Electronic Supplementary Material (ESI) for Environmental Science: Processes & Impacts

Electronic Supplementary Information (ESI)

for

Assessing pollution in Izmir Bay from rivers in western Turkey: Heavy metals

Table S1. General characteristics of the river sediments

	pH				Water content (%)				Organic matter content (% dry weight)			
	A[1]	W[2]	Sp[3]	S[4]	A[1]	W[2]	Sp[3]	S[4]	A[1]	W[2]	Sp[3]	S[4]
Old Gediz 2	8.3	8.7	8.4	8.6	33.8	23.8	33.5	38.9	8.6	7.8	5.5	5.0
Old Gediz 1	8.7	8.3	8.5	8.8	26.1	23.1	23.7	34.2	4.7	7.4	5.0	7.3
Ilıca	8.3	8.2	8.6	8.8	30.6	32.4	23.6	25.1	7.0	9.2	4.9	5.5
Bornova	8.5	7.8	8.6	8.3	32.7	39.2	28.7	47.2	5.0	14.1	4.5	21.3
Manda	8.3	7.9	8.1	8.5	48.5	33.6	47.8	48.4	16.0	26.5	16.8	19.0

Table S2. Sediment heavy metal concentrations (mg kg^{-1}) of the rivers and sediment quality guidelines (SQGs)

		Cd	Cr	Cu	Ni	Pb	Zn
SQGs	TEC	0.99	43.4	31.6	22.7	35.8	121.0
	PEC	4.98	111.0	149.0	48.6	128,0	459.0
Old Gediz 2	Autumn	[a]3.5	221.5	115.0	103.5	129.5	676.5
	Winter	1.0	141.5	28.0	91.0	31.5	834.0
	Spring	1.5	16.5	153.5	29.0	41.5	791.5
	Summer	1.5	60.0	71.0	47.0	78.0	281.0
Old Gediz 1	Autumn	1.5	52.5	30.0	47.5	30.5	612.5
	Winter	2.8	78.0	30.8	65.3	62.5	252.3
	Spring	1.0	78.5	48.5	63.0	157.0	210.0
	Summer	1.0	25.0	41.8	40.0	31.5	305.5
Ilıca	Autumn	3.0	38.5	38.0	34.0	66.5	389.0
	Winter	0.5	81.5	40.0	50.0	37.0	355.0
	Spring	nd[b]	nd	nd	nd	nd	nd
	Summer	0.5	10.0	36.0	13.0	81.5	124.0
Bornova	Autumn	1.0	43.0	59.0	59.0	33.5	350.0
	Winter	0.5	53.0	33.0	34.0	37.0	199.0
	Spring	0.5	31.0	28.5	30.0	29.0	216.5
	Summer	1.0	21.5	57.0	20.5	36.0	420.0
Manda	Autumn	2.5	132.0	112.0	69.5	91.5	1056.5
	Winter	1.0	144.0	98.5	80.5	55.5	427.0
	Spring	bdl	169.5	112.5	74.5	83.0	606.5
	Summer	1.5	40.0	57.0	49.0	44.0	279.5
Total	Samples < TEC, %	26	42	21	11	26	0
	Samples between TEC and PEC, %	74	32	74	37	63	68
	Samples>PEC, %	0	26	5	53	11	32

[a]The maximum concentrations of the heavy metals in corresponding river sediments during the study period are underlined., [b] nd: not detected

Table S3. The minimum and maximum heavy metal concentrations measured in the river waters and the SQuiRTs' standard values (µg l^{-1})

		Cr[a]	Cu	Ni	Pb	Zn
SQuiRTs	Chronic Limit	74	9	52	2.5	120
	Acute Limit	570	13	470	65	120
Old Gediz 2	Autumn	[b]**15.59**	23.01	**34.63**	7.48	252.5
	Winter	9.25	9.59	30.45	3.80	114.5
	Spring	1.85	1.90	10.96	1.00	41.9
	Summer	3.38	0.46	11.47	1.00	56.0
Old Gediz 1	Autumn	4.50	14.50	22.00	7.00	199.5
	Winter	3.50	23.00	28.00	9.00	**586.0**
	Spring	5.00	32.12	30.11	1.00	134.6
	Summer	3.00	12.00	17.00	4.00	115.0
Bostanlı	Autumn	5.42	19.83	13.27	10.25	197.7
	Winter	2.58	4.31	17.23	1.00	136.0
	Spring	3.14	11.59	15.90	2.56	164.0
	Summer	2.60	23.89	19.04	5.39	212.6
Ilıca	Autumn	8.31	37.60	16.71	**13.55**	248.4
	Winter	2.83	15.30	14.81	1.00	99.3
	Spring	4.33	8.93	14.37	1.56	86.5
	Summer	2.07	1.46	13.67	1.00	39.5
Bornova	Autumn	2.99	21.68	6.23	4.27	93.9
	Winter	3.20	7.06	8.14	3.54	59.7
	Spring	1.97	14.11	17.32	1.00	122.2
	Summer	3.68	11.97	14.11	7.10	136.2
Manda	Autumn	4.20	12.29	8.87	4.88	85.9
	Winter	4.34	7.00	8.01	6.25	41.0
	Spring	5.67	**88.70**	19.33	6.16	174.4
	Summer	5.97	6.17	32.80	3.33	193.2
Melez	Autumn	3.10	11.18	19.39	10.19	162.8
	Winter	3.09	0.25	12.61	0.44	51.6
	Spring	4.64	24.97	20.80	2.28	127.5
	Summer	2.21	1.00	6.31	1.00	32.7
Total	Samples< Chronic, %	100	36	100	39	46
	Samples between Chronic and Acute, %	0	21	0	61	-
	Samples> Acute, %	0	43	0	0	54

[a] Cr^{+3} chronic limit and acute limit were applied since Chromium is in trivalent form at pH between 7.4-9.

[b] The maximum values detected in the corresponding rivers are underlined, the bold values present the maximum level detected for the corresponding metal during the study period.

Table S4. Correlations between sediment (HM_s) and water (HM_w) concentrations of studied heavy metals (n=20)

		Cr_w	Cu_w	Ni_w	Pb_w	Zn_w
Cr_s	r	**0.561(*)**[a]	**0.472(*)**	0.275	0.242	0.135
	p	0.010	0.036	0.241	0.304	0.571
Cu_s	r	0.181	0.180	-0.160	-0.002	-0.206
	p	0.445	0.447	0.501	0.992	0.383
Ni_s	r	**0.676(**)**[b]	0.322	**0.455(*)**	0.239	0.263
	p	0.001	0.167	0.044	0.311	0.263
Pb_s	r	0.438	0.328	0.362	0.024	0.129
	p	0.054	0.158	0.117	0.920	0.588
Zn_s	r	0.361	0.120	0.053	0.221	-0.062
	p	0.118	0.616	0.824	0.349	0.796

[a] (*) Correlation is significant at the 0.05 level (2-tailed)
[b] (**) Correlation is significant at the 0.01 level (2-tailed)

Table S5. Annual heavy metal loads entering the Bay and the maximum and minimum loads obtained in different seasons, tons

		Cr	Cu	Ni	Pb	Zn
Old Gediz 2	Annual	**0.03**	**0.09**	**0.22**	**0.03**	**1.10**
	max.	0.014(w)[a]	0.049(a)	0.126(w)	0.016(a,w)	0.538(a)
	min.	0.001(s)	1.10^{-4}(s)	0.002(sp)	2.10^{-4}(s)	0.013(s)
Old Gediz 1	Annual	**0.25**	**0.62**	**0.73**	**0.18**	**10.34**
	max.	0.127(w)	0.316(w)	0.384(w)	0.124(w)	8.041(w)
	min.	0.003(s)	0.009(s)	0.013(s)	0.003(s)	0.089(s)
Bostanli	Annual	**0.03**	**0.10**	**0.15**	**0.04**	**1.55**
	max.	0.013(a)	0.049(a)	0.083(w)	0.025(a)	0.657(w)
	min.	0.001(s)	0.006(s)	0.005(s)	0.001(s)	0.058(s)
Ilica	Annual	**0.03**	**0.11**	**0.09**	**0.03**	**0.79**
	max.	0.008(w)	0.057(a)	0.044(w)	0.021(a)	0.377(a)
	min.	4.10^{-4}(s)	2.10^{-4}(s)	0.002(s)	3.10^{-4}(s)	0.007(s)
Bornova	Annual	**0.04**	**0.16**	**0.13**	**0.04**	**1.11**
	max.	0.021(w)	0.073(a)	0.054(w)	0.023(w)	0.393(w)
	min.	0.001(s)	0.004(s)	0.005(s)	0.003(sp,s)	0.005(s)
Manda	Annual	**0.14**	**0.79**	**0.35**	**0.18**	**2.62**
	max.	0.066(w)	0.586(sp)	0.128(sp)	0.095(w)	1.152(sp)
	min.	0.005(s)	0.005(s)	0.028(s)	0.003(s)	0.165(s)
Melez	Annual	**0.16**	**0.41**	**0.77**	**0.16**	**4.63**
	max.	0.074(w)	0.260(sp)	0.303(w)	0.126(a)	2.015(a)
	min.	0.003(s)	0.001(s)	0.008(s)	0.001(s)	0.044(s)
TOTAL		**0.68**	**2.28**	**2.44**	**0.66**	**22.14**

[a] (a) : autumn, (w) :winter, (sp) :spring, (s) : summer

Table S6: The results of Principal Component Analysis

	Water	**Sediment**	**Wash off flux**
	PC1*	**PC1**	**PC1**
Zn	0.797	0.901	0.888
Ni	0.752	0.865	0.876
Cr	0.746	0.740	0.809
Pb	0.696	0.678	0.785
Cu	0.616	0.525	0.624
% of Variance	52.41	56.84	64.31

*Principal component 1