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Conversion factors for metals between liver, muscle and wholebody in perch

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Report nr 1:2015

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NATIONAL
ENVIRONMENTAL
MONITORING
COMMISSIONED BY
THE SWEDISH EPA

FILE NO. NV-06938-13
CONTRACT NO. 2213-13-028
PROGRAMME AREA Miljögifter akvatiskt
SUBPROGRAMME Utredningsuppdrag, analys och infrastruktur

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Responsible publisher
Swedish Museum of Natural History

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Report title and subtitle
Conversion factors for metals between liver, muscle and wholebody in perch

Purchaser
Swedish Environmental Protection Agency, Environmental Monitoring Unit
SE-106 48 Stockholm, Sweden

Funding
National environmental monitoring

Keywords for location (specify in Swedish)
Degervattnet, Horsan, Lilla Öresjön, Fiolen, Hjärtsjön, Krageholmssjön

Keywords for subject (specify in Swedish)
Metals, conversion factors, target value, liver, muscle, wholebody

Period in which underlying data were collected
2013-2014

Summary

Different metals were distributed differently in the fish. The highest concentrations of Ag, Al, As, Cd, Cu, Sb, and Zn were found in liver; concentrations of Sn and Hg were highest in muscle, while Cr, Ni, and Pb were found in the highest concentrations in wholebody.

Target levels are set for mercury, lead, cadmium, and nickel. But these are set in wholebody while concentrations are measured in muscle or liver. However, by investigating linear relationships between wholebody and muscle/liver and then use the functions from the regression lines, it is possible to express the target values in muscle or liver.

For mercury, wholebody concentration was significantly correlated with muscle concentrations and the existing target level of 20 µg/kg wet weight was recalculated to the corresponding muscle value, and a value of 21.0 µg/kg wet weight was derived.

For both cadmium and lead, significant correlations between wholebody and liver concentrations were found. For cadmium, the existing target level of 0.16 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was 31.9 µg/g dry weight. For lead, the existing target level of 1 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was 1.46 µg/g dry weight. For nickel, most values were below the limit of quantification and therefore no recalculations were done.

Introduction

Within the national monitoring programme for contaminants, metals, except mercury, are measured in liver, and mercury is measured in muscle. However, the EQS_{biota} (Environmental Quality Standards) (for mercury) and $QS_{sec\ pois.}$ (Specific Quality Standards) (for cadmium, lead and nickel), derived under the Water Framework Directive to protect against secondary poisoning, refer to the tissue eaten by the predators, i.e. whole fish.
For these metals, the following EQS_{biota} and $QS_{sec\ pois.}$ have been set:

Mercury: the EQS_{biota} for mercury is set at 20µg/kg (mercury and its compounds) prey tissue wet weight to protect against secondary poisoning.

Cadmium: the $QS_{sec\ pois.}$ is set at 0.16 mg/kg prey tissue wet weight. The EC foodstuff regulation sets a maximum level for muscle meat at 0.05 mg/kg wet weight.

Lead: the $QS_{sec\ pois.}$ is set at 1000 µg/kg prey tissue wet weight. The EC foodstuff regulation sets a maximum level for muscle meat of fish at 0.3 mg/kg wet weight.

Nickel: the $QS_{sec\ pois.}$ is set at 0.73 mg/kg prey tissue wet weight.

Aim

The aim with this study were to (1) investigate if there are any linear relationships in metal concentration between liver, muscle, and whole fish (2) calculate conversion factors between liver, muscle, and whole fish (3) recalculate liver or muscle concentrations in order to be comparable with whole fish concentrations, for which target levels have been established (4) recalculate liver concentrations to muscle concentrations so that they can be comparable with the foodstuff regulation

Material and methods

Samples

For this project, 6 lakes out of the 32 lakes in the Swedish national monitoring programme for contaminants in biota were selected (Fig. 1, table 1). Only perch was used, in order to minimise species differences. From each lake, 12 specimens were used. Metals were analysed in liver, muscle and the remaining carcass of the fish. The analysed metals were: mercury (Hg), lead (Pb), cadmium (Cd), nickel (Ni), chromium (Cr), copper (Cu), zinc (Zn), arsenic (As), silver (Ag), aluminium (Al), antimony (Sb), and tin (Sn).

For each specimen, total body weight, body length, total length (body length plus the tail fin), sex, age, gonad weight, liver weight, and all sample weights (liver, muscle, and wholebody) were recorded. To avoid surface contamination and to obtain a sample consisting of only muscle tissue, the epidermis and subcutaneous fatty tissue were carefully removed before the muscle tissue was excised. Muscle samples were taken from the middle dorsal muscle layer. After the liver and muscle samples had been prepared, the otoliths were taken out and thereafter the rest of the fish was homogenized in a mixer (IKA ULTRA-TURRAX T 25 DIGITAL).

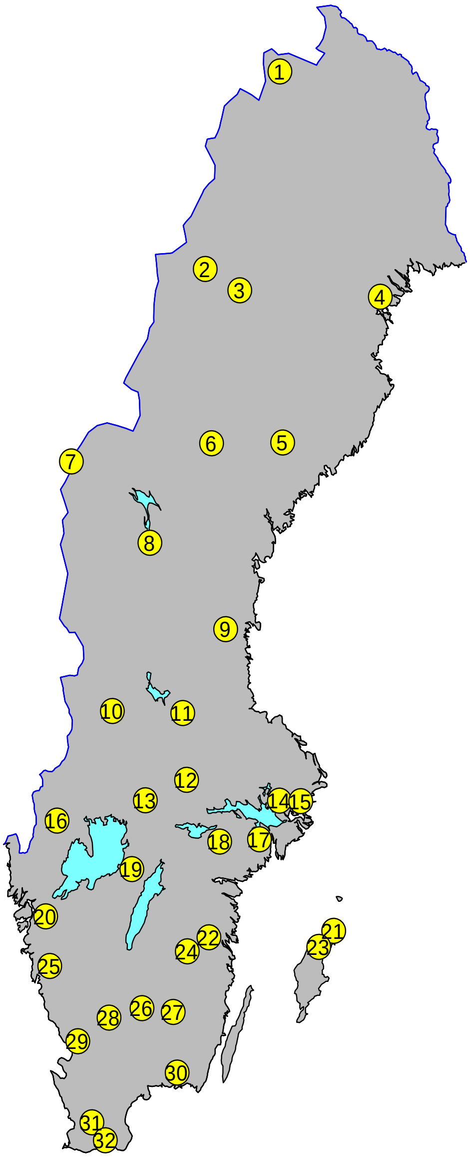


Fig. 1. Sampling sites within the Swedish National Monitoring Program for Contaminants in Freshwater Biota. See table 1 for information about the different lakes.

Table 1. Sampling sites and species within the Swedish National Monitoring Program for Contaminants in Freshwater Biota. Column four shows which lakes that were analysed for metals in liver, muscle, and wholebody and how many samples that were analysed at each lake. The first column refers to the sampling site numbers in figure 1.

N in map	Sampling site	Species	Metal samples
1	Abiskojaure	Arctic char	
2	Tjulträsk	Arctic char	
3	Storvindeln	Pike	
4	Brännträsket	Perch	
5	Remmarsjön	Perch	
6	Degervattnet	Perch	12
7	Stor-Björsjön	Arctic char	

8	Stor-Backsjön	Perch	
9	Stensjön	Perch	
10	Gipsjön	Perch	
11	Spjutsjön	Perch	
12	Övre Skärsjön	Perch	
13	Limmingsjön	Perch	
14	Fysingen	Perch	
15	Tärnan	Perch	
16	Bysjön	Perch	
17	Stora Envättern	Perch	
18	Älgsjön	Perch	
19	Svartsjön	Perch	
20	Fräcksjön	Perch	
21	Bästeträsk	Perch	
22	Allgjuttern	Perch	
23	Horsan	Perch	12
24	Skärgölen	Perch	
25	Lilla Öresjön	Perch	12
26	Fiolen	Perch	12
27	Hjärtsjön	Perch	12
28	Bolmen	Pike	
29	Stora Skärsjön	Perch	
30	Sännen	Perch	
31	Krankesjön	Perch	
32	Krageholmsjön	Perch	12

Analytical methods

The analyses of trace metals were carried out at the Analytical Environmental Chemistry Unit at the Department of Applied Environmental Science (ITM), University of Stockholm.

Sample preparation and instrumental analysis

Analytical methods for metals in liver are performed according to the Swedish standards SS-EN 13805 (Foodstuffs – Determination of trace elements – Pressure digestion) and SS-EN ISO 17294-2 (Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of 62 elements), and for mercury according to the US EPA Method 7473 (mercury in solids and solutions by thermal decomposition, amalgamation and atomic absorption spectrophotometry).

Quality control

The laboratory participates in the periodic QUASIMEME intercalibration rounds.

Reference Material

CRMs (certified reference material) used for mercury are:
DORM-2 and DORM-3 (dogfish muscle)
For all other metals, CRMs used are:
DOLT-3 (dogfish liver)
NIST 1566 (oyster tissue)
TORT-2 (lobster hepatopancreas)

Data treatment

Since the carcass concentration measured in the lab represented whole fish but without the muscle and liver samples taken from the respective fish, a whole fish concentration needed to be calculated before any further data treatments. The following formula was used for the calculation:

$$(C_{carcass} \text{ x } W_{carcass} + C_{liver} \text{ x } W_{liver} + C_{muscle} \text{ x } W_{muscle}) / W_{\text{whole fish}} = C_{\text{whole fish}}$$

C = contaminant concentration
W = weight

Before any statistical analyses were conducted, metal concentrations below the limit of quantification (LOQ) were substituted by dividing the reported value for LOQ with the square root of two. No correlations were conducted for samples where more than 50% were below LOQ. Linear regression analyses between liver & whole fish, muscle & whole fish, and liver & muscle were conducted, on both wet weight and dry weight. In addition, linear regression analyses were performed between whole fish concentrations in wet weight compared to liver concentrations in dry weight, for Pb and Cd, in an attempt to ease the translation between liver concentrations in dry weight (most results are reported in dry weight) to the target level, which is set in wet weight.

Since the target levels for Hg, Pb, Cd, and Ni are set in whole fish, the function for whole fish vs. liver or whole fish vs. muscle were used. For example, by using the function in Fig. 2:

Hg wholebody = 4.1041 + 0.75517 x Hg muscle

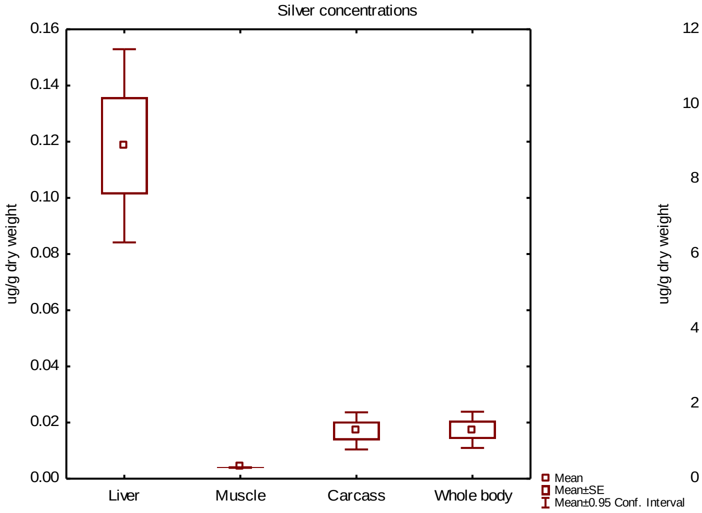
For Hg wholebody, the target level for Hg was used, i.e. 20 ng/g ww.

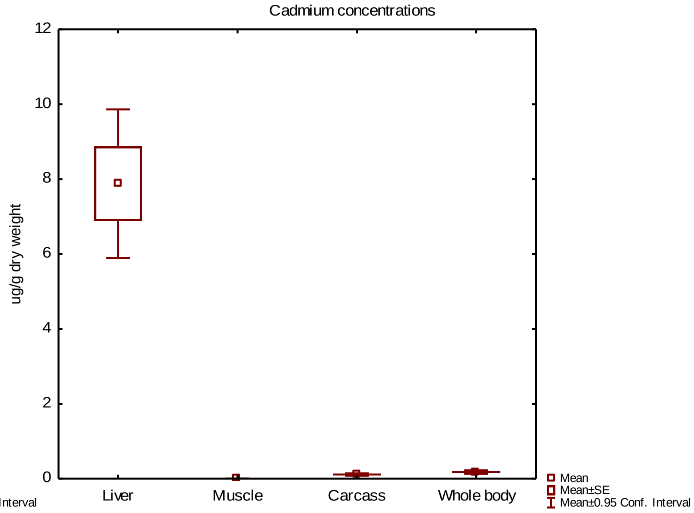
20 = 4.1041 + 0.75517 x Hg muscle
Hg muscle = (20 – 4.1041) /0.75517
Hg muscle = 21 ng/g ww

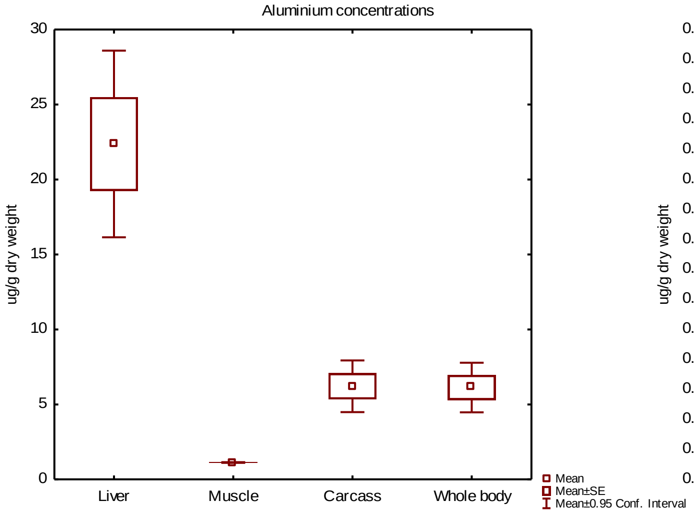
95% confidence intervals for the muscle and liver values were also calculated for Hg, Pb, and Cd, by using the standard errors for both the slope and the intercept of the regression functions.

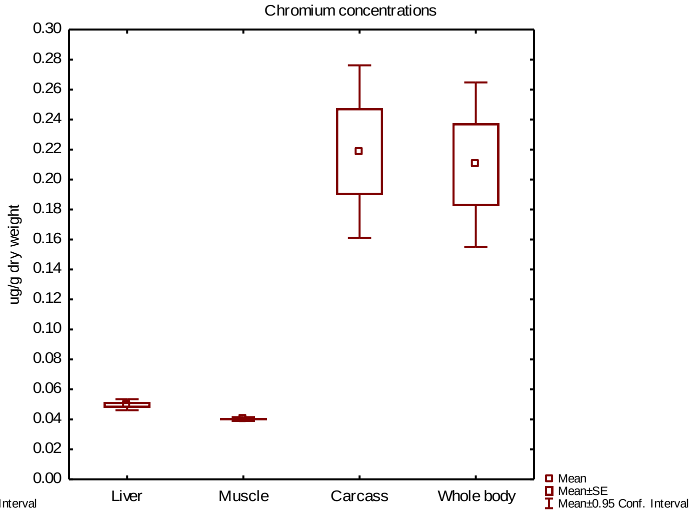
Results

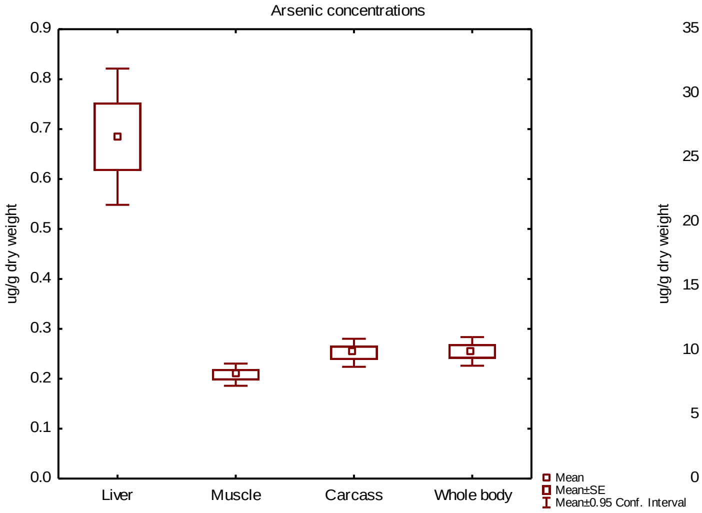
It is clear that the different metals are distributed differently in the fish (Fig. 2). The highest concentrations of Ag, Al, As, Cd, Cu, Sb, and Zn were found in liver; concentrations of Sn and Hg were highest in muscle, while Cr, Ni, and Pb were found in the highest concentrations in wholebody (Fig. 2). See appendix table 1-3 for information on all metal concentrations.

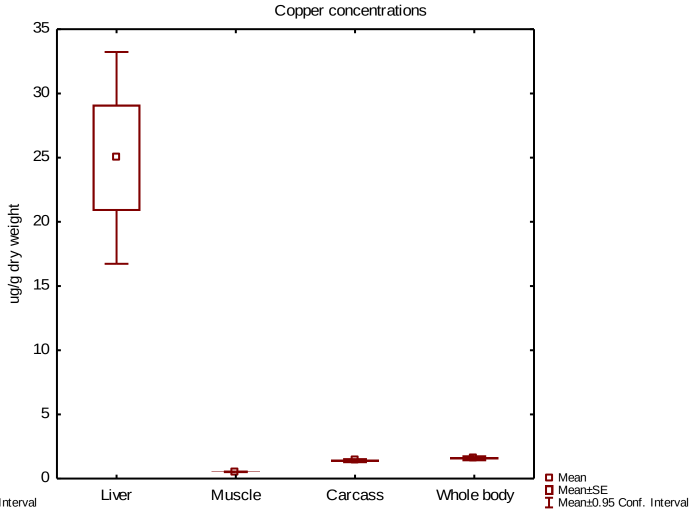

Silver concentrations
ug/g dry weight
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval


Cadmium concentrations
ug/g dry weight
12
10
8
6
4
2
0
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval


Aluminium concentrations
ug/g dry weight
30
25
20
15
10
5
0
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval


Chromium concentrations
ug/g dry weight
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval


Arsenic concentrations
ug/g dry weight
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval


Copper concentrations
ug/g dry weight
35
30
25
20
15
10
5
0
Liver
Muscle
Carcass
Whole body
Mean
Mean±SE
Mean±0.95 Conf. Interval

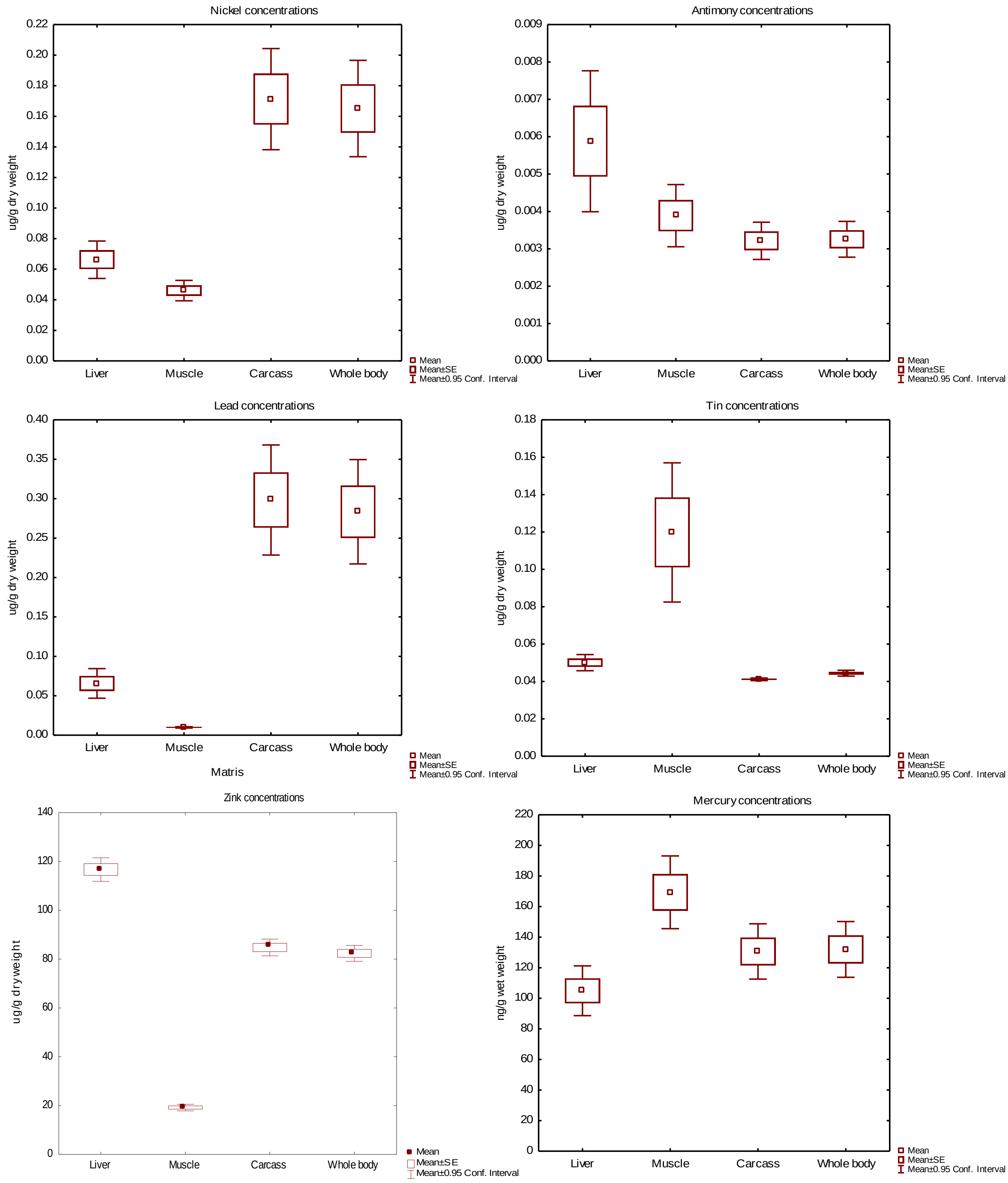


Fig. 2. Distribution of different metals in liver, muscle, carcass and wholebody. The plotted symbols shows mean values with standard error and 95% confidence interval. Mercury is shown in ng/g wet weight and all the other metals are shown in ug/g dry weight.

Regressions between different tissues

Wholebody and liver were significantly correlated for the eight analysed metals (Table 2), in many cases explained by liver contributing with the main part of metals to the whole fish. A few metals did also show significant correlations between wholebody and muscle or muscle and liver (Table 2).

Table 2. Correlations of different metals between wholebody & liver, wholebody & muscle, and muscle & liver. ns=non significant. Column five shows which figures in the report that are connected to each correlation.

Compounds	Correlations	r-value	p	Figure
Al	Wholebody vs. Liver	0.374	<0.05	Appendix Fig. 7,8
As	Wholebody vs. Liver	0.82	<0.05	Appendix Fig. 9,10
	Wholebody vs. Muscle	0.832	<0.05	Appendix Fig. 11,12
	Muscle vs. Liver	0.775	<0.05	Appendix Fig. 13,14
Cd	Wholebody vs. Liver	0.869	<0.05	Fig. 4,5,6
	Wholebody vs. Muscle	0.834	<0.05	Appendix Fig. 3,4
	Muscle vs. Liver	0.858	<0.05	Fig. 7, Appendix Fig. 5,6
Cu	Wholebody vs. Liver	0.656	<0.05	Appendix Fig. 27,28
	Wholebody vs. Muscle		ns	Appendix Fig. 29,30
	Muscle vs. Liver		ns	Appendix Fig. 31,32
Hg	Wholebody vs. Liver	0.785	<0.05	Appendix Fig. 1
	Wholebody vs. Muscle	0.985	<0.05	Fig. 3
	Muscle vs. Liver	0.726	<0.05	Appendix Fig. 2
Pb	Wholebody vs. Liver	0.852	<0.05	Fig. 8,9,10
Sb	Wholebody vs. Liver		ns	Appendix Fig. 15,16
	Wholebody vs. Muscle	0.295	<0.05	Appendix Fig. 17,18
	Muscle vs. Liver		ns	Appendix Fig. 19,20
Zn	Wholebody vs. Liver	0.296	<0.05	Appendix Fig. 21,22
	Wholebody vs. Muscle	0.799	<0.05	Appendix Fig. 23,24
	Muscle vs. Liver			Appendix Fig. 25,26

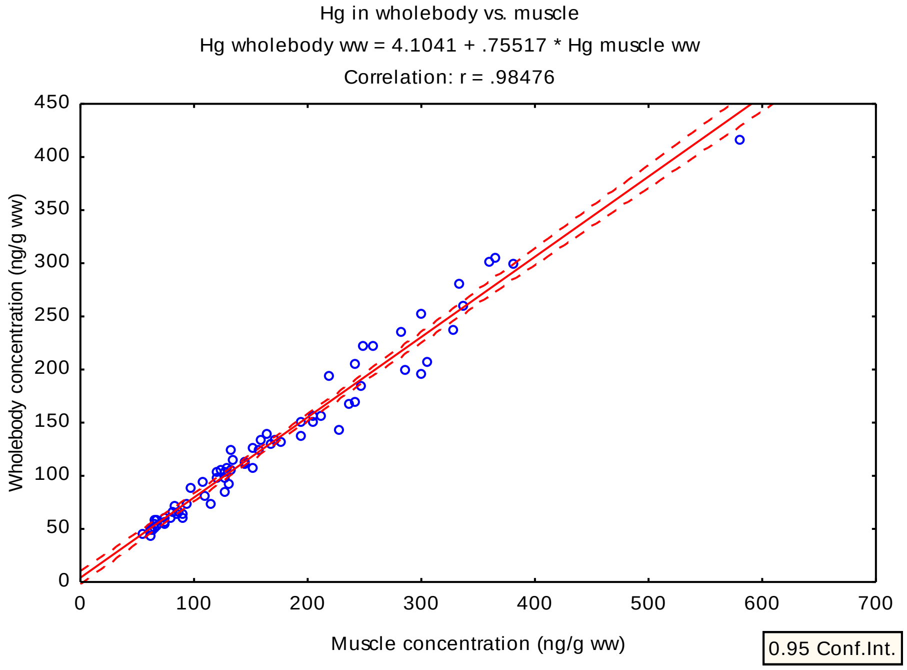


Fig. 3. Correlation of Hg (ng/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

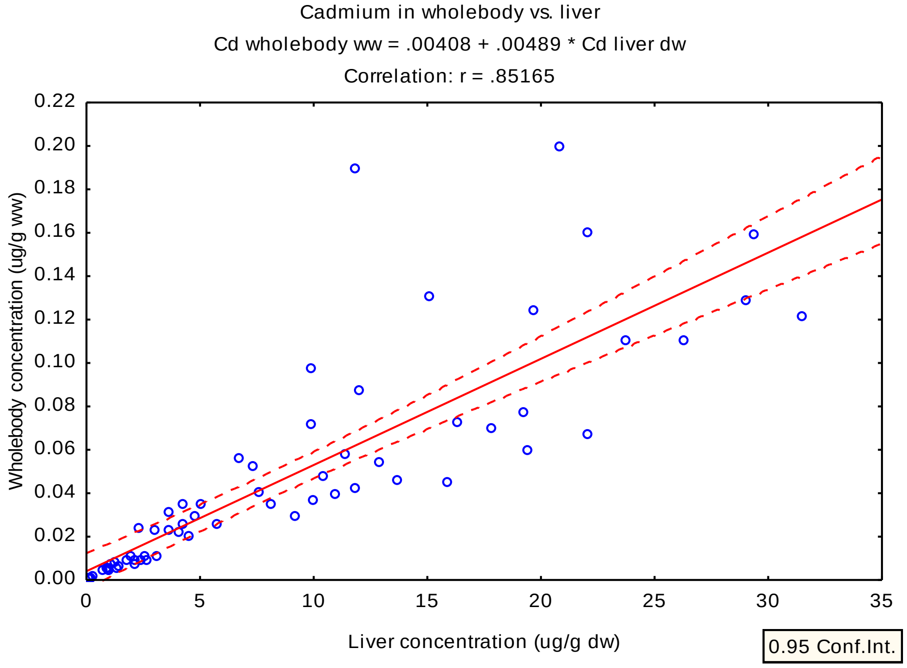


Fig. 4. Correlation of Cd in wholebody (ug/g wet weight) vs. liver (ug/g dry weight). The dotted line shows the 95% confidence interval.

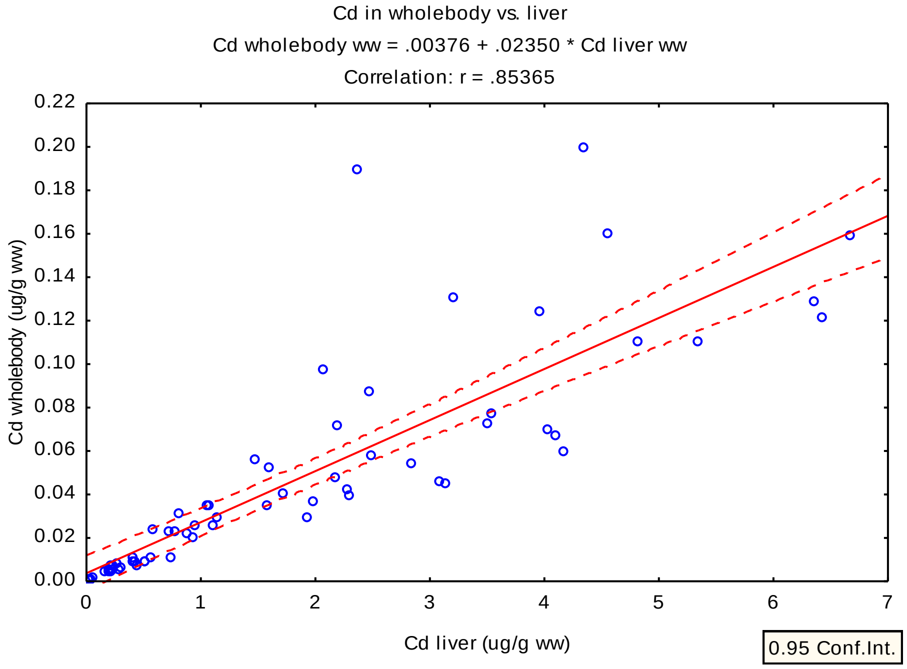


Fig. 5. Correlation of Cd (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

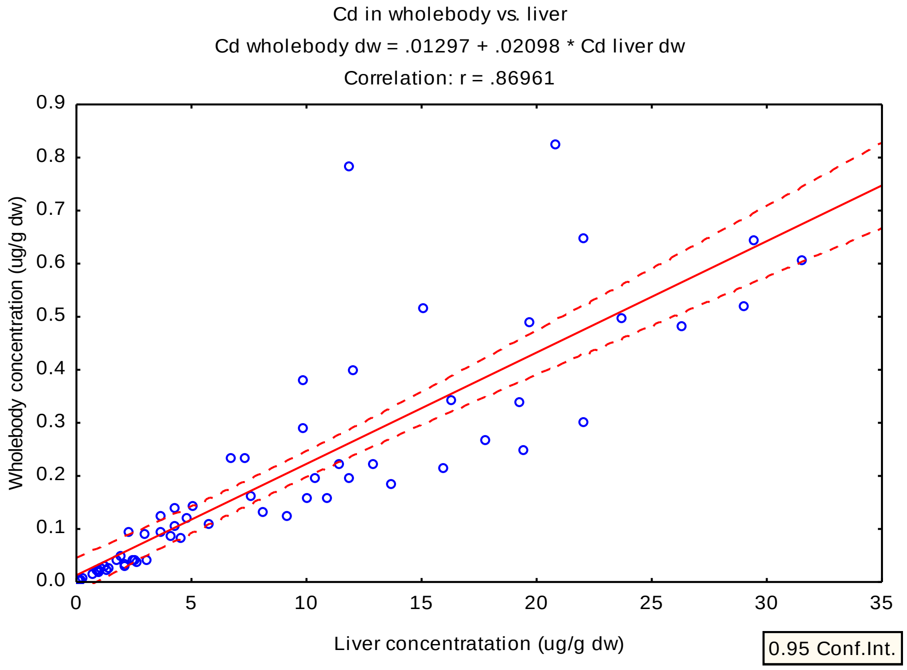


Fig. 6. Correlation of Cd (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

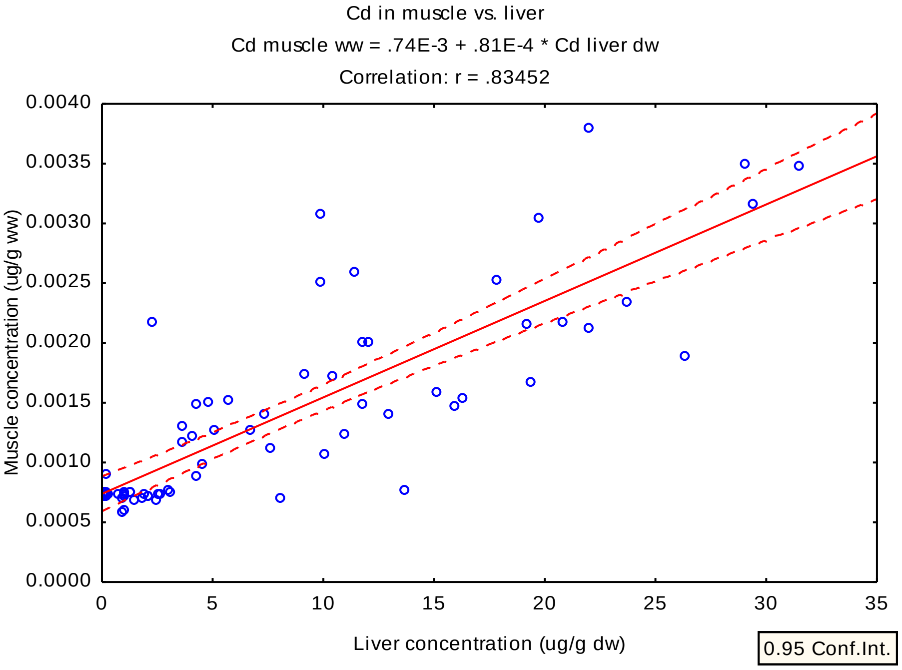


Fig. 7. Correlation of Cd in muscle (ug/g wet weight) vs. liver (ug/g dry weight). The dotted line shows the 95% confidence interval.

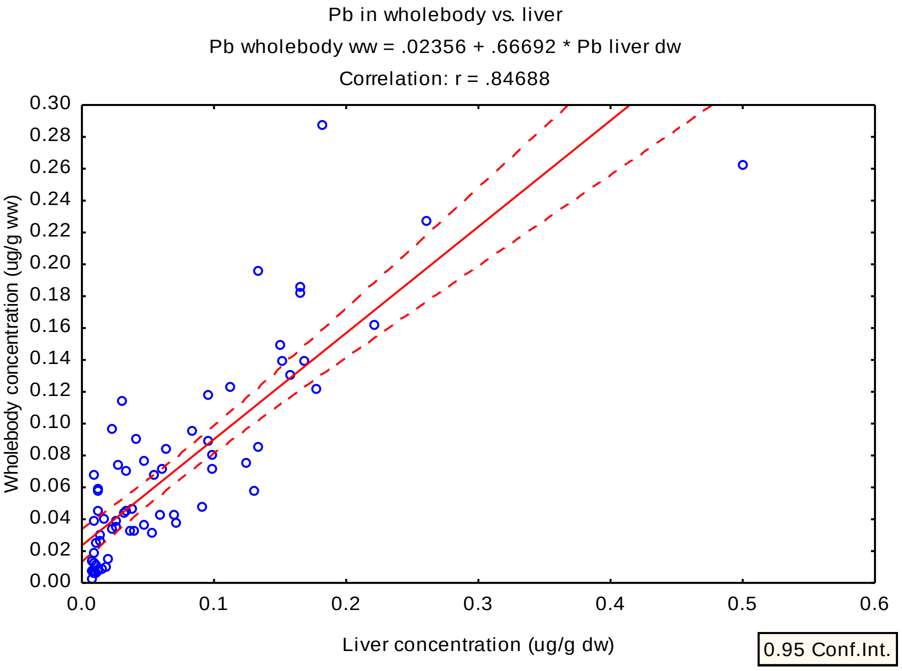


Fig. 8. Correlation of Pb in wholebody (ug/g wet weight) vs. liver (ug/g dry weight). The dotted line shows the 95% confidence interval

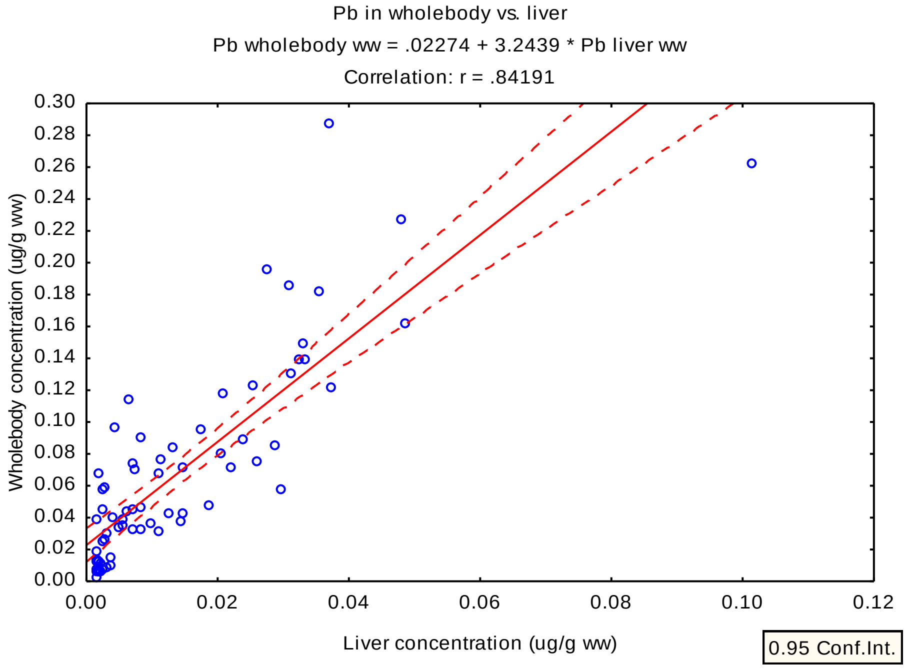


Fig. 9. Correlation of Pb (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

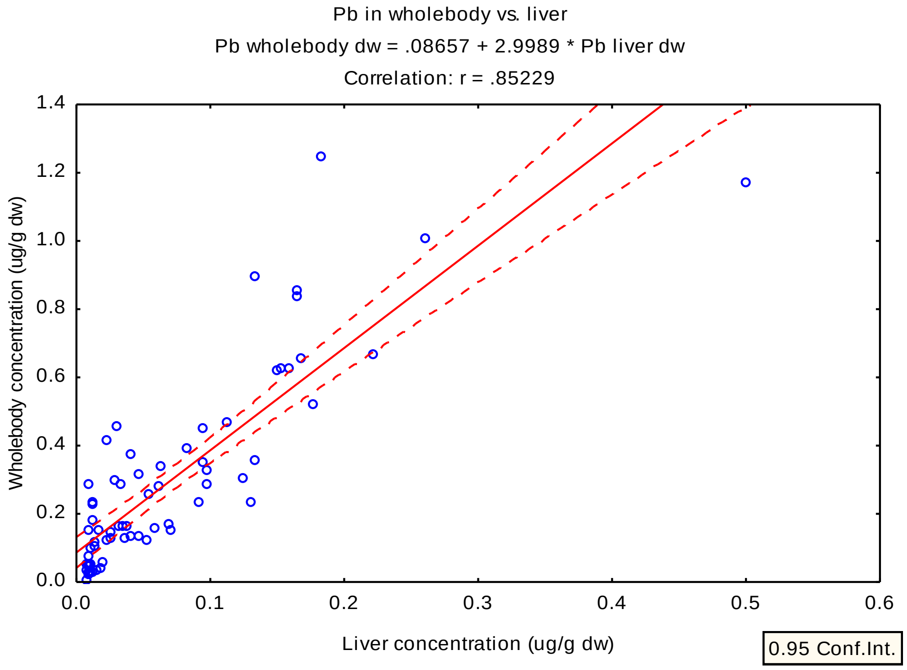


Fig. 10. Correlation of Pb (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

EQS values expressed as a muscle or liver value

For the compounds where target levels have been set, i.e. Hg, Pb, and Cd, the functions from the correlations were used in order to be able to express their respective target values in muscle (for Hg) and liver (for Pb and Cd). Since Ni had the majority of their values in liver and muscle below LOQ they were excluded for further calculations. For Cd, which also has a target value for foodstuff regulation, and where a significant correlation was seen between liver and muscle, the liver concentration was also recalculated to a corresponding muscle concentration. For lead, on the other hand, there was no significant correlation between liver and muscle and therefore no recalculation of the target level for foodstuff could be done.

Mercury

If using the function for Hg in Fig. 2, the existing target level of 20 µg/kg wet weight was recalculated to the corresponding muscle value, and a value of **21.0** (95% CI 12.8, 28.2) **µg/kg wet weight** was derived.

Cadmium

For Cd, where liver concentrations normally are presented in dry weight, while the target level is set in wet weight, three possible functions can be used;

(1) wholebody concentration in wet weight compared to liver concentration in dry weight (Fig. 4).
(2) wholebody concentration in dry weight compared to liver concentration in dry weight (Fig. 6).
(3) wholebody concentration in wet weight compared to liver concentration in wet weight (Fig. 5).

Function 1 is probably the most useful one. But in some cases perhaps one of the other two functions might be more appropriate.

If using **function 1** (Fig. 4), the existing target level of 0.16 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was **31.9** (95% confidence interval (CI) 29.3, 35.4) **µg/g dry weight**.
If using **function 3** (Fig. 5), the existing target level of 0.16 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was **6.65** (95% CI 6.11, 7.37) **µg/g wet weight**.
If using **function 2** (Fig. 6), the existing target level of 0.16 µg/g wet weight was recalculated to dry weight by using the mean dry weight percentage for the fish in this study (20%) and thereafter recalculated to a corresponding target level in liver in dry weight. A value of **37.5** (95% CI 34.4, 41.6) **µg/g dry weight** in liver was then derived.

For cadmium, there was also a significant correlation between muscle and liver, and therefore the function from that correlation could be used in order to compare liver concentrations to the foodstuff regulation for cadmium. By using the function from Fig 7, where wet weight in muscle was correlated to dry weight in liver, the recalculated target level of 0.05 µg/g wet weight in muscle corresponded to **608** (95% CI 531, 712) **µg/g dry weight in liver.**

Lead

For Pb, where liver concentrations normally are presented in dry weight, while the target level is set in wet weight, three possible functions can be used;

(1) wholebody concentration in wet weight compared to liver concentration in dry weight (Fig. 8).
(2) wholebody concentration in dry weight compared to liver concentration in dry weight (Fig. 10).

(3) wholebody concentration in wet weight compared to liver concentration in wet weight (Fig. 9).

Function 1 is probably the most useful one. But in some cases perhaps one of the other two functions might be more appropriate.

If using **function 1** (Fig. 8), the existing target level of 1 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was **1.46** (95% CI 1.29, 1.70) **µg/g dry weight**.
If using **function 3** (Fig. 9), the existing target level of 1 µg/g wet weight was recalculated to the corresponding target level in liver, and a value of **0.30** (95% CI 0.26, 0.35) **µg/g wet weight** was derived.
If using **function 2** (Fig. 10), the existing target level of 1 µg/g wet weight was recalculated to dry weight by using the mean dry weight percentage for the fish in this study (20%) and thereafter recalculated to a corresponding target level in liver in dry weight. A value of **1.64** (95% CI 1.44, 1.90) **µg/g dry weight** in liver was then derived.

Summary

For mercury, wholebody concentration was significantly correlated with muscle concentrations and the existing target value of 20 ng/g wet weight was recalculated to the corresponding concentration in muscle, and a value of 21 (95% CI 12.8, 28.2) ng/g wet weight was derived.

For both cadmium and lead, significant correlations were found between wholebody concentrations and liver concentrations. Since the target values are set in wet weight but the results are mostly presented in dry weight the most useful functions will be from figure 4 and 7, i.e. wholebody wet weight vs. liver dry weight.

For cadmium, the existing target level of 0.16 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was 31.9 (95% CI 29.3, 35.4) µg/g dry weight.

For lead, the existing target level of 1 µg/g wet weight for whole fish was recalculated to the corresponding concentration in liver. The new derived concentration in liver was 1.46 (95% CI 1.29, 1.70) µg/g dry weight.

Cadmium concentration in liver was also recalculated to the corresponding target level for foodstuff, which is set in muscle. The new derived concentration in liver was 608 (95% CI 531, 712) µg/g dry weight.

Acknowledgement

Henrik Dahlgren, Eva Kylberg, Jill Staveley Öhlund and Douglas Jones are thanked for the sampling and sample preparation. Marcus Sundbom and Karin Holm at ITM, Stockholm University are thanked for the chemical analyses.

Appendix

Table 1. Concentrations of different metals in liver (µg/g dw, but for Hg ng/g ww) in perch from different lakes in Sweden. A minus sign in front of some of the figures represents values below the reported LOQ.

Site	AG_L	AL_L	AS_L	CD_L	CR_L	CU_L	NI_L	PB_L	SB_L	SN_L	ZN_L	HG_L
Fiolen	0.508	11.9	0.58	20.8	-0.05	46.4	0.06	0.040	0.0086	-0.05	131	47.7
Fiolen	0.378	10.0	0.72	15.1	-0.05	57.0	-0.05	0.069	0.0051	-0.05	138	63.8
Fiolen	0.016	10.5	0.69	10.0	-0.09	12.7	-0.09	0.022	-0.0052	-0.09	120	96.0
Fiolen	0.430	8.9	0.72	29.4	-0.06	77.9	0.07	0.130	0.0041	-0.06	148	143
Fiolen	0.089	23.2	0.26	31.5	0.09	20.7	0.06	0.091	0.0035	-0.05	140	96.7
Fiolen	0.021	5.1	0.56	7.60	-0.05	9.23	-0.05	-0.012	-0.0029	-0.05	104	104
Fiolen	0.014	14.6	0.51	13.7	-0.07	11.3	-0.07	-0.015	-0.0038	-0.07	132	163
Fiolen	0.496	22.4	0.38	29.0	-0.07	53.8	0.08	0.030	0.0043	-0.07	138	73.1
Fiolen	0.214	9.5	0.37	9.87	-0.07	14.6	-0.07	0.053	-0.0042	-0.07	122	41.2
Fiolen	0.443	18.6	0.64	22.0	-0.07	62.4	-0.07	0.063	-0.0039	-0.07	133	76.4
Fiolen	0.317	7.3	0.51	11.8	-0.05	48.3	-0.05	0.041	0.0093	-0.05	114	43.0
Fiolen	0.334	17.7	0.40	19.7	-0.05	50.5	0.06	0.071	0.0060	-0.05	119	62.3
Degervattnet	0.174	27.6	0.47	3.65	-0.05	14.3	0.21	0.014	0.0038	-0.05	118	93.7
Degervattnet	0.041	8.3	1.55	2.41	-0.07	12.0	-0.07	-0.017	-0.0041	-0.07	113	89.2
Degervattnet	0.026	11.3	1.08	1.77	-0.06	7.71	0.06	-0.014	-0.0034	-0.06	104	110
Degervattnet	0.045	34.5	0.50	4.52	-0.08	10.7	0.12	0.018	-0.0043	-0.08	104	89.8
Degervattnet	0.047	19.4	0.73	2.55	-0.05	9.60	0.05	-0.012	-0.0030	-0.05	121	129
Degervattnet	0.126	30.5	0.65	5.72	-0.08	12.6	0.18	0.019	-0.0045	-0.08	113	106
Degervattnet	0.046	32.9	0.92	4.05	-0.08	10.4	0.15	-0.019	-0.0047	-0.08	109	104
Degervattnet	0.036	3.8	1.66	0.937	-0.05	7.64	-0.05	-0.011	-0.0028	-0.05	116	137
Degervattnet	0.061	15.6	1.16	1.92	-0.07	9.19	0.09	-0.015	-0.0038	-0.07	107	117
Degervattnet	0.038	3.2	1.73	1.43	-0.08	8.39	-0.08	-0.017	-0.0043	-0.08	104	106
Degervattnet	0.182	22.5	0.62	3.65	-0.08	13.0	0.21	-0.018	-0.0043	-0.08	106	100
Degervattnet	0.050	8.3	1.00	0.913	-0.06	9.01	-0.06	-0.013	-0.0031	-0.06	109	87.4
Horsan	0.404	3.7	0.33	0.976	-0.07	212	-0.07	0.059	0.0107	-0.07	172	49.6
Horsan	0.283	5.7	0.27	8.09	-0.05	209	-0.05	0.036	0.0049	-0.05	208	248
Horsan	0.017	4.6	0.28	1.30	-0.06	17.8	-0.06	0.026	0.0042	-0.06	116	44.7
Horsan	0.007	5.7	0.40	2.08	-0.07	12.5	-0.07	-0.017	0.0047	-0.07	115	119
Horsan	0.010	7.9	0.19	1.02	-0.05	10.4	0.05	0.034	0.0128	-0.05	139	53.4
Horsan	0.011	4.8	-0.27	0.987	-0.09	14.1	-0.09	0.022	0.0103	-0.09	110	66.8
Horsan	0.010	3.0	0.22	1.26	-0.06	10.6	0.08	0.047	0.0069	-0.06	109	58.8
Horsan	-0.005	5.4	-0.15	3.06	-0.05	6.80	-0.05	0.017	0.0071	-0.05	85.5	142
Horsan	-0.007	4.8	-0.21	1.04	-0.07	9.30	-0.07	0.038	0.0063	-0.07	103	46.2
Horsan	-0.008	4.2	-0.24	2.07	-0.08	10.0	-0.08	0.054	0.0098	-0.08	133	77.6
Horsan	0.010	-2.5	0.29	0.711	-0.09	10.2	-0.09	0.026	0.0063	0.14	110	54.5
Horsan	0.027	7.5	0.25	2.60	-0.06	29.3	-0.06	0.032	0.0100	-0.06	121	47.5
Hjärtsjön	0.180	92.7	-0.28	19.2	-0.10	18.2	-0.10	0.261	0.0089	-0.10	114	92.9
Hjärtsjön	0.082	80.5	-0.31	15.9	-0.11	13.4	-0.11	0.158	0.0090	-0.11	120	68.2
Hjärtsjön	0.306	91.8	-0.22	23.7	-0.08	35.5	-0.08	0.500	0.0071	-0.08	121	120
Hjärtsjön	0.416	96.3	-0.46	22.0	-0.16	48.3	-0.16	0.165	0.0685	-0.16	139	145
Hjärtsjön	0.438	29.6	0.21	12.9	-0.06	32.5	-0.06	0.221	0.0048	-0.06	132	94.4
Hjärtsjön	0.106	85.8	-0.17	12.0	-0.06	14.8	-0.06	0.133	0.0048	-0.06	109	72.1
Hjärtsjön	0.186	55.3	-0.28	16.3	-0.10	19.1	-0.10	0.165	0.0123	-0.10	124	104
Hjärtsjön	0.201	23.2	0.23	6.70	-0.08	20.3	-0.08	0.150	0.0067	-0.08	117	80.1
Hjärtsjön	0.177	21.0	0.26	7.29	-0.08	25.4	-0.08	0.152	0.0060	-0.08	106	72.8
Hjärtsjön	0.410	102	0.29	26.3	-0.07	51.3	-0.07	0.182	0.0082	-0.07	125	111
Hjärtsjön	0.057	34.7	0.28	9.13	-0.09	9.44	-0.09	0.177	0.0064	-0.09	120	72.4
Hjärtsjön	0.135	66.5	0.33	11.8	-0.11	19.7	-0.11	0.168	0.0116	-0.11	123	64.7
Krageholmssjön	-0.010	-2.8	1.74	0.069	-0.10	8.74	-0.10	-0.022	-0.0055	-0.10	95.4	45.8
Krageholmssjön	-0.005	-1.5	1.48	0.174	-0.05	8.37	-0.05	-0.012	-0.0029	-0.05	110	55.8
Krageholmssjön	-0.005	-1.4	1.79	0.166	-0.05	10.3	-0.05	-0.011	-0.0028	-0.05	108	36.3
Krageholmssjön	-0.005	-1.5	1.44	0.121	-0.05	5.56	-0.05	-0.012	-0.0029	-0.05	84.9	27.0
Krageholmssjön	-0.005	-1.5	2.46	0.137	-0.05	9.89	-0.05	-0.012	-0.0030	-0.05	113	46.6
Krageholmssjön	-0.005	-1.4	1.55	0.122	-0.05	13.0	-0.05	-0.012	-0.0028	-0.05	119	37.6
Krageholmssjön	-0.005	-1.4	1.99	0.242	-0.05	19.5	-0.05	-0.011	-0.0028	-0.05	106	39.0
Krageholmssjön	-0.005	-1.5	1.92	0.158	-0.05	13.2	-0.05	-0.012	-0.0029	-0.05	120	48.7
Krageholmssjön	-0.005	1.6	1.81	0.143	-0.05	19.1	-0.05	-0.012	-0.0029	-0.05	129	42.3
Krageholmssjön	-0.005	-1.5	1.40	0.118	-0.05	7.89	-0.05	-0.012	-0.0030	-0.05	117	59.7
Krageholmssjön	-0.005	-1.5	1.81	0.124	-0.05	8.05	-0.05	-0.012	0.0091	-0.05	106	41.8
Krageholmssjön	-0.006	-1.7	1.01	0.061	-0.06	9.74	-0.06	-0.013	0.0040	-0.06	114	45.2
Lilla Öresjön	0.050	44.3	0.46	11.4	-0.11	12.5	0.38	0.095	-0.0066	-0.11	116	329
Lilla Öresjön	-0.005	8.2	0.17	2.27	-0.05	5.05	-0.05	0.028	0.0034	-0.05	56.8	103
Lilla Öresjön	0.169	83.5	0.43	19.4	-0.06	30.1	-0.06	0.133	0.0048	-0.06	131	247
Lilla Öresjön	0.084	19.4	0.39	4.26	-0.05	21.2	-0.05	0.095	0.0030	-0.05	74.8	187
Lilla Öresjön	0.019	26.3	0.34	5.04	-0.05	6.49	-0.05	0.083	0.0043	-0.05	102	169
Lilla Öresjön	0.123	27.1	0.64	10.4	-0.11	19.0	-0.11	0.098	-0.0061	-0.11	128	158
Lilla Öresjön	0.059	19.9	0.32	4.75	-0.06	16.4	0.07	0.047	-0.0036	-0.06	87.4	348
Lilla Öresjön	0.123	31.8	0.62	10.9	-0.10	24.4	-0.10	0.124	-0.0058	-0.10	121	144
Lilla Öresjön	0.037	17.1	0.27	2.99	-0.09	15.6	-0.09	0.061	-0.0050	-0.09	102	245
Lilla Öresjön	0.116	51.3	0.58	17.8	-0.08	26.4	0.08	0.112	0.0095	-0.08	131	249
Lilla Öresjön	0.048	20.7	0.30	4.24	-0.06	13.7	-0.06	0.033	0.0041	-0.06	72.5	239
Lilla Öresjön	0.053	31.2	0.31	9.84	-0.07	25.4	0.07	0.098	-0.0037	-0.07	124	221

Table 2. Concentrations of different metals in muscle (µg/g dw, but for Hg ng/g ww) in perch from different lakes in Sweden. A minus sign in front of some of the figures represents values below the reported LOQ.

Site	AG_M	AL_M	AS_M	CD_M	CR_M	CU_M	NI_M	PB_M	SB_M	SN_M	ZN_M	HG_M
Fiolen	-0.01	-1.90	-0.19	0.01	-0.07	0.47	-0.07	-0.02	0.02	1.16	17.50	131.08
Fiolen	-0.01	-1.90	-0.19	0.01	-0.07	0.55	-0.07	-0.02	0.01	0.32	21.90	132.86
Fiolen	-0.01	-1.60	-0.16	0.01	-0.06	0.56	-0.06	-0.01	0.01	0.37	19.40	144.88
Fiolen	-0.01	-1.50	0.22	0.01	-0.05	0.47	-0.05	-0.01	0.00	0.10	21.40	171.53
Fiolen	-0.01	-1.50	0.16	0.02	-0.05	0.58	-0.05	-0.01	0.00	0.20	18.70	144.32
Fiolen	-0.01	-1.60	-0.16	0.01	-0.06	0.59	-0.06	-0.01	0.00	0.09	27.40	159.08
Fiolen	-0.01	-1.50	-0.15	-0.01	-0.05	0.50	-0.05	-0.01	0.01	0.47	16.50	122.98
Fiolen	-0.01	-1.80	-0.18	0.02	-0.06	0.51	-0.06	-0.01	0.01	0.46	16.70	120.45
Fiolen	-0.01	-2.00	-0.20	0.01	-0.07	0.59	-0.07	-0.02	0.00	0.07	21.00	92.62
Fiolen	-0.01	-1.70	0.21	0.02	-0.06	0.61	-0.06	-0.01	0.00	0.08	20.50	107.52
Fiolen	-0.01	-1.70	0.20	0.01	-0.06	0.63	-0.06	-0.01	0.00	0.15	20.50	115.51
Fiolen	-0.01	-1.50	0.22	0.01	-0.05	0.57	-0.05	-0.01	0.00	0.05	17.30	126.44
Degervattnet	-0.01	-1.60	0.17	0.01	-0.06	0.53	-0.06	-0.01	0.00	-0.06	17.70	82.12
Degervattnet	-0.01	-1.70	0.27	-0.01	-0.06	0.45	-0.06	-0.01	0.00	-0.06	15.90	133.08
Degervattnet	-0.01	-1.60	0.21	-0.01	-0.06	0.60	-0.06	-0.01	0.00	-0.06	17.90	175.63
Degervattnet	-0.01	-1.70	0.17	0.01	-0.06	0.60	-0.06	-0.01	0.00	0.08	18.30	108.90
Degervattnet	-0.01	-1.50	0.23	-0.01	-0.05	0.48	-0.05	-0.01	0.00	-0.05	17.30	247.52
Degervattnet	-0.01	-1.60	-0.16	0.01	-0.06	0.66	-0.06	-0.01	0.01	0.09	16.60	126.25
Degervattnet	-0.01	-1.50	0.20	0.01	-0.05	0.60	-0.05	-0.01	0.00	-0.05	18.10	128.54
Degervattnet	-0.01	-1.40	0.25	-0.01	-0.05	0.60	0.08	-0.01	0.00	0.09	15.90	236.00
Degervattnet	-0.01	-1.50	0.22	-0.01	-0.05	0.58	-0.05	-0.01	0.00	-0.05	17.30	145.17
Degervattnet	-0.01	-1.50	0.33	-0.01	-0.05	0.72	-0.05	-0.01	0.00	-0.05	21.80	166.92
Degervattnet	-0.01	-1.70	0.18	0.01	0.07	0.49	-0.06	-0.01	0.00	-0.06	15.70	85.93
Degervattnet	-0.01	-1.40	0.25	0.00	-0.05	0.55	-0.05	-0.01	0.00	0.05	17.60	127.72
Horsan	-0.01	-1.70	0.16	-0.01	-0.06	0.66	-0.06	-0.01	0.00	0.11	31.00	194.67
Horsan	-0.01	-1.70	0.21	-0.01	-0.06	0.62	-0.06	-0.01	0.00	-0.06	23.90	580.00
Horsan	-0.01	-1.40	0.15	-0.01	-0.05	0.49	-0.05	-0.01	0.00	-0.05	23.90	163.28
Horsan	-0.01	-1.70	0.17	-0.01	-0.06	0.45	-0.06	-0.01	0.00	0.22	24.60	305.02
Horsan	-0.01	-1.60	0.23	-0.01	-0.06	0.37	-0.06	-0.01	0.00	0.08	21.80	227.91
Horsan	-0.01	-1.30	0.20	0.00	-0.05	0.51	-0.05	-0.01	0.00	-0.05	34.00	286.20
Horsan	-0.01	-1.60	0.18	-0.01	-0.06	0.38	-0.06	-0.01	0.00	-0.06	21.40	204.79
Horsan	-0.01	-1.50	0.17	-0.01	-0.05	0.51	-0.05	-0.01	0.00	-0.05	23.00	381.60
Horsan	-0.01	-1.50	-0.15	-0.01	-0.05	0.41	0.09	-0.01	0.01	0.22	32.20	193.41
Horsan	-0.01	-1.60	-0.16	-0.01	-0.06	0.61	-0.06	0.03	0.00	0.14	49.60	298.96
Horsan	-0.01	-1.50	-0.15	-0.01	-0.05	0.41	-0.05	-0.01	0.00	-0.05	27.00	204.46
Horsan	-0.01	-1.50	0.18	-0.01	-0.05	0.49	-0.05	-0.01	0.00	0.18	30.00	211.14
Hjärtsjön	-0.01	-1.70	-0.17	0.01	-0.06	0.49	-0.06	-0.01	0.00	-0.06	15.50	120.34
Hjärtsjön	-0.01	-1.70	-0.17	0.01	-0.06	0.57	-0.06	-0.01	0.00	-0.06	17.90	96.97
Hjärtsjön	-0.01	-1.40	-0.14	0.01	-0.05	0.53	-0.05	-0.01	0.01	0.09	15.20	134.26
Hjärtsjön	-0.01	-1.60	-0.16	0.01	-0.06	0.46	-0.06	-0.01	0.00	-0.06	17.00	151.87
Hjärtsjön	-0.01	-1.40	0.15	0.01	-0.05	0.56	-0.05	-0.01	0.00	0.18	17.20	81.00
Hjärtsjön	-0.01	-1.60	-0.16	0.01	-0.06	0.52	-0.06	-0.01	0.00	-0.06	14.70	152.36
Hjärtsjön	-0.01	-1.60	-0.16	0.01	-0.06	0.59	-0.06	-0.01	0.01	0.30	17.80	89.55
Hjärtsjön	-0.01	-1.40	-0.14	0.01	-0.05	0.60	-0.05	-0.01	0.00	0.05	20.60	85.24
Hjärtsjön	-0.01	-1.60	-0.16	0.01	-0.06	0.53	-0.06	0.01	0.00	-0.06	17.00	74.17
Hjärtsjön	-0.01	-1.50	-0.15	0.01	-0.05	0.53	-0.05	-0.01	0.00	0.08	15.70	156.87
Hjärtsjön	-0.01	-1.70	-0.17	0.01	-0.06	0.92	-0.06	0.02	0.01	-0.06	22.40	79.93
Hjärtsjön	-0.01	-1.40	-0.14	0.01	-0.05	0.44	-0.05	-0.01	0.01	0.07	13.70	89.39
Krageholmssjön	-0.01	-1.50	0.43	-0.01	-0.05	0.60	-0.05	-0.01	0.00	0.07	16.70	54.94
Krageholmssjön	-0.01	-1.50	0.31	-0.01	-0.05	0.51	-0.05	-0.01	0.01	0.22	15.10	73.69
Krageholmssjön	-0.01	-1.50	0.36	-0.01	-0.05	0.55	-0.05	-0.01	0.01	0.25	16.40	65.10
Krageholmssjön	-0.01	-1.70	0.27	-0.01	-0.06	0.44	-0.06	-0.01	0.00	0.06	15.10	61.92
Krageholmssjön	-0.01	-1.50	0.43	-0.01	-0.05	0.39	-0.05	-0.01	0.00	0.10	15.20	63.26
Krageholmssjön	-0.01	-1.50	0.29	-0.01	-0.05	0.39	-0.05	-0.01	0.00	0.09	14.40	61.24
Krageholmssjön	-0.01	-1.60	0.37	-0.01	-0.06	0.42	-0.06	-0.01	0.00	-0.06	14.20	65.73
Krageholmssjön	-0.01	-1.90	0.37	-0.01	-0.07	0.42	-0.07	-0.02	0.00	-0.07	15.40	62.41
Krageholmssjön	-0.01	-1.60	0.36	-0.01	-0.06	0.42	-0.06	-0.01	0.00	-0.06	14.90	64.38
Krageholmssjön	-0.01	-1.70	0.35	-0.01	-0.06	0.42	0.13	-0.01	0.01	0.31	15.30	74.47
Krageholmssjön	-0.01	-1.50	0.40	-0.01	-0.05	0.38	-0.05	-0.01	0.00	-0.05	14.10	66.78
Krageholmssjön	-0.01	-1.60	0.32	-0.01	-0.06	0.39	-0.06	-0.01	0.00	0.08	17.00	67.84
Lilla Öresjön	-0.01	-1.70	0.32	0.01	-0.06	0.75	-0.06	0.03	0.00	0.11	22.10	328.32
Lilla Öresjön	-0.01	-1.60	0.23	0.01	-0.06	0.72	-0.06	0.01	0.00	-0.06	23.50	240.87
Lilla Öresjön	-0.01	-1.80	0.31	0.01	-0.06	0.49	-0.06	-0.01	0.00	0.12	14.20	333.90
Lilla Öresjön	-0.01	-1.60	0.30	0.01	-0.06	0.51	-0.06	-0.01	0.00	-0.06	14.90	337.08
Lilla Öresjön	-0.01	-1.50	0.20	0.01	-0.05	0.51	-0.05	-0.01	0.00	0.07	17.50	281.96
Lilla Öresjön	-0.01	-1.70	0.35	0.01	-0.06	0.56	-0.06	-0.01	0.00	0.13	18.00	219.30
Lilla Öresjön	-0.01	-1.60	0.21	0.01	-0.06	0.46	-0.06	-0.01	0.00	-0.06	17.30	359.05
Lilla Öresjön	-0.01	-1.50	0.27	0.01	-0.05	0.52	-0.05	-0.01	0.00	0.05	15.40	241.28
Lilla Öresjön	-0.01	-1.50	-0.15	-0.01	-0.05	0.48	-0.05	-0.01	0.00	0.14	15.50	299.20
Lilla Öresjön	-0.01	-1.70	0.38	0.01	-0.06	0.62	0.25	-0.01	0.00	-0.06	15.00	248.98
Lilla Öresjön	-0.01	-1.70	-0.17	-0.01	-0.06	0.50	-0.06	-0.01	0.00	-0.06	13.70	365.40
Lilla Öresjön	-0.01	-1.60	-0.16	0.01	-0.06	0.51	0.09	-0.01	0.00	0.10	16.70	258.30

Table 3. Concentrations of different metals in the remaining carcass (µg/g dw, but for Hg ng/g ww) in perch from different lakes in Sweden. A minus sign in front of some of the figures represents values below the reported LOQ.

Site	AG_C	AL_C	AS_C	CD_C	CR_C	CU_C	NI_C	PB_C	SB_C	SN_C	ZN_C	HG_C
Fiolen	0.07	4.80	0.26	0.62	0.20	2.25	0.24	0.14	0.00	-0.06	92.80	91.23
Fiolen	0.03	6.20	0.22	0.36	0.27	1.28	0.19	0.18	0.00	-0.06	84.80	123.98
Fiolen	-0.01	-1.50	-0.15	0.08	0.12	1.07	0.13	0.44	0.00	-0.05	103.00	111.57
Fiolen	0.04	5.60	0.28	0.41	0.15	1.77	0.25	0.24	0.00	-0.06	89.60	133.09
Fiolen	0.02	3.80	0.17	0.27	0.24	1.41	0.18	0.25	0.00	-0.06	78.40	109.40
Fiolen	-0.01	2.30	0.19	0.07	0.21	1.09	0.16	0.05	0.00	-0.06	95.90	132.18
Fiolen	-0.01	-1.50	-0.15	0.08	0.12	1.10	0.10	0.11	0.01	-0.05	96.00	104.30
Fiolen	0.02	4.40	0.18	0.28	0.14	1.47	0.11	0.49	0.01	-0.05	88.50	96.47
Fiolen	0.01	5.80	0.19	0.28	0.11	1.30	0.11	0.13	0.00	-0.06	95.00	71.91
Fiolen	0.11	22.00	0.30	0.48	0.19	3.23	0.18	0.36	0.01	-0.06	80.90	94.49
Fiolen	0.16	28.90	0.35	0.64	0.13	3.82	0.13	0.40	0.01	-0.06	99.90	72.84
Fiolen	0.03	4.50	0.22	0.27	0.09	1.63	0.11	0.16	0.00	-0.05	84.00	82.73
Degervattnet	0.01	18.00	0.24	0.06	0.47	1.08	0.31	0.13	0.00	-0.06	65.00	71.59
Degervattnet	0.01	8.80	0.37	0.02	0.24	1.38	0.19	0.03	0.00	-0.06	67.10	105.56
Degervattnet	-0.01	4.20	0.26	0.03	0.14	1.12	0.13	0.05	0.00	-0.05	75.50	129.92
Degervattnet	-0.01	4.20	0.23	0.04	0.11	1.11	0.12	0.04	0.00	-0.06	67.80	80.64
Degervattnet	-0.01	10.60	0.35	0.02	0.21	1.10	0.16	0.05	0.00	-0.06	75.50	182.66
Degervattnet	0.01	16.10	0.34	0.07	0.24	1.14	0.17	0.06	0.00	-0.06	78.10	102.66
Degervattnet	0.01	9.80	0.34	0.06	0.23	1.14	0.15	0.11	0.00	-0.06	67.60	106.64
Degervattnet	-0.01	1.70	0.46	0.01	0.09	1.15	0.06	-0.01	0.00	-0.06	85.20	165.74
Degervattnet	-0.01	3.00	0.31	0.04	0.09	1.44	0.10	0.03	0.00	-0.06	62.30	112.47
Degervattnet	0.01	4.00	0.45	0.02	0.07	1.27	0.09	0.20	0.00	-0.06	102.00	128.34
Degervattnet	0.03	41.40	0.41	0.10	0.38	1.22	0.32	0.24	0.00	-0.06	64.60	65.54
Degervattnet	0.01	6.50	0.35	0.01	0.32	1.27	0.23	0.03	0.00	-0.06	73.00	96.88
Horsan	-0.01	1.90	-0.16	0.01	2.07	1.29	1.19	0.17	0.00	-0.06	107.00	135.41
Horsan	-0.01	-1.50	-0.15	0.06	0.45	1.58	0.27	0.13	0.01	-0.05	91.80	412.38
Horsan	-0.01	-1.60	-0.16	0.01	0.30	1.16	0.17	0.15	0.00	-0.06	92.30	139.90
Horsan	-0.01	1.90	0.18	0.01	0.35	1.48	0.22	0.24	0.00	-0.05	96.80	203.20
Horsan	-0.01	-1.60	0.17	0.01	0.35	1.46	0.17	0.18	0.00	-0.06	104.00	140.13
Horsan	-0.01	-1.60	-0.16	0.02	0.13	1.13	0.10	0.13	0.00	-0.06	119.00	195.80
Horsan	-0.01	-1.60	0.16	0.01	0.13	1.33	0.09	0.14	0.00	-0.06	96.10	155.12
Horsan	-0.01	-1.60	-0.16	0.02	0.11	1.02	0.07	0.16	0.00	-0.06	90.50	298.10
Horsan	-0.01	1.60	-0.15	0.02	0.58	2.20	0.39	0.18	0.00	-0.05	109.00	149.21
Horsan	-0.01	3.00	-0.17	0.02	0.22	1.21	0.35	0.28	0.00	-0.06	140.00	192.10
Horsan	-0.01	-1.60	-0.16	0.01	0.19	1.71	0.15	0.14	0.00	-0.06	106.00	147.94
Horsan	-0.01	-1.60	-0.16	0.01	0.24	1.36	0.16	0.17	0.00	-0.06	107.00	154.28
Hjärtsjön	0.04	8.40	-0.15	0.19	0.30	1.42	0.27	1.06	0.00	-0.05	81.00	102.15
Hjärtsjön	0.01	8.30	-0.16	0.12	0.32	1.20	0.23	0.66	0.00	-0.06	84.40	88.62
Hjärtsjön	0.07	13.90	-0.17	0.30	0.19	2.13	0.18	1.24	0.00	-0.06	88.90	113.73
Hjärtsjön	-0.01	4.80	-0.16	0.18	0.16	1.10	0.15	0.89	0.00	-0.06	106.00	125.53
Hjärtsjön	0.01	2.90	-0.16	0.11	0.13	1.25	0.10	0.70	0.00	-0.06	84.80	64.15
Hjärtsjön	0.06	13.10	-0.16	0.27	0.20	2.03	0.20	0.95	0.00	-0.06	78.90	106.17
Hjärtsjön	0.09	22.60	0.16	0.25	0.33	2.44	0.25	0.90	0.01	-0.06	96.30	62.33
Hjärtsjön	0.06	18.20	0.18	0.18	0.32	2.30	0.22	0.66	0.00	-0.06	83.40	63.38
Hjärtsjön	0.07	13.40	0.16	0.19	0.21	2.34	0.19	0.66	0.00	-0.06	75.60	55.78
Hjärtsjön	0.07	17.10	0.17	0.27	0.17	2.32	0.14	1.31	0.00	-0.06	80.60	123.74
Hjärtsjön	-0.01	4.00	-0.17	0.06	0.08	1.15	0.10	0.55	0.00	-0.06	92.50	59.65
Hjärtsjön	0.01	14.50	-0.17	0.12	0.13	1.19	0.18	0.69	0.00	-0.06	77.00	59.71
Krageholmssjön	-0.01	-1.60	0.48	-0.01	0.15	1.16	0.16	0.04	0.01	-0.06	86.70	44.77
Krageholmssjön	-0.01	-1.50	0.30	-0.01	0.23	1.05	0.15	0.05	0.00	-0.05	72.80	53.31
Krageholmssjön	-0.01	-1.60	0.32	-0.01	0.16	1.07	0.12	0.04	0.00	-0.06	70.60	50.48
Krageholmssjön	-0.01	3.50	0.23	-0.01	0.28	0.85	0.19	0.03	0.00	-0.06	71.40	42.39
Krageholmssjön	-0.01	-1.60	0.48	-0.01	0.21	1.13	0.16	0.06	0.00	-0.06	77.70	48.76
Krageholmssjön	-0.01	-1.80	0.33	-0.01	0.09	0.95	0.08	0.03	0.00	-0.06	77.50	48.14
Krageholmssjön	-0.01	-1.60	0.48	-0.01	0.09	0.90	0.08	0.06	0.00	-0.06	64.90	58.21
Krageholmssjön	-0.01	3.40	0.42	-0.01	0.40	1.19	0.27	0.30	0.00	-0.05	70.70	51.67
Krageholmssjön	-0.01	-1.80	0.45	-0.01	0.09	0.89	0.07	0.03	0.00	-0.06	68.00	55.67
Krageholmssjön	-0.01	-1.50	0.42	-0.01	0.09	0.92	0.08	0.08	0.00	-0.05	65.60	59.29
Krageholmssjön	-0.01	-1.60	0.50	-0.01	0.08	0.89	0.07	0.16	0.00	-0.06	68.30	53.59
Krageholmssjön	-0.01	-1.70	0.41	-0.01	0.08	0.97	0.06	0.02	0.00	-0.06	65.80	58.24
Lilla Öresjön	-0.01	3.70	0.32	0.14	0.14	1.15	0.11	0.48	0.00	-0.06	104.00	231.14
Lilla Öresjön	-0.01	6.60	0.28	0.06	0.12	1.60	0.09	0.32	0.00	-0.06	82.10	166.33
Lilla Öresjön	0.02	3.10	0.30	0.12	0.14	1.15	0.13	0.37	0.00	-0.06	84.70	279.63
Lilla Öresjön	-0.01	2.50	0.31	0.08	0.15	1.14	0.12	0.37	0.00	-0.06	75.20	258.06
Lilla Öresjön	-0.01	3.70	0.30	0.09	0.08	1.22	0.09	0.42	0.00	-0.07	74.50	233.77
Lilla Öresjön	-0.01	8.10	0.40	0.12	0.14	1.19	0.13	0.35	0.00	-0.06	86.60	192.03
Lilla Öresjön	-0.01	3.30	0.30	0.08	0.21	1.79	0.17	0.33	0.00	-0.06	78.30	297.68
Lilla Öresjön	-0.01	4.00	0.32	0.09	0.10	1.25	0.10	0.32	0.00	-0.06	75.30	204.60
Lilla Öresjön	-0.01	6.00	0.24	0.07	0.16	1.23	0.14	0.30	0.00	-0.05	74.70	250.74
Lilla Öresjön	-0.01	4.00	0.32	0.13	0.10	1.02	0.09	0.50	0.00	-0.05	79.80	220.81
Lilla Öresjön	-0.01	2.60	0.23	0.05	0.12	1.07	0.12	0.31	0.00	-0.06	83.10	303.75
Lilla Öresjön	-0.01	3.80	0.21	0.22	0.11	1.33	0.09	0.30	0.00	-0.06	85.50	221.61

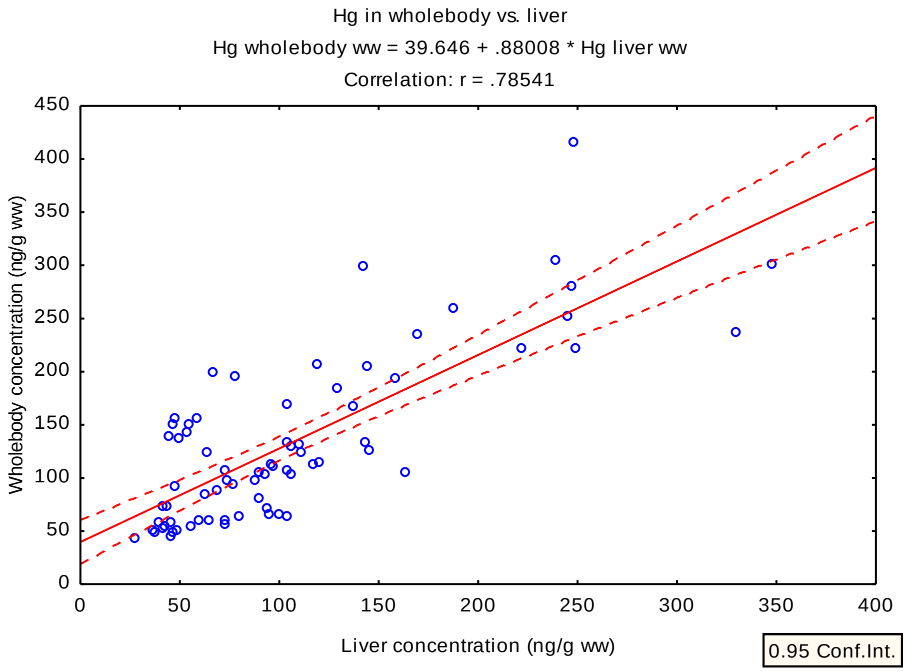


Fig. 1. Correlation of Hg (ng/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

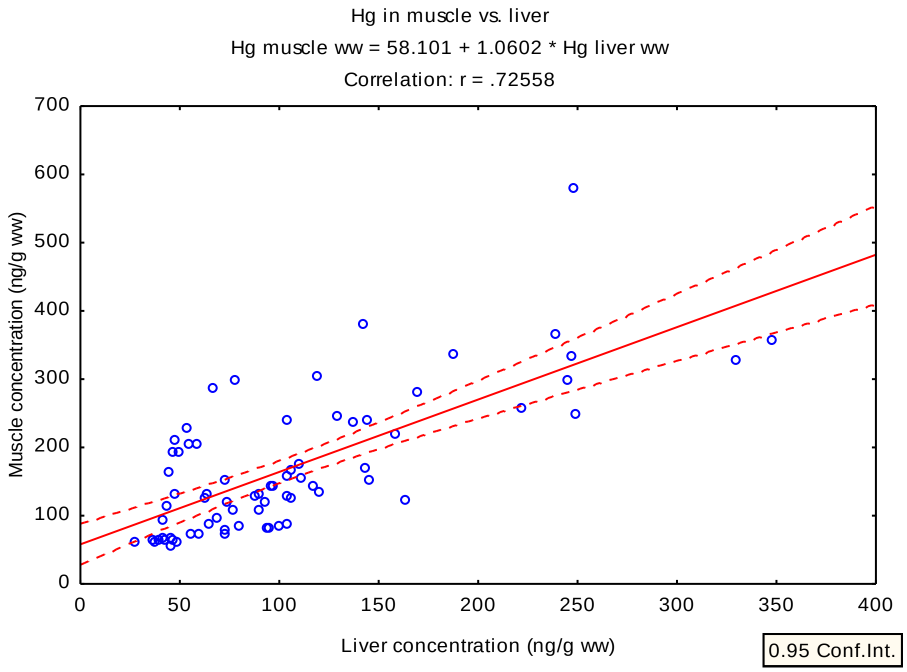


Fig. 2. Correlation of Hg (ng/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

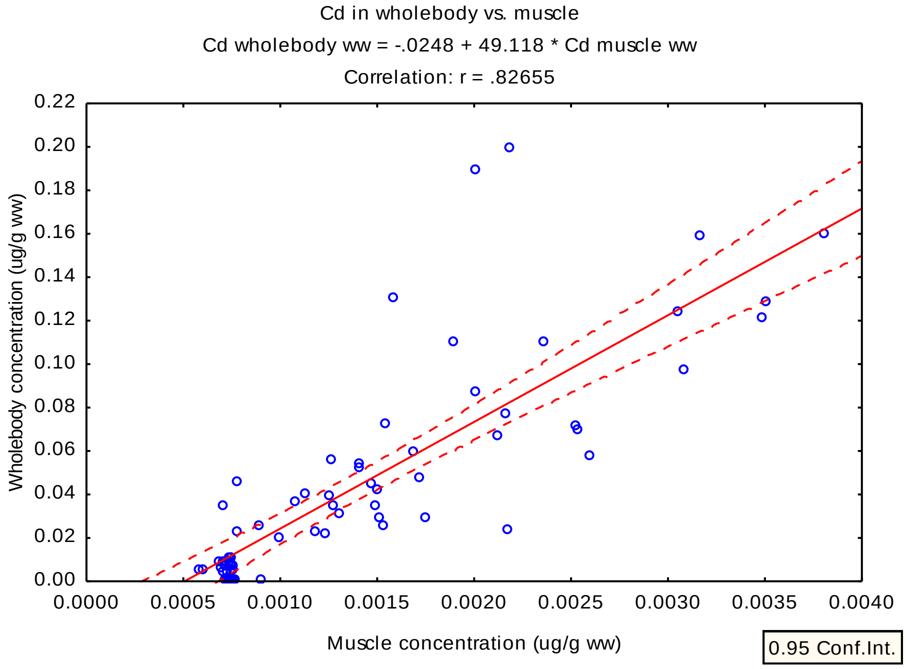


Fig. 3. Correlation of Cd (ug/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

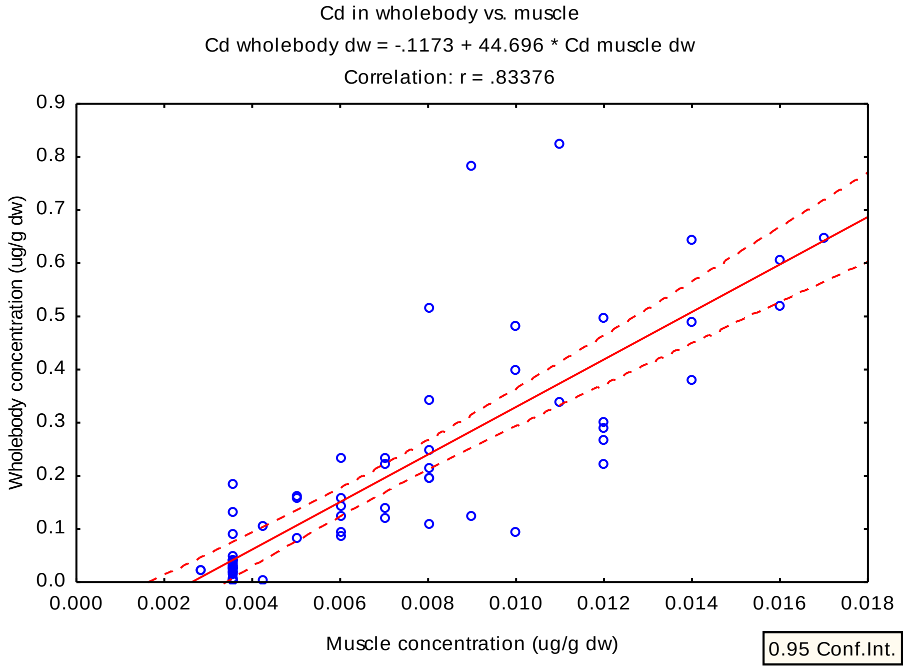


Fig. 4. Correlation of Cd (ug/g dw) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

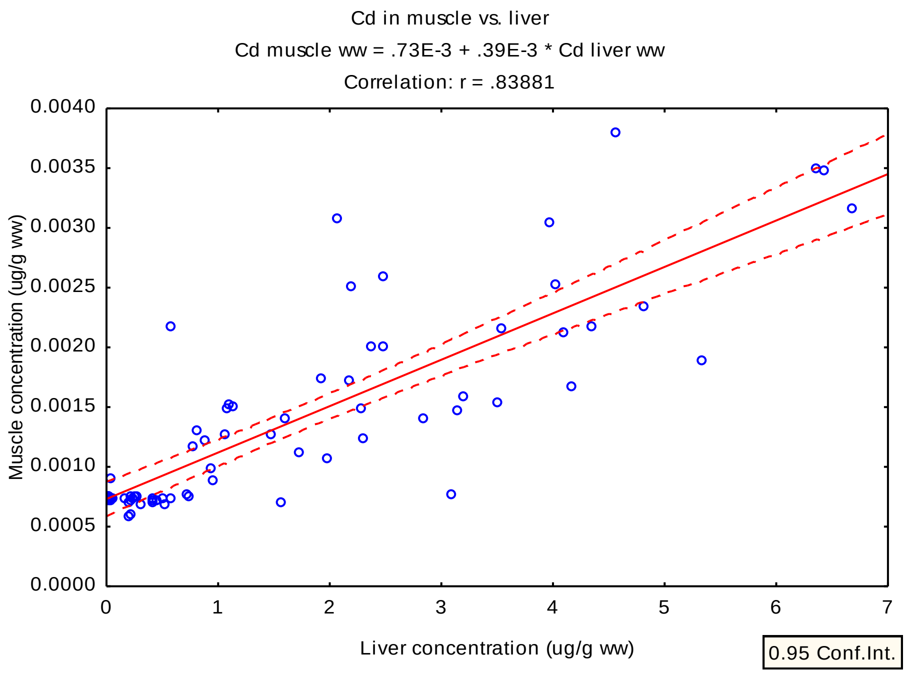


Fig. 5. Correlation of Cd (ug/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

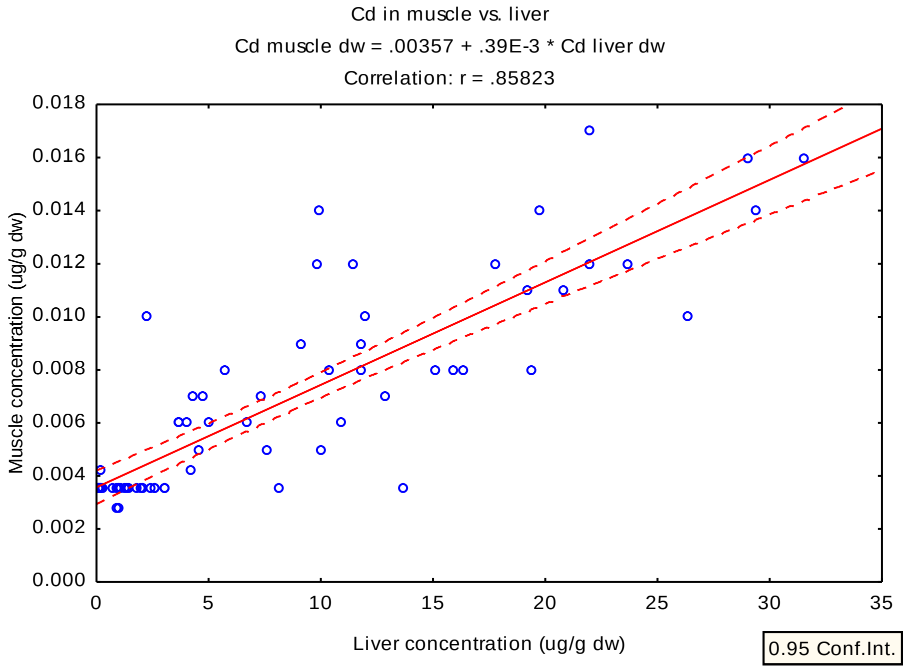


Fig. 6. Correlation of Cd (ug/g dw) in muscle vs. liver. The dotted line shows the 95% confidence interval.

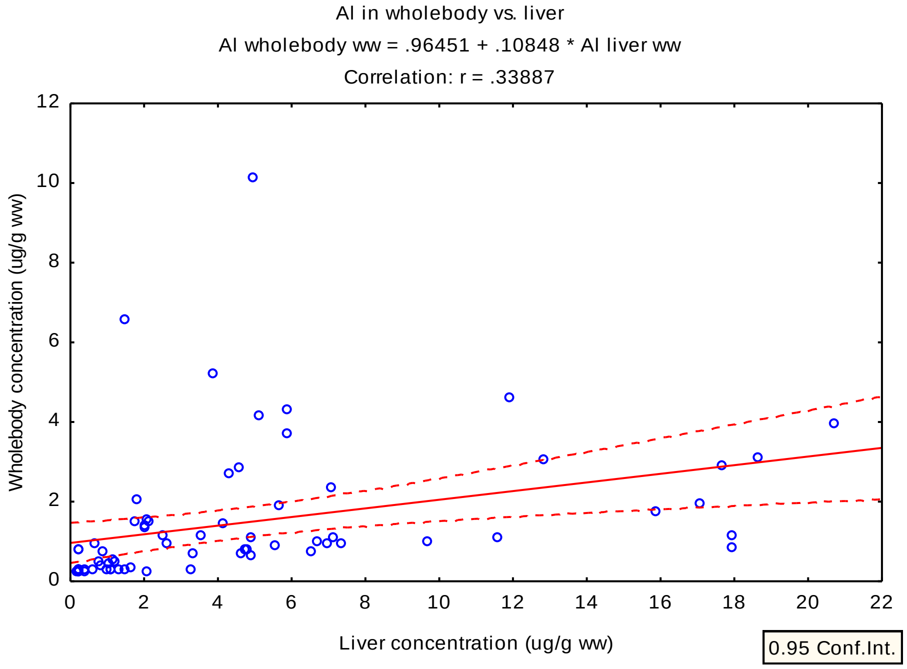


Fig. 7. Correlation of Al (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

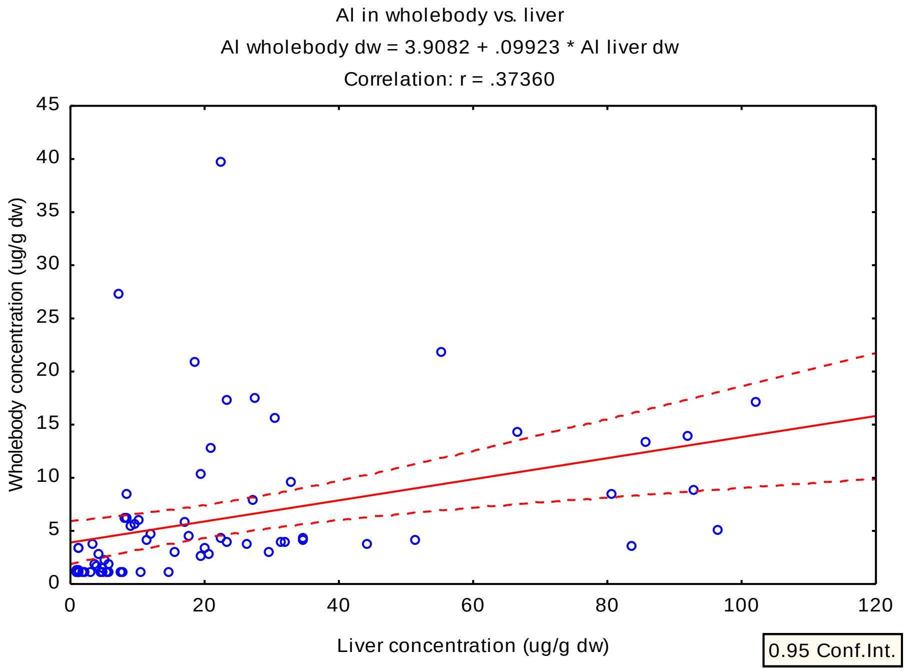


Fig. 8. Correlation of Al (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

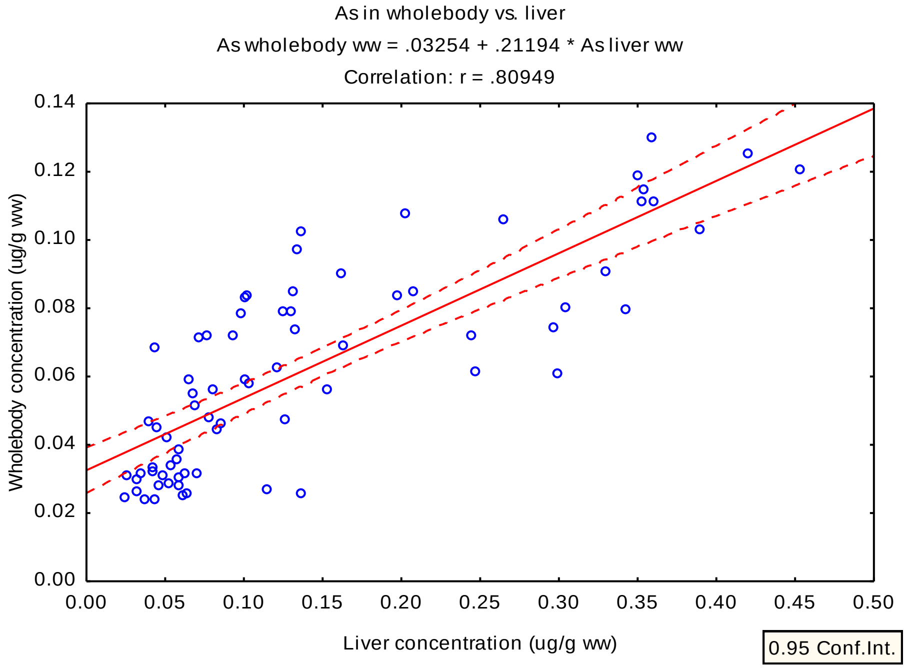


Fig. 9. Correlation of As (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

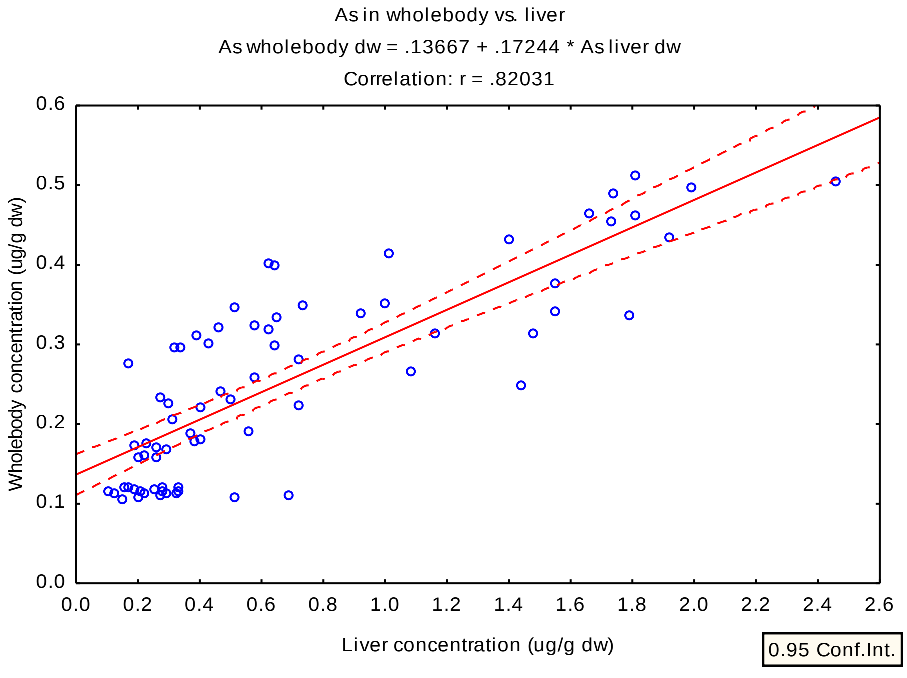


Fig. 10. Correlation of As (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

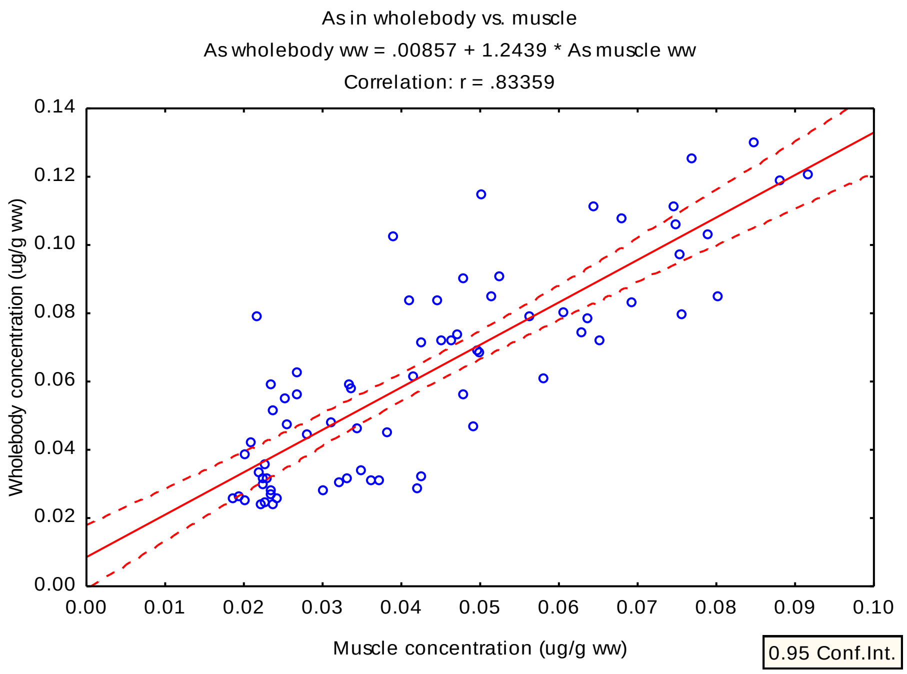


Fig. 11. Correlation of As (ug/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

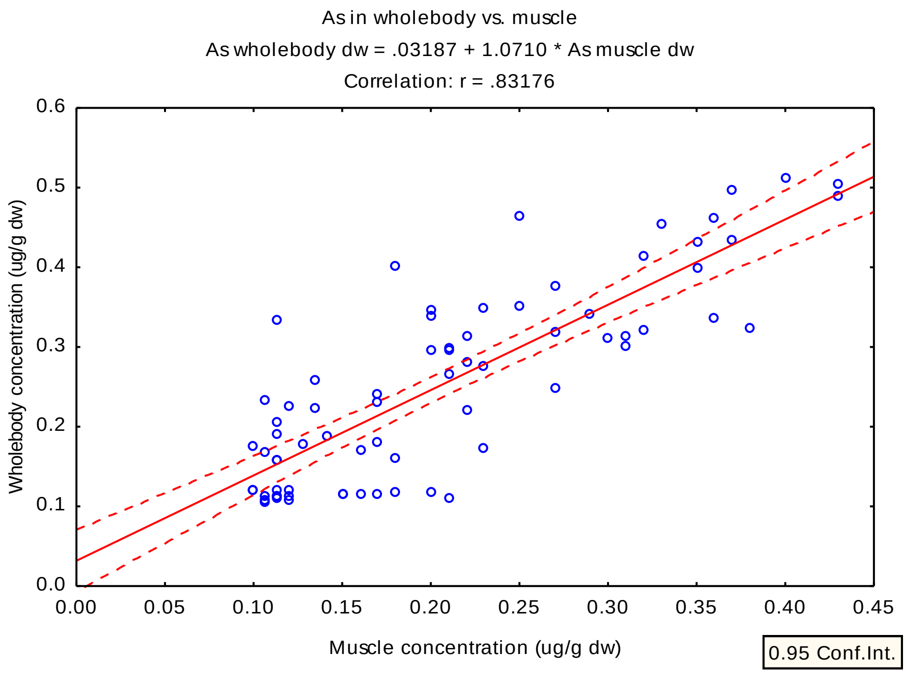


Fig. 12. Correlation of As (ug/g dw) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

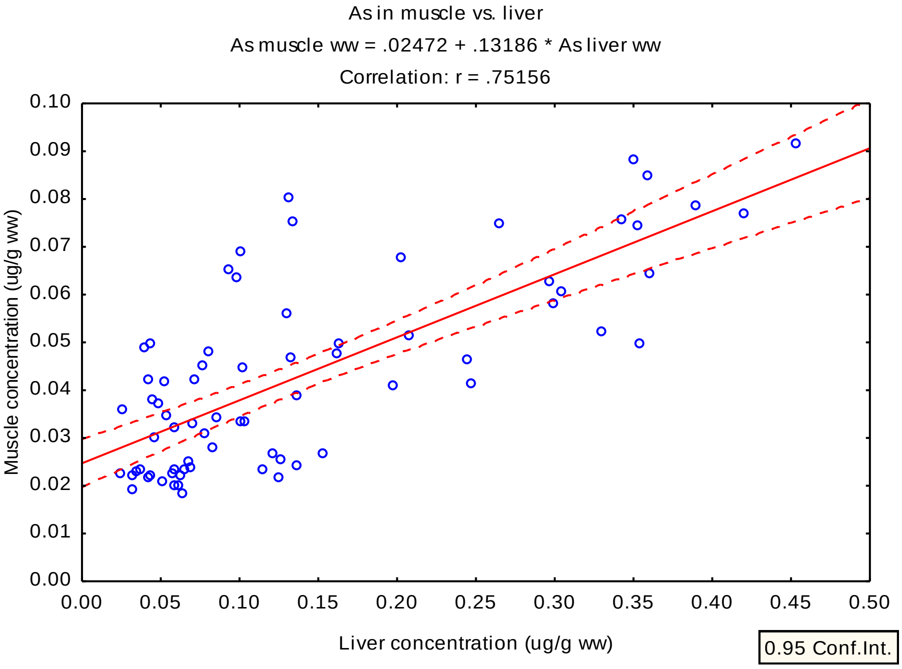


Fig. 13. Correlation of As (ug/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

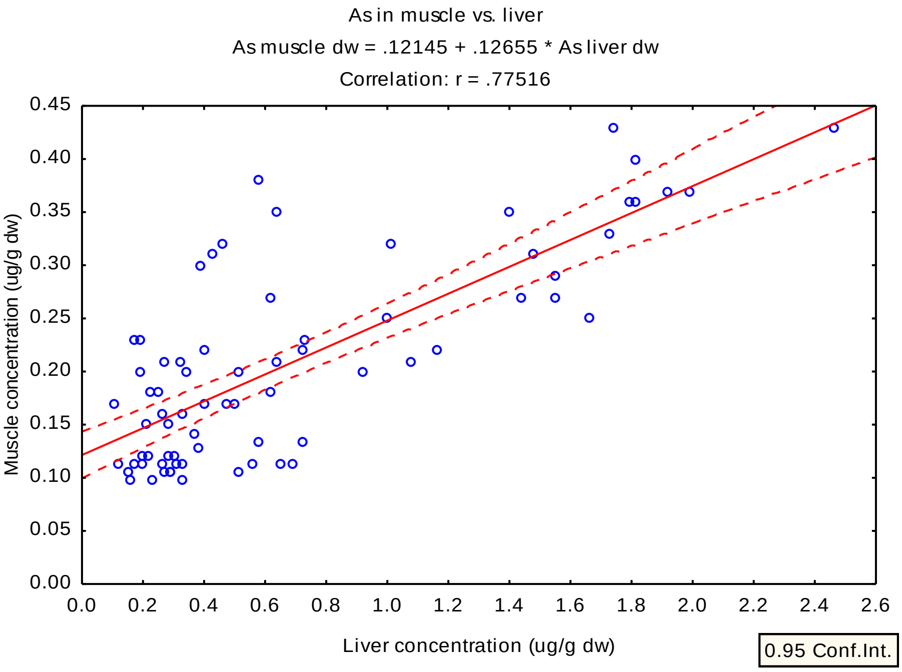


Fig. 14. Correlation of As (ug/g dw) in muscle vs. liver. The dotted line shows the 95% confidence interval.

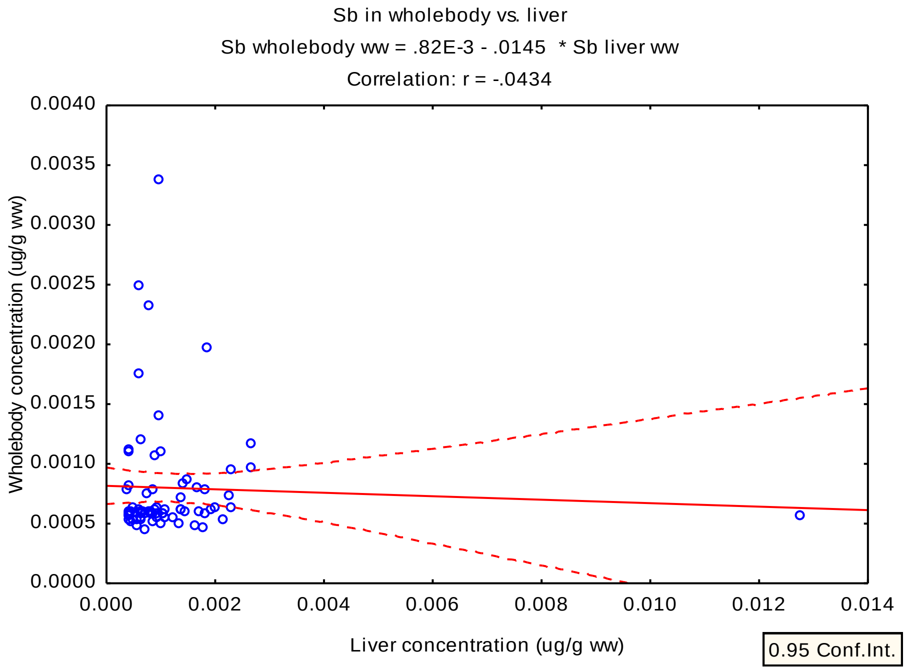


Fig. 15. Correlation of Sb (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

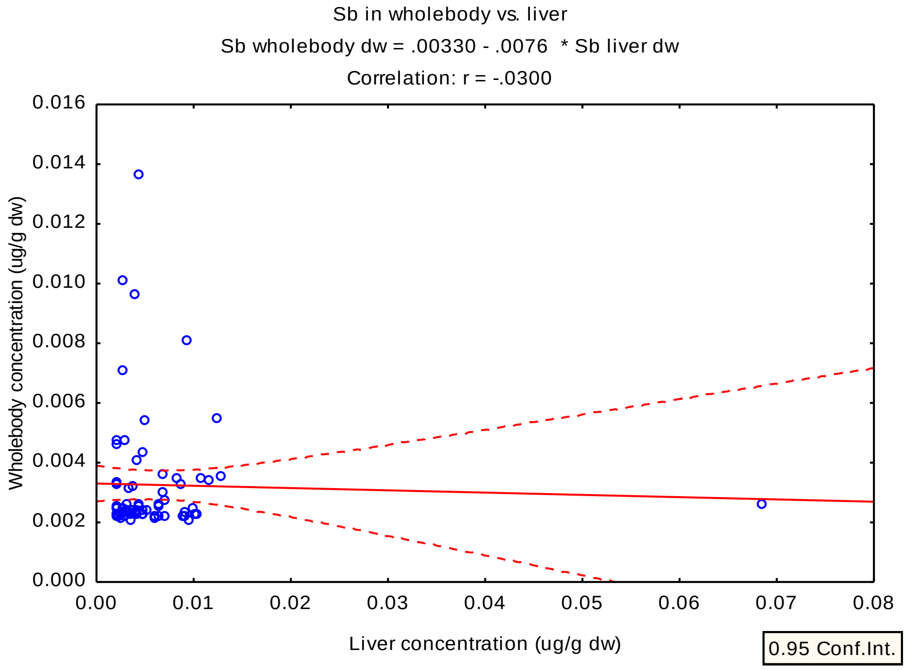


Fig. 16. Correlation of Sb (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

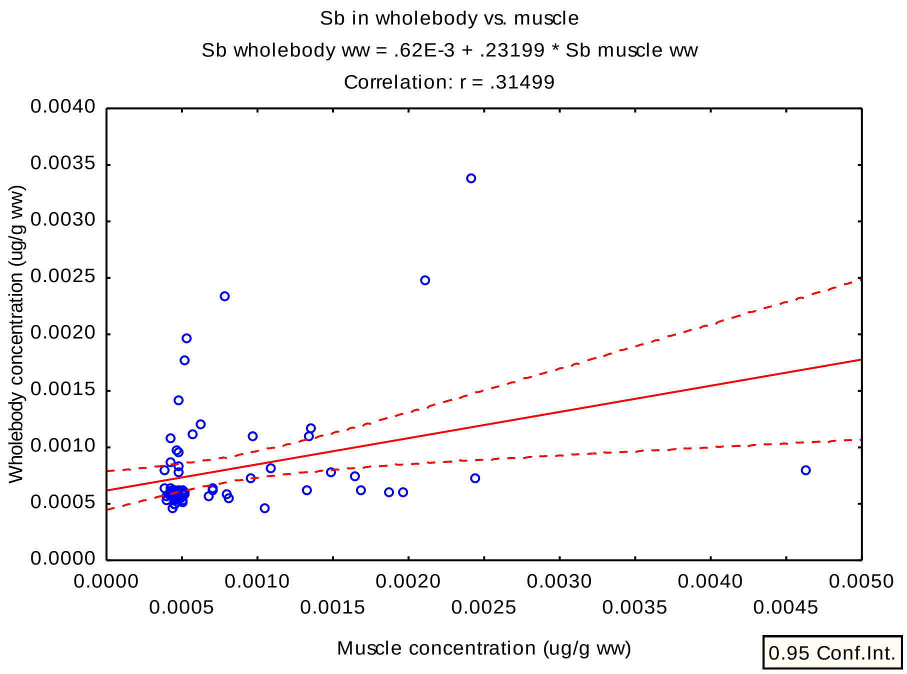


Fig. 17. Correlation of Sb (ug/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

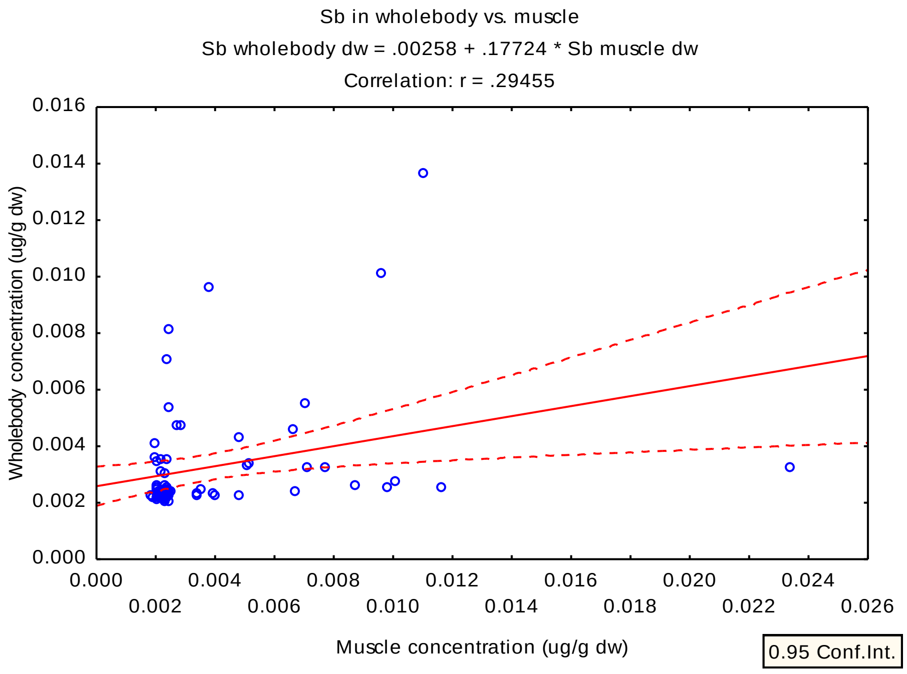


Fig. 18. Correlation of Sb (ug/g dw) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

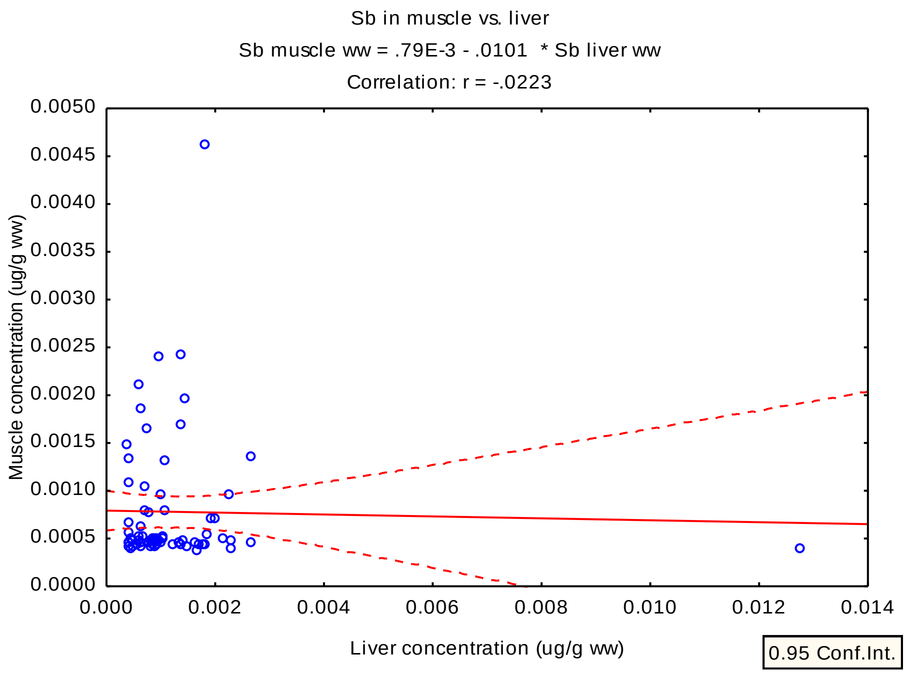


Fig. 19. Correlation of Sb (ug/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

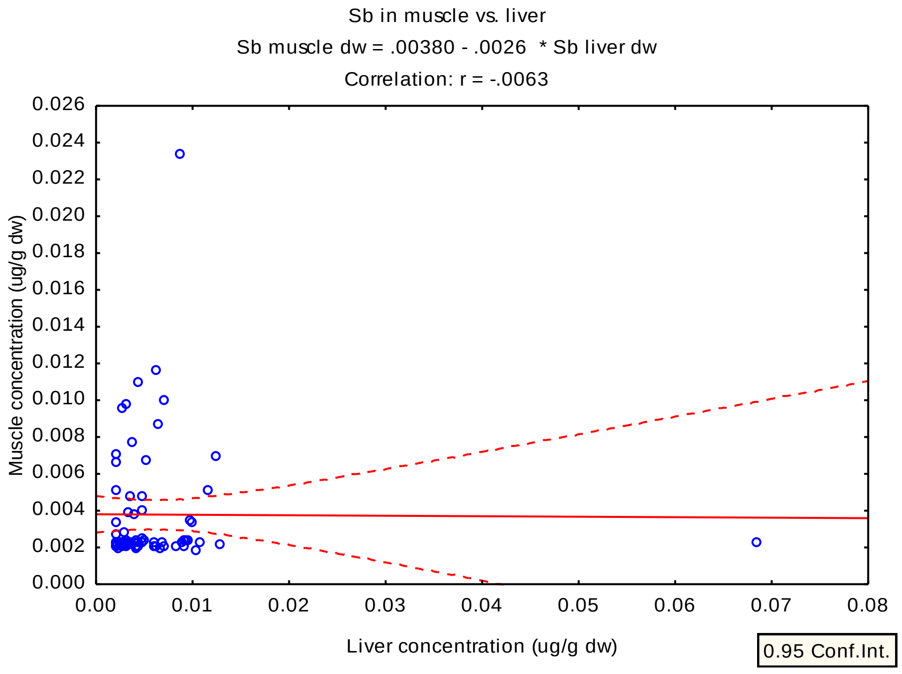


Fig. 20. Correlation of Sb (ug/g dw) in muscle vs. liver. The dotted line shows the 95% confidence interval.

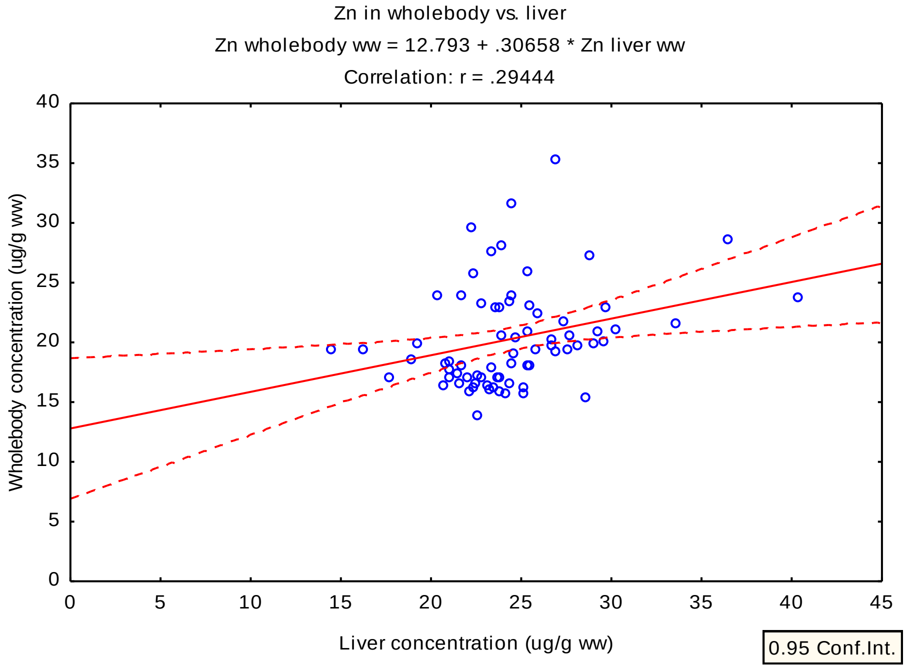


Fig. 21. Correlation of Zn (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

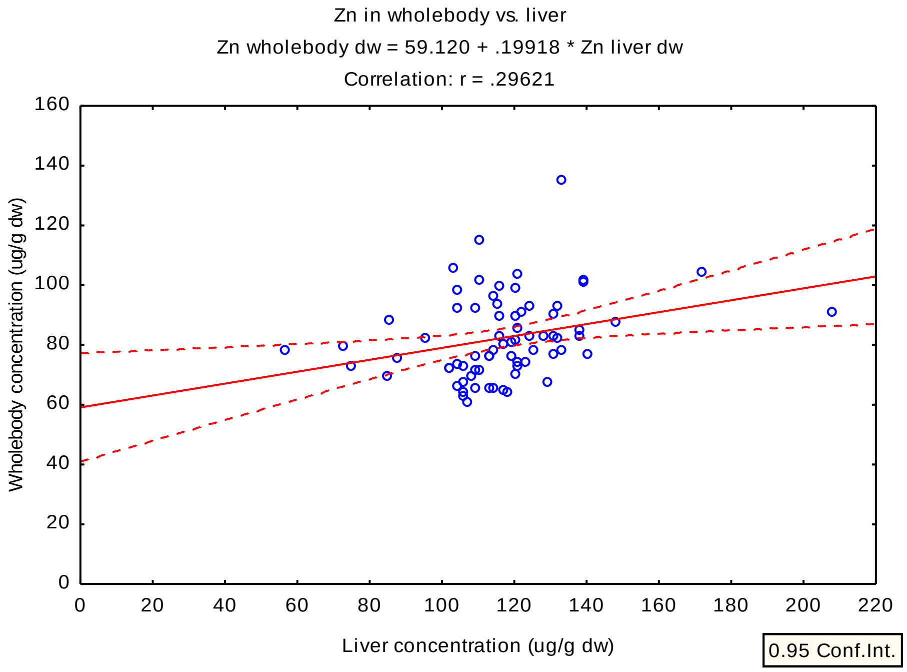


Fig. 22. Correlation of Zn (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

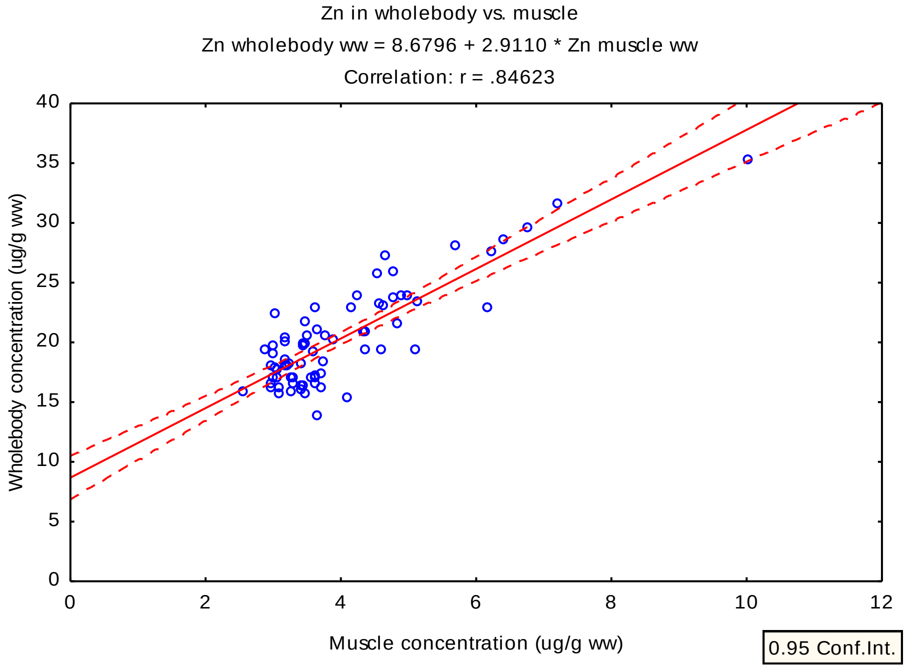


Fig. 23. Correlation of Zn (ug/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

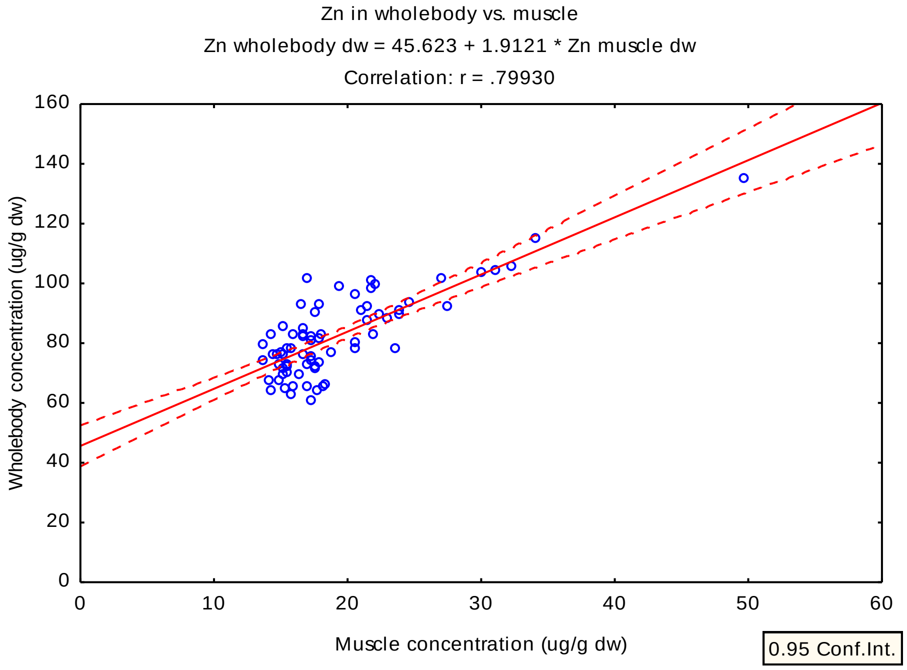


Fig. 24. Correlation of Zn (ug/g dw) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

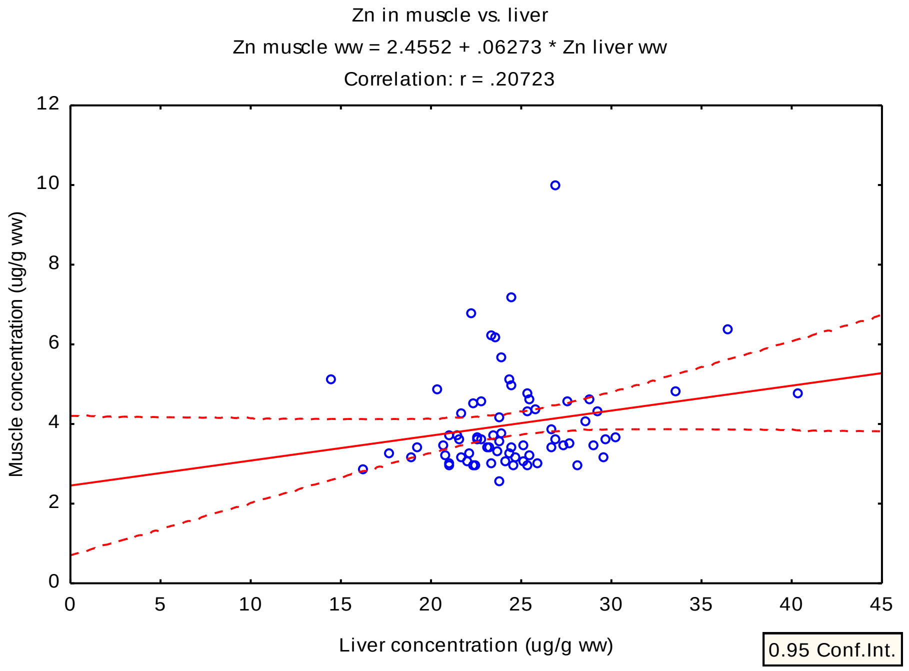


Fig. 25. Correlation of Zn (ug/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

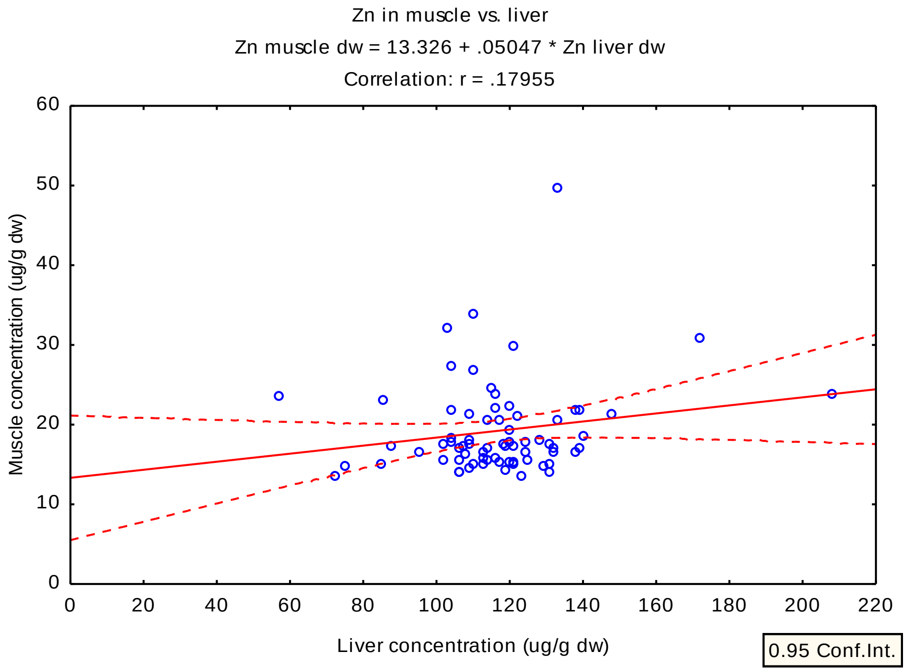


Fig. 26. Correlation of Zn (ug/g dw) in muscle vs. liver. The dotted line shows the 95% confidence interval.

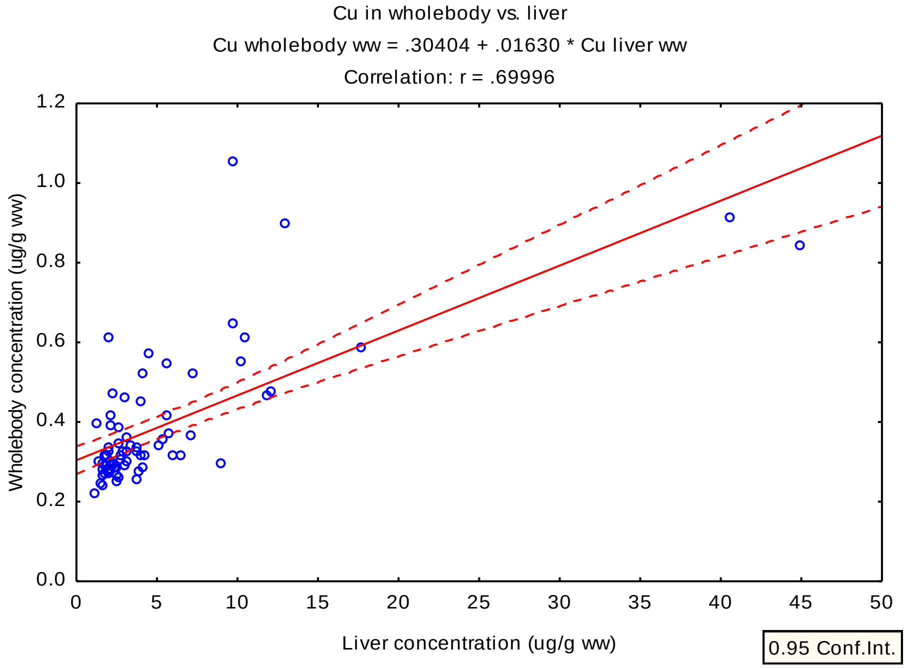


Fig. 27. Correlation of Cu (ug/g ww) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

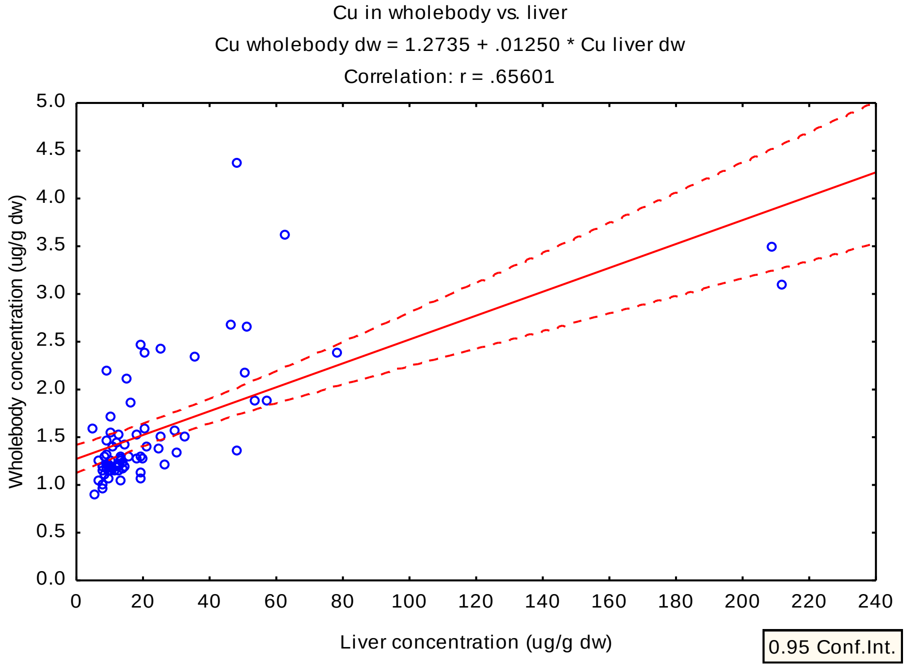


Fig. 28. Correlation of Cu (ug/g dw) in wholebody vs. liver. The dotted line shows the 95% confidence interval.

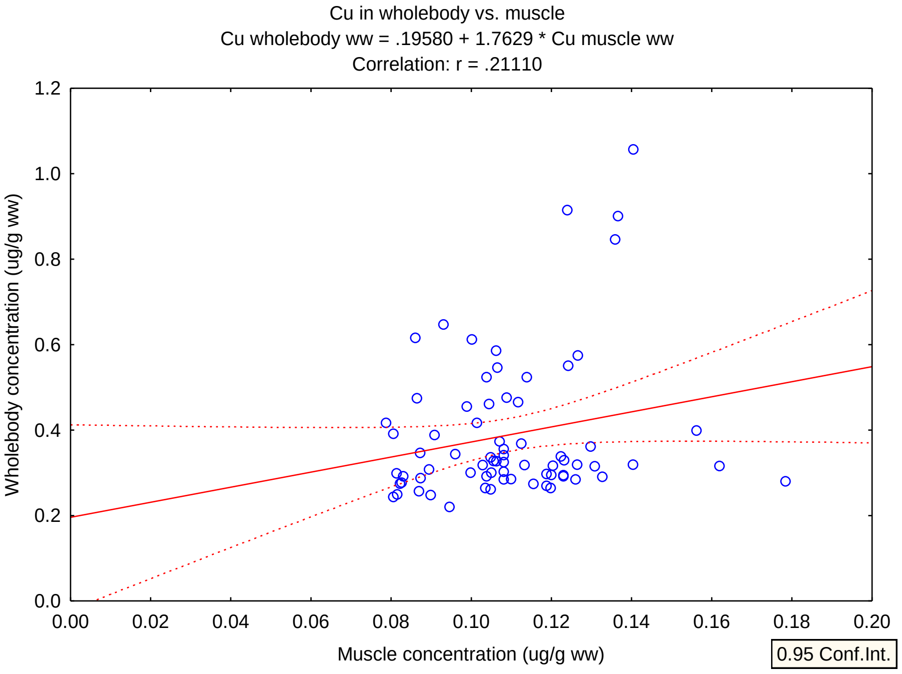


Fig. 29. Correlation of Cu (ug/g ww) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

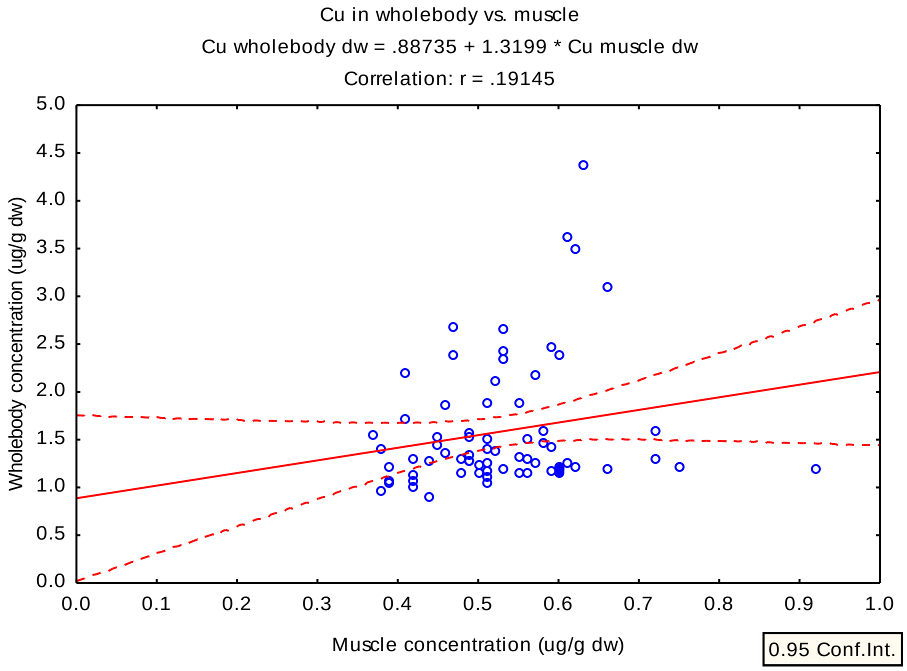


Fig. 30. Correlation of Cu (ug/g dw) in wholebody vs. muscle. The dotted line shows the 95% confidence interval.

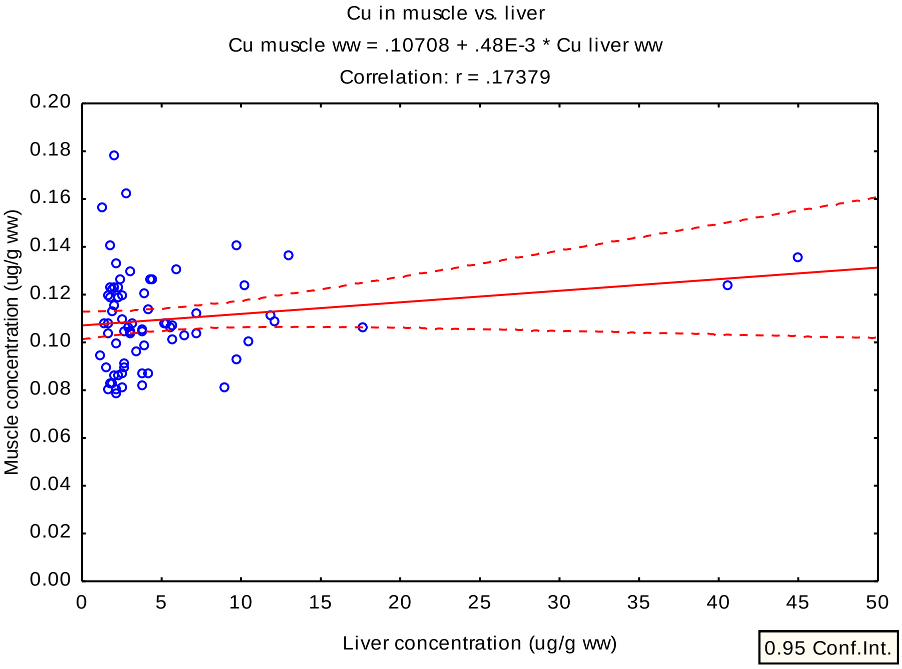


Fig. 31. Correlation of Cu (ug/g ww) in muscle vs. liver. The dotted line shows the 95% confidence interval.

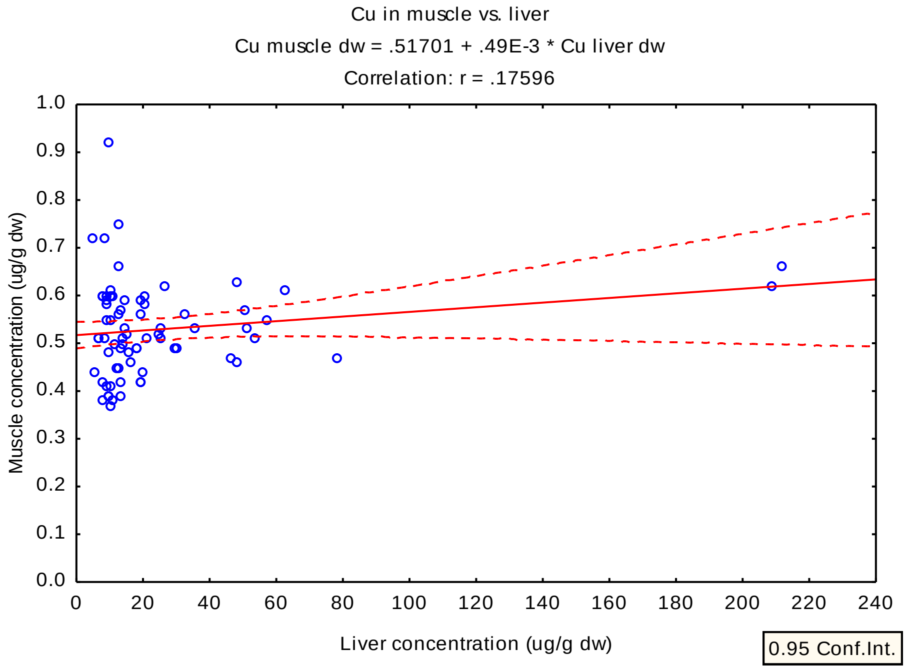


Fig. 32. Correlation of Cu (ug/g dw) in muscle vs. liver. The dotted line shows the 95% confidence interval.