

Supplementary material to: Long-term monitoring and bioaccumulation of heavy metals in European anchovy (*Engraulis encrasicolus*, Linnaeus, 1758) from the Romanian Black Sea area: A risk assessment perspective

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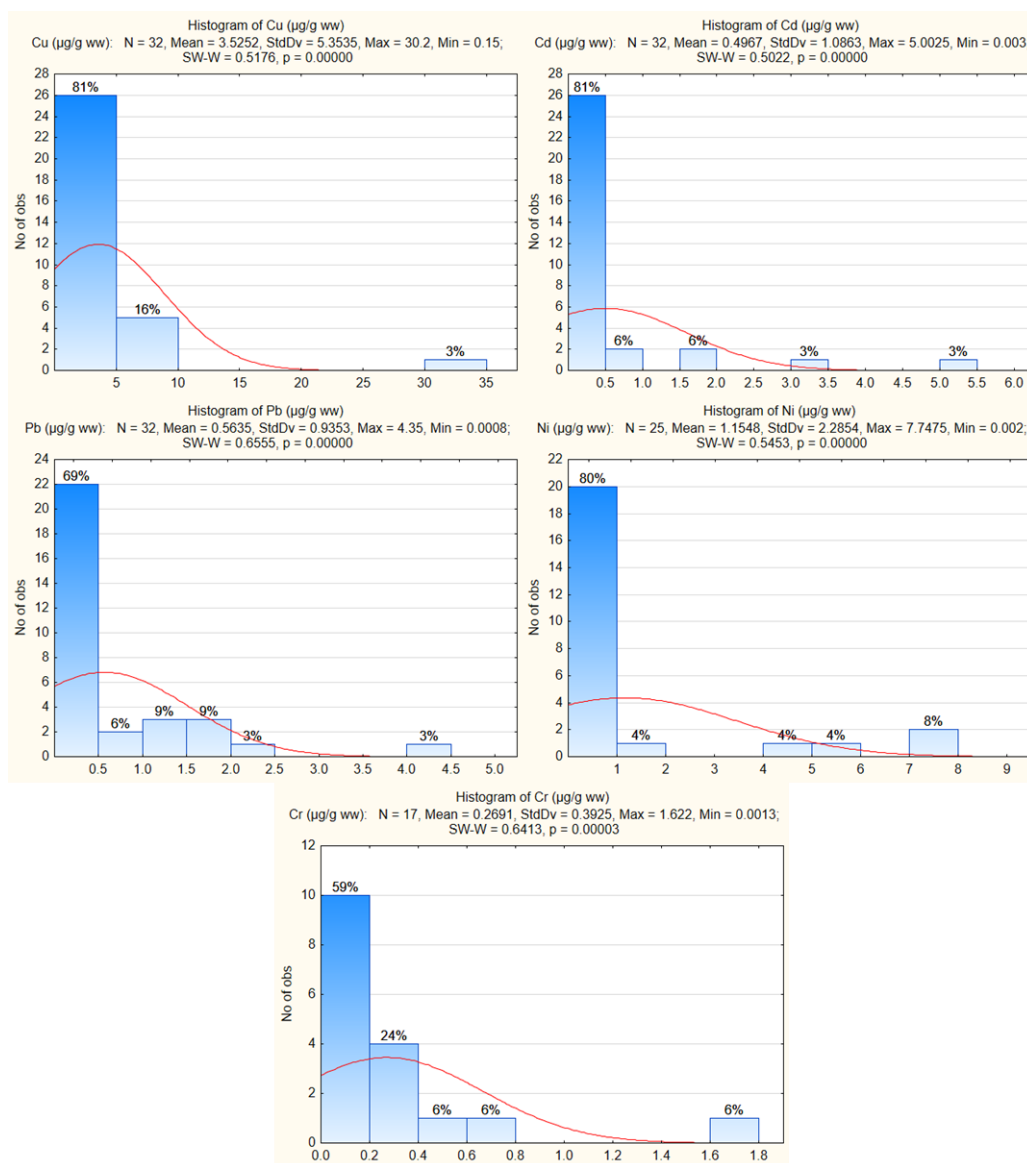


Figure S1. Histograms of HMs concentrations in anchovy measured between 1994-2019

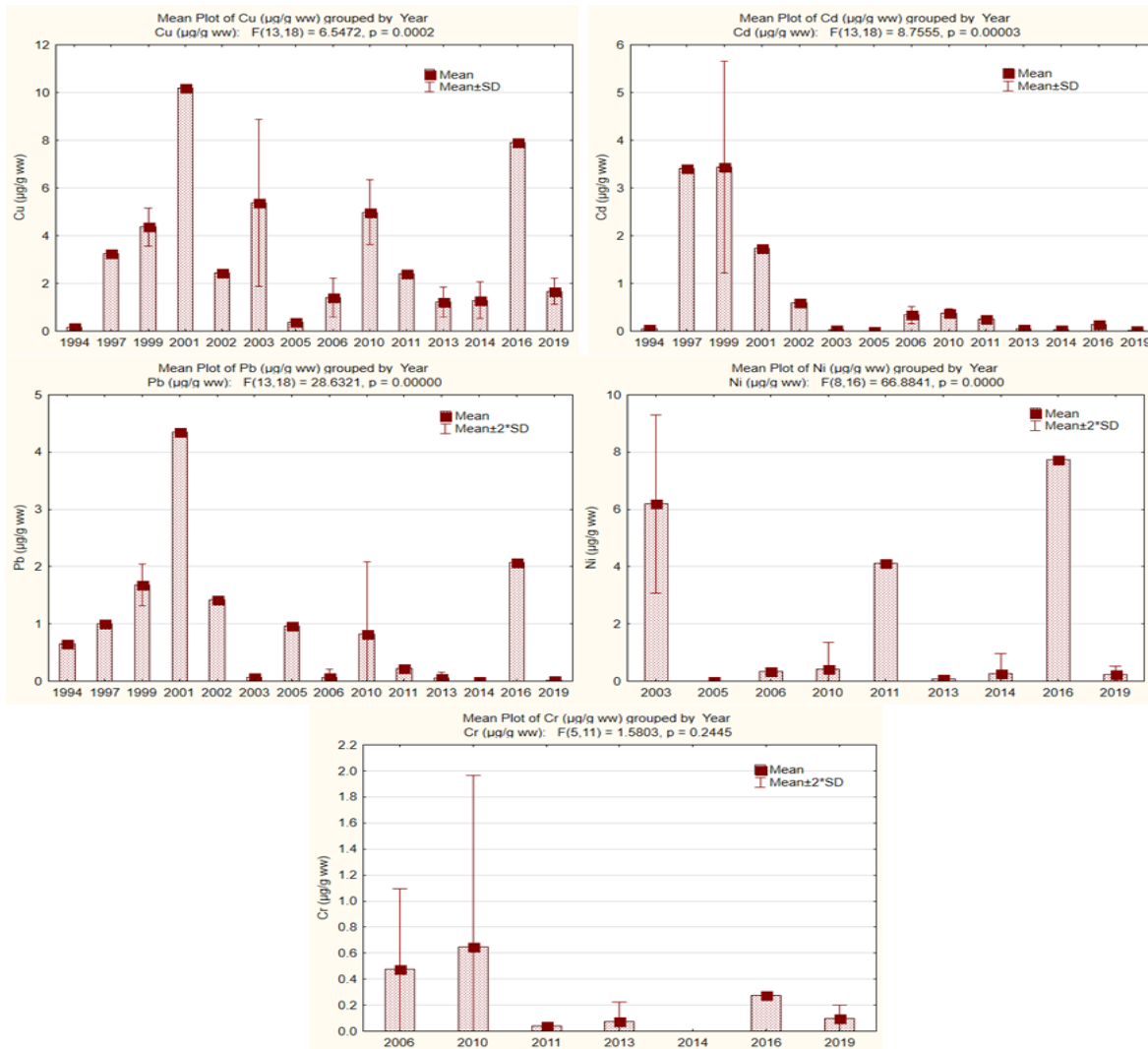


Figure S2. Temporal trends of mean HM concentrations in anchovy during 1994-2019

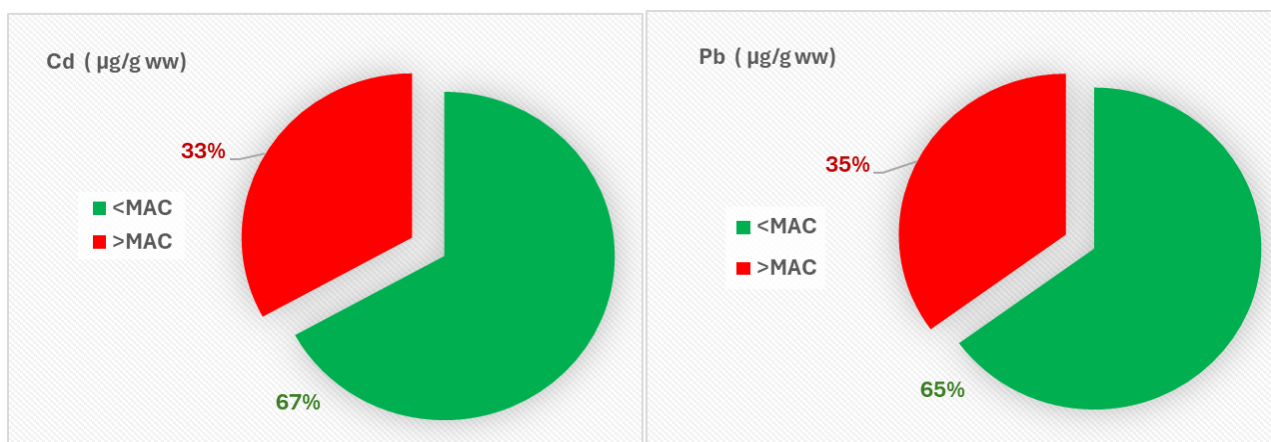


Figure S3. Heavy metals (Cd, Pb) values measured in anchovy investigated during 1994-2019, compared to the values permitted by European Commission Regulation (EU) 2023/915 for consumed seafood

Table S1. The annual mean values of the Estimated daily intake (EDI) (mg/kg/day), Target hazard quotient (THQ), Total hazard quotient (TTHQ), and Carcinogenic risk index (CRI) in two groups consuming anchovy (*Engraulis encrasicolus*) from the Romanian sector of the Black Sea (1994–2019)

No risk		Acceptable risk		Potential risk					
	Year	EDI Children	EDI Adults	THQ Children	THQ Adults	TTHQ Children	TTHQ Adults	CRI Children	CRI Adults
Cu	1994-1999 (N=4)	0.0011392± 7.6x10 ⁻⁴	0.0004882± 3.2x10 ⁻⁴	0.0284791± 1.9x10 ⁻²	0.0122053± 8.2x10 ⁻³	7.373462± 5.33	3.1600552± 2.28		
Cd		0.0007345± 5.3x10 ⁻⁴	0.0003148± 2.2x10 ⁻⁴	7.3449829± 5.3	3.1478498± 2.3				
Pb		0.0004706± 1.9x10 ⁻⁴	0.0002017± 8.4x10 ⁻⁵					4.01x10 ⁻⁶ ±1.60x10 ⁻⁶	1.72x10 ⁻⁶ ±7.11x10 ⁻⁷
Cu		0.0057052	0.0024451	0.1426301	0.0611272				
Cd	2001 (N=1)	0.0006531	0.0002799	6.5309589	2.7989824	6.6735890	2.8601096		
Pb		0.0016327	0.0006997					1.39x10 ⁻⁵	5.95x10 ⁻⁶
Cu	2002 (N=1)	0.0009121	0.0003909	0.0228021	0.0097723	2.2373226	0.9588525		
Cd		0.0002215	0.0000949	2.2145205	0.9490802				
Pb		0.0005330	0.0002284					4.53x10 ⁻⁶	1.94x10 ⁻⁶
Cu	2003 (N=3)	0.0020168± 1.3x10 ⁻³	0.0008644± 5.6x10 ⁻⁴	0.0504210± 3.2x10 ⁻²	0.0216090± 1.4x10 ⁻²	0.242971± 0.10	0.1041307± 0.046		
Cd		0.0000115± 1.7x10 ⁻⁶	0.0000049± 7.7x10 ⁻⁷	0.1151050± 1.7x10 ⁻²	0.0493307± 7.6x10 ⁻³				
Pb		0.0000244± 1.2x10 ⁻⁵	0.0000105± 5.2x10 ⁻⁶					2.10x10 ⁻⁷ ±1.03x10 ⁻⁷	8.89x10 ⁻⁸ ±4.41x10 ⁻⁸
Ni		0.0022170± 4.5x10 ⁻⁴	0.0009502± 1.9x10 ⁻⁴	0.0941484± 4.3x10 ⁻²	0.0403493± 1.8x10 ⁻²				
Cu	2005 (N=1)	0.0001464	0.0000627	0.0036596	0.0015684	0.0374779	0.0160620		
Cd		0.0000034	0.0000014	0.0337808	0.0144775				
Pb		0.0003603	0.0001544					3.06x10 ⁻⁶	1.31x10 ⁻⁶
Ni		0.0000008	0.0000003	0.0000375	0.0000161				
Cu	2006 (N=2)	0.0005289± 3.2x10 ⁻⁴	0.0002267± 1.2x10 ⁻⁴	0.0132208± 7.5x10 ⁻³	0.0056661± 3.2x10 ⁻³	1.354706± 0.65	0.5805884± 0.28		
Cd		0.0001275± 6.9x10 ⁻⁵	0.0000547± 2.9x10 ⁻⁵	1.2751424± 6.9x10⁻¹	0.5464896± 2.9x10 ⁻¹				
Pb		0.0000256± 2.5x10 ⁻⁵	0.0000110± 1.1x10 ⁻⁵					2.17x10 ⁻⁷ ±1.17x10 ⁻⁷	9.31x10 ⁻⁸ ±4.31x10 ⁻⁸

	Year	EDI Children	EDI Adults	THQ Children	THQ Adults	TTHQ Children	TTHQ Adults	CRI Children	CRI Adults
Ni		0.0001314± 1.5x10 ⁻⁵	0.0000563± 6.7x10 ⁻⁶	0.0065673± 7.9x10 ⁻⁴	0.0028146± 3.4x10 ⁻⁴				
Cr		0.0001794± 1.1x10 ⁻⁴	0.0000769± 4.9x10 ⁻⁵	0.0597759± 3.8x10 ⁻²	0.0256183± 1.6x10 ⁻²				
Cu	2010 (N=4)	0.0018686± 5.1x10 ⁻⁴	0.0008008± 2.1x10 ⁻⁴	0.0467154± 1.2x10 ⁻²	0.0200209± 5.4x10 ⁻³	1.542928± 0.47	0.6612548± 0.20		
Cd		0.0001408± 3.7x10 ⁻⁵	0.0000603± 1.6x10 ⁻⁵	1.4075343± 3.7x10⁻¹	0.6032290± 1.6x10 ⁻¹				
Pb		0.0003072± 2.3x10 ⁻⁴	0.0001317± 1.1x10 ⁻⁴					2.61x10 ⁻⁶ ±2.01x10 ⁻⁶	1.12x10 ⁻⁶ ±8.63x10 ⁻⁷
Ni		0.0001575± 1.7x10 ⁻⁴	0.0000675± 7.5x10 ⁻⁵	0.0078755± 8.8x10 ⁻³	0.0033752± 3.7x10 ⁻³				
Cr		0.0002424± 2.4x10 ⁻⁴	0.0001039± 1.1x10 ⁻⁴	0.0808029± 8.2x10 ⁻²	0.0346298± 3.5x10 ⁻²				
Cu		0.0007082	0.0003035	0.0177047	0.0075877				
Cd	2011 (N=1)	0.0000750	0.0000321	0.7500761	0.3214612	0.8318782	0.3565192		
Pb		0.0000662	0.0000284					5.63x10 ⁻⁷	2.41x10 ⁻⁷
Ni		0.0012040	0.0005160	0.0602009	0.0258004				
Cr		0.0000117	0.0000050	0.0038965	0.0016699				
Cu	2013 (N=7)	0.0004102± 1.6x10 ⁻⁴	0.0001758± 7.1x10 ⁻⁵	0.0102546± 4.1x10 ⁻³	0.0043948± 1.7x10 ⁻³	0.206452± 0.16	0.0884798± 0.06		
Cd		0.0000187± 1.5x10 ⁻⁵	0.0000080± 6.8x10 ⁻⁶	0.1867489± 1.5x10 ⁻¹	0.0800352± 6.8x10 ⁻²				
Pb		0.0000162± 1.7x10 ⁻⁵	0.0000069± 7.7x10 ⁻⁶					1.38x10 ⁻⁷ ±1.52x10 ⁻⁷	5.90x10 ⁻⁸ ±6.53x10 ⁻⁸
Ni		0.0000239± 7.6x10 ⁻⁶	0.0000102± 3.2x10 ⁻⁶	0.0011943± 3.8x10 ⁻⁴	0.0005119± 1.6x10 ⁻⁴				
Cr		0.0000248± 1.5x10 ⁻⁵	0.0000106± 6.7x10 ⁻⁶	0.0082551± 5.2x10 ⁻³	0.0035379± 2.3x10 ⁻³				
Cu		0.0004996± 2.9x10 ⁻⁴	0.0002141± 1.2x10 ⁻⁴	0.0124906± 7.3x10 ⁻³	0.0053531± 3.1x10 ⁻³				
Cd	2014 (N=5)	0.0000104± 1.1x10 ⁻⁵	0.0000044± 4.9x10 ⁻⁶	0.1038082± 1.1x10 ⁻¹	0.0444892± 4.9x10 ⁻²	0.121194± 0.110	0.0519403± 0.047		
Pb		0.0000007± 4.1x10 ⁻⁷	0.0000003± 1.8x10 ⁻⁷					5.90x10 ⁻⁹ ±3.3x10 ⁻⁹	2.54x10 ⁻⁹ ±1.43x10 ⁻⁹
Ni		0.0000979± 1.3x10 ⁻⁴	0.0000419± 5.8x10 ⁻⁵	0.0048953± 6.8x10 ⁻³	0.0020980± 2.9x10 ⁻³				
Cu		0.0034230	0.0014670	0.0855743	0.0366747				
Cd	2016 (N=1)	0.0000628	0.0000269	0.6276712	0.2690020	0.9209723	0.3947024		
Pb		0.0008993	0.0003854					7.64x10 ⁻⁶	3.28x10 ⁻⁶
Ni		0.0033537	0.0014373	0.1676856	0.0718653				
Cr		0.0001201	0.0000515	0.0400411	0.0171605				
Cu	2019 (N=2)	0.0007644± 2.5x10 ⁻⁴	0.0003277± 1.1x10 ⁻⁴	0.0191108± 6.3x10 ⁻³	0.0081904± 2.7x10 ⁻³	0.096988± 0.046	0.0415666± 0.020		
Cd		0.0000058± 2.9x10 ⁻⁶	0.0000025± 1.2x10 ⁻⁶	0.0574201± 2.9x10 ⁻²	0.0246086± 1.2x10 ⁻²				
Pb		0.0000065± 7.6x10 ⁻⁶	0.0000028± 3.2x10 ⁻⁶					5.57x10 ⁻⁸ ±6.48x10 ⁻⁸	2.39x10 ⁻⁸ ±2.78x10 ⁻⁸
Ni		0.0001068± 6.5x10 ⁻⁵	0.0000458± 2.7x10 ⁻⁵	0.0053372± 3.2x10 ⁻³	0.0022874± 1.4x10 ⁻³				
Cr		0.0000454± 2.3x10 ⁻⁵	0.0000195± 1.1x10 ⁻⁵	0.0151206± 7.8x10 ⁻³	0.0064803± 3.3x10 ⁻³				