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Document Processing Center (7407)
Office of Toxic Substances
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
Attn: TSCA Section 8(e) Coordinator

Dear Section 8(e) Docket Coordinator:

Re: TSCA 8(e) Supplemental Notice on Sulfonate-based Fluorochemicals

With this letter, 3M is providing final reports and other supplemental information related to previous TSCA Section 8(e) notifications. Many of the enclosed items are analytical reports providing blood serum and liver levels of test materials for which the in-life report referring to administered doses has already been submitted to the 8(e) docket. In other cases where the 8(e) notification consisted of preliminary data, we are submitting a final study report.

All of the enclosed items are already in EPA's possession and available in TSCA Docket AR-226. We believe, however, that placing these items in the 8(e) docket may allow for more convenient access to information directly related to previous 8(e) notifications by 3M.

The table below lists the enclosed items and references the study or data which already has been the subject of an 8(e) notification by 3M:

Attached Submission	Related Study/Data Already Filed Under 8(e)
1. Amended Analytical Study, 2(N-Ethylperfluorooctane sulfonamido)-ethanol in Two Generation Rat Reproduction, Determination of the Presence and Concentration of PFOS, M556, PFOSAA, and PFOSA in the Liver and PFOS, M556, PFOSAA, PFOSA and EtFOSE-OH in the Sera of Crl:CDBR VAF/Plus Rats Exposed to EtFOSE-OH, 3M Reference No. T-6316.5, Analytical Report TOX-013, LRN-U2095, June 11, 2001.	Combined Oral (Gavage) Fertility, Developmental and Perinatal/Postnatal Reproduction Toxicity Study of N-EtFOSE in Rats, 3M Reference No. T-6316.5, June 30, 1999, full report submitted February 15, 2000 to supplement earlier filing

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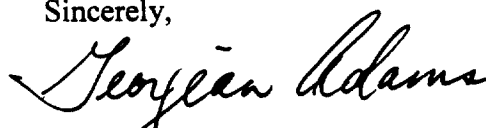
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Attached Submission	Related Study/Data Already Filed Under 8(e)
2. Analytical Laboratory Report, Determination of the Presence and Concentration of Potassium Perfluorooctanesulfonate (CAS Number: 2759-39-3) in the Serum and Liver of Sprague-Dawley® Rats Exposed to PFOS via Gavage, Laboratory Report No. U2006, Requestor Project No. 3M TOX 6295.9, October 27, 1999. 3. Report Amendment 1, Combined Oral (Gavage) Fertility, Developmental and Perinatal/Postnatal Reproduction Toxicity Study of PFOS in Rats, Argus Research Laboratories, Inc., Protocol 418-008, Sponsor's Study No. 6295.9, April 13, 2000.	Combined Oral (Gavage) Fertility, Developmental and Perinatal/Postnatal Reproduction Toxicity Study of PFOS in Rats, Argus Research Laboratories, Inc., Sponsor's Study No. 6295.9, June 10, 1999, full report submitted February 15, 2000 supplementing earlier filing
4. Analytical Report, Determination of the Presence and Concentration of Perfluorooctanesulfonate, Perfluorooctanesulfonylamide, M556, and M570 in the Liver and Sera Samples, 3M Environmental Laboratory Ref. No. U2636, TOX-028, February 23, 2001	13-Week Dietary Study of N-Methyl Perfluorooctanesulfonamido Ethanol (N-MeFOSE) in Rats, 3M Ref. No. T-6314.1, Covance Study No. 6329-225, dated June 30, 2000, Section 8(e) filing July 24, 2000
5. Analytical Laboratory Report, Determination of the Concentration of PFOS, PFOSA, PFOSAA, and EtFOSE-OH in the Sera and Liver of Crl:CDBR VAF/Plus Rats Exposed to N-EtFOSE, 3M Environmental Laboratory Report No. TOX-098, Laboratory Request No. U2402, 3M Ref. No. T-6316.7, February 6, 2001.	Final Report, Oral (Gavage) Developmental Toxicity Study of 2(N-Ethylperfluorooctanesulfonamido)-ethanol in Rats, 3M Reference No. T-6316.7, December 17, 1998, submitted to Section 8(e) docket per letter of August 21, 2000
6. Analytical Laboratory Report on the Determination of the Presence and Concentration of Potassium Perfluorooctanesulfonate (PFOS) or another metabolite of 2(N-ethylperfluorooctanesulfonamido)-ethanol (N-EtFOSE) in Liver and Serum Specimens, 3M Environmental Laboratory Report No. TOX-097, Laboratory Request No. U2452, 3M Ref. No. T-6316.8, February 8, 2001	Final Report, Oral (Stomach Tube) Developmental Toxicity Study of N-EtFOSE in Rabbits, 3M Reference No. T-6316.8, January 11, 1999, submitted to Section 8(e) docket per letter of August 21, 2000
7. Final Report, Alexander, B., Mortality Studies of Workers Employed at the 3M Decatur Facility, University of Minnesota, April 26, 2001.	Preliminary data submitted to Section 8(e) docket in letter of December 15, 2000

Attached Submission	Related Study/Data Already Filed Under 8(e)
8. Final Report, Acute Oral Toxicity Screen with T-3290CoC in Albino Rats, Safety Evaluation Laboratory, Riker Laboratories, Inc., Project No. 0882AR0362, 3M Reference No. T-3290 (40 % K⁺PFOSAA in 3 % EtOH, 17 % IPA and 40 % H₂O, L-6778, F-6873, Lot 501), November 5, 1982 <i>[Bibliography entry in Docket AR-226, final report was to be moved to TSCA 8(e) docket]</i>	Acute Oral Toxicity Screen with T-3290CoC in Albino Rats, Safety Evaluation Laboratory, Riker Laboratories, Inc., Project No. 0882AR0362, 3M Reference No. T-3290 (40 % K⁺PFOSAA in 3 % EtOH, 17 % IPA and 40 % H₂O, L-6778, F-6873, Lot 501), November 5, 1982, submitted to Section 8(e) docket in August 21, 2000 self-audit letter (which erroneously refers to rabbits rather than rats)
9. Giesy, J.P., and K. Kannan, Accumulation of Perfluorooctanesulfonate and Related Fluorochemicals in Fish Tissue, Michigan State University, June 20, 2001. 10. Giesy, J.P., and K. Kannan, Accumulation of Perfluorooctanesulfonate and Related Fluorochemicals in Mink and River Otters, Michigan State University, June 20, 2001. 11. Giesy, J.P., and K. Kannan, Perfluorooctanesulfonate and Related Fluorochemicals in Oyster, <i>Crassostrea Virginica</i>, From the Gulf of Mexico and Chesapeake Bay, Michigan State University, June 20, 2001. 12. Giesy, J.P. and K. Kannan, Perfluorooctanesulfonate and Related Fluorochemicals in Fish-Eating Water Birds, Michigan State University, June 20, 2001. 13. Giesy, J.P. and K. Kannan, Accumulation of Perfluorooctanesulfonate and Related Fluorochemicals in Marine Mammals, Michigan State University, June 20, 2001.	Preliminary data submitted to Section 8(e) docket May 26, 1999

If you have any questions about this submission, please contact me at (651)737-4795.

Sincerely,



Georjean Adams

Manager, 3M Corporate Product Responsibility

Enclosures

MR 51718

ACCUMULATION OF PERFLUOROOCTANESULFONATE
AND RELATED FLUOROCEMICALS IN MARINE
MAMMALS

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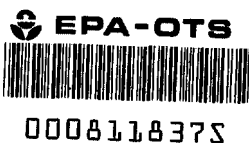
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Prepared for: 3M
St. Paul, MN
June 20, 2001

6EHQ-40-373



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SUMMARY

This report is a compilation of results of a global monitoring survey of perfluorooctane sulfonate (PFOS), perfluorooctanesulfonamide (FOSA), perfluorooctanoic acid (PFOA) and perfluorohexanesulfonate (PFHS) in marine mammals. Tissues of marine mammals collected from Florida, California and Alaskan coastal waters, the northern Baltic Sea, the Mediterranean Sea, the Arctic (Spitsbergen) and Sable Island in Canada were analyzed for the presence of PFOS, FOSA, PFOA and PFHS. PFOS was detected in liver and blood of marine mammals from most locations including those from Arctic waters. FOSA, PFOA and PFHS were rarely detected in the tissues of marine mammals. The greatest concentrations of PFOS found in liver and blood were 1520 ng/g wet wt in bottlenose dolphin from Sarasota Bay, Florida, and 475 ng/mL in ringed seal from the northern Baltic Sea (Bothnian Sea), respectively.

INTRODUCTION

This report provides compilation of data on PFOS and other fluorochemicals in tissues of marine mammals from coastal and open ocean waters, including the Arctic Ocean.

MATERIALS AND METHODS

Samples. Tissue samples of marine mammals species analyzed include: pygmy sperm whale (*Kogia breviceps*), short-snouted spinner dolphin (*Stenella clymene*), striped dolphin (*Stenella coeruleoalba*), rough-toothed dolphin (*Steno bredanensis*), bottlenose dolphin (*Tursopsis truncatus*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga augustirostris*), harbor seal (*Phoca vitulina*), northern fur seal (*Callorhinus ursinus*), southern sea otter (*Enhydra lutris nereis*), polar bear (*Ursus maritimus*), Steller sea lion (*Eumetopias jubatus*), ringed seal (*Phoca hispida*), gray seal (*Halichoerus grypus*) and Weddell seal (*Leptonychotes weddellii*). Samples included liver and blood as well as a few samples of brain and kidney from sea otters. The marine mammals analyzed in this study originated from coastal waters of Florida including the Gulf of Mexico, California, Alaska, northern Baltic Sea (Bothnian Bay), the Mediterranean Sea, the Arctic (Spitsbergen), Sable Island in Canada and Terra Nova Bay in the Antarctic. Similarly, livers of bottlenose and striped dolphins and *Balenoptera physalus*, *Delphinus delphi*, *Globicephala melas* were collected along the Italian coast of the Mediterranean Sea in the 1990s. Tissues of marine mammals were acquired from federal or state agencies or university laboratories. All samples were collected under permission of relevant state or federal agencies. Blood samples of ringed and gray seals were collected from the Bothnian Bay in the Baltic Sea, from Spitsbergen in the Arctic Ocean (ringed seals) and from Sable Island in Canada (gray seals). The Weddell seal was collected from Terra Nova Bay in Antarctica. Information regarding collection date, age, sex and cause of death were recorded when available. Tissues of most individual aquatic mammals were obtained from stranded dead animals. Samples were obtained to represent

various geographical locations including the Arctic and the Antarctic. Common and Scientific names of all the marine mammal species analyzed are given in Appendix X.

Analysis

Details of the analytical procedures have been outlined in standard operating procedures for the analysis of fluorochemicals in tissues which are stated below.

Preparatory Methods. ETS-8-6.0, “Extraction of Potassium Perfluorooctanesulfonate or other Fluorochemical Compounds from Liver for Analysis using HPLC-Electrospray/Mass Spectrometry”. 3M Environmental Laboratory, St. Paul, MN. & ETS-8-4, “Extraction of Potassium Perfluorooctanesulfonate or other Fluorochemical Compounds from Serum for Analysis using HPLC-Electrospray/Mass Spectrometry”. 3M Environmental Laboratory, St. Paul, MN. The analytical work was generated by the 3M Environmental Laboratory. (Refer to Reference (1) for the specific reports.)

An ion-pairing reagent was added to the sample and the analyte ion pair was partitioned into methyl-*tert*-butyl ether (MtBE). The extract was transferred to a centrifuge tube and put onto a nitrogen evaporator until dry. Each extract was reconstituted in 1.0 mL of methanol, and then filtered through a 3 cc plastic syringe attached to a 0.2 µm nylon filter into glass autovials.

Analytical Methods. ETS-8-7.0, “Analysis of Potassium Perfluorooctanesulfonate or other Fluorochemicals in Liver Extracts Using HPLC-Electrospray/Mass Spectrometry”. 3M Environmental Laboratory, St. Paul, MN.

The analyses were performed using HPLC-ES/MS/MS by monitoring a single product ion selected from a primary ion characteristic of a particular fluorochemical. For example, molecular ion 499, selected as the primary ion for PFOS (C₈F₁₇SO₃⁻) analysis, was fragmented further to produce ion 99 (FSO₃⁻). The characteristic product ion 99 was monitored for quantitative analysis.

Analytical Equipment

The following are representative of the actual settings used during the analytical phase of this study.

Liquid Chromatograph: Hewlett-Packard® Series 1100 Liquid Chromatograph system
Analytical column: Keystone® Betasil™ C₁₈ 2x50 mm (5 µm) Column temperature: Ambient;

Mobile phase components:

Component A: 2mM ammonium acetate

Component B: methanol

Flow rate: 300 µL/min

Injection volume: 10 µL

Solvent Gradient: 16.0 minutes

Time (minutes)	%B
0.0	10%
1.0	10%

6.0	90%
11.0	100%
13.0	10%

Mass Spectrometer: Micromass[®] API/Mass Spectrometer Quattro II[™] Triple Quadrupole system

Software: Mass Lynx[™] 3.4

Cone Voltage: 30–60 V

Collision Gas Energy: 25–45 eV

Mode: Electrospray Negative

Source Block Temperature: 150°C ±10°C

Electrode: Z-spray

Analysis Type: Multiple Reaction Monitoring (MRM)

Target Ions Monitored in 3M Laboratory Analyses

Target Analyte	Primary Ion (AMU)	Product Ion (AMU)
PFOS	499	80, 99
FOSA	498	78
PFOA	413	169
PFHS	399	99
THPFOS¹	427	80

¹ THPOS, Tetra-hydro perfluorooctanesulfonate, is used as a surrogate to monitor for gross instrument failure.

Data Quality Objectives and Data Integrity

The following data quality objectives were indicated in the method performance section of ETS-8-7.0, Analysis of Potassium Perfluorooctanesulfonate or Other Fluorochemicals in Liver Extracts Using HPLC-Electrospray/Mass Spectrometry:

Linearity: The coefficient of determination (r^2) equal to or greater than 0.980.

Limits of Quantitation (LOQ): The LOQ is equal to the lowest acceptable standard in the calibration curve.

Acceptable Spike Recoveries: Matrix spikes prepared in rabbit liver must be recovered at 70–130% for the analytical run to be valid.

Blanks: Matrix or surrogate matrix blanks must have a peak area $\leq \frac{1}{2}$ the peak area of the lowest acceptable standard (LOQ).

Summary of Quality Control Analyses Results

Linearity: The coefficient of determination (r^2) of the standard curve was >0.980 .

Calibration Standards: Quantitation of the target analytes was based on a quadratic curve weighted $1/x$ of a single, opening or two bracketing unextracted curves for each group of samples. High or low points on the curve may have been deactivated to provide a better fit over the curve range most appropriate to the data. Low curve points with peak areas less than two times that of the extraction blanks were deactivated to disqualify a data range that may have been significantly affected by background levels of the analyte.

Occasionally, a single mid-range curve point that was an obvious outlier may have been deactivated. Quantitation of each analyte was based on the response of one or more specific product ion(s) using the multiple reaction-monitoring mode of the instrument. Calibration standards were prepared to run, undiluted, approximately within the linear range of the instrument (approximately 0.5–1000 ng/g).

Limits of Quantitation (LOQ): The LOQ is equal to the lowest acceptable standard in the calibration curve (defined as a standard within $\pm 30\%$ of the theoretical value), and is at least two times the analyte peak area detected in the surrogate matrix blanks. Because low levels of the target analytes are ubiquitous in the laboratory, it is imperative that these criteria for LOQ determination be observed. The approximate LOQ for each analyte in each matrix is listed on the results summary table.

Blanks: All blanks were below the limit of quantitation for the compounds of interest, except for one water blank for PFHS. These outliers will not adversely affect the outcome of this study. Given the nature of the samples encompassed by this study, the well-characterized matrix of rabbit liver was used as surrogate tissue for matrix blanks. These surrogate matrix blanks were $\leq \frac{1}{2}$ the level of the LOQ.

Precision, Instrumental: Instrumental precision was not specifically determined within the course of this study. In other, similar liver/tissue studies, instrumental precision has been determined to be better than 7% for all target analytes.

Matrix Spikes: At least one set of matrix spikes was prepared for each type of tissue from each type of animal; spikes were prepared at approximately 600 ng/g.

Recoveries of PFOS varied widely depending on the species and matrix. Therefore, adequate caution should be exercised in interpreting the results. For instance, in polar bear liver, PFOS was recovered at $59 \pm 3\%$ and $55 \pm 1\%$, respectively. Therefore, polar bear liver data is considered to be accurate to $\pm 50\%$. Matrix spike recoveries are summarized in Appendix XI.

To verify the status of the extraction and analytical systems, matrix spikes were also prepared in a well-characterized surrogate matrix, rabbit liver. The matrix spike studies conducted in rabbit were all acceptable ($\pm 30\%$) for those analytical runs used when reporting data for samples and matrix spikes.

Demonstration of Specificity: Specificity for analyte identification was demonstrated by chromatographic retention time and mass spectral daughter ion characterization. Additional confirmatory tests were performed for PFOS. In the electrospray tandem mass spectrometry (ESMSMS) system, the 499 Da $\rightarrow$ 80 Da transition can provide a stronger signal than the 499 Da $\rightarrow$ 99 Da transition of the PFOS analysis. However, in the analysis of tissue samples collected from some species of animals, an unidentified interferent was present in the 499 Da $\rightarrow$ 80 Da transition. Although this interferent is

rarely observed, to ensure complete selectivity, quantitation was based on the 499 Da → 99 Da transition.

To verify the identity of the detected analyte, in samples determined to contain PFOS at > 70 ng/g (liver or other tissue), at least 2 transitions were monitored and showed quantitative agreement to within +/-30%. Typically, 499>99 and 499>80 transitions were monitored. On the occasions that these two transitions differed by more than 30%, the sample was re-analyzed monitoring the 499>130 transition. This third transition showed quantitative agreement with the reported data from the 499>99 determination.

Statement of Data Quality

It is not possible to verify true recovery of endogenous analyte from tissues without radiolabelled reference material. The only measurement of accuracy available at this time, matrix spike studies, indicate that the data can be reported with a stated accuracy of either +/-30%, +/-50%. The recoveries fall below 50%, reported data should be considered semi-quantitative. Details of matrix spike recoveries are summarized in Appendix XI. The concentrations of PFOS, FOSA, PFOA and PFHS were not corrected for the recoveries of the surrogate standard or matrix spike recoveries. The concentrations reported in the Tables were not corrected for purity of the PFOS standard. Also, no attempt was made to correct the fluorochemical concentrations for moisture content in relevant tissues such as liver.

RESULTS AND DISCUSSION

For the purpose of this discussion, the samples were grouped to represent five geographical regions: U.S. east coast (Florida), U.S. west coast (California, Oregon and Washington), Alaska, temperate and polar regions (Baltic Sea, Spitsbergen and Sable Island), the Mediterranean Sea, and the Antarctic. The analytical results for individual samples are given in Appendices I to VIII. FOSA, PFOS and PFHS were rarely detected in marine mammal tissues. See appendices I to VIII for detection limits for FOSA, PFOS and PFHS.

Florida coastal waters. PFOS was found in livers of all of the small cetaceans collected from the East coast of Florida and the Gulf of Mexico (Table 1). Concentrations of PFOS in the livers of cetaceans ranged from 6.6-1520 ng/g, wet wt. The average concentration of PFOS in livers of bottlenose dolphins was 489 ± 356 ng/g, wet wt.

California coastal waters. Concentrations of PFOS in livers of pinnipeds (sea lions and seals) collected from coastal waters of California were less than those found in cetaceans from coastal waters of Florida (Table 2). Among the four species of pinnipeds analyzed, the livers of northern fur seals contained the greatest PFOS concentration of 132 ng/g, wet wt. Mean concentrations of PFOS in livers of California sea lion and harbor seal were 27 ng/g, wet wt, approximately 20-fold less than those found for bottlenose dolphins from Florida.

Alaska waters. Livers of northern fur seals and polar bears and blood of northern fur seal, polar bears and Steller sea lions from Pribilof Islands, Beaufort Sea and southeastern coastal waters of Alaska were analyzed for the presence of PFOS (Tables 3 and 4). Livers of northern fur seal were from pups of less than 4 months or sub-adults of 2-4 years. PFOS was detected in livers of 5 of 13 individuals (38%). Livers from polar bears collected from Alaska contained PFOS concentrations of up to 678 ng/g, wet wt in livers. The presence of PFOS in livers of polar bears and northern fur seals from locations such as coastal waters of Alaska suggests the transport and distribution of PFOS or precursors to more remote marine locations. A second set of 14 livers of polar bear also contained concentrations of PFOS less than 640 ng/g, wet wt (see appendix).

PFOS was not found in the blood samples of northern fur seals collected from Pribilof Islands in 1995 at levels above the limits of quantitation (6 ng/mL) (Table 4). Similarly, blood of Steller sea lions collected from the southeast coast of Alaska did not contain quantifiable concentrations of PFOS. However, all of the blood samples collected from polar bears in the Beaufort Sea (n=14) collected in 1999 contained PFOS concentrations ranging from 27 to 52 ng/mL (mean: 34 ng/mL).

Temperate and Arctic waters. All of the blood samples of ringed seals (n=46) collected from Spitsbergen in the Arctic and from the northern Baltic Sea contained detectable concentrations of PFOS (Table 5). Blood from a four-year old male ringed seal collected in 1998 from the Baltic Sea was determined to contain the greatest PFOS concentration of 475 ng/mL in blood. Livers of ringed seal from the Baltic Sea contained PFOS concentrations of up to 1100 ng/g, wet wt.

Similar to ringed seals, gray seal blood collected from animals in the northern Baltic Sea and Sable Island in Canada was determined to contain PFOS (Table 5). Concentrations of PFOS in gray seal blood were significantly less than those found in ringed seals from the Baltic Sea ($p < 0.01$).

Mediterranean Sea. Concentrations of PFOS determined in blood of captive bottlenose dolphins from Italian coasts (n=4) ranged from 42 to 210 (mean $\pm$ SD: 143 $\pm$ 63) ng/mL (Table 6). Four of five livers collected from bottlenose dolphins from Italian coast contained quantifiable concentrations of PFOS. Concentrations of PFOS in livers of bottlenose dolphins that contained measurable concentrations were 270 $\pm$ 100 ng/g, dry wt (Table 6). The mean ($\pm$ SD) concentration of PFOS in livers of striped dolphins was 100 $\pm$ 35 ng/mL.

Baikal Lake and Caspian Sea: Caspian seals did not contain PFOS in their blood while the livers of Baikal seals contained up to 22 ng/mL PFOS.

Antarctica. Only one sample of Weddell seal liver was available for the analysis of fluorinated organic chemicals. PFOS was not measured above the limit of quantitation of 35 ng/g.

REFERENCE

(1) 3M Environmental Laboratory, St. Paul, MN LIMs Report numbers; W2491, W3197, E00-1386, E00-1634, E00-1922, E00-2456, E00-2701, E01-0118.

Table 1. Concentrations of PFOS in Livers (ng/g, wet wt) of Cetaceans Found Stranded Along Florida Coastal Waters

Species	Sex	Age	Length (cm)	Date	Waterbody	PFOS
Pygmy sperm whale	M	NA	283	2/18/00	Atlantic Ocean	23.0
	M	>20	290*	8/16/94	Anclote River	6.6
					Mean (n=2)	14.8
Short-snouted spinner dolphin	F	3	161	6/15/95	Gulf of Mexico	168
	F	4	154	6/15/95	Gulf of Mexico	122
	F	>18	183	6/15/95	Gulf of Mexico	78.7
					Mean (n=3)	123
					SD	36.3
Striped dolphin	M	13-16	208	7/3/97	Gulf of Mexico	36.6
	M	15	225	9/23/94	Venice Inlet	388
					Mean (n=2)	212
Rough-toothed dolphin	F	7	218	12/3/95	Tampa Bay	65.6
	F	15	243	11/27/95	Anna Maria Sound	42.8
					Mean (n=2)	54.2
Bottlenose dolphin	F	25	245	7/16/97	Palma Sola Bay	734
	F	22+	236	7/25/98	Palma Sola Bay	487
	F		234	11/22/99	Sarasota Bay	716
	F	20<	241	2/26/99	Anna Maria Sound	483
	M	NA	283	3/04/00	Gulf of Mexico	824
	F	10	236	2/7/92	Gulf of Mexico	48.2
	M	4	214	4/28/96	Sarasota Bay	1520
	F	5	209	9/6/91	Gulf of Mexico	291
	M	4	210	9/26/91	Anna Maria Sound	557
	F	3.5	214	10/29/91	Gulf of Mexico	551
	M	1.5	169	12/19/92	Gulf of Mexico	411
	F	8	239	2/15/94	Peace River	402
	F	16	258	4/12/92	Anna Maria Sound	97.1
	M	11.5	199	8/16/94	Gulf of Mexico	60.9
	F	44	250	8/9/96	Sarasota Bay	603
	M	12	254	3/10/96	Gulf of Mexico	180
	F	50+	251	1/5/94	Gulf of Mexico	75.3
	M	18	274	12/24/95	Gulf of Mexico	141
	F	23+	239	8/27/95	Sarasota Bay	614
	M	8	229	3/24/95	Peace River	979
					Mean (n=20)	489
					SD	356

NA: not available; Values below the detection limit were not included in calculating the mean.

Table 2. Concentrations (ng/g, wet wt) of PFOS in Livers of Aquatic Mammals from the West Coast of the United States

Species	Location	Date	Sex	Age class	Cause of death	PFOS
California Sea Lion	Pismo Beach	11/20/97	Female	Adult	Gunshot to head, Early carcinoma	38.4
	San Simeon	10/24/97	Female	Adult	Entangled in fishing net	49.4
	Oceano	7/26/96	Female	Adult	Interstitial nephritis	<3.5
	Cayucos	8/5/93	Female	Adult	Renal disease	10.4
	San Francisco	10/22/95	Male	Adult	Septicemia, Interstitial nephritis	12.8
	Morro Bay	7/26/94	Male	Adult	Hydronephrosis, Paralysis	17.9
Elephant Seal	Miramar Beach	4/14/97	Female	1 yr	Skin disease, septicemia	<5
	Lundborgh Beach	5/13/97	Male	Weaner	Pneumonia, Otostronglyus arteritis	<5
	Crecent City	3/13/92	Male	Yearling	Skin disease, Verminous pneumonia, Pyothorax	<3.5
	Pebble Beach	7/03/91	Female	Yearling	Septicemia, Skin disease	<5
	Pebble Beach	9/01/91	Male	Yearling	Skin disease, Hemorrhagic gastrointestinal tract	8.3
Harbor Seal	Coastal California	1991	Female	Pup		<3.5
	Abbott's lagoon	6/26/97	Male	Pup/Calf	Pneumonia	19.1
	Tiburon	10/02/97	Female	Adult	Meningocephalitis, Hepatitis	57.1
Northern fur seal	NA	10/29/97	NA	NA	NA	133
River otter	Willamette River	1996-97	Male	Adult	Trapped	279
	Willamette River	1996-97	Male	Adult	Trapped	994
	Fort Ward, Washington	1996-97	Male	Adult	Trapped	189
	Yaquina River	1996-97	Male	Adult	Trapped	33.6
	Silverdale, WA	1996-97	Male	Adult	Trapped	151
					Mean (n=5)	329
Sea otter liver	Monterey	2/16/94	Male	Adult	Trauma	<3.5
	San Luis Obispo	4/29/93	Female	Pup/Calf	Disease; Acanthocephalan	<3.5
	San Luis Obispo	8/1/94	Female	Subadult	Disease; bacterial	<3.5
	San Luis Obispo	2/4/93	Male	Adult	Disease; coccidioidomycosis	<3.5
	San Luis Obispo	5/20/94	Female	pup	Disease; Acanthocephalan	9.3
	Santa Barbara county	10/3/94	Male	Adult	Trauma	<3.5
	San Luis Obispo	3/25/94	Male	Juvenile	Disease; Acanthocephalan	<3.5
	San Luis Obispo	4/8/94	Male	Adult	Miscellaneous	<3.5
Sea otter brain	Monterey	2/16/94	Male	Adult	Trauma	<3.5
	San Luis Obispo	4/29/93	Female	Pup/Calf	Disease; Acanthocephalan	<3.5
Sea otter kidney	Monterey	2/16/94	Male	Adult	Trauma	<3.5
	San Luis Obispo	4/29/93	Female	Pup/Calf	Disease; Acanthocephalan	<3.5
	San Luis Obispo	8/1/94	Female	Subadult	Disease; bacterial	<3.5

NA: information not available. Values below LOQ are denoted by '<'

Table 3. Concentrations (mean and ranges) of PFOS in Livers of Northern Fur Seals and Polar Bear from Alaska (ng/g, wet wt)

Species	Location	n	Date	Sex	Age class	PFOS
Northern Fur Seal	Pribilof Is.	13	1995 or 1998	2F; 11M	3 pup (<4 m) ; 10 sub adult (2-4 yr)	<10-122 [38]
Polar Bear	Barrow; Nuiqsut; Point Lay; Gambell; Shishmaref; Little Diomede; Savoonga	17	12/13/97- 6/15/99	14M; 3F	13 adults (> 5 years); 4 subadults (3 to 4 years)	175-678 (350)

Values in brackets [] indicate the percentage of detectable observations. Values in parentheses () indicate mean. Values below LOQ are denoted by '<'

Table 4. Concentrations (ng/mL; mean and ranges) of PFOS in the Blood of Marine Mammals from Coastal Waters of Alaska

Species	Location	Date	n	Sex	Age class	PFOS
Northern Fur Seal pup	Pribilof Is.	1995	19	10F; 9M	pup (<4 m)	<6-12 [5]
Northern Fur Seal adult	Pribilof Is.	1995	10	10F	adult (>3 y)	<6
Northern Fur Seal subadult	Pribilof Is.	1995	7	7M	subadult (2-4 yr)	<6
Northern Fur Seal	Pribilof Is.	1995	8	6M; 2F	5 pup (<4 m); 3 subadult (2-4 yr)	<6
Polar Bear	Beaufort Sea	1999	14	7M; 7F	NA	26-52 (34)
Steller Sea Lion	Southeast Alaska	1999	12	7F; 5M	3-4 months	<6

NA: Information not available; Values in brackets [] indicate the percentage of detectable observations. Values below LOQ are denoted by '<'

Table 5. Concentrations (ng/mL; mean $\pm$ SD) of PFOS in Blood of Seals from the northern Baltic Sea (Bothnian Bay), the Arctic (Spitsbergen) and Sable Island (Canada)

Species	Location	Year	n	Sex	Age (yr)	PFOS
Ringed Seal	Baltic Sea	1996	10	1M; 9F	6-20	133 $\pm$ 47
	Baltic Sea	1997	9	3M; 6F	6-16	92 $\pm$ 81
	Baltic Sea	1998	10	5M; 5F	1.0-25	242 $\pm$ 142
	Spitsbergen	1996	10	4M; 6F	3.0-20	8.1 $\pm$ 2.5
	Spitsbergen	1998	8	3M; 5F	2.0-12	10.1 $\pm$ 2.7
Gray seal	Baltic Sea	1996	9	5M; 4F	2.0-20	42 $\pm$ 21
	Baltic Sea	1997	10	4M; 6F	5.0-33	43.9 $\pm$ 19
	Baltic Sea	1998	7	3M; 4F	8.0-25	25.5 $\pm$ 9.6
	Sable Island	1998	12	7M; 5F	10.0-35	27.7 $\pm$ 11

Table 6. Concentrations of PFOS (ng/mL or ng/g) in blood and livers of dolphins and whales from Italian coast of the Mediterranean Sea

Species	Sampling Area	Date of Collection	PFOS	Remarks
BN dolphin blood	Riccione (Adriatic Sea)	1997	210	M, 2 years
		1997	140	M, 5 years
		1997	42	F, 19 years
		1997	180	M, 11 years
Bottlenose Dolphin Liver*	Marina di Grosseto (North Tyrrhenian Sea)	1991	180	stranded
	Livorno (North Tyrrhenian Sea)	1991	300	stranded, 240 cm
	Croatia (North Adriatic Sea)	1992	170	stranded, M, 288 cm
	Lecce (South Adriatic Sea)	1991	430	stranded, M, 235 cm
	Lido di Camaiore (North Tyrrhenian Sea)	1991	<7	stranded, 279 cm
Striped Dolphin Liver*	Lecce (South Adriatic Sea)	August 1991	160	stranded, M, 201 cm
	Viareggio (North Tyrrhenian Sea)	1991	89	stranded, F, 200 cm
	Lecce (South Adriatic Sea)	August 1991	94	stranded, F
	Lecce (South Adriatic Sea)	August 1991	65	stranded, F, 201 cm

Values below LOQ are denoted by '<'

*Values are on a dry weight basis, because only freeze-dried samples were available for analysis.

APPENDIX I

Concentrations of (ug/g, wet for solid tissues and ug/mL for blood/sera) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	FOSA	PFOA
California Sealion	W2491-3,CSL 3448	Liver	California coast	0.038	0.044	<LOQ (0.0359)
California Sealion	W2491-4,CSL 3395	Liver	California coast	0.049	<LOQ (0.0375)	0.041
California Sealion	W2491-6,CSL 3020	Liver	California coast	<3.5	<LOQ (0.0375)	<LOQ (0.0359)
California Sealion	W2491-7,CSL 2169	Liver	California coast	0.010	<LOQ (0.0375)	<LOQ (0.0359)
California Sealion	W2491-9,CSL 2839	Liver	California coast	0.013	<LOQ (0.0375)	<LOQ (0.0359)
California Sealion	W2491-10,CSL 2367	Liver	California coast	0.018	<LOQ (0.0375)	<LOQ (0.0359)
Elephant Seal	W2491-2,ES 1500	Liver	California coast	<LOQ (0.0348)	<LOQ (0.0375)	<LOQ (0.0359)
Elephant Seal	W2491-5,ES 1552	Liver	California coast	<LOQ (0.0348)	<LOQ (0.0375)	<LOQ (0.0359)
Elephant Seal	W2491-11,ES 808	Liver	California coast	<LOQ (0.0348)	<LOQ (0.0375)	<LOQ (0.0359)
Elephant Seal	W2491-12,ES 772	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Elephant Seal	W2491-14,ES 782	Liver	California coast	0.0083	<LOQ (0.0375)	<LOQ (0.0359)
Harbor Seal	W2491-8,HS	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Harbor Seal	W2491-13,HS 1191	Liver	California coast	0.019	<LOQ (0.0375)	<LOQ (0.0359)
Harbor Seal	W2491-15,HS 1199	Liver	California coast	0.057	<LOQ (0.0375)	<LOQ (0.0359)
Northern furseal	W2491-1,NFS 100	Liver	California coast	0.133	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-16,SO 12593-001	Liver	California coast	<LOQ (0.0035)	0.081	<LOQ (0.0359)
Sea Otter	W2491-19,SO 11494-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-22,SO 11940-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-24,SO 11309-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-25,SO 12797-001	Liver	California coast	9.3	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-26,SO 13110-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-27,SO 12679-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-28,SO 12707-001	Liver	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-18,SO 12593-001	Brain	California coast	<LOQ (0.0035)	0.066	<LOQ (0.0359)

Sea Otter	W2491-21,SO 11494-001	Brain	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-17,SO 12593-001	Kidney	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-20,SO 11494-001	Kidney	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Sea Otter	W2491-23,SO 11940-001	Kidney	California coast	<LOQ (0.0035)	<LOQ (0.0375)	<LOQ (0.0359)
Caspian Seal Blood	W2491-46,J 12	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	<LOQ (0.00599)
Caspian Seal Blood	W2491-47,J 9	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	<LOQ (0.00599)
Caspian Seal Blood	W2491-48,J 14	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	0.007
Caspian Seal Blood	W2491-49,J 18	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	<LOQ (0.00599)
Caspian Seal Blood	W2491-50,J 52	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	0.011
Caspian Seal Blood	W2491-51,J 55	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	0.023
Caspian Seal Blood	W2491-52,J 10	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	<LOQ (0.00599)
Caspian Seal Blood	W2491-53,J 15	Blood	Caspian Sea, Russia	<LOQ (0.0116)	<LOQ (0.00625)	<LOQ (0.00599)

PFOS = Perfluorooctanesulfonate

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

FOSA = Perfluorooctanesulfonamide

Values in parenthesis are LOQs

LOQ = Limit of quantitation

APPENDIX II

Concentrations of (ug/g, wet for solid tissues and ug/mL for blood/sera) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	PFHS	PFOA	FOSA
Northern Fur Seal	P283	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	P285**	Liver	Coastal Alaska	0.122	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	P295	Liver	Coastal Alaska	0.054	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	97 CU 02	Liver	Coastal Alaska	NE	NE	NE	NE
Northern Fur Seal	98 CU KB 02	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 03	Liver	Coastal Alaska	<LOQ (0.0347)	0.059	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 07	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 09	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 10	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 11	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 12	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 13	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 14	Liver	Coastal Alaska	<LOQ (0.0347)	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Northern Fur Seal	98 CU KB 15	Liver	Coastal Alaska	<LOQ (0.0347)	0.086	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	970012	Liver	Alaska	0.456	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	970201	Liver	Alaska	0.301	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980341	Liver	Alaska	0.678	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	692-PLBR-0033	Liver	Alaska	0.471	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980127LB	Liver	Alaska	0.539	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980387LB	Liver	Alaska	0.221	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980390LB**	Liver	Alaska	0.209	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980563LA	Liver	Alaska	0.438	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	980565LB	Liver	Alaska	0.328	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	990112LB	Liver	Alaska	0.175	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	990592LA	Liver	Alaska	0.313	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	990594LB	Liver	Alaska	0.356	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)
Polar Bear	990598LB	Liver	Alaska	0.436	<LOQ (0.00683)	<LOQ (0.0719)	<LOQ (0.0188)

Polar Bear	990600LB	Liver	Alaska
Polar Bear	990610LB	Liver	Alaska
Polar Bear	990652LC	Liver	Alaska
Polar Bear	990658LB	Liver	Alaska
Northern Fur Seal	P205	Blood	Coastal Alaska
Northern Fur Seal	P206	Blood	Coastal Alaska
Northern Fur Seal	P207	Blood	Coastal Alaska
Northern Fur Seal	P208	Blood	Coastal Alaska
Northern Fur Seal	P209	Blood	Coastal Alaska
Northern Fur Seal	P210	Blood	Coastal Alaska
Northern Fur Seal	P211	Blood	Coastal Alaska
Northern Fur Seal	P212	Blood	Coastal Alaska
Northern Fur Seal	P215	Blood	Coastal Alaska
Northern Fur Seal	P217	Blood	Coastal Alaska
Northern Fur Seal	P219	Blood	Coastal Alaska
Northern Fur Seal	P220	Blood	Coastal Alaska
Northern Fur Seal	P221	Blood	Coastal Alaska
Northern Fur Seal	P222	Blood	Coastal Alaska
Northern Fur Seal	P223	Blood	Coastal Alaska
Northern Fur Seal	P224	Blood	Coastal Alaska

[illegible]

Northern Fur Seal	P226	Blood	Coastal Alaska
Northern Fur Seal	P229	Blood	Coastal Alaska
Northern Fur Seal	P230	Blood	Coastal Alaska
Northern Fur Seal	M104	Blood	Coastal Alaska
Northern Fur Seal	M105	Blood	Coastal Alaska
Northern Fur Seal	M106	Blood	Coastal Alaska
Northern Fur Seal	M107	Blood	Coastal Alaska
Northern Fur Seal	M112	Blood	Coastal Alaska
Northern Fur Seal	M115	Blood	Coastal Alaska
Northern Fur Seal	M116	Blood	Coastal Alaska
Northern Fur Seal	M118	Blood	Coastal Alaska
Northern Fur Seal	M119	Blood	Coastal Alaska
Northern Fur Seal	M122	Blood	Coastal Alaska
Northern Fur Seal	S001	Blood	Coastal Alaska
Northern Fur Seal	S002	Blood	Coastal Alaska
Northern Fur Seal	S003	Blood	Coastal Alaska
Northern Fur Seal	S006	Blood	Coastal Alaska
Northern Fur Seal	S007	Blood	Coastal Alaska
Northern Fur Seal	S008	Blood	Coastal Alaska

[illegible]

Northern Fur Seal	S009	Blood	Coastal Alaska
Northern Fur Seal	P298B	Blood	Coastal Alaska
Northern Fur Seal	P236A	Blood	Coastal Alaska
Northern Fur Seal	368C	Blood	Coastal Alaska
Northern Fur Seal	P406	Blood	Coastal Alaska
Northern Fur Seal	P411	Blood	Coastal Alaska
Northern Fur Seal	98 CUKB 3	Blood	Coastal Alaska
Northern Fur Seal	98 CUKB 7	Blood	Coastal Alaska
Northern Fur Seal	98 CUKB 9	Blood	Coastal Alaska
Polar Bear	6255 (Heparin)	Blood	Alaska
Polar Bear	20436 (NA2 EDTA)	Blood	Alaska
Polar Bear	20467 (NA2 EDTA)	Blood	Alaska
Polar Bear	20468 (EDTA)	Blood	Alaska
Polar Bear	20470	Blood	Alaska
Polar Bear	20472	Blood	Alaska
Polar Bear	20473*	Blood	Alaska
Polar Bear	20474 (NA2 EDTA)	Blood	Alaska
Polar Bear	20475 (NA2	Blood	Alaska

ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
0.052	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.038	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.036	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.032	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.028	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.033	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.031	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.026	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00290	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625

Polar Bear	EDTA) 20476 (NA2	Blood	Alaska
Polar Bear	EDTA) 20477	Blood	Alaska
Polar Bear	20485 (Heparin)	Blood	Alaska
Polar Bear	20486 (Heparin)	Blood	Alaska
Polar Bear	20487 (Heparin)	Blood	Alaska
Stellar Sealion	SSL49 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL50 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL51 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL52 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL53 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL54 (7.2 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL55 (5.4 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL56 (5.4 mg K2 EDTA)**	Blood	Coastal Alaska
Stellar Sealion	SSL57 (5.4 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL58 (5.4 mg K2 EDTA)*	Blood	Coastal Alaska
Stellar Sealion	SSL59 (5.4 mg K2 EDTA)	Blood	Coastal Alaska
Stellar Sealion	SSL60 (5.4 mg K2 EDTA)*	Blood	Coastal Alaska

ug/mL)	ug/mL)	ug/mL)	ug/mL)
0.035	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.027	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.043	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
0.032	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00290	<LOQ (0.00114	<LOQ (0.00240	<LOQ (0.000625
ug/mL)	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	
<LOQ (0.00579	<LOQ (0.0114	<LOQ (0.00958	I
ug/mL)	ug/mL)	ug/mL)	

PFOS = Perfluorooctanesulfonate
FOSA = Perfluorooctanesulfonamide
PFHS = Perfluorohexanesulfonate
PFOA = Perfluorooctanoate

I = Severe interference
LOQ = Limit of quantitation -
NE= Not extracted

Values in parenthesis are LOQs

APPENDIX III

Concentrations of (ug/g, wet for solid tissues) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	PFOA	FOSA	PFHS
Baikal Seal	J08 (81)	Liver	Lake Baikal, Russia	0.0127	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J09 (87)	Liver	Lake Baikal, Russia	0.0228	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J10 (86)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J12 (89)	Liver	Lake Baikal, Russia	0.014	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J19 (84)	Liver	Lake Baikal, Russia	0.009	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J20 (88)	Liver	Lake Baikal, Russia	0.015	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J24 (82)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J27 (83)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J36 (85)	Liver	Lake Baikal, Russia	0.015	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	J37 (80)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R04 (69)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R13 (78)	Liver	Lake Baikal, Russia	0.010	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R14 (74)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R16 (71)	Liver	Lake Baikal, Russia	0.008	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R29 (72)	Liver	Lake Baikal, Russia	0.008	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R42 (66)	Liver	Lake Baikal, Russia	0.014	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R43 (73)	Liver	Lake Baikal, Russia	0.016	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R45 (79)	Liver	Lake Baikal, Russia	0.008	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R46 (77)	Liver	Lake Baikal, Russia	0.008	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R47 (70)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R54 (67)	Liver	Lake Baikal, Russia	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R55 (75)	Liver	Lake Baikal, Russia	0.013	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R57 (76)	Liver	Lake Baikal, Russia	0.016	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Baikal Seal	R64 (68)	Liver	Lake Baikal, Russia	0.008	< LOQ (0.0359 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Ganges Dolphin	L04 (91)	Liver	River Ganges, India	< LOQ (0.0347 ug/g)	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Ganges Dolphin	L05 (90)	Liver	River Ganges, India	0.081	< LOQ (0.0718 ug/g)	< LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Bottlenose Dolphin	Tt5/91 (13)	Liver	Mediterranean Sea	0.181	< LOQ (0.0359 ug/g)	0.224	< LOQ (0.00683 ug/g)
Bottlenose Dolphin	Tt8/91 (17)	Liver	Mediterranean Sea	0.296	< LOQ (0.0718 ug/g)	0.358	< LOQ (0.00683 ug/g)

Bottlenose Dolphin	Tt61 (14)	Liver	Mediterranean Sea	0.169	<LOQ (0.0718 ug/g)	0.129	<LOQ (0.00683 ug/g)
Bottlenose Dolphin	TtA11 (16)	Liver	Mediterranean Sea	0.425	<LOQ (0.0718 ug/g)	0.129	<LOQ (0.00683 ug/g)
Bottlenose Dolphin	TtXT2 (15)	Liver	Mediterranean Sea	<LOQ (0.00696 ug/g)	<LOQ (0.0718 ug/g)	0.115	<LOQ (0.00683 ug/g)
Striped Dolphin	SCPO2 (18)	Liver	Mediterranean Sea	0.161	<LOQ (0.0718 ug/g)	<LOQ (0.0376 ug/g)	<LOQ (0.00683 ug/g)
Striped Dolphin	SCV1 (19)	Liver	Mediterranean Sea	0.089	<LOQ (0.0718 ug/g)	<LOQ (0.0376 ug/g)	<LOQ (0.00683 ug/g)
Striped Dolphin	SCPO3 (20)	Liver	Mediterranean Sea	0.094	<LOQ (0.0718 ug/g)	<LOQ (0.0376 ug/g)	<LOQ (0.00683 ug/g)
Striped Dolphin	SCPO4 (21)	Liver	Mediterranean Sea	0.065	<LOQ (0.0718 ug/g)	<LOQ (0.0376 ug/g)	0.027
Weddell Seal	WS1 (22)	Liver	Antarctica	<LOQ (0.0347 ug/g)	<LOQ (0.0718 ug/g)	<LOQ (0.0376 ug/g)	<LOQ (0.00683 ug/g)

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

LOQ = Limit of quantitation – Values in parenthesis are LOQs

APPENDIX IV

Concentrations of (ug/mL for blood/sera) fluorochemicals in biota

Species	I.d.	Tissue	Location	PFOS	PFHS	PFOA	FOSA
Ringed seal, Canada	990607-11 (62)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-06 (63)	Blood	Baffin Island, Canada	0.008	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-13 (64)	Blood	Baffin Island, Canada	0.004	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-07 (65)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-12 (66)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990608-24 (67)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-14 (68)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990617-46 (69)	Blood	Baffin Island, Canada	0.012	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-10 (70)	Blood	Baffin Island, Canada	0.005	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-15 (71)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-09 (72)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-16 (73)	Blood	Baffin Island, Canada	0.008	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990608-23 (74)	Blood	Baffin Island, Canada	<LOQ (0.00313 ug/mL)	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990608-48 (75)	Blood	Baffin Island, Canada	0.007	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990607-04 (78)	Blood	Baffin Island, Canada	0.005	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
Ringed seal	990608-25 (79)	Blood	Baffin Island,	<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125

Ringed seal	990607-22 (80)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-20 (81)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-47 (82)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-02 (83)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-21 (84)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-18 (85)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-19 (86)	Blood	Canada Baffin Island, Canada
Ringed seal	990607-17 (87)	Blood	Canada Baffin Island, Canada
Ringed seal, Baltic	N04-96, 99K0295 (88)	Blood	Baltic Sea 1996
Ringed seal	N06-96, 99K0268 (89)	Blood	Baltic Sea 1996
Ringed seal	N05-96, 99K0296 (90)	Blood	Baltic Sea 1996
Ringed seal	N09-96, 99K0271 (91)	Blood	Baltic Sea 1996
Ringed seal	N03-96, 99K0294 (92)	Blood	Baltic Sea 1996
Ringed seal	N01-96, 99K0267 (93)	Blood	Baltic Sea 1996
Ringed seal	N07-96, 99K0269 (94)	Blood	Baltic Sea 1996
Ringed seal	N08-96, 99K0270 (95)	Blood	Baltic Sea 1996
Ringed seal	N10-96, 99K0298 (96)	Blood	Baltic Sea 1996
Ringed seal	N03-97, 99K0426 (97)	Blood	Baltic Sea 1997

ug/mL)	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)	ug/mL)
0.007	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)	ug/mL)
0.010	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00313	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)	ug/mL)
0.007	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
	ug/mL)	ug/mL)	ug/mL)
0.082	0.002	<LOQ (0.00622	0.001
		ug/mL)	
0.234	0.004	<LOQ (0.00622	<LOQ (0.00125
		ug/mL)	ug/mL)
0.112	0.004	<LOQ (0.00622	<LOQ (0.00125
		ug/mL)	ug/mL)
0.106	0.005	<LOQ (0.00622	<LOQ (0.00125
		ug/mL)	ug/mL)
0.163	<LOQ (0.00125	<LOQ (0.00622	0.001
	ug/mL)	ug/mL)	
0.069	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
	ug/mL)	ug/mL)	ug/mL)
0.156	0.004	<LOQ (0.00622	0.003
		ug/mL)	
0.152	0.002	<LOQ (0.00622	0.002
		ug/mL)	
0.124	0.004	<LOQ (0.00622	0.002
		ug/mL)	
0.069	0.003	<LOQ (0.00622	<LOQ (0.00125
		ug/mL)	ug/mL)

Ringed seal	N02-97, 99K0425 (98)	Blood	Baltic Sea 1997
Ringed seal	N10-97, 99K0433 (99)	Blood	Baltic Sea 1997
Ringed seal	N05-97, 99K0428 (100)	Blood	Baltic Sea 1997
Ringed seal	N07-97, 99K0430 (101)	Blood	Baltic Sea 1997
Ringed seal	N09-97, 99K0432 (102)	Blood	Baltic Sea 1997
Ringed seal	N04-97, 99K0427 (103)	Blood	Baltic Sea 1997
Ringed seal	N08-97, 99K0431 (104)	Blood	Baltic Sea 1997
Ringed seal	N06-97, 99K0429 (105)	Blood	Baltic Sea 1997
Ringed seal	N08-98, 99K0477 (106)	Serum	Baltic Sea 1998
Ringed seal	N04-98, 99K0473 (107)	Serum	Baltic Sea 1998
Ringed seal	N05-98, 99K0474 (108)	Serum	Baltic Sea 1998
Ringed seal	N09-98, 99K0478 (109)	Serum	Baltic Sea 1998
Ringed seal	N01-98, 99K0469 (110)	Serum	Baltic Sea 1998
Ringed seal	N07-98, 99K0476 (111)	Serum	Baltic Sea 1998
Ringed seal	N06-98, 99K0475 (114)	Serum	Baltic Sea 1998
Ringed seal	N10-98, 99K0435 (115)	Serum	Baltic Sea 1998
Ringed seal	N02-98, 99K0471 (116)	Serum	Baltic Sea 1998
Ringed seal	N03-98, 99K0472 (117)	Serum	Baltic Sea 1998
Ringed seal	S08-98, 99K0466	Blood	Spitsbergen 1998

0.124	0.004	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.051	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	0.001
0.093	0.004	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.051	0.002	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.016	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.053	0.002	<LOQ (0.00622 ug/mL)	0.001
0.309	0.009	0.007	<LOQ (0.00125 ug/mL)
0.066	0.003	<LOQ (0.00622 ug/mL)	0.00126
0.066	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.116	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.475	0.004	0.0171	<LOQ (0.00125 ug/mL)
0.297	0.002	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.392	0.003	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.431	0.003	0.0146	<LOQ (0.00125 ug/mL)
0.222	0.002	0.00836	<LOQ (0.00125 ug/mL)
0.106	0.005	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.095	<LOQ (0.00125 ug/mL)	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.218	0.003	<LOQ (0.00622 ug/mL)	<LOQ (0.00125 ug/mL)
0.007	<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125

	(118)			
Ringed seal	S03-98, 99K0461	Blood	Spitsbergen 1998	0.010
	(119)			
Ringed seal	S09-98, 99K0467	Blood	Spitsbergen 1998	0.011
	(120)			
Ringed seal	S04-98, 99K0462	Blood	Spitsbergen 1998	0.012
	(121)			
Ringed seal	S05-98, 99K0463	Blood	Spitsbergen 1998	0.011
	(122)			
Ringed seal	S02-98, 99K0460	Blood	Spitsbergen 1998	0.005
	(123)			
Ringed seal	S07-98, 99K0465	Blood	Spitsbergen 1998	0.015
	(124)			
Ringed seal	S10-98, 99K0468	Blood	Spitsbergen 1998	0.011
	(125)			
Ringed seal	S16-96, 99K0287	Blood	Spitsbergen 1996	0.008
	(126)			
Ringed seal	S17-96, 99K0288	Blood	Spitsbergen 1996	0.006
	(127)			
Ringed seal	S01-96, 99K0272	Blood	Spitsbergen 1996	0.010
	(128)			
Ringed seal	S10-96, 99K0281	Blood	Spitsbergen 1996	0.008
	(129)			
Ringed seal	S15-96, 99K0286	Blood	Spitsbergen 1996	0.006
	(130)			
Ringed seal	S12-96, 99K0283	Blood	Spitsbergen 1996	0.005
	(131)			
Ringed seal	S14-96, 99K0285	Blood	Spitsbergen 1996	0.009
	(132)			
Ringed seal	S05-96, 99K0276	Blood	Spitsbergen 1996	0.009
	(133)			
Ringed seal	S19-96, 99K0290	Blood	Spitsbergen 1996	0.014
	(134)			
Ringed seal	S07-96, 99K0278	Blood	Spitsbergen 1996	0.006
	(135)			
Grey seal	H01-96, 99K0324	Blood	Baltic Sea, 1996	0.071
	(136)			

ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	0.003
ug/mL)	ug/mL)	
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	0.006
ug/mL)	ug/mL)	
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00125
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00622
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00622
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00622
ug/mL)	ug/mL)	ug/mL)
<LOQ (0.00125	<LOQ (0.00622	<LOQ (0.00622
ug/mL)	ug/mL)	ug/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)

Grey seal	H03-96, 99K0326 (137)	Blood	Baltic Sea, 1996	0.035
Grey seal	H06-96, 99K0329 (138)	Blood	Baltic Sea, 1996	0.034
Grey seal	H08-96, 99K0331 (139)	Blood	Baltic Sea, 1996	0.027
Grey seal	H10-96, 99K0333 (140)	Blood	Baltic Sea, 1996	0.037
Grey seal	H07-96, 99K0330 (141)	Blood	Baltic Sea, 1996	0.064
Grey seal	H02-96, 99K0325 (144)	Blood	Baltic Sea, 1996	0.015
Grey seal	H09-96, 99K0332 (145)	Blood	Baltic Sea, 1996	0.076
Grey seal	H05-96, 99K0328 (146)	Blood	Baltic Sea, 1996	0.019
Grey seal	H02-98, 99K0340 (147)	Blood	Baltic Sea, 1998	0.020
Grey seal	H04-98, 99K0342 (148)	Blood	Baltic Sea, 1998	0.025
Grey seal	H05-98, 99K0457 (149)	Blood	Baltic Sea, 1998	0.029
Grey seal	H06-98, 99K0343 (150)	Blood	Baltic Sea, 1998	0.047
Grey seal	H07-98, 99K0458 (151)	Blood	Baltic Sea, 1998	0.024
Grey seal	H01-98, 99K0456 (152)	Blood	Baltic Sea, 1998	0.020
Grey seal	H03-98, 99K0341 (153)	Blood	Baltic Sea, 1998	0.014
Grey seal	C07-98, 99K0442 (154)	Blood	Canadian Arctic, 1998	0.014
Grey seal	C06-98, 99K0441 (155)	Blood	Canadian Arctic, 1998	0.011
Grey seal	C03-98, 99K0438 (156)	Blood	Canadian Arctic, 1998	0.037
Grey seal	C20-98, 99K0312	Blood	Canadian Arctic,	0.026

<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	0.007
0.002	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
0.001	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)

	(157)		1998	
Grey seal	C02-98, 99K0437	Blood	Canadian Arctic,	0.026
	(158)		1998	
Grey seal	C01-98, 99K0436	Blood	Canadian Arctic,	0.018
	(159)		1998	
Grey seal	C08-98, 99K0443	Blood	Canadian Arctic,	0.030
	(160)		1998	
Grey seal	C09-98, 99K0444	Blood	Canadian Arctic,	0.042
	(161)		1998	
Grey seal	C17-98, 99K0309	Blood	Canadian Arctic,	0.036
	(162)		1998	
Grey seal	C04-98, 99K0439	Blood	Canadian Arctic,	0.029
	(163)		1998	
Grey seal	C11-98, 99K0446	Blood	Canadian Arctic,	0.015
	(164)		1998	
Grey seal	C19-98, 99K0311	Blood	Canadian Arctic,	0.049
	(165)		1998	
Grey seal	H11-97, 99K0337	Blood	Baltic Sea, 1997	0.068
	(166)			
Grey seal	H06-97, 99K0452	Blood	Baltic Sea, 1997	0.048
	(167)			
Grey seal	H02-97, 99K0335	Blood	Baltic Sea, 1997	0.020
	(168)			
Grey seal	H07-97, 99K0453	Blood	Baltic Sea, 1997	0.072
	(169)			
Grey seal	H10-97, 99K0336	Blood	Baltic Sea, 1997	0.018
	(170)			
Grey seal	H13-97, 99K0339	Blood	Baltic Sea, 1997	0.058
	(171)			
Grey seal	H12-97, 99K0450	Blood	Baltic Sea, 1997	0.018
	(172)			
Grey seal	H04-97, 99K0450	Blood	Baltic Sea, 1997	0.051
	(173)			
Grey seal	H08-97, 99K0454	Blood	Baltic Sea, 1997	0.052
	(174)			
Grey seal	H03-97, 99K0449	Blood	Baltic Sea, 1997	0.034
	(175)			

<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
0.003	0.00679	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
0.003	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
0.002	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)
<LOQ (1.00 ng/mL)	<LOQ (4.98 ng/mL)	<LOQ (4.98 ng/mL)

BN dolphin	Moo1 (3)	Blood	Italian coast	0.206
BN dolphin	Tabo1 (4)	Blood	Italian coast	0.139
BN dolphin	Candy1 (5)	Blood	Italian coast	0.042
BN dolphin	Micha1 (6)	Blood	Italian coast	0.177

PFOS = Perfluorooctanesulfonate
PFHS = Perfluorohexanesulfonate
PFOA = Perfluorooctanoate

FOSA = Perfluorooctanesulfonamide

0.006	0.003	0.198
0.005	0.004	0.226
<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	0.193
0.006	0.002	0.272

LOQ = Limit of quantitation - Values in parenthesis

APPENDIX V

Concentrations of (ug/g, wet for solid tissues) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	PFHS	PFOA	FOSA
Tursiops truncatus	(101)MML 9706	Liver	Palma Sola Bay, FL	0.734	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.023
Tursiops truncatus	(102)MML 9804	Liver	Palma Sola Bay, FL	0.487	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)
Tursiops truncatus	(103)MML 9912	Liver	Sarasota Bay	0.716	0.00420	<LOQ (0.00750 ug/g)	0.027
Stenella coeruleoalba	(104)MML9704	Liver	Gulf of Mexico	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)
Stenella clymene	(105)MML9510	Liver	Gulf of Mexico	0.168	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)
Tursiops truncatus	(106)MML9901	Liver	Anna Maria Sound	0.483	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.035
Kogia breviceps	(107)MML0006	Liver	Atlantic Ocean	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.046
Tursiops truncatus	(108)MML0008	Liver	Gulf of Mexico	0.824	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.178
Tursiops truncatus	(109)MML9204	Liver	Gulf of Mexico	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.045
Tursiops truncatus	(110)MML9619	Liver	Sarasota Bay	1.52	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.048
Tursiops truncatus	(111)MML9116	Liver	Gulf of Mexico	0.291	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.013
Tursiops truncatus	(112)MML9126	Liver	Anna Maria Sound	0.557	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.032
Tursiops truncatus	(113)MML9132	Liver	Gulf of Mexico	0.551	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.021
Tursiops truncatus	(114)MML9332	Liver	Gulf of Mexico	0.411	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.010
Tursiops truncatus	(115)MML9404	Liver	Peace River	0.402	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.012
Tursiops truncatus	(116)MML9212	Liver	Anna Maria Sound	0.097	0.009	<LOQ (0.00750 ug/g)	0.006
Tursiops truncatus	(117)MML9414	Liver	Gulf of Mexico	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.013
Stenella coeruleoalba	(118)MML9416	Liver	Venice Inlet	0.388	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.016
Kogia breviceps	(119)MML9413	Liver	Anclote River	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.022
Tursiops truncatus	(120)MML9625	Liver	Sarasota Bay	0.603	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.035
Tursiops truncatus	(121)MML9603	Liver	Gulf of Mexico	0.180	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.018
Tursiops truncatus	(122)MML9401	Liver	Gulf of Mexico	0.075	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.007
Stenella clymene	(123)MML9510J	Liver	Gulf of Mexico	0.122	<LOQ (0.00375 ug/g)	0.020	0.008
Steno bredanensis	(124)MML9521	Liver	Tampa Bay	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.006
Tursiops truncatus	(125)MML9523	Liver	Gulf of Mexico	0.141	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.012
Stenella clymene	(126)MML9510M	Liver	Gulf of Mexico	0.079	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.007
Tursiops truncatus	(127)MML9514	Liver	Sarasota Bay	0.614	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.016
Steno bredanensis	(128)MML9520	Liver	Anna Maria Sound	<LOQ (0.0750 ug/g)	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.004

Tursiops truncatus	(129)MML9505	Liver	Peace River	0.979	<LOQ (0.00375 ug/g)	<LOQ (0.00750 ug/g)	0.020
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PFOS = Perfluorooctanesulfonate

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

FOSA = Perfluorooctanesulfonamide

LOQ = Limit of quantitation- values in parenthesis

APPENDIX VI

Concentrations of (ug/g, wet for solid tissues) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	FOSA	PFOA	PFHS
Ringed Seal	(158) H1-96 99K0119	Liver	BalticSea	0.303	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(159) H2-96 99K0120	Liver	BalticSea	0.173	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(160) H8-96 99K0125	Liver	BalticSea	0.208	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(161) H3-96 99K0121	Liver	BalticSea	0.247	0.0384	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(162) H4-96 99K0122	Liver	BalticSea	0.205	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(163) H10-96 99K0127	Liver	BalticSea	0.206	0.0465	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(164) H9-96 99K0126	Liver	BalticSea	0.364	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(165) H6-96 99K0119	Liver	BalticSea	0.191	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(166) H7-96 99K0411	Liver	BalticSea	0.331	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(167) H5-96 99K0123	Liver	BalticSea	0.213	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(168) N8-97 98K0148	Liver	BalticSea	1.10	<LOQ (0.0375 ug/g)	0.0395	<LOQ (0.00375 ug/g)
Ringed Seal	(169) N7-97 98K0146	Liver	BalticSea	0.275	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(170) N10-97 98K0152	Liver	BalticSea	0.129	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	X
Ringed Seal	(171) N5-97 98K0142	Liver	BalticSea	0.340	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(172) N9-97 98K0150	Liver	BalticSea	0.149	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
Ringed Seal	(173) N6-97	Liver	BalticSea	0.318	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)

	98K0144		
Ringed Seal	(174) N4-97	Liver	BalticSea
	98K0140		
Ringed Seal	(175) N3-97	Liver	BalticSea
	98K0138		
Ringed Seal	(176) N2-97	Liver	BalticSea
	98K0136		
Ringed Seal	(177) N1-97	Liver	BalticSea
	98K0134		
Ringed Seal	(178) N9-96	Liver	BalticSea
	99K0142		
Ringed Seal	(179) N3-96	Liver	BalticSea
	99K0136		
Ringed Seal	(180) N8-96	Liver	BalticSea
	99K0141		
Ringed Seal	(181) N7-96	Liver	BalticSea
	99K0140		
Ringed Seal	(182) N6-96	Liver	BalticSea
	99K0139		
Ringed Seal	(183) H5-98	Liver	BalticSea
	98K1782		
Ringed Seal	(184) H6-98	Liver	BalticSea
	98K1783		
Ringed Seal	(185) H4-98	Liver	BalticSea
	98K1781		
Ringed Seal	(186) H3-98	Liver	BalticSea
	98K1780		
Ringed Seal	(187) H2-98	Liver	BalticSea
	98K1779		
Ringed Seal	(188) H1-98	Liver	BalticSea
	98K1778		
Ringed Seal	(189) H7-98	Liver	BalticSea
	98K1784		
Ringed Seal	(190) S3-98	Liver	BalticSea
	98K1813		
Ringed Seal	(191) S8-98	Liver	BalticSea
	98K1818		

		ug/g)	ug/g)
0.199	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.185	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.332	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.209	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.607	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.558	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.467	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.650	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
1.00	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.148	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.253	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.291	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.137	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.170	<LOQ (0.0375 ug/g)	<LOQ(0.0188	X
		ug/g)	
0.139	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.232	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.0983	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)
0.0634	<LOQ (0.0375 ug/g)	<LOQ(0.0188	<LOQ (0.00375
		ug/g)	ug/g)

Ringed Seal	(192) S7-98 98K1817	Liver	BalticSea
Ringed Seal	(193) S9-98 98K1819	Liver	BalticSea
Ringed Seal	(194) S10-98 98K1820	Liver	BalticSea
Ringed Seal	(195) S6-98 98K1816	Liver	BalticSea
Ringed Seal	(196) S5-98 98K1815	Liver	BalticSea
Ringed Seal	(197) S4-98 98K1814	Liver	BalticSea
Ringed Seal	(198) S2-98 98K1812	Liver	BalticSea
Ringed Seal	(199) N1-98 98K1792	Liver	BalticSea
Ringed Seal	(200) N2-98 98K1793	Liver	BalticSea
Ringed Seal	(201) N3-98 98K1794	Liver	BalticSea
Ringed Seal	(202) N4-98 98K1795	Liver	BalticSea
Ringed Seal	(203) N5-98 98K1796	Liver	BalticSea
Ringed Seal	(204) N6-98 98K1797	Liver	BalticSea
Ringed Seal	(205) N7-98 98K1798	Liver	BalticSea
Ringed Seal	(206) N8-98 98K1799	Liver	BalticSea
Ringed Seal	(207) N9-98 98K1800	Liver	BalticSea
Ringed Seal	(208) N10-98 98K1801	Liver	BalticSea
Ringed Seal	(209) H1-97 99K0408	Liver	BalticSea
Ringed Seal	(210) H2-97	Liver	BalticSea

0.125	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.0908	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.0985	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.0511	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.102	0.0391	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.0722	0.0377	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.0624	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.925	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.168	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.347	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.228	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.571	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
0.354	<LOQ (0.0375 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00375 ug/g)
1.05	<LOQ (0.0375 ug/g)	0.0291	<LOQ (0.00375 ug/g)
0.307	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.407	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.446	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.163	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.157	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)

	99K0409		
Ringed Seal	(211) H3-97	Liver	BalticSea
	99K0410		
Ringed Seal	(212) H4-97	Liver	BalticSea
	99K0411		
Ringed Seal	(213) H5-97	Liver	BalticSea
	99K0412		
Ringed Seal	(214) H6-97	Liver	BalticSea
	99K0413		
Ringed Seal	(215) H7-97	Liver	BalticSea
	99K0414		
Ringed Seal	(216) H8-97	Liver	BalticSea
	99K0415		
Ringed Seal	(217) H9-97	Liver	BalticSea
	99K0416		
Ringed Seal	(218) H11-97	Liver	BalticSea
	99K0417		
Ringed Seal	(219) S1-96	Liver	BalticSea
	99K0124		
Ringed Seal	(220) S2-96	Liver	BalticSea
	99K0130		
Ringed Seal	(221) S3-96	Liver	BalticSea
	99K0096		
Ringed Seal	(222) S4-96	Liver	BalticSea
	99K0132		
Ringed Seal	(223) S5-96	Liver	BalticSea
	99K0126		
Ringed Seal	(224) S6-96	Liver	BalticSea
	99K0128		
Ringed Seal	(225) S7-96	Liver	BalticSea
	99K0098		
Ringed Seal	(226) S8-96	Liver	BalticSea
	99K0122		
Ringed Seal	(227) S9-96	Liver	BalticSea
	99K0116		
Ringed Seal	(228) S10-96	Liver	BalticSea
	99K0100		

		ug/g)	ug/g)
0.153	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.297	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.175	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.168	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.206	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.215	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.198	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.230	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0467	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0659	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0462	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0622	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0723	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.102	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.035	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0762	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0361	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
0.0310	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)

Ringed Seal	(229) C1-98 99K1738	Liver	BalticSea	0.133	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(230) C2-98 99K1739	Liver	BalticSea	0.170	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(231) C3-98 99K1740	Liver	BalticSea	0.146	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(232) C4-98 99K1741	Liver	BalticSea	0.0888	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(233) C5-98 99K1742	Liver	BalticSea	0.111	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(234) C6-98 99K1743	Liver	BalticSea	0.0672	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(235) C7-98 99K1744	Liver	BalticSea	0.110	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(236) C8-98 99K1745	Liver	BalticSea	0.0962	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(237) C9-98 99K1746	Liver	BalticSea	0.129	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)
Ringed Seal	(238) C10-98 99K1747	Liver	BalticSea	0.132	<LOQ (0.0188 ug/g)	<LOQ(0.0188 ug/g)	<LOQ (0.00750 ug/g)

PFOS = Perfluorooctanesulfonate
PFHS = Perfluorohexanesulfonate

FOSA = Perfluorooctanesulfonamide
PFOA = Perfluorooctanoate

LOQ = Limit of quantitation – values in parenthesis

APPENDIX VII

Concentrations of (ug/g, wet for solid tissues) fluorochemicals in biota

Species	Sample id	Tissue	Location	PFOS	FOSA	PFOA	PFHS
Whale	(85) Balenoptera1	Muscle	Italy	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)
Whale	(86) Delphinus3	Muscle	Italy	0.0774	0.142	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)
Whale	(87) Delphinus4	Liver	Italy	0.941	0.878	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)
Whale	(88) Tursiops6	Liver	Italy	0.110	0.139	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)
Whale	(89) Globicephala7	Muscle	Italy	0.0517	0.0475	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)
Whale	(90) Globicephala8	Liver	Italy	0.267	0.0502	< LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

LOQ = Limit of quantitation – Values in parenthesis

APPENDIX VIII

Concentrations of (ug/g, wet for solid tissues) fluorochemicals in biota

Species	Sample id	Tissue	Location	PFOS	FOSA	PFOA	PFHS
Polar Bear Liver	1A (2372LK)	Liver	Alaska	0.183	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	2A (2368LF)	Liver	Alaska	0.296	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	3A (950089A)	Liver	Alaska	0.325	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	4A (940149B)	Liver	Alaska	0.346	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	5A (12216)	Liver	Alaska	0.400	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	6A (2372LB)	Liver	Alaska	0.347	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	7A (950095B)	Liver	Alaska	0.0824	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	8A (990671LC)	Liver	Alaska	0.634	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	9A (000245LE)	Liver	Alaska	0.161	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	10A (950086B)	Liver	Alaska	0.192	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	11A (940090B)	Liver	Alaska	0.272	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	12A (2372LF)	Liver	Alaska	0.303	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Polar Bear Liver	13A (990083LD)	Liver	Alaska	0.470	<LOQ (0.0038 ug/g)	0.0129	<LOQ (0.0038 ug/g)
Polar Bear Liver	14A (2367LC)	Liver	Alaska	0.394	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)

PFOS = Perfluorooctanesulfonate
FOSA = Perfluorooctanesulfonamide

PFHS = Perfluorohexanesulfonate
LOQ = Limit of quantitation – values in parenthesis

PFOA = Perfluorooctanoate

APPENDIX IX

Matrix spike and matrix spike duplicate recoveries (%) of fluorochemicals spiked to marine mammal matrices

Matrix	PFOS (Mean +/- RSD or PRD)	PFOSA (Mean +/- RSD or RPD)	PFOA (Mean +/- RSD or RPD)	PFHS (Mean +/- RSD or RPD)
California sealion liver	63 +/- 35	42 +/- 42	65 +/- 47	NA
Elephant seal liver	62 +/- 47	45 +/- 56	58 +/- 52	NA
Harbor seal liver	55 +/- 42	54 +/- 39	67 +/- 37	NA
Sea otter liver	47 +/- 33	30 +/- 45	50 +/- 39	NA
Sea otter brain	44 +/- 7	12 +/- 171	46 +/- 13	NA
Sea otter kidney	53 +/- 49	46 +/- 61	66 +/- 75	NA
Caspian seal blood	84 +/- 58	63 +/- 58	91 +/- 54	NA
Polar bear liver	158 +/- 102	57 +/- 11	107 +/- 41	73 +/- 9
Fur seal liver	108 +/- 5	73 +/- 8	76 +/- 10	90 +/- 15
Polar bear blood	82 +/- 21	49 +/- 6	76 +/- 1	76 +/- 2
Fur seal blood	Int	Int	Int	Int
Steller sealion blood	71 +/- 17	Int	74 +/- 7	80 +/- 9
Bottlenose dolphin liver	135 +/- 6	168 +/- 26	61 +/- 9	65 +/- 1
Striped dolphin liver	79 +/- 35	70 +/- 48	66 +/- 30	59 +/- 17
Weddell seal liver	77 +/- 10	69 +/- 0	62 +/- 2	60 +/- 1
Baikal seal liver	69 +/- 2	73 +/- 14	69 +/- 3	57 +/- 5
Bottlenose dolphin blood	Int	Int	Int	Int
Ringed seal blood	62 +/- 2	50 +/- 14	65 +/- 13	64 +/- 1
Harp seal blood	77 +/- 21	72 +/- 2	79 +/- 2	78 +/- 4
Gray seal blood	115 +/- 3	69 +/- 0	86 +/- 1	83 +/- 2
Bottlenose dolphin liver (FL)	94 +/- 77	40 +/- 40	66 +/- 1	35 +/- 4
Globicephala muscle	70 +/- 23	76 +/- 24	80 +/- 0	95 +/- 4
Delphinus liver	25 +/- 93	23 +/- 39	55 +/- 14	38 +/- 1
Polar bear liver (II set)	59 +/- 3	18 +/- 1	73 +/- 2	21 +/- 1

NA= Not analyzed PFOS = Perfluorooctanesulfonate
 Int = Interference resulted in negative recoveries
 RPD= Relative percent difference; RSD= Relative standard deviation

PFOA = Perfluorooctanoate FOSA = Perfluorooctanesulfonamide
 PFHS = Perfluorohexanesulfonate

APPENDIX X

Scientific names of marine mammals analyzed

Common name	Scientific name
Pygmy sperm whale	<i>Kogia breviceps</i>
Short-snouted spinner dolphin	<i>Stenella clymene</i>
Striped dolphin	<i>Stenella coeruleoalba</i>
Rough-toothed dolphin	<i>Steno bredanensis</i>
Bottlenose dolphin	<i>Tursopsis truncatus</i>
California Sea Lion	<i>Zalophus californianus</i>
Elephant Seal	<i>Mirounga augustirostris</i>
Harbor Seal	<i>Phoca vitulina</i>
Northern fur seal	<i>Callorhinus ursinus</i>
River otter	<i>Lutra canadensis</i>
Seaotter	<i>Enhydra lutris nereis</i>
Polar bear	<i>Ursus maritimus</i>
Steller sea lion	<i>Eumetopias jubatus</i>
Ringed seal	<i>Phoca hispida</i>
Gray seal	<i>Halichoerus grypus</i>
Weddell seal	<i>Leptonychotes weddellii</i>
Caspian seal	<i>Phoca caspica</i>
Baikal seal	<i>Phoca sibirica</i>
Harp seal	<i>Phoca groenlandica</i>
Fin whales	<i>Balaenoptera physalus</i>
Common dolphin	<i>Delphinus delphis</i>
Pilot whale	<i>Globicephala melaena</i>

