64,1	71,5	43,8	57,7	35,24	56,77	±13,14
Pb	mg/kg	4,83*	39,7	39,1	39,8	39,5		39,5	±0,27
V	mg/kg		123		52,9	106	58,62	85,18	±30,08
Zn	mg/kg	108		120	119	123	104,1	114,86	±7,31
Li	mg/kg				41,7	47,6	22,71	37,34	±10,62
Be	mg/kg						0,879		
B	mg/kg						49,76		
P	mg/kg						425,8		
Se	mg/kg						2,07		
Sr	mg/kg				79,1		160,7		
Mo	mg/kg			0,73			0,473		
Ag	mg/kg						0,324		
Sn	mg/kg				0,404		2,016		
Sb	mg/kg						0,706		
Ba	mg/kg						165		
Hg	mg/kg			0,239	0,281	0,198	0,209	0,23	±0,03
Tl	mg/kg						0,399		

* The results is excluded from the calculation of the mean and standard deviation, as it is outside of the range

Participants determined metals concentration in mussel's samples in three replicate. In Table 3 for each laboratory gives the average values.

Table 3 - Results of analyses of the trace metals in biota sample

Laboratory code numbers		1	2	4	5	6	8	average value	confidence range
Compounds	Units	value							
Al	mg/kg		217	193	269		85,0*	191,00	±67,08
As	mg/kg		3,70	3,74	6,58	7,11	6,15	5,46	±1,45
Cd	mg/kg		0,75	0,65	0,61	0,64	0,52	0,63	±0,08
Cr	mg/kg		0,69	1,65	0,85	1,24	1,44	1,18	±0,36
Co	mg/kg		0,71	0,86	0,60	0,56	0,52	0,65	±0,12
Cu	mg/kg	7,53	6,73	9,33	6,80	23,3*	7,72	10,23	±5,90
Fe	mg/kg	285	300	315	294	324	301	302,98	±12,77
Mn	mg/kg	13,2	18,7	22,9	17,0	16,5	58,5*	24,46	±15,48
Ni	mg/kg	2,17	1,86	1,97	1,37	1,71	5,32*	2,40	±1,33
Zn	mg/kg	98,8	109	145	106	127	101	114,38	±16,45
Li	mg/kg				0,364		0,187		
Be	mg/kg						10,5		
B	mg/kg						4,94		
P	mg/kg						7446		

Laboratory code numbers		1	2	4	5	6	8	average value	confidence range
Compounds	Units	value							
V	mg/kg				0,706		2,56		
Se	mg/kg						2,19		
Sr	mg/kg				27,5		20,4		
Mo	mg/kg			0,56			0,32		
Ag	mg/kg						0,018		
Sn	mg/kg				0,373		0,287		
Sb	mg/kg						0,04		
Ba	mg/kg						1,86		
Hg	mg/kg			0,066	<0,038	0,039	0,487*	0,20	±0,2
Tl	mg/kg						0,01		
Pb	mg/kg			0,92	0,98	1,00	0,34*	0,81	±0,27

* The results is excluded from the calculation of the mean and standard deviation, as it is outside of the range

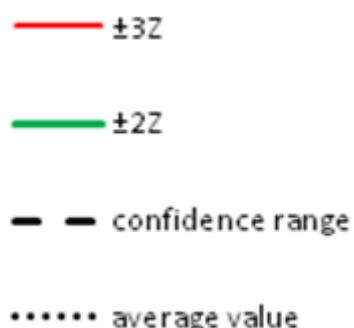
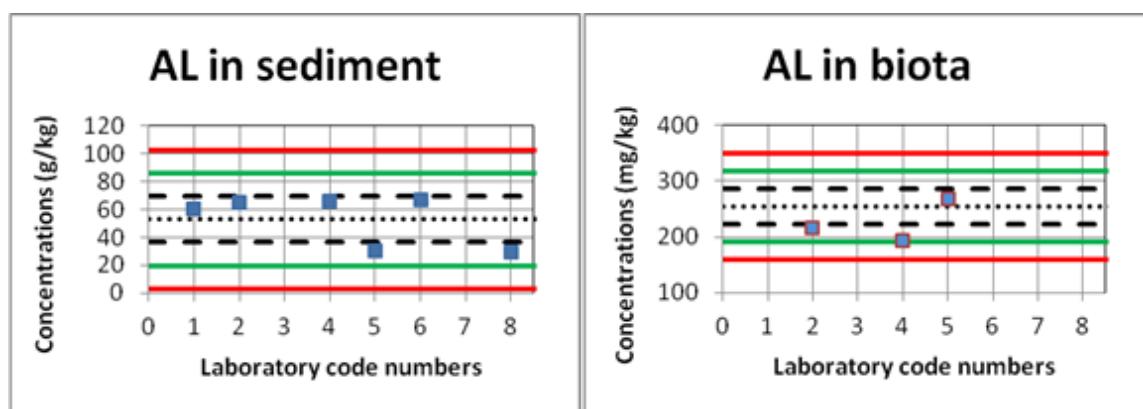
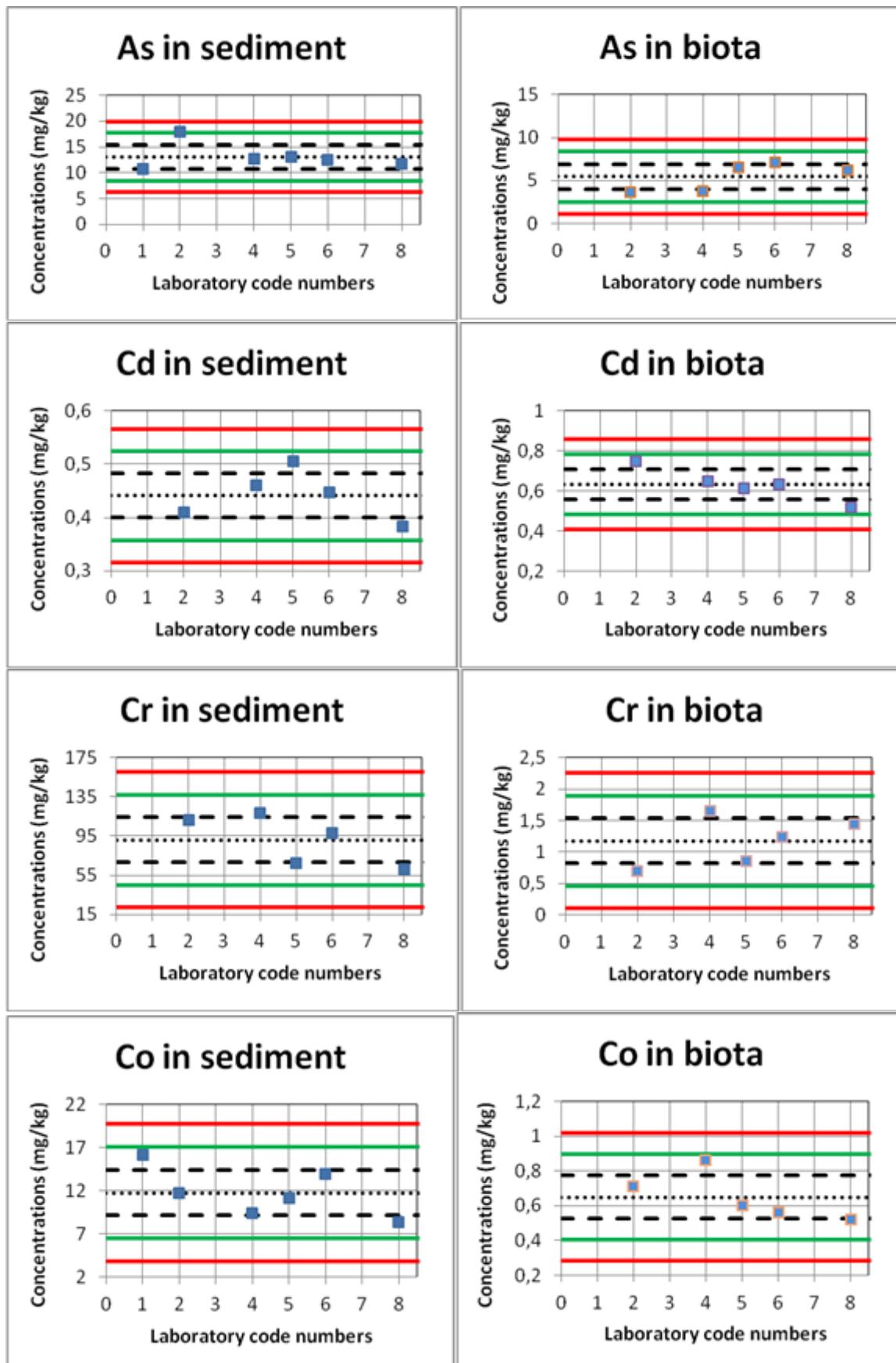
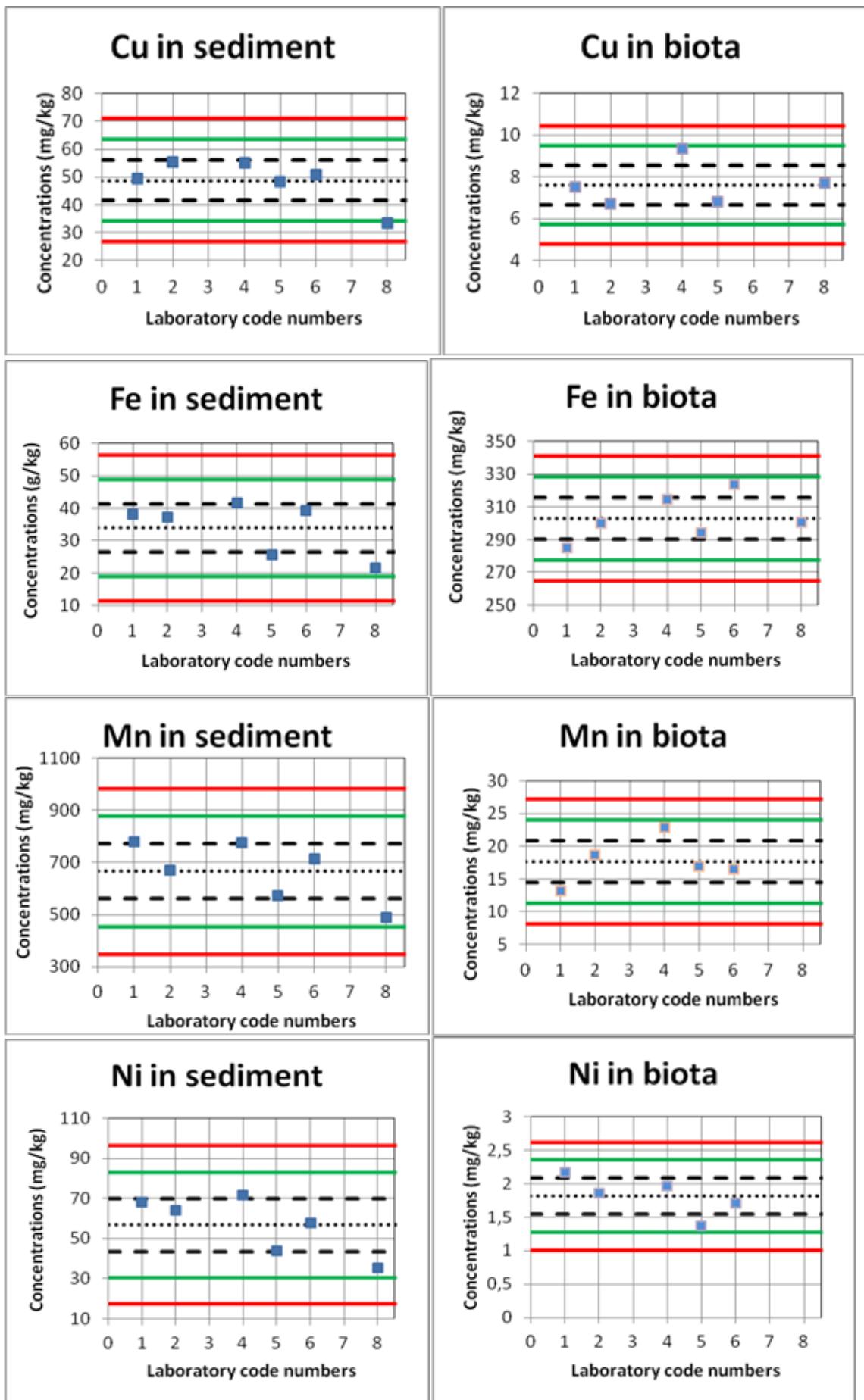


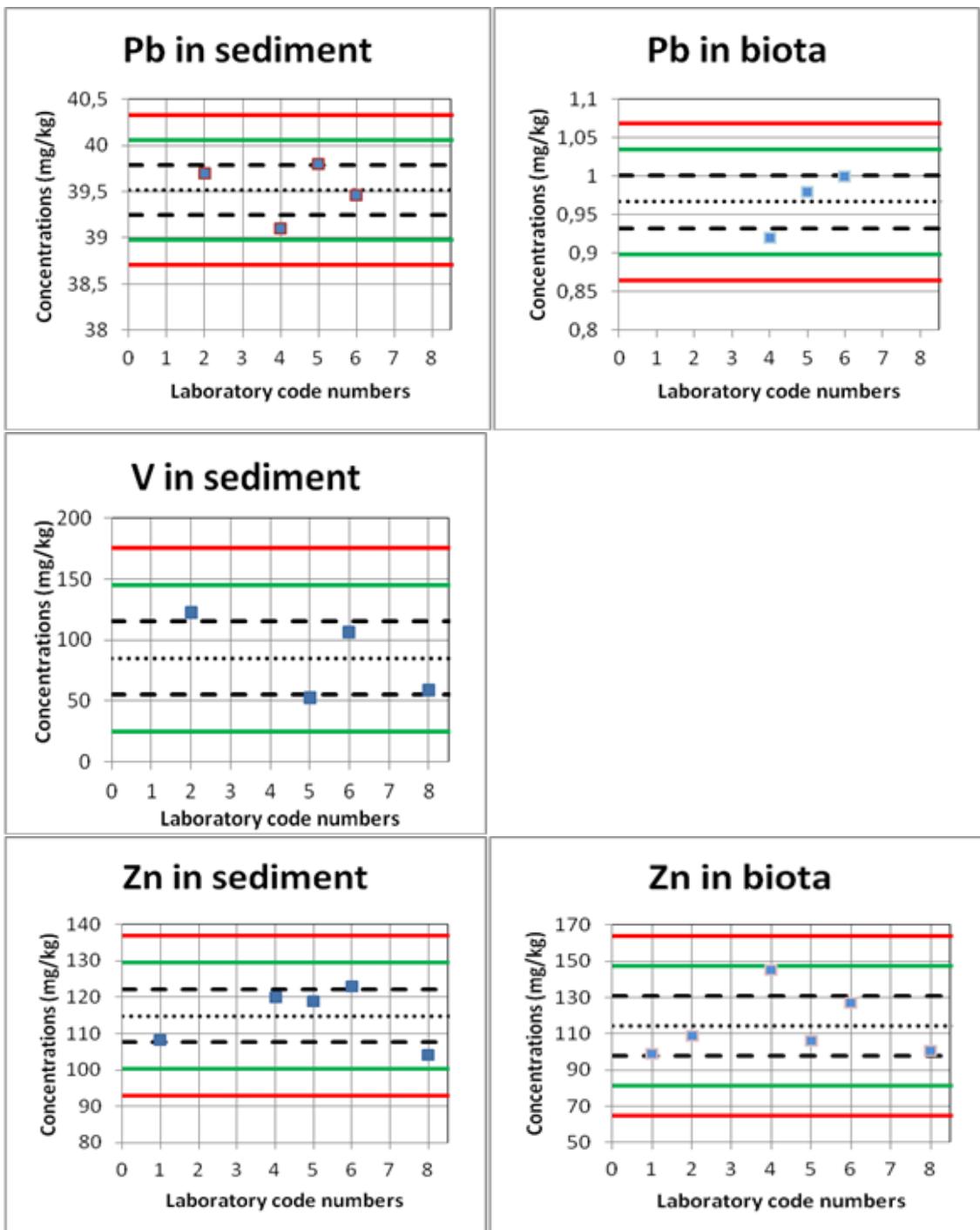
Figure 2 – Indications on the diagrams of processing results

The figures below show results of analyses from participating laboratories for reported Trace Metals concentrations in sediment and biota samples.









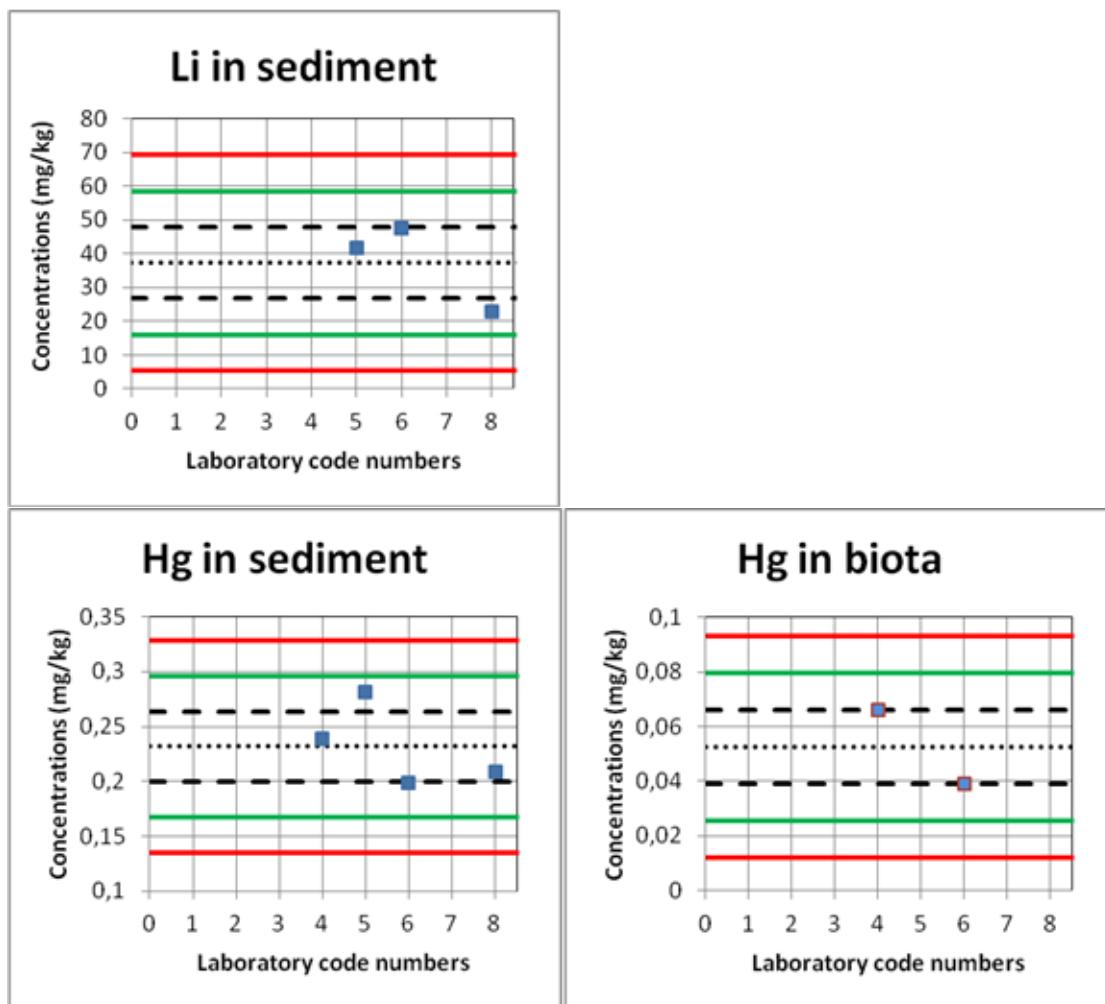


Figure 3 - Results of participating laboratories for reported Trace Me concentrations in sediment and biota samples

Conclusions – Trace Metals

Satisfactory agreements (within confidence range or $\pm 2Z$) were obtained for the most measurements of the participating laboratories, in both samples (sediment and biota).

Differences between results could be attributed to the differences between digestion methods for sediments samples and also instrumental techniques used by laboratories.

Especially it concerns the analysis of sediments. For those laboratories that do not use hydrofluoric acid to decompose the sample, results of the analysis of some metals (AL, Fe, Mn), naturally were obtained lower.

Organic pollutants

For each group of compounds the participants were requested to report:

1. Methods used to confirm identity of the compounds.
2. Calculation of the results.
3. Summary of the quality control procedures routinely employed within the laboratory.
5. The arithmetic mean value and the relative standard deviations of determinations.

Results of the analysis were reported by four laboratories, from the countries: Georgia (No. 1 - Tbilisi State University (TSU), Scientific Research firm “GAMMA”), Ukraine (Lab. 4 - Ukrainian Scientific Centre of the Ecology of Sea (UkrSCES), Greece (Lab. 5 - National and Kapodistrian University of Athens (UoA) and Turkey (Lab. 6 – TÜBİTAK Marmara Research Center Environment and Cleaner Production Institute). Georgian laboratory analysed only sediment sample and has reported 100% of the results as “not detected”.

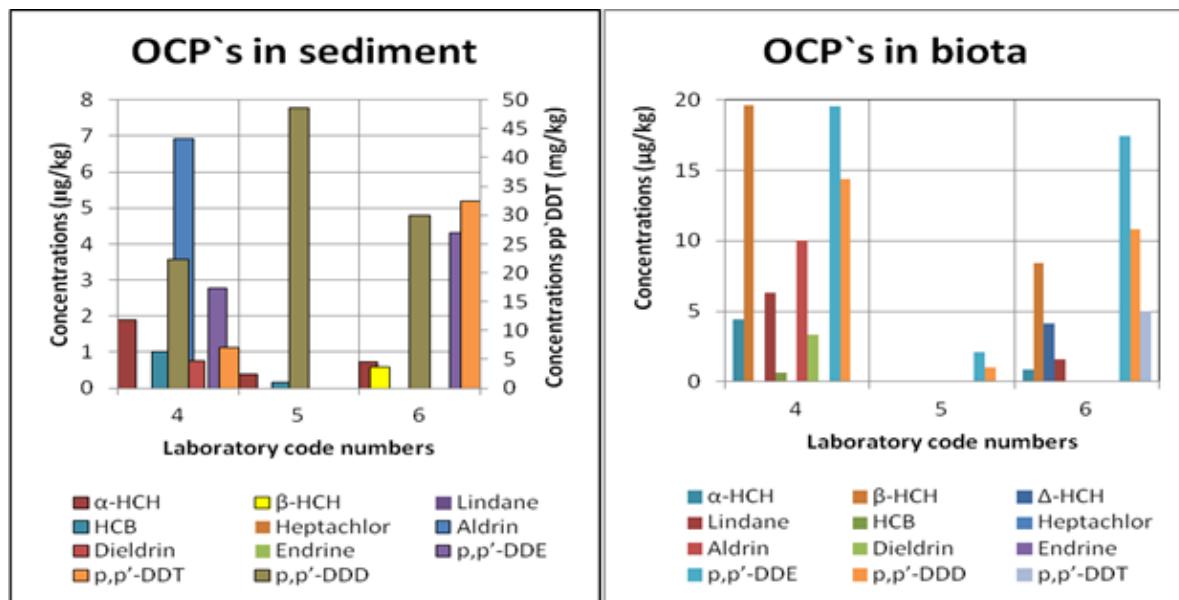
The data sets reported by the laboratories are given in this report (Table 4).

Table 4 – The results of the analysis of organic pollutants in sediment and biota

Laboratory code numbers		1	4	5	6	4	5	6
Compounds	Units	Sediment				Biota		
		value			value			
α-HCH	µg/kg	<1	1,89	0,39	0,74	4,42	<0,25	0,86
β-HCH	µg/kg		<0,05	<0,3	0,58	19,6	<0,25	8,39
Lindane	µg/kg	<1	<0,05			6,31	<0,25	1,6
HCB	µg/kg	<2	1,02	0,17		0,64	<0,08	
Heptachlor	µg/kg	<1	<0,05	<0,1		<0,05	<0,08	
Aldrin	µg/kg		6,92	<0,2		10,05	<0,42	
Dieldrin	µg/kg		0,76	<1		3,36	<0,83	
Endrine	µg/kg			<1			<0,42	
p,p'-DDE	µg/kg	<2	2,78	<0,1	4,32	19,6	2,06	17,4
p,p'-DDD	µg/kg	<2	22,4	48,6	30,0	14,4	1,02	10,8
p,p'-DDT	µg/kg	<2	1,12	<0,2	5,20	<0,05	<0,17	4,98
Ar 1254	µg/kg		23,5			65,9		
Ar 1260	µg/kg		13,7			27,6		
PCB 8	µg/kg		2,13			16,3		
PCB 18	µg/kg		<0,05			35,3		
PCB 28	µg/kg		2,37		0,82	<0,05		1,72
PCB 31	µg/kg		<0,05			3,31		
PCB 44	µg/kg		15,8			4,62		
PCB 49	µg/kg		12,6			57,1		
PCB 52	µg/kg		0,33		0,51	18,2		2,05
PCB 66	µg/kg		0,37			4,03		
PCB 101	µg/kg		0,99		0,55	12,0		2,94
PCB 110	µg/kg		1,24			14,5		
PCB 118	µg/kg		1,75		0,55	8,73		3,20
PCB 138	µg/kg		3,89		0,75	14,1		4,24
PCB 149	µg/kg		0,78			<0,05		
PCB 153	µg/kg		0,88		0,88	8,37		4,08

Laboratory code numbers		1	4	5	6	4	5	6
Compounds	Units	Sediment				Biota		
		value		value		value		
PCB 170	µg/kg		0,24			<0,05		
PCB 174	µg/kg		0,70			4,67		
PCB 177	µg/kg		0,76			3,54		
PCB 180	µg/kg		0,65		0,56	4,12		0,70
PCB 183	µg/kg		0,06			<0,05		
PCB 194	µg/kg		0,63			8,18		
PCB 199	µg/kg		<0,05			<0,05		
naphthalene	µg/kg		92,7	8,63		124	0,74	
acenaphthylene	µg/kg		39,4			<0,04		
acenaphthene	µg/kg		1,30	6,77		3,10	0,13	
fluorene	µg/kg		2,23	6,77		5,88	2,76	
phenanthrene	µg/kg		25,3	25,2		82,20	3,4	
anthracene	µg/kg		11,5	2,26		7,48	1,16	
fluoranthene	µg/kg		47,7	48,6		45,0	2,46	
pyrene	µg/kg		50,6	55,0		35,0	1,79	
benz[a]anthracene	µg/kg		30,4	20,2		5,90	0,27	
chrysene	µg/kg		35,7	15,3		27,3	2,83	
benzo[b]fluoranthene	µg/kg		38,3	22,2		9,21	0,36	
benzo[k]fluoranthene	µg/kg		28,1	13,1		4,77	0,15	
benzo[a]pyrene	µg/kg		40,9	6,3		13,4	0,16	
indeno[1,2,3-cd]pyrene	µg/kg		61,7	6,09		19,4	0,10	
dibenz[a,h]anthracene	µg/kg		12,2			1,14		
benzo[ghi]perylene	µg/kg		39,8	18,7		4,74	0,10	

The figures below show the Comparison of the results of the analysis of organic pollutants in sediment and biota.



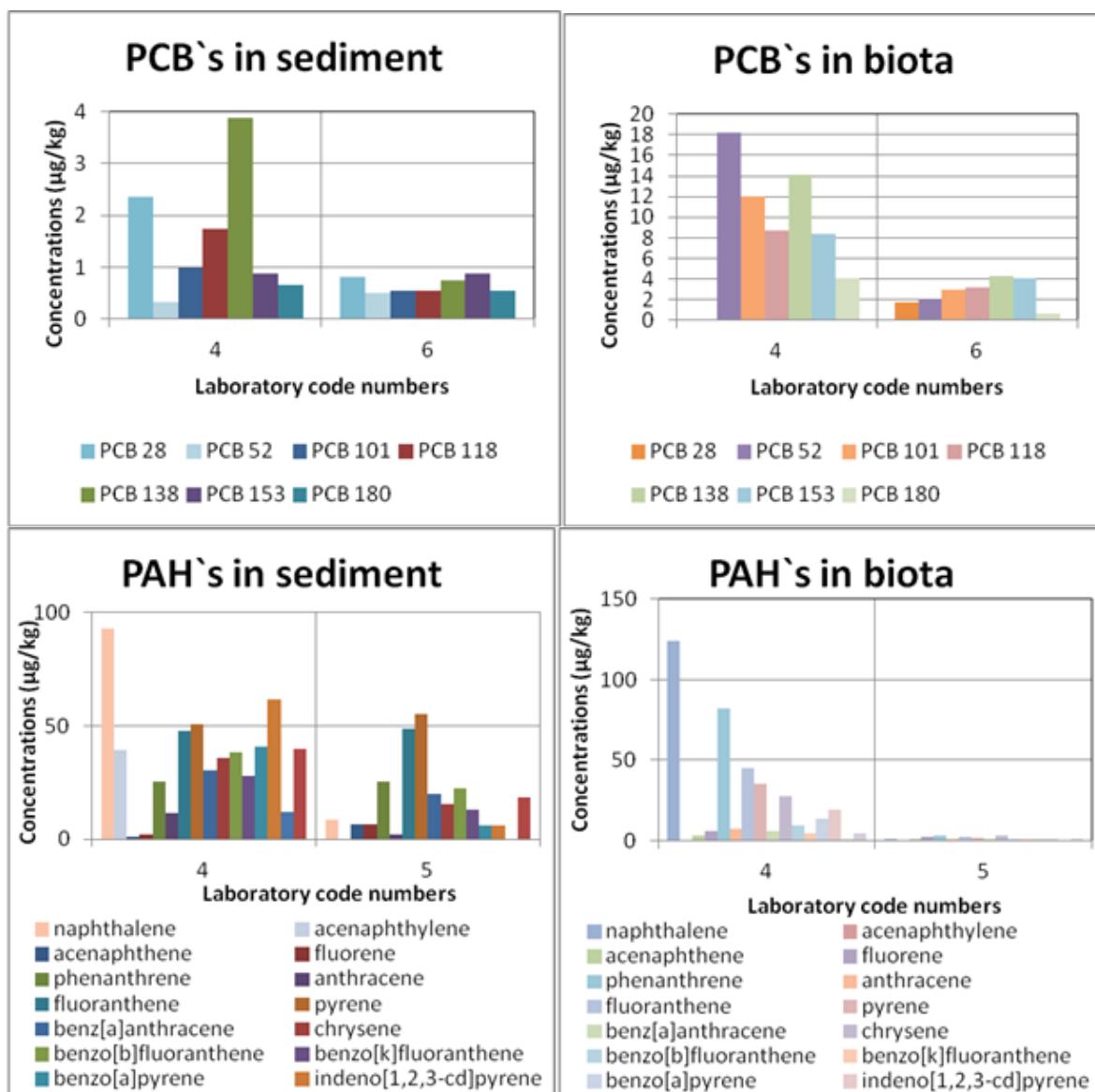


Figure 4 – Comparison of the results of the analysis of organic pollutants in sediment and biota

Conclusions – Organic pollutants

The final results from this interlaboratory comparison have no statistical significance due to the small number of data for an evaluation of the average and standard deviation and z-scores of the data to which it is applied.

From the three countries participating in the project EMLAS (Georgia, Russia and Ukraine), unfortunately, only Ukrainian laboratory performed the analysis of organic pollutants in samples of bottom sediments and biota.

Annex 2: Phytoplankton Intercomparison

REPORT II intercomparison results of the phytoplankton samples processing - January 2017, Odessa

Responsible person of the Phytoplankton Intercomparison:

Andrii Zotov - Institute Marine Biology, NAS Ukraine (IMB)

List of Participants:

	Name	Country	Affiliation	Contacts
1.	Gvarishvili Tsuri	Georgia	National Environmental Agency, Batumi (NEA)	ciuri-gvarishvili@rambler.ru
2.	Larisa Pautova	The Russian Federation	P.P. Shirshov Institute of Oceanology RAS, Moscow (SIO)	larisapautova@yahoo.com
3.	Olga Yasakova	The Russian Federation	Southern Scientific Center RAS, Rostov-on-Don (SSC)	yasak71@mail.ru
4.	Natalya Derezyuk	Ukraine	Odessa National University, Odessa (ONU)	n.derezyuk@onu.edu.ua
5.	Andrii Zotov	Ukraine	Institute of Marine Biology, Odessa (IMB)	zotovab@ukr.net
6.	Galyna Terenko	Ukraine	Ukrainian Scientific Center of Ecology Sea, Odessa (UkrSCES)	adlafia@mail.ru

Sampling Data:

NPMS-UA, St. 2, 6.5m – 17.05.2016

JOSS-UA-GE, St. 12.35m – 26.05.2016

NPMS-GE, St. 1, 15m - 28.05.2016

Sampling Location:

Station	Lat, °N	Long, °E	Bottom depth, m
NPMS-UA St. 2	45 ° 59.393'	30 ° 42.667'	19
JOSS-UA-GE St. 12	42°14.070'	39°53.161'	1909
NPMS-GE St. 1	41°33.477'	41°33.111'	46

Sampling Conditions:

Station	Water temperature (T, °C)	Salinity (S, ‰)	Oxygen (O ₂ , mg/l)
NPMS-UA, St. 2, 6.5m	15.08	15.70	10.46
JOSS-UA-GE, St. 12. 35m	9.40	18.09	9.56
NPMS-GE, St. 1, 15m	13.90	18.11	9.88

Number of samples passed to experts:

	Expert Name	Country	Affiliation	Number of sampls
1.	Gvarishvili Tsuri	Georgia	NEA	3
2.	Larisa Pautova	The Russian Federation	SIO	3
3.	Olga Yasakova	The Russian Federation	SSC	3
4.	Natalya Derezyuk	Ukraine	ONU	3
5.	Andrii Zotov	Ukraine	IMB	3
6.	Galyna Terenko	Ukraine	UkrSCES	3

Features of phytoplankton samples processing

Laboratory	Sample concentration	Microscope type	Volume of condensed sample	Volume of subsample	Magnification
GE	Back filtration method	KRUSS, (inverted)	80–120 ml	0.05 ml	200, 400
RF	Back filtration (to 80-120 ml) + sedimentation method (to 10-20 ml)	LOMO, Ergoval, (upright)	10–20 ml	0.05 ml, 1.0 ml	160, 400
UA	Back filtration (to 80-120 ml) + sedimentation method (to 10-20 ml)	LOMO, Ceiss (upright)	10–20 ml	0.05 ml, 0.1 ml	200, 400, 600

Results of Intercomparison

After processing of the phytoplankton samples in the laboratories of national institutions, the experts provide the results prepared according to “Format Protocol Station” (Template) which has been approved during the practical study of Odessa Workshop in February 2016. Detailed data of processing are presented in : Annex 2.1 – Taxonomic comparison; Annex 2.2 – Phytoplankton sample analysis_GE_St1.15m; Annex 2.3 – Phytoplankton sample analysis_JOSS St.12.35m; Annex 2.4 – Phytoplankton sample analysis_UA St.2 65m.

The taxonomic composition of phytoplankton samples identified by the experts that participated in intercorparision procedure show significant differences. Comparison of the species lists is presented in Annex 7.

Both the number of species reported differed significantly, as well as the number of species common for all partners (Fig. 1).

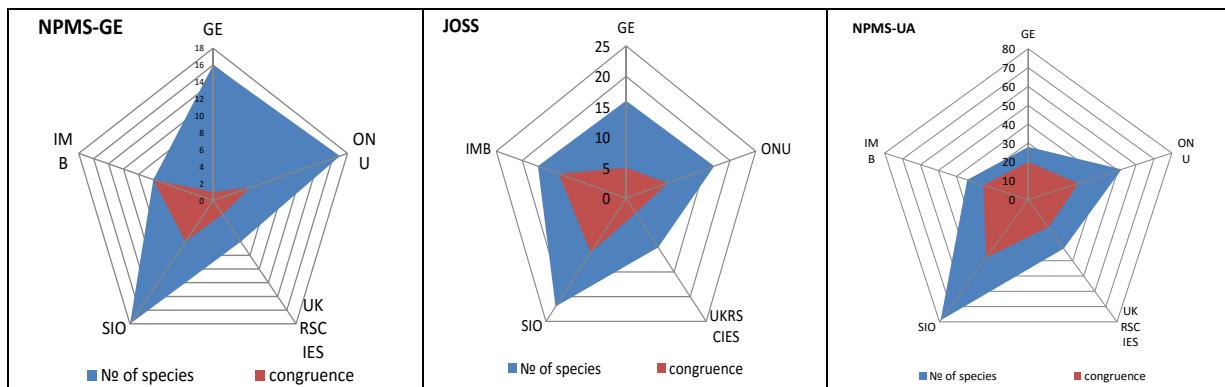


Fig. 1. Result of determination of the taxonomic composition for intercomparison of phytoplankton samples by EMBLAS's partners.

Analysis of Bray-Curtis similarity for species composition showed low values. The level of similarity for different samples ranged between 9-40% (NPMS-GE, St. 1) to 13-47% (JOSS-UA-GE, St. 12) and 20-47% (NPMS-UA, St. 2) (Fig. 2).

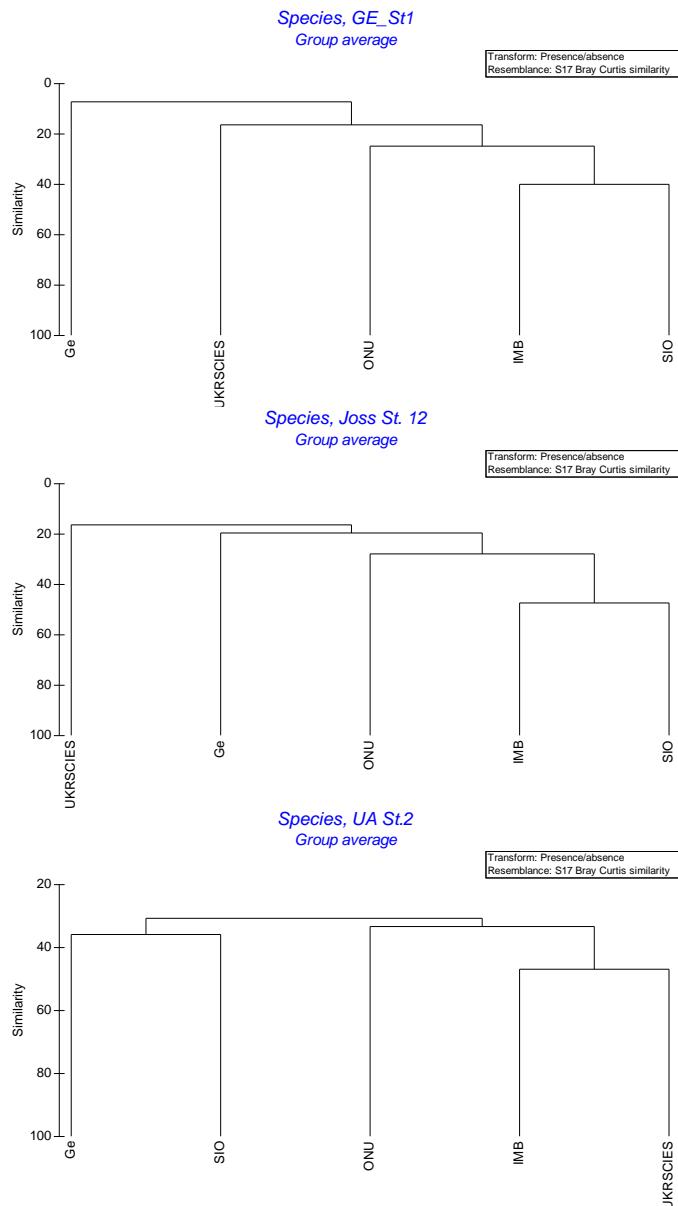


Fig. 2. Similarity of taxonomic composition for intercomparison of phytoplankton samples by EMBLAS partners.

The presented in Fig. 1 and Fig. 2 difference of the taxonomic composition identification may be determined by both subjective and objective reasons: problems of modern taxonomy, the quality of the microscope equipment and the volume of the analyzed subsample. The results of abundance and biomass calculation also showed significant differences (Fig 3, 5).

Among the possible reasons for these divergences - the use of different types of microscopes (direct and inverted), the difference in the volume chambers for processing samples, difference in the formulas for calculating the cell volume.

Analysis of the Bray-Curtis similarity for the abundance and biomass of taxonomic classes revealed a much higher similarity. The level of similarity for the abundance varied between 49-88% (NPMS-GE, St. 1) to 59-92% (JOSS-UA-GE, St. 12) and 54-83% (NPMS-UA, St. 2) (Fig. 4). For biomass, the similarity values were distributed as follows: 50-90% (NPMS-GE, St. 1), 75-92% (JOSS-UA-GE, St. 12) and 59-78% (NPMS-UA, St. 2) (Fig. 6).

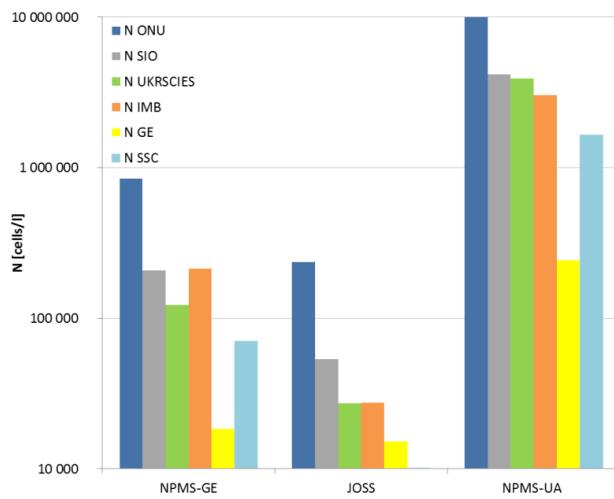


Fig. 3. Result of abundance intercomparison of phytoplankton samples by EMBLAS partners.

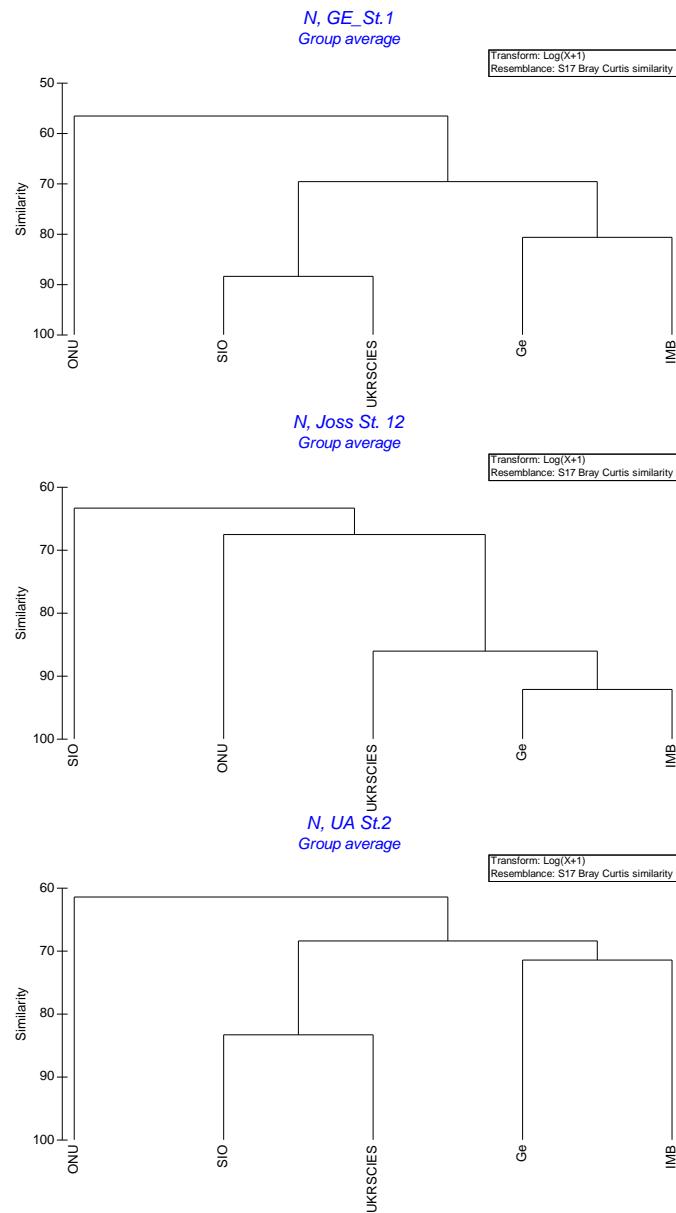


Fig. 4. Similarity of abundance distribution for intercomparison of phytoplankton samples by EMBLAS partners.

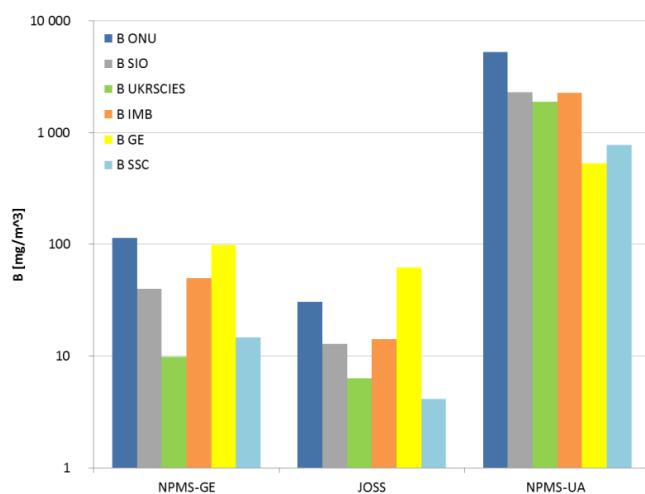


Fig. 5. Result of biomass intercomparison of phytoplankton samples by EMBLAS partners.

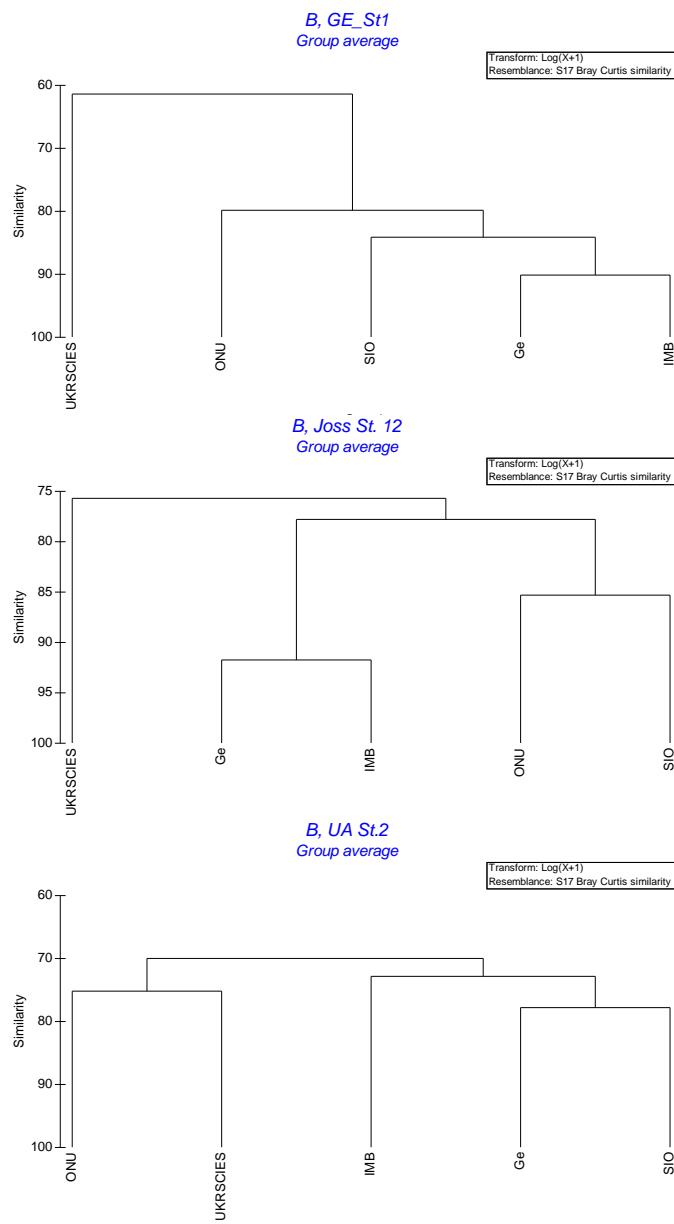


Fig. 6. Similarity of biomass distribution for intercomparison of phytoplankton samples by EMBLAS partners.

The differences in the values of biomass determined the discrepancies of the assessment of ecological status based on this index (Table 1). The status for NPMS-GE and JOSS stations by all EMBLAS's partners was within the «High» category. For NPMS-UA sample the evaluation ranged from «Bad» to «High».

Table 1. Result of comparative analysis of the biomass for determination of the ESC correspond to intercomparison phytoplankton samples by EMBLAS's partners.

EMBLAS's partner	Biomass, mg.m ⁻³		
	NPMS-GE	JOSS	NPMS-UA
ONU (UA)	High	High	Bad
SIO (RF)	High	High	Poor
IMB (UA)	High	High	Poor
UKRSCES (UA)	High	High	Moderate
SSC (RF)	High	High	Good
NEA (GE)	High	High	High

Conclusions:

1. The II Intercomparison of phytoplankton showed a complex of problems associated with taxonomic identification and processing of phytoplankton samples.
2. In defining the biodiversity there is a problem with the taxonomic identification of species of phytoplankton, associated with both objective and subjective reasons.
3. The results showed the need for implementation in national laboratories of unified hardware and techniques of microscopic processing of phytoplankton samples, as well as the need to use a single list of formulas for calculating the volume of the cells, allowing to obtain comparable values of biomass.

Recommendations

- Repetition of interlaboratory comparison of results may contribute to the development of unified approaches for the processing of samples.
- The interlaboratory comparison of the lists of species, obtained for different water areas may contribute to the reduction of the subjective factor in the taxonomic analysis.

Responsible person
of the phytoplankton Intercomparison:

Andrii Zotov
30-01-2017
Odessa

Annex 2.1 Taxonomic comparison

List of species NPMS-GE (St.1, 15m)	NEA	ONU	UKRSCES	SIO	IMB
Alexandrium sp.				+	+
CERATIUM TRIPPOS (O.F.Muller) Nitzsch.		+		+	
Chaetoceros affinis				+	
CHAETOCEROS LORENZIANUS Grun.		+			
CHAETOCEROS SOCIALIS Laud.		+			
CHAETOCEROS WIGHAMII Brightw.		+			
Chlorophyceae gen. sp.			+		
Coccilithus sp.				+	
Coccilitineae sp.6-8 µm	+				
Cocconeis scutellum	+				
Cochlodinium geminatum	+				
Coronosphaera mediterranea (Lohmann) Gaarder, 1977			+		
DACTYLIOSOLEN FRAGILISSIMUS (Berg.) Hasle		+			
DIATOMA TENUIS Ag.		+			
Diplopsalis lenticula				+	
Emiliania huxleyi (Lohmann) Hay , Mohler, 1967		+	+	+	+
Glenodinium penardii	+				
Gon.cochlea	+				
Goniaulax polyedra	+				
Gonyaulax polygramma				+	
Gymnodinium agile	+				
Gymnodinium simplex				+	
Gymnodinium sp.			+	+	+
GYMNODINIUM WULFFII Sch.		+			
Gyrodinium fusiforme	+				
Gyrodinium cornutum (Pouchet, 1885) Kofoed , Swezy, 1921			+		
Gyrodinium fusiforme				+	+
GYRODINIUM LACHRYMA (Meunier) Kof.et Sw.		+			
Gyrodinium spirale				+	
Heterocapsa triquetra	+				
Katodinium fungiforme (Anisimova) Loeblich III, 1965			+		
LESSARDIA ELONGATA Saldar. et F.J.R.Taylor		+			+
MONORAPHIDIUM CONTORTUM (Thur.) Kom.-Legn.		+			
Navicula sp.	+				
OCHROMONAS OBLONGA Cart.		+			
OSCILLATORIA SPP.		+			
Oxyrris marina	+				
PERIDINIELLA DANICA (Pauls.) Okolod. et Dodge		+			
Phalacroma pulchellum	+				
Phalacroma rotundatum				+	
Pontosphaera sp.	+				+
Pr.-per. steinii	+				
Prorocentrum compressum	+				
Prorocentrum cordatum				+	
Proto-peridinium bipes	+				
PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe		+			+
SCRIPPSIELLA TROCHOIDEA (St.) Loeb.III		+		+	+
Small flagellates d=6				+	

List of species NPMS-GE (St.1, 15m)	NEA	ONU	UKRSCES	SIO	IMB
Small flagellates d=8-10				+	
SYRACOSPHAERA MOLISCHII Schil.		+			
Torodinium teredo				+	
Cnopa dinoflagellate				+	

List of species NPMS-UA (St. 2,65m)	NEA	ONU	UKRSCES	SIO	IMB
Achnanthes brevipes				+	
Acutodesmus acuminatus (Lagerheim) Tsarenko, 2001			+		
Akashiwo sanguinea				+	
<i>Alexandrium</i> sp.	+			+	
Amphidinium crassum				+	
Amphidinium sp.				+	
Amphidinium sphaenoides				+	
AMPHIPLERA SPP.		+			
Amphiprora sp.				+	
<i>Amphora</i> sp.	+				
Anabaena sp.					+
<i>Ankistrodesmus</i> sp.	+			+	
Attheya septentrionalis (Østrup) Crawford in Crawford et al., 1994			+		
Binuclearia lauterbornii				+	
BORGHIELLA TENUISSIMA (Laut.) Moest.		+			
CERATAULINA PELAGICA (Cleve) Hendey		+	+	+	+
CERATIUM FURCA (Ehr.) Clap. et Lach.	+	+			
CERATIUM FUSUS (Ehr.) Dujard.		+		+	
CERATIUM TRIPOS (O.F.Müller) Nitzsch.		+			
<i>Ch. compressus</i>	+				
Chaetoceros affinis	+			+	
CHAETOCEROS BORGEI Lemm.		+			
Chaetoceros brevis				+	
Chaetoceros compressus				+	
CHAETOCEROS CURVISETUS Cl.	+	+	+	+	+
Chaetoceros danicus P.T.Cleve, 1889			+	+	+
Chaetoceros debilis				+	
Chaetoceros holsaticus				+	
CHAETOCEROS INSIGNIS Pr.-Lavr.	+	+		+	
Chaetoceros karianus				+	
CHAETOCEROS LACINIOSUS Schutt		+	+	+	
CHAETOCEROS LORENZIANUS Grun.		+	+		
Chaetoceros muelleri				+	
Chaetoceros similis f. solitarius Proshkina-Lavrenko, 1961			+		
CHAETOCEROS SOCIALIS Laud.		+	+	+	+
Chaetoceros subtilis (Proshkina-Lavrenko) Proshkina-Lavrenko, 1961			+		
Chaetoceros subtilis var. abnormis f. simplex Proshkina-Lavrenko, 1961			+		
CHAETOCEROS WIGHAMII Brightw.		+		+	
Chlamydomonas sp.			+		
Coccolithus sp.				+	
<i>Coscinodiscus janischii</i>	+				
Cryptomonas sp.				+	
Cyclotella choctawhatcheeana Prasad, 1990	+	+	+	+	+

List of species NPMS-UA (St. 2,65m)	NEA	ONU	UKRSCES	SIO	IMB
Cyclotella menighiniana				+	
Cyclotella sp.				+	
CYLINDROTHECA CLOSTERIUM (Ehr.) Reim.et Lewin		+		+	+
DACTYLIOSOLEN FRAGILISSIMUS (Berg.) Hasle	+	+		+	+
Desmodesmus bicaudatus					+
Desmodesmus communis				+	
DESMODESMUS COMMUNIS (Hegew.) Hegew.		+			
Detonula confervacea				+	
DIATOMA TENUIS Ag.		+	+	+	+
DICTYOSPHAERIUM GRANULATUM Hind.		+			
Dictyosphaerium sp.					+
DINOBRYON SOCIALE Ehr.		+			
Dinophyceae gen. sp.			+		
<i>Dinophysis sphaerica</i>	+				
DINOPHYYSIS ACUMINATA Clap.et Lach.		+		+	+
Dinophysis sacculus				+	
Diplopsalis lenticula				+	+
DITYLUM BRIGHTWELLII (West.) Grun.	+	+	+	+	
Ebria tripartita (Shumann) Lemmermann, 1899					+
Emiliania huxleyi (Lohmann) Hay , Mohler, 1967			+	+	
<i>Euglena</i> sp.	+			+	+
Eutreptia sp.				+	
Glenodinium sp.					+
Gonyaulax minima				+	+
Gonyaulax polygramma				+	
GONYAULAX SCRIPPSAE Kof.		+			
Gonyaulax spinifera	+			+	
<i>Gymn. agile</i>	+			+	
GYMNODINIUM CNECOIDES Harris		+			
<i>Gymnodinium najadeum</i>	+				
GYMNODINIUM NAJADEUM Sch.		+			
Gymnodinium simplex				+	
Gymnodinium simplex (Lohmann, 1911) Koifoid , Swezy, 1921			+		+
Gymnodinium sp.				+	+
Gymnodinium sp. 2					+
GYMNODINIUM WULFFII Sch.		+			
Gyrodinium cornutum (Pouchet, 1885) Koifoid , Swezy, 1921			+		
Gyrodinium fusiforme				+	+
GYRODINIUM LACHRYMA (Meunier) Kof.et Sw.		+		+	
Gyrodinium spirale				+	
<i>Heterocapsa triquetra</i>	+		+	+	+
Jaaginema kisselevii (Anissimova) Anagnostidis & Komárek, 1988			+		
Kofodinium velleloides				+	
LESSARDIA ELONGATA Saldar. et F.J.R.Taylor		+			+
LEUCOCRYPTOS MARINA (Braar.) Butcher		+			
LIMNOTHRIX PLANKTONICA (Wolosz.) Meffert		+			
Lyngbya limnetica				+	
LYNGULODINIUM POLYEDRUM (Stein) Dodge		+		+	
Melosira nummuloides				+	
MERISMOPEDIA MINIMA G.Beck.		+			

List of species NPMS-UA (St. 2,65m)	NEA	ONU	UKRSCES	SIO	IMB
MICROCYSTIS AERUGINOSA Kutz.	+	+			
MINUSCULA BIPES Pav.		+			
MONORAPHIDIUM CONTORTUM (Thur.) Kom.-Legn.		+	+		+
NAVICULA SPP.	+	+		+	+
NITZSCHIA LONGISSIMA (Bred.) Ralfs		+		+	
Olicola vangoorii (W.Conrad) Vørs, 1992			+		
Oocystis sp.	+				
OOCYSTIS BORGEI Snow		+			
PERIDINIELLA DANICA (Pauls.) Okolod. et Dodge		+			
POLYKRIKOS KOFOIDII Chatton		+			
Pontosphaera sp.1					+
Prorocentrum balticum				+	
Prorocentrum cordatum (Ostenfeld, 1901) Dodge, 1975			+	+	+
Prorocentrum micans				+	
PROROCENTRUM MINIMUM (Pav.) Schiller		+		+	
Prorocentrum scutellum	+				
Protoceratium reticulatum				+	
Protoperidinium bipes				+	
Protoperidinium breve				+	
Protoperidinium brevipes				+	
PROTOPERIDINIUM BROCHI Kof.et Sw.		+			
Proto-peridinium granii	+			+	+
PROTOPERIDINIUM PELLUCIDUM (Bergh) Schutt		+			
Prymnesiophyceae gen. sp.			+		
PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe	+	+	+	+	+
Pseudo-nitzschia seriata	+			+	
PSEUDOSOLENIA CALCAR AVIS (Schul.) Sunst.	+	+		+	
Raphidocelis danubiana (Hindák) Marvan, Komárek & Comas, 1984			+		
RHODOMONAS MINUTA Skuja		+			
SALPINGOECA SPINIFERA Thrond.		+			
SCENEDESMUS FALCATUS Chod.		+			
SCRIPPSIELLA TROCHOIDEA (St.) Loeb.III	+	+	+	+	+
SKELETONEMA COSTATUM (Grev.) Cl.		+	+	+	+
Small flagellates d=6				+	
Small flagellates d=8-10				+	
STEPHANODISCUS HANTZSCHII Grun.		+			
Striatella interrupta (Ehr.) Heib., 1863					+
Tetraselmis sp.			+		
Thalassionema nitzschiooides				+	
Thalassiosira caspica				+	
Thalassiosira nordenskioeldii P.T. Cleve, 1873			+		
THALASSIOSIRA PARVA Pr.-Lavr.		+	+		+
Thalassiosira sp.2.				+	
Thalassiosira subsalina				+	
Trachelomonas vovlovicina	+				
Tripos furca				+	
Tripos fusus (Ehrenberg) F.Gómez, 2013					+

List of species JOSS (St.12, 35m)	NEA	ONU	UKRSCES	SIO	IMB
ACANTHOICA QUATTROSPINA Lohm.		+			
Alexandrium sp.					+
Amphidinium sphaenoides				+	
CALYPTROSPAERA DALMATICA Sch.		+			
CALYPTROSPAERA INSIGNIS Sch.		+			
CERATIUM TRIPPOS (O.F.Muller) Nitzsch.		+			
Coccolithus sp.				+	
Coccolitineae sp.6-8 µm	+				
Coccolitus scutellum	+				
Cochlodinium geminatum	+				
Coronosphaera mediterranea (Lohmann) Gaarder, 1977			+		
Cryptomonas sp.				+	
CYCLOTELLA CASPIA Grun.	+	+			
Cyclotella sp.					+
Cylindrotheca closterium				+	+
DINOPHYYSIS FORTII Pavil.		+			
Diplopsalis lenticula				+	+
EMILIANIA HUXLEYI (Lohm.) Hay et Mohler		+	+	+	+
Glenodinium agile	+				
Gon. scrippsae	+				
Gon.cochlea	+				
Goniaulax polyedra	+				
GONYAULAX GRINDLEYI Reinecke		+			
Gonyaulax polygramma				+	
GYMNOdinium AGILE Kof.et Sw.		+		+	
Gymnodinium najadeum	+				
Gymnodinium sp.				+	+
Gymnodinium sp1					+
Gyrodinium cornutum (Pouchet, 1885) Kofoid , Swezy, 1921			+		
Gyrodinium fusiforme				+	+
Heterocapsa triquetra	+				
Hillea fusiformis (Schiller) Schiller, 1925			+		
LESSARDIA ELONGATA Saldar. et F.J.R.Taylor		+			+
LEUCOCRYPTOS MARINA (Braar.) Butcher		+			
Meringosphaera mediterranea Lohmann, 1902			+		
Monoraphidium contortum (Thuret) Komárková-Legnerová, 1969					+
NAVICULA SPP.		+		+	
OCHROMONAS MINIMA Thrond.		+			
Pontosphaera sp.	+		+		
Pontosphaera nigra (J.Schiller) J.Schiller, 1930			+		
PROBOSCIA ALATA (Bright.) Sunst.		+			+
Prorocentrum micans	+				
Prorocentrum balticum				+	
Prorocentrum caspicum A.Henckel					+
Prorocentrum compressum				+	
Prorocentrum cordatum				+	
Prorocentrum micans				+	+
Proto-peridinium steinii	+				+
PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe	+	+	+	+	+
RHODOMONAS MINUTA Skuja		+			

List of species JOSS (St.12, 35m)	NEA	ONU	UKRSCES	SIO	IMB
SCRIPPSIELLA TROCHOIDEA (St.) Loeb.III	+	+		+	+
Skeletonema costatum				+	+
Small flagellates d=6				+	
Small flagellates d=8-10				+	
Tetraselmis sp.			+		
Thalassiosira parva Proshk.-Lavr., 1955			+		
Thalassiosira sp.				+	
<i>Trachaelomonas volvocyna</i>	+				
Cnida dinoflagellate				+	

Annex 2.2 Phytoplankton sample analysis_GE_St1.15m

UkrSCES

Date	5/19/2016	Volume of decanted water V, ml	3045	counting chamber volume =0,05 ml			
Station	St. 1 - GE	volume after decantation (v), ml	17				
Depth	15 m	k=(v/(V+v))*1000, l	5.55				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	please insert the shape you use for the biovolume
			N [cells/l]	mkm ³		B [mg/m^3]	
Dinophyceae							
<i>Gyrodinium cornutum</i>	12		1340	347.280		0.470	0.02
<i>Gymnodinium blax</i>	4		450	390.690		0.180	0.01
<i>Gymnodinium simplex</i>	4		450	1200.2		0.54	0.01
			2240			1.190	
Haptophyta							
<i>Emiliania huxleyi</i>	1064		118800	69.420		8.250	0.48
<i>Syracospheara mediterranea</i>	4		450	476.160		0.180	0.01
			119250			8.430	
Flagellates							
<i>flagellata</i>	4		450	468.830		0.210	0.01
			450			0.210	
	N [cells/l]	B [mg/m^3]					
Dinophyceae	2240	1.190					
Haptophyta	119250	8.430					
Flagellates	450	0.210					
Total	121940	9.830					

NEA

Date	5/31/2016	Volume of decanted water V, ml	3000	counting chamber volume = 0,05 ml				
Station	1	volume after decantation (v), ml	45					
Depth	15m	k=(v/(V+v))*1000, l	14.8					
Intercalibracion NPMS-GE								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
		N [cells/l]				B [mg/m^3]	pi	pi*ln (pi)
Bacillariophyceae								
<i>Cocconeis scutellum</i>	3	60	888	4578.00	4.715	4.187	0.0483871	-0.146541
<i>Navicula sp.</i>	4	80	1184	3538.00	3.644	4.315	0.06451613	-0.176828
Dinophyceae								
<i>Cochlodinium geminatum</i>	2	40	592	12456.00	12.830	7.595	0.03225806	-0.110774
<i>Glenodinium penardii</i>	2	40	592	6128.00	6.312	3.737	0.03225806	-0.110774
<i>Goniaulax polyedra</i>	2	40	592	14116.00	14.539	8.607	0.03225806	-0.110774
<i>Gon.cochlea</i>	2	40	592	16012.00	16.492	9.763	0.03225806	-0.110774
<i>Gyrodinium fusiforme</i>	3	60	888	6678.00	6.878	6.108	0.0483871	-0.146541
<i>Gymnodinium agile</i>	3	60	888	248.00	0.255	0.227	0.0483871	-0.146541
<i>Heterocapsa triquetra</i>	4	80	1184	4852.00	4.998	5.917	0.06451613	-0.176828
<i>Oxyrris marina</i>	4	80	1184	3144.00	3.238	3.834	0.06451613	-0.176828
<i>Phalacroma pulchellum</i>	3	60	888	22556.00	23.233	20.631	0.0483871	-0.146541
<i>Proto-peridinium bipes</i>	2	40	592	3476.00	3.580	2.120	0.03225806	-0.110774
<i>Pr.-per. steinii</i>	2	40	592	18448.00	19.001	11.249	0.03225806	-0.110774
<i>Prorocentrum compressum</i>	2	40	592	12746.00	13.128	7.772	0.03225806	-0.110774
Coccolithophoridophycidae								
<i>Coccolitineae</i> sp.6-8 µm	18	360	5328	65.00	0.067	0.357	0.29032258	-0.35906
<i>Pontosphaera sp.</i>	6	120	1776	1255.00	1.293	2.296	0.09677419	-0.226004
	62		18352			98.714		-2.477131
	N [cells/l]	B [mg/m^3]						
<i>Bacillariophyceae</i>	2,072	8.502						
<i>Dinophyceae</i>	9176	87.559						
<i>Coccolithophoridophycidae</i>	7104	2.653						
Total	18352	98.714						

IMB

Date	5/31/2016	Volume of decanted water V, ml	1636	counting chamber volume = 0,05 ml				
Station	1	volume after decantation (v), ml	14					
Depth	15m	k=(v/(V+v))*1000, l	8.48					
Intercalibracion NPMS-GE								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
			N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)
Bacillariophyceae								
Pseudo-nitzschia delicatissima (P.T. Cleve, 1897) Heiden, 1928	3	10	84.8485	394	0.394	0.033	0.00462	-0.0249
Dinophyceae								
Alexandrium sp.1	3	10	84.8485	7694	7.694	0.653	0.00462	-0.0249
Amphidinium sp.1	1	3	28.28283333	1717	1.717	0.049	0.00154	-0.01
Lessardia elongata Saldarriaga , F.J.R.Taylor, 2003	4	13	113.1313333	735	0.735	0.083	0.00616	-0.0314
Gymnodinium sp.	1	3	28.28283333	5233	5.233	0.148	0.00154	-0.01
Gyrodinium fusiforme Koifoid , Swezy, 1921	3	10	84.8485	18807	18.807	1.596	0.00462	-0.0249
Scrippsiella trochoidea (Stein, 1883) Balech ex Loeblich III, 1965	9	30	254.5455	971	0.971	0.247	0.01387	-0.0593
Coccolithophoridophycidae								
Pontosphaera sp.	1	3	28.28283333	2524	2.524	0.071	0.00154	-0.01
Emiliania huxleyi (Lohmann) Hay , Mohler, 1967	7530	25100	212969.735	221	0.221	47.020	11.6047	28.4479
			213,677			49.900		28.2527
	N [cells/l]	B [mg/m^3]						
<i>Bacillariophyceae</i>	85	0.033						
<i>Dinophyceae</i>	593.9395	2.775						
<i>Coccolithophoridophycidae</i>	212998.0178	47.091						
Total	213,676.81	49.90						

ONU

Date	5/28/2016	Volume of decanted water V, ml	3045	counting chamber volume = 0,01 ml	1.477		
Station	NPMS-GE-1	volume after decantation (v), ml	45	counting chamber volume = 2,7 ml	0.005		
Depth	15 m	k=(v/(V+v))*1000, l	14.8				
	Taxa	No of cells counted in the chamber	number species/m^3	biovolume	weight		Shannon Weaver Index abundance
NN			N [cells*10^6/m^3]				B [mg/m^3]
	Bacillariophyceae						
1	CHAETOCEROS LORENZIANUS Grun.	8	0.04	3053.64	3145.25	0.13	0.0007
2	CHAETOCEROS SOCIALIS Laud.	4	5.91	62.83	64.71	0.38	0.0499
3	CHAETOCEROS WIGHAMII Brightw.	1	1.48	87.96	90.60	0.13	0.0160
4	DACTYLIOLENS FRAGILISSIMUS (Berg.) Hasle	1	1.48	1696.46	1747.35	2.59	0.0160
5	DIATOMA TENUIS Ag.	2	0.01	678.59	698.95	0.01	0.0002
6	PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe	29	42.86	167.55	172.58	7.40	0.2176
	Chlorophyceae						
7	MONORAPHIDIUM CONTORTUM (Thur.) Kom.-Legn.	1	1.48	18.85	19.42	0.03	0.0160
	Dinophyceae						
8	CERATIUM TRIPPOS (O.F.Müller) Nitzsch.	2	0.01	116142.86	119627.15	1.20	0.0002
9	GYMNOUDINUM WULFFII Sch.	1	1.48	384.85	396.40	0.59	0.0160
10	GYRODINIUM LACHRYMA (Meunier) Kof.et Sw.	1	0.01	8620.55	8879.17	0.04	0.0001
11	LESSARDIA ELONGATA Saldar. et F.J.R.Taylor	4	5.91	157.08	161.79	0.96	0.0499
12	PERIDINIELLA DANICA (Pauls.) Okolod. et Dodge	3	0.02	4846.59	4991.99	0.07	0.0003
13	SCRIPPSIELLA TROCHOIDEA (St.) Loebel.III	2	2.96	1781.29	1834.73	5.43	0.0285
	Haptophyta						
14	EMILIANIA HUXLEYI (Lohm.) Hay et Mohler	360	532.02	87.07	89.68	47.71	0.4222
15	SYRACOSPHEERA MOLISCHII Schil.	140	206.90	220.78	227.40	47.05	0.4965
	Cyanobacteria						
16	OSCILLATORIA spp.	30	44.33	6.28	6.47	0.29	0.2225
	Chrysophyceae						
17	OCHROMONAS OBLONGA Cart.	1	1.48	78.54	80.90	0.12	0.0160
	Total		N [cells*10^6/m^3]	848,370		114.12	1.5684
	Bacillariophyceae			51.78			
	Chlorophyceae			1			
	Dinophyceae			10.38			
	Haptophyta			738.92			
	Cyanobacteria			44			
	Chrysophyceae			1			
	Total			848			

SIO-RAS

Date		Volume of decanted water V, ml	3000	counting chamber volume =1ml		3 replicates
Station	1	volume after decantation (v), ml	45	counting chamber volume = 0.05 ml		
Depth	15m	k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Bacillariophyceae						
Chaetoceros affinis	1		5	943	0.971	0.005
			5			0.005
Dinophyceae						
Alexandrium sp.	1		5	14140.000	14.564	0.073
Ceratium tripos	1		5	130000.000	133.900	0.670
Diplopsalis lenticula	1		5	4135.000	4.259	0.021
Gonyaulax polygramma	3		15	14100.000	14.523	0.218
Gymnodinium simplex	3		15	420.000	0.433	0.006
Gymnodinium sp.	2		10	150.00	0.155	0.002
Gyrodinium fusiforme	32		160	4700.000	4.841	0.775
Gyrodinium spirale	1		5	16000.000	16.480	0.082
Phalacroma rotundatum	1		5	33500.000	34.505	0.173
Procentrum cordatum	1		5	2400.000	2.472	0.012
Scrippsiella trochoidea	13		65	2400.000	2.472	0.161
Torodinium teredo	1		5	23600.000	24.308	0.122
Chroa dinoflagellate	5		25	21860.00	22.516	0.563
			325			2.88
Prymnesiophyceae						
Coccolithus sp.	1		5	630.000	0.649	0.003
Emiliania huxleyi	303		200000	180.000	0.185	37.080
			200005			37.083
Microflagellates						
Small flagellates d=6	30		3000	110.000	0.113	0.340
Small flagellates d=8-10	34		3400	260.000	0.268	0.911
			6400			1.250
	N [cells/l]	B [mg/m^3]				
Bacillariophyceae	5.00	0.00				
Dinophyceae	325.00	0.00				
Prymnesiophyceae	200,005.00	2.88				
Microflagellates	6,400.00	37.08				
Total	206,735.00	39.97				

SSC

Date		Volume of decanted water V, ml	3000			
Station		volume after decantation (v), ml	45			
Depth		k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
<i>Bacillariophyta</i>						
Chaetoceros sp. Одиночный	2.00		2.67			0.00
Dactyliosolen fragilissimus	2.00		2.67			0.04
Thalassiosira sp.	2.00		2.67			0.00
Pseudonitzschia delicatissima complex	2.00		100.00			0.01
Pseudonitzschia delicatissima complex	6.00		300.00			0.04
Pseudonitzschia cf. pseudodelicatissima	4.00		200.00			0.06
Pseudonitzschia seriata complex	6.00		300.00			0.26
<i>Dinophyta</i>						
Ceratium tripos	4.00		5.33			1.72
Gymnodinium sp.	2.00		100.00			0.04
Gyrodinium fusiforme	12.00		600.00			0.16
Prorocentrum minimum	4.00		200.00			0.20
Protoperidinium cf. pellucidum	1.00		1.33			0.02
Heterocapsa sp.	2.00		2.67			0.01
<i>Chrysophyta</i>						
Emiliania huxleyi	228.00		68,400.00			12.28
			70,217.33			14.84

Annex 2.3 Phytoplankton sample analysis_JOSS St.12.35m

UkrSCES

Date	5/19/2016	Volume of decanted water V, ml	2680	counting chamber volume =0,05 ml			
Station	St. 12 - JOSS	volume after decantation (v), ml	15				
Depth	35 m	k=(v/(V+v))*1000, l	5.57				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	please insert the shape you use for the biovolume
			N [cells/l]	mkm ³		B [mg/m^3]	
Bacillariophyceae							
<i>Thallasiosira parva</i>	4		450	2344.14		1.050	0.01
<i>Pseudonitzschia delicatissima</i>	12		1340	458.61		0.610	0.02
			1790			1.660	
Dinophyceae							
<i>Gyrodinium cornutum</i>	2		450	173.640		0.040	0.01
			450			0.040	
Chlorophyceae							
<i>Tetraselmis sp.</i>	6		670	56.260		0.040	0.01
			670			0.040	
Cryptophyceae							
<i>Hillea fusiformis</i>	2		220	86.820		0.020	0.00
			220			0.020	
Haptophyta							
<i>Emiliania huxleyi</i>	154		17240	69.420		1.200	0.16
<i>Syracosphaera mediterranea</i>	48		5370	312.550		1.680	0.07
<i>Meringosphaera mediterranea</i>	4		450	296.920		0.13	0.01
<i>Pontosphaera nigra</i>	2		220	1445.280		0.320	0.00
<i>Pontosphaera sp.</i>	8		900	1445.280		1.300	0.02
			24180			4.630	
	N [cells/l]	B [mg/m^3]					
Bacillariophyceae	1790	1.660					
Dinophyceae	450	0.040					
Chlorophyceae	670	0.040					
Cryptophyceae	220	0.020					
Haptophyta	24180	4.630					
Total	27310	6.390					

NEA

Date	5/27/2016	Volume of decanted water V, ml	2655	counting chamber volume = 0,05 ml				
Station	12	volume after decantation (v), ml	25					
Depth	35m	k=(v/(V+v))*1000, l	9.3					
Intercalibracion JOSS								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
			N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)
Bacillariophyceae								
<i>Cyclotella caspia</i>	4	80	728	622.00	0.641	0.466	0.04819277	-0.146147
<i>Coccolitus scutellum</i>	3	60	546	4578.00	4.715	2.575	0.03614458	-0.120008
<i>Pseudonitzschia delicatissima</i>	8	160	1456	380.00	0.391	0.570	0.09638554	-0.225484
Dinophyceae							0	
<i>Cochlodinium geminatum</i>	3	60	546	12456.00	12.830	7.005	0.03614458	-0.120008
<i>Glenodinium agile</i>	7	140	1274	248.00	0.255	0.325	0.08433735	-0.20856
<i>Goniaulax polyedra</i>	3	60	546	14116.00	14.539	7.939	0.03614458	-0.120008
<i>Gon. scrippsae</i>	2	40	364	18612.00	19.170	6.978	0.02409639	-0.089776
<i>Gon.cochlea</i>	2	40	364	16012.00	16.492	6.003	0.02409639	-0.089776
<i>Gymnodinium najadeum</i>	3	60	546	2278.00	2.346	1.281	0.03614458	-0.120008
<i>Heterocapsa triquetra</i>	4	80	728	4852.00	4.998	3.638	0.04819277	-0.146147
<i>Proto-peridinium steinii</i>	3	60	546	18448.00	19.001	10.375	0.03614458	-0.120008
<i>Prorocentrum micans</i>	3	60	546	10886.00	11.213	6.122	0.03614458	-0.120008
<i>Scrippsiella trochoidea</i>	5	100	910	7287.00	7.506	6.830	0.06024096	-0.169241
Chlorophyta							0	
<i>Trachelomonas volvocyna</i>	3	60	546	905.00	0.932	0.509	0.03614458	-0.120008
Coccolithophoridophycidae								
<i>Coccolitinae sp.6-8 µm</i>	26	520	4732	65.00	0.067	0.317	0.31325301	-0.363607
<i>Pontosphaera sp.</i>	4	80	728	1255.00	1.293	0.941	0.04819277	-0.146147
			15106			1.258		-2.424942
	N [cells/l]	B [mg/m^3]						
Bacillariophyceae	2730	3.611						
Dinophyceae	6370	56.497						
Chlorophyta	546	0.509						
Coccolithophoridophycidae	5560.000	1.258						
Total	15206	61.875						

IMB

Date	5/27/2016	Volume of decanted water V, ml	2605	counting chamber volume = 0,05 ml				
Station	12	volume after decantation (v), ml	25					
Depth	35m	k=(v/(V+v))*1000, l	9.51					
Intercalibracion JOSS								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
		N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)	
Bacillariophyceae								
Ceratoneis closterium Ehrenberg, 1839	2	20	190.11	196.25	0.196	0.037	0.01036	-0.04734
Cyclotella sp.	1	10	95.06	1570	1.570	0.149	0.00518	-0.02726
Proboscia alata (Brightwell) Sundström, 1986	2	20	190.11	10332.6	10.333	1.964	0.01036	-0.04734
Pseudo-nitzschia delicatissima (P.T. Cleve, 1897) Heiden, 1928	3	30	285.17	393.75	0.394	0.112	0.01554	-0.06471
Skeletonema costatum (Greville) P.T. Cleve, 1878	4	40	380.23	106.858	0.107	0.041	0.02072	-0.08032
Chlorophyceae								
Monoraphidium contortum (Thuret) Komárková-Legnerová, 1969	2	20	190.11	27.8623	0.028	0.005	0.01036	-0.04734
Dinophyceae								
Alexandrium sp.	2	20	190.11	4726.35	4.726	0.899	0.01036	-0.04734
Diplopsalis lenticula Bergh, 1881	3	30	285.17	5961.09	5.961	1.700	0.01554	-0.06471
Gymnodinium sp.	1	10	95.06	3925	3.925	0.373	0.00518	-0.02726
Gymnodinium sp1	2	20	190.11	654.167	0.654	0.124	0.01036	-0.04734
Gyrodinium fusiforme Koifoid , Swezy, 1921	1	10	95.06	11775	11.775	1.119	0.00518	-0.02726
Lessardia elongata Saldarriaga , F.J.R.Taylor, 2003	2	20	190.11	396.038	0.396	0.075	0.01036	-0.04734
Prorocentrum caspicum A.Henckel	2	20	190.11	7555.63	7.556	1.436	0.01036	-0.04734
Prorocentrum micans Ehrenberg, 1834	2	20	190.11	9158.33	9.158	1.741	0.01036	-0.04734
Protoperidinium steinii (Jörgensen, 1899) Balech, 1974	1	10	95.06	16227.4	16.227	1.543	0.00518	-0.02726
Scrippsiella trochoidea (Stein, 1883) Balech ex Loeblich III, 1965	2	20	190.11	5464.34	5.464	1.039	0.01036	-0.04734
Prymnesiophyceae								
Emiliana huxleyi (Lohmann) Hay , Mohler, 1967	257	2570	24,429.66	65.4167	0.065	1.598	1.33117	0.38079
Pontosphaera sp.	1	10	95.06	2524.27	2.524	0.240	0.00518	-0.02726
			27,566.54			14.20	1.50	- 0.39
	N [cells/l]	B [mg/m^3]						
Bacillariophyceae	1.1412	2.304872843						
Chlorophyceae	0.1902	0.005299403						
Dinophyceae	1.7118	10.05401097						
Prymnesiophyceae	24.5358	1.838886786						

ONU

Date	5/26/2016	Volume of decanted water V, ml	2690	counting chamber volume = 0,01 ml	0.93		
Station	JOSS-12	volume after decantation (v), ml	25	counting chamber volume = 1,35 ml	0.007		
Depth	35 m	k=(v/(V+v))*1000, l	9.29				
	Taxa	No of cells counted in the chamber	number species/m^3	biovolume	weight		Shannon Weaver Index abundance
NN			N [cells*10^6/m^3]			B [mg/m^3]	
	Bacillariophyceae						
1	CYCLOTELLA CASPIA Grun.	4	3.72	226.20	232.99	0.87	0.0947
2	NAVICULA SPP.	1	0.01	703.72	724.83	0.01	0.0006
3	PROBOSCIA ALATA (Bright.) Sunst.	1	0.01	15118.95	15572.52	0.16	0.0006
4	PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe	19	0.13	246.94	254.35	0.03	0.0060
	Dinophyceae						
5	CERATIUM TRIPPOS (O.F.Muller) Nitzsch.	1	0.01	213340.30	219740.51	2.20	0.0006
6	DINOPHYYSIS FORTII Pavil.	1	0.01	53878.44	55494.79	0.55	0.0006
7	GONYAULAX GRINDLEYI Reinecke	1	0.01	14130.00	14553.90	0.15	0.0006
8	GYMNOODINIUM AGILE Kof.et Sw.	3	2.79	1766.25	1819.24	5.08	0.0759
9	LESSARDIA ELONGATA Saldar. et F.J.R.Taylor	2	1.86	154.43	159.06	0.30	0.0553
10	SCRIPPSIELLA TROCHOIDEA (St.) LoebL.III	13	0.09	2035.76	2096.83	0.19	0.0043
	Haptophyta						
11	ACANTHOICA QUATTROSPINA Lohm.	8	7.43	65.42	67.38	0.50	0.1576
12	CALYPTROSPHAERA DALMATICA Sch.	11	10.22	143.72	148.03	1.51	0.1967
13	CALYPTROSPHAERA INSIGNIS Sch.	1	0.93	904.32	931.45	0.87	0.0316
14	EMILIANIA HUXLEYI (Lohm.) Hay et Mohler	216	200.74	87.07	89.68	18.00	0.1942
	Cryptophyta						
15	LEUCOCRYPTOS MARINA (Braar.) Butcher	3	2.79	5.24	5.40	0.02	0.0759
16	RHODOMONAS MINUTA Skuja	3	2.79	78.54	80.90	0.23	0.0759
	Chrysophyceae						
17	OCHROMONAS MINIMA Thrond.	2	1.86	11.78	12.13	0.02	0.0553
	Total		N [cells*10^6/m^3]			30.67	1.03
	Bacillariophyceae		3.87				
	Dinophyceae		4.77				
	Haptophyta		219.32				
	Cryptophyta		5.58				
	Chrysophyceae		2				
	Total		235				

SIO-RAS

Date		Volume of decanted water V, ml	2660	counting chamber volume =1ml		3 replicates
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Station	12	volume after decantation (v), ml	25	counting chamber volume = 0.05 ml		
Depth	35m	k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Bacillariophyceae						
Cylindrotheca closterium	2		6.3	707.000	0.728	0.005
Navicula sp.	1		3.1	3700.00	3.811	0.012
Pseudo-nitzschia delicatissima	10		31.4	377.000	0.388	0.012
Skeletonema costatum	8		25.1	385.000	0.397	0.010
Thalassiosira sp.	19		59.6	880.000	0.906	0.054
			126			0.093
Dinophyceae						
Amphidinium sphaenoides	1		3	2700.000	2.781	0.009
Diplopsalis lenticula	2		6	4135.000	4.259	0.027
Gonyaulax polygramma	3		9	14100.000	14.523	0.137
Gymnodinium agile	1		3	2145.000	2.209	0.007
Gymnodinium sp.	5		16	948.000	0.976	0.015
Gyrodinium fusiforme	7		22	4700.00	4.841	0.106
Prorocentrum balticum	1		3	4200.000	4.326	0.014
Prorocentrum compressum	1		3	15300.000	15.759	0.049
Prorocentrum cordatum	3		9	2400.000	2.472	0.023
Prorocentrum micans	2		6	13091.000	13.484	0.085
Scrippsiella trochoidea	56		176	2400.000	2.472	0.435
Cnopa dinoflagellate	1		3	14100.000	14.523	0.046
			261			0.952
Cryptophyceae						
Cryptomonas sp.	6		19	157.000	0.162	0.003
			19			0.003
Prymnesiophyceae						
Coccolithus sp.	220		1400	810.000	0.834	1.168
Emiliania huxleyi	280		28876	219.130	0.226	6.518
			30276			7.686
Microflagellates						
Small flagellates d=6	200		12555	110.000	0.113	1.422
Small flagellates d=8-10	120		10044	260.000	0.268	2.690
			22599			4.112
	N [cells/l]	B [mg/m^3]				
Bacillariophyceae	126	0.09				
Dinophyceae	261	0.95				
Cryptophyceae	19	0.00				

Prymnesiophyceae	30276	7.69
Microflagellates	22599	4.11
Total	53280	12.85

SSC

Date		Volume of decanted water V, ml	2655			
Station		volume after decantation (v), ml	25			
Depth		k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m ³
			N [cells/l]			B [mg/m ³]
<i>Bacillariophyta</i>						
Cerataulina pelagica	7		11			0.01
Chaetoceros curvisetus	52		78			0.07
Chaetoceros curvisetus	18		27			0.07
Proboscia alata	2		3			0.05
Thalassiosira sp.	4		6			0.01
Pseudosolenia calcar-avis	1		2			0.05
Pseudosolenia calcar-avis	2		3			0.05
Ditylum brightwellii	1		2			0.02
Nitzschia tenuirostris	2		3			0.00
Pseudonitzschia delicatissima complex	54		1695			0.24
Pseudonitzschia delicatissima complex	6		188			0.03
Pseudonitzschia sp.	3		94			0.07
Pseudonitzschia sp.	4		126			0.06
Pseudonitzschia sp.	8		251			0.13
Pseudonitzschia seriata complex	4		126			0.10
<i>Dinophyta</i>						
Ceratium tripos	4		6			1.94
Ensiculifera carinata	2		3			0.03
Scrippsiella trochoidea	7		11			0.05
Scrippsiella trochoidea	6		9			0.08
Prorocentrum compressum	2		3			0.02
Gymnodinium sp.	5		471			0.01
Gymnodinium sp.	1		31			0.01
Gymnodinium sp.	2		3			0.00
Gymnodinium spp.	1		2			0.00
Gyrodinium fusiforme	11		17			0.01
Prorocentrum compressum	2		3			0.02
Protoperidinium cf. brevipes	1		2			0.01

Date		Volume of decanted water V, ml	2655			
Station		volume after decantation (v), ml	25			
Depth		k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m ³
			N [cells/l]			B [mg/m ³]
Protoperidinium granii	1		2			0.04
Gonyaulax spinifera	1		2			0.04
Protoceratium reticulatum	2		3			0.09
<i>Chrysophyta</i>						
Dictyocha speculum(6-7 лучей)	1		2			0.01
Emiliania huxleyi	12		2260			0.148
Emiliania huxleyi	20		3766			0.426
Emiliania huxleyi	5		942			0.252
			10149			4.15

Annex 2.4 Phytoplankton sample analysis_UA St.2 65m.xlsx

UkrSCES

Date	5/19/2016	Volume of decanted water V, ml	1175	counting chamber volume =0,05 ml			
Station	St. 2 - UA	volume after decantation (v), ml	12				
Depth	6,5 m	k=(v/(V+v))*1000, l	10.11				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	please insert the shape you use for the biovolume
			N [cells/l]	mkm ³		B [mg/m^3]	
Bacillariophyceae							
<i>Attheya septentrionales</i>	88		17970	84.39	1.520	0.17	
<i>Cyclotella caspia</i>	8		1630	122.44	0.2	0.03	
<i>Cerataulina pelagica</i>	132		26960	130434	35.17	0.22	
<i>Chaetoceros curvisetus</i>	72		14710	3303.33	48.590	0.14	
<i>Chaetoceros danicus</i>	4		820	1406.49	1.15	0.01	
<i>Chaetoceros laciniatus</i>	228		46570	2116.88	98.58	0.31	
<i>Chaetoceros lorensonianus</i>	20		4090	791.84	3.240	0.05	
<i>Chaetoceros similis f. solitarius</i>	4		820	1041.41	0.85	0.01	
<i>Chaetoceros socialis</i>	1456		297400	163.04	48.49	0.47	
<i>Chaetoceros subtilis</i>	4		820	91.72	0.08	0.01	
<i>Chaetoceros subtilis var. abnormis f. simplex</i>	4		820	208.37	0.17	0.01	
<i>Diatoma elongatum</i>	12		2450	449.32	1.1	0.04	
<i>Ditylum brightwellii</i>	1		200	30328.09	6.07	0.00	
<i>Thallasiosira parva</i>	12		2450	2344.14	5.740	0.04	
<i>Thallasiosira nordenskioldii</i>	12		2450	676.99	1.66	0.04	
<i>Pseudonitzschia delicatissima</i>	16576		3385740	458.61	1552.730	-17.26	
<i>Skeletonema costatum</i>	156		31860	253.17	8.070	0.24	
			3837760		1813.410		
Dinophyceae							
<i>Gyrodinium cornutum</i>	16		3270	868.200	2.840	0.05	
<i>Gymnodinium simplex</i>	1		200	1562.76	0.31	0.00	
<i>Heterocapsa triquetra</i>	16		3270	1719.04	5.620	0.05	
<i>Prorocentrum cordatum</i>	56		31860	2437.91	27.89	0.24	
<i>Protoperidinium sp.</i>	8		1630	5556.49	9.060	0.03	
<i>Scripsiella trochoideum</i>	24		4900	3613.10	17.700	0.06	
			45130		63.420		

Date	5/19/2016	Volume of decanted water V, ml	1175	counting chamber volume =0,05 ml			
Station	St. 2 - UA	volume after decantation (v), ml	12				
Depth	6,5 m	k=(v/(V+v))*1000, l	10.11				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	please insert the shape you use for the biovolume
			N [cells/l]	mkm ³		B [mg/m^3]	
Chlorophyceae							
<i>Chlamidomonas</i> sp.	4		820	152.170	0.120	0.01	
<i>Monoraphidium contortum</i>	112		22880	30.560	0.700	0.20	
<i>Tetraselmis</i> sp.	4		820	312.550	0.260	0.01	
<i>Raphidocelis danubiana</i>	12		2450	3.330	0.010	0.04	
<i>Scenedesmus acuminatus</i>	8		1630	19.450	0.030	0.03	
			28600		1.120		
Cyanophyceae							
<i>Oscillatoria kisselevii</i>	20		4090	70.500	0.290	0.05	
			4090		0.290		
Chrysophyceae							
<i>Ollicola vangoorii</i>	12		2450	19.560	0.050	0.04	
			2450		0.050		
Haptophyta							
<i>Emiliania huxleyi</i>	32		6540	234.290	1.530	0.08	
<i>Pontosphaera</i> sp.	4		820	69.420	0.060	0.01	
			7360		1.590		
	N [cells/l]	B [mg/m^3]					
Bacillariophyceae	3837760	1813.410					
Dinophyceae	45130	63.420					
Chlorophyceae	28600	1.120					
Chrysophyceae	2450	0.050					
Haptophyta	7360	1.590					
Total	3,921,300	1,880					

NEA

Date	5/26/2016	Volume of decanted water V, ml	1175	counting chamber volume = 0,05 ml				
Station	2	volume after decantation (v), ml	12					
Depth	65m	k=(v/(V+v))*1000, l	10.1					
Intercalibration NPMS-UA								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
		N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)	
Bacillariophyceae								
<i>Amphora</i> sp.	2	40	404	6478.00	6.672	2.696	0.00167168	-0.0106886
<i>Chaetoceros insignis</i>	78	1560	15756	2016.00	2.076	32.717	0.065195533	-0.178007557
<i>Ch. affinis</i>	96	1920	19392	1842.00	1.897	36.792	0.080240656	-0.202425105
<i>Ch. curvisetus</i>	64	128	1293	2380.00	2.451	3.169	0.005349377	-0.027981389
<i>Ch. compressus</i>	38	760	7676	2468.00	2.542	19.513	0.031761926	-0.109562351
<i>Cyclotella caspia</i>	5	100	1010	622.00	0.641	0.647	0.004179201	-0.022892138
<i>Coscinodiscus janischii</i>	2	40	404	268336.00	276.386	111.660	0.00167168	-0.0106886
<i>Ditylum brightwelli</i>	3	60	606	84652.00	87.192	52.838	0.00250752	-0.015016188
<i>Dactyliosolen fragilissimus</i>	7	140	1414	10442.00	10.755	15.208	0.005850881	-0.03080334
<i>Navicula</i> sp.	3	60	606	3538.00	3.644	2.208	0.00250752	-0.015016188
<i>Pseudo-nitzschia seriata</i>	28	560	5656	816.00	0.840	4.754	0.023403525	-0.087877161
<i>Pseudonitzschia delicatissima</i>	582	11640	117564	380.00	0.391	46.015	0.486458976	-0.350543654
<i>Pseudosolenia calcar avis</i>	4	80	808	122106.00	125.769	101.621	0.003343361	-0.01905976
Dinophyceae								
<i>Alexandrium</i> sp.	2	40	404	14722.00	15.164	6.126	0.00167168	-0.0106886
<i>Ceratium furca</i>	3	60	606	40166.00	41.371	25.071	0.00250752	-0.015016188
<i>Goniaulax spinifera</i>	3	60	606	23264.00	23.962	14.521	0.00250752	-0.015016188
<i>Gymnodinium najadeum</i>	3	60	606	2278.00	2.346	1.422	0.00250752	-0.015016188
<i>Gymn. agile</i>	4	80	808	248.00	0.255	0.206	0.003343361	-0.01905976
<i>Dinophysis sphaerica</i>	2	40	404	10000.00	10.300	4.161	0.00167168	-0.0106886
<i>Heterocapsa triquetra</i>	4	80	808	4852.00	4.998	4.038	0.003343361	-0.01905976
<i>Proto-peridinium grani</i>	3	60	606	42236.00	43.503	26.363	0.00250752	-0.015016188
<i>Prorocentrum scutellum</i>	3	60	606	12278.00	12.646	7.664	0.00250752	-0.015016188
<i>Scrippsiella trochoidea</i>	5	100	1010	7287.00	7.506	7.581	0.004179201	-0.022892138
Cyanophyta								
<i>Microcystis aeruginosatis</i>	280	5600	56560	4.00	0.004	0.233	0.234035246	-0.339885538
Chlorophyta								
<i>Euglena</i> sp.	4	80	808	864.00	0.890	0.719	0.003343361	-0.01905976

Date	5/26/2016	Volume of decanted water V, ml	1175	counting chamber volume = 0,05 ml				
Station	2	volume after decantation (v), ml	12					
Depth	65m	k=(v/(V+v))*1000, l	10.1					
Intercalibracion NPMS-UA								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
			N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)
Trachelomonas vovlvcina	12	240	2424	905.00	0.932	2.260	0.010030082	-0.046160107
<i>Protococcales</i>								
Ankistrodesmus sp.	8	160	1616	276.00	0.284	0.459	0.006686721	-0.033484637
Oocystis sp.	6	120	1212	936.00	0.964	1.168	0.005015041	-0.026556215
			241673			531.829		-1.702455082
	N [cells/l]	B [mg/m^3]						
Bacillariophyceae	172589	429.837						
Dinophyceae	6464	97.153						
Cyanophyta	56560	0.233						
Chlorophyta	2828	1.627						
<i>Protococcales</i>	3232	2.979						
Total	241673	531.829						

IMB

Date	5/26/2016	Volume of decanted water V, ml	1160	counting chamber volume = 0,05 ml				
Station	2	volume after decantation (v), ml	12					
Depth	65m	k=(v/(V+v))*1000, l	10.24					
Intercalibration NPMS-UA								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
		N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)	
Bacillariophyceae								
Cerataulina pelagica (Cleve) Hendey, 1937	11	110	1,126	21458.4	21.458	24.168	0.06137	-0.17128
Ceratoneis closterium Ehrenberg, 1839	1	10	102	166.813	0.167	0.017	0.00558	-0.02895
Chaetoceros curvisetus P.T. Cleve, 1889	167	1670	17,099	1868.3	1.868	31.946	0.93172	-0.06589
Chaetoceros danicus P.T.Cleve, 1889	1	10	102	1256	1.256	0.129	0.00558	-0.02895
Chaetoceros socialis Lauder, 1864	353	3530	36,143	48.6826	0.049	1.760	1.96945	1.334803
Cyclotella choctawhatcheeana Prasad, 1990	12	120	1,229	686.04	0.686	0.843	0.06695	-0.18102
Dactyliosolen fragilissimus (Bergon) G. R. Hasle, 1991	15	150	1,536	9032.01	9.032	13.872	0.08369	-0.2076
Diatoma tenuis C.A. Agardh, 1812	2	20	205	499.2	0.499	0.102	0.01116	-0.05016
Navicula sp.	1	10	102	1589.63	1.590	0.163	0.00558	-0.02895
Pseudo-nitzschia delicatissima (P.T. Cleve, 1897) Heiden, 1928	28333	283330	2,900,990	748.44	0.748	2171.217	158.075	800.3439
Skeletonema costatum (Greville) P.T. Cleve, 1878	5	50	512	388.575	0.389	0.199	0.0279	-0.09985
Striatella interrupta (Ehr.) Heib., 1863	2	20	205	2260.8	2.261	0.463	0.01116	-0.05016
Thalassiosira parva Proshk.-Lavr., 1955	1	10	102	3306.42	3.306	0.339	0.00558	-0.02895
Chlorophyceae								
Desmodesmus bicaudatus	4	40	410	37.68	0.038	0.015	0.02232	-0.08486
Monoraphidium contortum (Thuret) Komárková-Legnerová, 1969	597	5970	61,126	8.40212	0.008	0.514	3.33077	4.007593
Cyanophyceae								
Anabaena sp.	1	10	102	258.359	0.258	0.026	0.00558	-0.02895
Dinophyceae								
Dinophysis acuminata Clap. et Lach.	1	10	102	35325	35.325	3.617	0.00558	-0.02895
Diplopsalis lenticula Bergh, 1881	1	10	102	8177.08	8.177	0.837	0.00558	-0.02895
Glenodinium sp.	1	10	102	10549.2	10.549	1.080	0.00558	-0.02895
Gonyaulax minima Matzenauer, 1933	4	40	410	2712.96	2.713	1.111	0.02232	-0.08486
Gymnodinium fusus Schütt, 1896	6	60	614	451.979	0.452	0.278	0.03348	-0.11371
Gymnodinium simplex (Lohm.) Kof., Sw.,	2	20	205	833.048	0.833	0.171	0.01116	-0.05016
Gymnodinium sp.1	1	10	102	1430.99	1.431	0.147	0.00558	-0.02895
Gymnodinium sp.2	1	10	102	1205.76	1.206	0.123	0.00558	-0.02895

Date	5/26/2016	Volume of decanted water V, ml	1160	counting chamber volume = 0,05 ml				
Station	2	volume after decantation (v), ml	12					
Depth	65m	k=(v/(V+v))*1000, l	10.24					
Intercalibracion NPMS-UA								
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance	
			N [cells/l]			B [mg/m^3]	pi	pi*ln (pi)
Gyrodinium fusiforme Koifoid , Swezy, 1921	1	10	102	30144	30.144	3.086	0.00558	-0.02895
Heterocapsa triquetra (Ehrenberg, 1840) Stein, 1883	4	40	410	923.16	0.923	0.378	0.02232	-0.08486
Prorocentrum cordatum (Ostenfeld, 1901) Dodge, 1975	21	210	2,150	1491.5	1.492	3.207	0.11716	-0.25122
Protoperidinium granii	1	10	102	392.5	0.393	0.040	0.00558	-0.02895
Scrippsiella trochoidea (Stein, 1883) Balech ex Loeblich III, 1965	1	10	102	1766.25	1.766	0.181	0.00558	-0.02895
Tripos fusus (Ehrenberg) F.Gómez, 2013	1	10	102	21546.8	21.547	2.206	0.00558	-0.02895
Ebriophyceae								
Ebria tripartita (Shumann) Lemmermann, 1899	1	10	102	2861.98	2.862	0.293	0.00558	-0.02895
Euglenoidea								
Euglena sp.	1	10	102	6010.16	6.010	0.615	0.00558	-0.02895
Prymnesiophyceae								
Pontosphaera sp.1	1	10	102	315.533	0.316	0.032	0.00558	-0.02895
Trebouxiophyceae								
Dictyosphaerium chlorelloides (Nauman) Komárek , Perman 1978	16	160	1,638	4.81467	0.005	0.008	0.08927	-0.21568
			3,027,747			2,263		
	N [cells/l]	B [mg/m^3]						
Bacillariophyceae	2959.7696	2245.455715						
Chlorophyceae	61.5424	0.529078646						
Cyanophyceae	0.1024	0.026455982						
Dinophyceae	4.7104	16.4640352						
Ebriophyceae	0.1024	0.293066667						
Euglenoidea	0.1024	0.61544						
Prymnesiophyceae	0.1024	0.0323106						
Trebouxiophyceae	1.6384	0.00788835						
	3,027,747.4	2,263.2						

ONU

Date	5/18/2016	Volume of decanted water V, ml	1187.0	counting chamber volume = 0,01 ml	1.01		
Station	NPMS-UA - 3	volume after decantation (v), ml	12.0	counting chamber volume = 1,35 ml	0.0075		
Depth	2 m	k=(v/(V+v))*1000, l	10.11				
	Taxa	No of cells counted in the chamber	number species/m^3	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance
NN			N [cells*10^6/m^3]			B [mg/m^3]	
	Bacillariophyceae						
1	AMPHIPLERA SPP.	17	17.19	125.66	129.43	2.22	0.016
2	CERATAULINA PELAGICA (Cleve) Hendey	150	151.64	10735.44	11057.50	1676.76	0.091
3	CHAETOCEROS BORGEI Lemm.	46	46.50	1254.78	1292.42	60.10	0.036
4	CHAETOCEROS CURVISETUS Cl.	80	80.80	3053.64	3145.25	254.14	0.056
5	CHAETOCEROS INSIGNIS Pr.-Lavr.	54	54.54	785.40	808.96	44.12	0.041
6	CHAETOCEROS LACINIOSUS Schutt	74	74.81	1357.17	1397.89	104.58	0.052
7	CHAETOCEROS LORENZIANUS Grun.	281	284.09	3619.12	3727.69	1059.00	0.144
8	CHAETOCEROS SOCIALIS Laud.	698	705.68	248.87	256.34	180.89	0.268
9	CHAETOCEROS WIGHAMII Brightw.	288	291.17	649.43	668.91	194.77	0.147
10	CYCLOTELLA CASPIA Grun.	70	70.77	519.54	535.13	37.87	0.050
11	CYLINDROTHECA CLOSTERIUM (Ehr.) Reim.et Lewin	17	17.19	75.40	77.66	1.34	0.016
12	DACTYLIOSOLEN FRAGILISSIMUS (Berg.) Hasle	27	27.29	7868.66	8104.72	221.18	0.023
13	DIATOMA TENUIS Ag.	14	14.15	548.41	564.86	7.99	0.013
14	DITYLUM BRIGHTWELLII (West.) Grun.	4	0.03	35281.15	36339.58	1.09	0.000
15	NAVICULA SPP.	7	7.08	763.41	786.31	5.57	0.007
16	NITZSCHIA LONGISSIMA (Bred.) Ralfs	17	17.19	69.12	71.19	1.22	0.016
17	PSEUDO-NITZSCHIA DELICATISSIMA (Cl.) Heid. et Kolbe	6468	6539.15	132.54	136.52	892.70	0.408
18	PSEUDOSOLENIA CALCAR AVIS (Schul.) Sunst.	7	0.05	48150.26	49594.77	2.48	0.000
19	SKELETONEMA COSTATUM (Grev.) Cl.	216	218.38	142.54	146.82	32.06	0.119
20	STEPHANODISCUS HANTZSCHII Grun.	37	37.41	58.90	60.67	2.27	0.030
21	THALASSIOSIRA PARVA Pr.-Lavr.	31	31.34	2120.58	2184.20	68.45	0.026
	Chlorophyceae						
22	DESMODESMUS COMMUNIS (Hegew.) Hegew.	4	4.04	49.48	50.96	0.21	0.004
23	DICOTYSPHAERIUM GRANULATUM Hind.	40	40.44	14.13	14.55	0.59	0.032
24	MONORAPHIDIUM CONTORTUM (Thur.) Kom.-Legn.	274	277.01	29.32	30.20	8.37	0.142
25	OOCYSTIS BORGEI Snow	6	6.07	78.54	80.90	0.49	0.006
26	SCENEDESMUS FALCATUS Chod.	6	0.04	42.41	43.68	0.00	0.000
	Dinophyceae						
27	BORGHIELLA TENUISSIMA (Laut.) Moest.	4	4.04	10724.83	11046.57	44.63	0.004
28	CERATIUM FURCA (Ehr.) Clap.et Lach.	31	0.23	49247.63	50725.06	11.67	0.0003

Date	5/18/2016	Volume of decanted water V, ml	1187.0	counting chamber volume = 0,01 ml	1.01		
Station	NPMS-UA - 3	volume after decantation (v), ml	12.0	counting chamber volume = 1,35 ml	0.0075		
Depth	2 m	k=(v/(V+v))*1000, I	10.11				
	Taxa	No of cells counted in the chamber	number species/m^3	biovolume	weight	biomass mg/m^3	Shannon Weaver Index abundance
NN			N [cells*10^6/m^3]			B [mg/m^3]	
29	CERATIUM FUSUS (Ehr.) Dujard.	3	0.02	31992.44	32952.21	0.66	0.0000
30	CERATIUM TRIPPOS (O.F.Muller) Nitzsch.	2	0.01	113512.29	116917.66	1.17	0.0000
31	DINOPHYYSIS ACUMINATA Clap.et Lach.	11	0.08	17664.43	18194.36	1.46	0.0001
32	GONYAULAX SCRIPPSAE Kof.	2	0.01	22437.92	23111.06	0.23	0.0000
33	GYMNODINIUM CNECOIDES Harris	18	18.20	3445.94	3549.32	64.60	0.016
34	GYMNODINIUM NAJADEUM Sch.	7	7.08	6107.27	6290.49	44.54	0.007
35	GYMNODINIUM WULFFII Sch.	3	3.03	904.32	931.45	2.82	0.003
36	GYRODINIUM LACHRYMA (Meunier) Kof.et Sw.	9	0.07	33091.52	34084.27	2.39	0.000
37	LESSARDIA ELONGATA Saldar. et F.J.R.Taylor	27	27.30	423.33	436.03	11.90	0.023
38	LYNGULODINIUM POLYEDRUM (Stein) Dodge	1	0.01	38772.72	39935.90	0.40	0.000
39	MINUSCULA BIPES Pav.	12	12.13	2350.88	2421.41	29.37	0.012
40	PERIDINIELLA DANICA (Pauls.) Okolod. et Dodge	1	0.01	22437.92	23111.06	0.23	0.000
41	POLYKRIKOS KOFOIDII Chatton	6	0.04	206893.21	213100.01	8.52	0.000
42	PROROCENTRUM MINIMUM (Pav.) Schiller	110	111.21	552.92	569.51	63.33	0.071
43	PROTOPERIDINIUM BROCHI Kof.et Sw.	4	0.03	24416.64	25149.14	0.75	0.000
44	PROTOPERIDINIUM PELLUCIDUM (Bergh) Schutt	12	0.09	31043.61	31974.92	2.88	0.000
45	SCRIPPSIELLA TROCHOIDEA (St.) Loebli.III	85	85.93	735.13	757.18	65.06	0.058
	Cyanobacteria						
46	LIMNOTHRIX PLANKTONICA (Wolosz.) Meffert	576	582.31	3.53	3.64	2.12	0.237
47	MERISMOPEDIA MINIMA G.Beck.	32	0.24	4.19	4.32	0.00	0.000
48	MICROCYSTIS AERUGINOSA Kutz.	70	70.77	4.19	4.32	0.31	0.050
	Cryptophyta						
49	LEUCOCRYPTOS MARINA (Braar.) Butcher	135	136.48	15.32	15.78	2.15	0.084
50	RHODOMONAS MINUTA Skuja	51	51.56	110.87	114.20	5.89	0.039
	Chrysophyceae						
51	DINOBYRON SOCIALE Ehr.	12	12.13	5.24	5.40	0.07	0.012
	Choanoflagellata						
52	SALPINGOECA SPINIFERA Thrond.	7	7.08	7.33	7.55	0.05	0.007
	Total		10,144,140.00			5,227.65	2.4

	N [cells*10^6/m^3]		B [mg/m^3]
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Bacillariophyceae	8686		4850.80
Dinophyceae	270		356.61
Chlorophyceae	328		9.65
Chrysophyceae	12		0.07
Cyanobacteria	653		2.42
Cryptophyta	188		8.04
Choanoflagellatea	7		0.05
Total	10144140		5227.65

SIO-RAS

Date		Volume of decanted water V, ml	1175	counting chamber volume =1ml		
Station	2	volume after decantation (v), ml	12	counting chamber volume =0.05ml		
Depth	6.5 m	k=(v/(V+v))*1000, l	10.11			
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Bacillariophyceae						
Achnanthes brevipes	1		6.8	15100.000	15.553	0.106
Amphiprora sp.	1		3.4	11800.00	12.154	0.041
Cerataulina pelagica	27		5680.6	9050.000	9.322	52.951
Chaetoceros affinis	33		299.0	11090.719	11.423	3.416
Chaetoceros brevis	2		13.6	1700.000	1.751	0.024
Chaetoceros compressus	61		391.0	2650.000	2.730	1.067
Chaetoceros curisetus	145		313007.7	2189.510	2.255	705.893
Chaetoceros danicus	3		6.7	1700.00	1.751	0.012
Chaetoceros debilis	5		27.1	1600.000	1.648	0.045
Chaetoceros holsaticus	48		300.0	1200.000	1.236	0.371
Chaetoceros insignis	3		10.0	500.000	0.515	0.005
Chaetoceros karianus	3		10.0	2000.000	2.060	0.021
Chaetoceros laciniatus	6		40.9	2700.000	2.781	0.114
Chaetoceros muelleri	1		40.9	786.000	0.810	0.033
Chaetoceros socialis	206		511400.9	264.685	0.273	139.421
Chaetoceros wighamii	36		1073.3	230.000	0.237	0.254
Coccolithus sp.	56		800.0	630.000	0.649	0.519
Cyclotella caspia	9		50.0	263.333	0.271	0.014
Cyclotella menighiniana	1		3.3	300.000	0.309	0.001
Cyclotella sp.	29		100.0	1600.000	1.648	0.165

Date		Volume of decanted water V, ml	1175	counting chamber volume =1ml		
Station	2	volume after decantation (v), ml	12	counting chamber volume =0.05ml		
Depth	6.5 m	k=(v/(V+v))*1000, l	10.11			
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Cylindrotheca closterium	4		73.3	126.000	0.130	0.010
Dactyliosolen fragilissimus	12		626.7	12300.000	12.669	7.939
Detonula confervacea	9		30.0	943.000	0.971	0.029
Diatoma elongatum	62		510.0	113.000	0.116	0.059
Ditylum brightwellii	3		13.3	76000.000	78.280	1.044
Melosira nummuloides	3		10.0	12700.000	13.081	0.131
Navicula sp.	2		43.3	1546.154	1.593	0.069
Nitzschia longissima	20		133.3	2600.000	2.678	0.357
Pseudo-nitzschia delicatissima	1080		2939948.9	359.516	0.370	1088.669
Pseudo-nitzschia seriata	4		160.0	1700.000	1.751	0.280
Pseudosolenia calcar-avis	18		223.3	63600.000	65.508	14.630
Skeletonema costatum	114		82434.0	264.648	0.273	22.470
Thalassionema nitzschioides	2		43.3	1170.000	1.205	0.052
Thalassiosira caspica	8		36.7	3900.000	4.017	0.147
Thalassiosira sp.2.	1		6.7	3100.000	3.193	0.021
Thalassiosira subsalina	25		500.0	5660.000	5.830	2.915
			3858058			2043.295
Dinophyceae						
Akashiwo sanguinea	2		7	14800.000	15.244	0.102
Alexandrium sp.	2		13	9170.000	9.445	0.126
Amphidinium crassum	1		3	1800.000	1.854	0.006
Amphidinium sp.	1		7	900.000	0.927	0.006
Amphidinium sphaenoides	1		7	1100.000	1.133	0.008
Ceratium fusus	1		7	101690.00	104.741	0.698
Dinophysis acuminata	14		67	9000.000	9.270	0.618
Dinophysis sacculisi	1		7	14000.000	14.420	0.096
Diplopsalis lenticula	6		40	14590.000	15.028	0.601
Gonyaulax minima	1		7	22452.000	23.126	0.154
Gonyaulax polygramma	6		107	24400.000	25.132	2.681
Gonyaulax spinifera	4		17	16500.000	16.995	0.283
Gymnodinium agile	1		3	2145.000	2.209	0.007
Gymnodinium simplex	1		40	1200.000	1.236	0.049

Date		Volume of decanted water V, ml	1175	counting chamber volume =1ml		
Station	2	volume after decantation (v), ml	12	counting chamber volume =0.05ml		
Depth	6.5 m	k=(v/(V+v))*1000, l	10.11			
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Gymnodinium sp.	12		53	5439.688	5.603	0.299
Gyrodinium fusiforme	47		847	4700.000	4.841	4.099
Gyrodinium lachryma	3		10	31700.000	32.651	0.327
Gyrodinium spirale	2		10	20500.000	21.115	0.211
Heterocapsa triquetra	62		340	2500.000	2.575	0.876
Kofoidinium velleloides	3		13	230931.227	237.859	3.171
Lingulodinium polyedrum	3		17	65500.000	67.465	1.124
Prorocentrum balticum	4		20	4200.00	4.326	0.087
Prorocentrum cordatum	83		40867	3728.040	3.840	156.925
Prorocentrum micans	1		7	13091.000	13.484	0.090
Prorocentrum minimum	2		7	2400.000	2.472	0.016
Protoceratium reticulatum	2		10	35500.000	36.565	0.366
Protoperidinium bipes	37		570	8180.000	8.425	4.802
Protoperidinium breve	3		13	113100.000	116.493	1.553
Protoperidinium brevipes	1		7	4200.000	4.326	0.029
Protoperidinium granii	4		20	22450.000	23.124	0.462
Scrippsiella trochoidea	166		1613	1140.000	1.174	1.894
Tripos furca	23		477	41436.000	42.679	20.344
			45231			202.111
Chlorophyceae						
Ankistrodesmus sp.	125		8837	161.8218299	0.167	1.473
Binuclearia lauterbornii	230		1233	500	0.515	0.635
Desmodesmus communis	12		53	1040	1.071	0.057
Lyngbya limnetica	139		920	50	0.052	0.047
			11044			2.213
Cryptophyceae						
Cryptomonas sp.	11		77	157	0.162	0.012
			77			0.012
Cyanophyceae						
Lyngbya limnetica	139		920	50.000	0.052	0.047
			920			0.047
Euglenoidea						

Date		Volume of decanted water V, ml	1175	counting chamber volume =1ml		
Station	2	volume after decantation (v), ml	12	counting chamber volume =0.05ml		
Depth	6.5 m	k=(v/(V+v))*1000, l	10.11			
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Euglena sp.	1		7	5600.000	5.768	0.038
Eutreptia sp.	1		7	6000.000	6.180	0.041
			13			0.080
Prymnesiophyceae						
Emiliania huxleyi	60		68085	180.000	0.185	12.623
			68085			12.623
Microflagellates						
Small flagellates d=6	62		76255	110.000	0.113	8.640
Small flagellates d=8-10	52		95319	260.000	0.268	25.526
			171574			34.166
	N [cells/l]	B [mg/m^3]				
Bacillariophyceae	3858058	2043.3				
Dinophyceae	45231	202.1				
Chlorophyceae	11044	2.2				
Cryptophyceae	77	0.0				
Cyanophyceae	920	0.0				
Euglenoidea	13	0.1				
Prymnesiophyceae	68085	12.6				
Microflagellates	171574	34.2				
Total	4155002	2294.548				

SSC

Date		Volume of decanted water V, ml volume after decantation (v), ml	1175 12			
Depth		k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
<i>Bacillariophyta</i>						
Cerataulina pelagica	2	204				3.37
Cerataulina pelagica	2	204				6.86
Cerataulina pelagica	2	204				2.70
Chaetoceros curvisetus	12	1226				1.66
Chaetoceros curvisetus	10	1021				4.04
Coscinodiscus granii	1	2				0.49
Dactyliosolen fragillissimus	8	17				0.21
Dactyliosolen fragillissimus	6	13				0.30
Skeletonema costatum	20	2043				0.15
Pseudosolenia calcar-avis	2	204				9.73
Diatoma elongata	8	817				0.27
Ditylum brightwellii	2	4				0.07
Nitzschia longissima	1	2				0.04
Nitzschia tenuirostris	2	204				0.00
Pseudonitzschia sp.	137	559660				419.74
Pseudonitzschia sp.	257	1049872				308.66
<i>Dinophyta</i>						
Ceratium tripos	1	2				0.69
Ceratium fusus	3	6				0.22
Ceratium furca	23	49				3.21
Dinophysis sacculus	7	15				0.21
Diplopsalis lenticula f lenticula	5	11				0.32
Glenodinium sp.	2	204				0.37
Scrippsiella trochoidea	8	17				0.13
Gymnodinium sp.	2	204				0.08
Gymnodinium spp.	2	204				0.24
Katodinium rotundatum	1	102				0.12
Gyrodinium fusiforme	8	6536				2.57
Gyrodinium spirale	6	13				0.77
Gyrodinium spirale	9	19				0.58
Prorocentrum minimum	8	817				0.82

Date		Volume of decanted water V, ml	1175			
Station		volume after decantation (v), ml	12			
Depth		k=(v/(V+v))*1000, l				
Taxa	No of cells counted in the chamber	number cells/ml	number species/l	biovolume	weight	biomass mg/m^3
			N [cells/l]			B [mg/m^3]
Protoperidinium bipes	2		4			0.02
Protoperidinium depressum	1		2			0.66
Protoperidinium granii	10		21			0.90
Protoperidinium pallidum	1		2			0.12
Protoperidinium sp.	1		2			0.32
Protoperidinium sp.	1		2			0.02
Heterocapsa triquetra	2		4			0.03
Heterocapsa triquetra	9		19			0.11
Heterocapsa sp.	2		4			0.07
Lingulodinium polyedrum	2		4			0.24
Lingulodinium polyedrum	3		6			0.24
Polykrikos cofoidii	1		2			0.23
<i>Cyanophyta</i>						
Planktolyngbya limnetica	7		5719			1.01
<i>Cryptophyta</i>						
Hillea fusiformis	4		817			0.13
Plagioselmis prolonga	6		4902			0.41
<i>Chlorophyta</i>						
Monoraphidium contortum	12		9804			0.31
Binuclearia lauterbornii	10		1021			0.15
			1646236			773.58

Annex 3: Chlorophyl-a Intercomparison

Sampling

For the chlorophyll *a* inter-comparison exercise, three stations were chosen; the first one, in the upper mixed layer, station NPMS-UA 3, was selected for high Chl *a* concentration, while the second station, in the open waters - station JOSS-UA-GE 12 and NPMS-GE 1, was selected for Chl *a* low concentrations.

Region	Date	Station, №	Station Depth (m)	Sampling Depth (m)	Longitude	Latitude
NPMS-UA	18.05.2016	3	16,5	2	45,8218	30,30863
JOSS	26.05.2016	12	2040	35	42,2345	39,88602
NPMS GE	28.05.2016	1	45,5	15	41,55795	41,55185

Four laboratories attended the exercise: UkrSCES , IMB, ONU – Ukraine; SOI - Russian Federation; IO-BAS – Bulgaria. Each team sampled three water replicates (using separate Niskin bottles for each replicate) from stations NPMS-UA 3, JOSS 12; NPMS-GE 1.

To compare results of chl – a concentrations obtained with two different types of filters: (Whatman GF/F, 0.7 µm pore size (IO-BAS), and ACN Sartorius, 0.45 µm pore size (UkrSCES)) the subset of different areas from Pilot and JOSS parts were performed. The chosen stations are listed in Table 2.

Table 2: The list of station for inter-comparison with different types of filters used

Station	Date	Longitude	Latitude	Station Depth, m	Sampling Depth, m
NPMS-GE-8	30.05.2016	41,9037	41,7516	42	0
NPMS-GE-8	30.05.2016	41,9037	41,7516	42	8,6
NPMS-GE-8	30.05.2016	41,9037	41,7516	42	18,4
JOSS-GE-UA-13	02.06.2016	43,5260	36,0697	2100	0
JOSS-GE-UA-13	02.06.2016	43,5260	36,0697	2100	14
JOSS-GE-UA-13	02.06.2016	43,5260	36,0697	2100	45
JOSS-GE-UA-16	02.06.2016	43,3446	34,3632	2170	0
JOSS-GE-UA-16	02.06.2016	43,3446	34,3632	2170	14
JOSS-GE-UA-16	02.06.2016	43,3446	34,3632	2170	48
JOSS-GE-UA-19	03.06.2016	43,4174	32,8610	2106	0
JOSS-GE-UA-19	03.06.2016	43,4174	32,8610	2106	8
JOSS-GE-UA-19	03.06.2016	43,4174	32,8610	2106	50
JOSS-GE-UA-23	03.06.2016	44,6361	31,3883	391	0
JOSS-GE-UA-23	03.06.2016	44,6361	31,3883	391	12
JOSS-GE-UA-23	03.06.2016	44,6361	31,3883	391	40

The water samples (volumes within 1 – 3 l) were collected by Seabird CTD-Rosette system in 5 l plastic bottles during the up-cast. Immediately after collection, the samples were filtered onboard using two types of filters: Whatman GF/F, 0.7 µm pore size (for inter-comparison), and ACN Sartorius, 0.45 µm pore size (UkrSCES). Then, the filters were frozen at -20 °C until their subsequent analysis.

Methods for Chlorophyll a analysis reported by the participating laboratories

Processing method:

The filters are extracted in 10 ml cold 90% acetone after sonication for 1min, the time of extraction is between 20 hours in the refrigerator at temperature +8 o C. After centrifugation for 10min at 7000 r/min the extract is measured at the following wave lengths: 750, 665, 663, 645, 630, 480 and 430 nm. After acidification with 1N HCl within 5 min it is measured again at 750 and 665 nm for phaeophytin determination. The extinction at 750 nm should not exceed 0.002.

Calculation method:

UkrSCES , IMB, SOI, IO-BAS use a calculation method from Jeffrey, 1975 and UkrSCES , IMB, SOI using a calculation home method Standard Methods for the Examination of Water and Wastewater, 2005. ONU uses a calculation method from Jeffrey, 1979.

Statistics

The overall results of the chlorophyll-a intercalibration exercise are given in Table 1 as raw data, means, standard deviation and coefficients of variation for each laboratory and series of subsample.

Table 1 Raw data, means, standard deviations and coefficients of variation

Station	Dept,m	IMB-J	IMB-S	UkrSCES-J	UkrSCES-S	ONU-J	SOI -S
NPMS-UA 3	2	5,609	5,588	5,923	5,999	3,901	4,356
NPMS-UA 3	2	4,154	6,213	5,877	6,187	3,968	3,873
NPMS-UA 3	2	5,557	5,948	6,272	5,975	3,927	4,065
mean		5,107	5,916	6,024	6,054	3,932	4,098
st. dev.		0,826	0,313	0,216	0,116	0,034	0,243
coef of variation		16,170	5,298	3,582	1,921	0,860	5,940
JOSS-UA-GE 12	35	0,368	0,477	0,552	0,438	0,367	0,212
JOSS-UA-GE 12	35	0,466	0,444	0,462	0,477	0,330	0,298
JOSS-UA-GE 12	35	0,367	0,438	0,456	0,579	0,346	0,299
mean		0,400	0,453	0,490	0,498	0,348	0,270
st. dev.		0,057	0,021	0,054	0,073	0,019	0,050
coef of variation		14,223	4,587	11,011	14,600	5,355	18,588
NPMS-GE 1	15	0,416	0,551	0,681	0,561	0,368	0,419
NPMS-GE 1	15	0,414	0,551	0,710	0,455	0,369	0,371
NPMS-GE 1	15	0,420	0,562	0,568	0,456	0,389	0,424
mean		0,417	0,554	0,753	0,491	0,375	0,405
st. dev.		0,003	0,007	0,210	0,061	0,012	0,029
coef of variation		0,726	1,177	27,874	12,451	3,087	7,178

The standard deviations and coefficients of variation are generally low (CVs less than 10%, except UkrSCES-J ~28%). This shows that the precision (ability to reproduce the measurements) within the laboratories generally is high, but tells nothing about the accuracy (ability to get close to the true concentrations) of the measurements.

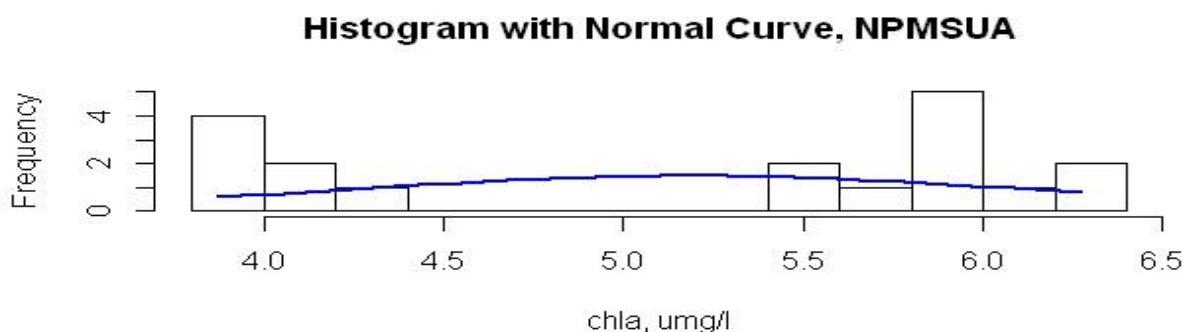
The statistical evaluation is dealing with the score z calculated from an assigned value established as consensus value and equal to median of each data set. The evaluation of intercalibration exercises was according to *The International Harmonized Protocol for the Proficiency Testing Of Analytical Chemistry Laboratories (IUPAC Technical Report)* (IUPAC, 2006) recommendations.

The assessment of results based on standardized deviations of laboratory values from the assigned value (consensus value), which are measured by so-called Z-scores [$=(\text{analysis result} - \text{target value})/\text{standard deviation}$]. If the analysis results are normally distributed, the probability of the absolute amount of the Z-score not exceeding a value of 2 is approximately 95%. Therefore, a Z-score of 2 is usually fixed as quality limit and the tolerance limit in this interlaboratory study was set to two.

For the establishment of the consensus value we followed the next steps:

- Calculate median and the range median $\pm 50\%$
- Exclude the values which are not included in the range median $\pm 50\%$
- Recalculate the median which is assumed to be a consensus value.

The raw data distribution are represented at the histogram below

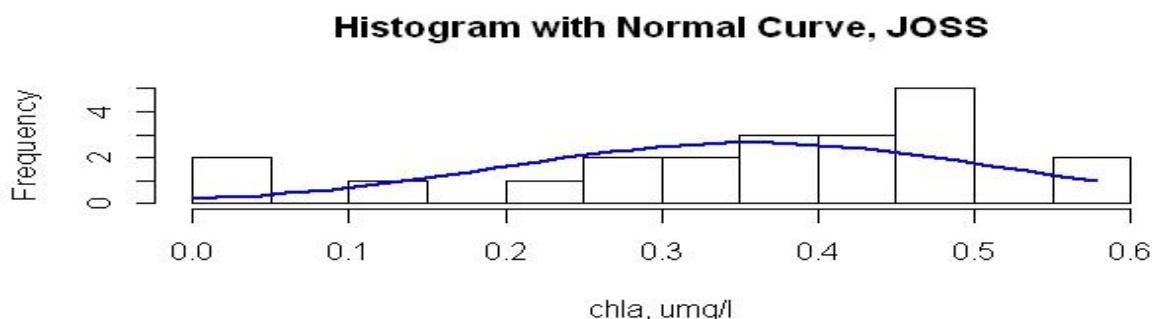


Station NPMS-UA

- Median: 5.60 $\mu\text{g/L}$
- The range (median $\pm 50\%$) values: 2.80 – 8.40 $\mu\text{g/L}$.
- No values were ranged outside the interval 2.80 – 8.40 $\mu\text{g/L}$.
- Consensus value: 5.60 $\mu\text{g/L}$.
- Z-scores ($\sigma=0.97$) are shown in the Table 2.

Table 2: Z-Scores – station NPMS-UA

IMB-J	IMB-S	UkrSCES-J	UkrSCES-S	ONU-J	SOI -S
-0,084	0,748	0,859	0,890	-1,292	-1,122



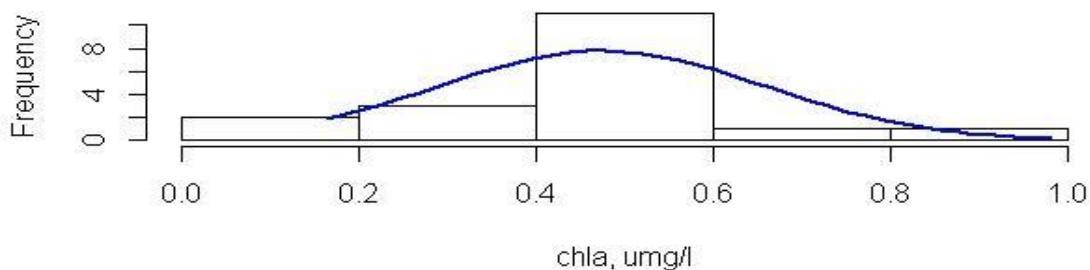
Station JOSS

- Median: 0.43 µg/L.
- The range (median ± 50%) values: 0.22 – 0.66 µg/L.
- No values were ranged outside the interval 0.22 – 0.66 µg/L.
- Consensus value: 0.43 µg/L.
- Z-scores ($\sigma=0.093$) are given in the Table 3.

Table 3: Z-Scores – station JOSS-UA-GE (sampling depth of 35 m)

IMB-J	IMB-S	UkrSCES-J	UkrSCES-S	ONU-J	SOI -S
-0,101	0,462	0,859	0,942	-0,661	-1,50

The raw data distribution is represented in the histograms below



Station NPMS-GE

- Median: 0.44 µg/L.
- The range (median ± 50%) values: 0.22 – 0.66 µg/L.
- No values were ranged outside the interval 0.22 – 0.66 µg/L, except UkrSCES-J
- Consensus value: 0.44 µg/L
- Z-scores ($\sigma=0.15$) are given in the Table 4

Table 4: Z-Scores – station NPMS-GE (sampling depth of 15 m)

IMB-J	IMB-S	UkrSCES-J	UkrSCES-S	ONU-J	SOI -S
-0,540	0,362	1,668	-0,055	-0,814	-0,620

For evaluation of IO-BAS results repeatability the datasets from IO-BAS and UkrSCES were tested with Student's t-test analysis. The stations NPMS-GE-8, JOSS-GE-UA-13, JOSS-GE-UA-16,

JOSS-GE-UA-19 and JOSS-GE-UA-23 were chosen for intercomparison. In previous part the data of UkrSCES were proven to be ranged inside of interval consensus value +/-50%. Thus we compare the data provided by Bulgarian research institute with dataset of UkrSCES to determine if two sets of data are significantly different from each other. In the table below we provide the results of Student's t-test. All the numbers are less than 2,776 critical value for 4 degrees of freedom and the p-value more than 0.05 which indicates the insignificant difference between two datasets.

Table 5: Results of Student's t-test

Station	t-test value	p-value
NPMS-GE-8	0,113	0,915
JOSS-GE-UA-13	0,880	0,429
JOSS-GE-UA-16	0,386	0,719
JOSS-GE-UA-19	-0,131	0,901
JOSS-GE-UA-23	-0,274	0,797

Conclusions:

- Generally, the precision (ability to reproduce the measurements) within laboratories were found to be high.
- All z-scores were ranged between 2 and -2.

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Annex 4: Zooplankton Intercomparison

Results of intercomparison exercises for biota – Zooplankton

The main objective of this exercise was to collect samples for biological parameters by the partners of the EMBLAS, following their routine methodology of sampling and analysis for assessment of the comparability of data collected during NPMS-UA, NPMS-GE and JOSS. The aim of the exercise was to compare the qualitative and quantitative composition of the mesozooplankton as the result of processing the samples, as well as assessing the quality of the marine environment on biological indicators. These exercises are expected to produce valuable results for making recommendations for further improvement and harmonization of research (monitoring) methodology in the Black Sea. In Intercomparison exercise II on mesozooplankton were participated representatives of five organizations (table 1).

Table 1. List of Participants of Intercomparison exercise II on mesozooplankton

	Name	Country	Affiliation	Contacts
1	Marina Mgledadze	Georgia	National Environmental Agency, Batumi (NEA)	mari.mgledadze@gmail.com
2	Aleksandr Korshenko	Russian Federation	State Oceanographic Institute, Moscow (SOI)	korshenko58@mail.ru
3	Anna Diamant	Ukraine	Ukrainian Scientific Center of Ecology Sea, Odesa (USC)	
4	Pavel Lumkis	Ukraine	Odesa National I.I. Mechnikov University (ONU)	pasha.lumkis@gmail.com
5	Vasiliy Dyadichko	Ukraine	Institute of Marine Biology, Odesa (IMB)	wasilij_d@mail.ru

During the voyage RV «Mare Nigrum» on EMBLAS II project were picked up 4 samples of mezozooplankton in different parts of the Black Sea (Table. 2). Together with Dr. Alexander Korshenko (SOI) all selected samples were divided into equal parts by Motoda plankton sample divider. Each total sample was divided into 8 equal parts by Motoda divider, with the separation of samples on the "left" (L) and "right" (R) are provided with appropriate markings to identify possible bias. After separation, samples were transferred to the participants of the exercises in the following form: NEA (I-LLL, II-RRL, III-LRL, IV-RLL), SOI (I-LRL, I-RLR, I-LRR), IO (I-RLL, II-RLR, III-LRR, IV-RLR), USC (I-RRL, II-LLL, III-LLR, IV-LLR), ONU (I-RRR, II-RLL, III-RLL, IV-LRR), IMB (I-LLR, II-RRR, III-RRR, IV-LRL).

Characteristics of samples involved in the comparative analysis:

Sample I was union of the two samples (station 12 in JOSS and station 1 in NPMS GE) and is used primarily to compare the qualitative composition of the zooplankton.

Sample II was picked up on station 12 (JOSS); sample is the result of seven-time vertical hauls on the horizon 0-13 m by Judey net with entering diameter 36 cm (total volume of filtering water - **9,258 m³**).

Sample III was picked up on station 2 (NPMS UA); sample is the result of one-time vertical hauls on the horizon 0-15 m, four-time vertical hauls on the horizon 0-10 m and two-time vertical hauls on the horizon 0-5 m by Judey net with entering diameter 36 cm (total volume of filtering water - **6,613 m³**).

Sample IV was picked up on station 1 (NPMS GE); sample is the result of seven-time vertical hauls on the horizon 0-15 m by Judey net with entering diameter 36 cm (total volume of filtering water - **10,682 m³**).

Samples were transferred to all the organizations that participate in the project EMBLAS from July to September 2016.

Table 2. Characteristics of sampling sites for mesozooplankton Intercomparison exercise

Part of the cruise	Station number	Sites Coordinates		Depth (m)	Sampling date	Time of sampling	Depth range of net haul (m) from	To	Number of replicates
		Latitude (northern)	Longitude (eastern)						
NPMS GE	1	41 33.477	41 33.111	44	28.05. 2016	17:20	15	0	7
							40	15	7
							40	0	7
JOSS	12	42 14.070	39 53.161	1909	26.05. 2016	15:40	13	0	7
							50	13	7
							170	0	7
NPMS UA	2	45 59.395	30 42.668	18,7	17.05. 2016	14:30	6	0	7
							16	6	7
							16	0	4

Results of intercomparison

The results of processing the sample transmitted to Alexander Korshenko for State Oceanographic Institute and Institute of Oceanology of the Russian Federation are not sent until today. Analysis of the data showed that sample processing results were worse than in the first intercomparison exercise, which was conducted in February-May 2016. The main differences were obtained in the evaluation of the species composition of pelagic animals (Table 3).

Table 3. Results of intercomparison exercises II by identification of species composition of zooplankton at all investigated samples

NN	Taxon (Species)	GE	USC	IMB	ONU
Sample I					
1	<i>Noctiluca scintillans</i> Kofoid & Swezy, 1921	+	+	+	+
2	Hydrozoa, planula	+			
3	<i>Mnemiopsis leidyi</i> (Agassiz, 1865), larvae	+			
4	Copepod g.sp., ova	+			
5	Copepod g.sp., nauplii	+			+
6	<i>Acartia clausi</i> Giesbrecht, 1889	+	+	+	+
7	<i>Acartia tonsa</i> Dana, 1849		+	+	+
8	<i>Acartia</i> sp. (clausi+tonsa)		+	+	+
9	<i>Calanipeda aquaedulcis</i> (Kritczagin, 1873)			+	+
10	<i>Calanus euxinus</i> Hulsemann, 1991	+	+	+	+
11	<i>Paracalanus parvus</i> (Claus, 1863)	+			+
12	<i>Pseudocalanus elongatus</i> (Boeck, 1865)	+	+	+	+
13	<i>Oithona davisiæ</i> (Ferrari F.D. and Orsi, 1984)		+	+	+
14	<i>Oithona similis</i> Claus, 1866	+			+
15	<i>Oithona</i> sp.	+			
16	Cyclopoida gen. sp.				
17	<i>Parasagitta setosa</i> (Müller, 1847)	+	+	+	+
18	<i>Oikopleura (Vexillaria) dioica</i> Fol, 1872	+	+	+	+
19	Trochophora sp.				+
20	Polychaeta g. sp., larvae	+	+	+	+
21	Cirripedia, nauplii	+	+	+	+
22	Misidae g. sp., larvae	+			
23	Bivalvia g. sp., larvae	+	+	+	+

NN	Taxon (Species)	GE	USC	IMB	ONU
24	<i>Phoronis euxincola</i> , larvae	+			
25	Pisces sp., ova	+			
26	Pisces sp., larvae	+			
	TOTALLY	20	12	13	17
Sample II					
1	<i>Noctiluca scintillans</i> Kofoid & Swezy, 1921	+	+	+	+
2	Copepoda g. sp., ova	+			
3	Copepoda g. sp., nauplii	+	+	+	+
4	<i>Acartia clausi</i> Giesbrecht, 1889	+	+	+	+
5	<i>Acartia tonsa</i> Dana, 1849		+	+	+
6	<i>Acartia</i> sp. (clausi+tonsa)		+	+	+
7	<i>Centropages ponticus</i> Karavaev, 1894				+
8	<i>Paracalanus parvus</i> (Claus, 1863)	+			+
9	<i>Pseudocalanus elongatus</i> (Boeck, 1865)		+	+	+
10	<i>Calanus euxinus</i> Hulsemann, 1991			+	
11	<i>Oithona daviseae</i> (Ferrari F.D. and Orsi, 1984)		+	+	+
12	<i>Oithona</i> sp.	+			
13	<i>Penilia avirostris</i> Dana, 1849				+
14	<i>Pleopis polyphaemoides</i> (Leucart, 1859)		+	+	+
15	<i>Parasagitta setosa</i> (Müller, 1847)		+	+	
16	<i>Mnemiopsis leidyi</i> (Agassiz, 1865), larvae	+			
17	Trohophora sp.				+
18	Bivalvia g. sp., larvae		+	+	+
19	Cirripedia, nauplii	+			+
20	<i>Phoronis euxincola</i> , larvae	+			
21	Pisces sp., ova	+			
	TOTALLY	10	10	11	14
Sample III					
1	<i>Noctiluca scintillans</i> Kofoid & Swezy, 1921	+	+	+	+
2	Copepoda g. sp., nauplii	+	+	+	+
3	<i>Acartia clausi</i> Giesbrecht, 1889	+	+	+	+
4	<i>Acartia tonsa</i> Dana, 1849		+	+	+
5	<i>Acartia</i> sp. (clausi+tonsa)		+	+	+
6	<i>Centropages ponticus</i> Karavaev, 1894			+	+
7	<i>Paracalanus parvus</i> (Claus, 1863)				+
8	<i>Oithona daviseae</i> (Ferrari F.D. and Orsi, 1984)	+	+	+	+
9	<i>Oithona nana</i> Giesbrecht, 1893			+	
10	<i>Pleopis polyphaemoides</i> (Leucart, 1859)	+	+	+	+
11	<i>Synchaeta</i> sp.	+	+	+	+
12	<i>Oikopleura dioca</i> Fol, 1872		+	+	+
13	<i>Aurelia aurita</i> (Linnaeus, 1758), ephyra			+	
14	Polychaeta g. sp., larvae	+	+	+	+
15	Bivalvia g. sp., larvae	+	+	+	+
16	Gastropoda g. sp., larvae	+	+	+	
17	Cirripedia, nauplii	+	+	+	+
	TOTALLY	10	13	16	14
Sample IV					
1	<i>Noctiluca scintillans</i> Kofoid & Swezy, 1921	+	+	+	+
2	Copepoda g. sp., ova	+			

NN	Taxon (Species)	GE	USC	IMB	ONU
3	Copepoda g. sp., nauplii	+	+	+	+
4	<i>Acartia clausi</i> Giesbrecht, 1889	+	+	+	+
5	<i>Acartia tonsa</i> Dana, 1849		+	+	+
6	<i>Acartia</i> sp. (clausi+tonsa)		+	+	+
7	<i>Centropages ponticus</i> Karavaev, 1894	+			+
8	<i>Calanipeda aquaedulcis</i> (Kritczagin, 1873)			+	+
9	<i>Paracalanus parvus</i> (Claus, 1863)	+	+	+	+
10	<i>Oithona similis</i> Claus, 1866	+			
11	<i>Oithona davisae</i> (Ferrari F.D. and Orsi, 1984)	+	+	+	+
12	<i>Pleopis tergestina</i> (Claus, 1877)				+
13	<i>Pleopis polyphaenoides</i> (Leucart, 1859)		+	+	+
14	<i>Synchaeta</i> sp.			+	+
15	<i>Oikopleura dioca</i> Fol, 1872	+		+	+
16	<i>Parasagitta setosa</i> (Müller, 1847)		+	+	
17	<i>Mnemiopsis leidyi</i> (Agassiz, 1865), larvae	+			
18	Polychaeta g. sp., larvae	+			
19	Bivalvia g. sp., larvae	+	+	+	+
20	Gastropoda g. sp., larvae		+	+	+
21	Cirripedia, nauplii	+	+	+	+
22	Decapoda g. sp., larvae		+	+	+
23	<i>Phoronis euxinica</i> , larvae	+			
24	Pisces g. sp., larvae			+	
	TOTALLY	14	13	17	17

Dominant species marked in grey.

Similar results were obtained by quantitative analysis of total biomass determination, which is a key indicator of zooplankton state (Table 4). All zooplankton experts were obtained the same assessment of water quality, which corresponds to the “Bad” or “Poor” on WFD or “Low ecological status” for MSFD (Table 5).

Table 4. Normative value of zooplankton metrics (characteristics) for different kind of marine water quality in shelf area

Characteristics (mesozooplankton metrics)	Numerical value	Water quality
MSFD variant (two-point evaluation system)		
Total mesozooplankton biomass ($\text{mg} \cdot \text{m}^{-3}$)	280-550	GES
	< 280	LES
Copepods biomass (% to total mesozooplankton)	> 42	GES
	≤ 42	LES
Noctiluca biomass (% to total mesozooplankton)	< 30	GES
	≥ 30	LES
Shannon-Weaver index ($\text{bit} \cdot \text{ind}^{-1}$)	≥ 3 (2,5)*	GES
	< 3 (2,5)*	LES
WFD variant (five-point rating system)		
Total mesozooplankton biomass, $\text{mg} \cdot \text{m}^{-3}$ **	> 300	High
	300-150	Good
	150-70	Medium
	70-10	Poor
	< 10	Bad

Note: GES – Good Environment Status / LES – Low Environment Status

* Significance of index for open sea areas in brackets

** For spring period (Moncheva, Boicenco, 2014)

Table 5. Comparative characteristics of water quality on the base of zooplankton indicators

Indicators of water quality	NEA	UkrSCES	IMB	ONU
Station I (mix area)				
Zooplankton abundance, ind·m ⁻³	121	398	403	52
Zooplankton total biomass, mg·m ⁻³	37,74	57,46	48,67	6,56
Copepoda biomass, %	18,39	84,20	75,7	84,77
Noctiluca biomass, %	2,80	9,18	13,2	8,94
Biodiversity by Shannon indices, bit·ind ⁻¹	4,016 3,025	2,849	3,186	2,688 3,154
Water quality status (MSFD)	LES	LES	LES	LES
Water quality status (WFD)	Poor	Poor	Poor	Bad
Station II (JOSS area)				
Zooplankton abundance, ind·m ⁻³	96	526	563	91
Zooplankton total biomass, mg·m ⁻³	9,446	15,28	14,00	1,44
Copepoda biomass, %	7,02	39,86	56,30	70,76 73,48
Noctiluca biomass, %	11,38	46,01	37,51	24,01
Biodiversity by Shannon indices, bit·ind ⁻¹	3,147 2,048	2,444	2,745	2,688 2,975
Water quality status (MSFD)	LES	LES	LES	LES
Water quality status (WFD)	Bad	Poor	Poor	Bad
Station III (NPMA UA area)				
Zooplankton abundance, ind·m ⁻³	507	4296	4354	500
Zooplankton total biomass, mg·m ⁻³	1,435	25,55	35,33	3,24
Copepoda biomass, %	34,74	14,91	35,81	15,31 16,47
Noctiluca biomass, %	5,27	12,33	5,57	28,33
Biodiversity by Shannon indices, bit·ind ⁻¹	2,533	2,173	1,511	2,162 2,202
Water quality status (MSFD)	LES	LES	LES	LES
Water quality status (WFD)	Bad	Poor	Poor	Bad
Station IV (NPMA GE area)				
Zooplankton abundance, ind·m ⁻³	256	1829	1807	224
Zooplankton total biomass, mg·m ⁻³	5,027	47,92	43,56	4,78
Copepoda biomass, %	22,77 25,47	28,64	35,25	32,68 38,73
Noctiluca biomass, %	43,80	65,11	59,7	59,54
Biodiversity by Shannon indices, bit·ind ⁻¹	3,068 2,406	2,589	2,772	2,465 2,640
Water quality status (MSFD)	LES	LES	LES	LES
Water quality status (WFD)	Bad	Poor	Poor	Bad

Underlined values calculated incorrectly

Note. **NEA** - National Environmental Agency of Fishery and Black Sea monitoring (Georgia); **IO** – P.P.Shirshov Institute of Oceanology RAS, **SOI** – State Oceanographic Institute (Russia); **USC** – Ukrainian Scientific Center of Ecology of the Sea, **IMB** – Institute of Marine Biology NASU, **ONU** – Odessa national university I.I. Mechnikov (Ukraine).

Analysis of obtained results of different experts shows similar species composition, quantitative estimates of the components of plankton community and water quality assessment at whole. The results of determining the qualitative (see Table 3) and quantitative (see Table 5)

characteristics of the control samples in USC and IMB experts did not differ. Perhaps this fact was associated with a preliminary discussion of the results between them. All the experts evaluated the water quality criteria for the MSFD as a Low Ecological Status and “Bad” (NEA and ONU) or “Poor” (USC and IMB) water quality for the WFD criteria.

All the experts found a joint mistake. Value of Shannon index can not be negative. The experts NEA and ONU had small errors in its calculation (see Table 5). Georgia experts there were no data to determine the biomass of some organisms, for example, Misidae larvae, Hydrozoa larvae, Fish larvae, Fish ova. It is easy to do with the help of the mesozooplankton guideline (Aleksandrov et al., 2014). ONU expert in Station III protocol was mention one species (*Oithona davisae*) with different values of number and biomass. General lack of the determination of the zooplankton species composition is not possible to distinguish *Acartia clausi* and *A. tonsa*, although these species is not only mass, but also non-indigenous. All experts do not identify the nauplia stages of copepods, although their determination is not difficult according Mordukhay-Boltovskoy , F.D. (Ed.), 1969 (Table. 5).

The value of the average error was twice as much as in Exercise 1 (Table 6). A possible explanation is the fact that the control samples in the first case had to view almost completely, and in the second case to analyse subsamples.

Table 6. The average values of some mesozooplankton characteristics in the control stations (calculated according data in Table 5)

№ station	Abundance		Biomass	
	N, ind·m ⁻³	Average error, %	B, mg·m ⁻³	Average error, %
I	244 ± 92	37,7	37,608 ± 11,107	29,5
II	319 ± 130	40,9	10,042 ± 3,129	31,2
III	2414 ± 1103	45,7	16,389 ± 8,360	51,0
IV	1029 ± 456	44,3	25,322 ± 11,820	46,7
Average		42,1 ± 1,8		39,6 ± 5,4

Conclusions

1. By processing of the control samples were found of 34 zooplankton taxa relating to 6 groups: Rotatoria (1), Calanoida (10), Cyclopoida (4), Cladocera (3), Meroplankton (10), Others (6). Only 18 taxa from 34 were identified to the species level. Experts of the NEA and ONU were determine the maximum number of taxa (22-23), the minimum number of taxa (16) has been registered USC expert. This may explain the maximum difference in the definition of the Shannon index, 2.623 ± 0.201 and 2.513 ± 0.141 , respectively in results of these experts.
2. The reason of serious differences in the determination of the species composition of the zooplankton should be considered the difficulties of identification mass species of the Black Sea copepods, which belong to the genera *Acartia* and *Oithona*. The difference between look (appearance) of invasive *Acartia tonsa* and aborigine species *Acartia clausi* is so insignificant that after the first registration of *A. tonsa* in the Black Sea in 1994 (Belmonte et al., 1994) this species was found in old plankton samples collected off the coast of Sevastopol in 1976 (Gubanova, 1997). *Oithona brevicornis*, first recorded in the Black Sea in 2002 as an invader in 2012 was redefined as *Oithona davisae*. Identification of this species as *O. brevicornis* was declared as mistake (Temnykh, Nishida, 2012). It was established that *Oithona similis* and females *O. davisae* found in

the Black Sea during the cold season (Svetlichny et al., 2016), and theoretically could be detected in the samples sent for comparison, but this fact requires careful checking.

3. Future monitoring investigations to provide a definition of different species of copepods on their nauplia stages (Mordukhay-Boltovskoy, 1969).
4. Analysis of the results of intercomparison exercise II by all experts has shown quite good results. The average error of zooplankton number and biomass were $42,1 \pm 1,8$ and $39,6 \pm 5,4$ % correspondingly. These differences in biomass, which is one of the indicators of environmental quality, were even smaller.
5. In assessing the quality of the marine environment on the base of four zooplankton indicators all the experts got close result. Environmental quality was evaluated as "Poor" and "Bad".

Recommendations

1. To reduce the error in the determination of the water quality is not taken into account during processing the zooplankton sample of organisms that happened to be in the collected samples and are benthic, for example Harpacticoida.
2. In determining the species composition of zooplankton pay special attention to identification of *Acartia* and *Oithona* species. To do this, use the more closely publications transmitted at a seminar in Odessa on 23-24 September 2016 (Belmonte et al, 1994; Nishida, 1985; Prusova, 2002; Temnykh, Nishida, 2012). To identification the nauplii of copepods and rotifers should use a well-known key guide book (Mordukhay-Boltovskoy, 1968; Mordukhay-Boltovskoy, 1969; Kutikova, 1970).
3. To accurately quantifying zooplankton sample recommended to count of dominated organisms (taxa with main occurrence) in an amount no less than 100 individuals in the subsamples. All rare species must be count in the whole sample.
4. To determine the Shannon index, even in the case of doubt during identification of species the accuracy of determination of species should not be determined in one taxon (e.g., Rotatotia sp.), And to account for each of them individually.
5. The reported results of the intercomparison exercise II considered as preliminary. Due to the presence of duplicate samples from station II, II and IV recommended to repeat intercomparison exercise II by the experts USC and IMB. As soon as possible transmit the results of processing the control samples by experts from Russian Federation (IO and SOI).

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Annex 5: Macrozoobenthos Intercomparison

Results of inter-comparison exercises for biota: Macrozoobenthos

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The report presents the macrozoobenthos results of the EMLAS-II intercomparison exercise at the sampling station NPMS UA 02 (Intercomparison station; Ukrainian shelf of the Black Sea; the Dniester river sandbanks). Results from five institutes from three countries are reported. The participating institutes were UkrSCES, ONU, IMB, NEA and GeoEcoMar (GEM).

Methodology

The methodology for collecting and processing of samples on board was the same for all participants. Benthic samples were taken using a Van Veen grab with sampling area of 0.14 m². Three replicates were taken by NEA and GeoEcoMar, two by ONU and IMB and one by UkrSCES. The samples were sieved through 0.5 mm mesh size and fixed in 4% formalin solution. Specimens of each group were identified, counted and wet weighed (total individuals belonging to each species). Molluscs were weighed with shells.

In order to overcome taxonomic discrepancies due to usage of synonymous names common nomenclature was used according to the World Register of Marine Species (WoRMS) available on <http://www.marinespecies.org/index.php>. This facilitates comparison of data not only within the Black Sea region but also with other European seas.

Bray-Curtis Similarity Index was used to determine the similarity/dissimilarity in terms of species composition among replicates evaluated by each institute and between institutes. Since the number of individuals belonging to each species did not reveal a normal distribution, the data was transformed to Log10(X+1). A similarity matrix was obtained according to the Bray-Curtis index and the matrix results were shown in dendograms. Bray-Curtis Similarity Index is an index calculated based on the number of species and individuals and it is calculated according to the formula (Magurran and McGill, 2011):

$$S_{BC} = \frac{2 \sum_{i=1}^S \min(M_{i1}, M_{i2})}{\sum_{i=1}^S (M_{i1} + M_{i2})} = 1 - \frac{\sum_{i=1}^S |M_{i1} - M_{i2}|}{\sum_{i=1}^S (M_{i1} + M_{i2})}$$

Where,

- M_{i1} represents the total number of individuals in the first replicate;
- M_{i2} the total number of individuals in the second replicate.

Similarity percentage Analysis-SIMPER was applied using the software package PRIMER 5.0 in order to find the species most contributing to the observed differences of species compositions among the replicates of the institutes. As a result of this analysis, the species with the highest contributions to the differences among the institutes and their percentage contributions were established.

Results

The evaluation of results regarding the macrozoobenthic community was carried out on five data sets from each institute with the following considerations:

- Whether the species were found/not found by the institutes' experts (Presence/Absence Matrix);
- The abundance values of the species were calculated by the institutes' experts.

Presence/Absence

As a result of taxonomical analysis, a total of 102 taxa belonging to 14 groups were identified. The macrozoobenthos species list identified by 5 different institutes from the Intercomparison station is given in Table 1. Accordingly, UkrSCES found a total of 44, IMB - 42, ONU - 33, NEA - 47 and GeoEcoMar found 62 taxa. The detailed number of species found at each replicate is given in Table 2.

Table 1. The total number of taxonomic groups identified by the institutes participating in the intercomparison exercise

	UkrSCES	IMB	ONU	NEA	GEM
HYDROZOA		1	1		6
TURBELLARIA	1	1	1	1	3
NEMERTEA	1	1	1	1	3
POLYCHAETA	19	23	14	24	18
OLIGOCHAETA	1	1	1	1	1
PHORONIDA					1
GASTROPODA	1	2		2	3
BIVALVIA	7	6	7	8	9
CIRRIPEDIA	1	1	1	1	1
AMPHIPODA	5	3	4	3	11
ISOPODA	1	1	1	1	1
CUMACEA	2	1	1	2	2
MYSIDA					1
DECAPODA	5	1	1	3	2
TOTAL	44	42	33	47	62

Table 2. The total number of species within taxonomic groups identified by the participating institutes for each replicate

replicate	A					B					C	
	institute	UkrSCES	IMB	ONU	NEA	GEM	IMB	ONU	NEA	GEM	NEA	GEM
HYDROZOA		1	1			6	1	1		2		2
TURBELLARIA	1	1	1	1		2	1	1	1	2	1	2
NEMERTEA	1	1	1			2	1	1		3	1	2
POLYCHAETA	19	19	13	10	15	21	12	18	14	15	15	
OLIGOCHAETA	1	1	1	1	1	1	1	1	1	1	1	1
PHORONIDA						1				1		
GASTROPODA	1	1					1		1	2	1	1
BIVALVIA	7	5	7	3	6	4	4	5	3	4	4	
CIRRIPEDIA	1	1	1	1	1	1	1			1	1	1
AMPHIPODA	5	2	4	3	8	3	3	2	7	2	6	
ISOPODA	1	1	1	1	1			1			1	1
CUMACEA	2	1	1	1	2	1	1	2	1	2	2	
MYSIDA										1		
DECAPODA	5	1	1	2	2	1	1	1	1	2	1	
TOTAL	44	35	32	23	47	36	27	32	39	31	38	

As a result of taxonomical analysis performed by the five teams was found out that only 16 (15%) of total number of taxa were found by all five institutes (no. 1 on the Figure 1), while 51

(49%) were determined only once (no. 5 on the Figure 1) (Figure 1). The great number of taxa determined only once could be explained by the natural variability of species distribution in their habitats, on one hand, and by the level of taxonomic expertise and methodological standards needed to obtain comparable results between the teams, on the other hand. The greatest number of taxa identified by only one team belonged to GEM - 25 (49% of total number of taxa determined only once), followed by NEA - 15 (29%). In case of GEM, this could be explained by their ability to identify down to genus/species level 3 taxonomic groups (Hydrozoa, Turbellaria and Nemertea), which was not the case for the other teams. In case of NEA, there were probably misidentified species like bivalve *Arca tetragna* and polychaet *Aricidea pseudoarticulata*, which need further clarification.

Differences revealed in terms of species reported by the participating laboratories at the exercise (*Polydora ciliata* and *Polydora cornuta*, *Spiophila filicornis* and *Spiophila decoratus* etc.) pointed out to the necessity of organizing common training/exercises to harmonize taxonomic identification.

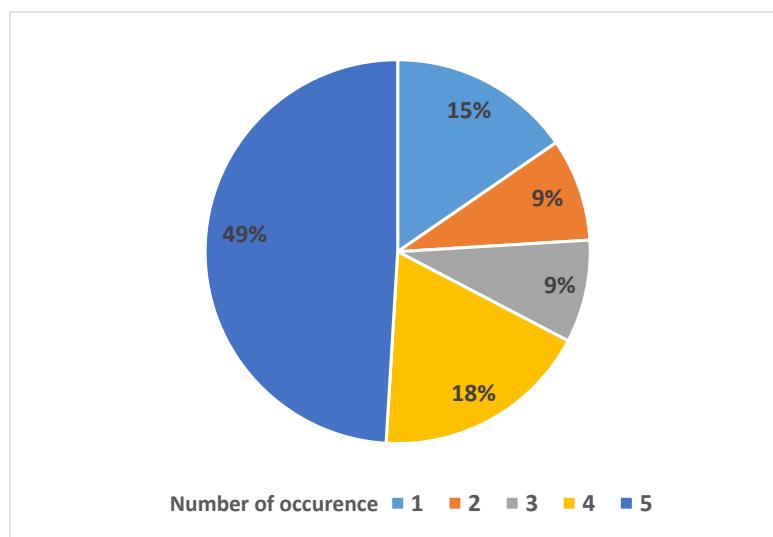


Figure 1. Number of occurrences of macrozoobenthic taxa found by the participating teams

The species list, presence/absence data given by all five institutes upon which the statistical analysis was conducted are presented in tables in Annex 9.

The Bray - Curtis cluster analysis of similarities based on presence/absence transformed data was performed for all replicates analysed by the institutes. Thus, the similarity percentage between replicates within each institute as well as among all five institutes revealed four main clusters (Group I, Group II, Group III and Group IV) (Figure 2).

Accordingly, the replicates within each institute clustered together, excepting Group II cluster, which joined samples from two institutions (UkrSCES and IMB). The best similarity was yielded by UkrSCES and IMB, with about 70%. The low similarity between teams suggests significant taxonomic expertise differences, rather than true taxonomic composition variability.

SIMPER analysis used to calculate the similarities and dissimilarities percentages within each group among replicates and between groups was employed (Table 3).

However, differences were observed between the institutes in terms of qualitative similarities. A major difference of 52.3% was seen between group III (GeoEcoMar) and IV (NEA). Similarly, a difference of 51.9% was found between group I (ONU) and IV (NEA). Group I (ONU) and II (UkrSCES and IMB) revealed the lowest difference of 42.4%.

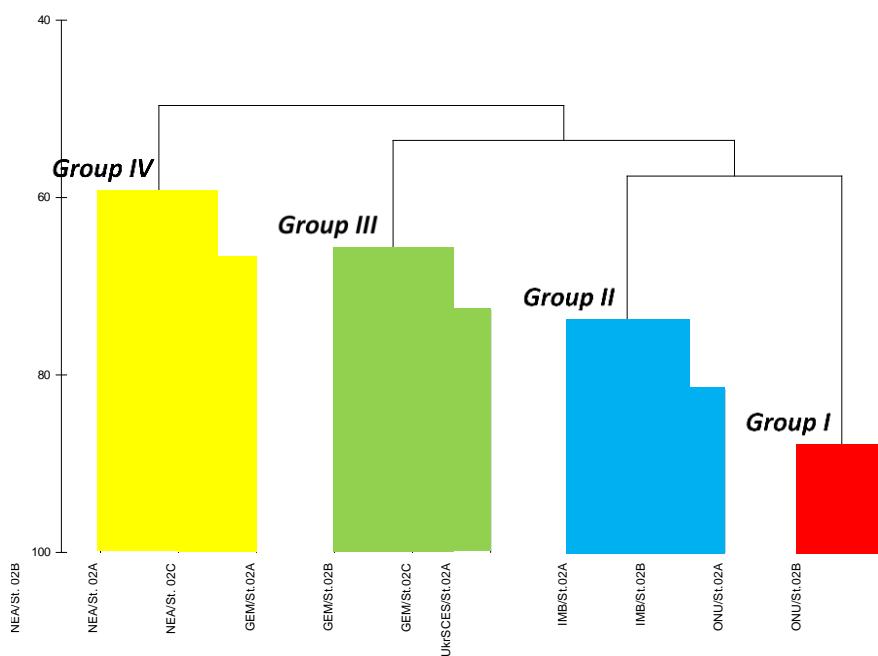


Figure 2. Bray-Curtis similarity of macrozoobenthos based on presence/absence data

Dissimilarities observed between results obtained by the teams who analysed the samples were due to the natural variability of species distribution in their habitats, processing of the samples in the laboratory, taxonomic expertise and methodological standards (need for harmonisation in order to achieve comparable results between the countries in the Black Sea region).

Table 3. Similarity and dissimilarities calculated as a result of the SIMPER analysis based on presence/absence data of macrozoobenthos

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	88.1	
Group II	76.7	
Group III	68.2	
Group IV	61.9	
Group I&II		42.4
Group I&III		47.9
Group I&IV		51.9
Group II&III		45.5
Group II&IV		47.5
Group III&IV		52.3

GEM - UkrSCES and GEM - IMB identified 29 common taxa from a total of 79 and 78 taxa, respectively, in all replicates. The highest number of common species (32 from a total of 54 taxa) was recorded between UkrSCES - IMB and the lowest (20 out of 61) was recorded between ONU - NEA on one hand, and between ONU - UkrSCES (21 out of 55) on the other hand (Table 4).

Table 4. Common taxa number between institutions (light blue cells in diagonal - total number of taxa identified by each institute; green cells - the highest number of common taxa; red cells - the lowest number of common taxa)

	GEM	NEA	UkrSCES	IMB	ONU
GEM	62				
NEA	26	47			
UkrSCES	29	24	44		
IMB	29	23	32	42	
ONU	26	20	21	23	33

Abundance

The dendrogram obtained as a result of the CLUSTER analysis based on the Log (x+1) matrix of species abundance values at station 2 is given in Figure 3. Four important clusters were observed (Group I, Group II Group III and Group IV).

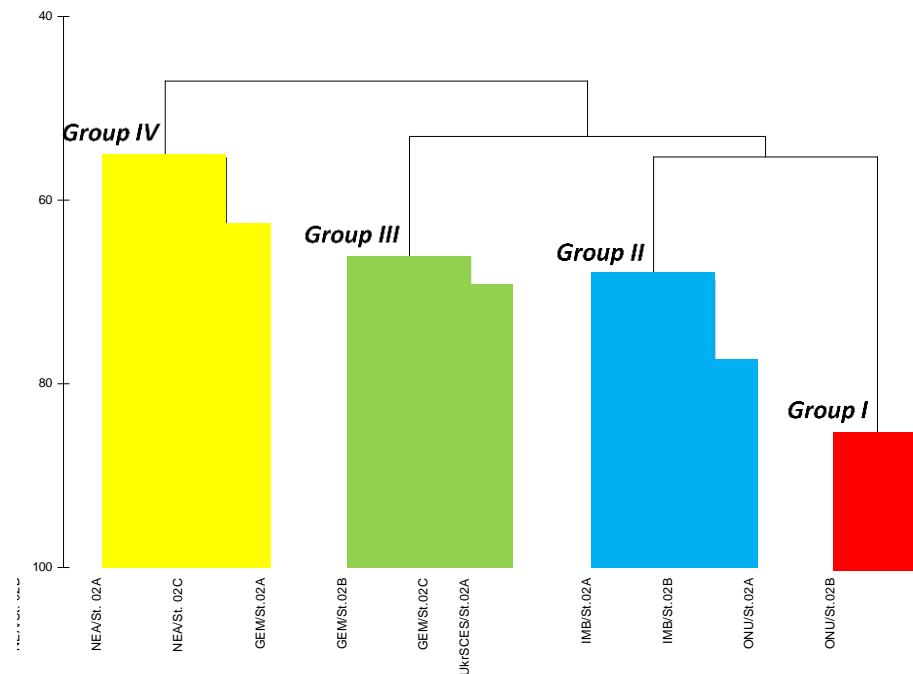


Figure 3. Bray-Curtis similarity of macrozoobenthos based on Log(x+1) abundance transformed data

Similarity percentages and percentage differences among these four important groups are given in Table 5. Also in case of abundances, clusters were formed between samples processed by each institute, excepting UkrSCES and IMB which grouped together. A dissimilarity of 57% and 53% were observed between groups I and IV and the groups III and IV, respectively.

Table 5. Similarity and dissimilarities calculated as result of the SIMPER analysis based on Log(x+1) data of macrozoobenthos abundance

Analysis Groups	Average Similarity	Average Dissimilarity
Group I	85.8	
Group II	71.6	
Group III	67.4	
Group IV	57.9	
Group I&II		44.7
Group I&III		49.6
Group I&IV		57.0
Group II&III		45.2
Group II&IV		50.3
Group III&IV		53.0

Conclusions and Recommendations

Dissimilarities observed between results obtained by the teams who analysed the samples were due to:

- The natural variability of species distribution in their habitats;
- The sampling design (the repetitive cast of Van Veen in the same place affected the species composition, so that each sample collected had different number of species (different qualitative composition) and number of individuals (quantitative composition) from each species (especially for those species that have small populations);
- Samples' processing on board (washing, sieving, preserving and staining) also can be claimed for the observed differences;
- The processing of samples in the laboratories of individual participants;
- Taxonomic expertise and methodological standards.

The results can be considered satisfactory only from the comparability point of view since at the Intercomparison station were found significant dissimilarities (<52% for presence/absence species and <57% for taxa abundance) between the results provided by the five teams (ONU, UkrSCES, IMB, GeoEcoMar, NEA) who participated in the inter-comparison exercise.

The SIMPER analysis of similarities and dissimilarities within the groups concerning the abundance and presence/absence parameters of benthic populations has been proved an appropriate statistical method to reveal the gaps and synergies. The inter-comparison exercise was useful for fine-tuning the future Black Sea regional monitoring programme design.

Future inter-calibration/inter-comparison and exercises should be considered (to be suggested to the BSC, if there are sufficient taxonomic experts to participate at the exercise).

Considering the taxonomic level and uncertainty related to identification of some species the data should be viewed with caution.

The above aspects are very important to achieving comparable results between the countries in the Black Sea region under MSFD reporting in the future.

Annex 6: Macrophytobentos Intercomparison

Results of intercomparing exercises for biota: Macrophytes

Responsible person of the Macrophytobenthos Intercomparing exercises (MIE):
Galina Minicheva - Institute Marine Biology, NAS Ukraine (IMB)

Information about participants, periods and places of the Ith and IIth MIE, are presented in Tabl.1.

Table1. Participants, periods and place of the Ith and IIth MIE.

№	Name	Country	Affiliation	Participation in MIE (Data, place)	
				I th 03.02.2016, Biostation, Odessa coast, Ukraine	II th 08.06.2016, Biostation, Odessa coast, Ukraine
1.	Miriam Tsetskhadze	Georgia	National Environmental Agency, Batumi (NEA), m-marie@mail.ru	-	+
2.	Marina Mgelandze	Georgia	National Environmental Agency, Batumi (NEA), mari.mgelandze@gmail.com	-	+
3.	Dmitry Afanasyev	The Russian Fed.	State Oceanographic Institute, Moscow (SOI), dafanas@mail.ru	+	+
4.	Evgen Dykiy	Ukraine	Ukrainian Scientific Center of Ecology Sea, Odessa (UkrSCES), evgendykyi@gmail.com	+	+
5.	Irina Tretyak	Ukraine	Ukrainian Scientific Center of Ecology Sea, Odessa (UkrSCES), iratretiak@mail.ru	+	+
6.	Fedor Tkachenko	Ukraine	Odessa National University, Odessa (ONU), tvf@ukr.net	+	+
7.	Anna Marinets	Ukraine	Institute of Marine Biology, Odessa (IMB), samoylenko_anna@ukr.net	+	+
8.	Ekaterina Kalashnik	Ukraine	Institute of Marine Biology, Odessa (IMB), kalashnik.eka@gmail.com	+	+

For macrophytobenthos collection and processing to used the manual “Black Sea Monitoring Guideline: Macrophytobenthos” which was prepared within the EMBLAS I project and approved by the Black Sea Environmental Commission (Minicheva et al., 2015).

Results to determination the floristic composition of macrophytes communities under the Ith and IIth MIE presented in Tabl.2-3.

Table 2. The results identify the floristic composition of macrophytes at the Ith MIE.

Species	EMBLAS's partner					Joint species
	IMB (UA)	ONU (UA)	UkrSCES (UA)	SOI (Ru F)	NEA (GE)*	
Chlorophyta						
<i>Ulva intestinalis</i> (Linnaeus) Nees = <i>Enteromorpha intestinalis</i> (L.) Link.	+	+	+	+	-	4
<i>U. linza</i> Linnaeus = <i>E. linza</i> (L.) G. Ag.	+	-	+	-	-	2
<i>U. compressa</i> L.	-	+	-	-	-	1
<i>U. flexuosa</i> Wulfen	-	-	+	-	-	1
<i>Cladophora vagabunda</i> (L.) Van Hoek.	+	+	+	+	-	4
<i>Bryopsis plumosa</i> (Huds.) Ag.	+	+	-	-	-	2
<i>Ulothrix implexa</i> Kutz.	-	+	-	-	-	1
<i>U. flacca</i> (Dillwyn) Thur.	-	+	-	-	-	1
<i>Rhizoclonium implexum</i> (Dillwyn) Kutz.	-	+	-	-	-	1
Rhodophyta						
<i>Porphyra leucosticta</i> Thuret	+	+	+	+	-	4
<i>Ceramium diaphanum</i> var. <i>elegans</i> (Roth) Roth = <i>Ceramium elegans</i> Ducl.	+	+	-	-	-	2
<i>Ceramium virgatum</i> Roth = <i>Ceramium rubrum</i> (Huds.) Ag.	+	-	-	-	-	1
<i>Acrochaetium virgatum</i> (Harvey) Batters = <i>Kylinia virgatula</i> (Harv.) Papenf.	+	+	+	+	-	4
Ochrophyta						
<i>Ectocarpus siliculosus</i> (Dillw.) Lyngb. = <i>Ectocarpus confervoides</i> (Roth) Le Jolis	+	+	+	-	-	3
<i>Punctaria latifolia</i> Grev.	+	-	+	-	-	2
Total species:	10	11	8	4	-	

* Absent data,  - Dominant species.

Table 3. The results identify the floristic composition of macrophytes at the IIth MIE.

Species	EMBLAS's partner					Joint species
	IMB (UA)	ONU (UA)	UkrSCES (UA)	SOI (RF)	NEA (GE)	
Chlorophyta						
<i>Ulva intestinalis</i> (Linnaeus) Nees = <i>Enteromorpha intestinalis</i> (L.) Link.	+	+	+	+	+	5
<i>U. linza</i> Linnaeus = <i>E. linza</i> (L.) G. Ag.	+	-	-	-	-	1
<i>U. prolifera</i> O. Müller = <i>Enteromorpha prolifera</i> (O.F.Mull.) J. Ag.	+	-	-	+	-	2
<i>Ulva compressa</i> L.	-	+	+	-	-	2
<i>Cladophora vagabunda</i> (L.) Van Hoek.	+	+	+	-	+	4
<i>C. albida</i> (Huds.) Kutz.	-	+	+	-	-	2
<i>C. laetevirens</i> (Dillw.) Kütz.	-	-	-	+	-	1
Rhodophyta						
<i>Porphyra leucosticta</i> Thuret	+	-	-	-	+	2
<i>Ceramium diaphanum</i> var. <i>elegans</i> (Roth) Roth = <i>Ceramium elegans</i> Ducl.	+	-	+	-	+	3
<i>C. tenuissimum</i> (Lyngb.) J. Ag.	-	-	-	+	-	1
<i>Acrochaetium virgatum</i> (Harvey) Batters	+	+	+	+	+	5
Total	7	5	6	5	5	

 - Dominant species

The difference identification of the related species of Ith and IIth MIE can be have the objective reasons: the natural differently of field data quality, problems of modern taxonomy (for example a *U. intestinalis* can be identify as a *U. compressa* or vice versa). There are a quality of the microscope equipment and the volume of the scanned materials.

Comparison the calculative values of the main indicators for the assessment of Ecological Status Class (ESC) within the Ith MIE presented the same results for the all experts concerning the indicators: *Three Dominants Ecological Activity* (S/W_{3Dp} , $m^2 \cdot kg^{-1}$) and *Phytosrenouces Surface Index*, (SI_{ph} , units) (Tab.4).

Table 4. The result of comparative analysis of the main indicators for determination of the ESC corresponds to Ith MIE.

EMBLAS's partner	Biomass of over growth, $kg \cdot m^{-2}$	Ecological Evaluation Index					
		S/W_{3Dp} , $m^2 \cdot kg^{-1}$	ESC	S/W_x , $m^2 \cdot kg^{-1}$	ESC	SI_{ph} , units	
IMB (UA)	0,585	53,9	Poor	92,5	Moderate	32,40	Good
ONU (UA)	0,505	53,0	Poor	134,4	Poor	28,58	Good
UkrSCES (UA)	0,654	53,5	Poor	111,8	Moderate	35,57	Good
SOI (RF)	0,476	53,6	Poor	133,2	Poor	26,69	Good
*NEA (GE)	-	-	-	-	-	-	-

*Absent data

Difference between categories of ESC assessment by S/W_{3Dp} and SI_{ph} explained its intended use. The Ecological Evaluation Index (EEI) - S/W_{3Dp} should be using under identification of the ESC for the region (stations) with the different level of autotrophic process. Result which is resaved by experts in intercomparison procedure corresponding to recently situation - within the Ukrainian coastal zone the Odessa coast now has the "Poor" category. The EEI - SI_{ph} can be using under identification of the ESC for the temporal (seasonal) monitoring at the same stations.

Difference within the categories of ESC assessment by EEI- *Average Species Ecological Activity*, S/W_x , $m^2 \cdot kg^{-1}$ can be explained the different numbers of related species which are identified by experts (see Tab.2). To avoid the technically difficult problem connection with determining the total floristic composition of macrophytobenthos, proposed to calculation the average value of the populations specific surface (S/W_p), only for those species whose biomass exceeds more than $0,001 \text{ kg} \cdot \text{m}^{-2}$.

Comparison the calculative values of the main indicators for the assessment of Ecological Status Class (ESC) within the IIth MIE presented practically the same results for the all experts concerning the indicators: *Three Dominants Ecological Activity* (S/W_{3Dp} , $m^2 \cdot kg^{-1}$), *Average Species Ecological Activity*, (S/W_x , $m^2 \cdot kg^{-1}$) and *Phytosrenouces Surface Index*, (SI_{ph} , units) (Tab.5).

Table 5. Result of comparative analysis of the main indicators for determination of the ESC correspond to IIth MIE.

EMBLAS's partner	Biomass of over growth, $kg \cdot m^{-2}$	Ecological Evaluation Index					
		S/W_{3Dp} , $m^2 \cdot kg^{-1}$	ESC	S/W_x , $m^2 \cdot kg^{-1}$	ESC	SI_{ph} , units	
NEA (GE)	0,890	34,17	Moderate	107,6	Moderate	38,90	Good
SOI (RF)	0,842	45,32	Moderate	112,6	Moderate	35,06	Good
UkrSCES (UA)	0,540	49,47	Moderate	109,2	Moderate	25,58	Good
ONU (UA)	1,345	44,07	Moderate	117,9	Moderate	50,05	Moderate
IMB (UA)	0,967	39,84	Moderate	89,5	Moderate	34,85	Good

Indicators of *Three Dominants Ecological Activity* and *Average Species Ecological Activity* showed the high level convergence of results that correspond to the ESC – Moderate. This category is typical for

Odessa coastal marine ecosystem and for this season. According to the indicator of *Phytosenouces Surface Index*, the estimated area is characterized by higher category for one ESC – Good. Macrophyte biomass losses during sampling and laboratory processing can lead to overestimation of the ESC category. As is evident from the ONU expert data, which have the highest biomass (see Tab. 5) - category is correspond to ESC - Moderate.

Conclusions

4. The Ith and IIth MIE showed good results similarity evaluation of ESC categories for all experts. The all participants the high qualification to identify the main important indicators: *Dominant species, Biomass, Three Dominants Ecological Activity, Average Species Ecological Activity, Phytosenouces Surface Index* have been demonstrated.
5. Existing deference between the absolute value of data processing of macrophytes samples can be explanation both natural heterogenic structure of macrophytes community and natural deference in the skill peculiarities of the experts persons. However essentially it is not reflected in target results of ESC assessment with use macrophytes indicators.
6. All experts which was taken part in Ith and IIth MIE (see Tabl.1) can be invite for preparation the chapter Macrophytobenthos of the Assessment Report by results of EMBLAS Nationals Pilot Monitoring Surveys 2016.

Recommendations

- In order to reduce errors under the calculation the morphofunctional indictor - *Average Species Ecological Activity* for to avoid the technically difficult problem connection with determining the total floristic composition of macrophytobenthos, proposed to calculation the average value of the populations specific surface (S/W_p), only for those species whose biomass exceeds more than 0,001 kg. m⁻².
- Given of the results of macrophytobenthos intercomparison study to propose using for the Georgia, Russian Federation and Ukraine Nationals Pilot Monitoring Surveys included morphofunctional indicators in “Format Protocol Station” for assessment ESC
- Recommend to EMBLAS project management team to find of opportunity to continue training of Georgian expert - Miriam Tsetskhladze (NEA). Priorities: - Practical advice on sampling of macrophytes on the Georgian coastal habitats. Help to calculating the ecological activity coefficients (S/W_p) for the species populations of Georgian coast macrophytes.

Annex 7: List of Phytoplankton species

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Bacillariophyceae					
Achnanthes brevipes C.A. Agardh, 1824	21.4	8.0		4.1	
Achnanthes longipes C. Agardh, 1824	7.1	6.0			
Amphora hyalina Kützing, 1844	14.3	6.0		4.1	
Amphora sp.			2.3	4.1	
Asterionellopsis glacialis (Castracane) Round, 1990		8.0			
Attheya septentrionalis (Østrup) Crawford in Crawford et al., 1994				8.2	
Aulacoseira granulata var. angustissima (O. Müller) Simonsen, 1979				2.0	
Bacillaria paxillifera (O.F. Müller) T. Marsson, 1901		4.0		8.2	
Cerataulina pelagica (Cleve) Hendey, 1937			13.6	40.8	
Ceratoneis closterium Ehrenberg, 1839		2.0	59.1	22.4	11.5
Chaetoceros affinis Lauder, 1864		2.0		2.0	1.3
Chaetoceros borgei Lemmermann, 1904			4.5	2.0	
Chaetoceros ceratosporus Ostenfeld, 1910				2.0	
Chaetoceros compressus Lauder, 1864				14.3	1.3
Chaetoceros curvisetus P.T. Cleve, 1889		20.0	13.6	59.2	3.8
Chaetoceros danicus P.T. Cleve, 1889			6.8	10.2	
Chaetoceros diadema (Ehrenberg) Gran, 1897				2.0	
Chaetoceros fallax Proschkina-Lavrenko, 1955				2.0	
Chaetoceros heterovalvatus Proschkina-Lavrenko			2.3	2.0	
Chaetoceros holsaticus Schütt, 1895			15.9	2.0	
Chaetoceros insignis Proschkina-Lavrenko, 1955				12.2	
Chaetoceros karianus Grunow, 1880				2.0	
Chaetoceros laciniatus Schütt, 1895			2.3	16.3	
Chaetoceros lorenzianus Grunow, 1863				2.0	
Chaetoceros muelleri Lemmermann, 1898			2.3		
Chaetoceros paulsenii Ostenfeld, 1901				2.0	
Chaetoceros rigidus Ostenfeld, 1902				2.0	
Chaetoceros similis f. solitarius Proschkina-Lavrenko, 1961			4.5	14.3	
Chaetoceros socialis Lauder, 1864		6.0		26.5	
Chaetoceros sp.		8.0	15.9	18.4	
Chaetoceros subtilis (Proschkina-Lavrenko) Proschkina-Lavrenko, 1961				2.0	
Chaetoceros subtilis var. abnormis f. simplex Proschkina-Lavrenko, 1961				4.1	
Chaetoceros wighamii Brightwell, 1856				2.0	
Cocconeis pediculus Ehrenberg, 1838			6.8	6.1	
Cocconeis placentula Ehrenberg, 1838				2.0	
Cocconeis scutellum (Grunow in Van Heurck) P.T. Cleve, 1896	78.6	30.0		6.1	1.3
Cocconeis sp.		2.0		8.2	
Coscinodiscus janischii A. Schmidt, 1878	28.6	8.0			2.6
Coscinodiscus radiatus Ehrenberg, 1841			2.3	10.2	
Coscinodiscus sp.			6.8		
Cyclotella choctawhatcheeana Prasad, 1990	28.6	26.0	11.4	28.6	
Cyclotella kuetzingiana Thwaites, 1848			25.0		
Cyclotella meneghiniana Kützing, 1844				20.4	
Cyclotella planctonica Brunnthaler 1901				4.1	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Cyclotella sp.			20.5	6.1	
Dactyliosolen fragilissimus (Bergon) G. R. Hasle, 1991			36.4	18.4	
Detonula confervaceae (P.T. Cleve) Gran, 1900				6.1	
Diatoma tenuis C.A. Agardh, 1812		4.0	6.8	36.7	
Diatoma vulgare Bory de Saint-Vincent, 1824				4.1	
Diploneis sp.				2.0	
Ditylum brightwellii (T. West) Grunow in Van Heurck, 1883				20.4	
Fragilaria capucina Desmazières, 1830				6.1	
Gomphonema parvulum (Kützing) Kützing, 1849				2.0	
Gomphonema sp.				2.0	
Grammatophora marina (Lyngbye) Kützing, 1844		4.0			
Halamphora coffeaeformis (C. Agardh) Kützing, 1844				10.2	
Hyalodiscus ambiguus (Grunow) Tempère & Peragallo 1889		4.0			
Hyalodiscus scoticus (Kützing) Grunow 1879		2.0			
Leptocylindrus danicus P.T. Cleve, 1889		4.0		4.1	
Leptocylindrus minimus Gran, 1915				2.0	
Licmophora ehrenbergii (Kützing) Grunow, 1867				2.0	
Licmophora gracilis (Ehrenberg) Grunow, 1867	7.1	6.0		16.3	
Licmophora sp.				2.0	
Lioloma pacificum (Cupp) Hasle, 1996				6.1	
Mastogloia sp.				2.0	
Melosira moniliformis (O.F. Müller) C. Agardh, 1824			4.5	2.0	
Microtabella interrupta (Ehrenberg) Round, 1990	28.6	26.0			
Navicula sp.	21.4	2.0			
Navicula cancellata Donkin, 1872	21.4	14.0		4.1	
Navicula distans (W. Smith) Ralfs, 1861				2.0	
Navicula lanceolata (C.A. Agardh) Ehrenberg, 1838				2.0	
Navicula pennata A. Schmidt, 1876			2.3	12.2	
Navicula pennata var. pontica Mereschkowsky				16.3	
Navicula sp.	7.1		4.5	18.4	1.3
Nitzschia holsatica Hustedt, 1930		4.0		4.1	
Nitzschia hybrida Grunow, 1880				2.0	
Nitzschia longissima (Brébisson in Kützing) Ralfs in Pritchard, 1861			2.3	6.1	
Nitzschia lorenziana Grunow, 1880				2.0	
Nitzschia palea (Kützing) W. Smith, 1856				4.1	
Nitzschia paleacea (Grunow) Grunow in Van Heurck, 1881				4.1	
Nitzschia sp.				6.1	
Nitzschia tenuirostris Mereschkowsky				2.0	
Odontella sinensis (Greville) Grunow, 1884	21.4	4.0			
Paralia sulcata (Ehrenberg) P.T. Cleve, 1873				12.2	
Pauliella sp.				6.1	
Peridiniella danica (Paulsen, 1907) Okolodkov et Dogde, 1995				2.0	
Pleurosira laevis (Ehrenberg) Compère, 1982				2.0	
Proboscia alata (Brightwell) Sundström, 1986	7.1	6.0	77.3	16.3	38.5
Pseudo-nitzschia delicatissima (P.T. Cleve, 1897) Heiden, 1928	7.1	4.0	84.1	93.9	20.4
Pseudo-nitzschia pseudodelicatissima (G.R. Hasle) G.R. Hasle 1993				4.1	
Pseudo-nitzschia pungens (Grunow ex P.T. Cleve, 1897) Hasle, 1993			6.8	4.1	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Pseudo-nitzschia seriata (P.T. Cleve, 1883) H. , M. Peragallo, 1900				4.1	
Pseudosolenia calcar-avis (Schultze) B.G.Sundström, 1986		2.0	40.9	22.4	26.9
Shionodiscus oestrupii (Ostenfeld) A.J.Alverson, S.H.Kang & E.C.Theriot, 2006					1.3
Skeletonema costatum (Greville) P.T. Cleve, 1878		4.0	47.7	65.3	
Skeletonema subsalsum (A.Cleve) Bethge, 1928				4.1	
Stephanodiscus hantzschii Grunow, 1880		6.0	2.3	6.1	
Stephanodiscus sp.				2.0	
Striatella delicatula (Kützing) Grunow ex Van Heurck, 1881	7.1				
Synedra crystallina (C.Agardh) Kützing, 1844				4.1	
Synedra curvata Proshkina-Lavrenko				2.0	
Synedra sp.		2.0		4.1	
Tabularia fasciculata (C.Agardh) D.M.Williams & Round, 1986			2.3	32.7	
Tabularia parva (Kützing) D.Williams , Round				4.1	
Thalassionema nitzschiooides (Grunow, 1862) Van Heurck, 1896	14.3	16.0	6.8	6.1	10.3
Thalassiosira nordenskioldii P.T. Cleve, 1873				2.0	
Thalassiosira parva Proshk.-Lavr., 1955			2.3	18.4	
Thalassiosira sp.			4.5		19.2
Chlorodendrophyceae					
Tetraselmis sp.			2.3	2.0	
Chlorophyceae					
Acutodesmus acuminatus (Lagerheim) Tsarenko, 2001		2.0	4.5	2.0	
Acutodesmus obliquus (Turpin) Hegewald & Hanagata, 2000				2.0	
Chlamydomonas sp.				2.0	
Chlorophyceae gen. sp.			6.8	20.4	
Desmodesmus armatus (R.Chodat) E.Hegewald, 2000				4.1	
Kirchneriella lunaris (Kirchner) K. Möbius, 1894				4.1	
Monoraphidium arcuatum (Korshikov) Hindák, 1970			2.3	24.5	
Monoraphidium contortum (Thuret) Komárková-Legnerová, 1969			63.6	85.7	
Monoraphidium griffithii (Berkeley) Komárková-Legnerová, 1969				10.2	
Monoraphidium komarkovae Nygaard, 1979				4.1	
Monoraphidium sp.				4.1	
Oocystis borgei J. Snow, 1903				2.0	
Raphidocelis danubiana (Hindák) Marvan, Komárek & Comas, 1984				8.2	
Scenedesmus ellipticus Corda, 1835				2.0	
Scenedesmus quadricauda (Turpin) Brébisson in Brébisson , Godey, 1835				8.2	
Scenedesmus sp.				2.0	
Tetrastrum elegans Playfair, 1917				6.1	
Trachelomonas sp.	14.3	10.0			
Trachelomonas volvocina (Ehrenberg) Ehrenberg, 1834	21.4	2.0			
Treubaria crassispina G.M.Smith 1926			4.5		
Chrysophyceae					
Chromulina sp.			2.3		
Dinobryon balticum (Schütt) Lemmermann, 1900			6.8	4.1	
Dinobryon faculiferum (T.Willén) T.Willén, 1992			4.5		7.7
Ochromonas oblonga N.Carter, 1937			2.3		
Ollicola vangoorii (W.Conrad) Vørs, 1992				16.3	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Cryptophyceae					
<i>Cryptomonas</i> sp.					47.4
<i>Cryptophyceae</i> gen. sp.				2.0	
<i>Hillea fusiformis</i> (Schiller) Schiller, 1925			4.5	85.7	
<i>Plagioselmis prolonga</i> Butcher ex G.Novarino, I.A.N.Lucas , S.Morrall, 1994			6.8	22.4	
<i>Plagioselmis</i> sp.			13.6	22.4	
Cyanophyceae					
<i>Anabaena</i> sp.				6.1	
<i>Anabaenopsis</i> sp.				2.0	
<i>Aphanizomenon flos-aquae</i> (Linnaeus) Ralfs ex Bornet , Flahault, 1888				4.1	
<i>Aphanothecae</i> sp.				2.0	
<i>Chroococcus minimus</i> (von Kessler) Lemmermann, 1904				2.0	
<i>Chroococcus minor</i> (Kützing) Nägeli, 1849				10.2	
<i>Chroococcus</i> sp.	28.6	6.0			
<i>Cyanophyceae</i> gen .sp.				4.1	57.7
<i>Gomphosphaeria aponina</i> Kützing, 1836				2.0	
<i>Gomphosphaeria</i> sp.				2.0	
<i>Jaaginema kisselevii</i> (Anissimova) Anagnostidis & Komárek, 1988				26.5	
<i>Limnothrix plantonica</i> (Woloszynska) Meffert, 1988		2.0		8.2	
<i>Merismopedia glauca</i> (Ehrenberg) Kützing, 1844		2.0		2.0	
<i>Microcystis</i> sp.		2.0			
<i>Microcystis aeruginosa</i> (Kützing) Kützing, 1846	7.1			2.0	
<i>Microcystis pulvorea</i> (Wood) Forti in De Toni, 1907 sensu auct.				4.1	
<i>Nodularia spumigena</i> Mertens in Jürgens, 1822				2.0	
<i>Oscillatoria</i> sp.				4.1	
<i>Planktolyngbya limnetica</i> (Lemmermann) J.Komárková-Legnerová , G.Cronberg, 1992				6.1	
<i>Spirulina laxa</i> G.M.Smith, 1916			2.3		
<i>Spirulina</i> sp.			2.3		
<i>Woronichinia</i> sp.				2.0	
Dictyochophyceae					
<i>Apedinella radians</i> (Lohmann) Campbell, 1973				10.2	
<i>Dictyocha fibula</i> Ehrenberg, 1839			6.8		
<i>Dictyocha speculum</i> Ehrenberg, 1839			11.4		3.8
Dinophyceae					
<i>Achradina pulchra</i> Lohmann, 1903				4.1	
<i>Akashiwo sanguinea</i> (K.Hirasaka) G.Hansen , Ø.Moestrup			2.3	6.1	1.3
<i>Alexandrium minutum</i> Halim, 1960				2.0	
<i>Alexandrium</i> sp.			25.0	22.4	52.6
<i>Alexandrium tamarensense</i> (Lebour, 1925) Balech, 1985				2.0	
<i>Amphidinium crassum</i> Lohmann, 1908				6.1	3.8
<i>Amphidinium emarginatum</i> (Diesing) Kofoid & Swezy, 1921					1.3
<i>Amphidinium operculatum</i> Claparède , Lachmann, 1859				2.0	
<i>Amphidinium ovum</i> Herdman, 1924		2.0			
<i>Amphidinium</i> sp.1		34.0	11.4		21.8
<i>Amphidinium</i> sp.2		2.0			
<i>Amphidinium sphenoides</i> Wülff, 1916				11.5	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Aulacoseira islandica (O.Müller) Simonsen, 1979				2.0	
Ceratium tripos (O.F.Müller) Nitzsch, 1817		8.0	2.3		37.2
Cochlodinium sp.		2.0			
Cochlodinium archimedes (Pouchet) Lemmermann, 1899					6.4
Cochlodinium brandtii Wulff, 1916					2.6
Cochlodinium citron Kofoid , Swezy, 1921			4.5	6.1	
Cochlodinium geminatum (Schütt, 1895) Schütt, 1896	7.1	24.0		2.0	
Cochlodinium helicoides Lebour, 1925			2.3		7.7
Cochlodinium pirum (Schütt) Lemmermann, 1921		24.0			
Desmodesmus communis (E.Hegewald) E.Hegewald, 2000				2.0	
Dinophyceae gen. sp.			6.8	4.1	
Dinophysis acuminata Claparède , Lachmann, 1859		4.0	9.1	32.7	7.7
Dinophysis acuta Ehrenberg, 1841			15.9	6.1	32.1
Dinophysis caudata Saville-Kent, 1881					3.8
Dinophysis dentata Schiller, 1928				2.0	
Dinophysis fortii Pavillard, 1923			9.1	2.0	
Dinophysis ovum (F.Schütt) T.H.Abé		2.0			
Dinophysis pulchella (Lebour) Balech, 1967		6.0			
Dinophysis sacculus Stein, 1883			6.8	12.2	
Dinophysis sp.		2.0	6.8	2.0	
Diplopsalis lenticula Bergh, 1881			47.7	38.8	43.6
Durinskia agilis (Kofoid & Swezy) Saburova, Chomérat & Hoppenrath, 2012	7.1	18.0	4.5	4.1	
Glenodinium obliquum Pouchet			2.3		
Glenodinium paululum Lindemann	7.1	4.0	13.6	8.2	
Glenodinium pilula (Ostenfeld) Schiller	14.3	20.0	6.8		
Glenodinium sp.		2.0	4.5	8.2	
Gonyaulax apiculata Entz, 1904					1.3
Gonyaulax cochlea Meunier, 1919		8.0			
Gonyaulax digitalis (Pouchet) Kofoid, 1911					11.5
Gonyaulax minima Matzenauer, 1933		22.0		4.1	
Gonyaulax polygramma Stein, 1883					69.2
Gonyaulax scrippsae Kofoid, 1911	21.4	24.0		2.0	
Gonyaulax sp.		2.0	9.1		
Gonyaulax spinifera (Claparède & Lachmann) Diesing, 1866		2.0			10.3
Gymnodinium sp.		2.0			
Gymnodinium agiliforme Schiller, 1928		6.0	4.5		
Gymnodinium fuscum (Ehrenberg, 1834) Stein, 1883	7.1	10.0	18.2		
Gymnodinium fusus Schütt, 1896	35.7			4.1	
Gymnodinium lacustre Schiller, 1933				6.1	
Gymnodinium najadeum Schiller, 1928		14.0	2.3	24.5	
Gymnodinium rhomboides Schütt, 1895		8.0			
Gymnodinium simplex (Lohmann, 1911) Kofoid , Swezy, 1921			2.3	12.2	47.4
Gymnodinium sp.1			104.5	40.8	78.2
Gymnodinium sp.2			31.8	30.6	
Gymnodinium sp.3			25.0	20.4	
Gymnodinium sp.4			4.5	10.2	
Gymnodinium wulffii Schiller, 1933			18.2	51.0	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Gyrodinium contortum (Schütt, 1895) Kofoid , Swezy, 1921			4.5		
Gyrodinium cornutum (Pouchet, 1885) Kofoid , Swezy, 1921			2.3	8.2	
Gyrodinium fusiforme Kofoid , Swezy, 1921			22.7	22.4	
Gyrodinium fusus (Meunier, 1910) Akselman, 1985			2.3		70.5
Gyrodinium helveticum (Penard) Y.Takano & T.Horiguchi, 2004			2.3		
Gyrodinium lachryma (Meunier, 1910) Kofoid , Swezy, 1921	14.3	2.0	2.3	18.4	2.6
Gyrodinium pellucidum (Wulff) Schiller, 1933		2.0			
Gyrodinium pingue (Schütt, 1895) Kofoid , Swezy, 1921	7.1		18.2		28.2
Gyrodinium pusillum (Schilling) Kofoid , Swezy 1921				4.1	
Gyrodinium sp.				2.0	
Gyrodinium spirale (Bergh) Kofoid & Swezy, 1921					57.7
Heterocapsa triquetra (Ehrenberg, 1840) Stein, 1883	71.4	72.0	15.9	102.0	10.3
Katodinium fungiforme (Anisimova) Loeblich III, 1965			20.5	8.2	
Katodinium glaucum (Lebour, 1917) Loeblich III, 1965			2.3		17.9
Lessardia elongata Saldarriaga , F.J.R.Taylor, 2003			59.1	46.9	
Levanderina fissa (Levander) Ø.Moestrup, P.Hakanen, G.Hansen, N.Daugbjerg & M.Ellegaard, 2015	35.7	36.0		2.0	
Licmophora ehrenbergii (Kützing) Grunow, 1867				2.0	
Lingulodinium polyedrum (Stein, 1883) Dodge, 1989	71.4	34.0	4.5	18.4	1.3
Mesoporus perforatus (Gran) Lillick, 1937		8.0			
Monoraphidium arcuatum (Korshikov) Hindák, 1970			2.3		
Oblea rotunda (Lebour, 1922) Balech, 1964 ex Sournia, 1973			4.5		
Oxyrrhis marina Dujardin, 1841		10.0			
Parvodinium umbonatum F. Stein, 1883			2.3		
Peridiniella danica (Paulsen, 1907) Okolodkov et Dogde, 1995		8.0		14.3	
Peridiniopsis oculatum (F.Stein) Bourrelly, 1968				20.4	
Peridiniopsis penardiforme (Lindemann) Bourrelly, 1968		4.0	6.8		
Peridiniopsis penardii (Lemmermann) Bourrelly, 1968	35.7	4.0	18.2	8.2	
Peridinium cinctum (O.F.Müller) Ehrenberg 1832		12.0			
Peridinium sp.			9.1		5.1
Phalacroma ovatum (Claparède & Lachmann) Jorgensen, 1923		2.0			
Phalacroma rotundata (Claparéde , Lachmann) Kofoid , Michener, 1911	14.3	10.0	4.5	4.1	16.7
Phalacroma sphaeroideum J.Schiller, 1928		2.0			
Pronoctiluca sp.		6.0			
Prorocentrum balticum (Lohmann) Loeblich, 1970					34.6
Prorocentrum caspicum A.Henckel			20.5	2.0	
Prorocentrum compressum (J.W.Bailey) Abé ex J.D.Dodge, 1975		2.0		2.0	38.5
Prorocentrum cordatum (Ostenfeld, 1901) Dodge, 1975	7.1	26.0	75.0	65.3	46.2
Prorocentrum dentatum Stein, 1883		8.0			
Prorocentrum lima (Ehrenberg, 1860) Stein, 1975			2.3		
Prorocentrum micans Ehrenberg, 1834	71.4	34.0	36.4	6.1	56.4
Prorocentrum sp.			9.1		
Prosoaulax lacustris (F.Stein) Calado , Moestrup, 2005				6.1	
Protoceratium reticulatum (Claparède & Lachmann) Bütschli, 1885			2.3		23.1
Protoperidinium bipes (Paulsen, 1904) Balech, 1974	7.1	22.0	2.3	46.9	9.0
Protoperidinium breve Paulsen		2.0			3.8
Protoperidinium brevipes (Paulsen, 1908) Balech, 1974		4.0		8.2	21.8

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
Protoperidinium brochii (Kofoid & Swezy, 1921) Balech, 1974		4.0			1.3
Protoperidinium bulla (Meunier, 1910) Balech, 1974			25.0	2.0	
Protoperidinium claudicans (Paulsen, 1907) Balech, 1974			2.3		
Protoperidinium crassipes (Kofoid, 1907) Balech, 1974	14.3	12.0	2.3		2.6
Protoperidinium depressum (Bailey, 1850) Balech, 1974			4.5	12.2	3.8
Protoperidinium divergens (Ehrenberg, 1841) Balech, 1974		6.0		6.1	9.0
Protoperidinium globulus (Stein, 1883) Balech, 1974		2.0			
Protoperidinium granii (Ostenfeld, 1906) Balech, 1974	14.3	12.0	15.9	22.4	5.1
Protoperidinium knipowitschii (Usachev) Balech 1974					1.3
Protoperidinium pellucidum Bergh, 1882	21.4	18.0	9.1	30.6	
Protoperidinium sp. 1			22.7	10.2	2.6
Protoperidinium sp. 2			4.5	6.1	
Protoperidinium sp.3			4.5		
Protoperidinium steinii (Jörgensen, 1899) Balech, 1974	64.3	16.0	15.9	6.1	34.6
Protoperidinium subinerme (Paulsen) Loeblich III, 1969		10.0			
Scripsiella trochoidea (Stein, 1883) Balech ex Loeblich III, 1965	7.1	44.0	109.1	75.5	94.9
Torodinium teredo (Pouchet) Kofoid & Swezy, 1921					24.4
Tripos declinatus (Karsten) F.Gómez, 2013		20.0		10.2	
Tripos furca (Ehrenberg) F.Gómez, 2013		4.0	34.1	34.7	20.5
Tripos fusus (Ehrenberg) F.Gómez, 2013			6.8	12.2	5.1
Tripos minutus (Jörgensen) F.Gómez, 2013		2.0			
Tripos muelleri Bory de Saint-Vincent, 1824			6.8		
Tripos trichoceros (Ehrenberg) F.Gómez, 2013			2.3		
Dinophyceae					
Akashiwo sanguinea (K.Hirasaka) G.Hansen , Ø.Moestrup	7.1				
Cochlodinium brandtii Wulff, 1916		4.0			
Cochlodinium geminatum (Schütt, 1895) Schütt, 1896	78.6	32.0			
Cochlodinium pirum (Schütt) Lemmermann, 1921	28.6	18.0			
Dinophysis acuta Ehrenberg, 1841	21.4	4.0			
Dinophysis ovum (F.Schütt) T.H.Abé		4.0			
Dinophysis pulchella (Lebour) Balech, 1967	50.0				
Durinskia agilis (Kofoid & Swezy) Saburova, Chomérat & Hoppenrath, 2012	64.3	14.0			
Glenodinium sp.		4.0			
Gonyaulax apiculata Entz, 1904	7.1				
Gonyaulax cochlea Meunier, 1919	28.6	2.0			
Gonyaulax polygramma Stein, 1883	7.1				
Gonyaulax spinifera (Claparède & Lachmann) Diesing, 1866	14.3				
Gymnodinium fusiforme Kofoid & Swezy, 1921	7.1				
Gymnodinium najadeum Schiller, 1928	35.7	8.0			
Gymnodinium rhomboides Schütt, 1895	7.1	4.0			
Gyrodinium fusiforme Koifoid , Swezy, 1921	14.3				
Gyrodinium pellucidum (Wulff) Schiller, 1933	7.1				
Mesoporus perforatus (Gran) Lillick, 1937	21.4	4.0			
Oxyrrhis marina Dujardin, 1841	28.6	6.0			
Peridinium cinctum (O.F.Müller) Ehrenberg 1832	21.4	10.0			
Phalacroma ovatum (Claparède & Lachmann) Jorgensen, 1923		12.0			
Prorocentrum compressum (J.W.Bailey) Abé ex J.D.Dodge, 1975	7.1	4.0		2.0	

Species	OCURRENCE per STATIONS %				
	GE	GE	UA	UA	RF
	Open waters	Shelf	Open waters	Shelf	Open waters
<i>Prorocentrum dentatum</i> Stein, 1883	7.1	4.0			
<i>Protoperidinium brochii</i> (Kofoid & Swezy, 1921) Balech, 1974	7.1				
<i>Protoperidinium globulus</i> (Stein, 1883) Balech, 1974		6.0			
<i>Protoperidinium globulus</i> var. <i>ovatum</i> (Pouchet) Balech, 1974	7.1				
<i>Protoperidinium subinerme</i> (Paulsen) Loeblich III, 1969	14.3	10.0			
<i>Scrippsiella trochoidea</i> (Stein, 1883) Balech ex Loeblich III, 1965	78.6	28.0			
<i>Tripos declinatus</i> (Karsten) F.Gómez, 2013	21.4	6.0			
<i>Tripos furca</i> (Ehrenberg) F.Gómez, 2013	7.1	6.0			
<i>Tripos fusus</i> (Ehrenberg) F.Gómez, 2013	7.1	6.0			
Euglenoidea					
<i>Euglena</i> sp.	21.4	30.0	18.2	20.4	10.3
<i>Euglena viridis</i> (O.F. Müller) Ehrenberg, 1832			11.4	10.2	
<i>Eutreptia lanowii</i> Steuer, 1904			2.3	4.1	
<i>Eutreptia</i> sp.		6.0		2.0	1.3
<i>Monomorphina pyrum</i> (Ehrenberg) Mereschkowski 1877			2.3		
<i>Strombomonas fluviatilis</i> (Lemmermann) Deflandre 1930			2.3		
Prasinophyceae					
<i>Pyramimonas longicauda</i> L.Van Meel, 1969				2.0	
Prymnesiophyceae					
<i>Acanthoica acanthifera</i> Lohmann ex Lohmann, 1913			2.3		
<i>Acanthoica monospina</i> Schiller, 1914				2.0	
<i>Acanthoica quattrospina</i> Lohmann, 1903				4.1	11.5
<i>Acanthoica</i> sp.			2.3	2.0	
<i>Anacanthoica acanthos</i> (Schiller) Deflandre, 1952			9.1	2.0	
<i>Calyptrosphaera</i> sp.			9.1	6.1	
<i>Coccolithus pelagicus</i> (Wallich, 1877) Schiller, 1930			18.2		
<i>Coccolithus</i> sp.			11.4	2.0	
<i>Emiliania huxleyi</i> (Lohmann) Hay , Mohler, 1967			97.7	81.6	87.2
<i>Flagellata</i> sp.				2.0	
<i>Ochromonas oblonga</i> N.Carter, 1937			2.3		
<i>Pontosphaera</i> sp.		4.0			
<i>Pontosphaera nigra</i> (J.Schiller) J.Schiller, 1930				8.2	
<i>Pontosphaera</i> sp.	64.3	48.0	75.0	32.7	
<i>Prymnesiophyceae</i> gen. sp.	92.9	62.0	9.1	32.7	24.4
<i>Syracosphaera</i> sp.			6.8		
Synurophyceae					
<i>Mallomonas</i> sp.		2.0			
Trebouxiophyceae					
<i>Actinastrum hantzschii</i> Lagerheim, 1882				4.1	
<i>Dictyosphaerium</i> sp.				2.0	
<i>Lagerheimia</i> sp.			4.5		
<i>Oocystis</i> sp.				6.1	
Ulvophyceae					
<i>Binuclearia lauterbornii</i> (Schmidle) Proschkina-Lavrenko, 1966			4.5		
<i>Merismopedia minima</i> Beck, 1897				2.0	

Annex 8: List of Zooplankton species

Species composition of zooplankton in different Black Sea areas during RV “Mare Nigrum” (May-June, 2016)

N	TAXON (Species)	NPMS UA	NPMS GE	JOSS
MICROZOOPLANKTON (ciliates and metazoa)				
1	<i>Amphileptus</i> sp.	+		
2	<i>Askenasia stellaris</i> (Eichw., 1852)	+	+	
3	<i>A. regina</i> Earlander & Mont., 2002	+		
4	<i>Balanion comatum</i> (Wulff, 1919)	+	+	+
5	<i>Bursellopsis</i> sp.	+	+	+
9	<i>Chlamyodontidae</i> gen. sp.	+	+	+
7	<i>Cyclidium</i> sp.	+		
8	<i>Didinium</i> sp.	+		
9	<i>Didinium</i> sp. 1		+	
10	<i>Dysteriida</i> fam. gen. sp.		+	
11	<i>Holophrya</i> sp.			+
12	<i>Laboea strobila</i> (Lohm., 1908)	+	+	+
13	<i>Lohmanniella oviformis</i> (Leeg., 1915)	+		+
14	<i>Lynnella semiglobulosa</i> Liu et al., 2011	+	+	+
15	<i>Mesodinium acarus</i> Stein, 1862		+	
16	<i>M. rubrum</i> (Lohm., 1908)	+	+	+
17	<i>Mesodinium</i> sp.	+		+
18	<i>Nolaclusilis</i> sp.	+	+	+
19	<i>Paramecium</i> sp.	+		
20	<i>Pelagostrobilidium conicum</i> (Kahl, 1932) Liu et al., 2012		+	+
21	<i>P. epacrum</i> (Lynn & Mont., 1988) Agatha et al., 2005	+	+	
22	<i>P. spirale</i> (Leeg., 1915)	+	+	+
23	<i>Pelagostrobilidium</i> sp.	+		
24	<i>Pleuronema</i> sp.	+		
25	<i>Pleuronema</i> sp. 1	+	+	
26	<i>Prorodon</i> sp.	+		+
27	<i>Prorodon</i> sp. 1	+		
28	<i>Prorodon</i> sp. 2	+		
29	<i>Rimostrombidium caudatum</i> (Kahl, 1932)			+
30	<i>Strobilidium</i> sp.	+	+	+
31	<i>Strombidinopsis minima</i> Song & Bradb., 1998	+		
32	<i>Strombidium acutum</i> (Leeg., 1915)	+	+	+
33	<i>S. conicooides</i> (Leeg., 1915)	+		
34	<i>S. conicum</i> (Lohm., 1908)	+	+	+
35	<i>S. emergens</i> (Leeg., 1915)	+	+	+
36	<i>S. epidemum</i> Lynn et al., 1988	+	+	+
37	<i>S. rhynchum</i> Lynn et al., 1988	+	+	+
38	<i>S. ventropinnum</i> Martin & Mont., 1993		+	+
39	<i>S. vestitum</i> (Leeg., 1915)	+	+	+
40	<i>S. tintinnodes</i> (?) Entz, 1884			+
41	<i>Strombidium</i> sp.	+		
42	<i>Strombidium</i> sp. 1		+	
43	<i>Tiarina fusus</i> (Clap. & Lachm., 1857)	+		+
44	<i>Tintinnidium mucicola</i> (Clap. & Lachm., 1858)	+		

N	TAXON (Species)	NPMS UA	NPMS GE	JOSS
45	<i>Tintinnopsis minuta</i> Wailes, 1925	+		
46	<i>T. baltica</i> Brandt, 1896		+	+
47	<i>T. karajacensis</i> Brandt, 1908	+		
48	<i>Tintinnopsis</i> sp.	+		
49	<i>Tintinnina</i> fam. gen. sp. proter stage			+
50	<i>Tontonia</i> sp.		+	+
51	<i>Urotricha globosa</i> Schew., 1893	+	+	
52	<i>Urotricha</i> sp.	+	+	+
53	<i>Urotricha</i> sp. 1	+	+	+
54	<i>Urotricha</i> sp. 2			+
55	<i>Brachionus</i> sp.	+		
56	<i>Synchaeta</i> sp.	+	+	
57	<i>Rotifera</i> unidentified	+	+	
58	<i>Acartia</i> larvae sp.	+	+	+
59	<i>Harpacticoida</i> larvae sp.	+		+
60	<i>Neanthes</i> larvae sp.	+		
61	<i>Oikopleura dioica</i> Fol, 1872			+
62	<i>Polychaeta</i> larvae sp.	+	+	+
63	<i>Veliger</i> spp.	+	+	
64	<i>Ova</i> spp.	+	+	+
	Total	50	35	35

MESOZOOPLANKTON

	HOLOPLANKTON			
	Dinophyceae			
1	<i>Noctiluca scintillans</i> Kofoid & Swezy, 1921	+	+	+
	Hydrozoa			
2	<i>Hydrozoa</i> , planula	+	+	
	Scyphozoa			
3	<i>Aurelia aurita</i> (Linnaeus, 1758), ephyra	+		+
	Ctenophora			
4	<i>Mnemiopsis leidyi</i> (Agassiz, 1865), larvae		+	
	Rotatoria			
5	<i>Keratella quadrata</i> (Müller, 1786)	+		
6	<i>Synchaeta</i> sp.	+		
	Cladocera			
7	<i>Moina micrura</i> Kurz, 1874	+		
8	<i>Penilia avirostris</i> Dana, 1849			+
9	<i>Pleopis polyphaemooides</i> (Leucart, 1859)	+	+	+
10	<i>Pleopis tergestina</i> (Claus, 1877)		+	
11	<i>Podonevadne trigona</i> (G.O. Sars, 1897)	+	+	
	Copepoda			
12	Copepod g.sp., ova		+	
13	Copepod g.sp., nauplii	+	+	+
	Calanoida			
14	<i>Acartia clausi</i> Giesbrecht, 1889	+	+	+
15	<i>Acartia tonsa</i> Dana, 1849	+	+	+
16	<i>Acartia</i> sp. (clausi+tonsa)	+	+	+
17	<i>Calanipeda aquaedulcis</i> (Kritczagin, 1873)		+	
18	<i>Calanus euxinus</i> Hulsemann, 1991	+	+	+

N	TAXON (Species)	NPMS UA	NPMS GE	JOSS
19	<i>Centropages ponticus</i> Karavaev, 1894	+	+	+
20	<i>Euritemora velox</i> (Lilljeborg, 1853)			+
21	<i>Heterocope caspia</i> Sars G.O., 1897	+		+
22	<i>Paracalanus parvus</i> (Claus, 1863)	+	+	+
23	<i>Pseudocalanus elongatus</i> (Boeck, 1865)	+	+	+
Cyclopoida				
24	<i>Cyclopoida</i> gen. sp.	+		+
25	<i>Oithona</i> sp.	+	+	
26	<i>Oithona daviseae</i> (Ferrari F.D. and Orsi, 1984)	+	+	+
27	<i>Oithona similis</i> Claus, 1866			+
28	<i>Oithona nana</i> Giesbrecht, 1893			+
29	<i>Cyclopina gracilis</i> Claus, 1863	+		
Harpacticoida				
30	<i>Harpacticoida</i> , sp.	+		+
Chaetognatha				
31	<i>Parasagitta setosa</i> (Müller, 1847)	+	+	+
Appendicularia				
32	<i>Oikopleura</i> (<i>Vexillaria</i>) <i>dioica</i> Fol, 1872	+	+	+
MEROPLANKTON				
33	<i>Trohophora</i> sp.		+	+
34	<i>Polychaeta</i> g. sp., larvae	+	+	+
35	<i>Cirripedia</i> , nauplii (<i>Amphibalanus improvisus</i> (Darwin, 1854))	+	+	+
36	<i>Misidae</i> g. sp., larvae			+
37	<i>Decapoda</i> g. sp., larvae		+	+
38	<i>Bivalvia</i> g. sp., larvae	+	+	+
39	<i>Gastropoda</i> g. sp., larvae	+	+	
40	<i>Ascidia</i> g. sp., larvae			+
41	<i>Phoronis euxinica</i> , larvae		+	
42	<i>Pisces</i> sp., ova	+	+	+
43	<i>Pisces</i> sp., larvae	+		+
	Total	30	29	29

Annex 9: List of Macrozoobenthos species

LIST OF MACROZOOBENTHIC SPECIES FOUND ON THE UKRAINIAN AND GEORGIAN BLACK SEA SHELF DURING NATIONAL PILOT MONITORING SURVEY (NPMS UA, GE), 2016

Responsible: Adrian TEACA, NIRD GeoEcoMar

Contributors: GeoEcoMar (Inter-comparison station NPMS UA 02 UA, GE); UkrSCES (UA, Inter-comparison station NPMS UA 02, UA); IMB (UA, Inter-comparison station NPMS UA 02, UA, GE); NEA (Inter-comparison station NPMS UA 02, UA, GE); ONU (Inter-comparison station NPMS UA 02, UA)

Legend: UA - Ukrainian National Pilot Monitoring Study Sites (15 stations), GE - Georgian National Pilot Monitoring Study Sites (11 stations), Inter-comparison station NPMS UA 02

GEM - National Research and Development Institute for Marine Geology and Geoecology - GeoEcoMar, Bucharest/Constanta, Romania

UkrSCES - Ukrainian Scientific Center of Ecology of the Sea, Odessa, Ukraine

IMB - Institute of Marine Biology, Odessa, Ukraine

ONU - Odessa I.I.Mechnikov National University, Odessa, Ukraine

NEA - National Environmental Agency, Batumi, Georgia

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
PORIFERA								
<i>Suberites prototypus</i> Czerniavsky, 1880							+	
CNIDARIA								
<i>Bougainvillia muscus</i> (Allman, 1863)							+	
<i>Edwardsia</i> sp.							+	
<i>Corymorpha nutans</i> M. Sars, 1835							+	
<i>Clytia hemisphaerica</i> (Linnaeus, 1767)	+	+						
<i>Gonothryaea loveni</i> (Allman, 1859)	+	+						
<i>Hartlaubella gelatinosa</i> (Pallas, 1766)	+	+					+	
<i>Laomedea angulata</i> Hincks, 1861	+	+						
<i>Obelia longissima</i> (Pallas, 1766)	+	+		+			+	
<i>Opercularella lacerata</i> (Johnston, 1847)	+	+						
Hydrozoa g.spp.	+		+					
<i>Actinia equina</i> (Linnaeus, 1758)	+						+	
<i>Sagartia elegans</i> (Dalyell, 1848)	+							
<i>Sagartiogeton undatus</i> (Müller, 1778)	+						+	
<i>Pachycerianthus solitarius</i> (Rapp, 1829)							+	
PLATYHELMINTHES								
<i>Leptoplana tremellaris</i> (Müller OF, 1773)	+	+					+	
<i>Notoplana</i> sp.	+	+						
<i>Stylochus (Stylochus) tauricus</i> Jacubowa, 1909	+	+						
Platyhelminthes g. spp.	+		+	+	+	+		
NEMERTEA								
<i>Amphiporus</i> sp.							+	
<i>Carinina heterosoma</i> Müller, 1965	+	+					+	
<i>Micrura fasciolata</i> Ehrenberg, 1828	+	+						

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
<i>Nemertea</i> g.spp.	+	+	+	+	+	+	+	
ANNELEIDA								
<i>Alitta succinea</i> (Leuckart, 1847)	+						+	
<i>Amphitritides gracilis</i> (Grube, 1860)	+			+	+		+	
<i>Aonides paucibranchiata</i> Southern, 1914	+	+					+	
<i>Aricidea (Strelzovia) claudiae</i> Laubier, 1967	+					+	+	
<i>Aricidea (Aricidea) pseudoarticulata</i> Hobson, 1972	+					+		Questionable, need for further investigation [4]
<i>Capitella minima</i> Langerhans, 1881							+	
<i>Capitella "capitata"</i> (Fabricius, 1780)	+	+	+	+	+	+	+	Stands for a group of species [1, 2, 3, 4]
<i>Dipolydora quadrilobata</i> Jacobi, 1883	+	+		+	+		+	
<i>Eunereis longissima</i> (Johnston, 1840)							+	
<i>Exogone naidina</i> Örsted, 1845							+	
<i>Eulalia viridis</i> (Linnaeus, 1767)	+	+		+				
<i>Fabricia stellaris</i> (Müller, 1774)	+					+	+	
<i>Genetyllis tuberculata</i> (Bobretzky, 1868)	+			+	+			Misidentified/Syn. <i>Nereiphylla rubiginosa</i> [1, 2]
<i>Glycera alba</i> (O.F. Müller, 1776)	+		+					
<i>Glycera tridactyla</i> Schmarda, 1861	+	+		+	+	+		
<i>Harmothoe imbricata</i> (Linnaeus, 1767)	+	+	+	+	+	+		
<i>Harmothoe impar</i> (Johnston, 1839)	+	+		+	+	+	+	Misidentified as <i>H. reticulata</i> (Claparède, 1870) [1, 2, 4]
<i>Hediste diversicolor</i> (O.F. Müller, 1776)	+							
<i>Heteromastus filiformis</i> (Claparede, 1864)	+	+	+	+	+	+	+	
<i>Lagis koreni</i> Malmgren, 1866	+	+			+	+		
<i>Lagis neapolitana</i> (Claparède, 1869)	+			+	+			
<i>Leiochone leiopygosa</i> (Grube, 1860)	+			+	+		+	
<i>Magelona mirabilis</i> (Johnston, 1865)							+	
<i>Magelona minuta</i> Eliason, 1962	+					+	+	Inaccurate <i>M. rosea</i> Moore, 1907 [4]
<i>Melinna palmata</i> Grube, 1870	+					+	+	
<i>Micronephthys stammeri</i> (Augener, 1932)							+	Misidentified as <i>Nephtys cirrosa longicornis</i> Jakubova, 1930 [4]
<i>Microspio mecznikowianus</i> (Claparède, 1869)	+					+		
<i>Myriochele heeri</i> Malmgren, 1867							+	
<i>Mysta picta</i> (Quatrefages, 1866)	+	+	+	+	+	+		
<i>Nephtys hombergii</i> Savigny in Lamarck, 1818	+	+	+	+	+	+	+	
<i>Nereiphylla rubiginosa</i> (Saint-Joseph, 1888)	+	+						
<i>Nereis zonata</i> Malmgren, 1867	+			+			+	
<i>Notomastus profundus</i> (Eisig, 1887)							+	
<i>Notomastus</i> sp.	+					+		
<i>Orbinia</i> sp.							+	
<i>Oriopsis armandi</i> (Claparède, 1864)							+	
<i>Paraonis fulgens</i> (Levinsen, 1884)							+	
<i>Pholoe inornata</i> Johnston, 1839	+	+	+	+	+	+	+	

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
<i>Phyllodoce lineata</i> (Claparède, 1870)							+	
<i>Phyllodoce maculata</i> (Linnaeus, 1767)	+		+			+		
<i>Phyllodoce mucosa</i> Oersted, 1843	+						+	
<i>Platynereis dumerilii</i> (Audouin & Milne Edwards, 1834)	+	+	+	+	+	+	+	
<i>Polycirrus jubatus</i> Bobretzky, 1869	+	+	+				+	
<i>Polydora ciliata</i>	+		+			+		Inaccurate [3, 4]
<i>Polydora cornuta</i> Bosc, 1802	+			+				Misidentified as <i>P. ciliata</i> [3, 4]
<i>Pseudomystides limbata</i> (Saint-Joseph, 1888)							+	
<i>Prionospio multibranchiata</i> Berkeley, 1927*	+	+	+	+	+	+	+	Misidentified as <i>Prionospio cirrifera</i> Wirén, 1883 [1, 2, 3, 4]
<i>Protodrilus flavocapitatus</i> (Ulianin, 1877)	+			+	+			
<i>Pygospio elegans</i> Claparede, 1863	+						+	
<i>Salvatoria limbata</i> (Claparède, 1868)							+	
<i>Salvatoria clavata</i> (Claparede, 1863)	+			+	+			
<i>Sigambra tentaculata</i> (Treadwell, 1941)							+	
<i>Sphaerosyllis bulbosa</i> Southern, 1914	+					+	+	
<i>Sphaerosyllis hystrix</i> Claparède, 1863							+	
<i>Scolelepis (Parascolelepis) tridentata</i> (Southern, 1914)	+							
<i>Spio decoratus</i> Bobretzky, 1870	+	+		+	+	+		Misidentified as <i>Spio filicornis</i> (Müller, 1776) [1, 2, 4]
<i>Spirobranchus triquetus</i> (Linnaeus, 1758)	+	+	+	+		+		
<i>Syllides longocirratus</i> (Örsted, 1845)	+			+	+		+	
<i>Syllis gracilis</i> Grube, 1840							+	
<i>Terebellides stroemii</i> Sars, 1835	+					+	+	
<i>Vermiliopsis infundibulum</i> (Philippi, 1844)	+							
Oligochaeta g.spp.	+	+	+	+	+	+	+	
PHORONIDA								
<i>Phoronis euxinicola</i> Selys-Longchamps, 1907	+	+					+	
MOLLUSCA								
<i>Bela nebula</i> (Montagu, 1803)							+	
<i>Brachystomia scalaris</i> (MacGillivray, 1843)	+						+	
<i>Bittium reticulatum</i> (da Costa, 1778)	+						+	
<i>Bittium submammillatum</i> (de Rayneval & Ponzi, 1854)							+	
<i>Calyptaea chinensis</i> (Linnaeus, 1758)	+						+	
<i>Retusa umbilicata</i> (Montagu, 1803)	+						+	Syn. <i>Cylichna strigella</i> Lovén, 1846 [2]
<i>Hydrobia acuta</i> (Draparnaud, 1805)	+							
<i>Parthenina interstincta</i> (J. Adams, 1797)							+	
<i>Pusillina lineolata</i> (Michaud, 1830)	+	+		+				
<i>Rapana venosa</i> (Valenciennes, 1846)	+	+		+		+	+	
<i>Retusa truncatula</i> (Bruguière, 1792)	+						+	
<i>Retusa sp.</i>	+	+					+	
<i>Retusa variabilis</i> (Milaschewitsch, 1912)							+	
<i>Rissoa parva</i> (da Costa, 1778)	+				+			

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
<i>Tritia neritea</i> (Linnaeus, 1758)							+	
<i>Tritia reticulata</i> (Linnaeus, 1758)							+	
<i>Trophonopsis breviata</i> (Jeffreys, 1882)							+	
<i>Abra alba</i> (W. Wood, 1802)	+					+	+	
<i>Abra nitida</i> (O. F. Müller, 1776)	+						+	Inaccurate [1]
<i>Abra prismatica</i> (Montagu, 1808)	+							Misidentified as <i>A. nitida</i> [1]
<i>Acanthocardia paucicostata</i> (G. B. Sowerby II, 1834)	+						+	
<i>Acanthocardia tuberculata</i> (Linnaeus, 1758)							+	Possibly misidentified as <i>A. paucicostata</i> [4]
<i>Anadara kagoshimensis</i> (Tokunaga, 1906)	+	+					+	Inaccurate as <i>A. inaequivalvis</i> (Bruguière, 1789) [1, 2, 4]
<i>Arca tetragona</i> Poli, 1795	+					+	+	Questionable, need for further investigation [4]
<i>Cerastoderma glaucum</i> (Bruguière, 1789)	+		+					
<i>Chamelea gallina</i> (Linnaeus, 1758)	+				+		+	
<i>Donax semistriatus</i> Poli, 1795							+	
<i>Donax trunculus</i> Linnaeus, 1758							+	
<i>Gastrana fragilis</i> (Linnaeus, 1758)	+							
<i>Gibbomodiola adriatica</i> (Lamarck, 1819)	+	+	+	+				
<i>Gouldia minima</i> (Montagu, 1803)	+						+	
<i>Kurtiella bidentata</i> (Montagu, 1803)	+	+	+	+	+			
<i>Lentidium mediterraneum</i> (O. G. Costa, 1830)	+					+	+	
<i>Loripes orbiculatus</i> Poli, 1791	+							
<i>Lucinella divaricata</i> (Linnaeus, 1758)	+	+					+	
<i>Modiolula phaseolina</i> (Philippi, 1844)							+	
<i>Mya arenaria</i> Linnaeus, 1758	+	+	+		+			
<i>Mytilaster lineatus</i> (Gmelin, 1791)	+	+	+	+	+	+	+	
<i>Mytilus galloprovincialis</i> Lamarck, 1819	+	+	+	+	+	+	+	
<i>Papillocardium papillosum</i> (Poli, 1791)							+	
<i>Parvicardium exiguum</i> (Gmelin, 1791)	+	+			+	+	+	
<i>Pitar rudis</i> (Poli, 1795)	+	+	+	+	+	+	+	
<i>Parvicardium simile</i> (Milaschewitsch, 1909)	+						+	Syn. <i>Plagiocardium simile</i> (Milaschewitsch, 1909) [1, 2]
<i>Polititapes aureus</i> (Gmelin, 1791)	+			+			+	
<i>Fabulina fabula</i> (Gmelin, 1791)	+					+	+	Syn. <i>Tellina fabula</i> Gmelin, 1791 [4]
<i>Spisula subtruncata</i> (da Costa, 1778)	+						+	
BRYOZOA								
<i>Conopeum seurati</i> (Canu, 1928)							+	
<i>Electra</i> sp.							+	
ARTHROPODA								
<i>Amphibalanus improvisus</i> (Darwin, 1854)	+	+	+	+	+	+		
<i>Ampelisca sarsi</i> Chevreux, 1888	+	+					+	
<i>Ampelisca diadema</i> (Costa, 1853)	+			+	+	+	+	
<i>Apherusa bispinosa</i> (Bate, 1857)	+	+	+				+	
<i>Dexamine spinosa</i> (Montagu, 1813)	+	+	+		+			

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
<i>Caprella acanthifera</i> Leach, 1814	+							
<i>Cardiophilus baeri</i> G.O. Sars, 1896	+							
<i>Gammarus insensibilis</i> Stock, 1966	+	+						
<i>Melita palmata</i> (Montagu, 1804)	+	+	+	+	+			
<i>Medicorophium runcincorne</i> (Della Valle, 1893)							+	
<i>Microdeutopus algicola</i> Della Valle, 1893							+	
<i>Microdeutopus anomalus</i> (Rathke, 1843)	+	+						
<i>Microdeutopus damnoniensis</i> (Bate, 1856)	+					+	+	Questionable, need for further investigation [1]
<i>Microdeutopus gryllotalpa</i> Costa, 1853	+	+	+					
<i>Microdeutopus versiculatus</i> (Bate, 1857)	+	+						
<i>Nototropis guttatus</i> Costa, 1853	+	+				+		
<i>Orchomene humilis</i> (Costa, 1853)	+						+	
<i>Periocolodes longimanus</i> (Bate & Westwood, 1868)	+	+					+	
<i>Phtisica marina</i> Slabber, 1769	+	+		+	+	+	+	
<i>Gnathia</i> sp.							+	
<i>Stenosoma capito</i> (Rathke, 1837)	+	+	+	+	+	+	+	
<i>Cumella (Cumella) pygmaea euxinica</i> Bacescu, 1950	+	+				+		
<i>Cumopsis goodsir</i> (Van Beneden, 1861)	+							
<i>Eudorella truncatula</i> (Bate, 1856)							+	
<i>Iphinoe elisae</i> Băcescu, 1950	+				+	+	+	
<i>Iphinoe maeotica</i> Sowinsky, 1893							+	
<i>Iphinoe tenella</i> Sars, 1878	+	+	+	+	+			
<i>Pseudocuma (Pseudocuma) longicornue</i> (Bate, 1858)							+	
<i>Gastrosaccus sanctus</i> (Van Beneden, 1861)	+	+						
<i>Paramysis (Longidentia) kroyeri</i> (Czerniavsky, 1882)							+	
<i>Paramysis (Pseudoparamysis) pontica</i> Bacescu, 1940	+						+	
<i>Apseudopsis ostroumovi</i> Băcescu & Carausu, 1947	+							
<i>Stenosoma capito</i> (Rathke, 1837)	+							
<i>Athanas nitescens</i> (Leach, 1813 [in Leach, 1813-1814])	+	+	+	+	+	+		
<i>Brachynotus sexdentatus</i> (Risso, 1827)	+						+	
<i>Carcinus aestuarii</i> Nardo, 1847	+				+			
<i>Diogenes pugilator</i> (Roux, 1829)	+				+	+	+	
<i>Liocarcinus vernalis</i> (Risso, 1827)	+							Misidentified as <i>L. holsatus</i> (Fabricius, 1798) [1]
<i>Liocarcinus navigator</i> (Herbst, 1794)	+				+	+		
<i>Palaemon elegans</i> Rathke, 1837	+	+						
<i>Pestarella candida</i> (Olivi, 1792)	+				+		+	
<i>Pilumnus hirtellus</i> (Linnaeus, 1761)	+							
<i>Pisidia longimana</i> (Risso, 1816)	+							
<i>Upogebia pusilla</i> (Petagna, 1792)							+	
ECHINODERMATA								
<i>Amphiura stepanovi</i> Djakonov, 1954	+						+	

Taxa	UA	Inter-comparison station					GE	Taxonomical issues
		GEM	ONU	IMB	UkrSCES	NEA		
<i>Leptosynapta inhaerens</i> (O.F. Müller, 1776)							+	
<i>Oestergrenia digitata</i> (Montagu, 1815)							+	
<i>Stereoderma unisemita</i> (Stimpson, 1851)							+	Questionable, need for further investigation [4]
Holothuroidea g.spp.							+	
TUNICATA								
<i>Ascidia aspersa</i> (Muller, 1776)	+						+	
<i>Ciona intestinalis</i> (Linnaeus, 1767)	+							
<i>Eugyra adriatica</i> Drasche, 1884							+	
<i>Molgula appendiculata</i> Heller, 1877							+	
TOTAL		137	62	33	42	44	47	12 0
TOTAL TAXA	187							

WoRMS Editorial Board (2017). World Register of Marine Species. Available from <http://www.marinespecies.org> at VLIZ. Accessed 2017-02-02. doi: 10.14284/170

WoRMS Editorial Board (2017). World Register of Marine Species. Available from <http://www.marinespecies.org> at VLIZ. Accessed 2017-02-03. doi: 10.14284/170

[1] - reported by UkrSCES

[2] - reported by IMB

[3] - reported by ONU

[4] - reported by NEA

* Until recently, *P. cirrifera* or *P. multibranchiata* has been widely reported from the Mediterranean and Black seas. However, Dagli and Çinar, (2011) recently described it from Turkey as being in fact a new species *Prionospio (Minuspio) maciolekae* Dagli & Çinar, 2011 which is probably a native inhabitant of the Mediterranean and Black Sea region. However, until new studies based on genetic analysis, we keep the old nomenclature of the species as *P. multibranchiata*.

Dagli, E.; Çinar, M. E. 2011. Species of the subgenus Minuspio (Polychaeta: Spionidae: Prionospio) from the southern coast of Turkey (Levantine eastern Mediterranean), with the description of two new species. Zootaxa (3043).

Inaccurate: taxon was cited for this area but it is clear that it does not live there (misidentification, wrong label, etc.)

Annex 10: List of Macrophytobenthos species

(Systematic position, ecological activity of populations - S/W_p, m²·kg⁻¹, distribution on the nationals sampling sites)

Species	S/W _p , m ² ·kg ⁻¹	Ukraine				Georgia		Russia Federation			
		Odessa coast (Biostation)	Zernov's Phyllophora Field, NPMS (St.9,10)	Dniester region, NPMS (St.2)	Damping region, NPMS (St.14)	Batumi coast (Green Cape)	Batumi coast (Sarpi)	Sochi region, Sochi	Sochi region, NPMS II (St.11)	Kerch strait, NPMS I (St.13)	Kerch strait, Taman
1	2	3	4	5	6	7	8	9	10	11	12
Chlorophyta											
<i>Ulva intestinalis</i> (Linnaeus) Nees = <i>Enteromorpha intestinalis</i> (L.) Link.	36,1 ± 1,1	+	-	-	-	+	+	+	-	-	+
<i>U. linza</i> Linnaeus = <i>E. linza</i> (L.) G. Ag.	39,0 ± 1,8	+	-	-	-	-	-	-	-	-	+
<i>U. prolifera</i> O. Müller = <i>Enteromorpha prolifera</i> (O.F.Mull.) J. Ag.	52,5 ± 1,5	+	-	-	-	-	-	-	-	-	-
<i>U. compressa</i> L.	34,2 ± 1,7	+	-	-	-	-	-	+	-	-	-
1	2	3	4	5	6	7	8	9	10	11	12
<i>U. flexuosa</i> Wulfen	50,4 ± 1,5	+	-	-	-	-	-	-	-	-	-
<i>U. rigida</i> C. Agardh	36,4 ± 1,6	-	-	-	-	+	-	+	-	-	-
<i>Chaetomorpha aerea</i> (Dillw.) Kutz.	28,3 ± 0,6	-	-	-	-	-	-	+	-	-	+
<i>Cladophora vagabunda</i> (Linnaeus) Hoek	47,8 ± 3,8	+	-	-	-	+	+	-	-	-	-
<i>C. albida</i> (Huds.) Kütz.	109,6 ± 3,9	+	+	-	-	-	-	+	-	+	-
<i>C. liniformis</i> Kützing	88,1 ± 3,4	-	-	-	+	-	-	-	-	-	-
<i>C. laetevirens</i> (Dillw.) Kütz.	60,8 ± 2,9	+	-	-	-	-	-	-	-	-	+
<i>C. vadorum</i> (Areschoug) Kützing	41,3 ± 1,9	-	-	+	-	-	-	-	-	-	-
<i>Bryopsis plumosa</i> (Huds.) Ag.	47,6 ± 2,6	+	-	-	-	-	-	-	-	-	-
<i>B. hypnoides</i> J.V. Lamouroux	72,8 ± 2,9	-	-	+	-	-	-	-	-	-	-
<i>Ulothrix implexa</i> Kutz.	219,4 ± 5,2	+	-	-	-	-	-	-	-	-	-
<i>U. flacca</i> (Dillwyn) Thur.	287,3 ± 7,2	+	-	-	-	-	-	-	-	-	-
<i>Rhizoclonium implexum</i> (Dillwyn) Kutz.	219,4 ± 5,2	+	-	-	-	-	-	-	-	-	-
<i>Ulvella leptochaete</i> (Huber) R.Nielsen, C.J.O'Kelly & B.Wysor = <i>Ectochaete leptochaete</i> (Huber) Wille	427,2 ± 21,5	-	+	-	-	-	-	-	-	-	-
Rhodophyta											
<i>Antithamnion cruciatum</i> (C. Agardh) Nägeli	198,2 ± 16,7	-	+	-	-	-	-	-	-	-	-
<i>Porphyra leucosticta</i> Thuret	63,1 ± 2,4	+	-	-	-	-	-	-	-	-	-
<i>Callithamnion corymbosum</i> (Smith) Lyngbye	165,0 ± 4,1	-	+	-	-	-	-	+	-	-	-

Species	S/W _p , m ² ·kg ⁻¹	Ukraine				Georgia		Russia Federation			
		Odessa coast (Biostation)	Zernov's Phyllophora Field, NPMS (St.9,10)	Dniester region, NPMS (St.2)	Damping region, NPMS (St.14)	Batumi coast (Green Cape)	Batumi coast (Sarpi)	Sochi region, Sochi	Sochi region, NPMS II (St.11)	Kerch strait, NPMS I (St.13)	Kerch strait, Taman
1	2	3	4	5	6	7	8	9	10	11	12
<i>Ceramium diaphanum</i> var. <i>elegans</i> (Roth) Roth = <i>Ceramium elegans</i> Ducl.	26,2 ± 1,2	+	+	+	+	-	-	-	-	-	-
<i>Ceramium virgatum</i> Roth = <i>Ceramium rubrum</i> (Huds.) Ag.	25,7 ± 1,2	+	-	-	-	-	-	-	-	-	-
<i>C. tenuissimum</i> (Lyngb.) J.Ag.	44,6 ± 1,7	+	+	-	-	-	-	-	-	-	-
<i>C. arborescens</i> J.Agardh	27,4 ± 1,8	-	-	-	-	+	+	-	-	-	-
<i>Coccotylus truncatus</i> (Pallas) M.J.Wynne & J.N.Heine	14,7±0,9	-	+	-	-	-	-	-	-	-	-
<i>Colaconema thuretii</i> (Bornet) P.W.Gabrielson = <i>Acrochaetium thuretii</i> (Bornet) Collins & Hervey	398,4 ± 14,5	-	+	-	-	-	-	-	-	-	-
<i>Acrochaetium virgatum</i> (Harvey) Batters = <i>Kylinia virgatula</i> (Harv.) Papenf.	270,8 ± 6,1	+	-	-	-	-	+	-	-	-	+
<i>Gratelupia dicotoma</i> J. Ag.	8,2 ± 0,4	-	-	-	-	+	-	-	-	-	-
<i>Gelidium crinale</i> (Turn.) Lamour	16,6 ± 1,0	-	-	-	-	+	-	+	-	-	-
<i>Lomentaria clavelosa</i> (Lightfoot ex Turner) Gaillon	13,0± 1.17	-	+	+	-	-	-	-	-	-	-
<i>Nemalion helminthoides</i> (Vell.) Batt	5,7 ± 0,2	-	-	-	-	+	-	-	-	-	-
<i>Phyllophora crispa</i> (Hudson) P.S.Dixon	11,2±0,6	-	+	-	-	-	-	-	-	-	-
<i>Pneophyllum fragile</i> Kützing = <i>Melobesia lejolisii</i> Rosan	236,5 ± 7,3	-	+	-	-	-	-	-	-	-	-
<i>Polysiphonia denudata</i> (Dillwyn) Greville ex Harvey	56,9 ± 1,9	-	+	-	-	-	-	-	-	-	+
<i>Polysiphonia elongata</i> (Hudson) Sprengel	60,0 ± 12,3	-	-	+	+	-	-	-	-	-	-
<i>Polysiphonia sanguinea</i> (C.Agardh) Zanardini	78,3 ± 2,9	-	+	+	-	-	-	-	-	-	-
<i>Polysiphonia opaca</i> (Ag.) Zanard.	28,2 ± 0,9	-	-	-	-	-	-	+	-	-	-
<i>Polysiphonia subulifera</i> (Ag.) Harv.	21,5 ± 1,9	-	-	-	-	-	-	+	+	-	-
<i>Spermothamnion strictum</i> (C.Agardh) Ardissone	150,5±7,4	-	+	+	-	-	-	-	-	-	-
<i>Sahlingia subintegra</i> (Rosenvinge) Kornmann = <i>Erythrocladia subintegra</i> Rosan.	686,3±40.1	-	+	-	-	-	-	-	-	-	-

Species	S/W_p , $m^2 \cdot kg^{-1}$	Ukraine				Georgia		Russia Federation			
		Odessa coast (Biostation)	Zernov's Phyllophora Field, NPMS (St.9,10)	Dniester region, NPMS (St.2)	Damping region, NPMS (St.14)	Batumi coast (Green Cape)	Batumi coast (Sarpi)	Sochi region, Sochi	Sochi region, NPMS II (St.11)	Kerch strait, NPMS I (St.13)	Kerch strait, Taman
1	2	3	4	5	6	7	8	9	10	11	12
Ochrophyta											
<i>Desmarestia viridis</i> (O.F.Müller) J.V.Lamouroux	$76,7 \pm 3,6$	-	+	+	-	-	-	-	-	-	-
<i>Chorda tomentosa</i> Lyngbye	$82,2 \pm 4,3$	-	-	+	-	-	-	-	-	-	-
<i>Ectocarpus siliculosus</i> (Dillw.) Lyngb. = <i>Ectocarpus confervoides</i> (Roth) Le Jolis	$123,1 \pm 4,8$	+	+	+	+	-	+	-	-	-	-
<i>Feldmannia irregularis</i> (Kützing) G.Hamel	$172,9 \pm 4,1$	-	+	+	+	-	-	-	-	-	-
<i>Punctaria latifolia</i> Grev.	$22,8 \pm 1,7$	+	-	-	-	-	-	-	-	-	-
<i>Cystoseira bosphorica</i> Sauvageau	$8,7 \pm 0,25$	-	-	-	-	-	+	-	-	-	+
<i>C. barbata</i> (Stackhouse) C.Agardh	$9,4 \pm 0,8$	-	-	-	-	-	+	+	+	-	+
<i>Sphaelaria cirroza</i> (Roth) C.Agardh	$95,0 \pm 1,8$	-	+	-	+	-	-	-	-	-	-
<i>Striaria attenuana</i> (Greville) Greville	$37,07 \pm 1,3$	-	+	+	+	-	-	-	-	-	-
Magnoliophyta											
<i>Zostera noltii</i> (Cavol.) Nolte	$19,77 \pm 2,15$	-	-	-	-	-	-	-	-	+	+
Total: 51		19(1)	20(3)	12(1)	7(0)	7(3)	7(3)	10(3)	2(2)	2(1)	9(3)

Sensitive species: $S/W_p = 5-25 m^2 \cdot kg^{-1}$, ESG I, *k*-species

Tolerant species: $S/W_p \geq 25 m^2 \cdot kg^{-1}$, ESG II, *r*-species

Annex 11: Monitoring of priority pollutants and emerging contaminants in the Black Sea

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Part A: Instrumental Methods used and data treatment for target and non-target analysis of seawater, sediment and biota samples

A1. Target screening

1. LC-ESI-MS/MS (QQQ) analyses were conducted by a Thermo UHPLC Accela system interfaced with a Thermo TSQ Quantum Access Triple Quadrupole Instrument (Thermo, San Jose, CA, USA).

Pesticides Analysis

An X-Bridge C18 column (2.1 x 50 mm, 2.5 µm) from WATERS (Dublin, Ireland) preceded by a guard column was used at a constant flow of 100 µL min⁻¹, thermostated at 30°C. The mobile phases consisted of water containing 0.1 % formic acid (v/v) (solvent A) and methanol (solvent B). The gradient program was initialized with 50% B, increased to 100% B in 9 min and then it kept constant for 3 min. Afterwards, the initial conditions were restored within 1.5 min and kept constant for 3.5 min. The injection volume was set up to 5 µL. The ESI probe was operated in Positive Ionization. ESI voltage was set at 4000 V. The sheath gas (N₂) flow rate was set at 40 A.U (Arbitrary Units), the auxiliary gas (N₂) flow rate was set at 20 A.U and the ion transfer capillary temperature was set at 270° C. Data acquisition was performed in multiple reaction monitoring (MRM) mode.

PFCs Analysis

An X-Terra C18 column (2.1 x 100 mm, 3.5 µm) from WATERS (Dublin, Ireland) protected by a guard column was used at a constant flow of 100 µL min⁻¹, thermostated at 30°C. The mobile phases consisted of modified water (1 mM ammonium formate (Solvent A)) and methanol (Solvent B). The adopted gradient program started with 30 % B and it increased to 75 % B in 1.5 min. 100 % B was reached in the following 10.5 min and kept constant for 5 min. Initial chromatographic conditions were restored within 0.6 min and kept constant for 12.4 min. The injection volume was set up to 5 µL. The ESI probe was operated in Negative Ionization. ESI voltage was set at 3500 V. The sheath gas (N₂) flow rate was set at 40 A.U, the auxiliary gas (N₂) flow rate was set at 20 A.U and the ion transfer capillary temperature was set at 270° C. Data acquisition was performed in multiple reaction monitoring (MRM) mode.

2. LC-ESI-QTOFMS analyses were conducted by an ultrahigh-performance liquid chromatographic (UHPLC) system with a HPG-3400 pump (Dionex Ultimate 3000 RSLC, Thermo Fischer Scientific, Dreieich, Germany) coupled to a QTOF mass spectrometer (Maxis Impact, Bruker Daltonics, Bremen, Germany).

Chromatographic separation was performed using an Acclaim RSLC C18 column (2.1 x 100 mm, 2.2 µm) from Thermo Fischer Scientific (Dreieich, Germany) preceded by a guard column of the same packaging material, thermostated at 30°C. For positive ionization mode (PI), the mobile phases were water/methanol 90/10 (solvent A) and methanol (solvent B) both amended with 5 mM ammonium formate and 0.01% formic acid. For negative ionization mode (NI), the mobile phases consisted of water/methanol (solvent A) and methanol (solvent B) both acidified with 5 mM ammonium acetate. The adopted gradient elution program was the same for both ionization modes, starting with 1% B with a flow rate of 0.2 mL min⁻¹ for 1 min and it increased to 39 % in 2 min (flow rate 0.2 mL min⁻¹), and then to 99.9 % (flow rate 0.4 mL min⁻¹) in the following 11 min. Then, it kept constant for 2 min (flow rate 0.48 mL min⁻¹), then initial conditions were restored within 0.1 min, kept for 3 min and then the flow rate decreased to 0.2 mL min⁻¹. The injection volume was 5 µL.

The QTOFMS system was equipped with an electrospray ionization interface (ESI), operating in positive and negative mode, with the following operation parameters: capillary voltage 2500 V (PI) and 3500 (NI); end plate offset, 500 V; nebulizer pressure 2 bar; drying gas 8 L min⁻¹ and gas temperature 200°C. The QTOF MS system was operated in data-independent (broadband collision-induced dissociation (bbCID)) acquisition, as well as in data dependent (Auto MS/MS)

acquisition mode and records spectra over the range m/z 50–1200, with a scan rate of 2 Hz. A QTOFMS external calibration was performed daily with the manufacturer's solution. The instrument provided a typical resolving power (FWHM) between 36,000-40,000 at m/z 226.1593, 430.9137 and 702.8636.

Phthalates Analysis

For phthalates determination only positive ESI analysis was needed.

Phenols Analysis

Both positive and negative ESI analyses were performed for phenols determination. Most of the compounds included in this class are detected as negatively charged ion, except for nonylphenol and octylphenol ethoxylates.

Emerging Contaminants Analysis

Emerging contaminants screening method encompasses up to 2040 compounds . For their detection both positive and negative ESI analyses were performed.

3. ICP-MS analysis was conducted on a Thermo Scientific iCAP RQ ICP-MS for the determination of metals and arsenic. Kinetic energy discrimination (KED) was performed using He for the reduction of interferences. Element-specific internal standards were added constantly with an on-line fast autosampler system.

4. GC-EI-MS/MS analysis was performed with an Agilent 6890N GC equipped with a GERSTEL MultiPurpose Sampler MPS 2 and a GERSTEL Cooled Injection System CIS 4 with a PTV-type inlet coupled to Chromtech Evolution MS/MS triple quadrupole mass spectrometer (built on an Agilent 5975 B inert XL EI/CI MSD system). GC was operated in splitless injection mode and the splitless purge valve was activated 0.75 min after injection. The injection volume was 2 µL. A 30 m Agilent J&W HP-5ms column (0.25 mm i.d. x 0.25 µm film thickness) was used with He as carrier gas in a constant flow of 1.5 mL min⁻¹. The initial PTV-type inlet temperature was 50°C, increasing with a step of 12°C min⁻¹ to 300°C and then hold for 3 min. The GC oven was programmed as follow: 70°C initial hold for 4 min, increase at a rate of 25°C min⁻¹ to 150°C, then increase with a step of 3°C min⁻¹ to 225°C followed by an increase of 10°C min⁻¹ to 310°C and hold for 2 min. The temperature of GC-MS transfer line, MS source and quadrupole was maintained at 300, 230 and 150°C respectively. The data was acquired in SRM mode.

This method was used for the determination of PAHs, OCPs, PCNs and PBDEs including different compound-specific SRM table.

For the determination of organotin compounds, the initial PTV-type inlet temperature was 50°C hold for 0.1 min, increasing with a step of 8°C min⁻¹ to 280°C and then hold for 1 min. The GC oven was programmed as follow: 45°C initial hold for 2 min, increase at a rate of 35°C min⁻¹ to 175°C, then increase with a step of 10°C min⁻¹ to 300°C and hold for 2 min.

5. GC-NCI-MS analysis was performed in an Agilent HP-7890 GC equipped with a Multimode inlet, connected to an Agilent 5975C single quadrupole. The injection volume was 20 µL. A 30 m Agilent J&W HP-5ms column (0.25 mm i.d. x 0.25 µm film thickness) was used with Hydrogen as carrier gas in a constant flow of 1.0 mL min⁻¹. The GC oven was programmed as follows: 60°C initial hold for 5 min, increase at a rate of 20°C min⁻¹ to 170°C, then increase with a step of 5°C min⁻¹ to 270°C and hold for 20 min. The data was acquired in SIM mode.

6. For Dioxins and dioxin-like compounds, **GC-EI-HRMS** Measurements were carried out on the Thermo Scientific DFS high resolution GC/MS system coupled to a Thermo Scientific TRACE GC ULTRA gas chromatograph. GC was operated in pulsed splitless injection mode. The injection volume was 1 µL. A 60 m Agilent J&W DB-5ms column (0.25 mm i.d. x 0.25 µm film thickness) was used with He as carrier gas. The magnetic sector mass spectrometer was automatically calibrated with Perfluorotributylamine prior to each injection.

A2. Non-target screening

Methods – Instrumental Analysis

Extracts were analyzed by three instrumental setups; GC-EI-MS, GC-APCI-QTOFMS and LC-ESI-QTOFMS.

GC-EI-MS analysis was performed with an Agilent 6890N GC equipped with a GERSTEL MultiPurpose Sampler MPS 2 and a GERSTEL Cooled Injection System CIS 4 with a PTV-type inlet coupled to Chromtech Evolution MS/MS triple quadrupole mass spectrometer (built on an Agilent 5975 B inert XL EI/CI MSD system). GC was operated in splitless injection mode and the splitless purge valve was activated 0.75 min after injection. The injection volume was 2 µL. A 30 m Agilent J&W HP-5ms column (0.25 mm i.d. x 0.25 µm film thickness) was used with He as carrier gas in a constant flow of 1.5 mL min⁻¹. The initial PTV-type inlet temperature was 50°C, increasing with a step of 12°C min⁻¹ to 300°C and then hold for 3 min. The GC oven was programmed as follow: 70°C initial hold for 4 min, increase at a rate of 25°C min⁻¹ to 150°C, then increase with a step of 3°C min⁻¹ to 225°C followed by an increase of 10°C min⁻¹ to 310°C and hold for 2 min. The temperature of GC-MS transfer line, MS source and quadrupole was maintained at 300, 230 and 150°C respectively. The data was acquired in full scan mode with a mass range of 50-800 Da.

GC-APCI-QTOFMS analysis was conducted with a Bruker 450 GC equipped with a CP-8400 AutoSampler coupled to a Bruker QTOF-MS mass analyzer (Compact, Bruker Daltonics, Bremen, Germany). GC was operated in splitless injection mode and the splitless purge valve was activated 1 min after injection. The injection volume was 1 µL. A 30 m Restek Rx-5Sil MS column (0.25 mm i.d. x 0.25 µm film thickness) was used with He as carrier gas in a constant flow of 1.5 mL min⁻¹. The GC oven was programmed as follow: 70°C initial hold for 2 min, increase at a rate of 25°C min⁻¹ to 150°C, then increase with a step of 3°C min⁻¹ to 225°C followed by an increase of 10°C min⁻¹ to 300°C and hold for 2 min. The temperature of splitless injector port, GC-MS transfer line and MS source was maintained at 280, 290 and 250°C, respectively. The QTOF mass spectrometer was automatically calibrated with Perfluorotributylamine prior to each injection. MS/MS spectra was generated by an AutoMS/MS acquisition method either in positive or in negative polarity mode. With this method a full scan and the MS/MS spectra of the 5 most abundant ions were acquired. A mass range between 50 and 1000 m/z was scanned and the spectra rate was set at 8 Hz.

LC-ESI-QTOFMS analysis was conducted with a Dionex UltiMate 3000 using RP RSLC an Acclaim RSLC C18 column (2.1 x 100 mm, 2.2 µm) from Thermo Fischer Scientific (Dreieich, Germany) coupled to a Bruker QTOF-MS mass analyzer (Maxis Impact, Bruker Daltonics, Bremen, Germany). For positive ionization, the aqueous phase consisted of H₂O/MeOH 90/10 with 5 mM ammonium formate and 0.01% formic acid and the organic phase was MeOH with 5 mM ammonium formate and 0.01% formic acid. For negative ionization, the aqueous phase consisted of H₂O/MeOH 90/10 with 5 mM ammonium acetate and the organic phase was MeOH with 5 mM ammonium acetate. Gradient for both ionizations for organic phase was 1% (0-1 min), 39% (1-3 min), 99.9% (3-14 min), 99.9% (14-16 min), 1% (16-16.1 min), 1% (16.1-20 min) and flow rate gradient was 0.2 mL min⁻¹ (0-3 min), 0.4 mL min⁻¹ (3-14 min), 0.48 mL min⁻¹ (16-19 min), 0.2 mL min⁻¹ (19.1-20 min). All samples were injected in positive and negative ionization in data-dependent (5 most abundant precursors) and data-independent (full scan collision energy 4 eV and 25 eV) acquisition mode (bbCID mode). The data acquired in data-independent mode were processed using the latest available non-target screening tools and data acquired in data-dependent mode were used for identification purposes. This decision was based on the fact that data-independent files allow more reliable peak picking, since they

contain 1 full scan per 1 second. Calibrant substance (Na Formate and Na Acetate for positive and negative ionization respectively) was injected in the beginning of each chromatographic run.

Methods - Data Treatment

GC-EI-MS

An integrated set of procedures for extracting pure component spectra and related information from the complex chromatograms of GC-EI-MS analyses, was performed with AMDIS software. Afterwards, this information was used to determine whether the components could be identified as one of the compounds represented in a mass spectral library (NIST 08). Particularly, GC-EI-MS data files were deconvoluted according to a set of optimized parameters (component width: 12, resolution: medium, sensitivity: very low and shape requirements: low) to locate all of the separate components present in the samples. Subsequently the extracted spectrum for each component was searched against NIST 08 mass spectral database. The match factor (>700) between the target spectrum and the deconvoluted component spectrum as well as the percentage probability (>60%) of the target proposed structure, were the thresholds that hits must exceed to be reported as tentatively identified compounds. Manual inspection of the tentatively identified compounds was performed to reduce potential false positive identifications.

GC-APCI-QTOFMS and LC-ESI-QTOFMS

The averaged peaks of the calibrant substance were used to recalibrate the whole chromatogram using HPC fitting algorithm, which is embedded in DataAnalysis 4.3. (Bruker Daltonics, Bremen, Germany). This calibration method ensures mass accuracy below 2 mDa during whole chromatographic run for m/z from 50-1200. For exporting files in mzML format, CompassXport 3.0.9.2. (Bruker Daltonics, Bremen, Germany) was used. CompassXport was used instead of ProteoWizard, because the latter was unable to export HPC calibrated chromatograms.

Afterwards, an in-house R-script was used for subtracting the procedural blank from the samples. Peak picking using centwave algorithm (MassSpecWavelet package) with optimized parameters was applied in the subtracted mzML files. For each sample, peaks produced from one compound (isotopes and adducts) were grouped to form components (nontarget package). $[M+H]^+$, $[M+NH_4]^+$, $[M+Na]^+$, $[M+H]^+$ were selected for positive ESI and $[M-H]^-$, $[M+Na-2H]^-$, $[M+K-2H]^-$, $[M+Cl]^-$, $[M+Br]^-$ were selected for negative ESI. Component's molecular ions and one-peak components were matched against the NORMAN SusDat (NORMAN suspect list exchange, <http://www.norman-network.com/datatable>; 9881 substances; excluding 2041 target substances). For this mapping, the following settings were used; mass accuracy below 2 mDa and predicted retention time within window ± 2 min. Predicted retention time derived from QSRR prediction models that were trained on known retention times of >2000 of target compounds. Components were exported to the Data Collection Template (DCT, format can be found in **Part F**) format as established by NORMAN experts and together with the mzML files uploaded in NORMAN Digital Sample Freezing (NDSF) platform (<http://www.norman-data.eu>), sometimes termed also NORMAN non-target screening (NTS) data exchange platform. This pre-processing procedure is depicted in **Fig. A1a**. Moreover, an application for mapping the signals

acquired from the LC-ESI-HRMS analysis was set up (<http://www.norman-data.eu/BS>). This application helped in finding patterns and pollution hotspots as will be later discussed.

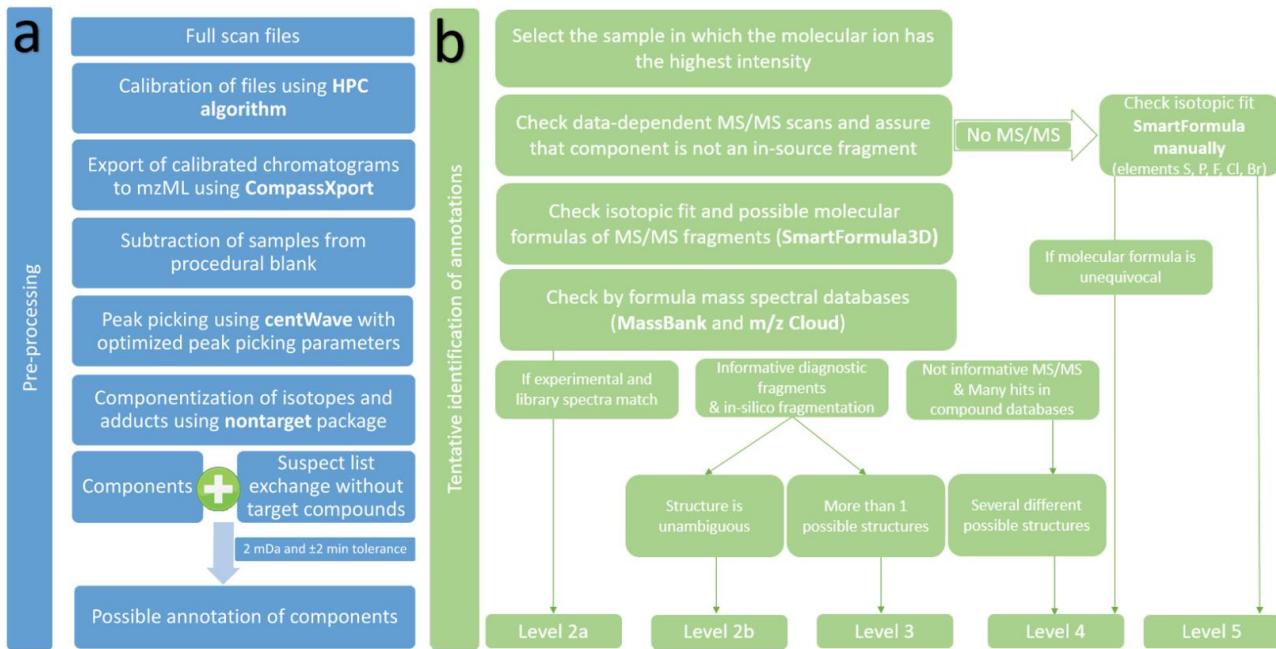


Fig. A1 a) Pre-processing procedure of HRMS files, **b)** Scheme for tentative identification of compounds' annotations.

Annotated components were further investigated, confirmed or rejected (in case of false positive annotations) following the identification scheme presented in **Fig. A1b.**. The following identification levels were followed; Level 2 refers to probable structures (2a in case there is match of experimental with library spectra), level 3 for tentative candidate(s), Level 4 to unequivocal molecular formulas, and level 5 to exact mass(es) of interest [1]. For each annotated component of interest, all samples were searched and the one with the highest intensity was chosen for identification with the help of the NDSF platform. The next step, ensures that the component of interest is not part of another component (in-source fragment). This is proven by the absence of the mass of the component of interest in MS/MS scans of other co-eluting substances. If no MS/MS was obtained for the compound of interest, then unequivocal formula could be reached by mass accuracy (≤ 2 mDa) and isotopic fit ($mSigma \leq 60$) in case mass is low (typically below 250 Da). If there is MS/MS for the annotated substance, fragments of MS/MS were also evaluated for assigning unequivocal molecular formula using SmartFormula3D (Bruker Daltonics, Bremen, Germany). SmartFormula3D assigns possible molecular formulae to the precursor ion based on settings (mass accuracy ≤ 2 mDa, isotopic fit ≤ 60 mSigma, elements $F_0S_0P_0Cl_0Br_0$, even electron configuration) and afterwards assigns possible formulae to fragments (mass accuracy < 2 mDa, isotopic fit ≤ 100 mSigma, elements $F_0S_0P_0Cl_0Br_0$, even or odd electron configuration). SmartFormula3D scores higher the formulae that explain more MS/MS fragments based on neutral losses. In most of the cases, the formula of the possible annotation was in agreement with the formula suggested from SmartFormula manually or SmartFormula3D. Once molecular formula was unequivocal, mass spectral databases were queried for reference spectra (MassBank by formula and m/z Cloud by monoisotopic mass). If no reference spectra existed, MS/MS fragmentation and especially presence of diagnostic fragments (e.g., 149.0233: $C_8H_4O_3^+$ for phthalate esters, 98.9842: $H_3PO_4^+$ for phosphates , 45.0335: $(CH_2CH_2O)^+$, 89.0597: $(CH_2CH_2O)_2^+, 133.0859:$

$(CH_2CH_2O)_3^+$ and 177.1121: $(CH_2CH_2O)_4^+$ for polyethyleneglycol-like surfactants, 118.9926: $(CF_3CF_2)^-$, 168.9894: $(CF_3CF_2CF_2)^-$ for perfluorinated substances, etc.) were used to tentatively identify the compounds. Thus, reaching either level 2B in case structure is unambiguous and level 3 in case there is structural evidence but not enough to end up with one candidate. Metfrag 2.3. was used as *in-silico* fragmentation tool (Database queried: ChemSpider, all rest parameters let to the preselected ones).

Pre-processing and identification scheme applied for GC-APCI-QTOF was similar to that used for LC-ESI-QTOF. One difference was that only adducts $[M^+]$, $[M+H]^+$ and $[M^-]$, $[M-H]^-$ were used for componentization. Moreover, only mass accuracy (below 2 mDa) was used for mapping the NORMAN SusDat to the peak lists, since no retention time prediction models have been developed yet.

Part B: Statistical Analysis of the contaminants detected in seawater, sediment and biota samples

B1: Distribution of contaminants detected in seawaters samples

Table A1. Concentrations of atrazine and simazine (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

Pesticides	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	2013/39/EC Directive EQS (ng/L)	% Frequency of detection
Atrazine	Ukraine	24.3	27.1	4.75	36.8	9.3	600	100
	Open Sea	34.8	34.3	27.9	44.4	4.2		100
	Georgia	31.0	31.4	23.4	42.0	5.3		100
	All samples	30.3	31.5	4.75	44.4	7.4		100
Simazine	Ukraine	27.4	29.0	7.57	47.5	11	1000	100
	Open Sea	38.2	37.3	33.1	48.8	4.3		100
	Georgia	40.8	40.8	29.0	48.7	4.8		100
	All samples	36.4	38.0	7.57	488	8.7		100

Table A2. Concentrations of PFOA (ng/L) in seawater samples from Open Sea and Georgian area, May/June 2016.

PFCs	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	% Frequency of detection
PFOA	Open Sea	1.70	173	0.77	2.65	0.61	70
	Georgia	1.0	1.1	0.6	1.4	0.30	57
	All samples	1.3	1.3	0.6	2.7	0.58	45

Table A3. Concentrations of PAHs (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

PAHs	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/LOQ (ng/L)	2013/39/EC Directive EQS (ng/L)	% Frequency of detection	No. of samples >EQS		
Anthracene	Ukraine	3.4	3.4	1.8	4.9	2.2	0.09/0.28	100	22	-		
	Open Sea	(detected only in JOSS 1 at 1.3 ng/L)							10			
	Georgia	2.2	2.3	1.5	2.7	0.47			36			
	All samples	2.4	2.1	1.3	4.9	1.1			24			
Benzo(a)pyrene	Ukraine	4.3	1.8	<0.21	13.4	5.6	0.07/0.21	0.17	78	6		
	Open Sea	3.0	3.0	0.4	5.6	3.7			20	2		
	Georgia	2.3	0.9	<0.21	8.7	3.6			36	4		
	All samples	3.4	1.2	<0.21	13.4	4.5			42	12		
	Ukraine	4.5	6.1	1.0	6.3	3.0		17*	33	-		

PAHs	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/LOQ (ng/L)	2013/39/EC Directive EQS (ng/L)	%Frequency of detection	No. of samples >EQS		
Benzo(b)fluoranthene	Open Sea	(detected only in JOSS 2 at < LOQ (0.27 ng/L))					0.09/0.27	2013/39/EC Directive EQS (ng/L)	10			
	Georgia	0.3	0.3	<0.27	0.4	0.20						
	All samples	2.4	0.7	<0.27	6.3	3.0						
Benzo(g,h,i)perylene	Ukraine	26.3	18.9	9.6	75.6	23	0.03/0.09	0.82*	78			
	Open Sea	9.1	1.8	0.5	38.3	16			50			
	Georgia	12.7	3.3	<0.09	36.5	15			50			
	All samples	16.8	11.0	<0.09	75.6	19			58			
Benzo(k)fluoranthene	Ukraine	3.7	4.4	0.6	6.1	2.8	0.10/0.31	17*	33			
	Open Sea	(all samples were <LOD)							-			
	Georgia	(detected only in G11 at 0.56 ng/L)							7			
	All samples	2.9	2.5	0.6	6.1	2.8			12			
Fluoranthene	Ukraine	5.5	3.3	0.4	20.1	7.4	0.04/0.12	6.3	67	1		
	Open Sea	2.7	0.7	0.2	11.4	4.8			50			
	Georgia	4.5	2.5	0.6	19.5	5.2			100			
	All samples	4.4	2.4	0.2	20.1	5.6			76			
Indeno(1,2,3-cd)pyrene	Ukraine	14.8	10.0	0.4	38.7	18	0.04/0.13	**	44			
	Open Sea	(detected only in JOSS 25 at 4.72 ng/L)							10			
	Georgia	(detected only in GE 15 at 1.34 ng/L)							7			
	All samples	10.9	3.2	0.4	38.7	15			18			
Naphthalene	Ukraine	39.3	40.9	3.0	73.0	25	0.04/0.13	2000	67			
	Open Sea	(detected only in JOSS 25 at 5.76 ng/L)							10			
	Georgia	15.4	15.0	0.7	40.0	11			79			
	All samples	22.9	20.0	0.7	73.0	20			55			
Acenaphthene	Ukraine	10.5	3.8	<0.13	41.0	15	0.04/0.13	-	67			
	Open Sea	(detected only in JOSS 2 at 3.73 ng/L)							10			
	Georgia	(detected only in GE 11 at 1.03 ng/L)							7			
	All samples	8.4	3.8	<0.13	41.0	14			24			
Fluorene	Ukraine	8.5	8.4	1.2	20.4	6.7	0.03/0.09	-	89			
	Open Sea	5.7	4.6	1.6	11.5	3.9			100			
	Georgia	2.6	2.2	0.8	7.1	1.9			93			
	All samples	5.1	3.2	0.8	20.4	4.7			94			
Phenanthrene	Ukraine	29.3	20.0	1.0	79.4	24	0.09/0.29	-	100			
	Open Sea	18.4	14.0	0.6	45.3	12			100			
	Georgia	47.6	39.1	9.5	87.6	28			100			
	All samples	33.8	24.9	1.0	87.6	26			100			
Pyrene	Ukraine	16.1	11.1	2.0	57.8	21	0.05/0.16	-	67			
	Open Sea	13.7	0.43	0.4	40.3	23			30			
	Georgia	14.8	7.7	1.4	56.1	19			57			
	All samples	15.1	10.4	0.4	57.8	19			52			
Chrysene	Ukraine	6.6	7.1	1.7	10.3	4.1	0.10/0.29	-	44			
	Open Sea	(detected only in JOSS 25 at 6.79 ng/L)							10			
	Georgia	2.0	1.6	0.5	5.2	1.9			50			
	All samples	3.9	2.9	0.5	10.3	3.5			36			

*maximum allowable concentration (MAC)-EQSs are used for chemical status assessment

**Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the corresponding AA-EQS in water.

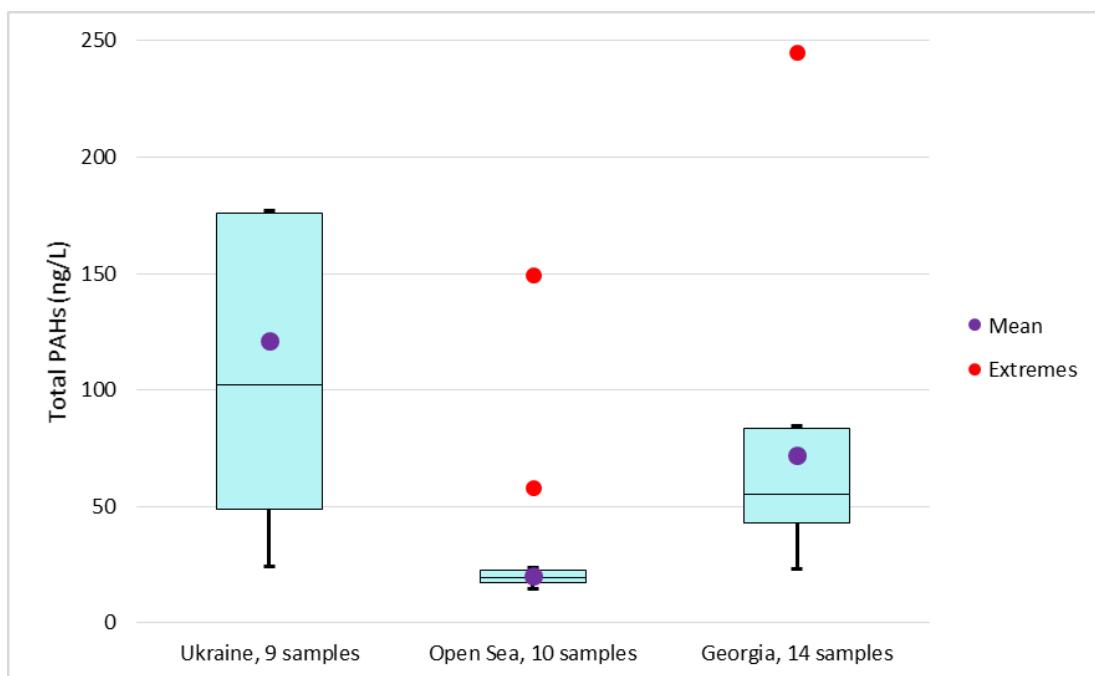


Fig. B1 Box plot of Σ PAHs (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/ June 2016.

Table A4. Concentrations of detected HCH isomers (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/ June 2016.

OCPs	Tested area	Median (ng/L)	Mean (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency detection*	No. of samples >EQS
Sum of γ , β - and δ -HCH	Ukrain	4.87	5.16	<0.23	12.9	4.4	0.11/ 0.33	100	6
	Open Sea	<0.23	<0.23	<0.23	0.27	-		40	0
	Georgia	3.41	4.93	<0.23	16.6	5.3		93	8
	All samples	0.74	3.54	<0.23	16.6	4.6		73	14

*the % frequency of detection refers to β - and δ -HCH isomers detection, since γ - HCH was between LOD and LOQ in all samples.

Table A5. Concentrations of Chloroalkanes, C14-17 (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/ June 2016.

Chloroalkanes	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency of detection
C14-17	Ukraine	4.6	3.9	1.9	11.1	3.7	0.3/ 1.0	56
	Open Sea	11.8	11.0	4.9	16.5	4.8		50
	Georgia	5.8	3.9	3.2	12.4	4.4		29
	All samples	7.5	4.8	1.9	16.5	5.2		42

Table A6. Concentrations of Metals (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

Elements	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency of detection	
Cadmium	Ukraine	(detected <LOQ (50 ng/L) in all tested samples)					15/ 50	100	
	Open Sea	33 (<50)	<50	<50	59	15		80	
	Georgia	(detected <LOQ (50 ng/L) in all tested samples)						100	
	All samples	28 (<50)	<50	<50	59	10		64	
Lead	Ukraine	100	71	30.2	310	87	6/ 20	100	

Elements	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency of detection
	Open Sea	72	45	<20	229	69		100
	Georgia	58	55	22	121	25		100
	All samples	74	55	<20	310	61		100
Nickel	Ukraine	972	934	787	1461	200	30/ 100	100
	Open Sea	857	856	709	1055	104		100
	Georgia	764	739	248	1395	245		100
	All samples	849	819	248	1461	212		100
Arsenic	Ukraine	1280	1268	938	1675	221	100/ 300	100
	Open Sea	1324	1349	970	1632	183		100
	Georgia	1363	1380	451	1982	325		100
	All samples	1329	1349	451	1982	256		100
Chromium	Ukraine	258	256	125	388	73	30/100	100
	Open Sea	177	171	115	273	42		100
	Georgia	171	177	<100	227	47		100
	All samples	196	181	<100	388	65		100
Copper	Ukraine	855	647	435	2025	502	100/ 300	100
	Open Sea	648	652	381	867	175		100
	Georgia	708	539	<300	1796	460		100
	All samples	730	632	<300	2025	406		100
Zinc	Ukraine	5493	4883	2281	15527	4633	500/ 1500	78
	Open Sea	9428	7212	4214	18703	5177		100
	Georgia	12397	9193	2471	32191	9999		100
	All samples	9880	6081	2281	32191	7948		94
Mercury	Ukraine	45.6	25.0	25.0	86.9	36	15/ 50	33
	Open Sea	95	89	<50	250	72		100
	Georgia	40 (<50)	<50	<50	121	30		86
	All samples	63	<50	<50	250	57		76

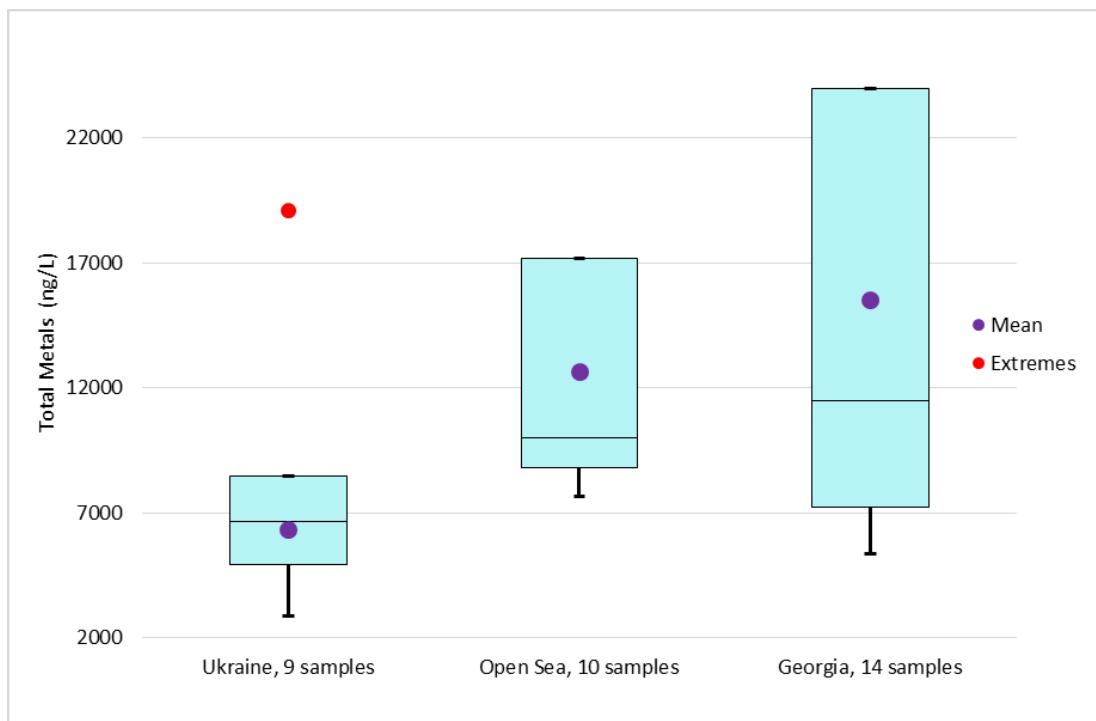


Fig. B2. Box plot of Σ Metals (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/ June 2016.

Table A7. Concentrations of phthalates (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

Phthalates	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency of detection
Phthalate - dimethyl	Ukraine	2.9	2.9	2.0	3.9	0.70	0.42/ 1.4	56
	Open Sea	3.1	3.3	<1.4	4.5	1.1		100
	Georgia	3.6	3.2	2.6	6.0	1.2		57
	All samples	3.2	3.2	<1.4	6.0	1.1		70
Phthalate - diethyl	Ukraine	139 (<180)	<180	<180	260	62	54/ 180	89
	Open Sea	193	200	<180	345	107		90
	Georgia	164 (<180)	<180	<180	367	105		79
	All samples	166 (<180)	<180	<180	367	95		85

Table A8. Concentrations of phenols (ng/L) in seawater samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

Phenols	Tested area	Mean (ng/L)	Median (ng/L)	Min (ng/L)	Max (ng/L)	StdDv (ng/L)	LOD/ LOQ (ng/L)	% Frequency of detection
	Ukraine	61	54	29	129	33	8.8/ 29	89
	Open Sea	61	61	38	98	16		90
	Georgia	72	68	<29	145	38		100
	All samples	66	60	<29	145	32		94
DNP	Ukraine	3.8	4.1	<3.0	5.5	1.5	0.91/ 3.0	100
	Open Sea	5.7	5.5	4.4	7.3	1.0		100
	Georgia	5.5	5.5	3.5	7.0	1.0		100
	All samples	5.1	5.3	<3.0	7.3	1.4		100

B2: Distribution of contaminants detected in sediment samples

Table B1. Concentrations of PAHs (µg/ Kg) in sediment samples from Ukrainian, Open Sea and Georgian area, May/June 2016.

PAHs	Tested area	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	LOD/ LOQ (µg/Kg)	% Frequency of detection
Anthracene	Ukraine	3.4	2.0	<1.05	14.1	4.6	0.35/ 1.05	100
	Open Sea	1.3	0.5	<1.05	2.9	1.4		60
	Georgia	2.2	2.2	<1.05	3.7	1.2		100
	All samples	2.6	2.2	<1.05	14	6.4		89
Benzo(a)pyrene	Ukraine	6.6	4.1	1.3	25	7.6	0.40/ 1.20	100
	Open Sea	(detected only in JOSS3 at <LOQ (1.2 µg/Kg))						20
	Georgia	9.2	8.0	5.6	18	4.5		100
	All samples	7.2	5.6	<1.2	25	6.4		79
Benzo(b)fluoranthene	Ukraine	24	22	4.7	48	15	0.04/ 0.12	100
	Open Sea	6.9	6.5	3.4	11.5	3.3		80
	Georgia	7.2	5.3	3.2	19	5.7		100
	All samples	15	9.2	3.2	49	14		95
Benzo(g,h,i)perylene	Ukraine	16	11	2.8	44	13	0.04/ 0.12	100
	Open Sea	4.8	4.0	1.8	9.3	3.6		80
	Georgia	6.4	5.5	3.1	14	3.9		100
	All samples	11	6.8	1.8	44	10		95
Benzo(k)fluoranthene	Ukraine	18	16	4.5	38	10	0.04/ 0.12	100
	Open Sea	4.2	4.0	2.2	7.9	2.3		100
	Georgia	6.8	4.8	3.7	17	5.0		100
	All samples	11	6.8	2.2	38	9.4		100
Fluoranthene	Ukraine	50	45	11	108	27		100

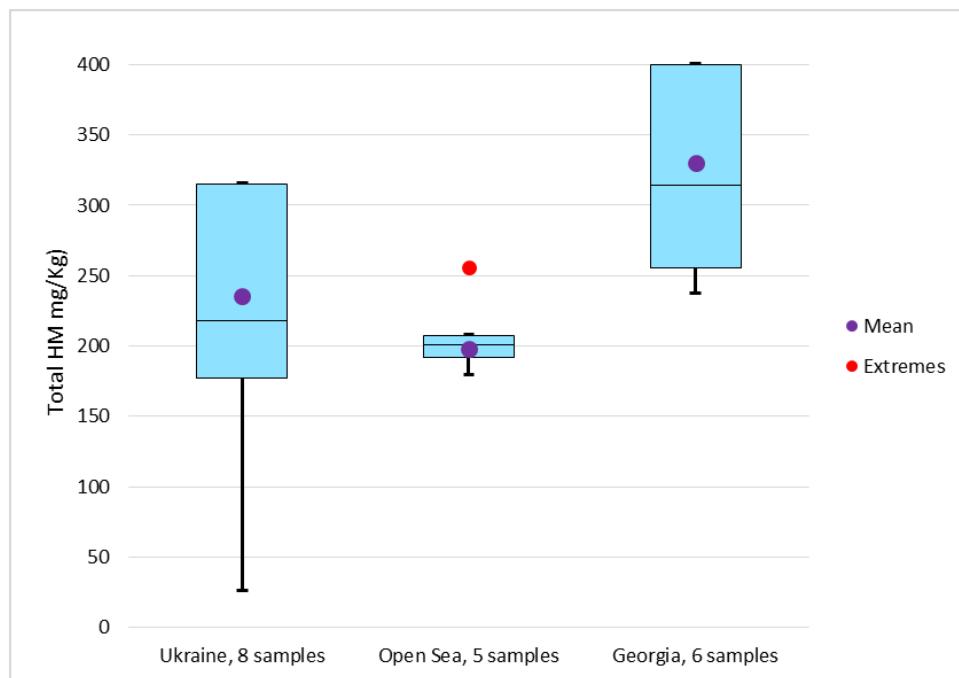
PAHs	Tested area	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	LOD/ LOQ (µg/Kg)	% Frequency of detection
	Open Sea	12.4	10.2	5.4	27	8.2	0.17/ 0.51	100
	Georgia	11	8.3	4.3	26	7.8		100
	All samples	28	14	43	108	27		100
Indeno(1,2,3-cd)pyrene	Ukraine	12	11	3.9	31	8.8	0.04/ 0.12	100
	Open Sea	4.3	3.8	2.9	6.3	1.7		60
	Georgia	7.3	7.1	2.6	14	4.3		100
	All samples	9.1	7.4	2.6	31	7.1		89
Naphthalene	Ukraine	7.3	4.1	0.9	26	8.2	0.13/ 0.38	100
	Open Sea	1.7	1.7	1.3	2.1	0.5		40
	Georgia	5.0	4.0	1.8	8.4	2.9		83
	All samples	5.8	4.0	0.9	26	6.3		79
Acenaphthene	Ukraine	2.5	2.4	0.49	4.9	1.4	0.08/ 0.24	100
	Open Sea	1.1	0.7	0.26	2.9	1.1		100
	Georgia	0.7	0.7	<0.24	1.2	0.5		100
	All samples	1.5	1.1	<0.24	4.9	1.3		100
Benz[a]anthracene	Ukraine	26	27	4.3	52	14	0.50/ 1.50	100
	Open Sea	3.4	3.3	2.0	4.9	1.2		80
	Georgia	9.9	7.4	3.3	25	7.9		100
	All samples	16	9.7	2.0	52	1.3		95
Chrysene	Ukraine	21	21	3.8	32	9.6	0.07/ 0.22	100
	Open Sea	4.3	5.3	1.3	5.6	1.8		100
	Georgia	10	11	3.4	15	4.5		100
	All samples	13	13	05	16	4.4		100
Fluorene	Ukraine	7.6	6.7	0.5	16.0	4.9	0.10/ 0.30	100
	Open Sea	9.8	11	4.5	13	3.3		100
	Georgia	5.5	4.5	0.6	12	4.0		100
	All samples	7.5	6.7	0.5	16	4.4		100
Phenanthrene	Ukraine	29	28	5.5	59	16	1.06/ 3.18	100
	Open Sea	16	13	9.7	31	8.7		100
	Georgia	18	18	5.4	32	9.4		100
	All samples	22	20	5.4	59	13		100
Pyrene	Ukraine	66	64	8.3	134	40	0.38/ 1.13	100
	Open Sea	11	10	7.8	17	3.7		100
	Georgia	15	14	5.9	34	10		100
	All samples	36	17	5.9	134	37		100

Table B2. Concentrations of Heavy Metals and Arsenic (mg/Kg) in sediment samples from Ukrainian, Open Sea and Georgian area, May/ June 2016.

Elements	Tested area	Mean (mg/Kg)	Median (mg/Kg)	Min (mg/Kg)	Max (mg/Kg)	StdDv (mg/Kg)	LOD/ LOQ (mg/Kg)	% Frequency of detection
Cadmium	Ukraine	0.31	0.36	0.04	0.65	0.19	0.0029/ 0.009	100
	Open Sea	0.51	0.65	0.11	0.86	0.31		100
	Georgia	0.21	0.21	0.06	0.34	0.10		100
	All samples	0.35	0.29	0.04	0.86	0.23		100
Lead	Ukraine	25	21	3.3	49.4	16	0.049/ 0.15	100
	Open Sea	13.3	13.5	8.2	17.2	3.6		100
	Georgia	20.4	18.1	13.1	30.7	6.5		100
	All samples	20.4	17.4	3.3	49.4	12		100
Nickel	Ukraine	29	29	3.5	46.7	15	0.18/ 0.55	100
	Open Sea	36.4	34.8	29.8	47.0	6.7		100
	Georgia	35.9	32.3	23.0	59.9	13		100
	All samples	32.9	32.1	3.5	59.9	13		100
Arsenic	Ukraine	10.7	8.7	1.4	24.1	7.0		100

Elements	Tested area	Mean (mg/Kg)	Median (mg/Kg)	Min (mg/Kg)	Max (mg/Kg)	StdDv (mg/Kg)	LOD/ LOQ (mg/Kg)	% Frequency of detection
Chromium	Open Sea	12.0	12.2	10.1	13.5	1.3	0.015/ 0.045	100
	Georgia	16.6	15.8	9.9	24.2	6.3		100
	All samples	12.9	12.2	1.4	24	6.1		100
Copper	Ukraine	49	51	6.1	74	23	0.16/ 0.49	100
	Open Sea	39.2	96.0	24.5	64.5	15		100
	Georgia	46.0	43.1	33.2	75.8	16		100
	All samples	45.3	46.7	6.1	75.8	18		100
Zinc	Ukraine	34	27	4.2	81	24	0.75/ 2.3	100
	Open Sea	39.5	43.1	30.0	46.8	7.5		100
	Georgia	95.1	95.0	26.5	168	55		100
	All samples	54.6	43.1	4.2	169	44		100
Mercury	Ukraine	89	82	7.9	179	55	0.84/ 2.5	100
	Open Sea	68.4	60.3	50.7	90.6	20		100
	Georgia	113	111	95	141	18		100
	All samples	91.2	90.1	7.9	179	41		100

Fig. B3. Box plot of total Heavy Metals plus Arsenic (mg/Kg) in sediment samples from Ukrainian, Open Sea and Georgian area, May/June 2016.



B3: Distribution of contaminants in biota samples

Table C1. Concentrations of PAHs ($\mu\text{g}/\text{Kg}$) in three different biota matrices from Ukrainian and Georgian area, May/June 2016.

PAHs	Analyzed matrix	Mean ($\mu\text{g}/\text{Kg}$)	Median ($\mu\text{g}/\text{Kg}$)	Min ($\mu\text{g}/\text{Kg}$)	Max ($\mu\text{g}/\text{Kg}$)	StdDv ($\mu\text{g}/\text{Kg}$)	2013/39/EC Directive EQS ($\mu\text{g}/\text{Kg}$)	LOD/ LOQ ($\mu\text{g}/\text{Kg}$)	% Frequency of detection
Anthracene	whole body fish	0.50	0.45	0.20	0.91	0.34	-	0.006/ 0.019	100

PAHs	Analyzed matrix	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	2013/39/EC Directive EQS (µg/Kg)	LOD/ LOQ (µg/Kg)	% Frequency of detection		
	fish muscle tissue	0.183	0.183	0.150	0.222	0.027			100		
	mussels muscle	3.0	0.8	0.4	7.8	4.1			100		
Benzo(a)pyrene	whole body fish	0.058	0.061	0.030	0.079	0.020	5	0.004/ 0.011	100		
	fish muscle tissue	0.0202	0.0147	0.012	0.035	0.010			100		
	mussels muscle	0.38	0.46	0.06	0.61	0.28			100		
Benzo(b)fluoranthene	whole body fish	0.0624	0.0618	0.0548	0.0712	0.0079	*	0.016/ 0.049	100		
	fish muscle tissue	<0.049	<0.049	<0.049	<0.049	-			100		
	mussels muscle	0.88	1.18	0.23	1.24	0.57			100		
Benzo(g,h,i)perylene	whole body fish	(<LOD in all samples)					*	0.020/ 0.060	-		
	fish muscle tissue	(<LOD in all samples)							-		
	mussels muscle	0.22	0.26	0.06	0.34	0.14			100		
Benzo(k)fluoranthene	whole body fish	0.0319	0.0307	0.0238	0.0424	0.0083	*	0.006/ 0.017	100		
	fish muscle tissue	0.20	<0.017	<0.017	0.48	0.26			100		
	mussels muscle	0.37	0.47	0.07	0.57	0.27			100		
Fluoranthene	whole body fish	0.6871	0.6871	0.6815	0.6927	0.0079	30	0.018/ 0.053	50		
	fish muscle tissue	0.50	0.48	0.35	0.73	0.14			100		
	mussels muscle	0.79	0.79	0.45	1.12	0.47			67		
Indeno(1,2,3-cd)pyrene	whole body fish	(<LOD in all samples)					*	0.060/ 0.18	-		
	fish muscle tissue	(<LOD in all samples)							-		
	mussels muscle	0.20	0.23	<0.18	0.28	0.10			100		
Naphthalene	whole body fish	0.93	0.73	0.56	1.69	0.52	-	0.059/ 0.18	100		
	fish muscle tissue	0.50	0.54	0.25	0.73	0.18			100		
	mussels muscle	0.67	0.57	0.18	1.25	0.54			100		
Acenaphthene	whole body fish	0.098	0.098	0.086	0.111	0.013	-	0.002/ 0.005	75		
	fish muscle tissue	0.079	0.066	0.058	0.118	0.025			100		
	mussels muscle	0.057	0.043	0.016	0.113	0.050			100		
Benz[a]anthracene	whole body fish	(detected only in the whole fish from Batumi at 0.63 µg/Kg)					-	0.016/ 0.049	25		
	fish muscle tissue	0.030 (<0.049)	<0.049	<0.049	0.051	0.012			100		

PAHs	Analyzed matrix	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	2013/39/EC Directive EQS (µg/Kg)	LOD/LOQ (µg/Kg)	% Frequency of detection
	mussels muscle	0.71	0.94	0.09	1.08	0.53			100
Chrysene	whole body fish	0.483	0.533	0.381	0.537	0.089	-	0.012/ 0.035	75
	fish muscle tissue	0.320	0.318	0.258	0.385	0.053			100
	mussels muscle	2.1	2.5	0.1	3.8	1.9			100
Fluorene	whole body fish	2.3	1.5	0.3	6.1	2.6	-	0.061/ 0.18	100
	fish muscle tissue	1.2	1.2	1.1	1.5	0.17			100
	mussels muscle	1.9	0.8	0.6	4.4	2.1			100
Phenanthrene	whole body fish	3.7	4.4	1.1	5.0	1.8	-	0.020/ 0.060	100
	fish muscle tissue	3.3	3.3	2.8	3.8	0.39			100
	mussels muscle	13	3	2	35	19			100
Pyrene	whole body fish	0.46	0.46	0.29	0.63	0.24	-	0.042/ 0.13	50
	fish muscle tissue	0.57	0.50	0.35	0.96	0.23			100
	mussels muscle	1.14	1.14	0.47	1.80	0.94			67

*Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the corresponding AA- EQS in water.

Table C2. Concentrations of OCPs (µg/Kg) in three different biota matrices From Ukrainian and Georgian area, May/ June 2016.

OCPs	Analyzed matrix	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	LOD/LOQ (µg/Kg)	% Frequency of detection
para-para-DDT	whole body fish	0.32	0.16	<0.12	0.90	0.40	0.04/ 0.12	100
	fish muscle tissue	0.083 (<0.12)	<0.12	<0.12	0.153	0.046		80
	mussels muscle	0.22	0.17	<0.12	0.42	0.18		100
o-p-DDT	whole body fish	1.4	1.2	0.50	2.8	1.1	0.05/ 0.14	100
	fish muscle tissue	0.44	0.18	0.16	1.29	0.48		100
	mussels muscle	1.9	2.6	0.30	2.7	1.4		100
DDE	whole body fish	9.2	9.0	3.8	14.8	4.5	0.03/ 0.09	100
	fish muscle tissue	3.3	2.1	1.9	7.6	2.4		100
	mussels muscle	2.3	0.7	0.60	5.6	2.9		100
DDD	whole body fish	3.23	3.26	2.44	3.96	0.75	0.0037/ 0.011	100
	fish muscle tissue	0.98	0.60	0.51	2.22	0.72		100
	mussels muscle	1.6	1.0	0.40	3.5	1.6		100
Sum of (β-HCH and δ-HCH)*	whole body fish	2.3	2.3	0.20	4.4	3.0	0.05/ 0.15	50
	fish muscle tissue	0.7	0.2	0.20	2.2	1.0		80
	mussels muscle	<LOD in all samples						-

* β-HCH and δ-HCH could not be separated by the instrumental method used, and thus are provided as a sum

Table C3. Concentrations of dioxins and dioxin-like compounds (ng/Kg) in three selected samples from Ukrainian and Georgian area, May/June 2016.

Sample	Class of compounds	Concentration (ng/Kg)	No. of total detected compounds	2013/39/EC Directive EQS (ng/Kg)	
Fish, GE (Batumi), Muscle	Sum-PCDD/F-TEQ	0.159	22	6.5***	
	Sum-PCB-TEQ *	0.472			
	PCB-NDL **	3130			
	Sum of Dioxins and dioxin-like compounds***	0.631			
Round Goby, UA (Odessa bay), Muscle	Sum-PCDD/F-TEQ	0.054	19		
	Sum-PCB-TEQ *	0.071			
	PCB-NDL **	829			
	Sum of Dioxins and dioxin-like compounds***	0.125			
Round Goby,UA (Zmiinyi island), Muscle	Sum-PCDD/F-TEQ	0.045	20		
	Sum-PCB-TEQ *	0.113			
	PCB-NDL **	730			
	Sum of Dioxins and dioxin-like compounds***	0.158			

*included only PCB-DL compounds that are included in 2013/39/EC Directive

**included also PCB-NDL compounds that are not included in 2013/39/EC Directive

***expressed as Sum of PCDD+PCDF+ PCB-DL (0.0065 µg/kg) toxic equivalents (TEQ)

Table C4. Concentrations of Heavy Metals (µg/Kg) in biota samples from Ukrainian and Georgian area, May/ June 2016.

Elements	Analyzed matrix	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	2013/39/EC Directive EQS (µg /Kg)	No of samples >EQS	LOD/ LOQ (µg/Kg)	% Frequency of detection			
Cd	whole body fish	36	34	20	56	18	-	-	2.1/ 6.2	100			
	fish muscle tissue	(detected in 3 samples <LOQ (6.2 µg/Kg))								80			
	mussels muscle	260	191	158	432	149				100			
Pb	whole body fish	(detected in 2 samples <LOQ (167 µg/Kg))					-	-	56/ 167	50			
	fish muscle tissue	(all samples were <LOD)								0			
	mussels muscle	165	196	<167	215	71				100			
Ni	whole body fish	47 (<62)	<62	<62	97	33	-	-	21/ 62	100			
	fish muscle tissue	(detected in 2 samples <LOQ (62 µg/Kg))								40			
	mussels muscle	480	368	310	762	246				100			
Hg	whole body fish	3611	46	<29	14337	7151	20	2	9.6/ 29	100			
	fish muscle tissue	34	<29	<29	91	38		1		80			

Elements	Analyzed matrix	Mean (µg/Kg)	Median (µg/Kg)	Min (µg/Kg)	Max (µg/Kg)	StdDv (µg/Kg)	2013/39/EC Directive EQS (µg /Kg)	No of samples >EQS	LOD/ LOQ (µg/Kg)	% Frequency of detection
	mussels muscle	(all samples were <LOD)						-		100

Part C: Risk Assessment of the contaminants detected through target and non-target analysis in this survey.

C1. Target screening

Table D1. Calculated PNECs of the detected contaminants of this study.

	PNECs (ng/L)		
	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
2,4-Dinitrophenol	1.48×10 ⁴	5.37×10 ³	1.27×10 ³
4-5-Dichloro-2-n-octyl-isothiazol-3(2H)-on (DCOIT)	1.32×10 ³	3.36×10 ²	2.84×10 ²
Acenaphthene	4.85×10 ³	1.81×10 ³	9.28×10 ²
Acesulfame	1.60×10 ⁴	1.56×10 ⁶	1.88×10 ⁶
Adenosine	5.08×10 ⁵	4.60×10 ⁵	8.63×10 ²
Albuterol	1.33×10 ⁵	1.68×10 ⁵	1.80×10 ⁴
Amantadine	1.95×10 ⁴	8.82×10 ⁴	7.78×10 ³
Ametryn	1.82×10 ³	2.03×10 ⁴	30.5
Anabasine	8.67×10 ³	1.43×10 ⁵	5.72×10 ⁴
2-Aminobenzimidazole	8.20×10 ³	9.85×10 ⁴	1.39×10 ³
Amisulpiride	1.97×10 ³	1.90×10 ⁴	1.02×10 ⁴
Amphetamine-2-5-dimethoxy-4-methyl (DOM)	2.64×10 ³	8.70×10 ⁴	2.15×10 ⁴
Antipyrine- 4-Aacetamido	3.62×10 ⁴	6.68×10 ⁴	2.41×10 ⁴
Antipyrine- 4-Formylamino	5.83×10 ⁴	1.75×10 ⁴	1.46×10 ⁴
Apophedrin	9.97×10 ⁴	3.74×10 ⁵	4.90×10 ⁴
Atenolol acid	5.20×10 ⁴	4.61×10 ⁴	5.40×10 ⁴
Atrazine 2-Hydroxy	2.38×10 ⁵	4.25×10 ⁴	3.17×10 ²
Atrazine-desisopropyl	1.39×10 ⁴	2.24×10 ⁵	2.44×10 ²
Azoxystrobin	1.57×10 ³	4.22×10 ²	4.77×10 ²
Bentazone	2.17×10 ⁴	5.16×10 ⁴	1.84×10 ³
Benzenesulfonamide	6.95×10 ³	3.84×10 ⁵	3.71×10 ⁴
benzoic acid	3.49×10 ⁴	1.81×10 ⁵	1.81×10 ⁵
Benzophenone 3	3.15×10 ³	1.37×10 ³	2.46×10 ³
Benzothiazole	1.09×10 ⁴	4.54×10 ⁴	5.97×10 ³
Benzothiazole -2-OH	1.35×10 ⁴	8.58×10 ⁴	4.53×10 ³
Benzothiazole-Mercapto	3.49×10 ³	1.01×10 ⁴	3.85×10 ²
Benzotriazole	1.60×10 ⁴	1.17×10 ⁵	5.91×10 ³
Benzotriazole-1-Hydroxy	3.50×10 ⁴	2.03×10 ⁵	5.15×10 ³
Bisphenol A	5.77×10 ³	2.01×10 ³	6.15×10 ³
Boscalid	425	264	86.2
Caffeine	9.04×10 ⁴	1.77×10 ⁵	1.42×10 ³
Carbamazepine	8.52×10 ³	2.17×10 ⁴	1.13×10 ³

	PNECs (ng/L)		
	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
Carbamazepine-10-hydroxy	9.21×10 ³	1.66×10 ³	282
Carbamazepine-10,11-epoxide	1.41×10 ⁴	2.68×10 ²	155
Carbendazim	8.77×10 ³	8.39×10 ³	2.71×10 ³
Carboxin	4.61×10 ³	4.79×10 ³	5.11×10 ³
Carteolol	1.13×10 ⁵	1.53×10 ⁵	1.53×10 ³
Cathine	5.10×10 ⁴	1.16×10 ⁵	4.75×10 ⁴
Cetirizine	7.39×10 ⁴	1.49×10 ⁵	3.67×10 ³
Chlordimeform	1.09×10 ⁴	8.50×10 ³	1.29×10 ³
Chloridazone	3.09×10 ⁴	7.81×10 ³	3.03×10 ³
Chloridazone-methyl-desphenyl	2.62×10 ⁴	1.51×10 ⁵	1.15×10 ⁴
Chlorotoluron	1.88×10 ⁴	1.71×10 ⁴	1.88×10 ⁴
Chrysene	56.2	62.8	14.4
Climbazole	1.99×10 ³	556	507
Clobenzepam	3.17×10 ³	1.60×10 ³	52.9
Clopidogrel	2.60×10 ⁴	2.45×10 ³	1.58×10 ⁴
Clopidogrel Carbon acid	2.82×10 ⁴	5.28×10 ³	9.45×10 ³
Clozapine	1.98×10 ⁴	3.10×10 ³	1.01×10 ³
Cotinine	4.77×10 ⁴	2.11×10 ⁵	9.41×10 ³
Cotinine-Hydroxy	8.13×10 ⁴	1.90×10 ⁵	9.70×10 ³
Crotamiton	6.03×10 ³	7.20×10 ³	3.72×10 ³
Cyclamic acid	7.42×10 ³	6.40×10 ⁵	8.46×10 ⁴
Cytarabine	1.45×10 ⁶	8.46×10 ⁵	8.94×10 ³
D617 (met. of verapamil)	2.18×10 ³	5.16×10 ³	2.35×10 ³
Dalapon	4.57×10 ⁴	3.04×10 ⁵	7.80×10 ³
4-5-Dichloro-2-n-octyl-isothiazol-3(2H)-on (DCOIT)	1.32×10 ³	442	284
DEET (Diethyltoluamide)	8.31×10 ⁴	4.89×10 ⁴	1.40×10 ⁴
Diazepam	4.23×10 ³	2.77×10 ³	1.37×10 ³
Dichlorobenzamide (BAM)	8.19×10 ³	4.37×10 ⁵	3.16×10 ³
Didecyldimethylammonium (DADMAC (C10:C10))	117	309	52.5
Dimethachlor-ESA	9.27×10 ³	1.75×10 ⁴	1.33×10 ⁴
Dimethenamide	3.90×10 ⁴	2.03×10 ⁴	5.64×10 ³
Dimethoate	705	1.05×10 ⁴	3.03×10 ⁴
Dimethylaniline (N.N-)	4.01×10 ³	3.08×10 ³	462
Dinoseb	121	184	1.27×10 ³
Dinoterb	328	577	21
Diquat	8.13×10 ³	1.98×10 ⁴	1.87×10 ³
DMT (Dimethyltryptamine)	1.01×10 ⁴	1.17×10 ⁴	7.23×10 ³
Ephedrine	5.51×10 ⁴	5.90×10 ⁴	4.18×10 ⁴
Epoxiconazole	9.45×10 ³	9.85×10 ³	5.89×10 ³
Esmolol	3.91×10 ⁴	9.69×10 ⁴	2.58×10 ⁴
Ethenzamide	1.30×10 ⁴	6.75×10 ⁴	5.64×10 ⁴
Fenproporex (NARL)	1.45×10 ⁴	7.93×10 ⁴	2.97×10 ⁴
Fentanyl-Nor	8.85×10 ³	4.24×10 ⁴	1.85×10 ³

	PNECs (ng/L)		
	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
Fipronil	22.3	75.2	310
Florfenicol	112	43.7	502
Fluconazole	3.25×10 ³	4.89×10 ³	1.79×10 ⁴
Fludioxonil	1.64×10 ⁴	3.42×10 ³	609
Fluorene	1.27×10 ⁵	3.15×10 ⁴	1.89×10 ³
Gabapentin	5.01×10 ³	4.01×10 ⁵	8.93×10 ⁴
Galaxolidone	3.73×10 ²	253	2.42×10 ³
Gemfibrozil	3.16×10 ⁴	5.53×10 ³	1.66×10 ⁴
Glufosinate	5.21×10 ⁴	9.50×10 ⁵	3.00×10 ⁵
Griseofulvin	2.34×10 ³	151	4.23×10 ³
Guaifenesin	1.59×10 ³	1.85×10 ⁵	1.94×10 ⁵
Imazalil	5.75×10 ³	6.28×10 ²	1.32×10 ³
Imazamox	9.85×10 ⁴	5.38×10 ⁴	1.03×10 ⁴
Imidacloprid	3.74×10 ⁴	3.29×10 ⁴	4.94×10 ³
Irbesartan	8.34×10 ³	184	2.30
Lamotrigine	1.73×10 ⁴	3.15×10 ³	47.6
Levetiracetam	1.79×10 ⁵	4.07×10 ⁵	2.65×10 ⁴
Levomepromazine	1.45×10 ³	2.01×10 ³	56.2
Levomepromazine-sulfoxide	2.25×10 ³	1.24×10 ⁴	189
Lidocaine	6.21×10 ³	3.14×10 ⁴	1.06×10 ⁴
Lidocaine-N-oxide	1.19×10 ⁴	2.94×10 ⁵	4.45×10 ⁴
Lidocaine-Nor	1.66×10 ⁴	9.11×10 ⁴	1.78×10 ⁴
Linuron	6.53×10 ³	1.17×10 ⁴	1.45×10 ⁴
Melamine	1.34×10 ⁵	9.93×10 ⁶	256
Metalaxyl	9.23×10 ⁴	4.18×10 ⁴	9.46×10 ³
Metamitron-desamino	1.67×10 ⁴	1.95×10 ⁴	1.71×10 ³
Metformin	1.29×10 ⁶	7.60×10 ⁴	4.10×10 ³
Methfuroxam	7.34×10 ³	2.20×10 ³	1.50×10 ⁴
Methoprene	807	100	2.20×10 ³
Metolachlor	9.73×10 ³	7.53×10 ³	2.88×10 ³
Metolachlor-ESA	3.09×10 ³	8.83×10 ⁴	6.39×10 ³
Metoprolol	3.56×10 ⁴	2.82×10 ⁵	4.23×10 ⁴
Metribuzin-Desamino	9.51×10 ³	3.56×10 ⁴	122
Moxislyte	4.08×10 ³	5.23×10 ³	4.96×10 ³
Myclobutanil	8.83×10 ³	2.14×10 ³	6.28×10 ³
Nicosulfuron	5.27×10 ⁴	1.33×10 ⁵	296
Nicotine	1.25×10 ⁴	1.88×10 ⁵	5.89×10 ⁴
nicotine-Nor	9.36×10 ³	2.22×10 ⁵	5.38×10 ⁴
Niflumic acid	2.30×10 ⁴	3.60×10 ³	604
Nonylphenol di-ethoxylate	211	8.28×10 ²	656
Oxfendazole	3.45×10 ³	1.60×10 ⁴	203
Oxprenolol	1.06×10 ⁵	1.59×10 ⁴	6.71×10 ³
PFOA	4.18×10 ⁴	302	6.41×10 ⁴

	PNECs (ng/L)		
	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
PFDS	53.7	171	8.41×10 ³
Phenacetin	1.39×10 ⁴	6.18×10 ⁴	3.72×10 ⁴
Phenanthrene	451	526	126
Phosphate-triethyl	1.05×10 ⁵	2.45×10 ⁵	8.86×10 ⁴
Phosphate-Triphenyl	980	866	1.52×10 ³
Phthalate benzyl butyl	832	2.29×10 ³	1.12×10 ³
Phthalate -di-n-butyl	4.75×10 ³	338	4.11×10 ³
phthalate Diethyl	4.30×10 ⁴	1.47×10 ⁴	2.67×10 ⁴
phthalate Dimethyl	4.25×10 ⁴	5.30×10 ⁴	5.47×10 ⁴
Pindolol	1.14×10 ⁵	6.28×10 ³	1.29×10 ³
Probenecid	2.64×10 ⁴	8.34×10 ⁴	5.80×10 ³
Progesterone	3.85×10 ²	2.57×10 ³	1.46×10 ⁴
Prometryn	3.88×10 ³	1.86×10 ⁴	7.32
Propazine	5.33×10 ³	1.56×10 ⁴	18.1
Propoxur	3.31×10 ³	8.86×10 ³	1.19×10 ⁴
Pyrene	125	140	19.7
Quetiapine	1.03×10 ⁵	5.09×10 ⁴	551
Saccharine	8.15×10 ³	2.37×10 ⁵	6.78×10 ⁴
Salicylamide	2.25×10 ⁴	9.44×10 ⁴	3.50×10 ⁴
Salicylamide-N-Isopropyl	7.38×10 ⁴	7.11×10 ³	4.79×10 ³
Salicylic acid	1.60×10 ⁴	2.02×10 ⁵	9.77×10 ⁴
Sucralose	4.10×10 ⁵	1.55×10 ⁶	4.98×10 ⁴
Sulfadiazine	1.21×10 ⁴	3.64×10 ⁵	1.62×10 ³
Sulfamethoxazole	9.23×10 ³	4.40×10 ⁴	3.51×10 ³
Sulfamethoxazole-N4-Acetyl	1.94×10 ⁴	3.05×10 ⁴	1.99×10 ³
Sulfapyridine	9.97×10 ³	1.85×10 ⁵	1.81×10 ³
Sulpiride	2.52×10 ⁴	1.08×10 ⁵	4.28×10 ⁴
Tebuconazole	5.42×10 ³	3.69×10 ³	7.73×10 ³
Telmisartan	1.10×10 ³	42.4	1.21
Terbutylazine	1.91×10 ⁴	1.63×10 ⁴	11.2
Terbutylazine-desethyl	8.07×10 ⁴	1.10×10 ⁴	12.7
Theobromine	1.14×10 ⁵	2.91×10 ⁵	3.76×10 ³
Theophylline	2.94×10 ⁵	4.73×10 ⁵	1.65×10 ³
Thiacloprid	5.27×10 ⁴	3.38×10 ⁴	3.70×10 ³
Thiacloprid-amide	5.39×10 ⁴	1.17×10 ⁵	3.02×10 ³
Tiapride	2.34×10 ⁴	6.15×10 ⁴	4.15×10 ⁴
toluenesulfonamide	3.01×10 ³	1.24×10 ⁵	3.09×10 ⁴
Tolytriazole	1.85×10 ⁴	1.06×10 ⁴	4.78×10 ³
Tramadol	2.53×10 ⁴	9.64×10 ⁴	1.52×10 ⁴
Tramadol-O-Desmethyl	3.34×10 ⁴	8.09×10 ⁴	9.12×10 ³
Tramadol-O-Desmethylnor	3.76×10 ⁴	6.65×10 ⁴	8.79×10 ³
Tributylamine	7.36×10 ³	2.21×10 ³	6.40×10 ³
Trimethoprim	6.49×10 ⁴	6.10×10 ⁴	691

	PNECs (ng/L)		
	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
Tyramine	2.29×10^4	2.70×10^5	4.97×10^4
Valsartan	1.90×10^4	57.4	2.69
Venlafaxine	1.10×10^4	4.47×10^4	9.42×10^3
Venlafaxine-N-Desmethyl	1.75×10^4	5.16×10^4	1.02×10^4
Venlafaxine-O-Desmethyl	1.59×10^4	3.62×10^4	7.11×10^3

Table D2: Calculated RQs of the detected contaminants in seawater through non-target screening.

		Ukraine			JOSS			Georgia		
		RQs			RQs			RQs		
		<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)	<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)	<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)
PAHs	Acenaphthene	0.0085	0.023	0.044	0.00077	0.0021	0.0040	0.00021	0.00057	0.0011
	Fluorene	0.182	0.47	0.041	0.103	0.264	0.023	0.063	0.1613	0.014
	Phenanthrene	0.18	0.15	0.63	0.10	0.086	0.36	0.19	0.17	0.695
	Pyrene	0.46	0.41	2.93	0.32	0.29	2.04	0.45	0.40	2.84
	Chrysene	0.18	0.16	0.71	0.12	0.11	0.47	0.092	0.083	0.36
Phthalates	Phthalate-Dimethyl	0.000091	0.000073	0.000071	0.00011	0.000086	0.000083	0.00014	0.00011	0.00011
	Phthalate-Diethyl	0.0060	0.018	0.010	0.0080	0.023	0.013	0.0085	0.025	0.014
Phenols	2,4-Dinitrophenol (DNP)	0.00037	0.0010	0.0043	0.00049	0.0014	0.0057	0.00047	0.0013	0.0055
	Bisphenol A (BPA)	-	-	-	0.14	0.407	0.13	0.094	0.269	0.088
PFCs	Perfluorooctanoic acid (PFOA)	-	-	-	0.000063	0.0088	0.000041	0.000033	0.0045	0.000021
Emerging contaminants	1-H-Benzotriazole (BTR)	0.00422	0.00058	0.011	-	-	-	-	-	-
	4-5-Dichloro-2-n-octyl-isothiazol-3(2H)-on (DCOIT)	0.00084	0.0025	0.0039	0.00048	0.00145	0.0022	0.00068	0.0020	0.0032
	Acesulfame	0.0054	0.000055	0.00005	0.00076	0.000078	0.0000065	0.0011	0.000012	0.000010
	Adenosine	0.0057	0.0063	3.36	-	-	-	0.0029	0.0032	1.69
	Amantadine	0.00015	0.000033	0.00038	-	-	-	-	-	-
	Amisulpiride	0.00066	0.000069	0.00013	-	-	-	-	-	-
	Bentazone	0.00040	0.00017	0.0047	0.000062	0.000026	0.00073	-	-	-
	Benzenesulfonamide	0.0057	0.00010	0.0011	0.0058	0.000106	0.00109	-	-	-
	Benzothiazole	0.00040	0.00010	0.00073	-	-	-	-	-	-
	Benzothiazole -2-OH	0.10	0.016	0.30	0.057	0.0090	0.169	0.048	0.0076	0.14
	Caffeine	0.0011	0.00058	0.072	-	-	-	0.00088	0.00045	0.056335
	Carbamazepine	0.0033	0.0013	0.025	-	-	-	-	-	-
	Carbendazim	0.00015	0.00015	0.00047	-	-	-	-	-	-

		Ukraine			JOSS			Georgia		
		RQs			RQs			RQs		
		Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
Carboxin	Carboxin	-	-	-	0.00090	0.00086	0.00081	0.00062	0.00059	0.00056
	Cathine	0.00013	0.000058	0.00014	-	-	-	0.000059	0.000026	0.000063
Cetirizine	Cetirizine	0.000022	0.000011	0.00044	-	-	-	-	-	-
	Chloridazone	0.000066	0.00026	0.00067	0.000057	0.00022	0.00058	0.000061	0.00024	0.00062
	Chloridazone-methyl-desphenyl	0.00028	0.000048	0.00063	-	-	-	-	-	-
	Chlorotoluron	0.000070	0.000077	0.000070	-	-	-	-	-	-
	Climbazole	0.0019	0.0068	0.0075	-	-	-	-	-	-
	Clopidogrel Carbon acid	0.00026	0.0014	0.00079	-	-	-	-	-	-
	Cotinine	0.00015	0.000033	0.00074	0.00020	0.000046	0.00104	0.00021	0.000048	0.0011
	Cotinine-Hydroxy	0.000030	0.000013	0.00026	-	-	-	-	-	-
	Cyclamic acid	0.017	0.00020	0.0015	-	-	-	0.011	0.00013	0.0010
	D617 (met. of verapamil)	0.00091	0.00039	0.00085	-	-	-	-	-	-
	DEET (Diethyltoluamide)	0.00012	0.00020	0.00071	0.000129	0.00022	0.00077	0.000082	0.00014	0.00049
	Dichlorobenzamide (BAM)	0.00015	0.000029	0.00039	-	-	-	0.00012	0.0000022	0.00030
	Didecyldimethylammonium (DADMAC (C10:C10))	0.0074	0.0028	0.017	-	-	-	0.022	0.0084	0.050
	Dimethenamide	0.00081	0.0016	0.0056	-	-	-	-	-	-
	Dimethoate	0.00065	0.000044	0.000015	-	-	-	-	-	-
	Dinoterb	0.0049	0.0028	0.0060	0.0141	0.0080	0.0170	0.0030	0.0017	0.0036
	Epoxiconazole	0.00039	0.00038	0.00063	-	-	-	-	-	-
	Fentanyl-Nor	0.00020	0.000042	0.0010	-	-	-	0.00014	0.000029	0.00067
	Fipronil	0.014	0.0042	0.0010	-	-	-	-	-	-
	Galaxolidone	0.032	0.047	0.0049	0.022	0.033	0.0034	0.014	0.021	0.0022
	Griseofulvin	0.00026	0.0041	0.00015	-	-	-	-	-	-
	Imazalil	0.00011	0.0010	0.00050	-	-	-	-	-	-
	Lamotrigine	0.00013	0.00074	0.049	-	-	-	-	-	-

		Ukraine			JOSS			Georgia		
		RQs			RQs			RQs		
		Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)	Daphnia Magna (48h)	Pimephales promelas (96h, fish)	Algae (72h)
	Lidocaine	0.00026	0.000052	0.00015	-	-	-	-	-	-
	Lidocaine-N-oxide	0.00042	0.000017	0.00011	0.00086	0.000035	0.00023	0.00041	0.000017	0.00011
	Linuron	0.00024	0.00013	0.00011	-	-	-	-	-	-
	Melamine	0.00012	0.0000017	0.064	-	-	-	-	-	-
	Metformin	0.000095	0.0016	0.030	-	-	-	-	-	-
	Metolachlor	0.019	0.025	0.065	-	-	-	-	-	-
	Metolachlor-ESA	0.030	0.0010	0.014	-	-	-	-	-	-
	Metoprolol	0.00012	0.000015	0.00010	-	-	-	-	-	-
	Metribuzin-Desamino (DA)	0.0012	0.00033	0.096	-	-	-	-	-	-
	Nicosulfuron	0.00001	0.0000044	0.0020	-	-	-	-	-	-
	Nicotine	0.0029	0.00019	0.00062	0.000352	0.000023	0.000075	0.0016	0.00011	0.00035
	Niflumic acid	0.000042	0.00027	0.0016	0.000009	0.000057	0.00034	-	-	-
	Phosphate-triethyl	0.0000061	0.0000026	0.0000072	-	-	-	0.0000052	0.0000022	0.0000062
	Phosphate-Triphenyl	-	-	-	0.013	0.014	0.0082	0.015	0.017	0.0096
	Pindolol	-	-	-	0.000013	0.00023	0.0011	0.00023	0.00041	0.0020
	Prometryn	0.00142	0.00030	0.75	0.00230	0.00048	1.22	0.0011	0.00023	0.58
	Propazine	0.00069	0.00023	0.20	0.00091	0.00031	0.27	0.00073	0.00025	0.21
	Propoxur	-	-	-	-	-	-	0.011	0.0041	0.0030
	Saccharine	0.00265	0.000091	0.00032	0.00087	0.000030	0.000104	0.0015	0.000052	0.00018
	Sucralose	0.000064	0.000017	0.00053	-	-	-	-	-	-
	Sulfamethoxazole	0.00063	0.00013	0.0017	-	-	-	-	-	-
	Sulfamethoxazole-N4-Acetyl	0.00005	0.000034	0.0005	-	-	-	-	-	-
	Sulpiride	0.000041	0.000010	0.000024	-	-	-	-	-	-
	Tebuconazole	0.0027	0.0040	0.0019	-	-	-	-	-	-
	Telmisartan	0.029	0.76	26.49	-	-	-	-	-	-

		Ukraine			JOSS			Georgia		
		RQs			RQs			RQs		
		<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)	<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)	<i>Daphnia Magna</i> (48h)	<i>Pimephales promelas</i> (96h, fish)	<i>Algae</i> (72h)
G13: Emerging contaminants	Terbutylazine	0.0022	0.0026	3.74	-	-	-	-	-	-
	Terbutylazine-desethyl	0.00027	0.0020	1.70	-	-	-	-	-	-
	Theobromine	0.00053	0.00021	0.016	-	-	-	-	-	-
	Theophylline	0.00016	0.00010	0.029	-	-	-	-	-	-
	Thiacloprid	0.000017	0.000027	0.00024	-	-	-	-	-	-
	Tiapride	0.00020	0.000076	0.00011	0.000023	0.0000086	0.000013	-	-	-
	Toluenesulfonamide	0.014	0.00035	0.0014	0.016	0.00039	0.0016	0.013	0.00031	0.0012
	Tolytriazole	0.00328	0.0057	0.013	-	-	-	-	-	-
	Tramadol	0.000068	0.000018	0.00011	-	-	-	-	-	-
	Tributylamine	0.00013	0.00044	0.00015	-	-	-	0.00060	0.0020	0.00069
	Valsartan	0.00087	0.29	6.16	-	-	-	-	-	-
	Venlafaxine	0.00019	0.000046	0.00022	-	-	-	-	-	-
	Venlafaxine-N-Desmethyl	0.000062	0.000021	0.00011	-	-	-	-	-	-

C1. Non-target screening

Table D3. Calculated PNECs of the detected contaminants of this study through non-target screening..

Coded name	Name	Daphnia Magna PNEC ($\mu\text{g/L}$)	AD* for Daphnia	Pimephales Promelas PNEC ($\mu\text{g/L}$)	AD* for fish	Algae PNEC ($\mu\text{g/L}$)	AD* for algae
B1	Phenyl phosphate	0.98	Within AD	0.86	Exp proof needed	1.52	Within AD
B2	N-Butylbenzenesulfonamide	3.18	Within AD	76.1	Within AD	20.1	Within AD
B3	Tetradecylamine	0.50	Within AD	0.23	Within AD	0.28	Within AD
B4	4-Indolecarbaldehyde	14.9	Within AD	10.5	Within AD	7.41	Within AD
B5	Salicylamide	12.6	Within AD	33.8	Within AD	9.37	Within AD
B6	Decanamide	5.78	Within AD	6.76	Within AD	10.4	Within AD
B7	Panthenol	359	Within AD	351	Within AD	137	Within AD
B8	Trichloroacetic acid	100	Within AD	989	Within AD	1670	Within AD
B9	S-(2-[(3-Cyclohexyloxy)propyl]amino)ethyl hydrogen sulfurothioate	2.48	Within AD	388	Within AD	21.5	Within AD
B10	Triisobutyl phosphate/Tributyl phosphate	22.2	Within AD	13.8	Within AD	5.10	Exp proof needed
B11	Triethylphosphate	105	Within AD	245	Within AD	88.6	Within AD
B12	Metolachlor-hydroxy	35.9	Within AD	37.6	Within AD	6.08	Within AD
B13	Nitroanisole	5.71	Within AD	26.4	Within AD	41	Within AD
B14	4-Chlorobenzenesulfonamide	4.00	Within AD	93.3	Within AD	29.3	Within AD
B15	Avobenzene	0.19	Within AD	1.7	Within AD	2.01	Within AD
B16	1-(4-Methoxyphenyl)-N-(4-methylbenzyl)methanamine	19.8	Within AD	19.7	Within AD	6.4	Within AD
B17	4-Propylbenzenesulfonic acid	2.64	Within AD	191	Within AD	25.1	Within AD
B18	4-Hydroxybenzaldehyde	16.2	Within AD	74.8	Within AD	82.8	Within AD
B19	2-Methylimidazole	16.4	Within AD	23.2	Within AD	38.1	Within AD
B20	di-p-tolyl sulfone	2.17	Within AD	4.95	Within AD	8.51	Within AD
B21	PEG-5	9.31×10^3	Within AD	6.19×10^4	Within AD	4.43×10^3	Within AD
B22	PEG-6	1.32×10^4	Within AD	8.97×10^4	Within AD	4.34×10^3	Within AD
B23	PEG-7	1.65×10^4	Within AD	7.76×10^4	Within AD	4.38×10^3	Within AD
B24	PEG-8	1.93×10^4	Within AD	1.20×10^5	Within AD	4.60×10^3	Within AD
B25	PEG-9	2.17×10^4	Within AD	8.77×10^4	Within AD	4.98×10^3	Within AD

Coded name	Name	Daphnia Magna PNEC ($\mu\text{g/L}$)	AD* for Daphnia	Pimephales Promelas PNEC ($\mu\text{g/L}$)	AD* for fish	Algae PNEC ($\mu\text{g/L}$)	AD* for algae
B26	PEG-10	2.37×10^4	Exp proof needed	1.24×10^5	Within AD	5.48×10^3	Within AD
B27	PEG-11	2.53×10^4	Exp proof needed	1.32×10^5	Within AD	6.05×10^3	Within AD
B28	PEG-12	2.65×10^4	Exp proof needed	1.69×10^5	Exp proof needed	6.65×10^3	Within AD
B29	PEG-13	2.74×10^4	Exp proof needed	1.77×10^5	Exp proof needed	7.22×10^3	Exp proof needed
B30	PEG-14	2.80×10^4	Exp proof needed	1.83×10^5	Exp proof needed	7.73×10^3	Exp proof needed
B31	PEG-15	2.84×10^4	Exp proof needed	1.94×10^5	Exp proof needed	8.16×10^3	Exp proof needed
B32	PEG-16	2.86×10^4	Exp proof needed	2.25×10^5	Exp proof needed	8.49×10^3	Exp proof needed
B33	PEG-17	2.86×10^4	Exp proof needed	2.79×10^5	Exp proof needed	8.71×10^3	Exp proof needed
B34	PEG-18	2.85×10^4	Exp proof needed	2.67×10^5	Exp proof needed	8.83×10^3	Exp proof needed
B35	PEG-19	2.82×10^4	Exp proof needed	3.08×10^5	Exp proof needed	8.87×10^3	Exp proof needed
B36	PEG-20	2.78×10^4	Exp proof needed	3.37×10^5	Exp proof needed	8.83×10^3	Exp proof needed
B37	PEG-21	2.74×10^4	Exp proof needed	3.44×10^5	Exp proof needed	8.73×10^3	Exp proof needed
B38	PEG-22	2.68×10^4	Exp proof needed	3.55×10^5	Exp proof needed	8.59×10^3	Exp proof needed
B39	PEG-23	2.62×10^4	Exp proof needed	3.65×10^5	Exp proof needed	8.40×10^3	Exp proof needed
B40	PEG-24	2.55×10^4	Exp proof needed	4.26×10^5	Exp proof needed	8.20×10^3	Outside of AD
B41	PEG-25	2.48×10^4	Exp proof needed	4.83×10^5	Exp proof needed	7.98×10^3	Outside of AD
B42	PEG-26	2.40×10^4	Exp proof needed	4.78×10^5	Exp proof needed	7.75×10^3	Outside of AD
B43	PEG-27	2.32×10^4	Exp proof needed	5.09×10^5	Exp proof needed	7.52×10^3	Outside of AD
B44	PEG-28	2.24×10^4	Exp proof needed	5.45×10^5	Exp proof needed	7.29×10^3	Outside of AD
B45	C10-LAS	2.68	Within AD	0.56	Within AD	0.54	Within AD
B46	C11-LAS	1.81	Within AD	0.28	Within AD	0.33	Within AD
B47	C12-LAS	1.33	Within AD	0.13	Within AD	0.21	Within AD
B48	C10-PEG02	18.4	Within AD	12.2	Within AD	8.59	Within AD
B49	C10-PEG03	13.0	Within AD	20.7	Within AD	18	Within AD
B50	C10-PEG04	15.9	Within AD	44.9	Within AD	36.7	Within AD
B51	C10-PEG05	25.7	Within AD	54.4	Within AD	64.2	Within AD
B52	C10-PEG06	43.9	Within AD	92.4	Within AD	101	Within AD
B53	C10-PEG07	71.9	Within AD	115	Within AD	154	Within AD
B54	C10-PEG08	110	Within AD	164	Within AD	239	Within AD
B55	C10-PEG09	156	Within AD	252	Within AD	378	Within AD

Coded name	Name	Daphnia Magna PNEC ($\mu\text{g/L}$)	AD* for Daphnia	Pimephales Promelas PNEC ($\mu\text{g/L}$)	AD* for fish	Algae PNEC ($\mu\text{g/L}$)	AD* for algae
B56	C10-PEG10	208	Exp proof needed	391	Within AD	589	Within AD
B57	C10-PEG11	263	Exp proof needed	548	Within AD	872	Within AD
B58	C10-PEG12	320	Exp proof needed	823	Within AD	1.21×10^3	Within AD
B59	C10-PEG13	375	Exp proof needed	1.32×10^3	Within AD	1.57×10^3	Within AD
B60	C10-PEG14	427	Exp proof needed	2.00×10^3	Within AD	1.92×10^3	Within AD
B61	C10-PEG15	476	Exp proof needed	3.07×10^3	Within AD	2.23×10^3	Within AD
B62	C10-PEG16	8.43	Exp proof needed	19.9	Within AD	240	Within AD

*AD stands for the applicability domain

C3. Applicability domain of the prediction model

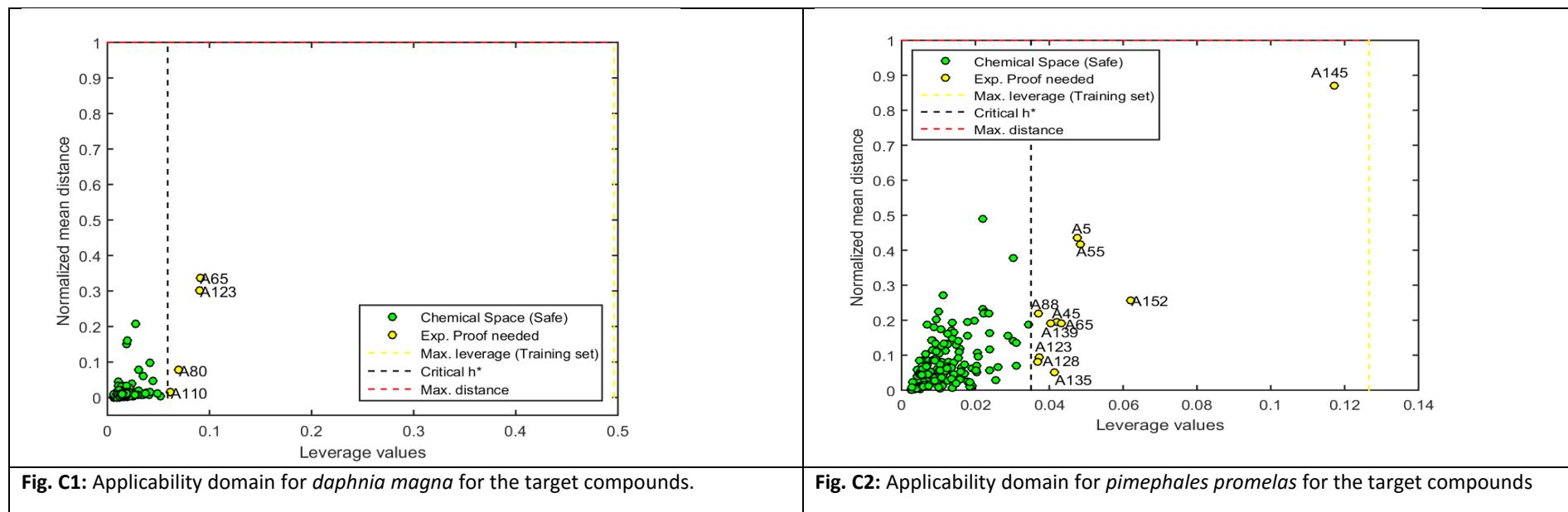


Fig. C1: Applicability domain for *daphnia magna* for the target compounds.

Fig. C2: Applicability domain for *pimephales promelas* for the target compounds

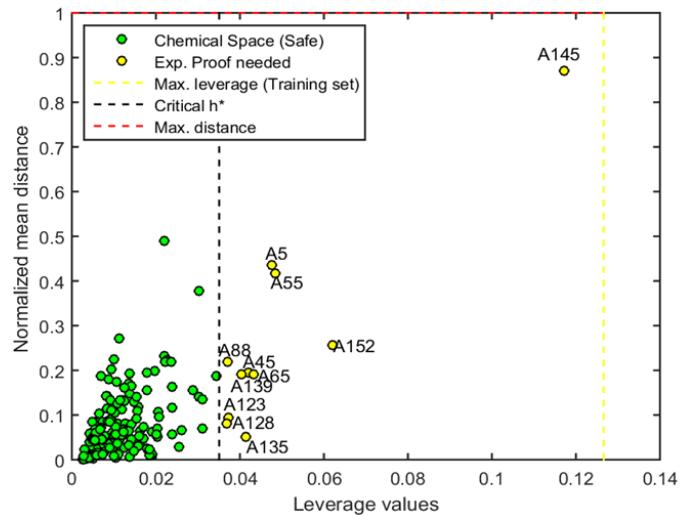


Fig. C3: Applicability domain for *algae* for the target compounds.

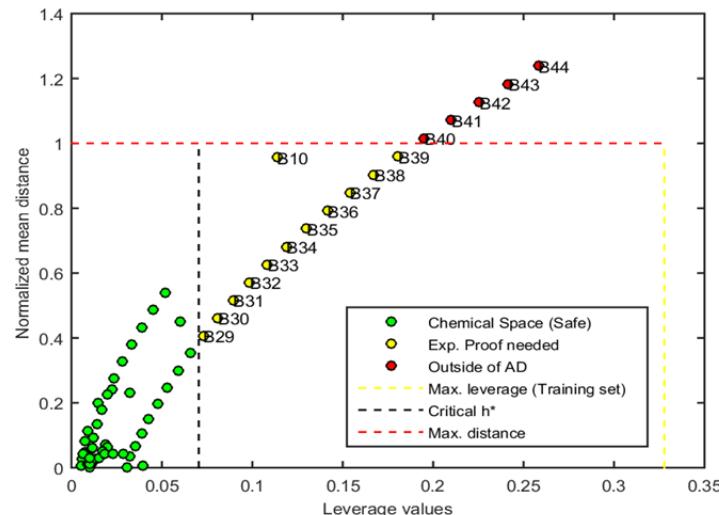


Fig. C4: Applicability domain for *algae* detected by non-target screening.

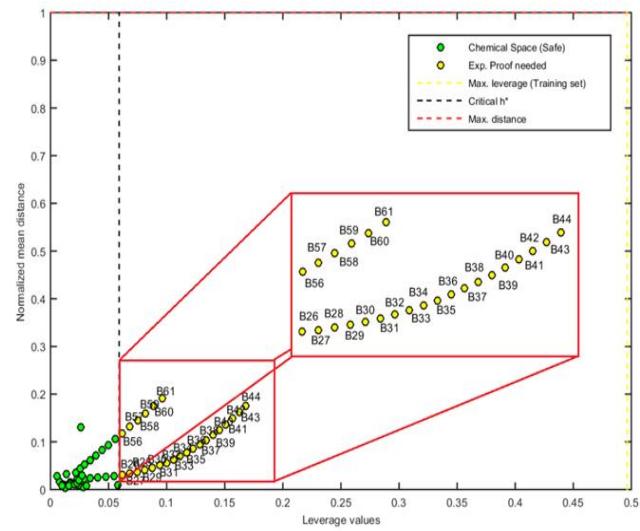


Fig. C5: Applicability domain for *daphnia magna* detected by non-target screening.

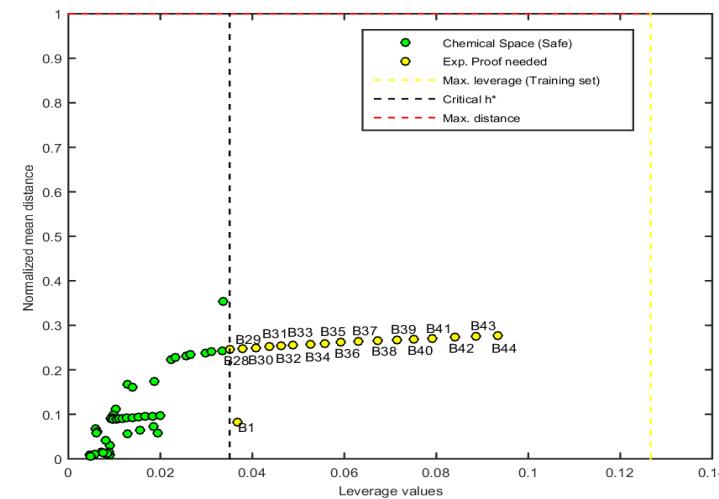


Fig. C6: Applicability domain for *pimephales promelas* detected by non-target screening.

Table D4: Compounds that are outside of the applicability domain. For these compounds additional experimental proofs are needed and the estimations based on the model are not fully reliable.

Applicability domain					
Daphnia Magna		Fish		Algae	
A65	Didecyldimethylammonium (DADMAC (C10:C10))	A5	Adenosine	A145	Sucralose
A80	Fipronil	A45	Chrysene	A5	Adenosine
A110	Metolachlor-ESA	A55	Cytarabine	A55	Cytarabine
A123	PFDS	A65	Didecyldimethylammonium (DADMAC (C10:C10))	A45	Chrysene
		A88	Glufosinate	A88	Glufosinate
		A123	PFDS	A152	Telmisartan
		A128	Phosphate-Triphenyl	A65	Didecyldimethylammonium (DADMAC (C10:C10))
		A135	Progesterone	A139	Pyrene
		A139	Pyrene	A123	PFDS
		A145	Sucralose	A128	Phosphate-Triphenyl
		A152	Telmisartan	A135	Progesterone

Part D: Spatial Distribution of the detected pollutants in seawater and sediments through target analysis

In order to visualize the pollution, the spatial contribution of the pollutants in seawater samples and sediments is presented in **Fig. D1** and **D2**, respectively. The Figures are divided in two parts; the Western and the Eastern side of Black Sea where the sampling took place. The bigger the size of the bubble is, the highest the number of the detected priority pollutants and emerging contaminants is. Moreover, the color of the bubble is related to the sum of the normalized concentrations per class of compounds. The red color refers to the most polluted, while the green bubble is attributed to less contaminated sampling points.

For sediments, UA 15 new is the orange circle, and UA 15 old is the yellow one.

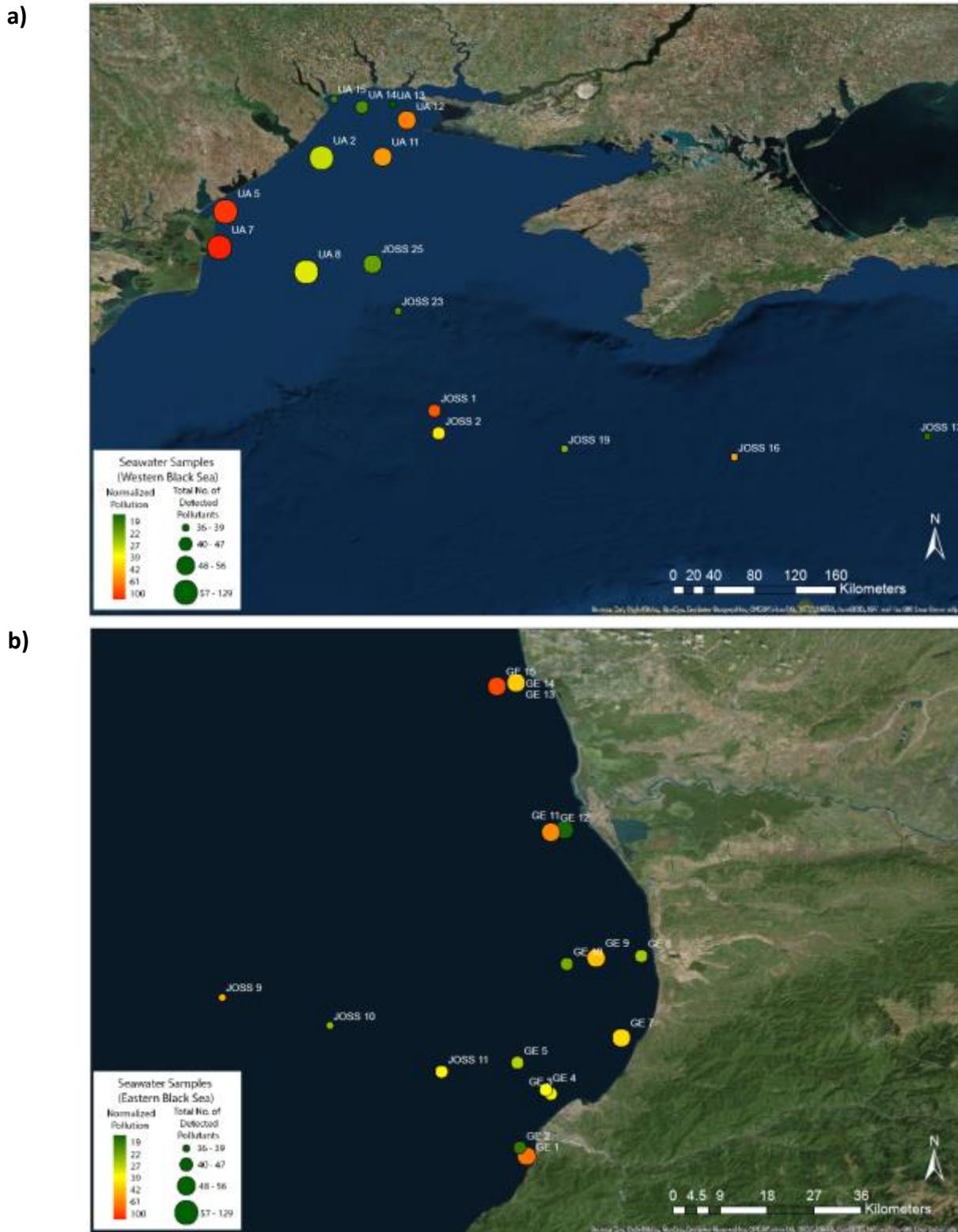


Fig. D1. Spatial distribution of the detected contaminants in seawater samples from
a) the Western and b) the Eastern Black Sea area.

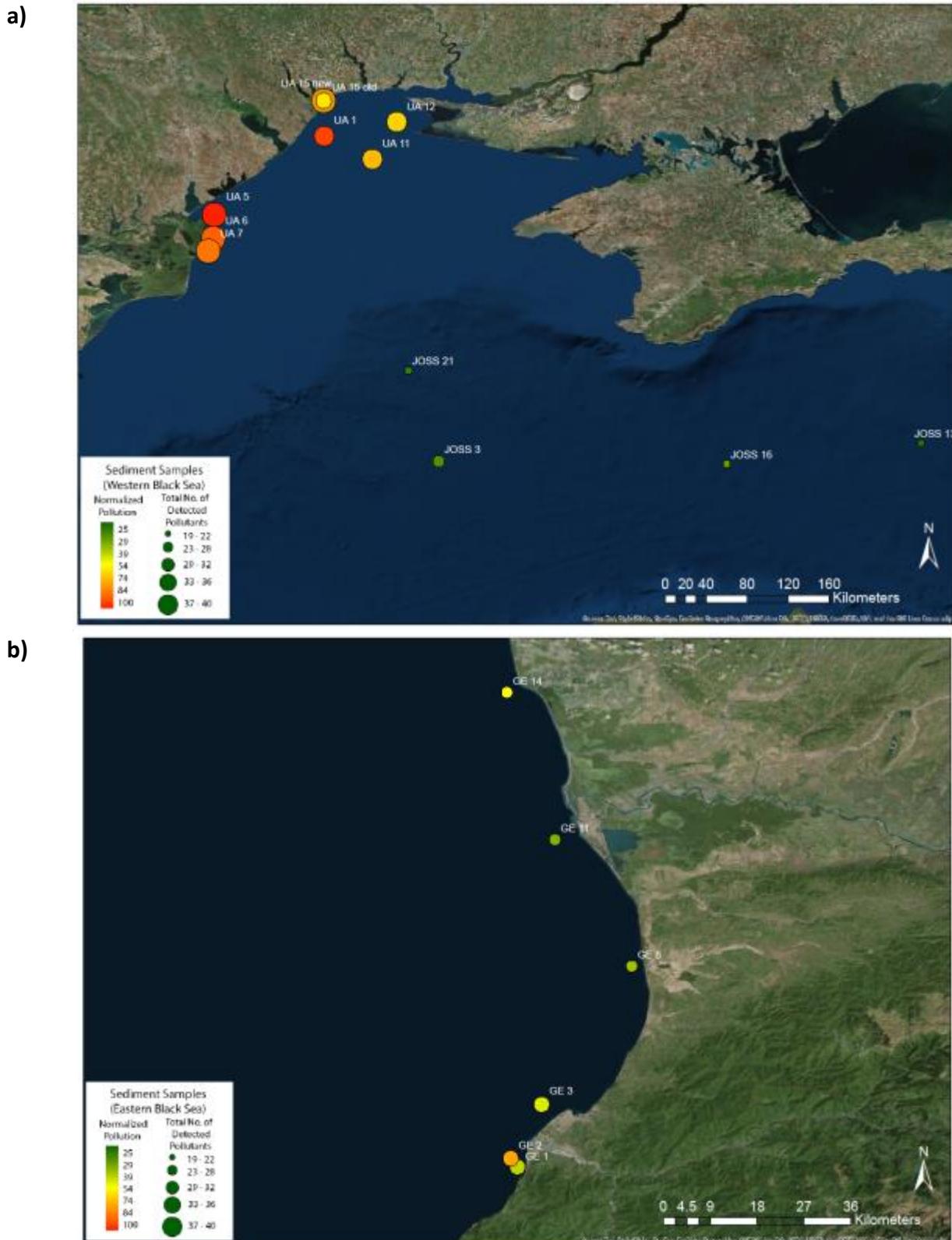


Fig D2. Spatial distribution of the detected contaminants in the sediments samples of a) the Western and b) the Eastern Black Sea area.

Part E: Identification and spatial distribution of non-targets

Identified surfactants included polyethylenoglycols, carbon10-polyethylenoglycols and Bis(2-2butoxyethoxy)ethyl)adipate. These surfactants were identified by their $[M+NH_4]^+$ adduct (or $[M+NH_4]^{2+}$ for members with high oxygen in their formula). Moreover, linear alkylbenzene sulfonates (group of LAS) were also detected in negative ionization. Although present in procedural/field blank, these chemicals exceeded the signal of procedural/field blank in many cases and several orders of magnitude especially near the coasts of the Black Sea. These chemicals clearly indicate human activity and although they seem to originate from land, they could also be a result of shipping activity.

Another group of substances was phosphate compounds. Spatial distribution of triethyl phosphate (Level 3) and tributyl phosphate (Level 3) is widespread as shown for latter substance in Fig. E1.

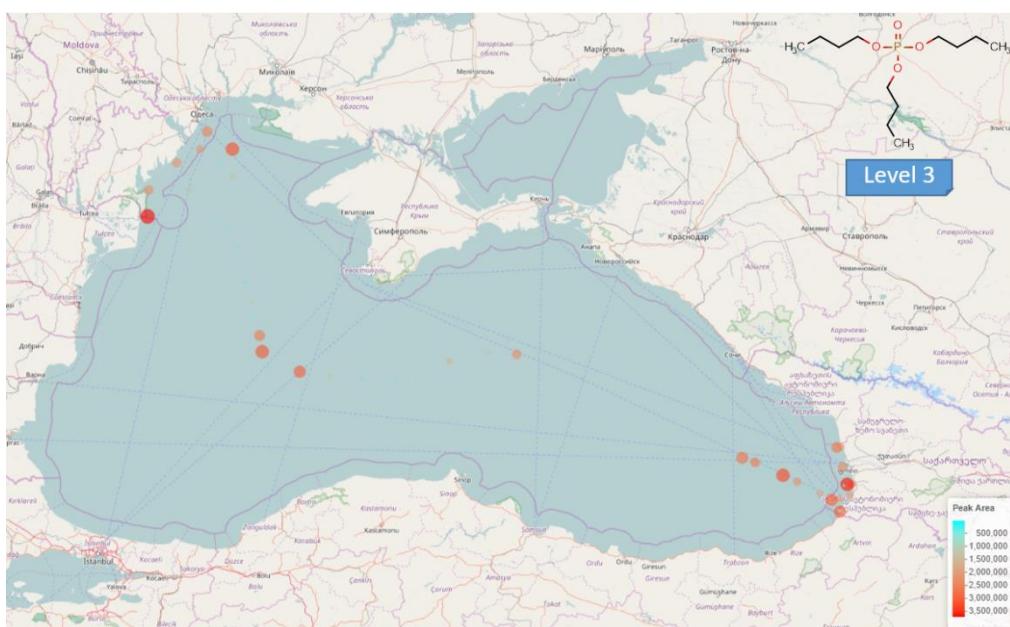


Fig. E1. Spatial distribution of Tributyl phosphate in seawater samples.

Hotspots of concentration levels were found near the coast of Ukraine and Georgia but they were also present in the middle of the Black Sea. Triethylphosphate was not detected in sediments but was present in almost all seawater samples. The opposite was observed for tributyl phosphate. As carbon chain increased, concentration level was reduced in seawater and increased in sediments. Similar pollution pattern was observed for phthalates esters.

Moreover, sediments seem to adsorb compounds originating from oil. Non-target screening revealed 3 substances of natural oil origin which were detected in almost all sediment samples while they were not detected in seawater samples. Decanamide (Level 2A), avobenzone (Level 3) and p-Hydroxybenzaldehyde (Level 3) are produced from lignin decomposition and originate from oil.

Another important category of substances were industrial chemicals. N-Butyl benzenesulfonamide (Level 2A, m/z Cloud record: 2705, MassBank record: SM823401) was detected with high signal in both ionization modes alongside the coastlines of Georgia and Ukraine. In addition, this plasticizer has been proven to be neurotoxic [2].

Tetradecylamine (level 2A, m/z Cloud record: 1724) was detected in seawater samples with the highest concentration at station UA 14 (near Odessa) and at relatively low concentration levels in sediments. This substance is used in textiles, water treatment, concrete, asphalt, ceramics, paint, metals, rubber, plastics, etc. 4-Indolecarbaldehyde (level 2A, m/z Cloud: 1723) was detected in sediments and in a few seawater samples. This chemical is mainly used in synthesis of pharmaceuticals. Nitroanisole (level 3, ortho, meta, para candidates) which is an industrial chemical and is used for manufacturing of dyes and other pharmaceutical products was detected in all seawater samples, while its presence was not revealed in sediments. The highest concentration levels were observed in Ukrainian seawater samples.

Trichloroacetic acid (Level 2B) was detected in 70% of seawater samples at evenly distributed concentration levels. This chemical is used for cosmetic treatments (reducing age spots, improving skin coloration and brightness) but has more applications such as herbicide (although it has banned in 1990s). Salicylamide (Level 2A) was detected in 65% of seawater samples with highest intensity at the sampling station GE 15, while it remained undetected in sediment samples. Panthenol (Level 2A) used as pharmaceutical for wound healing and as cosmetic product (moisturizer), was detected in almost 40% of seawater samples and in a few sediment samples. Clear hotspots of panthenol are the Danube river (UA 7) and sampling stations alongside the Georgian coastline.

Tentative identifications derived from LC-HRMS analysis, and samples in which compounds were detected, are summarized in **Table E1** for seawater and sediments samples.

Table E1. Identified substances in seawater and sediment samples by suspect LC-HRMS analysis and samples in which these substances were detected.

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
Phenyl phosphate	2A 869;EQ3638 & UF4175	c1ccc(cc1)OP(=O)(Oc2ccccc2)Oc3 ccccc3	[M+H] ⁺	C ₁₈ H ₁₅ O ₄ P	11.2	Seawater:JOSS03,JOSS11,JOSS19,JOSS21 Sediment:GE01,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
N- Butylbenzenesulfona mide	2A (2705;SM8234)	CCCCNS(=O)(=O)c1ccccc1	[M+H] ⁺	C ₁₀ H ₁₅ NO ₂ S	7.8	Seawater:GE01,GE03,GE05,GE07,GE09,GE15,JOSS01,JOSS03,JOSS07,JOSS12,JOSS19,UA01,UA03 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS16,JOSS21,UA05,UA06,UA07,UA11,UA12,UA15
Tetradecylamine	2A (1724;)	CCCCCCCCCCCN	[M+H] ⁺	C ₁₄ H ₃₁ N	10.5	Seawater:GE01,GE02,GE03,GE08,GE10,GE13,GE14,JOSS16,JOSS19,JOSS21,JOSS24,UA01,UA07,UA08,UA09,UA10,UA11,UA12,UA13,UA14 Sediment:GE01,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,UA01,UA06,UA07,UA11,UA12,UA15B,UA15
4-Indolecarbaldehyde	2A (1723;)	c1cc(c2cc[nH]c2c1)C=O	[M+H] ⁺	C ₉ H ₇ NO	5.6	Seawater:GE01,GE02,GE03,GE04,GE08,GE09,GE10,GE12,GE13,GE14,GE15,JOSS02,JOSS03,JOSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JOSS11,JOSS12,JOSS14,JOSS18,JOSS20,JOSS21,JOSS22,JOSS23,JOSS24,UA02,UA03,UA04,UA05,UA06,UA07,UA10,UA11,UA12,UA15 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
Salicylamide	2A (593;)	c1ccc(c(c1)C(=N)O)O	[M-H] ⁻	C ₇ H ₇ NO ₂	6.1	Seawater:GE01,GE02,GE03,GE04,GE05,GE07,GE10,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,JOSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JOSS11,JOSS12,JOSS14,JOSS15,JOSS16,JOSS17,JOSS18,JOSS19,JOSS20,JOSS21,JOSS22,JOSS23,JOSS24
N- Butylbenzenesulfona mide	2A (2705;)	CCCCNS(=O)(=O)c1ccccc1	[M-H] ⁻	C ₁₀ H ₁₅ NO ₂ S	7.8	Seawater:GE01,GE09,GE15,JOSS03,JOSS07,JOSS12,JOSS19,UA01

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
Decanamide	2A (683;)	CCCCCCCCCC(=O)N	[M+H] ⁺	C ₁₀ H ₂₁ NO	10.3	Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
Panthenol	2A (535;BML0111)	CC(C)(CO)C(C(=O)NCCCO)O	[M+H] ⁺	C ₉ H ₁₉ NO ₄	3.3	Seawater:GE03,GE04,GE07,GE08,JOSS13,JOSS16,JOSS22,JOSS23,JOSS24,JOSS25,UA03,UA04,UA05,UA06,UA07,UA08,UA09,UA10,UA11,UA12,UA13 Sediment:GE02,GE14,JOSS12,JOSS16,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
Trichloroacetic acid	2B	C(=O)(C(Cl)(Cl)Cl)O	[M-H] ⁻	C ₂ HCl ₃ O ₂	3.3	Seawater:GE01,GE02,GE03,GE05,GE07,GE08,GE10,GE11,GE13,JOSS01,JOSS03,JOSS04,JOSS06,JOSS09,JOSS10,JOSS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JOSS18,JOSS19,JOSS20,JOSS22,JOSS23,JOSS24,JOSS25,UA01,UA04,UA05,UA06,UA09,UA11,UA12,UA14,UA15 Sediment:UA12,UA15B
S-(2-{[3-(Cyclohexyloxy)propyl]amino}ethyl)hydrogen sulfurothioate	2B	C1CCC(CC1)OCCCNCSS(=O)(=O)O	[M+H] ⁺	C ₁₁ H ₂₃ NO ₄ S ₂	2.2	Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
Triisobutyl phosphate/Tributyl phosphate	3	CC(C)COP(=O)(OCC(C)C)OCC(C)C;CCCCOP(=O)(OCCCC)OCCCC	[M+H] ⁺	C ₁₂ H ₂₇ O ₄ P	11.8	Seawater:GE01,GE02,GE04,GE05,GE07,GE08,GE09,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,JOSS04,JOSS05,JOSS07,JOSS08,JOSS09,JOSS10,JOSS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JOSS18,JOSS19,JOSS22,JOSS24,JOSS25,UA01,UA02,UA03,UA04,UA05,UA06,UA07,UA08,UA09,UA10,UA11,UA12,UA14,UA15 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
Triethylphosphate	3	CCOP(=O)(OCC)OCC	[M+H] ⁺	C ₆ H ₁₅ O ₄ P	6.2	Seawater:GE01,GE02,GE05,GE07,GE08,GE09,GE10,GE11,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,JOSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JOSS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JOSS18,JOSS19

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
						,JOSS20,JOSS21,JOSS22,JOSS23,JOSS24,JOSS25,UA01,UA02,UA03,UA04,UA05,UA06,UA07,UA08,UA09,UA10,UA11,UA12,UA13
Metolachlor-hydroxy	3	CCc1cccc(c1N(C(C)COC)C(=O)CO)C	[M+H] ⁺	C ₁₅ H ₂₃ NO ₃	6.9	Seawater:GE01,GE02,GE03,GE04,GE05,GE07,GE08,GE09,GE10,GE11,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,J OSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JO SS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JO SS18,JOSS19,JOSS20,JOSS21,JOSS22,JOSS23,UA01,UA02,UA03,UA04,UA05,UA06,UA08,UA09,UA10,UA11,UA12,UA13,UA14,UA15
Nitroanisole	3	COc1ccccc1[N+](=O)[O-]	[M-H] ⁻	C ₇ H ₇ NO ₃	7.3	Seawater:GE01,GE02,GE03,GE04,GE05,GE07,GE08,GE09,GE10,GE11,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,J OSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JO SS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JO SS18,JOSS19,JOSS20,JOSS21,JOSS22,JOSS23,JOSS24,JOSS 25,UA01,UA02,UA03,UA04,UA05,UA06,UA07,UA08,UA09,UA10,UA11,UA12,UA13,UA14,UA15
4-Chlorobenzenesulfon amide	3	c1cc(ccc1S(=O)(=O)N)Cl	[M-H] ⁻	C ₆ H ₆ ClN ₂ O ₂ S	5.4	Seawater:GE01,GE02,GE03,GE04,GE05,GE07,GE08,GE09,GE10,GE11,GE12,GE13,GE14,GE15,JOSS01,JOSS02,JOSS03,J OSS04,JOSS05,JOSS06,JOSS07,JOSS08,JOSS09,JOSS10,JO SS11,JOSS12,JOSS13,JOSS14,JOSS15,JOSS16,JOSS17,JO SS18,JOSS19,JOSS20,JOSS21,JOSS22,JOSS23,JOSS24,JOSS 25,UA01,UA02,UA03,UA04,UA05,UA06,UA07,UA08,UA09,UA10,UA11,UA12,UA13,UA14,UA15
Avobenzone	3	CC(C)(C)c1ccc(cc1)C(=O)CC(=O)c2ccc(cc2)OC	[M+H] ⁺	C ₂₀ H ₂₂ O ₃	14	Sediment:GE01,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JO SS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
1-(4-Methoxyphenyl)-N-(4-methylbenzyl)methan amine	3	Cc1ccc(cc1)CNCc2ccc(cc2)OC	[M+H] ⁺	C ₁₆ H ₁₉ NO	3.7	Seawater:GE01

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
4- Propylbenzenesulfoni c acid	3	O=S(=O)(O)c1ccc(cc1)CCC	[M-H] ⁻	C ₉ H ₁₂ O ₃ S	5.5	Seawater:GE01,GE02,GE03,GE04,GE05,GE07,GE08,GE09,GE 10,GE11,GE12,GE13,GE14,GE15,JOSS01,JOSS04,JOSS05,J OSS06,JOSS07,JOSS08,JOSS10,JOSS12,JOSS13,JOSS14,JO SS15,JOSS16,JOSS17,JOSS20,JOSS21,JOSS22,JOSS24,JO S25,UA01,UA02,UA03,UA04,UA05,UA06,UA07,UA08,UA10,UA 11,UA12,UA13,UA14,UA15
4- Hydroxybenzaldehyd e	3	c1cc(ccc1C=O)O	[M-H] ⁻	C ₇ H ₆ O ₂	4.6	Seawater:GE03,UA01 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS1 2,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA1 2,UA15B,UA15
2-Methylimidazole	3	Cc1[nH]ccn1	[M+H] ⁺	C ₄ H ₆ N ₂	1.6	Seawater:GE01,GE02,GE03,GE07,GE08,GE09,GE10,GE11,GE 13,GE14,GE15,JOSS13,JOSS17,JOSS19,JOSS20,JOSS21,JO SS22,JOSS23,JOSS25,UA02,UA03,UA04,UA05,UA06,UA07,UA 08,UA09,UA10,UA12,UA13,UA14
di-p-Tolyl sulfone	3	Cc1ccc(cc1)S(=O)(=O)c2ccc(cc2)C	[M+H] ⁺	C ₁₄ H ₁₄ O ₂ S	9.29	Seawater:JOSS03,JOSS19,JOSS21 Sediment:GE01,GE02,GE03,JOSS03,JOSS12,JOSS13,JOSS16 ,UA07,UA11,UA12,UA15
PEG-5	3	OCCOCOCOCOCOCOCOC	[M+H] ⁺	C ₁₀ H ₂₂ O ₆	3.46	Seawater:GE11 Sediment:UA06,UA11
PEG-6	3	OCCOCOCOCOCOCOCOC	[M+NH ₄] ⁺	C ₁₂ H ₂₆ O ₇	3.83	Seawater:GE01,GE11,JOSS12,JOSS16,UA11,UA15 Sediment:GE01,GE02,GE03,GE08,GE11,JOSS03,JOSS12,JO SS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA1 5B,UA15
PEG-7	3	OCCOCOCOCOCOCOCOC O	[M+NH ₄] ⁺	C ₁₄ H ₃₀ O ₈	4.16	Seawater:GE01,GE11,JOSS12,JOSS14,JOSS16,JOSS18,UA11 ,UA13,UA15 Sediment:GE02,GE03,GE08,JOSS12,JOSS13,JOSS16,UA06,U A07,UA15B
PEG-8	3	OCCOCOCOCOCOCOCOC OCO	[M+NH ₄] ⁺	C ₁₆ H ₃₄ O ₉	4.37	Seawater:GE01,JOSS12,JOSS16,JOSS18,UA11,UA13,UA15 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS1 2,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA1 2,UA15B,UA15

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
PEG-9	3	OCCOCCOCOCOCOCOCOCOC OCCOCCO	[M+NH ₄] ⁺	C ₁₈ H ₃₈ O ₁₀	4.52	Seawater:GE11,JOSS12,JOSS16,JOSS18,UA11 Sediment:GE01,GE02,GE03,GE08,GE11,JOSS03,JOSS12,JOS S13,JOSS16,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
PEG-10	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOC	[M+NH ₄] ⁺	C ₂₀ H ₄₂ O ₁₁	4.7	Seawater:GE11,JOSS12,JOSS16,UA11 Sediment:GE01,GE03,GE08,JOSS12,JOSS16,UA01,UA07,UA1 2,UA15B,UA15
PEG-11	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOC	[M+NH ₄] ⁺	C ₂₂ H ₄₆ O ₁₂	4.79	Seawater:JOSS12,UA11 Sediment:GE08,GE11,GE14,JOSS12,JOSS16,JOSS21,UA07
PEG-12	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOC	[M+NH ₄] ⁺	C ₂₄ H ₅₀ O ₁₃	4.92	Seawater:GE11 Sediment:GE08,JOSS12,JOSS16
PEG-13	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC	[M+NH ₄] ⁺	C ₂₆ H ₅₄ O ₁₄	5.12	Seawater:GE11,GE12 Sediment:GE01,GE08,JOSS12,JOSS16,UA07,UA12,UA15
PEG-14	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC O	[M+NH ₄] ⁺	C ₂₈ H ₅₈ O ₁₅	5.17	Seawater:GE11 Sediment:GE01,JOSS12,JOSS16,UA01,UA12,UA15
PEG-15	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC OCCO	[M+NH ₄] ⁺	C ₃₀ H ₆₂ O ₁₆	5.32	Sediment:GE01;GE03,GE08,JOSS12,JOSS16,UA01,UA05,UA0 7,UA12,UA15
PEG-16	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC OCCOCCO	[M+NH ₄] ⁺	C ₃₂ H ₆₆ O ₁₇	5.47	Sediment:GE01,GE02,GE08,JOSS12,JOSS16,UA07,UA12,UA1 5
PEG-17	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC OCCOCCOCOC	[M+NH ₄] ²⁺	C ₃₄ H ₇₀ O ₁₈	5.61	Seawater:GE11 Sediment:GE01,GE02,GE03,GE08,JOSS12,JOSS13,JOSS16,U A01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
PEG-18	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC OCCOCCOCOCOC	[M+NH ₄] ²⁺	C ₃₆ H ₇₄ O ₁₉	5.75	Sediment:GE01,GE02,GE03,GE08,JOSS03,JOSS12,JOSS13,J OSS16,UA01,UA05,UA07,UA11,UA12,UA15
PEG-19	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOC OCCOCCOCOCOCOC	[M+NH ₄] ²⁺	C ₃₈ H ₇₈ O ₂₀	5.89	Seawater:GE11 Sediment:GE01,GE02,GE03,GE08,GE14,JOSS03,JOSS12,JOS S13,JOSS16,UA01,UA05,UA07,UA11,UA12,UA15B,UA15

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
PEG-20	3	OCCOCCOCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC	[M+NH ₄] ²⁺	C ₄₀ H ₈₂ O ₂₁	6.02	Sediment:GE01,GE03,GE08,JOSS03,JOSS12,JOSS16,UA01,UA05,UA07,UA11,UA12,UA15B,UA15
PEG-21	3	OCCOCCOCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC O	[M+NH ₄] ²⁺	C ₄₂ H ₈₆ O ₂₂	6.14	Sediment:GE01,GE02,GE03,GE08,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
PEG-22	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCO	[M+NH ₄] ²⁺	C ₄₄ H ₉₀ O ₂₃	6.24	Sediment:GE01,GE02,GE03,GE08,GE14,JOSS03,JOSS12,JOS S13,JOSS16,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
PEG-23	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCO	[M+NH ₄] ²⁺	C ₄₆ H ₉₄ O ₂₄	6.36	Sediment:GE01,GE02,GE03,JOSS03,JOSS12,JOSS16,UA01,UA05,UA07,UA11,UA12,UA15
PEG-24	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOC	[M+NH ₄] ²⁺	C ₄₈ H ₉₈ O ₂₅	6.49	Sediment:GE01,GE02,GE03,GE08,GE14,JOSS03,JOSS12,JOS S16,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
PEG-25	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOC	[M+NH ₄] ²⁺	C ₅₀ H ₁₀₂ O ₂ ₆	6.59	Sediment:GE01,GE02,GE03,GE08,JOSS12,JOSS13,JOSS16,UA01,UA05,UA07,UA11,UA12,UA15B,UA15
PEG-26	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOC	[M+NH ₄] ²⁺	C ₅₂ H ₁₀₆ O ₂ ₇	6.67	Sediment:GE01,GE02,GE03,JOSS12,UA05,UA06,UA07,UA12
PEG-27	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOC	[M+NH ₄] ²⁺	C ₅₄ H ₁₁₀ O ₂ ₈	6.8	Sediment:GE01,GE03,JOSS03,JOSS12,JOSS16,JOSS21,UA05,UA07,UA15B,UA15

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
PEG-28	3	OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC OCCOCCOCOCOCOCOCOCOC O	[M+NH ₄] ²⁺	C ₅₆ H ₁₁₄ O ₂ 9	6.89	Seawater:GE09 Sediment:GE01,UA01
C10-LAS	3	OS(=O)(c1ccc(CCCCCCCCCC)cc1)=O	[M-H] ⁻	C ₁₆ H ₂₆ O ₃ S	11.8	Seawater:JOSS05,JOSS08,JOSS12,UA07 Sediment:GE02,JOSS12,JOSS21
C11-LAS	3	OS(=O)(c1ccc(CCCCCCCCCC)c c1)=O	[M-H] ⁻	C ₁₇ H ₂₈ O ₃ S	12.43	Seawater:JOSS05,JOSS08,JOSS12,UA06,UA07 Sediment:GE02,JOSS16,UA05,UA12
C12-LAS	3	OS(=O)(c1ccc(CCCCCCCCCCCC) cc1)=O	[M-H] ⁻	C ₁₈ H ₃₀ O ₃ S	12.9	Seawater:JOSS05,JOSS06,JOSS08,JOSS12,UA01
C10-PEG02	3	CCCCCCCOCCOCOC	[M+NH ₄] ⁺	C ₁₄ H ₃₀ O ₃	12.6	Seawater:GE02,GE03,GE09,GE10,GE13,JOSS02,JOSS03,JOSS 04,JOSS12,JOSS16,JOSS20,JOSS21,JOSS24,UA02,UA03,UA 04,UA05,UA07,UA14 Sediment:JOSS12
C10-PEG03	3	CCCCCCCOCCOCOCOC	[M+NH ₄] ⁺	C ₁₆ H ₃₄ O ₄	12.65	Seawater:GE01,JOSS01,JOSS03,JOSS05,JOSS11,JOSS13,JO SS19,JOSS20,JOSS24,UA01,UA02,UA03,UA04,UA05,UA08,UA 10,UA11,UA14 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS1 3,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B, UA15
C10-PEG04	3	CCCCCCCOCCOCOCOC CO	[M+NH ₄] ⁺	C ₁₈ H ₃₈ O ₅	12.6	Seawater:GE01,GE04,JOSS01,JOSS02,JOSS03,JOSS20,JOSS 21,UA01,UA05,UA08,UA09,UA10,UA12 Sediment:GE01,GE03,GE08,GE11,GE14,JOSS03,JOSS13,JOS S16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
C10-PEG05	3	CCCCCCCOCCOCOCOC COCOC	[M+NH ₄] ⁺	C ₂₀ H ₄₂ O ₆	12.6	Seawater:JOSS01,JOSS02,JOSS03,JOSS12,UA01,UA02,UA03 ,UA05,UA12 Sediment:GE02,GE03,GE08,GE11,GE14,JOSS12,JOSS13,JOS S16,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
C10-PEG06	3	CCCCCCCOCCOCOCOC COCCOC	[M+NH ₄] ⁺	C ₂₂ H ₄₆ O ₇	12.63	Seawater:GE01,GE04,JOSS01,JOSS02,JOSS03,JOSS12,UA01 ,UA02,UA03,UA06,UA09,UA10,UA11

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
						Sediment:GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS12,JOS S13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA12,UA1 5B,UA15
C10-PEG07	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOC	[M+NH ₄] ⁺	C ₂₄ H ₅₀ O ₈	12.63	Seawater:GE01,GE04,GE11,GE13,GE15,JOSS03,JOSS12,JOS S16,UA01,UA03,UA05,UA06,UA08,UA10,UA11 Sediment:GE01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS1 2,JOSS13,JOSS16,JOSS21,UA01,UA05,UA06,UA07,UA11,UA1 2,UA15B,UA15
C10-PEG08	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOC	[M+NH ₄] ⁺	C ₂₆ H ₅₄ O ₉	12.65	Seawater:GE01,GE04,GE12,GE13,GE14,JOSS01,JOSS03,JOS S12,UA12,UA14 Sediment:GE02,GE03,GE08,GE11,GE14,JOSS12,JOSS13,JOS S16,UA01,UA05,UA06,UA07,UA11,UA12,UA15B,UA15
C10-PEG09	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOC	[M+NH ₄] ⁺	C ₂₈ H ₅₈ O ₁₀	12.65	Seawater:GE01,GE04,GE11,GE13,JOSS01,JOSS12,UA03 Sediment:E01,GE02,GE03,GE08,GE11,GE14,JOSS03,JOSS13, JOSS16,JOSS21,UA01,UA05,UA07,UA11,UA12,UA15B,UA15
C10-PEG10	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOCOC	[M+NH ₄] ⁺	C ₃₀ H ₆₂ O ₁₁	12.68	Seawater:GE01,GE04,GE13,JOSS01,JOSS03,JOSS12,UA12 Sediment:GE01,GE02,GE08,GE14,JOSS03,JOSS12,JOSS13,U A01,UA11,UA12
C10-PEG11	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOCOC CO	[M+NH ₄] ⁺	C ₃₂ H ₆₆ O ₁₂	12.66	Seawater:GE01,GE04,GE13,GE14,JOSS01,JOSS12,JOSS14,U A14 Sediment:GE01,GE02,GE08,GE14,JOSS03,UA11,UA12,UA15
C10-PEG12	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOCOC COCCO	[M+NH ₄] ⁺	C ₃₄ H ₇₀ O ₁₃	12.66	Seawater:GE01,GE04,GE09,GE10,GE11,GE13,GE15,JOSS01, JOSS05,JOSS12,JOSS14,UA12,GE14,UA01
C10-PEG13	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOCOC COCCOCOC	[M+NH ₄] ⁺	C ₃₆ H ₇₄ O ₁₄	12.75	Seawater:GE01,GE13,JOSS12
C10-PEG14	3	CCCCCCCCCCOCOCOCOCOC COCCOCOCOCOCOCOCOC COCCOCOCOC	[M+NH ₄] ⁺	C ₃₈ H ₇₈ O ₁₅	12.75	Seawater:GE01,GE04,JOSS01,JOSS12,UA03,UA12,UA14

Name	Level (m/z Cloud; MassBank records)	SMILES	Adduct	Formula	Ret Time (min)	Samples (in which were detected)
C10-PEG15	3	CCCCCCCCCCCOCOCOCOCOCOC COCCOCOCOCOCOCOCOCOCOC COCCOCOCOCOCOC	[M+NH ₄] ⁺	C ₄₀ H ₈₂ O ₁₆	12.75	Seawater:GE01,GE13
C10-PEG16	3	CCCCOCCOCOC(=O)CCCCC(=O) OCCOCOCOCOC	[M+NH ₄] ⁺	C ₂₂ H ₄₂ O ₈	11.55	Seawater:GE01,GE09,GE15,JOSS03,JOSS07,JOSS11,JOSS12 ,JOSS19,JOSS21,UA03,UA04

Table E2. Identified substances in biota samples by suspect LC-HRMS analysis and samples in which these substances were detected.

Name	Level (m/z Cloud; MassBank)	SMILES	Adduct	Formula	Ret Time (min)	Biota samples (in which were detected)
4- Indolecarbald ehyde	2A	c1cc(c2cc[nH]c2c1)C=O	[M+H] ⁺	C ₉ H ₇ NO	5.6	FISH, GE (BATUMI), WHOLE FISH/ ROUND GODY, UA (O. B.*), WHOLE FISH/ ROUND GOBY, UA (Z. I.**), WHOLE FISH/ COMMON BLENNY, UA (Z. I.), WHOLE FISH/ FISH, GE (BATUMI), MUSCLE /ROUND GODY, UA (O. B.), MUSCLE/ SYRMAN GOBY, UA (O. B.)/ ROUND GOBY, UA (Z. I.), MUSCLE/ COMMON BLENNY, UA (Z. I.), MUSCLE/ MUSSELS 1, GE/ MUSSELS 2/ GE,MUSSELS, UA
Panthenol	2A	CC(C)(CO)C(C(=O)NCCCO)O	[M+H] ⁺	C ₉ H ₁₉ NO ₄	3.3	MUSSELS 1, GE/ MUSSELS 2, GE/ MUSSELS, UA
Trichloroaceti c acid	2B	C(=O)(C(Cl)(Cl)Cl)O	[M-H] ⁻	C ₂ HCl ₃ O ₂	3.3	MUSSELS, UA
Triethylphosp hate	3	CCOP(=O)(OCC)OCC	[M+H] ⁺	C ₆ H ₁₅ O ₄ P	6.2	FISH, GE (BATUMI), WHOLE FISH/ ROUND GODY, UA (O. B.), MUSCLE/ MUSSELS, UA
Nitroanisole	3	COc1ccccc1[N+](=O)[O-]	[M-H] ⁻	C ₇ H ₇ NO ₃	7.3	ROUND GODY, UA (O. B.), WHOLE FISH/ ROUND GOBY, UA (Z. I.), WHOLE FISH /SYRMAN GOBY, UA (O. B.)/ ROUND GOBY, UA (Z. I.), MUSCLE/ MUSSELS, UA
Avobenzone	3	CC(C)(C)c1ccc(cc1)C(=O)CC(=O)c2ccc(cc2)OC	[M+H] ⁺	C ₂₀ H ₂₂ O ₃	14	ROUND GOBY, UA (Z. I.), WHOLE FISH/ ROUND GODY, UA (O. B.), MUSCLE/ MUSSELS 1, GE

*O. B.: Odessa Bay

**Z.I.: Zmiinyi island

Part F: Data Collection Template (DCT) for non-target screening results.

Sample identification (link to the raw data file name)	Retention time in the 1 st column [min]	Retention time in the 2 nd column [sec]	Mass of ion [m/z] (peak or component)	Intensity of the ion	Intensity of the ion in the blank	Ion type	
							Other
EXAMPLE							
ElbeSW01	4.64		216.1012	1666665	0	M+	
DanubeSED01	16.64		243	14222	0	Other	Base

MS/MS available	Category	Proposed identification (name of the substance or n.i. for not identified)	Molecular formula	Exact. Mass	Identifier: SMILES	CAS No.
Yes	Target	atrazine	C8H14Cl1N5		c1(nc(nc(n1)Cl)NCC)NC(C)C	1912-24-9
No	Unknown	n.i.	n/a		n/a	n/a

Estimated concentration [ug/l]	Level of confirmation of identification	Component information		Retention Time Index LC-MS (TUM index; other index)	Retention Time Index LC-MS (UoA approach)	Retention Time Index GC-MS (Kovat's index)
		Fragment masses of detected compounds				
0.25	reference standard, ratio of MS/MS			87.6	640.3	-
0.15	characteristic pattern at ion 243 shows presence of chlorine atom	245.0322 25.3, 258.3405 32.5, 260.0665 60.0		-	-	1421

Date of sampling (DD/MM/YYYY)	Date of analysis (DD/MM/YYYY)	Serial No. in Method LC-MS(MS) or GC-MS(MS) worksheet	LC-MS - files attached			
			Raw chromatogram; Positive/Negative mode; MS-MS... (Organization abbreviation_Ionization mode [POS/NEG]_Collision Energy in eV or %_Instrument_Matrix_Sampling Site_Country_Date of Sampling [DD.MM.YYYY]_Project abbreviation_Unde Sample ID.mzML)			
			No. of peaks	Intensity cut-off value	Data analysis report (mzML)	Data aquisition
12/12/2013	12/13/2013	LC001, LC002, GC001	10,021	100	UFZ_POS_4eV_LC-ESI-Orbitrap-MS_Elbe_Lipzig_Germany_NoProject_01.01.2014.mzML	Auto MS/MS 5 the most abundant precursors per scan
12/12/2013	12/13/2013	GC001	-	-	-	MRM

GC-MS - files attached
Raw chromatogram; EI/PCI/NCI; MS/MS... (mzML) (Organization abbreviation_Ionization mode [POS/NEG]_Collision Energy in eV or %_Instrument_Matrix_Sampling Site_Country_Date of Sampling [DD.MM.YYYY]_Project abbreviation_Unde Sample ID.mzML)
-
EI_POS_70eV_GC-EI-MS_Danube_Bratislava_Slovakia_JDS3_01.02.2014.mzML

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