Appendix 1 Dioxins / PCB Methodology

The methods used for the analysis of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) were based on US EPA Methods 1613 (PCDDs & PCDFs) and 1668A (PCBs). These methods utilise high-resolution gas chromatography and high resolution mass spectrometry (HRGC-HRMS) techniques for the identification and quantification of individual PCDD, PCDF and PCB congeners and enable their corresponding Toxic Equivalents (TEQs) to be calculated.

In the case of dioxins, the tetra- to octa- 2,3,7,8 substituted dibenzodioxins and dibenzofurans congeners are included in the analytical regime. In the case of PCBs, the 12 coplanar congeners with dioxin-like toxicity as well as a number of other congeners are covered by the method.

Each toxic dioxin and PCB congener is assigned a WHO toxic equivalency factor (WHO-TEF), as detailed in Table 2. Individual toxic equivalents (TEQs) are calculated for each individual toxic congener by multiplying the concentration of the congener with its assigned WHO-TEF. The individual TEQs are then summed to give a total TEQ.

The sum of congeners and total TEQ are reported at three levels – lowerbound, mediumbound (not included in this report) and upperbound. Lowerbound includes only the detected congener levels, thus giving a best-case scenario. Upperbound includes both detected and non-detected congeners, where the non-detected congeners are assumed to be at the level of the reported detection limit, thus giving a worse case scenario.

Responses observed above a signal to noise ratio of 3:1 that meet all identification criteria are reported as detected and their concentrations are calculated on the basis of the area of the peak observed. However, if the same response is observed without meeting the identification criteria, a statistically-derived factor is applied to the theoretical concentrations calculated on the basis of the area of the peak observed and the result is reported as a non-detect with the LOD set at the adjusted value (rounded to one significant figure). Similarly, the same factor is also applied to any response detected in the sample which is not five times above the level of the same response detected in the blank, whether this response meets or does not meet the identification criteria. Again, the response is reported as a non-detect and the LOD is set at the adjusted value rounded to one significant figure. The approach of using a statistically derived factor for non-detected congeners is based on coefficients of variation (CVs) of ~30% being achieved for low level detections and represents the setting of an LOD at ≥ 3 standard deviations above the detected value to give a ≥99% confidence limit. Consequently, by using this factor for non-detected congeners, the laboratory is confident (at ≥99% level) that a target dioxin congener is not present above the reported LOD.

Dioxin Sampling (Meat)

The usual procedure for collection of meat samples for residue testing was used by the National Residue Survey (NRS) to collect samples for the dioxin project, with a few modifications. Sample requests were sent by NRS to AQIS officers at export abattoirs with special instructions and materials to collect the fat samples. Additional precautions were taken to ensure that fat samples were not contaminated during the sampling process, including wrapping the fat in aluminium foil provided by the testing laboratory as soon as possible after collection. Fat samples (perirenal fat preferred) of 200-250 g (minimum 50 g) were collected from carcases of cattle, sheep and pork. The samples were frozen at the abattoir and despatched by courier to the NRS receiver facility in Canberra. Hard frozen fat samples were aggregated into batches for despatch at regular intervals to the laboratory, AgriQuality, in New Zealand for analysis.

Anticipating an age effect on dioxin levels, samples were collected from younger and older animals within each species. For cattle, approximately 70 fat samples were collected from steer/heifer carcases and approximately 40 samples were collected from older cow/bull/ox carcases. For sheep, fat samples were collected from 20 lamb carcases and 25 samples from wether/ewe carcases. For pig, 15 porker samples and five sow samples were collected. Sample collection coincided with the worse drought in the eastern part of Australia for 100 years. This caused problems with the collection of fat samples from some carcases. The laboratory could derive sufficient analysable lipid from all fat samples except for one beef sample.

Dioxin Sampling (Fish)

Fish sample selection was carried out on fish ready for marketing, at the end of the farming cycle. Salmonid samples were collected from different farms on the east and west coasts of Tasmania. Fish samples made up of muscle tissue (200-250 g) were collected from individual fish specimens. The fish samples were part of the National Residue Survey Random Sampling Programs, and as such were analysed for other residues. Information on size and weight was also recorded. Samples were collected by State officers, following collection instructions provided by the NRS and using collection materials and containers provided by the laboratory.

Dioxin Sampling (Poultry)

Poultry samples were collected at random from 12 different abattoirs across the country with the largest throughput. It was expected that this strategy would maximise the chance of a broad representation of different diets. Composite samples of fat were collected by industry quality assurance managers, following collection instructions provided by the NRS and using collection materials and containers provided by the laboratory.

Dioxin Sampling (Milk)

The collection of milk samples was arranged by Dairy Food Safety Victoria, the agency responsible for administering the Australian Milk Residue Analysis (AMRA) survey on behalf of Dairy Australia. Samples of whole milk were collected from bulk milk silos at selected dairy processing facilities. Dairy processing facilities were selected to provide representative coverage of Australian milk production. At each sample site two litres of milk were collected. The milk was collected into1 litre Schott bottles specially prepared for dioxin sampling and supplied by the testing laboratory. Twenty samples were collected and forwarded to the laboratory. Unfortunately, the two bottles from one of the sample sites were damaged in transit. As a consequence only 19 of the 20 samples were analysed.

Appendix 2 Summary of Results by Species

The results presented in this report use the WHO TEFs as outlined in Table 2. The use of the WHO TEFs, rather than the I-TEFs, is consistent with the NHMRC/TGA recommended intake standard for dioxins and dioxin-like PCBs.

Table 2: WHO TEFs for dioxins, furans and PCBs

Analyte	**TEFs***
Dioxins and Furans	
2,3,7,8-TCDF	0.1
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
1,2,3,4,6,7,8-HpCDD	0.01
OCDF	0.0001
OCDD	0.0001
PCBs	
PCB#77	0.0001
PCB#81	0.0001
PCB#126	0.1
PCB#169	0.01
PCB#105	0.0001
PCB#114	0.0005
PCB#118	0.0001
PCB#123	0.0001
PCB#156	0.0005
PCB#77	0.0001
PCB#157	0.0005
PCB#167	0.00001
PCB#189	0.0001

* TEF = toxic equivalency factors

Table 2.1: Dioxins and PCBs in beef

Beef	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fat)	0.104	0.256	0.00	0.00	1.31
Dioxins upperbound (pg TEQ/g fat)	0.557*	0.315	0.0877	0.485	1.77
PCBs lowerbound (pg TEQ/g fat)	0.0731	0.208	0.00	0.00560	1.44
PCBs upperbound (pg TEQ/g fat)	0.289	0.191	0.0882	0.253	1.50
Total TEQ lowerbound (pg TEQ/g fat)	0.177	0.401	0.00	0.0119	2.08**
Total TEQ upperbound (pg TEQ/g fat)	0.847	0.399	0.326	0.783	2.58**

n =109
dioxins = dioxins and furans
TEQ = WHO TEQ

* The Australian data (mean dioxin upperbound result in pg TEQ/g fat) for beef was 18.6% of the EU standard ([EC Regulation] No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in beef occurs in sample 1085-1. The maximum upperbound PCB TEQ in beef occurs in sample 1086-2. However, the highest total TEQ upperbound of any beef sample occurs in sample 941-13 (see Figures 3.1a – c).

Table 2.2: Dioxins and PCBs in milk

Milk	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fat)	0.0277	0.0752	0.00	0.00	0.299
Dioxins upperbound (pg TEQ/g fat)	0.434*	0.154	0.208	0.402	0.749
PCBs lowerbound (pg TEQ/g fat)	0.0280	0.0513	0.00362	0.0113	0.196
PCBs upperbound (pg TEQ/g fat)	0.186	0.108	0.0819	0.129	0.451
Total TEQ lowerbound (pg TEQ/g fat)	0.0557	0.121	0.00362	0.0119	0.445**
Total TEQ upperbound (pg TEQ/g fat)	0.620	0.195	0.365	0.631	1.02**

n =19
dioxins = dioxins and furans
TEQ = WHO TEQ

* The Australian data (mean dioxin upperbound result in pg TEQ/g fat) for milk was 14.5% of the EC standard ((EC Regulation) No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in milk occurs in sample 1559-1. The maximum upperbound PCB TEQ in milk occurs in sample 1505-6. However, the highest total TEQ upperbound of any milk sample occurs in sample 1505-8 (see Figures 3.2a – c).

Table 2.3: Dioxins and PCBs in pigs

Pigs	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fat)	0.00289	0.0129	0.00	0.00	0.0577
Dioxins upperbound (pg TEQ/g fat)	0.331*	0.133	0.146	0.331	0.551
PCBs lowerbound (pg TEQ/g fat)	0.0106	0.0233	0.00	0.00295	0.0995
PCBs upperbound (pg TEQ/g fat)	0.244	0.106	0.102	0.221	0.458
Total TEQ lowerbound (pg TEQ/g fat)	0.0212	0.466	0.00	0.00590	0.199**
Total TEQ upperbound (pg TEQ/g fat)	0.575	0.160	0.303	0.553	0.967**

n = 20
dioxins = dioxins and furans
TEQ = WHO TEQ

* The Australian data (mean dioxin upperbound result in pg TEQ/g fat) for pigs was 33.1% of the EC standard ((EC Regulation) No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in pigs occurs in sample 1022-10. The maximum upperbound PCB TEQ in pigs occurs in sample 973-18. However, the highest total TEQ upperbound of any pig sample occurs in sample 1024-16 (see Figures 3.3a – c).

Table 2.4: Dioxins and PCBs in poultry

Poultry	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fat)	0.00117	0.00236	0.00	0.00	0.00700
Dioxins upperbound (pg TEQ/g fat)	0.330*	0.0862	0.183	0.317	0.529
PCBs lowerbound (pg TEQ/g fat)	0.0173	0.0550	0.00	0.00280	0.216
PCBs upperbound (pg TEQ/g fat)	0.249	0.125	0.0846	0.226	0.452
Total TEQ lowerbound (pg TEQ/g fat)	0.0184	0.0548	0.00	0.00410	0.216**
Total TEQ upperbound (pg TEQ/g fat)	0.579	0.165	0.302	0.593	0.805**

n = 15
dioxins = dioxins and furans
TEQ = WHO TEQ

* The Australian data (mean dioxin upperbound result in pg TEQ/g fat) for poultry was 16.5% of the EC standard ((EC Regulation) No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in poultry occurs in sample 940-06. The maximum upperbound PCB TEQ in poultry occurs in sample 940-04. The highest total TEQ upperbound of any poultry sample occurs in sample 940-04 (see Figures 3.4a – c).

Table 2.5: Dioxins and PCBs in aquaculture salmonids

Salmonids	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fw)	0.173	0.0849	0.0989	0.127	0.317
Dioxins upperbound (pg TEQ/g fw)	0.228*	0.0716	0.150	0.216	0.350
PCBs lowerbound (pg TEQ/g fw)	0.398	0.228	0.120	0.395	0.780
PCBs upperbound (pg TEQ/g fw)	0.602	0.201	0.339	0.573	0.878
Total TEQ lowerbound (pg TEQ/g fw)	0.571	0.245	0.246	0.521	1.10**
Total TEQ upperbound (pg TEQ/g fw)	0.830	0.242	0.489	0.798	1.15**

n =10
dioxins = dioxins and furans
TEQ = WHO TEQ
fw = fresh weight

* The Australian data (mean dioxin upperbound result in pg TEQ/g fw) for salmonids was 5.7% of the EC standard ((EC Regulation) No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in salmonids occurs in sample 1084-6. The maximum upperbound PCB TEQ in salmonids occurs in sample 1084-2. The highest total TEQ upperbound of any salmonid sample occurs in sample 1084-6 (see Figures 3.5a – c).

Table 2.6: Dioxins and PCBs in sheep

Sheep	Mean	Standard Deviation	Minimum	Median	Maximum
Dioxins lowerbound (pg TEQ/g fat)	0.112	0.419	0.00	0.00	2.72
Dioxins upperbound (pg TEQ/g fat)	0.572*	0.418	0.134	0.531	2.83
PCBs lowerbound (pg TEQ/g fat)	0.0346	0.143	0.00	0.00	0.813
PCBs upperbound (pg TEQ/g fat)	0.231	0.159	0.0796	0.215	0.866
Total TEQ lowerbound (pg TEQ/g fat)	0.147	0.477	0.00	0.00	2.77**
Total TEQ upperbound (pg TEQ/g fat)	0.803	0.487	0.257	0.712	3.32**

n = 45
dioxins = dioxins and furans
TEQ = WHO TEQ

* The Australian data (mean dioxin upperbound result in pg TEQ/g fat) for sheep was 19.1% of the EC standard ((EC Regulation) No 2375/2001). The EU standard for dioxins does not include dioxin-like PCBs.

** Maximum 'Total TEQ' results represent the maximum value across all samples for the sum of dioxin and dioxin-like PCB results in an individual sample. For any sample, maximum 'Total TEQ' results are not the sum of maximum dioxin TEQ and maximum PCB TEQ values unless both maximums occur in the same sample. For example, the maximum upperbound dioxin TEQ in sheep occurs in sample 957-02. The maximum upperbound PCB TEQ in sheep occurs in sample 957-01. The highest total TEQ upperbound of any sheep sample occurs in sample 957-02 (see Figures 3.6a – c).

Appendix 3 Individual Results by Species

Graphical summaries of individual results are provided to facilitate analysis of the results.

Annex 1: List of beef sample numbers in order used in figures

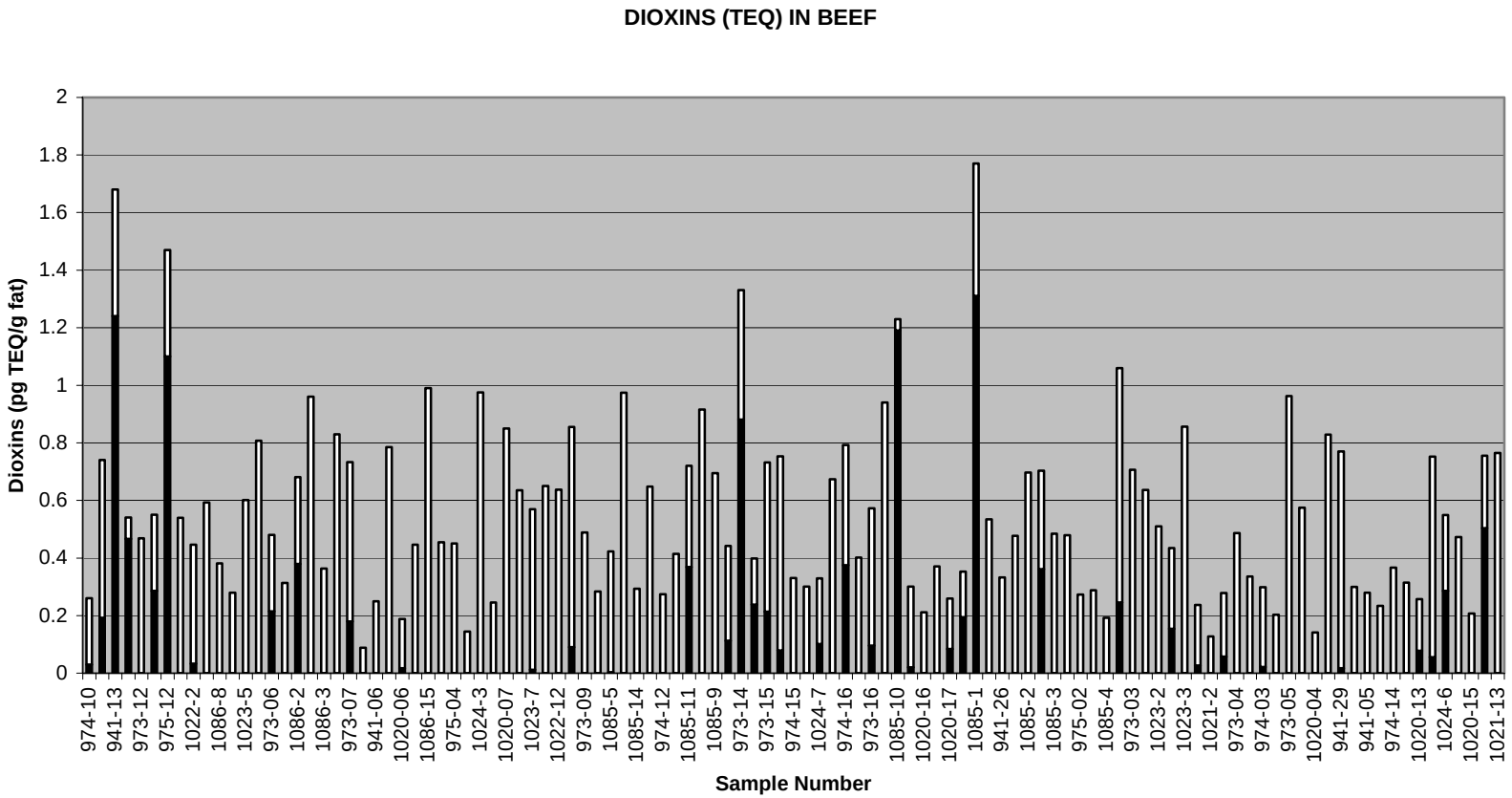
This list can be used to determine the sample number of unlabelled results in Figures 3.1(a), (b) and (c).

Due to the large number of beef samples it is unwieldy to display all samples numbers on the x-axis of Figures 3.1(a), (b) and (c). The following list of beef sample numbers is in the same sequence used in the figures.

NOTE: the order of samples presented on graphs is based on the order of results provided by the NRS to Product Safety and Integrity Branch, DAFF.

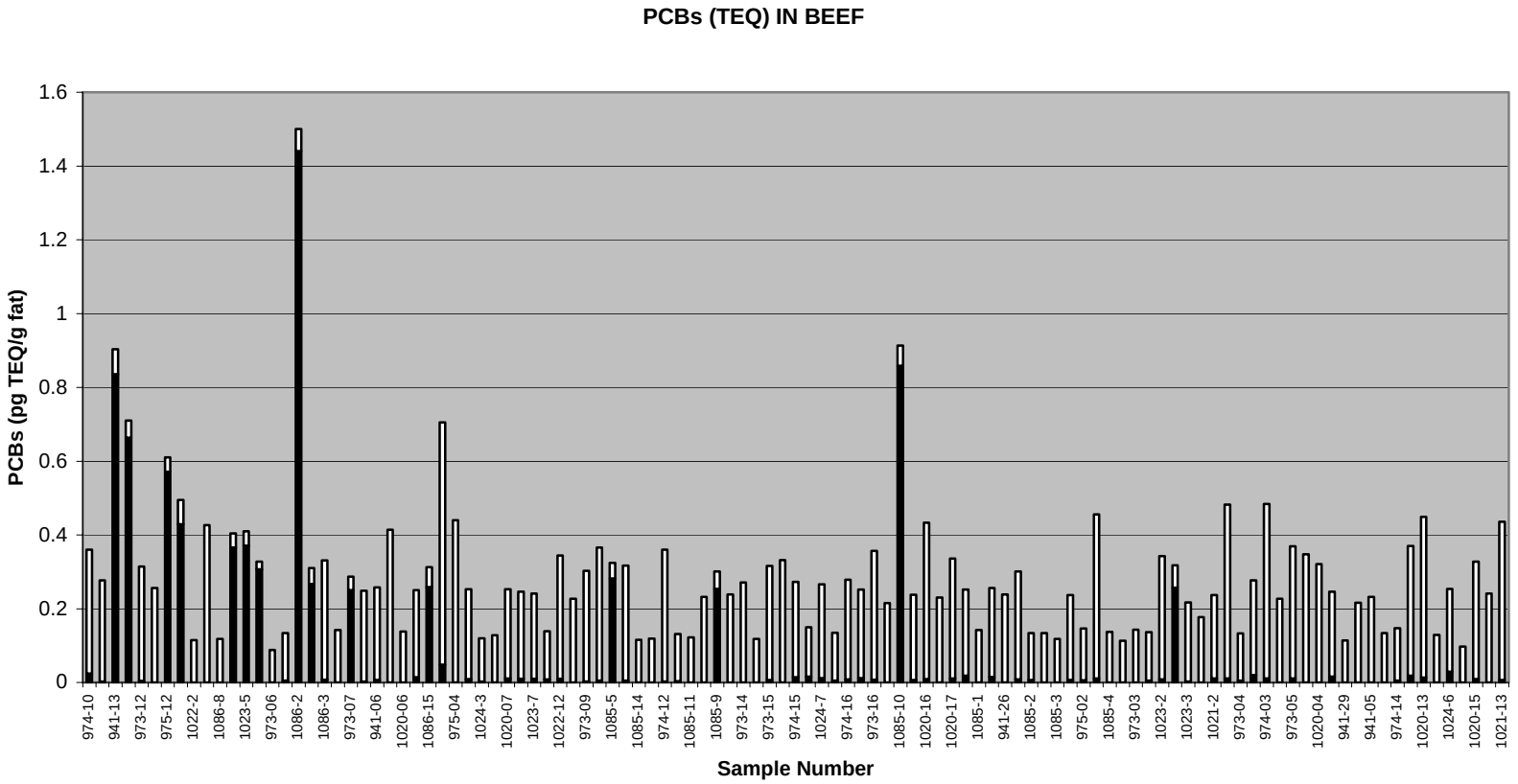
974-10	1020-07	1020-16	941-29
973-11	1086-9	1085-13	1021-3
941-13	1023-7	1020-17	941-05
1024-5	1102-1	974-11	1021-4
973-12	1022-12	1085-1	974-14
1020-12	1022-3	1024-1	941-27
975-12	973-09	941-26	1020-13
957-03	941-04	973-01	1085-7
1022-2	1085-5	1085-2	1024-6
1086-7	973-13	1020-01	1085-8
1086-8	1085-14	1085-3	1020-15
1021-5	1085-6	973-02	974-17
1023-5	974-12	975-02	1021-13
1086-1	974-13	1020-02	
973-06	1085-11	1085-4	
1021-6	1021-9	1022-1	
1086-2	1085-9	973-03	
1023-6	1085-12	1021-1	
1086-3	973-14	1023-2	
1020-05	1020-14	1020-03	
973-07	973-15	1023-3	
1024-2	1022-9	974-01	
941-06	974-15	1021-2	
973-08	1023-19	974-02	
1020-06	1024-7	973-04	
941-07	1021-10	941-02	
1086-15	974-16	974-03	
975-03	1024-8	941-03	
975-04	973-16	973-05	
1021-7	1021-11	974-04	
1024-3	1085-10	1020-04	
1021-8	1021-12	1023-4	

Figure 3.1(a): Dioxins (TEQ) in beef



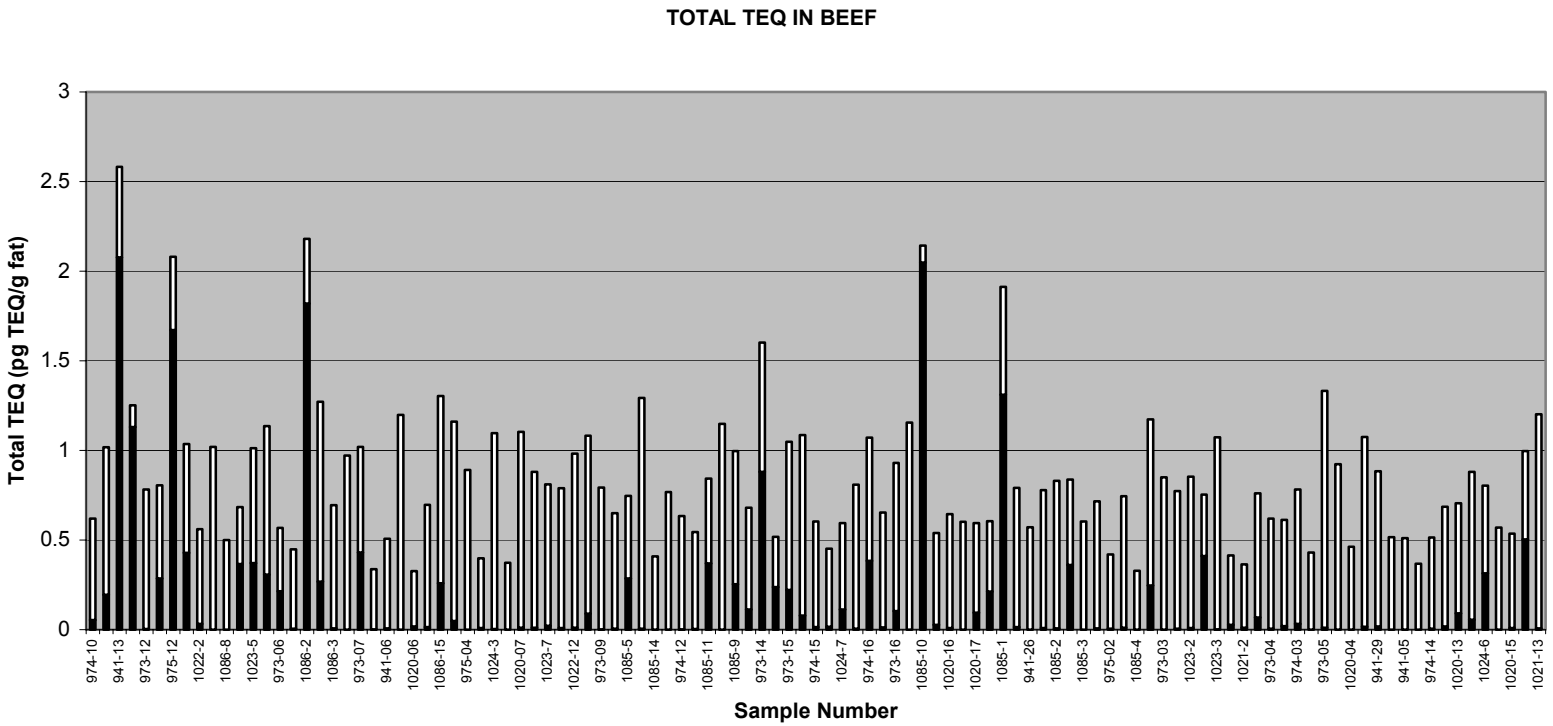
Note: Only every second sample number is labelled due to space limitations. The order of samples corresponds to the order they were entered into the NRS database (see Annex 1).
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.1(b): PCBs (TEQ) in beef



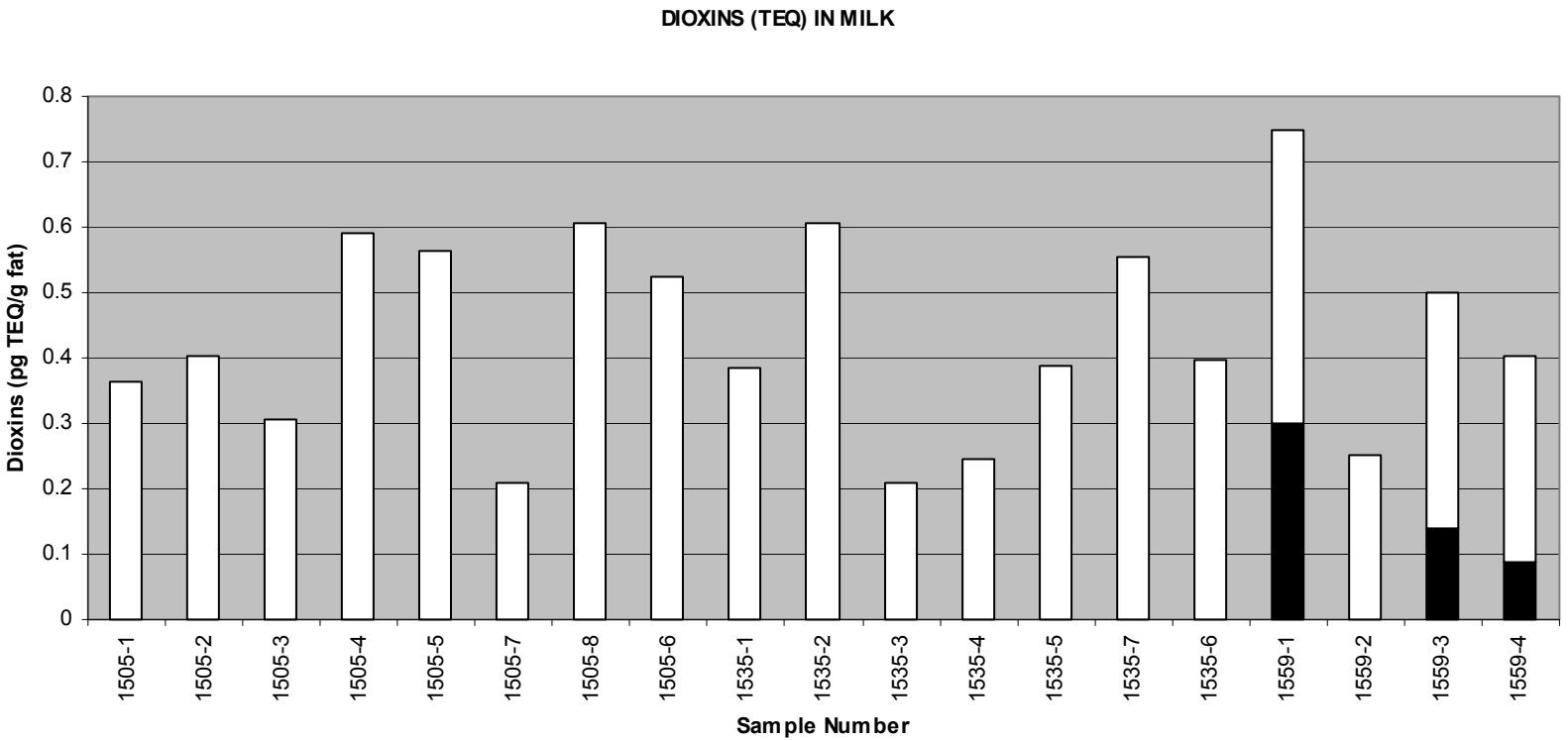
Note: Only every second sample number is labelled due to space limitations. The order of samples corresponds to the order they were entered into the NRS database (see Annex 1).
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.1(c): Total TEQ in beef



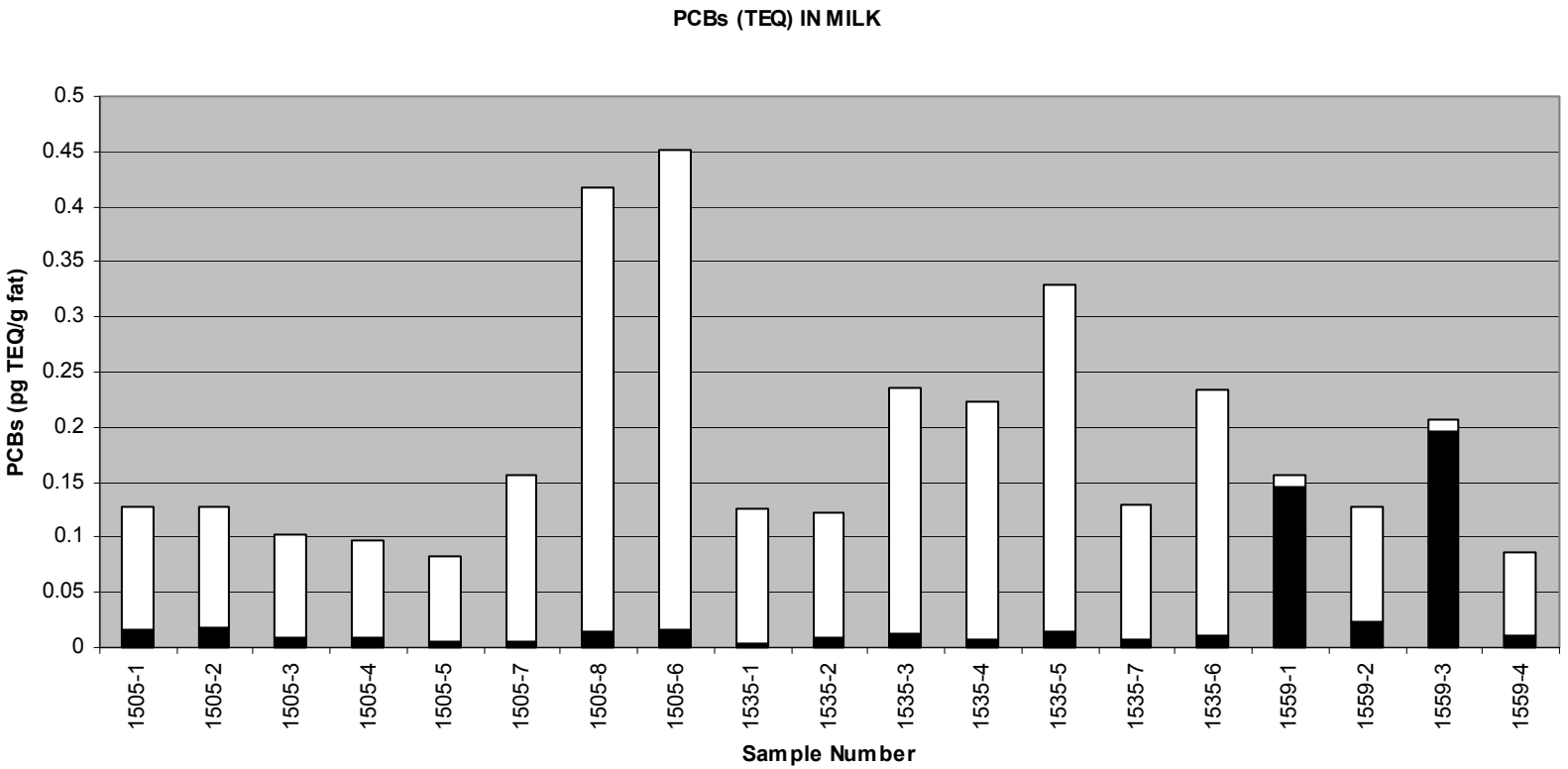
Note: Only every second sample number is labelled due to space limitations. The order of samples corresponds to the order they were entered into the NRS database (see Annex 1).
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.2(a): Dioxins (TEQ) in milk



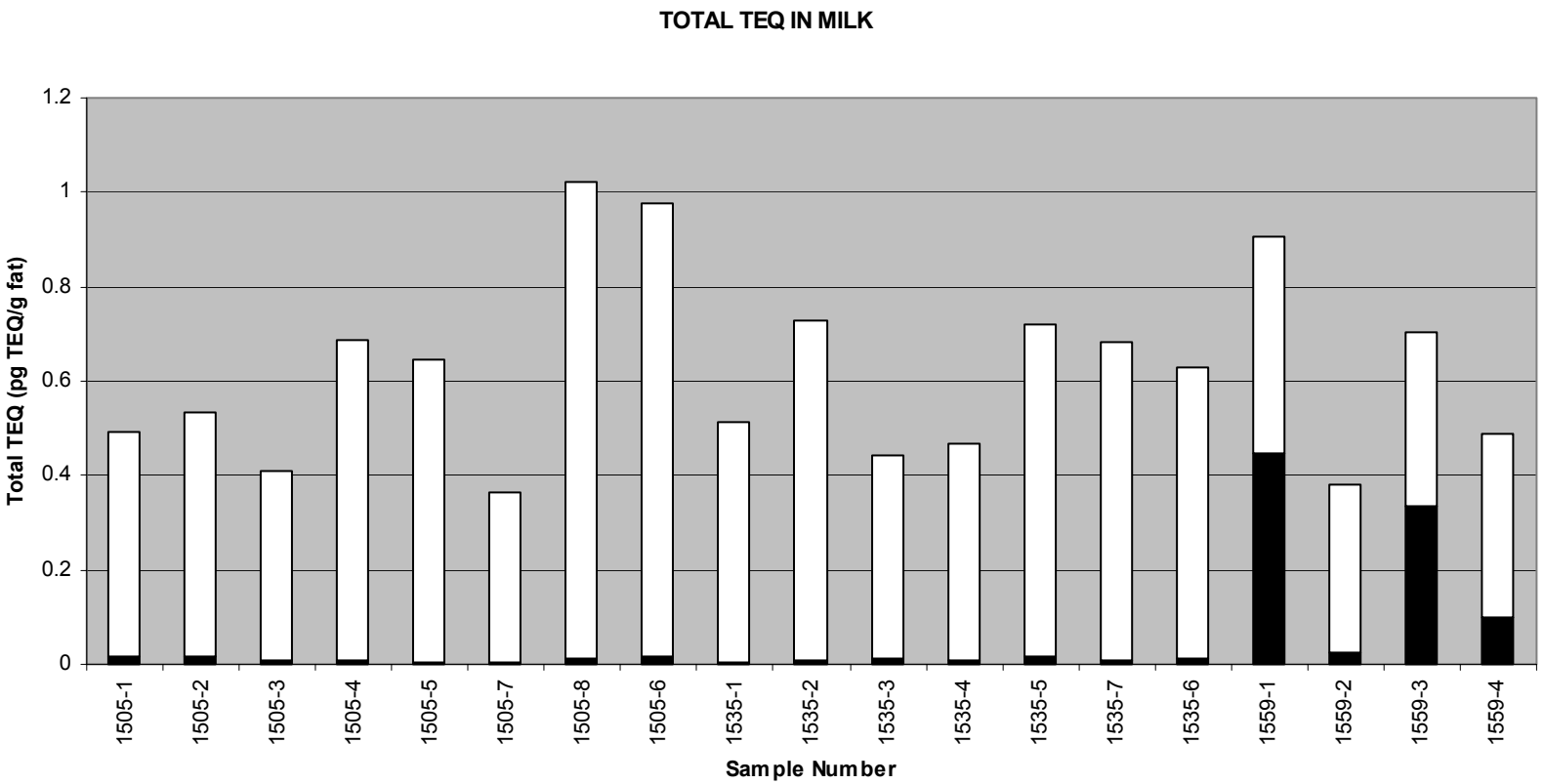
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.2(b): PCBs(TEQ) in milk



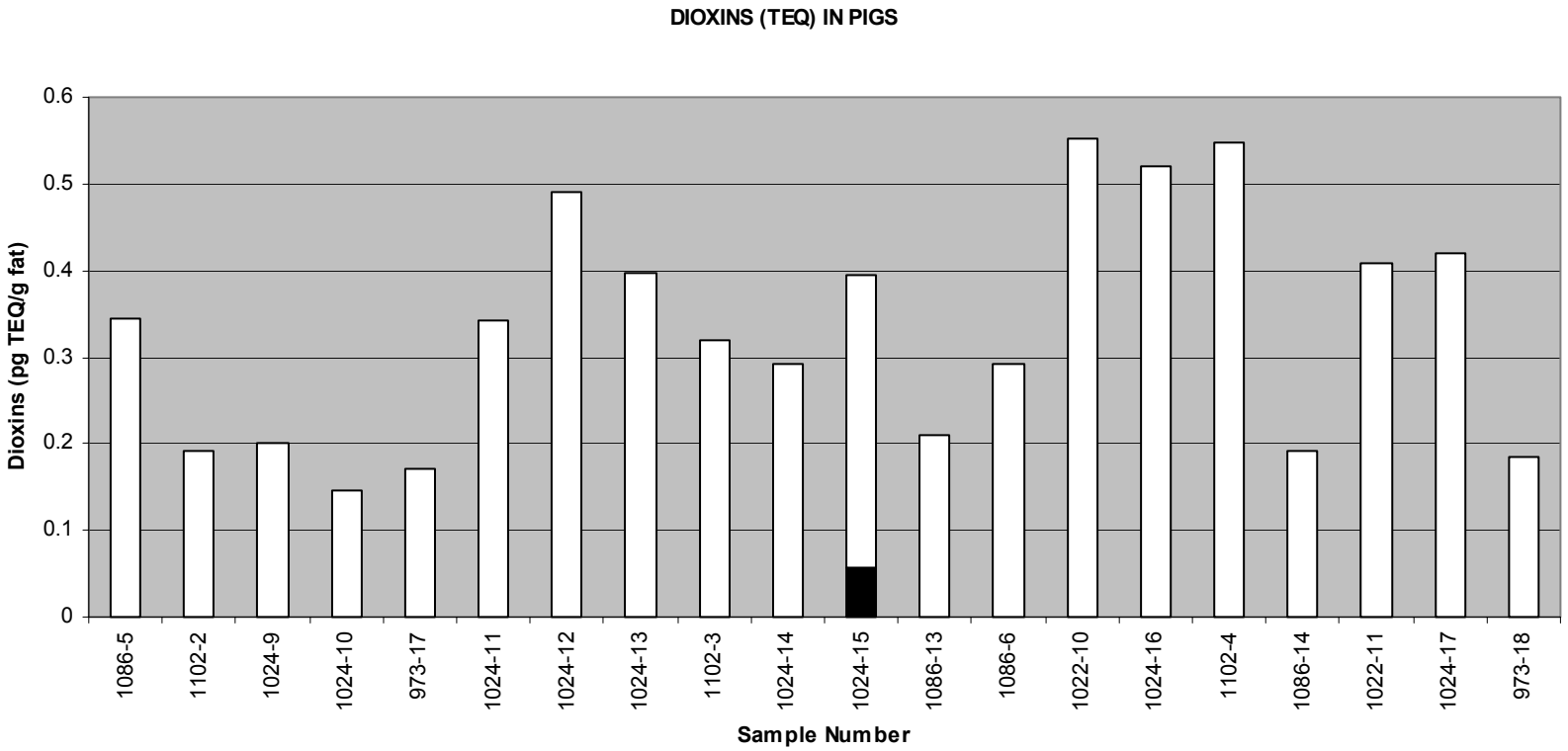
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.2(c): Total TEQ in milk



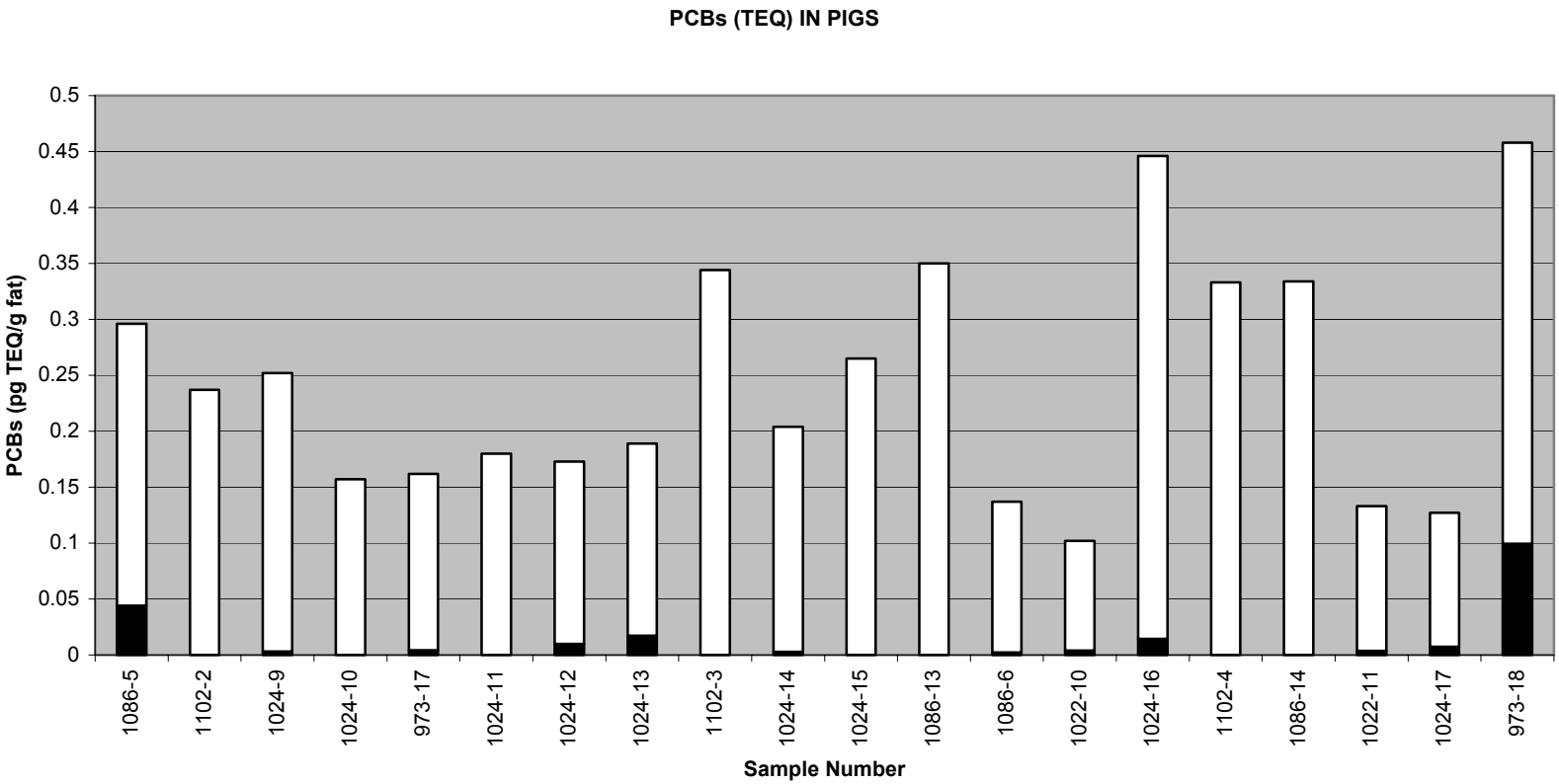
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.3(a): Dioxins (TEQ) in pigs



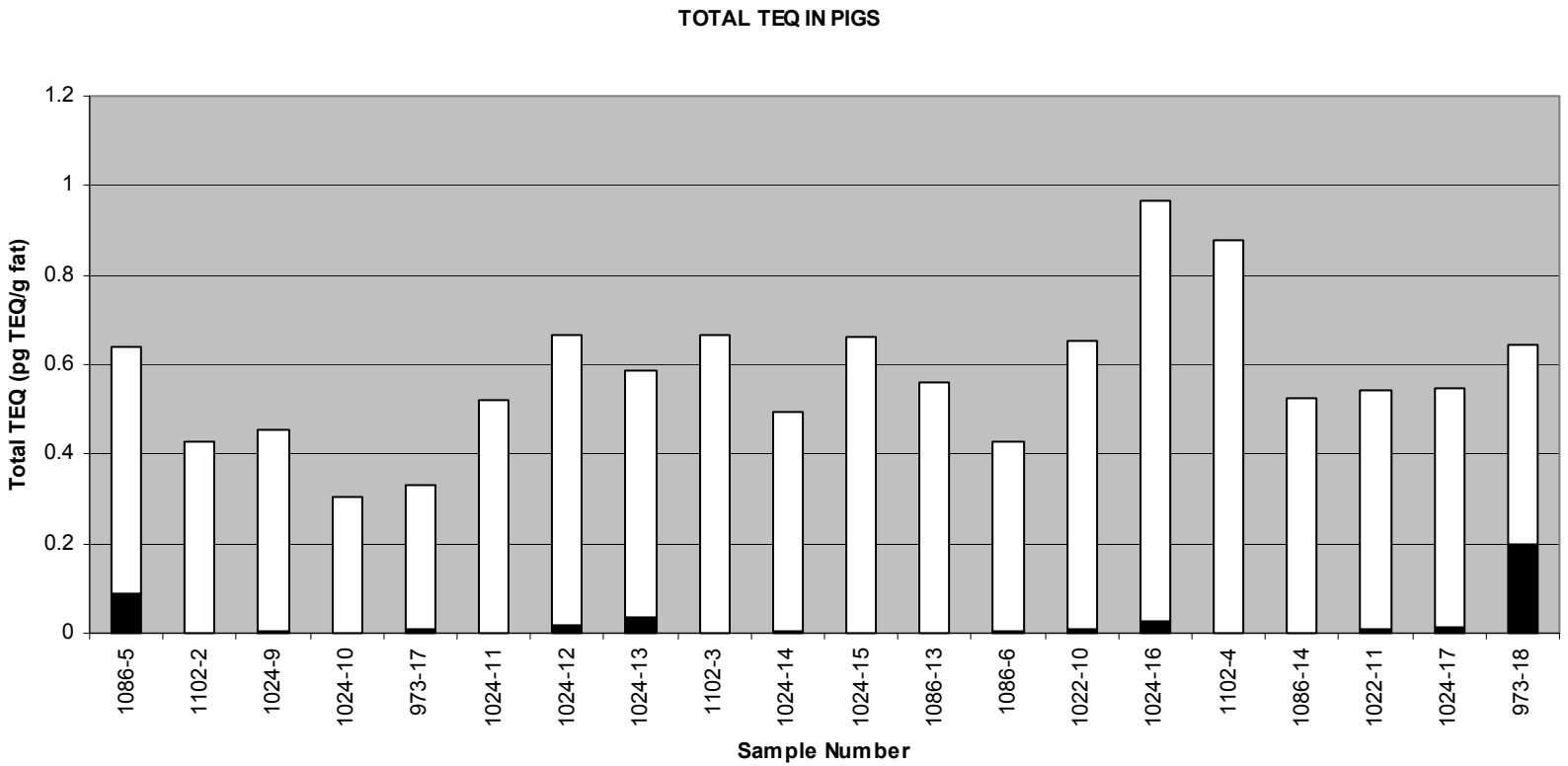
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.3(b): PCBs (TEQ) in pigs



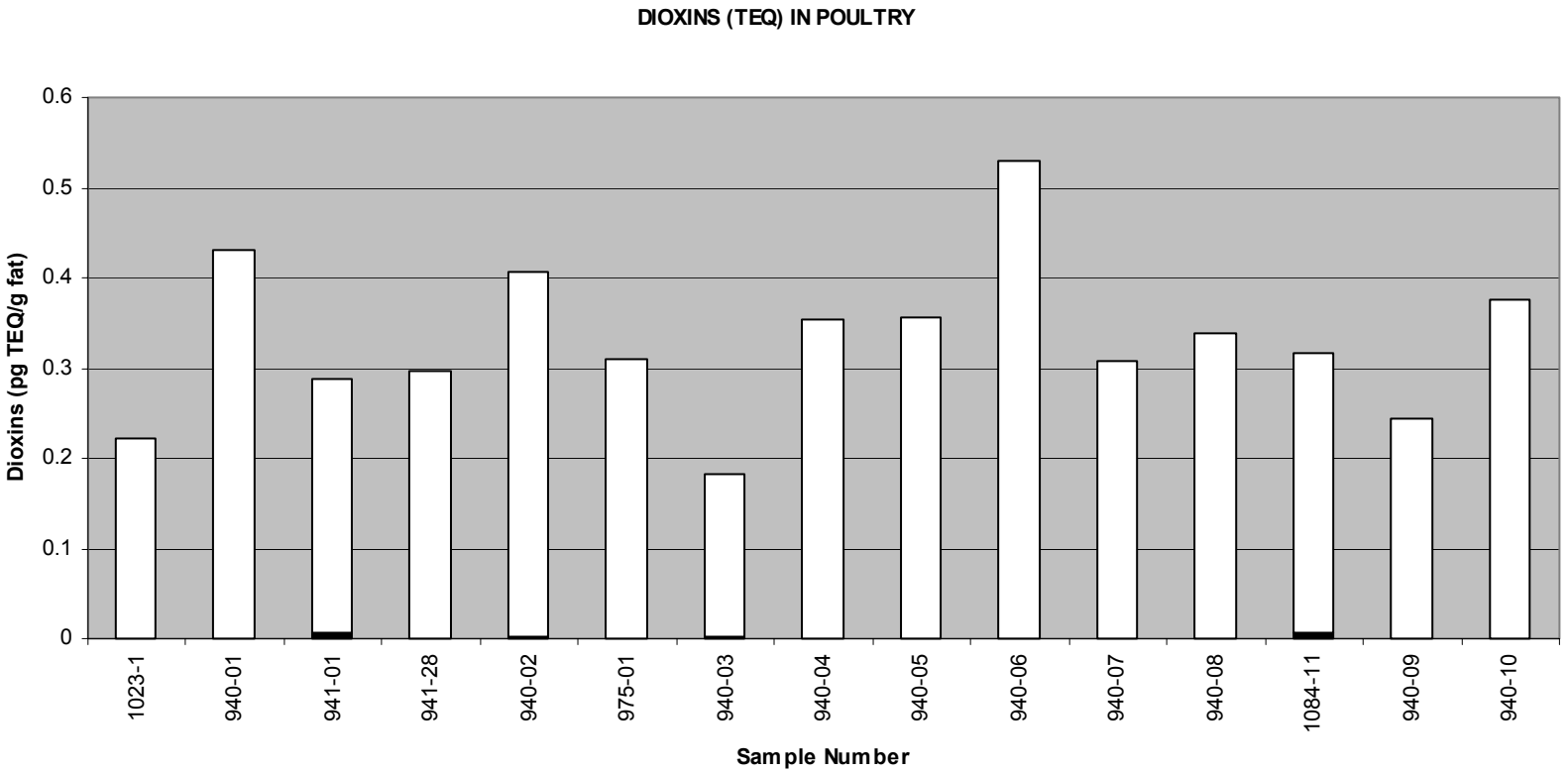
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.3(c): Total TEQ in pigs



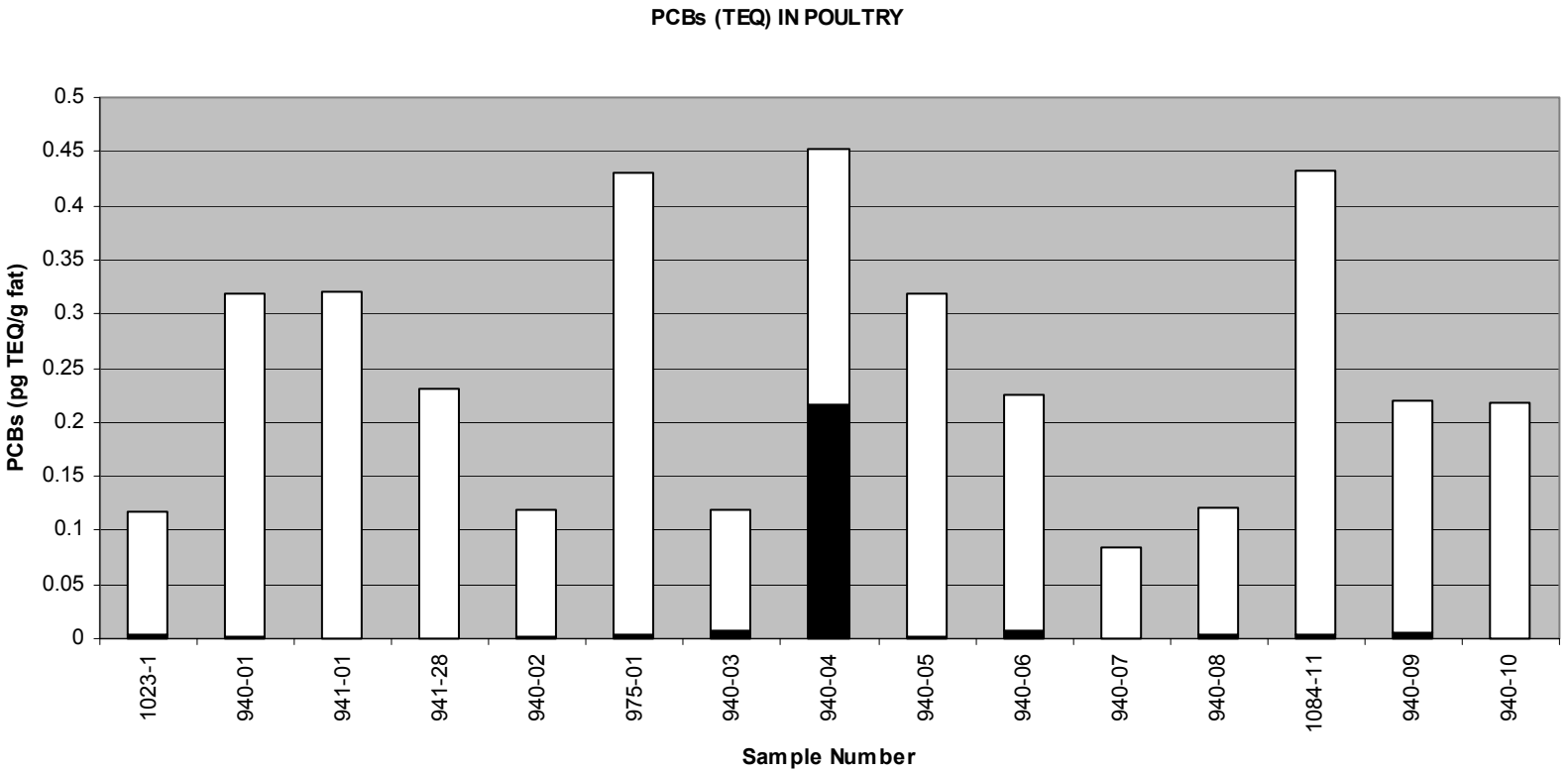
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample.

Figure 3.4(a): Dioxins (TEQ) in poultry



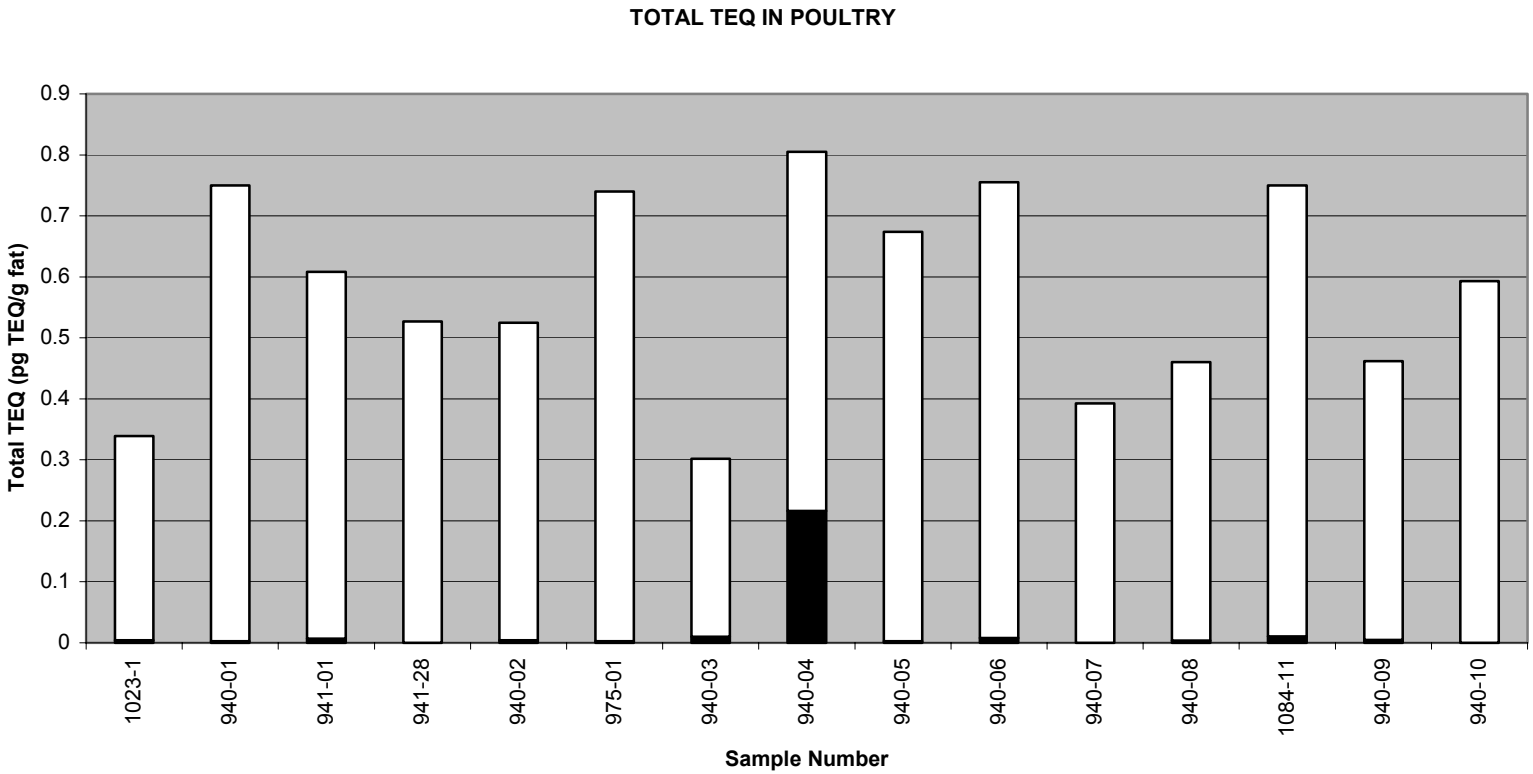
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.4(b): PCBs (TEQ) in poultry



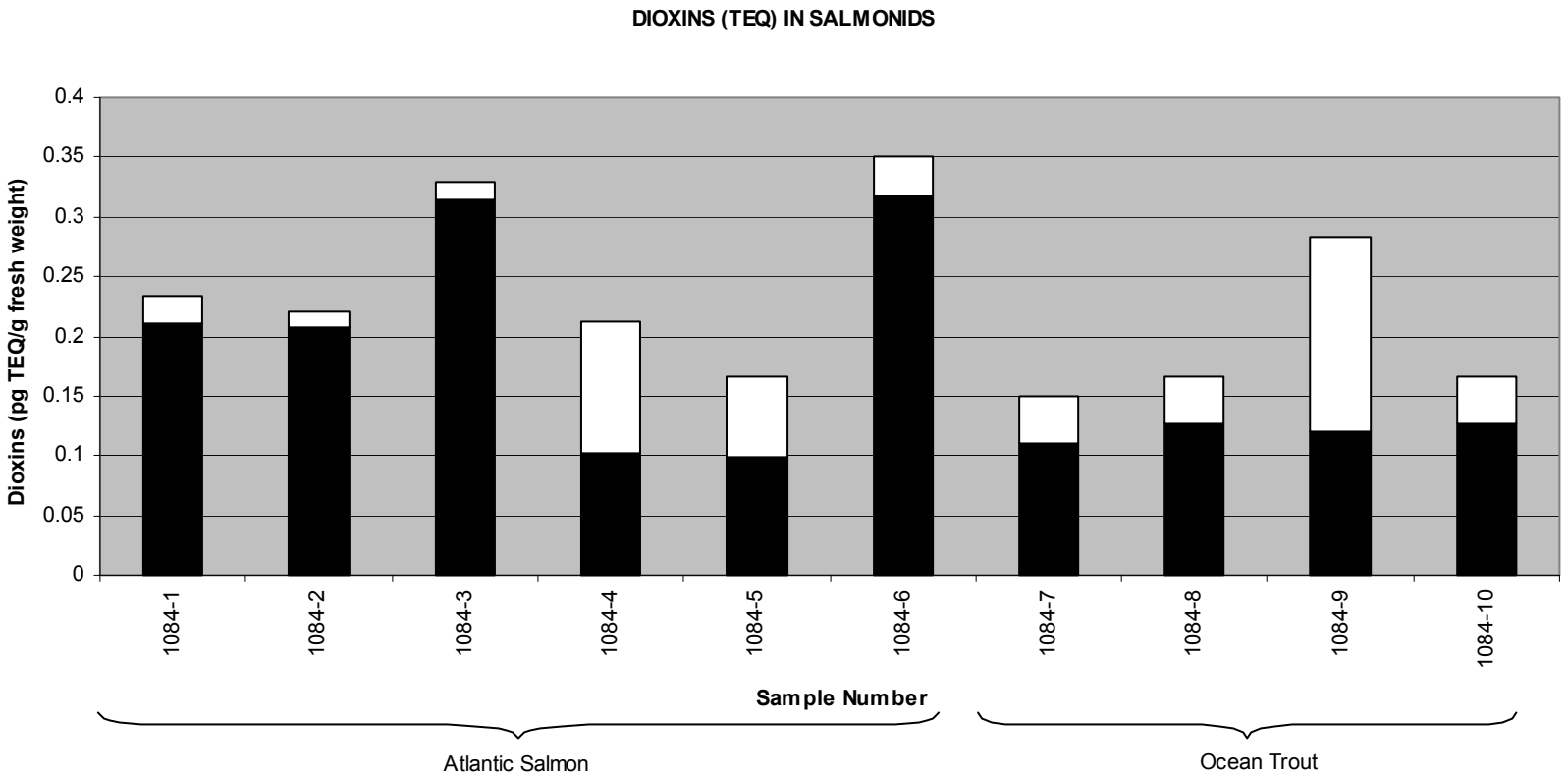
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.4(c): Total TEQ in poultry



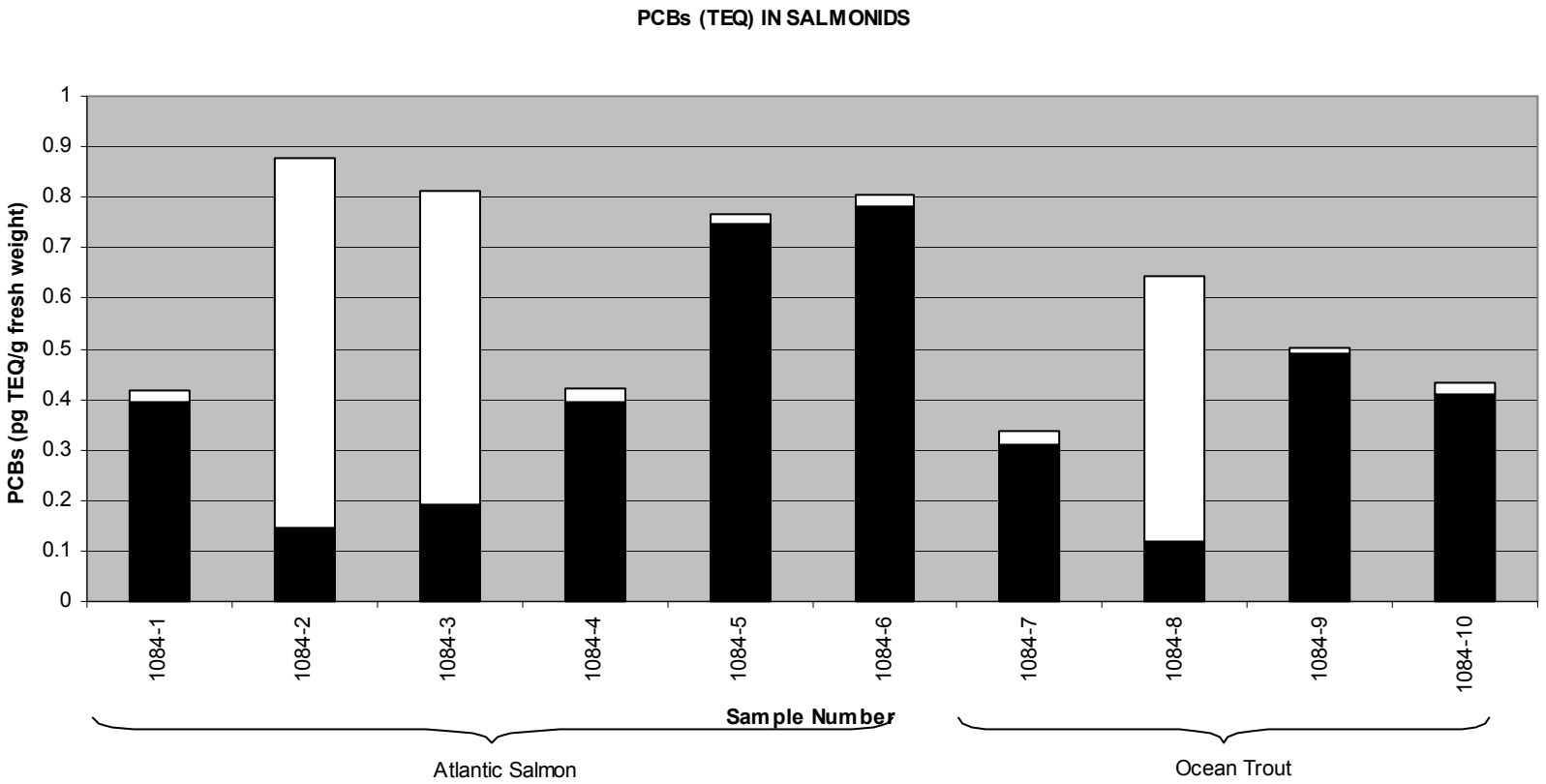
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.5(a): Dioxins (TEQ) in aquaculture salmonids



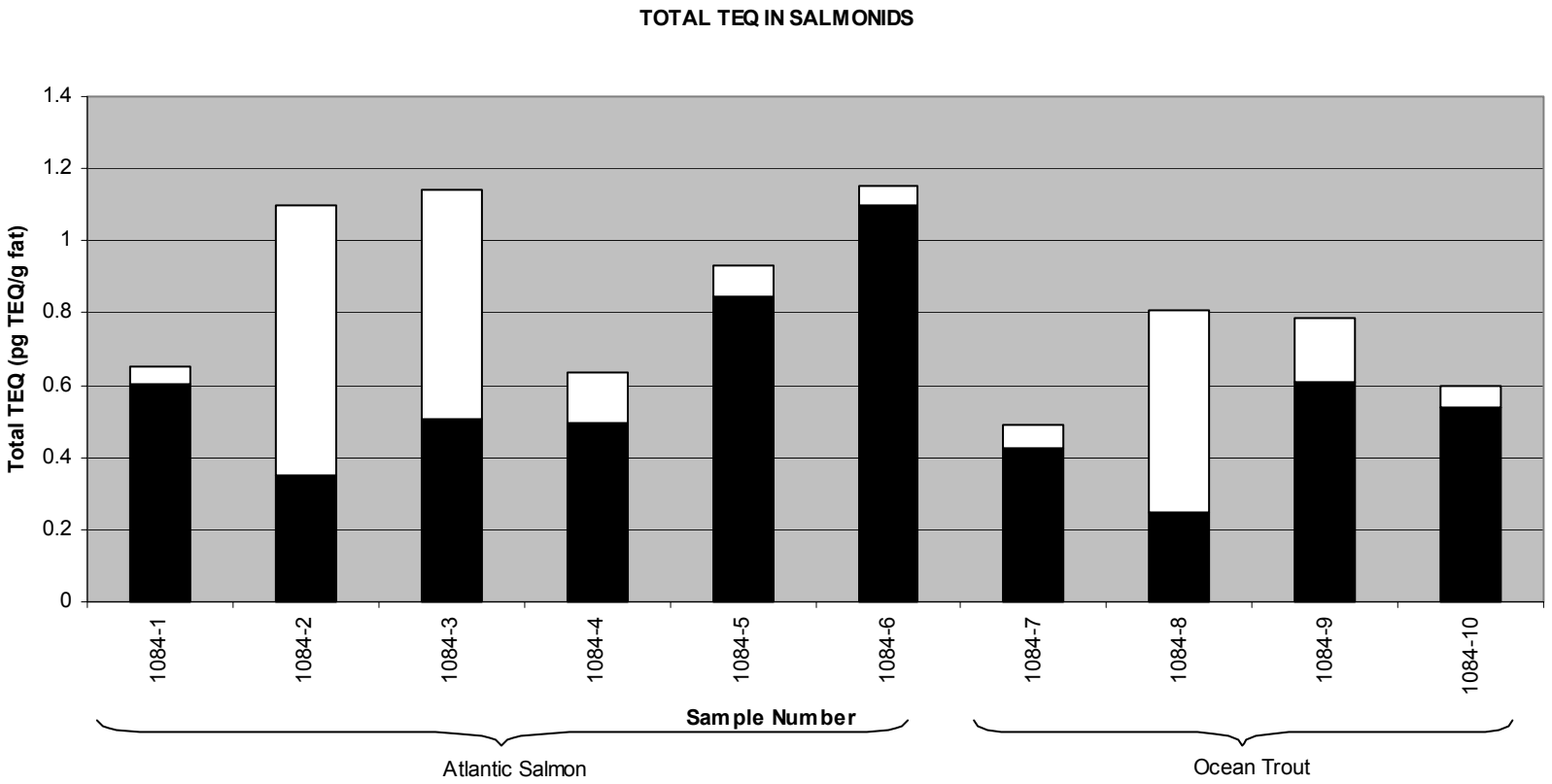
Note: Results of fish sample testing are expressed in different unit (i.e., per gram fresh weight rather than per gram fat). This is consistent with international practice.
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.5(b): PCBs (TEQ) in aquaculture salmonids



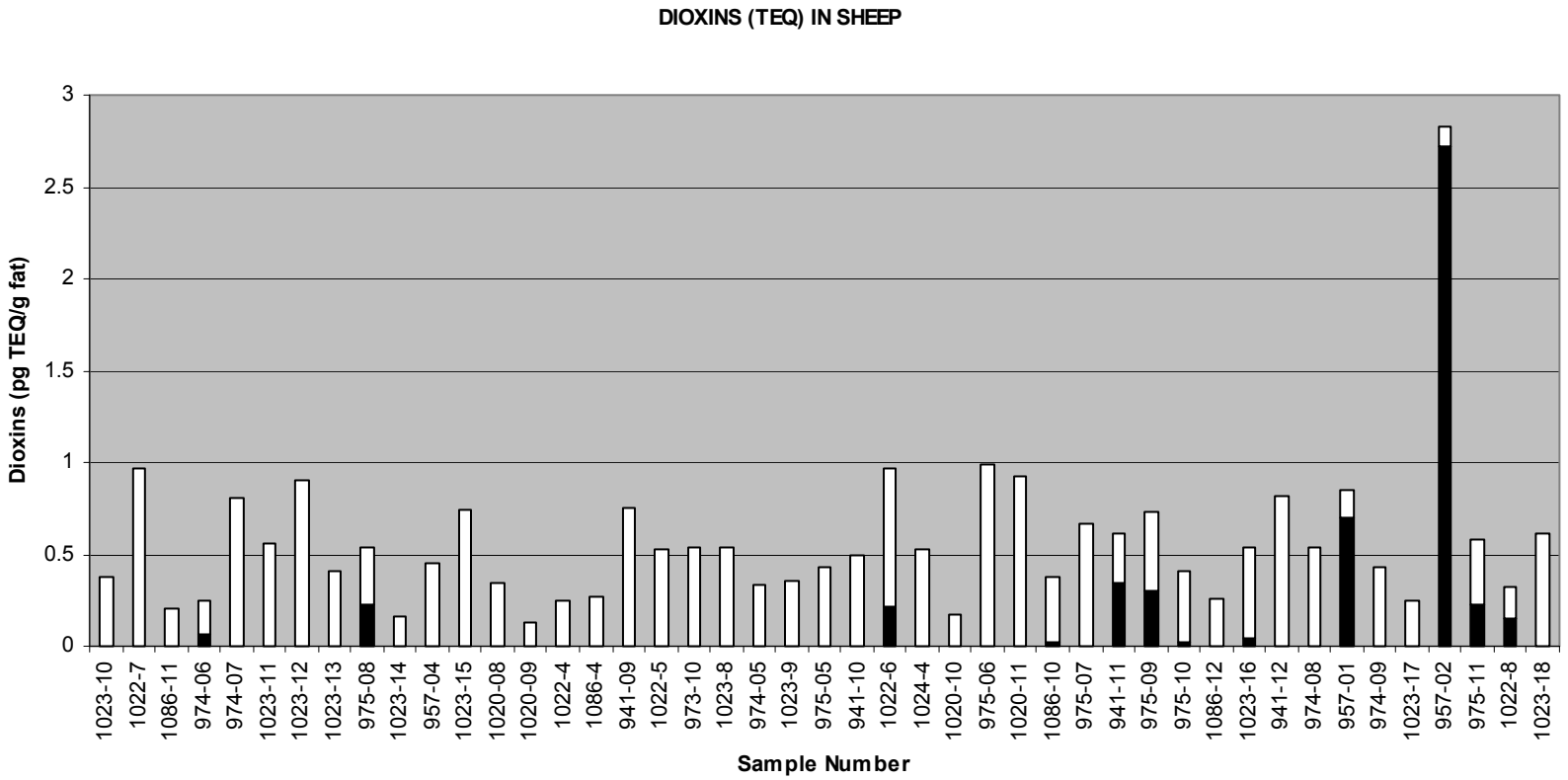
Note: Results of fish sample testing are expressed in different unit (i.e., per gram fresh weight rather than per gram fat). This is consistent with international practice.
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.5(c): Total TEQ in aquaculture salmonids



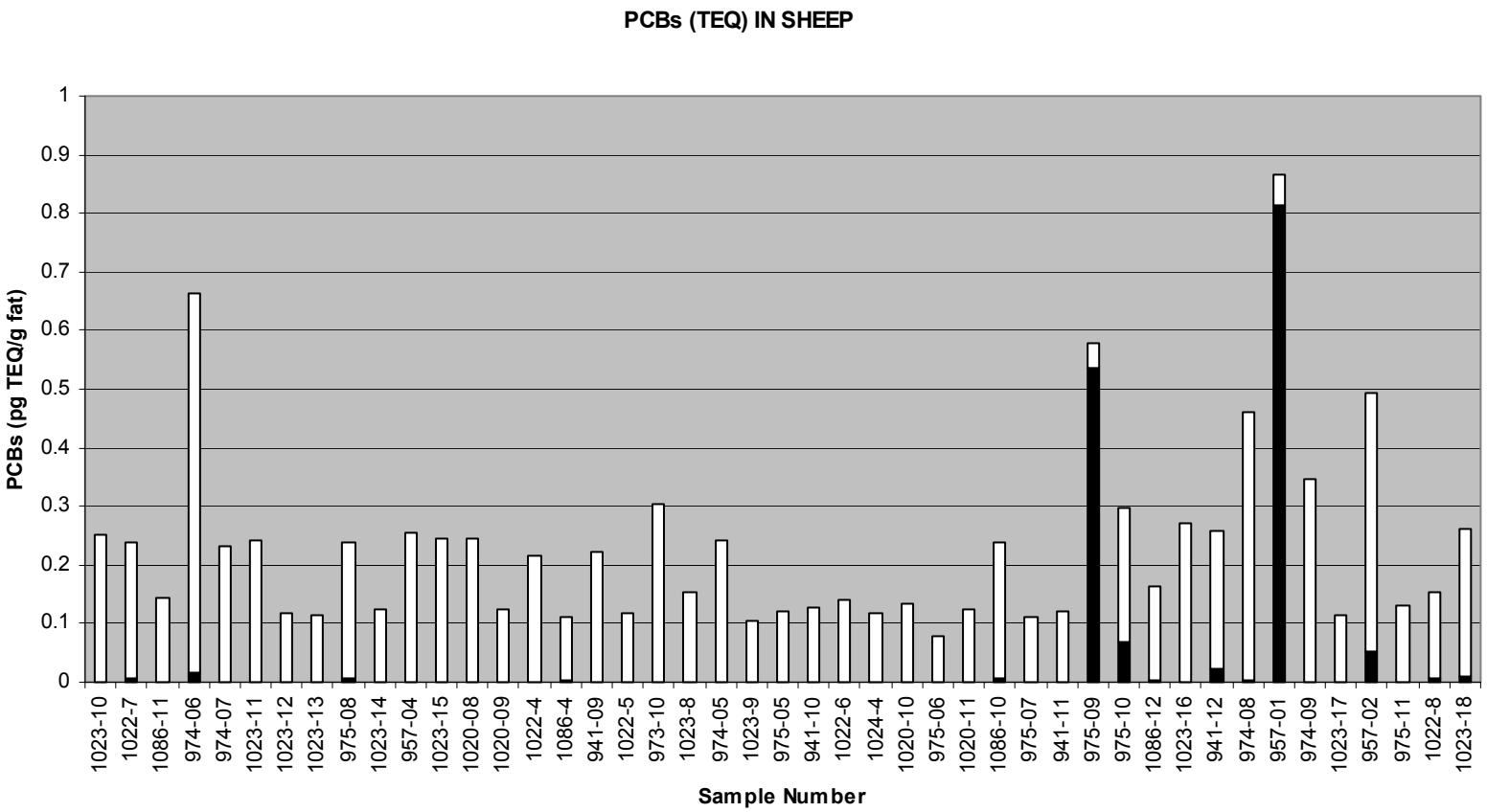
Note: Results of fish sample testing are expressed in different unit (i.e., per gram fresh weight rather than per gram fat). This is consistent with international practice.
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.6(a): Dioxins (TEQ) in sheep



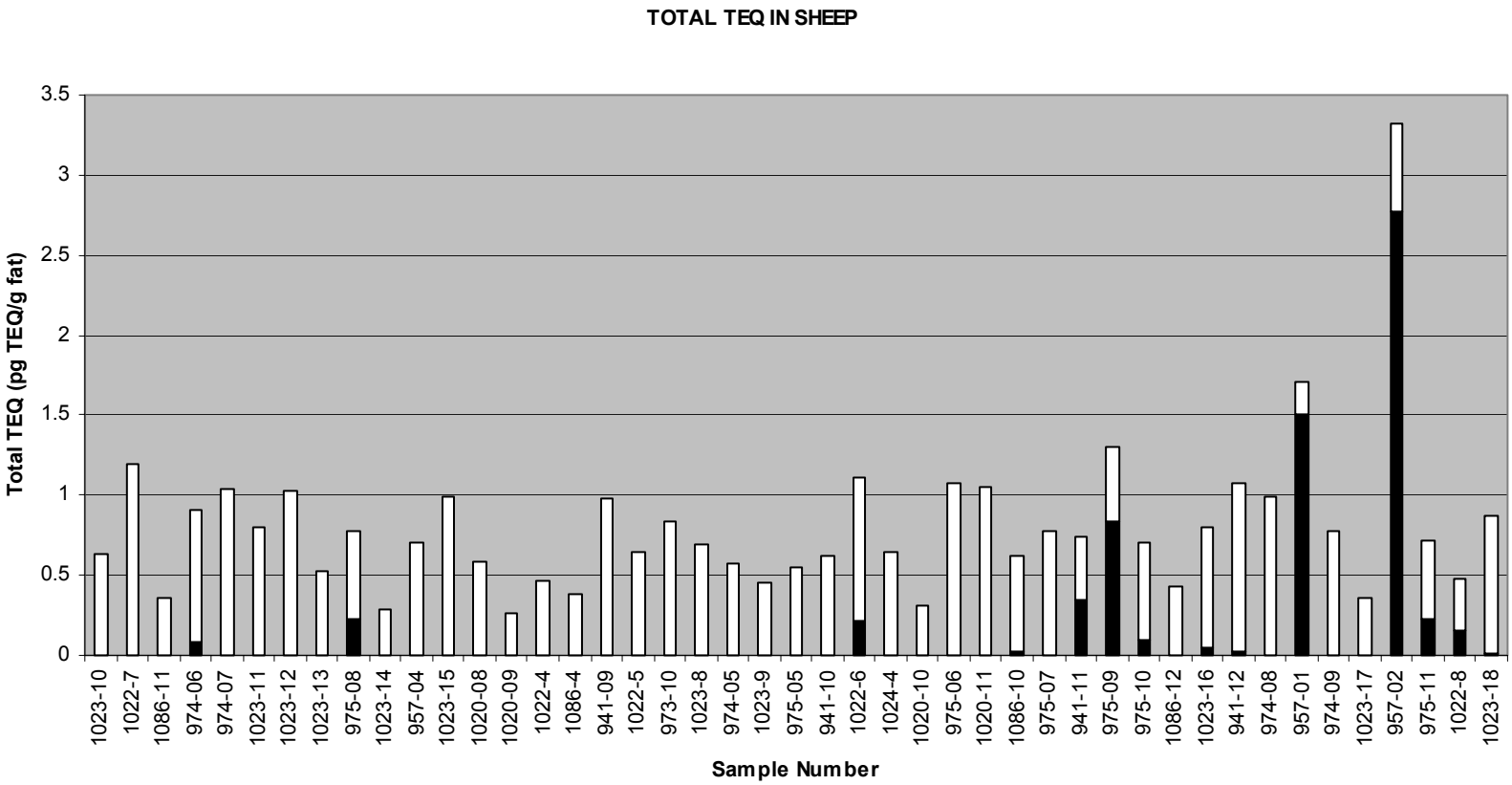
Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.6(b): PCBs (TEQ) in sheep



Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Figure 3.6(c): Total TEQ in sheep



Black bars represent lowerbound value (i.e., the sum of detected congeners multiplied by the relevant TEF).
White bars represent the sum of LOD contributions (i.e., the sum of the LOD for non-detected congeners multiplied by the relevant TEF).
The black and white bars together represent the upperbound value or maximum possible TEQ in that sample

Appendix 4 Existing Intake Standards

4.1 Australian provisional Tolerable Monthly Intake

In January 2002, the National Health and Medical Research Council (NHMRC), Therapeutic Goods Administration (TGA) and the Department of Health and Ageing (DoHA) released a recommendation for a proposed Tolerable Monthly Intake Standard of 70 pg TEQ/kg bodyweight.

4.2 Overseas intake standards

The World Health Organization (WHO), European Union (EU), Joint FAO/WHO Expert Committee on Food Additives (JECFA) and the Australian NHMRC/TGA/DoHA intake standards are compared in the following table.

Table 4.2: Comparison of intake standards for dioxins/furans and dioxin-like PCBs.

Agency/organisation	**Intake/exposure standard**	**Standards converted to the same units for comparison**
NHMRC/TGA/DoHA (2002)	70 pg/kg bw/**month**	70 pg/kg bw/month
JECFA (2001)	70 pg/kg bw/**month**	70 pg/kg bw/month
EU (2001)	14 pg/kg bw/**week**	60 pg/kg bw/month
WHO (1998)	1-4 pg kg/bw/**day**	30-120 pg/kg bw/month

Appendix 5 Existing Commodity Standards

In the absence of an Australian commodity standard for dioxins and furans, the most relevant existing commodity standards for comparative assessment of Australian data are:

- the EU standard in EU Regulation (EC) No 2375/2001
- the EU action levels in EU Recommendation 2002/201/EC
- the levels in the Korean Sanitary and Phytosanitary notification of 29 January 2001.

5.1 European Union

Table 5.1: EU Standard for dioxins/furans

Species	Maximum pg TEQ/g*	Mean** result from this study (%)	Maximum** result from this study (%)
Beef	3	0.557 (18.6%)	1.77 (59.0%)
Fish (salmonids)	4	0.228 (5.7%)	0.350 (8.75%)
Milk	3	0.434 (14.5%)	0.749 (25.0%)
Pig	1	0.331 (33.1%)	0.551 (55.1%)
Poultry	2	0.330 (16.5%)	0.529 (26.45%)
Sheep	3	0.572 (19.1%)	2.83 (94.3%)

* on a fat basis except for fish which is on a fresh weight basis. Where a congener is not detected, the EU standard assumes the LOD for that congener.
** mean and maximum results are upperbound concentrations expressed as pg TEQ/g. Values in parentheses are expressed as a percentage of the EU standard for that species).

Table 5.2: EU Action levels for dioxins/furans

Species	Maximum pg TEQ/g*	Mean** result from this study (%)	Maximum** result from this study (%)
Beef	2	0.557 (27.9%)	1.77 (88.5%)
Fish (salmonids)	3	0.228 (7.6%)	0.350 (11.7%)
Milk	2	0.434 (21.7%)	0.749 (37.5%)
Pig	0.6	0.331 (55.2%)	0.551 (91.8%)
Poultry	1.5	0.330 (22.0%)	0.529 (35.3%)
Sheep	2	0.572 (28.6%)	2.83 (141.5%)***

* on a fat basis except for fish which is on a fresh weight basis. Where a congener is not detected, the EU action level assumes the LOD.
** mean and maximum results are upperbound concentrations expressed as pg TEQ/g. Values in parentheses are expressed as a percentage of the EU action level for that species).
*** this result exceeds the EU action level.

The definition of application of "action level" in EU Recommendation 2002/201/EC is that Member States in cooperation with operators:

- initiate investigations to identify the source of contamination
- check for the presence of dioxin-like PCBs
- take measures to reduce or eliminate the source of contamination.

5.2 Korea

Table 5.3: Korean temporary maximum levels for dioxins/furans

Species*	Maximum pg TEQ/g**	Mean*** result from this study (%)	Maximum*** result from this study (%)
Beef	5	0.557 (11.1%)	1.77 (35.4%)
Pig	5	0.331 (6.6%)	0.551 (11.0%)
Poultry	5	0.330 (6.6%)	0.529 (10.0%)

* The Korean SPS notification of 29 January 2001 does not set levels for fish, milk, or sheep meat.
** on a fat basis.
*** mean and maximum results are upperbound concentrations expressed as pg TEQ/g. Values in parentheses are expressed as a percentage of the Korean maximum level for that species.

Appendix 6 Commodity comparison

Figures 6.1 compares the mean level of dioxins (including furans) and PCBs in the various non-fish commodities tested in this study. Because of the international convention of testing fish with different units (i.e. per gram fresh weight, not per unit fat), the fish results are presented separately in Figure 6.2, as they are not directly comparable to other data.

Figure 6.1: Commodity comparison (non-fish)

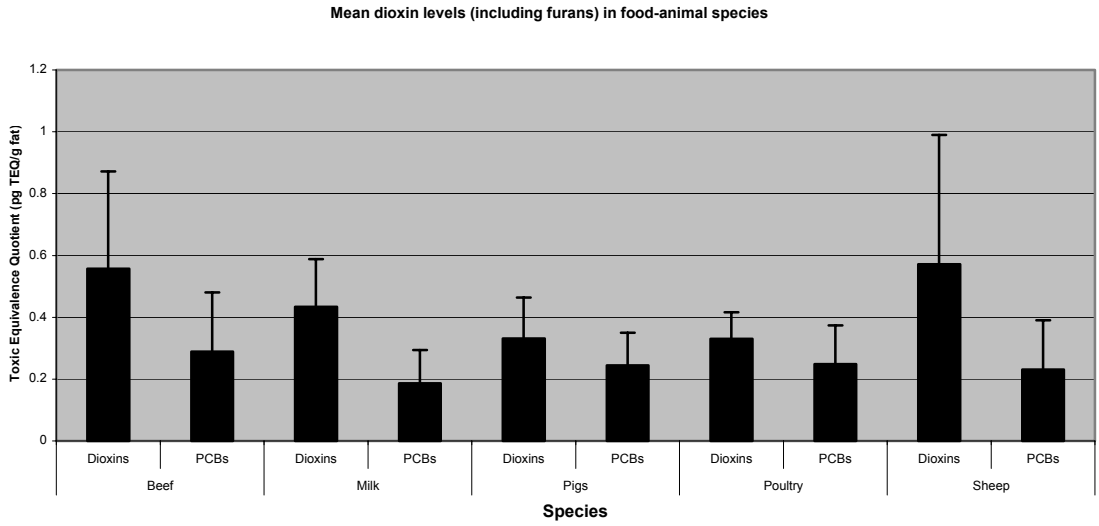
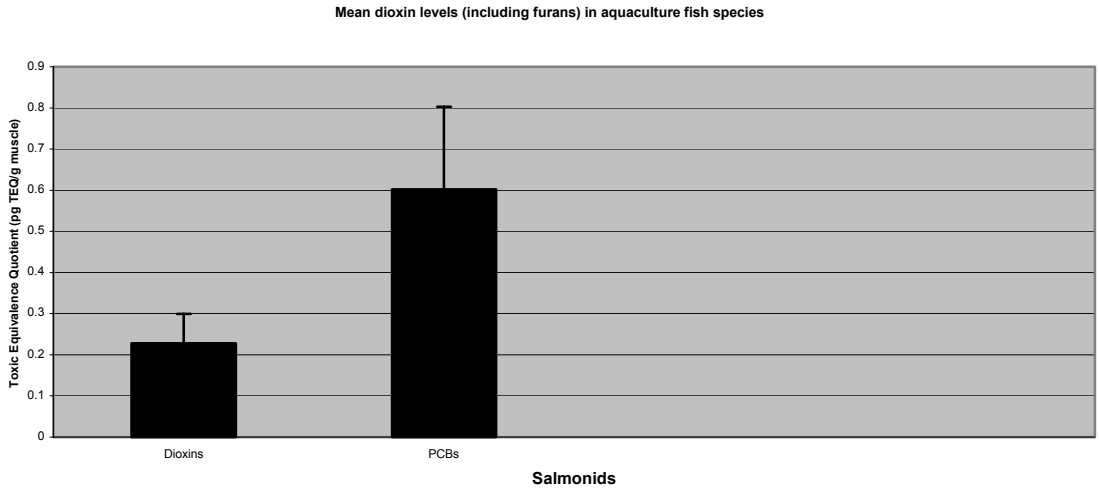


Figure 6.2: Commodity summary results (fish)



Appendix 7 International comparison

Despite the inconsistency of methods and sampling of international dioxin data, the DTG felt it would be useful to compare Australian data to international findings. The DTG requested a comparison between data generated in this study and the dioxin data for geographical regions in the recent Codex Commission on Food Additives and Contaminants (CCFAC) position paper (CX/FAC 03/32, January 2003). It is important to note that these results are not directly comparable and various methods are outlined or referenced in the Codex paper.

Note the testing conducted for the Australian study includes more species (e.g. sheep) and more compounds (i.e. dioxins, PCBs and Total TEQ) than data presented in the CCFAC paper. Therefore, several species/compound comparisons are not possible. Those that are possible are included below. The figures show the countries that provided data for any species, but not all countries provided data for all species. Where no horizontal bar is shown, no data was provided for that country in the paper. Figures 7.1(a), 7.2(a), 7.3(a), 7.4(a) and 7.5(a) are presented as upperbound ranges of dioxins in the various species. Figures 7.6 to 7.8 show the range of PCBs. Figure 7.9 shows the range of total TEQ (dioxins and dioxin-like PCBs). Also included below in Figures 7.1(b), 7.2(b), 7.3(b), 7.4(b) and 7.5(b) are comparisons of Australian dioxins data against other dioxins data from several international studies (extracted from the papers listed in References). These comparisons are presented as dioxin point estimates (means), with the exception of 7.5(b), which shows the range of dioxins.

Figure 7.1(a): Range of dioxins in beef

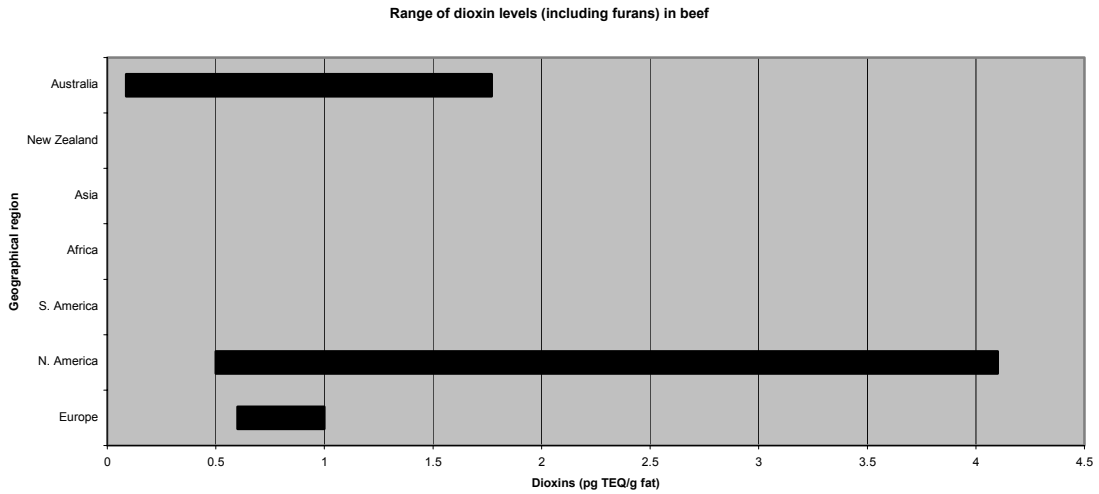


Figure 7.1(b): Upperbound concentrations of dioxins in beef

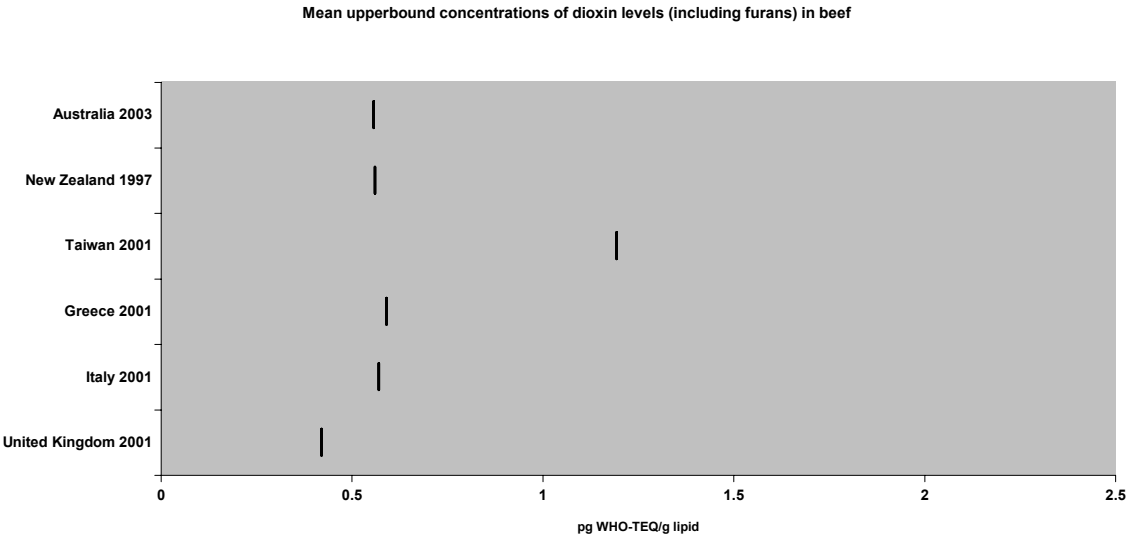
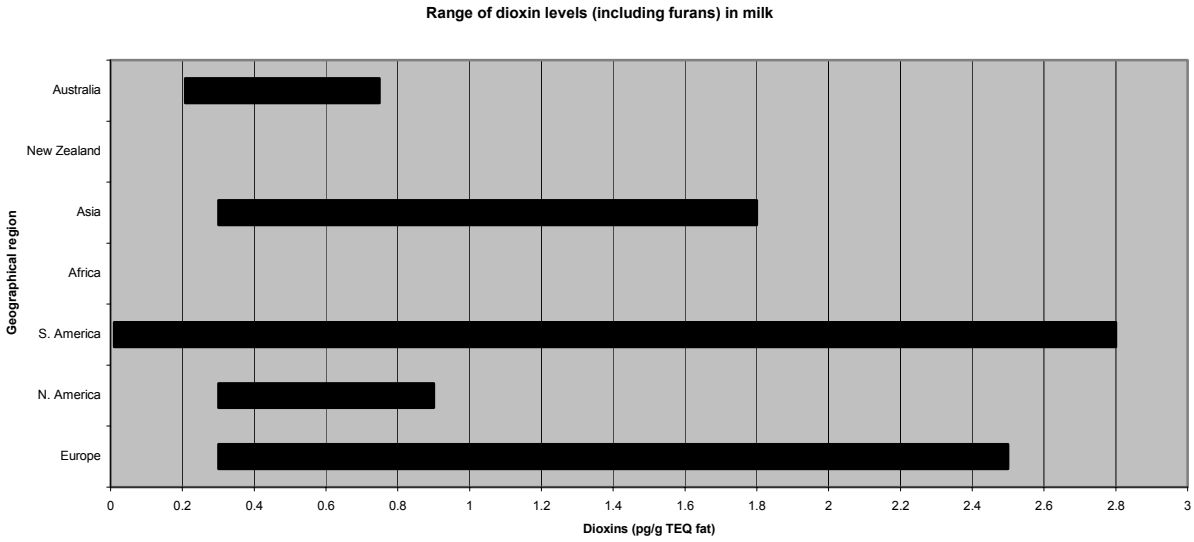


Figure 7.2(a): Range of dioxins in milk



Note: Where no horizontal bar is shown for a country no data was provided for that country in the CCFAC position paper (CX/FAC 03/32, January 2003)

Figure 7.2(b): Upperbound concentrations of dioxins in milk

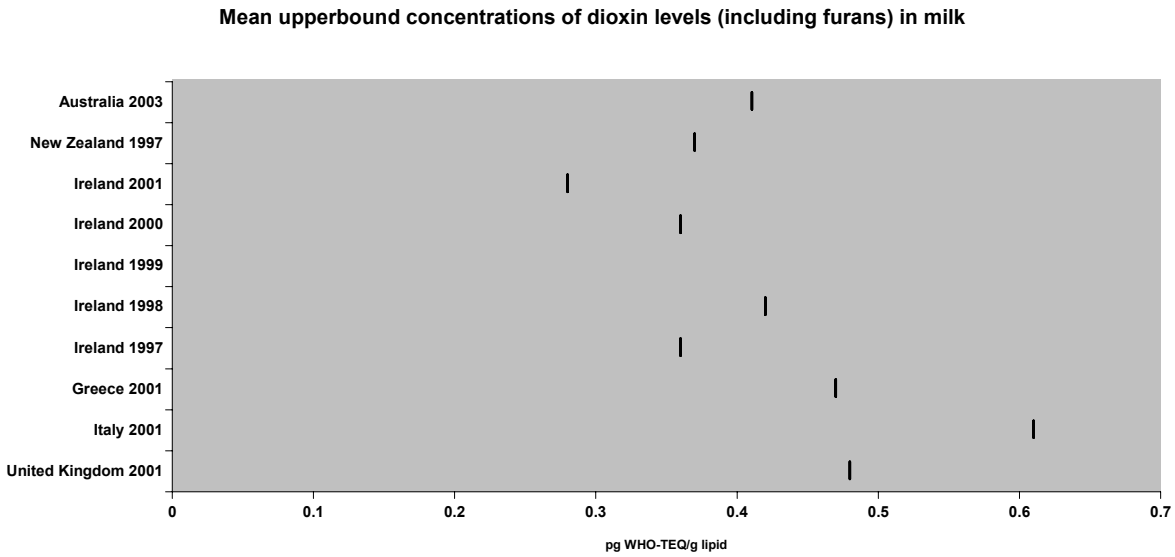


Figure 7.3(a): Range of dioxins in pigs

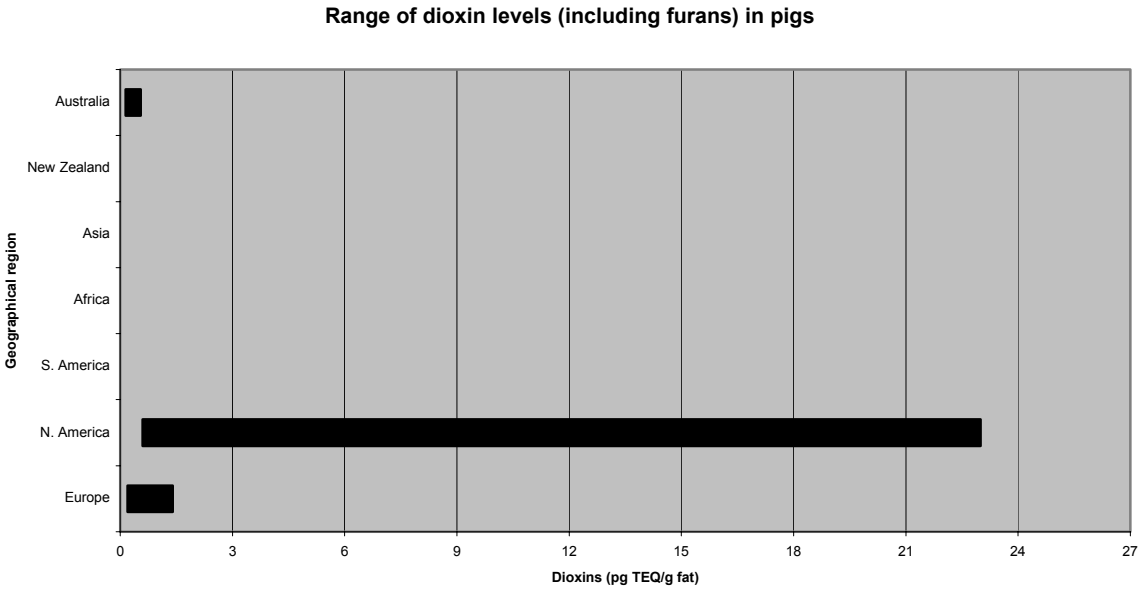


Figure 7.3(b): Upperbound concentrations of dioxins in pork

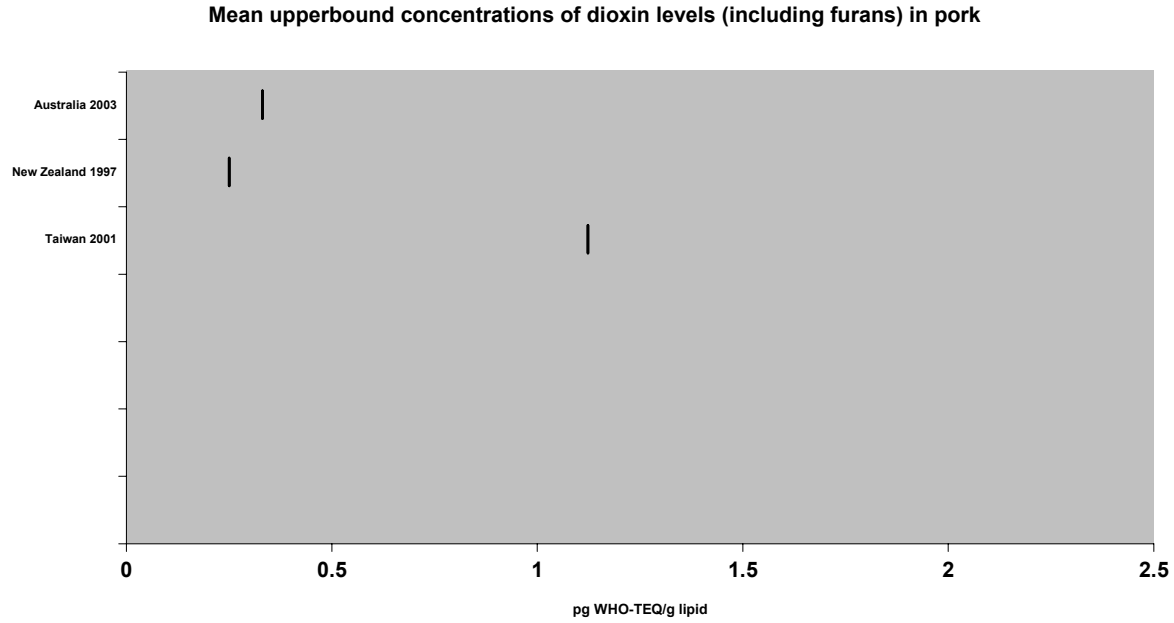


Figure 7.4(a): Range of dioxins in poultry

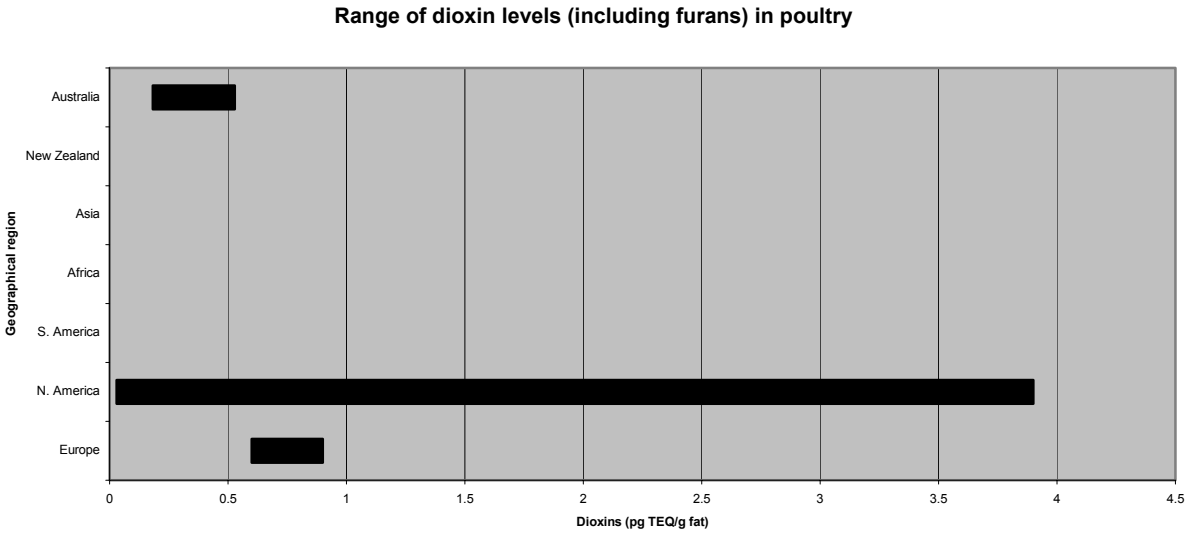


Figure 7.4(b): Upperbound concentrations of dioxins in poultry

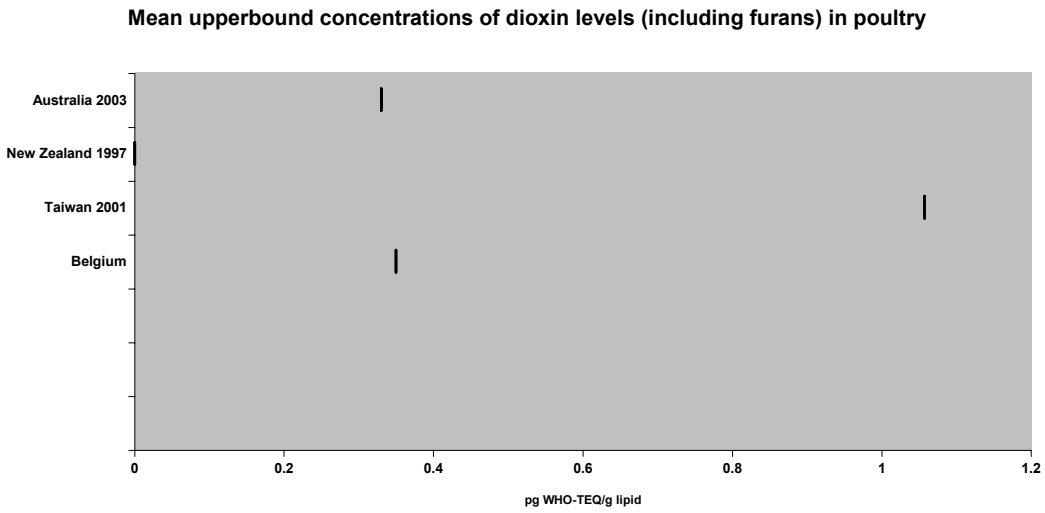


Figure 7.5(a): Range of dioxins in fish

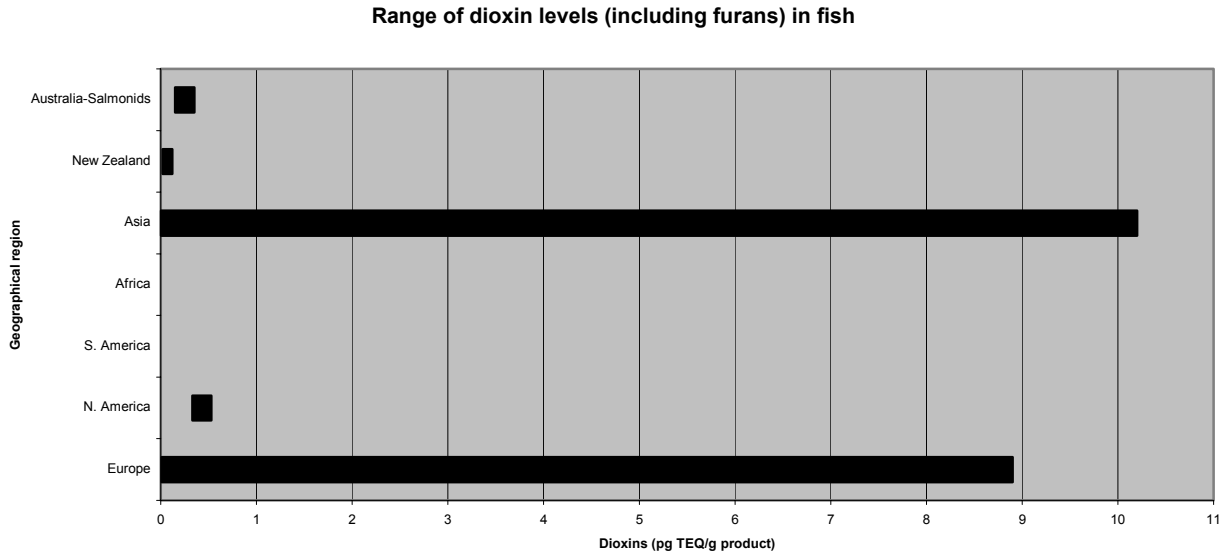


Figure 7.5(b): Range of dioxins in fish

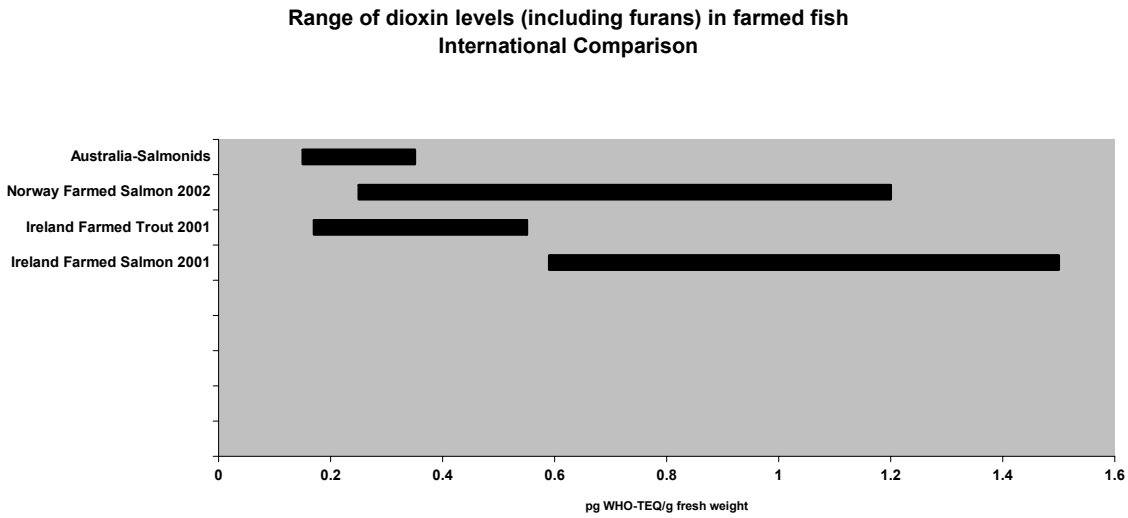


Figure 7.6: Range of PCBs in milk

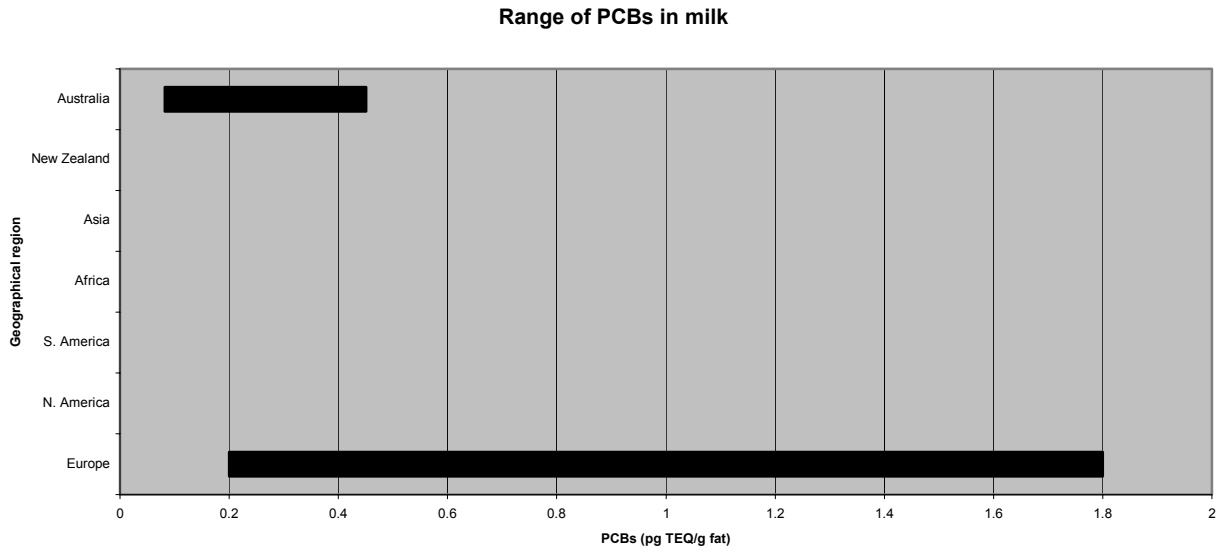


Figure 7.7: Range of PCBs in pigs

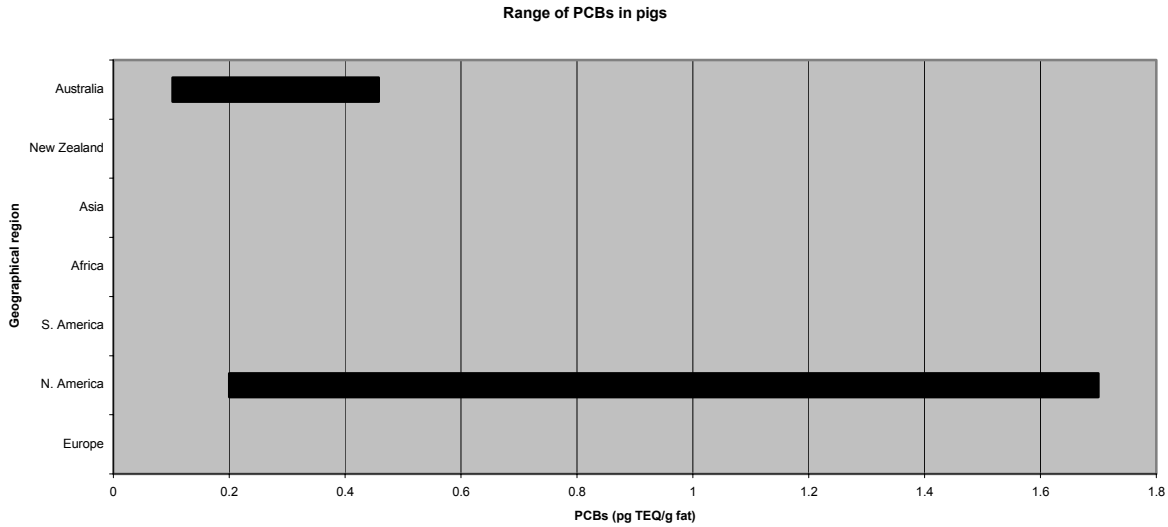
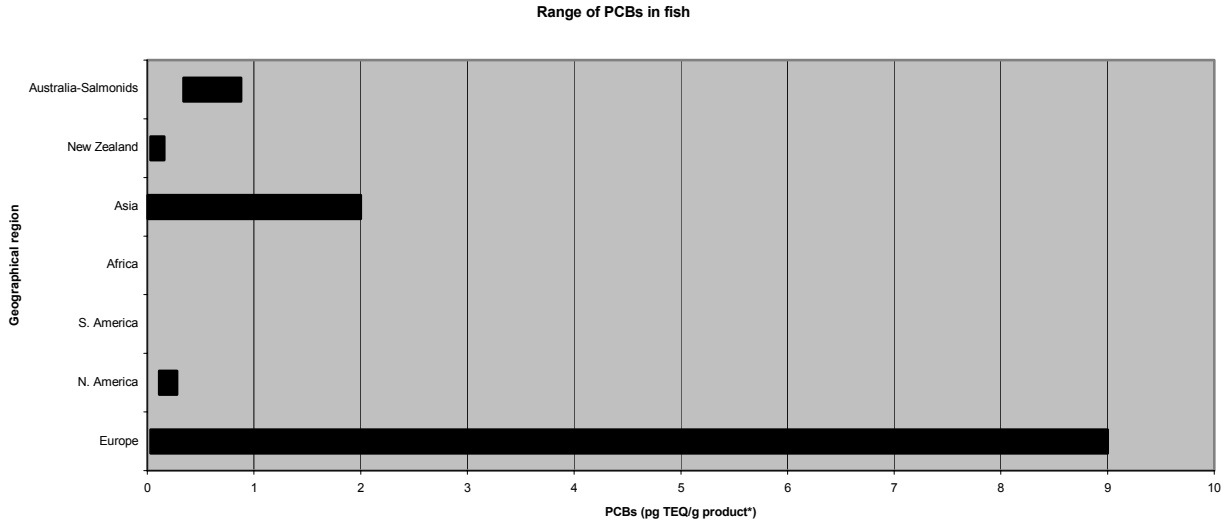
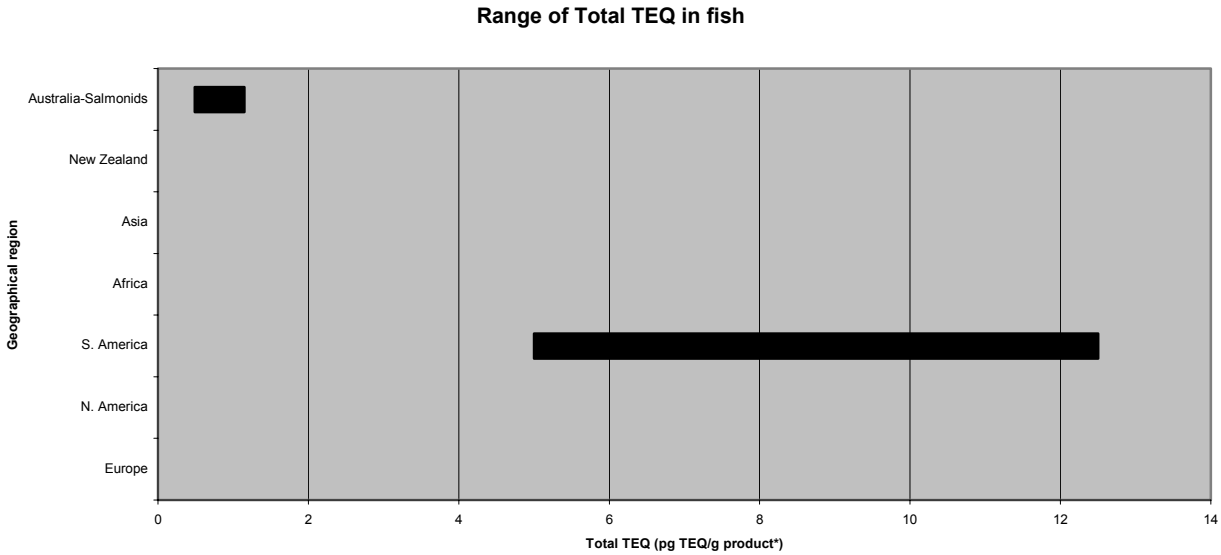


Figure 7.8: Range of PCBs in fish



* on a fresh weight basis

Figure 7.9: Range of Total TEQ in fish



* on a fresh weight basis