



Predatory Bird
Monitoring Scheme

<http://pbms.ceh.ac.uk/>



Addendum to report: Inorganic elements in the livers of the Eurasian otter, *Lutra lutra*, from England and Wales in 2009 - a Predatory Bird Monitoring Scheme report.

L.A Walker, A.J. Lawlor, E.A. Chadwick¹, E. Potter, M.G. Pereira & R.F. Shore

Centre for Ecology and Hydrology, Lancaster Environment Centre, Library Avenue, Bailrigg, Lancaster, LA1 4AP

¹Cardiff School of Biological Sciences, Biomedical Sciences Building, Museum Avenue, Cardiff, CF10 3AX



Centre for
Ecology & Hydrology

NATURAL ENVIRONMENT RESEARCH COUNCIL



Environment
Agency



This report should be cited as:

Walker, L.A., Lawlor, A.J., Chadwick, E.A., Potter, E., Pereira, M.G. & Shore, R.F.¹ (2011). *Addendum to report: Inorganic elements in the livers of Eurasian otters, Lutra lutra, from England and Wales in 2009 - a Predatory Bird Monitoring Scheme (PBMS) report*. Centre for Ecology & Hydrology, Lancaster, UK.

Suggested keywords: Otter; Metals; Liver; Environmental contamination; Monitoring; Pollution; England; Wales

Centre for Ecology and Hydrology Project Number: NEC04288

E-copies of this report:

This report can be requested through the Natural Environment Research Council's Open Research Archive <http://nora.nerc.ac.uk/> or can be downloaded directly from the PBMS website

¹Corresponding author: RF Shore, Centre for Ecology and Hydrology, Lancaster Environment Centre, Library Avenue, Bailrigg, Lancaster, LA1 4AP, UK. E-mail: rfsh@ceh.ac.uk Website: www.ceh.ac.uk

Introduction

This addendum gives the concentrations of a selected range of metals in the livers of otters, *Lutra lutra*, found dead in England and Wales in 2009. Analysis of these results is presented in the full report which can be down-loaded at: http://pbms.ceh.ac.uk/docs/AnnualReports/PBMS_Metals_Otters_2009.pdf

Methods

Metal concentrations were measured in approximately 1 g sub-samples that were dried to constant weight at 80°C for 24 h, solubilised at room temperature overnight in 2 ml of (Analar) nitric acid, then heated at 90°C for 20 min followed by 120°C for 1 h. To further digest the organic matter, 0.5 ml of 30% hydrogen peroxide was added to the sample which was then heated at 120°C for 15 min. Samples were diluted with double-deionised water to known volume and a 10% acid strength. The resulting digests were analysed for a suite of trace metals and mercury by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) using a Perkin Elmer DRCII ICP-MS with standard conditions. All metal concentrations in livers are expressed on a µg/g dry weight basis, and are not recovery corrected.

Limits of detection and % recovery data are given in table A1. Data for element concentrations in the livers for individual otters that died in 2009 are given in tables A2.

Table A1. Inorganic elements quantified in otter livers. The method limit of detection (LoD) is given in $\mu\text{g/g}$ dry weight and % recovery is the average recovery for that analyte from the Tort2 certified reference material.

Analyte	LoD	% Recovery
Aluminum (Al)	1.201	N/C
Arsenic (As)	0.016	96.0
Antimony (Sb)	0.020	N/C
Cadmium (Cd)	0.003	99.1
Chromium (Cr)	0.080	76.3
Cobalt (Co)	0.012	90.8
Copper (Cu)	0.040	82.0
Iron (Fe)	2.002	85.5
Manganese (Mn)	0.012	85.6
Mercury (Hg)	0.200	121.9
Molybdenum (Mo)	0.060	103.0
Nickel (Ni)	0.020	82.0
Selenium (Se)	0.060	116.2
Strontium (Sr)	0.060	91.2
Zinc (Zn)	2.002	94.6

N/C indicates that the element wasn't certified in reference material.

Instrumental LoDs are calculated as 4.03 times the standard deviation of replicate blank determinations (N=6). Method LoD is based on the instrumental LoD, a dilution factor and the minimum sample weight.

Table A2. Inorganic contaminant concentrations ($\mu\text{g/g}$ dry weight) in livers of Eurasian otters, *Lutra lutra*, found dead in 2009

CEH Reference	CUOP Reference	Sex	Age Class	Location (County)	Al	Mn	Fe	Co	Ni	Cu	Zn	Se	Sr	Mo	Cd	Sb	Pb	Hg	Cr	As
16674	1264	M	A	Northamptonshire	ND	8.27	654	0.049	1.14	37.5	107	4.59	0.22	1.55	0.061	ND	NA	8.18	0.237	0.098
16675	1270	M	S/A	Humberside	1.69	10.3	557	0.066	0.07	37.8	135	4.69	0.218	1.28	0.062	ND	NA	3.59	0.362	0.692
16676	1271	F	S/A	Norfolk	ND	8.67	441	0.044	0.015	35	92.7	5.49	0.14	1.23	0.07	ND	NA	2.75	0.207	0.127
16677	1273	F	S/A	Buckinghamshire	ND	7.59	269	0.054	0.082	34.8	77.5	7.65	0.125	1.06	ND	ND	NA	2.97	0.159	0.064
16678	1274	F	S/A	Gloucestershire	ND	6.64	353	0.047	ND	32.1	101	10.1	0.109	1.33	0.022	ND	NA	2.87	0.265	0.131
16679	1302	F	A	H'ford & Worc.	1.32	10.4	590	0.043	0.054	62.5	123	19.8	0.227	1.42	0.917	ND	NA	50.3	0.336	0.092
16680	1309	M	A	Devon	ND	6.88	734	0.038	0.051	46.1	81	7.54	0.168	0.928	0.19	ND	NA	10.3	0.199	0.195
16681	1312	M	A	Somerset	1.82	9.78	733	0.1	0.169	22	179	6.28	0.645	1.01	0.303	ND	NA	4.22	0.173	0.12
16682	1317	M	S/A	Dorset	6.18	5.94	416	0.159	ND	36.6	86.9	7.72	0.46	1.09	0.046	ND	NA	2.31	0.125	0.05
16683	1319	F	S/A	Northumberland	ND	9.27	915	0.088	0.087	40.3	98.1	5.28	0.191	1.44	0.069	ND	NA	4.1	0.31	0.06
16684	1320	F	A	Northumberland	ND	7.74	1010	0.072	0.051	27.3	89.1	6.52	0.381	1.4	0.336	ND	NA	8.41	0.215	0.083
16685	1321	M	A	Powys	ND	10.1	279	0.043	ND	64.1	108	11.9	0.141	1.39	0.618	ND	NA	29.1	0.317	0.096
16686	1330	M	A	Essex	3.3	6.56	945	0.027	0.065	54.7	106	6.15	0.496	1.19	0.134	ND	NA	10.6	0.21	0.071
16687	1331	F	S/A	Suffolk	2.51	9.97	585	0.053	ND	31.1	107	5.27	0.243	1.45	0.061	ND	NA	6.48	0.238	0.074
16688	1344	F	S/A	Powys	1.9	5.87	537	0.08	0.133	39.2	89.7	5.47	0.44	0.899	0.137	ND	NA	3.86	0.304	0.114
16689	1353	M	A	Cambridgeshire	ND	6.1	815	0.053	ND	26.9	76.3	14.3	0.281	0.97	0.055	ND	NA	1.31	0.277	0.088
16690	1354	F	A	Devon	ND	8.06	778	0.083	0.059	30.1	74.1	9.41	0.332	1.14	0.654	ND	NA	8.18	0.221	0.174
16691	1358	M	A	Dorset	ND	7.31	730	0.047	0.059	37	86.7	5.37	0.187	1.34	0.129	ND	NA	11	0.166	0.101
16692	1366	M	S/A	Roxburghshire	ND	16.9	2480	0.112	0.304	45.4	319	7.14	ND	1.27	0.258	ND	NA	19.2	0.168	0.092
16693	1367	M	S/A	Cornwall	ND	8.21	357	0.086	0.139	27.7	79.7	6.53	0.291	1.01	0.062	ND	NA	0.352	0.228	0.231
16694	1368	F	A	Devon	60	6.65	1020	0.133	0.361	37	92.8	10.7	0.306	1.11	0.215	ND	NA	10.1	0.278	0.402
16695	1372	F	A	Northumberland	ND	7.31	1140	0.055	0.11	33.3	105	5.19	0.641	1.29	0.595	ND	NA	10	0.119	0.062
16696	1374	M	S/A	Oxfordshire	ND	6.18	466	0.066	0.997	32.3	107	7.51	0.292	0.944	0.055	ND	NA	6.01	0.33	0.118
16697	1375	M	A	Suffolk	ND	8.02	760	0.042	0.057	17.3	154	6.03	ND	1.11	0.064	ND	NA	4.82	0.084	0.024
16698	1376	F	S/A	Suffolk	ND	7.61	735	0.106	0.117	41.3	90.2	4.88	4.82	1.49	0.043	ND	NA	2.74	0.217	1.82

ND indicates that concentrations were below the limit of detection for that element. For age-classes, A = Adult, SA = sub-adult, and J = juvenile

NA indicates not analysed

Table A2 (cont..). Inorganic contaminant concentrations ($\mu\text{g/g}$ dry weight) in livers of Eurasian otters, *Lutra lutra*, found dead in 2009

CEH Reference	CUOP Reference	Sex	Age Class	Location (County)	Al	Mn	Fe	Co	Ni	Cu	Zn	Se	Sr	Mo	Cd	Sb	Pb	Hg	Cr	As
16699	1378	M	A	Cambridgeshire	ND	6.91	581	0.019	0.187	17.2	74.9	5.84	0.402	1.07	0.156	ND	NA	8.32	0.239	ND
16700	1385	M	S/A	Cornwall	ND	6.17	588	0.068	0.232	26.8	81.1	4.7	0.318	0.834	0.249	ND	NA	1.87	0.232	0.132
16701	1392	F	S/A	Oxfordshire	ND	4.95	481	0.071	0.12	23.4	103	6.85	0.246	1.13	0.434	ND	NA	7.42	0.131	0.055
16702	1398	F	A	Dyfed	ND	17.7	2440	0.24	0.424	42.9	465	9.85	0.838	1.23	17.1	ND	NA	19	ND	0.994
16703	1403	F	A	Devon	ND	7.51	1170	0.073	0.064	19.3	105	7.16	0.161	1.43	1.81	ND	NA	14.7	0.211	0.062
16704	1405	M	A	North Yorkshire	ND	5.78	959	0.022	0.122	12.9	83.1	4.64	0.363	0.953	0.77	ND	NA	8.29	0.32	0.091
16705	1409	F	S/A	Hampshire	ND	6.78	401	0.043	0.164	28.3	77.8	8.31	0.166	1.25	0.028	ND	NA	4.88	0.141	0.06
16706	1411	M	A	Dorset	ND	8.83	459	0.062	0.212	14.6	103	5.8	ND	1.47	0.107	ND	NA	5.03	0.285	0.02
16707	1415	F	A	Cumbria	ND	10.8	604	0.067	0.103	27.5	86.4	5.22	0.282	1.28	0.368	ND	NA	5.32	1.07	0.108
16708	1423	M	S/A	Hampshire	ND	7.53	227	0.061	0.266	49.6	110	8.78	0.059	1.12	0.11	ND	NA	3.97	ND	1.03
16709	1424	F	S/A	Norfolk	ND	14.1	834	0.062	0.106	54.9	157	8.88	0.366	1.63	0.132	ND	NA	2.59	0.129	0.07
16710	1437	F	A	Dyfed	ND	10.1	809	0.084	0.129	41.6	115	7.81	0.06	1.34	1.67	ND	NA	14.3	0.132	0.178
16711	1443	F	A	Devon	ND	6.89	644	0.126	0.062	22.1	78.4	5.33	ND	1.1	1.89	ND	NA	3.91	ND	0.594
16712	1453	M	A	Gwynedd	ND	10.7	1180	0.064	0.018	14.8	95.9	6.1	0.166	3.23	0.108	ND	NA	1.24	0.35	0.051
16713	1456	M	S/A	Gwynedd	ND	7.49	528	0.131	0.455	40.8	90.7	6.43	0.118	1.02	0.284	ND	NA	9.52	0.143	0.215
16714	1458	F	S/A	Gwynedd	ND	7.31	1720	0.076	0.026	16.1	137	4.72	0.184	2.73	0.996	ND	NA	2.28	0.228	0.08
16715	1460	F	S/A	Clwyd	ND	5.25	339	0.083	0.098	24.1	74.9	7.49	0.204	0.869	0.132	ND	NA	3.57	0.171	0.072
16716	1463	M	J	Essex	ND	13.3	1790	0.161	0.025	24.2	138	7.21	0.365	3.3	0.958	ND	NA	1.46	0.547	0.084
16717	1466	F	J	Somerset	3.68	25	1280	0.251	0.399	48.5	267	8.22	0.133	1.37	0.134	ND	NA	2.93	0.132	0.144
16718	1468	M	S/A	Dyfed	ND	7.26	655	0.06	0.113	25.9	116	4.05	0.238	0.889	0.088	ND	NA	5.36	0.367	0.225
16719	1470	F	A	Somerset	ND	19.1	1760	0.192	ND	31.6	153	9.02	0.289	5.36	1.01	ND	NA	1.54	0.546	0.057
16720	1471	F	A	Somerset	ND	11.1	762	0.088	0.11	31.5	85.9	11.3	0.132	1.13	1.06	ND	NA	15.3	0.17	0.197
16721	1473	M	S/A	Durham	9.07	15.1	1620	0.083	ND	23.5	133	9.83	0.182	4.41	1.37	ND	NA	4.67	0.202	0.068
16722	1475	M	S/A	Devon	ND	7.55	435	0.073	0.142	22	76.7	6.99	0.648	1.17	0.177	ND	NA	2.25	0.354	0.224
16723	1490	M	S/A	Cornwall	2.62	21.4	1740	0.136	ND	27.9	131	10.3	0.201	4.14	1.07	ND	NA	6.97	0.298	0.091

ND indicates that concentrations were below the limit of detection for that element. For age-classes, A = Adult, SA = sub-adult, and J = juvenile

NA indicates not analysed