environments

Supplementary Material

Mercury Bioavailability in Fluvial Sediments Estimated Using *Chironomus riparius* and Diffusive Gradients in Thin-Films (DGT)

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Figure S1. Sampling stations on the Toce River (Northern Italy).

Table S1. Geographical coordinates of sampling stations along the Toce River and distance from the point source of mercury contamination, i.e. from the chlor-alkali plant industrial area (negative numbers mean that the site is upstream from the contaminated area).

Station	Coordinates UTM32N, Datum WGS84		Distance from the Point Source (km)
Prata	5098218.45 N	444406.74 E	−3.4
Bosco Tenso	5093606.39 N	447860.02 E	3.7
Premosello	5093013.99 N	452275.98 E	8.7
Ornavasso	5091633.48 N	455197.71 E	13.1

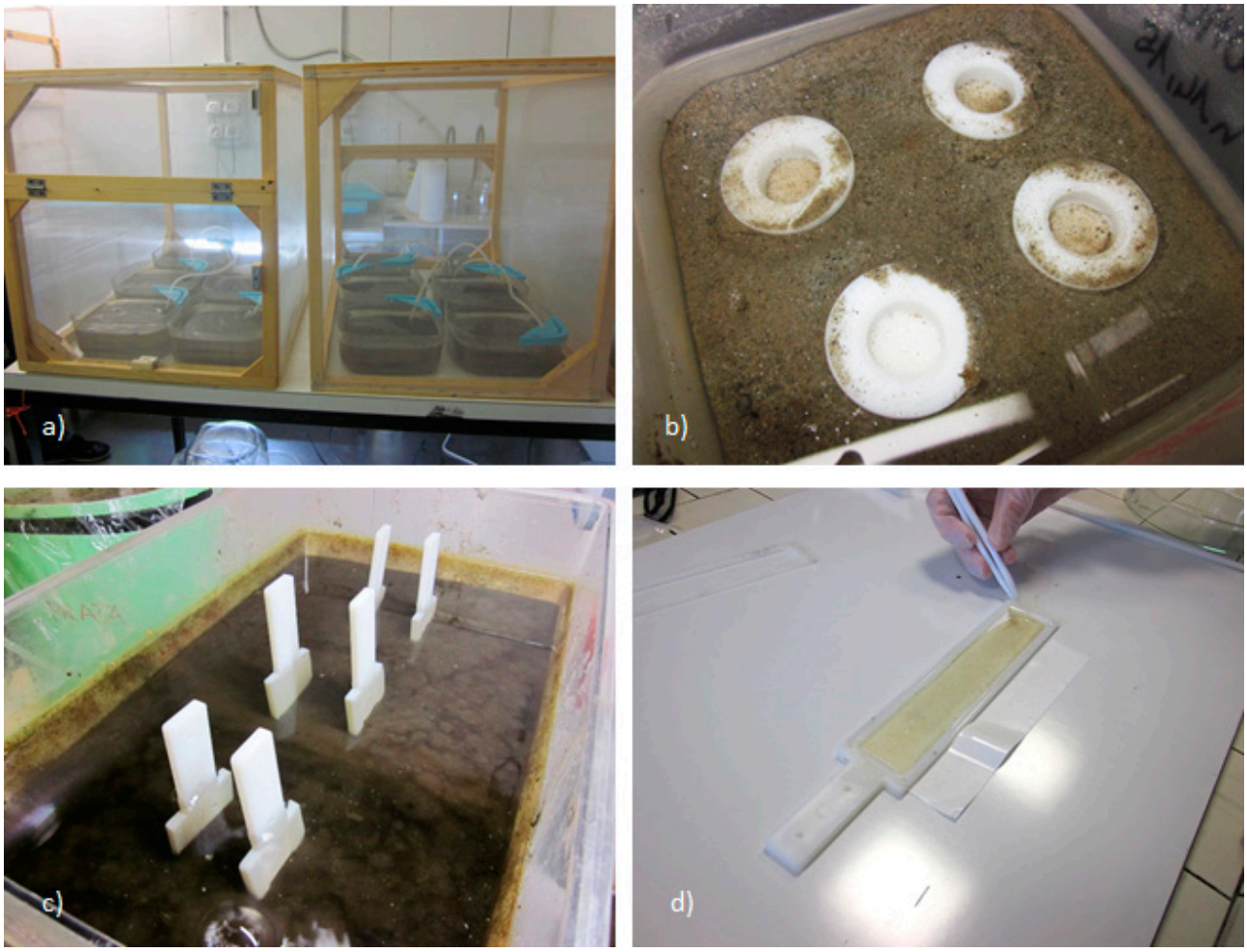

Figure S2. Lab experiment with *C. riparius* (**a**) and with DGT pistons (**b**) and probes (**c**, **d**).

Table S2. Characteristics of sediments collected in the Toce River and for: a) Test 1: (bio)accumulation experiment with Chironomids and DGTs; and b) Test 2: bioaccumulation experiment with Chironomids only.

Test	Sediment	Sampling Date	Humidity	Grain Size Composition				Organic Carbon	Total Mercury
				< 63 µm	63 µm–1 mm	1–2 mm	> 2 mm		
			%	%	%	%	%	%	mg kg^{-1} d.w.
T1,T2	Control		23	0.8	87.5	8.0	3.7	1.77	0.010 ± 0.0004
T1	Prata	November 2014	44	35.6	63.9	0.5	0.0	1.42	0.038 ± 0.003
	Bosco Tenso		35	32.0	67.8	0.1	0.1	0.47	0.051 ± 0.004
	Premosello		22	1.1	94.8	3.0	1.1	1.03	0.102 ± 0.007
	Ornavasso		33	8.7	87.4	3.5	0.4	0.88	0.115 ± 0.004
T2	Prata	February 2015	25	0.9	99.1	0.0	0.0	1.37	0.040 ± 0.002
	Bosco Tenso		29	5.3	94.4	0.1	0.2	0.95	0.142± 0.007
	Premosello		25	1.1	98.0	0.7	0.1	0.61	0.134 ± 0.002
	Ornavasso		28	0.8	99.0	0.5	0.0	1.52	0.285 ± 0.004

Table S3. Mercury analysis in DGT pistons and probes deployed in sediments of the Toce River (Test 1) at different deployment times, expressed as ng Hg in the resin and as ng L^{-1} according to Equation (3). Concentrations of mercury in chironomid larval tissue are also reported (mean ± standard deviation).

Sediment	Deployment Time	Piston DGTs		Probe DGTs		Chironomid Tissue
	d	ng Hg	ng L^{-1}	ng Hg	ng L^{-1}	mg Hg kg^{-1} d.w.
Control	16	1.350	0	12.150	2	0.050 ± 0.003
Control	16	1.625	0	12.915	3	
Prata	16	3.017	3	16.335	10	0.113 ± 0.054
Prata	16	4.462	8	15.097	6	
Bosco Tenso	16	3.201	3	19.273	12	0.157 ± 0.017
Bosco Tenso	16	4.776	9	19.909	11	
Premosello	7	4.577	19	18.607	19	0.155 ± 0.015
Premosello	7	6.623	36	14.469	7	
Premosello	11	6.407	22	19.378	11	0.158 ± 0.028
Premosello	11	4.728	13	16.112	6	
Premosello	16	5.883	13	20.116	7	0.174 ± 0.032
Premosello	16	6.958	17	19.664	6	
Premosello	28	8.023	12	n.a.	n.a.	n.a.
Premosello	28	5.320	6	n.a.	n.a.	
Ornavasso	7	3.812	13	21.310	16	0.167 ± 0.029
Ornavasso	7	4.710	20	17.233	9	
Ornavasso	11	6.272	21	19.273	7	0.286 ± 0.062
Ornavasso	11	3.960	9	20.353	8	
Ornavasso	16	7.187	18	17.597	3	0.338 ± 0.057
Ornavasso	16	6.287	14	23.435	6	
Ornavasso	28	6.238	8	n.a.	n.a.	n.a.
Ornavasso	28	8.345	12	n.a.	n.a.	

Kinetic Bioaccumulation Model Parameters

Ingestion rates of sediments for *C. riparius* are scarcely known [8,12], as well as the assimilation efficiency from sediments (considered as food) [33]. Notwithstanding these limitations, we calculated empirically the mercury uptake rates as the slope of linear regression of tissue concentrations versus time (in days) for the linear portion of the uptake phase [4,12]: for Premosello, the uptake between days 1 and 7 was calculated and a coefficient a of 0.017 $mg_{Hg} \cdot kg_{larva} \cdot d^{-1}$ was obtained. For Ornavasso, since the tissue concentrations increased linearly with time, we considered the steepest portion of the line, i.e., between days 7 and 11, obtaining a coefficient a value of 0.030 $mg_{Hg} \cdot kg_{larva} \cdot d^{-1}$. Growth rate coefficients of larvae in terms of fresh mass per day were calculated using logistic growth models, obtaining a mean k_g value of 0.144 d^{-1} for Premosello and of 0.098 d^{-1} for Ornavasso. We could not calculate the excretion rate k_e because we did not perform a depuration experiment, but we tried to calculate the model considering k_e as negligible, since excretion rates reported in the literature are generally low in comparison with k_g values (e.g., 0.02–0.06 d^{-1} for *Daphnia magna* and bivalves [34,35]. The results of this preliminary model calculations are reported in Figure 1.

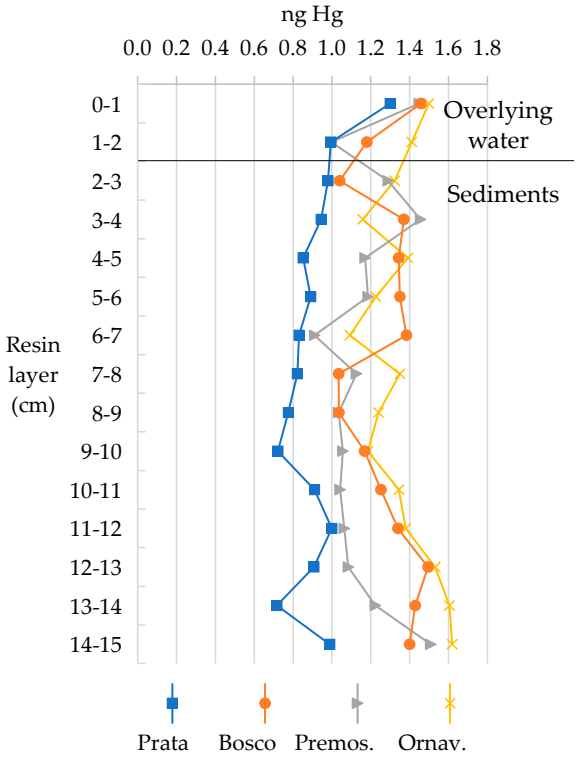

Figure S3. Examples of vertical profiles of mercury analysed deploying probe DGTs in sediments collected at different sites (Prata, Bosco Tenso, Premosello, Ornavasso) of the Toce River (Test 1). Probes were analysed by sectioning the resin into 1-cm layers. Values of mercury are given in ng Hg in each resin layer. Here some probes after 16 days deployment are represented.