

PERFLUOROOCTANESULFONATE AND RELATED FLUOROCHEMICALS IN FISH-EATING WATER BIRDS

John P. Giesy*
Kurunthachalam Kannan

*Department of Zoology, National Food Safety and Toxicology Center, Institute for
Environmental Toxicology, Michigan State University, East Lansing, MI 48824, USA*

*To whom correspondence should be addressed:

Prof. J.P. Giesy

218C National Food Safety and Toxicology Ctr

Michigan State University

East Lansing, MI 48824

USA

Tel: (517)-353-2000; Fax: 517-432-2310; E-mail: jgiesy@aol.com

Prepared for: 3M

St. Paul, MN

June 20, 2001

SUMMARY

This report is a compilation of results of a global monitoring survey of perfluorooctanesulfonate (PFOS), perfluorooctanesulfonamide (FOSA), perfluorooctanoate (PFOA) and perfluorohexanesulfonate (PFHS) in birds. PFOS, FOSA, PFOA and PFHS were measured in liver, kidney, blood or egg yolk of fish-eating water birds collected in the United States including albatrosses from Sand Island, Midway Atoll in the central North Pacific Ocean. Similarly, tissues of birds collected from the Baltic and the Mediterranean Seas, Japanese and Korean coasts were also analyzed. Concentrations of PFOS in the blood plasma of bald eagles collected from the midwestern USA ranged from 13 to 2220 ng/mL (mean: 330 ng/mL) except one sample which did not contain quantifiable concentrations of PFOS. Among 82 livers from various species of birds from inland or coastal U.S. locations, Brandt's cormorant from San Diego, California, contained the greatest concentration of PFOS (1780 ng/g, wet wt). PFOS was also found in the sera of albatrosses from the central North Pacific Ocean at concentrations ranging from 3 to 34 ng/mL. Concentrations of PFOS in the blood or livers of birds from the Mediterranean and the Baltic Seas were relatively less than those found in the US birds.

INTRODUCTION

This report is a compilation of results of analysis of PFOS, FOSA, PFOA and PFHS in tissues of birds collected across the United States, certain European and Asian countries. Liver, kidney and sera of Laysan and black-footed albatrosses from the Sand Island, Midway Atoll, central North Pacific Ocean, were also analyzed to examine the presence of PFOS in more remote marine locations. Eggs of penguins and tissues of polar skua from the Antarctica were also analyzed. Fish eating water birds and predatory birds at the higher trophic level in the food chain have been used to monitor exposures to organic contaminants in the environment. For this reason, several species of birds were chosen for this analysis.

MATERIALS AND METHODS

Samples. The species analyzed include: double-crested cormorant (*Phalacrocorax auritus*), herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), bald eagle (*Haliaeetus leucocephalus*), common loon (*Gavia immer*), brown pelican (*Pelecanus occidentalis*), white pelican (*Pelecanus erythrorhynchos*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), wood stork (*Mycteria americana*), white-faced ibis (*Plegadis chihi*), black-crowned night heron (*Nycticorax nycticorax*), Franklin's gull (*Larus pipixcan*), northern gannet (*Sula bassanus*), great black-backed gull (*Larus marinus*), osprey (*Pandion haliaetus*), red-throated loon (*Gavia stellata*), Brandt's cormorant (*Phalacrocorax penicillatus*), great blue heron (*Ardea herodias*), Laysan albatross (*Diomedea immutabilis*) and black-footed albatross (*Diomedea nigripes*). Birds were from several locations across the USA including the Sand Island, Midway Atoll in central North Pacific Ocean (Figure 1). Livers of cormorant (*Phalacrocorax carbo*) were collected from

the Italian coast. These birds were originally sacrificed in 1997 by the Department of Sanitary, Division of Rearing and Zootechnical Resources, for sanitary regulations. White-tailed sea eagle livers were collected from the German coast of the Baltic Sea during 1979 to 1997. Liver samples were wrapped in clean aluminum foil or whirlpac bags and stored frozen at -20°C until analysis. For the purpose of discussion, results were grouped into the following major classes: Great Lakes region, other U.S. locations (locations other than the Great Lakes region) and Midway Atoll, the Baltic Sea, the Mediterranean Sea, Asia and Antarctica. Appendix X provides a list of common and scientific names of the birds analyzed.

Tissues of birds from the midwestern USA including the Great Lakes were collected as a part of earlier monitoring studies for organochlorine pollutants in birds. Double-crested cormorants, herring gulls, ring-billed gulls and bald eagle tissues were collected from several colonies in Michigan waters of the Great Lakes. All samples were collected between 1990 and 1998. Details regarding sampling location and sampling date are given in Tables 1 and 2. Age and sex of individuals were recorded when available. Blood plasma was collected primarily from nestlings. Blood samples of bald eagles were collected from nestling eagles from Michigan, Wisconsin, Minnesota and Ohio. Samples were collected from nestlings by venipuncture of the brachialis vein using a 10 mL syringe. Plasma samples were prepared by centrifugation within 12 h of collection and were frozen at -20°C until analysis.

Liver tissue came primarily from birds that died at rehabilitation centers and wildlife shelters, or from carcasses found on wildlife refuges, in the continental US. Liver samples were collected from the carcasses, wrapped in clean aluminum foil and stored frozen at -20°C until analysis. Liver and blood plasma of albatrosses were collected from adult male Laysan and black-footed albatrosses (≥ 11 years old) on Sand Island, Midway Atoll in the central North Pacific Ocean (28°11'N, 177°22'W) during 1993-1995. Blood was drawn from the brachial vein of each bird and placed in Vacutainers® (Becton Dickinson vacutainer systems, Rutherford, New Jersey) containing 0.015 mL of ethylenediaminetetraacetic acid (EDTA) anticoagulant, centrifuged, and the plasma was harvested and stored at -20°C until analysis.

Analysis

Details of the analytical procedure have been outlined in 3M Environmental Laboratory, St. Paul, MN, standard operating procedures for the analysis of fluorochemicals in tissues. The titles of the SOPs are: ETS-8-6, "Extraction of Potassium Perfluorooctanesulfonate or other Fluorochemical Compounds from Liver for Analysis using HPLC-Electrospray/Mass Spectrometry" and ETS-8-4, "Extraction of Potassium Perfluorooctanesulfonate or other Fluorochemical Compounds from Serum for Analysis using HPLC-Electrospray/Mass Spectrometry". The analytical work was generated by 3M Environmental Laboratory. (Refer to Reference (1) for 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 μ m nylon filter into glass autovials.

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 (FSO_3^-). 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 $\mu\text{L}/\text{min}$

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 $\pm$ 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, 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 and rabbit sera 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).

Data Summary, Analyses, and Results

Data quality objectives for the analytical phase of this study were met with the exceptions noted in this report.

Linearity: The coefficient of determination (r^2) of the standard curve was >0.99 .

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 a single specific product ion 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. Given the nature of the samples encompassed, the well-characterized matrices of rabbit liver or rabbit sera was used as surrogate tissue for matrix blanks. Surrogate matrix blanks were $\leq \frac{1}{2}$ the level of the LOQ for all analytes except one PFHS liver blank which was above the LOQ. These outliers will not adversely affect the outcome of this study.

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 show less than 7% variability for all target analytes.

Matrix Spikes: Please see Appendix IX for the assessment of data quality for PFOS, FOSA, PFOA, and PFHS in liver and whole blood.

To verify the status of the extraction and analytical systems, matrix spikes were also prepared in a well-characterized surrogate matrix, rabbit liver and rabbit sera. With one exception, the matrix spike studies conducted in rabbit tissue were all acceptable ($\pm 30\%$) for those analytical

runs used when reporting data for samples and matrix spikes. FOSA determination in rabbit sera averaged 57%, significantly less than the expected recovery of >90%. Although all unextracted QC was acceptable, it is possible that matrix effects challenged either the separation or detection systems. Data quality for FOSA in sera is adversely affected and is noted. During the course of this study, actions were not taken to further characterize the nature of the challenge.

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 → 80 Da transition can provide a stronger signal than the 499 Da → 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 → 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 radiolabeled reference material. The only measurement of accuracy available at this time is matrix spike studies. Recoveries of PFOS, FOSA, PFOA and PFHS spiked to matrices of various bird species are presented in Appendix IX. 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 Tables 1 to 6 were 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

PFOS Recoveries. Recoveries of PFOS spiked to various tissues of birds showed considerable variation, from 17 to 129% (Table 3). The reason for the variability in the recovery among species is not known, but could be due to the differences in the lipid content of the tissues. The data presented is not corrected for the recoveries of matrix spikes. Results of PFOS, FOSA, PFOA and PFHS in individual bird samples are presented in Appendices I to VIII. PFOS is the major fluorochemical detected in bird tissues. Concentrations of FOSA, PFOA and PFHS were not found in more than 90% of the bird tissues analyzed and therefore were not discussed in detail.

Great Lakes Region. Concentrations of PFOS greater than the LOQ were found in blood plasma of most water birds collected from the Great Lakes region (Table 1). Concentrations of PFOS in whole blood of herring gulls and double-crested cormorants ranged

from 34 to 243 ng PFOS/mL (mean: 124 ng/mL for double-crested cormorants and 63 ng/mL for herring gulls), while those in blood plasma samples of these birds from the same region ranged from 63 to 391 ng PFOS/mL (mean: 185 ng/mL for double-crested cormorants and 315 ng/mL for herring gulls). The mean concentration of PFOS in whole blood samples of herring gull from Little Charity Island on Lake Huron was 63 ng/mL (range: 57-68) while plasma samples from gulls native to this area were determined to contain PFOS at 315 ng/mL (range: 239-391). Similarly, the mean concentration of PFOS in blood plasma of double-crested cormorants from Little Charity Island (mean: 291; range: 209-372 ng/mL) was greater than that observed in whole blood (mean: 176; range: 164-188 ng/mL) or cormorants from the same general region. The ratios of concentrations of PFOS in plasma to that in whole blood varied from 2 to 5.

The mean concentration of PFOS in plasma of cormorants from Little Charity Island (mean: 291; range: 209-372 ng/mL) was 3.5 fold greater than those from Huron Island on Lake Superior (mean: 79; range: 63-95 ng/mL). Similarly, blood samples of cormorants from Little Charity Island (mean: 176; range: 164-188 ng/mL) contained 5 fold greater concentrations of PFOS than cormorant blood samples from Hyrn and Otter Islands on Lake Superior (mean: 35; range: 34-36 ng/mL). The results suggest that birds in more urbanized areas have greater exposure to PFOS than those in more remote areas.

PFOS was found in all but one sample of blood plasma from nestling bald eagles collected from the midwestern United States. The mean concentration of PFOS (n=33) in bald eagle plasma was 330 ng/mL (standard deviation: 518 ng/mL; range: <1 – 2220 ng/mL). However, these levels may under represent analyte levels; the mean recovery of PFOS spiked to eagle plasma was only 17% (Table 3). The greatest concentration of PFOS in eagle plasma (2220 ng /mL) was measured in a 50-day old, male bald eagle nestling that was collected from the Pine River, Wisconsin. Blood plasma of bald eagle nestlings from Menard Island, Wisconsin and Wellston, Michigan, were determined to contain PFOS concentrations greater than 1000 ng/mL. All of the blood plasma samples of bald eagles analyzed in this study were from immature birds of less than 70 days old. Despite noticeable concentrations of PFOS in the plasma of bald eagles, livers of adult bald eagles from Oregon, Illinois and California contained related lower concentrations in the range of 24-467 ng/g, wet wt (Table 2).

Other U.S. Locations. Livers of most water birds (n=74) collected across the U.S. contained quantifiable concentrations of PFOS (Table 2). The greatest concentration of PFOS (1780 ng/g, wet wt) was determined in the liver of a Brandt's cormorant from San Diego, California. PFOS concentrations greater than 1000 ng/g, wet wt, were measured in livers of some individuals of red-throated loon from North Carolina, great egret from Florida, and white pelican from California. Almost all the species analyzed in this study were fish-eating water birds. Concentrations of PFOS in liver from Franklin's gull were the lowest of all the species analyzed (<12-61 ng/g, wet wt).

Livers of adult bald eagles collected from various locations contained concentrations of PFOS ranging from 24 to 467 ng/g, wet wt (mean: 193 ng/g). These values were, in general, less than the mean concentration of PFOS in blood plasma of bald eagle nestlings from the midwestern United States.

Baltic Sea. Livers of white tailed sea eagles collected from Germany and the Baltic Sea contained PFOS concentrations ranging from <3.9 to 127 ng/g (mean: 40 ng/g) on a wet wt basis. FOSA, PFOA and PFHS were not found at the quantifiable concentrations (Table 4).

Mediterranean Sea. Concentrations of PFOS in livers of cormorants collected from Cabras lagoon in Sardinia, Italy, ranged from 32 to 150 ng/g, wet wt (n=12; mean: 61 ng/g) (Table 5).

Korea and Japan. Concentrations of PFOS in the blood of black-tailed gulls from Hokkaido, Japan ranged from 2 to 12 ng/ml (mean: 6 ng/ml; n=24). Livers of sea gulls from Hokkaido, Japan contained PFOS in the range of <19 to 226 ng/g, wet wt. Cormorants from Kanagawa prefecture contained detectable concentrations of FOSA, although PFOS concentrations were not quantified in the samples. PFOA and PFHS were rarely found in the birds from Japan and Korea. Livers of black tailed gulls from Korea contained PFOS concentrations ranging from 88 to 500 ng/g, wet wt (mean: 170 ng/g).

Midway Atoll, North Pacific Ocean. PFOS was not detected in livers or kidneys of Laysan or black-footed albatrosses (Table 6). However, samples of sera of all Laysan and black-footed albatrosses contained quantifiable concentrations of PFOS. Concentrations of PFOS in black-footed albatross sera ranged from 3 to 17 ng/mL (mean: 6.2 ng/mL); PFOS levels in Laysan albatross ranged from 5.7 to 34 ng/mL (mean: 14 ng/mL). These two populations are not statistically distinct enough to make conclusions. However, concentrations of PFOS in albatross sera were 10 to 100 fold less than those found in bald eagles from the midwestern United States, adding further suggestive evidence that PFOS levels are lower in birds from remote locations.

Antarctica. Eggs of penguins and tissues of skua did not contain quantifiable concentrations of PFOS or other fluorochemicals analyzed in this study.

REFERENCES

(1) 3M Environmental Laboratory, St. Paul, MN LIMS Report numbers E01-0118, E01-0470, E00-2456, W2845, E00-1386, E00-1634, E00-1922.

TABLE 1. Concentrations (mean) of PFOS in Tissues of Water Birds from the Great Lakes Region. Concentrations are Given in ng/mL for Blood Plasma and Whole Blood and ng/g wet wt for Egg Yolk

Location	Date	PFOS	Remarks
Double crested cormorant blood (Michigan)			
Gull Is., Geo Bay	18-Jul-91	78	
Hyrn Island, Lake Superior	29-Jul-91	36	
Little Charity Is., Lake Huron	25-Jul-91	164-188 (176)	N=2
Otter Island, Lake Superior	29-Jul-91	34	
Scar Crow Is., Thunder Bay	4-Jul-91	132	
St. Matrin Is., Great Lakes	13-Jul-91	124-243 (184)	N=2
Herring gull blood (Michigan)			
Little Charity Is., Lake Huron	29-Jul-91	57-68 (63)	N=2
Double crested cormorant Plasma (Michigan)			
Huron Is., Lake Superior	29-Jul-91	63-95 (79)	N=2
Little Charity Is., Lake Huron	25-Jul-91	209-372 (291)	N=2
Herring gull Plasma (Michigan)			
Little Charity Is., Lake Huron	29-Jul-91	239-391 (315)	N=2
Ring-billed gull egg yolk (Michigan)			
Sulphur Is., Thunder Bay, Lake Huron	9-Jun-95	30-126 (67)	N=3
Double crested cormorant egg yolk			
Lake Winnepegosis, Manitoba, Canada	14-Jun-95	21-220 (157)	N=4
Bald eagle Plasma (Midwestern USA)			
Devils' Lake, Alpena, MI	8-Jun-93	388	58d, F
Roach Point, Chippewa, MI	8-Jun-93	273	42d, M
Sucker Creek, Mackinac, MI	15-Jun-93	160	42d, M
Rabbit Bay, Houghton County, MI	7-Jun-92	144	NA, M
Caulkins Creek, Otsego, MI	4-Jun-90	35	52d, M, 4.7 kg
Harding creek, Montgomery County, MI	6-Jun-90	13	44d, M, 3.4 kg
Boney Falls, Marquette, MI	5-Jun-91	105	42d, F, 3.2 kg
Seney National Wildlife refuge, Schoolcraft County, MI	18-Jun-91	75	45d, M, 3.7 kg
Pine River, WI	13-Jun-91	2220	50d, M, 4.3 kg
Menard Is., WI	13-Jun-91	2030	48d, M, 3.4 kg
Pine Is., Voyagers Natl Park, MN	19-Jun-92	29	46d, F, 4.3 kg
Lake George, Clare County, MI	31-May-93	79	48d, M, 3.4 kg
Swan Lake, Presque Isle County, Great Lakes, MI	7-Jun-93	188	39d, M
Mio Pond, Oscoda County, MI	29-May-93	145	68d, F
Marquette, MI, Lake Superior	21-Jun-92	141	NA, M
Gene's Pond, Dickinson County, MI	5-Jun-91	71	49d, M, 3.5 kg

Table 1 . continued			
Dog Lake/Lake St. Kathryn, Iron County, MI	9-Jun-91	21	37d, M, 3.2 kg
N. Branch Au Sable River, Ostego Count, MI	1-Jun-93	49	58d, F
Woods Lake/Twin Lake, Roscommon County, MI	22-May-93	<1	40d, M
Pt. Movillee, Monroe County, MI	14-May-93	247	40d, M
MSU veterinary clinic (deformed)	7-Sep-93	243	NA
MSU veterinary clinic (deformed)	11-Oct-93	561	NA
MSU veterinary clinic (deformed)	7-Sep-93	289	NA
W. Sandpoint Is., Voyager's Natl Park, MN	20-Jun-92	62	45d, F, 3.6 kg
Wakeley Lake, Crawford County, MI	31-May-93	33	41d, M
Bamfield Pond, Alcona County, MI	29-May-93	102	54d, F
Lower Peninsula, Michigan	28-Jun-93	143	NA
Lower Peninsula, Michigan	28-Jun-93	173	NA
Grand Pt., Voyager's Natl park, MN	23-Jun-92	432	38d, F, 4.7 kg
Wellston, Manistee County, MI	5-Jun-92	1250	F, 4.8 kg
Devil's Is., Lake Superior, WI	24-Jun-92	200	54d, F, 4.7 kg
Mud Creek, Ottawa, Ohio	22-Jun-92	320	67d, M
White's Landing, Ohio	4-Jun-92	328	66d, F

NA: Not available or Not analyzed; M- Male, F-Female

Values in parentheses indicate mean. Values below LOQ are denoted by '<'

Means are calculated only for the detectable observations (i.e., non-detects were not included in calculating means).

TABLE 2. Concentrations of PFOS in Livers (ng/g, wet wt) of Water Birds from Various Locations in the United States.

Species	Location	Date	n	PFOS	Remarks
Bald eagle	NE Portland, Multnomah County, Oregon	3/27/1997	1	207	F/adult, 4.8 kg
Bald eagle	Savannah, Jo Daviess County, Illinois	2/17/1996	1	467	Young adult
Bald eagle	Columbia River, Hammond, Oregon	11/21/1996	1	71	F/adult, 8 kg
Bald eagle	Durham, Butte County, California	2/1/1995	1	24	
Black-crowned night heron	San Diego, California	6/4/1997-5/30/1998	5	32-648 (393)	1 juvenile, 2-3 yrs
Brandt's cormorant	San Diego, California	Jun-1997	2	46-1780 (907)	
Brown pelican	East Pascagoula R., Mississippi	1997	1	254	M/adult, 2.48 kg
Brown pelican	East Pascagoula R., Mississippi	1997	1	533	F/adult, 2.62 kg
Brown pelican	Mustang Island, Nueces County, Texas	10/15/1997	1	118	M/adult, 2.61 kg
Common loon	Carteret County, North Carolina	11/25/1997-4/17/1998	5	160-595 (280)	1adult, 4 immature, 2.6-2.9 kg
Common loon	Monterey Bay, California	1/26/1998	4	8.6-91 (37)	1 M, 3F, 4adults, 2.3-2.7kg
Common loon	Pompano, Florida	12/21/1997-1/1/1998	4	30-46 (40)	1M, 1F, 1 immature
Common loon	Ft. Lauderdale, Florida	2/26/1998	1	115	F/sub-adult

Table 2. continued.,

Common loon	South Carlsbad State Beach, California	11/15/1997	1	<12	
Common loon	San Diego, California	11/26/1997	2	16-107 (62)	
Common loon	Coronado, California	12/4/1997	1	451	
Common loon	San Diego, California	12/4/1997	1	112	
Double-crested cormorant	St. Martinville, Louisiana	Jun-1996	2	51-288 (169)	
Franklin's gull	Red Rock Lakes, Beaverhead County, Montana	7/31/1997- 8/6/1997	4	<12-61 (40)	3 Males, 1 immature, 0.12-0.21 kg
Great black- backed gull	Carteret County, North Carolina	1/7/1998- 3/17/1998	2	187-841 (608)	
Great blue heron	St. Martinville, Louisiana	Jun-1996	2	162-916 (539)	
Great egret	Naples, Florida	5/10/1997- 11/15/1997	3	81-1030 (638)	
Great egret	Carteret County, North Carolina	2/9/1998	1	218	
Great egret	St. Martinville, Louisiana	5/1/1996	1	27	
Great egret	Miami Beach, Florida	Dec-1996	1	500	
Great egret	Swan Lake National Wildlife Refuge, Sumner, Missouri	8/13/1996		171	
Herring gull	Sacramento Valley, California	10/22/1996	1	16	
Herring gull	Carteret County, North Carolina	2/16/1998	4	89-353 (228)	
Northern gannet	Carteret County, North Carolina	3/8/1998	1	85	
Osprey	Tavernier, Florida	9/9/1997 – 9/12/1997	2	444-959 (702)	
Osprey	Carteret County, North	10/22/1997	1	60	

Carolina					
Table 2 continued.,					
Osprey	Delaware County, Ohio	9/28/1996	1	42	
Red-throated loon	Carteret County, North Carolina	2/13/1998-4/12/1998	2	599-1120 (861)	
Red-throated loon	San Diego, California	5/11/1998	1	34	
Snowy egret	Naples, Florida	9/19/1997-11/11/1997	2	99-413 (256)	
Snowy egret	Bonita Springs, Florida	7/19/1997	1	43	
White pelican	Sacramento National Wildlife Refuge, California	7/31/1997	1	121	
White pelican	Swan Lake National Wildlife Refuge, Sumner, Missouri	NA	1	68	
White pelican	Sacramento Valley, California	11/25/1996	1	80	
White pelican	Delevan National Wildlife Refuge, California	8/9/1997	1	200	
White pelican	Calipatria, CA	Jun-1997	2	30-1120 (575)	
White-faced ibis	Sacramento Valley, California	1/3/1995	1	17	
Wood stork	Charleston County, South Carolina	Sep-1996	1	158	F/adult, 2.65 kg

NA: Not available or Not analyzed; M- Male, F-Female

Values in parentheses indicate mean. Values below LOQ are denoted by '<'

Means are calculated only for the detectable observations (i.e., non-detects were not included in calculating means)

TABLE 3. Recoveries (%) of PFOS Spiked at 250 ng to Bird Tissue Matrices

Matrix	MS	MSD
Cormorant yolk	127	130
Albatross kidney	71	87
Albatross serum	81	96
Bald eagle plasma	11	23
Cormorant blood	63	115
Common loon liver	28	28
Herring gull liver	120	120
Cormorant liver	97	97

MS = Matrix spike; MSD = Matrix spike duplicate

TABLE 4. Concentrations (ng/g, wet wt; n=44) of PFOS, FOSA, PFOA and PFHS in white-tailed sea eagle livers from the Baltic coast of Germany collected during 1979-1997

Species	PFOS	FOSA	PFOA	PFHS
White tailed sea eagle liver	40 (<3.9-127)	<38	<40	<7.7

Table 5. Concentrations of PFOS in livers (ng/g, wet wt) of common cormorants from Italian coastal waters

Species	Sampling Area	Date of Collection	PFOS	Remarks
Comorant Liver	Cabras Lagoon (Sardinian Sea)	1997	43	M, adult, 2.4 kg
		1997	57	F, adult, 2.2 kg
		1997	49	F, adult, 2.3 kg
		1997	98	F, ault, 2.33 kg
		1997	34	F, adult, 2.7 kg
		1997	150	F, adult, 2.2 kg
		1997	91	F, juvenile, 2 kg
		1997	47	F, juvenile, 1.4 kg
		1997	50	F, juvenile, 1.96 kg
		1997	43	M, juvenile, 2 kg
		1997	32	M, juvenile, 2.4 kg
		1997	34	M, juvenile, 2.4 kg

TABLE 6. Concentrations of PFOS in Liver, Kidney (ng/g, wet wt) and Sera (ng/mL) of Black-Footed and Laysan Albatrosses from Sand Island, Midway Atoll, North Pacific Ocean

Species	Tissue	N	Date	PFOS
Black-footed albatross	Liver	5	Mar 94-Nov 94	<30
	Kidney	5	Mar 94-Apr 94	<30
	Serum	8	May 93-Nov 95	3.0-17 (6.2)
Laysan albatross	Liver	3	Feb 94-Mar 94	<30
	Kidney	3	Feb 94-Apr 94	<30
	Serum	7	May 93-Nov 94	5.7-34 (14)

Values below LOQ are denoted by '<'

Values in parentheses indicate mean. Means are calculated only for the detectable observations

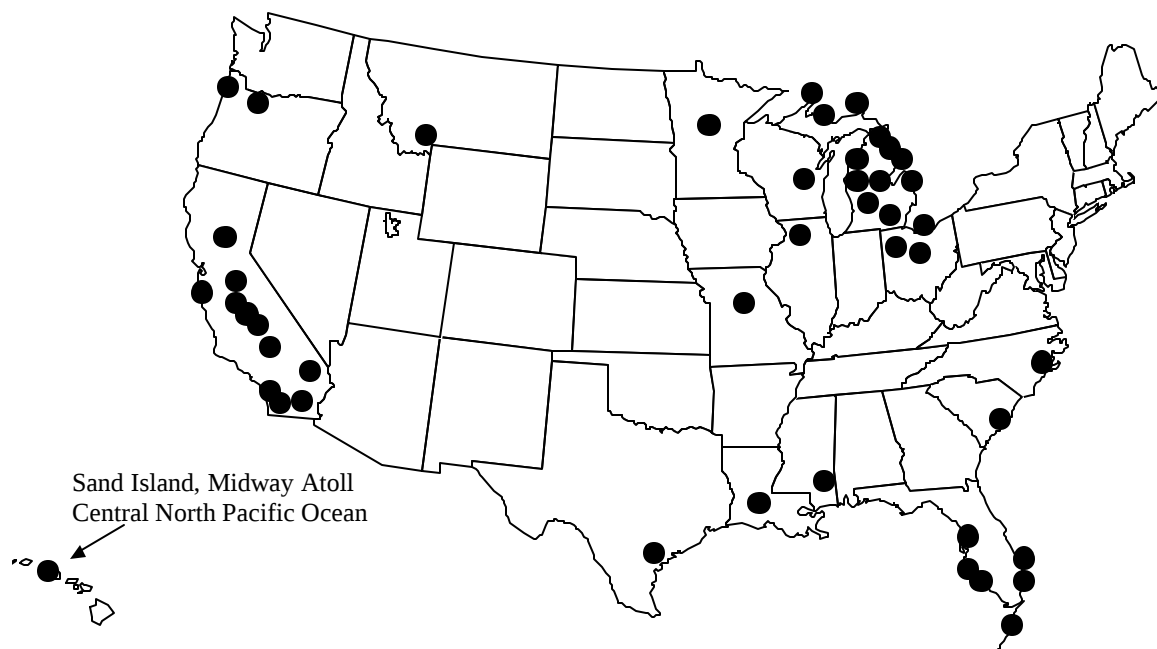


Figure 1. Map of the United States showing sampling locations of birds analyzed in this study.

APPENDIX I

Concentrations of (ug/ml for blood) fluorochemicals in biota

Species	Lab ID	Tissue	Location	PFOS	FOSA	PFOA
Double crested cormorant	W2491-54,Cormorant DCCO L Charity	Blood	Little Charity Is., Great Lakes	0.190	<LOQ (0.0375)	<LOQ (0.0359)
Double crested cormorant	W2491-55,Cormorant DCCO Hyrn Island, Lake Sup	Blood	Lake Superior, Great Lakes	0.042	<LOQ (0.0375)	<LOQ (0.0359)
Double crested cormorant	W2491-56,Otter DCCO Great Lakes	Blood	Lake Superior, Great Lakes	0.039	0.112	<LOQ (0.0359)

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

LOQ = Limit of quantitation

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

Numbers in the parenthesis are LOQs

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	FOSA	PFOA
Common loon	Bird001;4411-010	Liver	Carteret County, NC	0.345	0.015	<LOQ (0.180 ug/g)
Common loon	Bird002;4411-003	Liver	Carteret County, NC	0.689	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Common loon	Bird003;4411-021	Liver	Carteret County, NC	0.185	0.015	<LOQ (0.180 ug/g)
Common loon	Bird004; 4411-001	Liver	Carteret County, NC	0.199	0.026	<LOQ (0.180 ug/g)
Common loon	Bird005; 4411-015	Liver	Carteret County, NC	0.202	0.021	<LOQ (0.180 ug/g)
Common loon	Bird006; 4425-006	Liver	Monterey Bay, CA	0.105	0.024	<LOQ (0.180 ug/g)
Common loon	Bird007; 4425-002	Liver	Monterey Bay, CA	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Common loon	Bird008; 4425-007	Liver	Monterey Bay, CA	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Common loon	Bird009; 4425-008	Liver	Monterey Bay, CA	0.046	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Brown pelican	Bird010; 14712-002	Liver	East Pascagoula R., MS	0.294	0.178	<LOQ (0.180 ug/g)
Brown pelican	Bird011;14712-001	Liver	East Pascagoula R., MS	0.617	0.527	<LOQ (0.180 ug/g)
Black footed albatross	Bird012;9511	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird013; 9402	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird014; 9404	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird015; 9401	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird016; 9406	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird020; 9406	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird021; 9422	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird022; 9417	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	0.182
Black footed albatross	Bird017; 9401	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird018; 9404	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Black footed albatross	Bird019; 9407	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird023; 9413	Liver	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird024; 9424	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird025; 9413	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Laysan albatross	Bird026; 9422	Kidney	Sand Is., Midway Atoll	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Double crested cormorant	Bird027; DCC1	Yolk	Lake Winnipeg	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)

Double crested cormorant	Bird028; DCC2	Yolk	Lake Winnipeg	0.134	<LOQ (0.00750 ug/g)	0.245
Double crested cormorant	Bird029; DCC3	Yolk	Lake Winnipeg	0.317	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Double crested cormorant	Bird030; DCC4	Yolk	Lake Winnipeg	0.254	<LOQ (0.00750 ug/g)	0.192
Ring billed gull	Bird031; RBG5	Yolk	Sulphur Is., Great Lakes	0.146	<LOQ (0.00750 ug/g)	0.197
Ring billed gull	Bird032; RBG9	Yolk	Sulphur Is., Great Lakes	<LOQ (0.0348 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.180 ug/g)
Ring billed gull	Bird033; RBG8	Yolk	Sulphur Is., Great Lakes	0.0541	<LOQ (0.00750 ug/g)	0.196
Laysan albatross	Bird 034; pool of 3	Serum	Sand Is., Midway Atoll	0.0393	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Laysan albatross	Bird 035; pool of 3	Serum	Sand Is., Midway Atoll	0.0256	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Laysan albatross	Bird 036; pool of 3	Serum	Sand Is., Midway Atoll	0.00755	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 037; 1993	Serum	Sand Is., Midway Atoll	0.0196	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 038; 1273-1300	Serum	Sand Is., Midway Atoll	0.00348	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 039; 1307-07581	Serum	Sand Is., Midway Atoll	0.00677	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 040; pool 2, 1117-83377	Serum	Sand Is., Midway Atoll	0.00621	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 041; 1067-22375	Serum	Sand Is., Midway Atoll	0.00430	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 042; 1307-07625	Serum	Sand Is., Midway Atoll	0.00402	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Blackfooted albatross	Bird 043; 1067-22226	Serum	Sand Is., Midway Atoll	0.00546	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Laysan albatross	Bird 044; 1367-32748	Serum	Sand Is., Midway Atoll	0.00897	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Laysan albatross	Bird 045; 977-49069	Serum	Sand Is., Midway Atoll	0.00657	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Laysan albatross	Bird 046; 977-49089	Serum	Sand Is., Midway Atoll	0.00889	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 047; DCC01	Plasma	Little Charity Is., Lake Huron	0.431	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 048; DCC 3,6	Plasma	Little Charity Is., Lake Huron	0.242	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)

Double crested cormorant	Bird 049; DCC 1,5	Plasma	Huron Is., Lake Superior	0.110	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 050; DCC 3,4	Plasma	Huron Is., Lake Superior	0.0725	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 051	Blood	Little Charity Is., Lake Huron	0.218	0.0145	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 052	Blood	Scar Crow Is., Thunder Bay	0.153	0.00871	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 053	Blood	Gull Is., Geo Bay	0.090	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 054	Blood	St. Matrin Is., Great Lakes	0.144	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Double crested cormorant	Bird 055	Blood	St. Matrin Is., Great Lakes	0.273	0.0426	0.0489
Herring gull	Bird 056; HG1	Plasma	Little Charity Is., Lake Huron	0.453	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Herring gull	Bird 057; HG2	Plasma	Little Charity Is., Lake Huron	0.277	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Herring gull	Bird 058; HG1	Blood	Little Charity Is., Lake Huron	0.0790	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Herring gull	Bird 059; HG2	Blood	Little Charity Is., Lake Huron	0.0664	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 060; 629-39346	Plasma	Devils' Lake, Great Lakes	0.449	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 061; 599-46888	Plasma	Roach Point, Great Lakes	0.316	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 062; 629-39429	Plasma	Sucker Creek, Bois Blanc Is.	0.185	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 063; 599-46837	Plasma	Rabbit Bay, Houghton County	0.167	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 064; 629-35417	Plasma	Caulkins creek, Michigan	0.0402	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 065; 629-35423	Plasma	Harding creek, Michigan	0.0147	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 066; 599-45234	Plasma	Boney Falls, Marquette, MI	0.122	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 067; 599-45208	Plasma	Seney wildlife refuge, MI	0.0865	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 068; 629-35399	Plasma	Pine River, Wisconsin	2.57	0.0751	<LOQ (0.0299 ug/mL)

Bald Eagle	Bird 069; 629-35397	Plasma	Menard Is., Wisconsin	2.35	0.0996	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 070; 629-14589	Plasma	Pine Is., Voyagers Natl Park, MN	0.0324	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 071; 629-39416	Plasma	Lake George, MI	0.0908	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 072; 629-39424	Plasma	Swan Lake, MI	0.217	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 073; BAEAMI93011	Plasma	Mio Pond, MI	0.168	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 074; 629-14598	Plasma	Salmon trout River, Lake Superior	0.163	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 075; 599-45233	Plasma	Gene Pond, Dickinson County, MI	0.0822	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 076; 599-45238	Plasma	Lake St. Kathryn, MI	0.0238	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 077; 629-39418	Plasma	N. Brach Au Sable River, MI	0.0573	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 078; 629-39301	Plasma	Woods Lake, MI	<LOQ (0.00116 ug/mL)	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 079; 629-39401	Plasma	Pt. Movillee, Great Lakes, MI	0.286	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 080; DEFBAEA93032	Plasma	MSU veterinary clinic	0.281	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 081; DEFBAEA93049	Plasma	MSU veterinary clinic	0.649	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 082; DEFBAEA93030	Plasma	MSU veterinary clinic	0.335	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 083; 629-07409	Plasma	W. sandpoint Is., Voyager's Natl park, MN	0.0718	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 084; 629-39326	Plasma	Wakeley Lake, MI	0.0381	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)
Bald Eagle	Bird 085; BAEAMI93062	Plasma	Bamfield Pond, MI	0.118	<LOQ (0.00625 ug/mL)	<LOQ (0.0299 ug/mL)

PFOS = Perfluorooctanesulfonate
PFHS = Perfluorohexanesulfonate
PFOA = Perfluorooctanoate

FOSA = Perfluorooctanesulfonamide
Values in parenthesis are LOQs

LOQ = Limit of quantitation

APPENDIX III

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

Species	Lab ID	Tissue	Location	PFOS	PFOA	FOSA	PFHS
Comorant	6F (1),F,A	Liver	Mediterranean Sea	0.043	0.041	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	29F (5),F,A	Liver	Mediterranean Sea	0.057	0.102	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	30F (6),F,A	Liver	Mediterranean Sea	0.049	0.051	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	32F (7),F,A	Liver	Mediterranean Sea	0.098	0.090	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	34F (9),F,A	Liver	Mediterranean Sea	0.034	0.030	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	42F (11),F,A	Liver	Mediterranean Sea	0.150	0.143	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	7F (2),F,J	Liver	Mediterranean Sea	0.091	0.084	0.089	< LOQ (0.00683 ug/g)
Comorant	9F (3),F,J	Liver	Mediterranean Sea	0.468	0.444	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	36F (10),F,J	Liver	Mediterranean Sea	0.050	0.047	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	22F (4),M,J	Liver	Mediterranean Sea	0.043	0.045	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	33F (8),M,J	Liver	Mediterranean Sea	0.032	0.030	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Comorant	44F (12),M,J	Liver	Mediterranean Sea	0.034	0.029	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BHG01 (100)	Liver	Korea	0.292	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BHG02 (101)	Liver	Korea	0.260	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BHG03 (102)	Liver	Korea	0.148	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BHG04 (103)	Liver	Korea	0.503	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BHG05 (104)	Liver	Korea	0.271	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9305 (92)	Liver	Korea	0.0881	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9306 (99)	Liver	Korea	0.107	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9310 (96)	Liver	Korea	0.215	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9311 (98)	Liver	Korea	0.143	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9312 (97)	Liver	Korea	0.0705	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTG9401 (93)	Liver	Korea	0.126	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTGhongdo1 (94)	Liver	Korea	0.0737	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	BTGnando1 (95)	Liver	Korea	0.0707	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	HRG04 (106)	Liver	Korea	0.116	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)
Blacktailed Gull Liver	HRG09 (105)	Liver	Korea	0.0939	<LOQ (0.0359 ug/g)	<LOQ (0.0376 ug/g)	< LOQ (0.00683 ug/g)

PFOS = Perfluorooctanesulfonate
PFHS = Perfluorohexanesulfonate

FOSA = Pefluorooctanesulfonamide
PFOA = Perfluorooctanoate

LOQ = Limit of quantitation
Values in parenthesis are LOQs

APPENDIX IV

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

Species	Sample id	Tissue	Location	PFOS	PFHS	PFOA	FOSA
Black tailed gull	99BTG750 (25)	Blood	Hokkaido, Japan	0.00214	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG769 (26)	Blood	Hokkaido, Japan	0.00646	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG770 (27)	Blood	Hokkaido, Japan	0.00910	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG751 (28)	Blood	Hokkaido, Japan	0.00968	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG771 (29)	Blood	Hokkaido, Japan	0.00523	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG756 (30)	Blood	Hokkaido, Japan	0.00541	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG754 (31)	Blood	Hokkaido, Japan	0.00479	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG755 (32)	Blood	Hokkaido, Japan	0.00640	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG757 (33)	Blood	Hokkaido, Japan	0.00346	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG753 (34)	Blood	Hokkaido, Japan	0.00731	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG772 (35)	Blood	Hokkaido, Japan	0.0110	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG764 (36)	Blood	Hokkaido, Japan	0.00278	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG539 (37)	Blood	Hokkaido, Japan	0.00668	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG523 (38)	Blood	Hokkaido, Japan	0.00223	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG527 (39)	Blood	Hokkaido, Japan	0.00640	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
	99BTG536 (40)	Blood	Hokkaido, Japan	0.00866	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG518 (41)	Blood	Hokkaido, Japan	0.00295	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG537 (42)	Blood	Hokkaido, Japan	0.00479	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG534 (45)	Blood	Hokkaido, Japan	0.0114	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG531 (46)	Blood	Hokkaido, Japan	0.0104	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	0.00198
Black tailed gull	99BTG533 (47)	Blood	Hokkaido, Japan	0.00685	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG535 (48)	Blood	Hokkaido, Japan	0.00363	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG538 (49)	Blood	Hokkaido, Japan	0.01264	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)
Black tailed gull	99BTG525 (50)	Blood	Hokkaido, Japan	0.00374	<LOQ (1.00 ng/mL)	<LOQ (2.50 ng/mL)	<LOQ (1.00 ng/mL)

PFOS = Perfluorooctanesulfonate
PFHS = Perfluorohexanesulfonate

FOSA = Perfluorooctanesulfonamide
PFOA = Perfluorooctanoate

LOQ = Limit of quantitation
Values in parenthesis are LOQs

APPENDIX V

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

Species	Lab ID	Tissue	Location	PFOS	PFHS	PFOA	FOSA
Great Egret	(130)4390-004	Liver	Naples, FL	0.930	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Egret	(131)4428-001	Liver	Carteret County, NC	0.252	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.02
Great Egret	(132)4313-001	Liver	St. Martinville, LA	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Egret	(133)4387-001	Liver	Miami Beach, FL	0.577	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Egret	(134)4335-001	Liver	Sumner, MO	0.198	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Egret	(135)4390-002	Liver	Naples, Florida	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Egret	(136)4390-001	Liver	Naples, Florida	1.19	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Wood Stork	(137)4350-001	Liver	Charleston county, South Carolina	0.183	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
White-faced Ibis	(138)4370-001	Liver	Sac Valley, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Black-Crowned Night Heron	(139)4309-002	Liver	San Diego, California	0.374	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Snowy Egret	(140)4394-002	Liver	Naples, FL	0.478	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.02
Snowy Egret	(141)4394-003	Liver	Naples, FL	0.114	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Snowy Egret	(142)4394-001	Liver	Bonita Springs, FL	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Black-Crowned Night Heron	(143)4309-010	Liver	San Diego, California	0.615	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Black-Crowned Night Heron	(144)4309-003	Liver	San Diego, California	0.484	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.02
Black-Crowned Night Heron	(145)4309-005	Liver	San Diego, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Black-Crowned Night Heron	(146)4309-008	Liver	San Diego, California	0.750	0.00947	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)

Franklin's Gull	(147)15570-002	Liver	Red Rock Lakes, Montana	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Franklin's Gull	(148)15570-004	Liver	Red Rock Lakes, Montana	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Franklin's Gull	(149)15570-001	Liver	Red Rock Lakes, Montana	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Franklin's Gull	(150)15570-003	Liver	Red Rock Lakes, Montana	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
White Pelican	(151)4374-002	Liver	Sacramento National Wildlife Refuge, California	0.139	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
White Pelican	(152)4386-001	Liver	Sumner, MO	0.0792	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
White Pelican	(153)4374-001	Liver	Sacramento Valley, California	0.0923	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
White Pelican	(154)4374-003	Liver	Delevan National Wildlife Refuge, California	0.232	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Brown Pelican	(155)15526-001	Liver	Mustang Island, Nueces County, Texas	0.136	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Northern Gannet	(156)4430-001	Liver	Carteret County, NC	0.0975	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Herring Gull	(157)4369-001	Liver	Sacramento Valley, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Herring Gull	(158)4415-006	Liver	Carteret County, NC	0.188	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Herring Gull	(159)4415-005	Liver	Carteret County, NC	0.103	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Herring Gull	(160)4415-001	Liver	Carteret County, NC	0.408	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Herring Gull	(161)4415-004	Liver	Carteret County, NC	0.358	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Black-backed Gull	(162)4423-002	Liver	Carteret County, NC	0.973	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Great Black-backed Gull	(163)4423-001	Liver	Carteret County, NC	0.217	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Common loon	(164)4379-018	Liver	Pompano, FL	<LOQ (0.0750 ug/g)	0.185	<LOQ (0.0187 ug/g)	0.01
Common loon	(165)4379-020	Liver	Pompano, FL	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Common loon	(166)4379-014	Liver	Pompano, FL	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)

Common loon	(167)4379-068	Liver	Ft. Lauderdale, FL	0.133	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Common loon	(168)4379-021	Liver	Pompano, FL	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Bald Eagle	(169)14820-001	Liver	NE Portland, Multnomah County, Oregon	0.237	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Bald Eagle	(170)4310-001	Liver	Savannah, Jo Daviess County, Illinois	0.541	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.09
Bald Eagle	(171)14820-002	Liver	Columbia River, Hammond, Oregon	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Bald Eagle	(172)4373-001	Liver	Durham, Butte County, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Osprey	(173)4400-001	Liver	Tavernier, Florida	0.514	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Osprey	(174)4422-001	Liver	Carteret County, NC	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Osprey	(175)4400-002	Liver	Tavernier, Florida	1.11	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Osprey	(176)4342-001	Liver	Delaware County, Ohio	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	<LOQ (0.00750 ug/g)
Red-throated Loon	(177)4429-003	Liver	Carteret County, NC	0.693	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.08
Red-throated Loon	(178)4435-001	Liver	San Diego, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Red-throated Loon	(179)4429-001	Liver	Carteret County, NC	1.29	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.12
Common loon	(180)4402-008	Liver		0.124	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Common loon	(181)4402-002	Liver	South Carlsbad State Beach, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.02
Common loon	(182)4402-005	Liver	San Diego, California	<LOQ (0.0750 ug/g)	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
Common loon	(183)4402-006	Liver	Coronado, California	0.522	0.00982	<LOQ (0.0187 ug/g)	0.01
Common loon	(184)4402-007	Liver	32nd St. Naval Station, California	0.130	<LOQ (0.00750 ug/g)	<LOQ (0.0187 ug/g)	0.01
PFOS = Perfluorooctanesulfonate PFHS = Perfluorohexanesulfonate;				FOSA = Perfluorooctanesulfonamide PFOA = Perfluorooctanoate		LOQ = Limit of quantitation Values in parenthesis are LOQs	

APPENDIX VI

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	PFHS
Skua	(37) SK1L	Liver	Antarctica	< LOQ (0.0188 ug/g)	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Skua	(38) SK1K	Kidney	Antarctica	< LOQ (0.0188 ug/g)	< LOQ (0.0750 ug/g)	< LOQ (0.0374 ug/g)	< LOQ (0.0188 ug/g)
Skua	(39) SK1H	Heart	Antarctica	< LOQ (0.0188 ug/g)	< LOQ (0.0750 ug/g)	< LOQ (0.0374 ug/g)	< LOQ (0.0188 ug/g)
Sea Gull	(45) SG28	Liver	Japan	0.0456	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(46) 980514	Liver	Japan	0.0247	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(47) SG20	Liver	Japan	0.0540	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(48) SG11	Liver	Japan	< LOQ (0.0188 ug/g)	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(49) SG29	Liver	Japan	0.0438	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(50) SG15	Liver	Japan	0.0322	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(51) SG26	Liver	Japan	0.0374	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(52) SG35	Liver	Japan	0.0536	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(53) SG1-3	Liver	Japan	0.0624	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(54) SG31	Liver	Japan	0.0483	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(55) SG1-2	Liver	Japan	0.0498	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(56) SG30	Liver	Japan	0.0301	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(57) SG16	Liver	Japan	0.0307	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(58) SG17	Liver	Japan	0.0229	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)

Sea Gull	(59) SG32	Liver	Japan	0.0563	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(60) SG27	Liver	Japan	0.0597	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(61) SG34	Liver	Japan	0.0480	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	X
Sea Gull	(62) SG24	Liver	Japan	0.0892	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(63) SG19	Liver	Japan	0.0526	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(64) SG43	Liver	Japan	0.0758	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea Gull	(65) SGHanAP	Liver	Japan	0.226	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Spotted duck	(66) SPDUK	Liver	Japan	X	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Black-headed gull	(67) BHG	Liver	Japan	< LOQ (0.0188 ug/g)	< LOQ (0.0750 ug/g)	X	< LOQ (0.00750 ug/g)
Kite	(68) K092999	Liver	Japan	X	< LOQ (0.0750 ug/g)	X	X
Kite	(69) K091299	Liver	Japan	X	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Heron	(70) H101797	Liver	Japan	X	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Heron	(71) H072898	Liver	Japan	X	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Sea gull	(72) SG40	Liver	Japan	0.0359	< LOQ (0.0750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(73) CMR99022-02	Liver	Japan	X	0.133	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(74) CMR99022-01	Liver	Japan	X	0.189	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(75) CMR99022-06	Liver	Japan	X	0.136	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(76) CMR99022-09	Liver	Japan	X	0.151	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(77) CMR99022-08	Liver	Japan	X	0.188	< LOQ (0.0188 ug/g)	< LOQ (0.00750 ug/g)
Cormorant	(78) CMR99022-12	Liver	Japan	X	0.215	< LOQ (0.0188 ug/g)	0.0103
Cormorant	(79)	Liver	Japan	X	0.160	< LOQ (0.0188 ug/g)	< LOQ

Cormorant	CMR99022-07 (80)	Liver	Japan	X	0.111	ug/g) < LOQ (0.0188	(0.00750 ug/g) < LOQ
Cormorant	CMR99022-05 (81)	Liver	Japan	X	0.147	ug/g) < LOQ (0.0188	(0.00750 ug/g) < LOQ
Cormorant	CMR99022-04 (82)	Liver	Japan	X	0.0988	ug/g) < LOQ (0.0188	(0.00750 ug/g) < LOQ
Bald eagle	CMR99022-03 (130) WDL373	Liver	Michigan, USA	1.74	<LOQ (0.0750 ug/g)	ug/g) < LOQ (0.0188	(0.00750 ug/g) < LOQ (0.0188
Bald eagle	(131) WDL373	Kidney	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(132) WDL373	Gall bladder	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(133) WDL373	Muscle	Michigan, USA	0.0962	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(134) WDL374	Liver	Michigan, USA	0.394	<LOQ (0.0750 ug/g)	ug/g) < LOQ (0.0188	ug/gL) < LOQ (0.0188
Bald eagle	(135) WDL374	Testes	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(136) WDL377	Muscle	Michigan, USA	0.0793	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(137) WDL377	Kidney	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(138) WDL378	Muscle	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(139) WDL378	Liver	Michigan, USA	0.0754	<LOQ (0.0750 ug/g)	ug/g) < LOQ (0.0188	ug/g) < LOQ (0.0188
Bald eagle	(140) WDL378	Kidney	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(141) WDL378	Ovary	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(142) WDL379	Muscle	Michigan, USA	0.0139	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(143) WDL379	Liver	Michigan, USA	0.0791	<LOQ (0.0750 ug/g)	ug/g) < LOQ (0.0188	ug/g) < LOQ (0.0188
Bald eagle	(144) WDL381	Muscle	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	ug/g) < LOQ (0.0188
Bald eagle	(145) WDL381	Liver	Michigan, USA	0.0265	<LOQ (0.0375 ug/g)	ug/g) <LOQ (0.0374	< LOQ (0.00375 ug/g)
Bald eagle	(146) WDL381	Kidney	Michigan, USA	X	<LOQ (0.0750 ug/g)	ug/g) <LOQ (0.0374	< LOQ (0.0188

Bald eagle	(147) WDL382	Muscle	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0750 ug/g)	ug/g <LOQ (0.0374 ug/g)	ug/g < LOQ (0.0188 ug/g)
Bald eagle	(148) WDL382	Liver	Michigan, USA	0.0472	<LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00375 ug/g)
Chicken	(149) CHKLIV1	Liver	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00375 ug/g)
Chicken	(150) CHKLIV2	Liver	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00375 ug/g)
Chicken	(151) CHKLIV3	Liver	Michigan, USA	<LOQ (0.0075 ug/g)	<LOQ (0.0375 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.00375 ug/g)
Cormorant	(1) 18301	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(2) 18302	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(3) 18303	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(4) 18304	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(5) 18305	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(6) 18306	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(7) 18307	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(8) 18308	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00165
Cormorant	(9) 18309	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(10) 18310	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00159

Cormorant	(11) 18311	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(12) 18312	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(13) 18313	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(14) 18314	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00168
Cormorant	(15) 18315	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(16) 18316	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(17) 18319	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(18) 18320	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00194
Cormorant	(19) 18321	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(20) 18322	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(21) 18323	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Cormorant	(22) 18324	Whole blood	India	< LOQ (0.00314 ug/mL)	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	< LOQ (0.00125 ug/mL)
Bald eagle	(23) AL01	Plasma	Alabama, USA	1.36	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00283
Bald eagle	(24) AL02	Plasma	Alabama, USA	1.37	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00215
Bald eagle	(25) AL03	Plasma	Alabama, USA	0.918	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00254

Bald eagle	(26) AL04	Plasma	Alabama, USA	0.920	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00205
Bald eagle	(27) SC01	Plasma	South Carolina, USA	0.235	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00265
Bald eagle	(28) SC02	Plasma	South Carolina, USA	0.378	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00630
Bald eagle	(29) SC03	Plasma	South Carolina, USA	0.378	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00726
Bald eagle	(30) SC04	Plasma	South Carolina, USA	0.263	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00541
Bald eagle	(31) SC05	Plasma	South Carolina, USA	0.247	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00660
Bald eagle	(32) SC06	Plasma	South Carolina, USA	0.823	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.0118
Bald eagle	(33) SC07	Plasma	South Carolina, USA	0.828	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.0135
Bald eagle	(34) SC08	Plasma	South Carolina, USA	1.31	0.0170	< LOQ (0.00624 ug/mL)	0.0293
Bald eagle	(35) SC09	Plasma	South Carolina, USA	1.99	0.0239	< LOQ (0.00624 ug/mL)	0.0526
Bald eagle	(36) SC10	Plasma	South Carolina, USA	0.431	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.0286
Bald eagle	(37) SC11	Plasma	South Carolina, USA	0.490	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.0317
Bald eagle	(38) SC12	Plasma	South Carolina, USA	0.880	< LOQ (0.0125 ug/mL)	< LOQ (0.00624 ug/mL)	0.00683
Great Horned Owl	(1) HGBN1-A	Whole egg homogenate	Michigan, USA	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Great Horned Owl	(2) HGBN2-B	Whole egg homogenate	Michigan, USA	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Great Horned Owl	(3) KMS001-B	Whole egg homogenate	Michigan, USA	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Tree Swallow	(4) Composite 1	Whole egg homogenate	Michigan, USA	0.0518	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Tree Swallow	(5) Composite 2	Whole egg homogenate	Michigan, USA	0.0998	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Tree Swallow	(6) Composite 3	Whole egg homogenate	Michigan, USA	0.0546	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Tree Swallow	(7) Composite 2	Whole egg homogenate	Michigan, USA	0.0709	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)

Tree Swallow	(8) Composite 1	Whole egg homogenate	Michigan, USA	0.0607	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(9) J1	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(10) J2	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(11) J90	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(12) H2	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(13) D10	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(14) D2	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(15) B5	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(16) B4	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(17) A3	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Adelie Penguin	(18) K3	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Skua eggs	(19) S1	Whole egg homogenate	Antarctica	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Skua eggs	(20) S2	Whole egg homogenate	Antarctica	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Skua eggs	(21) S5	Whole egg homogenate	Antarctica	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Skua eggs	(22) S6	Whole egg homogenate	Antarctica	X	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Caspian tern eggs	(23) CSN100-109	Whole egg homogenate	Michigan, USA	2.25	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Caspian tern eggs	(24) CDF130-139	Whole egg homogenate	Michigan, USA	3.35	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Caspian tern eggs	(29) CPT001-010	Whole egg homogenate	Michigan, USA	1.91	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Caspian tern eggs	(32) HGH140-149	Whole egg homogenate	Michigan, USA	2.91	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
DC cormorant	(25) SRC060-	Whole egg	Michigan, USA	1.81	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)

DC cormorant	069 (26) WRK090-	homogenate Whole egg	Michigan, USA	1.21	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
DC cormorant	099 (27) TAQ020-	homogenate Whole egg	Michigan, USA	1.29	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
DC cormorant	029 (28) CSN120-	homogenate Whole egg	Michigan, USA	1.69	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
DC cormorant	129 (30) LGG030-	homogenate Whole egg	Michigan, USA	0.571	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
DC cormorant	039 (31) ELM166-	homogenate Whole egg	Michigan, USA	0.960	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
Herring gull eggs	174 (33) LCH011-	homogenate Whole egg	Michigan, USA	0.355	< LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)	ug/g < LOQ (0.0188 ug/g)
Herring gull eggs	019 NA	homogenate Whole egg	Michigan, USA	NA	NA	ug/g NA	ug/g NA
Chicken eggs	(34) CHKEG001	homogenate Whole egg	Michigan, USA	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Chicken eggs	(35) CHKEG002	homogenate Whole egg	Michigan, USA	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)
Chicken eggs	(36) CHKEG003	homogenate Whole egg	Michigan, USA	<LOQ (0.00750 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)	< LOQ (0.0188 ug/g)

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

LOQ = Limit of quantitation
NA = Not analyzed
X = Detected, not quantified

Values in parenthesis are LOQs

APPENDIX VII

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

Species	Sample id	Tissue	Location	PFOS	FOSA	PFOA	PFHS
Sea Eagle Liver	26 (7)	Liver	Poland	0.0288	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Sea Eagle Liver	27 (9)	Liver	Poland	0.0586	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Sea Eagle Liver	28 (11)	Liver	Poland	0.0408	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Sea Eagle Liver	29 (3)	Liver	Poland	0.0758	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Sea Eagle Liver	30 (1)	Liver	Poland	< LOQ (0.0039 ug/g)	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)
Sea Eagle Liver	31 (8)	Liver	Poland	0.0754	<LOQ (0.0038 ug/g)	<LOQ (0.00803 ug/g)	<LOQ (0.0038 ug/g)

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

LOQ = Limit of quantitation

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

Values in parenthesis are LOQs

APPENDIX VIII

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

Species	Sample id	Tissue	Location	PFOS	FOSA	PFOA	PFHS
Sea Eagle	(81) No1, 11/02/00	Liver	Baltic Sea/Germany	0.0297	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(82) No2, 20/01/00	Liver	Baltic Sea/Germany	0.0335	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(83) No3, 28/02/00	Liver	Baltic Sea/Germany	0.03176	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(84) No4, Jan 2001	Liver	Baltic Sea/Germany	0.0634	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(85) No5, 3/06/00	Liver	Baltic Sea/Germany	0.0444	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(86) No6, Oct00	Liver	Baltic Sea/Germany	0.0620	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(87) No7, Oct00	Liver	Baltic Sea/Germany	0.0107	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(88) No8, UNK	Liver	Baltic Sea/Germany	0.0244	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)

Sea Eagle	(89) BB, 94/18	Liver	Baltic Sea/Germany	0.0328	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(90) 87/18	Liver	Baltic Sea/Germany	0.0405	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(91) SA 93/17	Liver	Baltic Sea/Germany	0.0233	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(92) S92/1	Liver	Baltic Sea/Germany	0.0380	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(93) MV91/4	Liver	Baltic Sea/Germany	0.00801	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(94) S93/7	Liver	Baltic Sea/Germany	0.108	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(95) 94/6	Liver	Baltic Sea/Germany	0.0115	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(96) 79/6	Liver	Baltic Sea/Germany	<LOQ (0.0039 ug/g)	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(97) MV92/3	Liver	Baltic Sea/Germany	0.127	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(98) S96/7	Liver	Baltic Sea/Germany	0.0650	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(99) MV 94/19	Liver	Baltic Sea/Germany	0.0585	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(100) BB 94/4	Liver	Baltic Sea/Germany	0.0166	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(101) BB 94/9	Liver	Baltic Sea/Germany	0.0338	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(102) BB 93/19	Liver	Baltic Sea/Germany	0.0398	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(103) MV 91/8	Liver	Baltic Sea/Germany	0.0256	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(104) S 97/22	Liver	Baltic Sea/Germany	0.0996	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(105) S 98/18	Liver	Baltic Sea/Germany	0.0421	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(106) BB 92/20	Liver	Baltic Sea/Germany	0.0368	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(107) MV 92/21	Liver	Baltic Sea/Germany	0.0124	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(108) 79/8	Liver	Baltic Sea/Germany	0.0113	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)

Sea Eagle	(109) MV 92/2	Liver	Baltic Sea/Germany	0.0238	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(110) 89/6	Liver	Baltic Sea/Germany	<LOQ (0.0039 ug/g)	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(111) M 87/21	Liver	Baltic Sea/Germany	0.0258	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(112) 90/7	Liver	Baltic Sea/Germany	<LOQ (0.0039 ug/g)	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(113) MV 95/5	Liver	Baltic Sea/Germany	0.1197	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(114) 89/1	Liver	Baltic Sea/Germany	0.0210	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(115) MV 92/9	Liver	Baltic Sea/Germany	0.0119	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(116) MV 91/10	Liver	Baltic Sea/Germany	0.0208	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(117) 190/3	Liver	Baltic Sea/Germany	<LOQ (0.0039 ug/g)	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(118) MV 94/11	Liver	Baltic Sea/Germany	0.0281	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(119) MV 90/9	Liver	Baltic Sea/Germany	0.0351	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(120) 79/5	Liver	Baltic Sea/Germany	0.0495	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(121) BB 94/2	Liver	Baltic Sea/Germany	0.0105	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(122) MV 93/2	Liver	Baltic Sea/Germany	0.0375	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(123) MV 91/12	Liver	Baltic Sea/Germany	0.0301	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(124) 90/4	Liver	Baltic Sea/Germany	0.0432	<LOQ (0.0381 ug/g)	<LOQ (0.0402 ug/g)	<LOQ (0.00773 ug/g)
Sea Eagle	(1) IT01	Whole blood	Mediterranean/Italy	0.0098	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0018
Sea Eagle	(2) IT02	Whole blood	Mediterranean/Italy	0.0041	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0019
Sea Eagle	(3) IT03	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0013
Sea Eagle	(4) IT04	Whole blood	Mediterranean/Italy	0.0045	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0020

Sea Eagle	(5) IT05	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0013
Sea Eagle	(6) IT06	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0017
Sea Eagle	(7) IT07	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0014
Sea Eagle	(8) IT08	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0013
Sea Eagle	(9) IT09	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(10) IT10	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0016
Sea Eagle	(11) IT11	Whole blood	Mediterranean/Italy	0.0041	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(12) IT12	Whole blood	Mediterranean/Italy	0.0033	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(13) IT13	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(14) IT14	Whole blood	Mediterranean/Italy	0.0047	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(15) IT15	Whole blood	Mediterranean/Italy	0.0069	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(16) IT16	Whole blood	Mediterranean/Italy	0.0084	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(17) IT17	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(18) IT18	Whole blood	Mediterranean/Italy	0.0041	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0021
Sea Eagle	(19) IT19	Whole blood	Mediterranean/Italy	0.0041	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(20) IT20	Whole blood	Mediterranean/Italy	0.0077	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0017
Sea Eagle	(21) IT21	Whole blood	Mediterranean/Italy	0.0065	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0019
Sea Eagle	(22) IT22	Whole blood	Mediterranean/Italy	0.0051	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0017
Sea Eagle	(23) IT23	Whole blood	Mediterranean/Italy	0.0062	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0014
Sea Eagle	(24) IT24	Whole blood	Mediterranean/Italy	0.0039	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)

Sea Eagle	(25) IT25	Whole blood	Mediterranean/Italy	0.0032	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(26) IT26	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(27) IT27	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	0.0017
Sea Eagle	(28) IT28	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(29) IT29	Whole blood	Mediterranean/Italy	0.0076	<LOQ (0.00318 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(30) IT30	Whole blood	Mediterranean/Italy	0.0042	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(31) IT31	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(32) IT32	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(33) IT33	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	X	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(34) IT34	Whole blood	Mediterranean/Italy	0.0056	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(35) IT35	Whole blood	Mediterranean/Italy	0.0042	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(36) IT36	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(37) IT37	Whole blood	Mediterranean/Italy	0.0042	X	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(38) IT38	Whole blood	Mediterranean/Italy	0.0035	X	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(39) IT39	Whole blood	Mediterranean/Italy	0.0079	X	<LOQ (0.00335 ug/mL)	0.0013
Sea Eagle	(40) IT40	Whole blood	Mediterranean/Italy	0.0052	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(41) IT41	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(42) IT42	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(43) IT43	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(44) IT44	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(45) IT45	Whole blood	Mediterranean/Italy	0.0064	X	<LOQ (0.00335 ug/mL)	0.001

Sea Eagle	(46) IT46	Whole blood	Mediterranean/Italy	0.0044	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(47) IT47	Whole blood	Mediterranean/Italy	0.0035	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(48) IT48	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(49) IT49	Whole blood	Mediterranean/Italy	0.0053	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(50) IT50	Whole blood	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(51) SANserum	serum	Mediterranean/Italy	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	0.0016
Sea Eagle	(52) SANBLD2	Whole blood	Mediterranean/Italy	E	E	E	E
Sea Eagle	(53) KANBLD1	Whole blood	Mediterranean/Italy	E	E	E	E
Sea Eagle	(54) YCU-1	Whole blood	Japan	E	E	E	E
Sea Eagle	(55) YCU-2	Whole blood	Japan	E	E	E	E
Sea Eagle	(56) YCU-3	Whole blood	Japan	0.0158	<LOQ (0.00128 ug/mL)	0.0045	0.0015
Sea Eagle	(57) YCU-4	Whole blood	Japan	E	E	E	E
Sea Eagle	(58) YCU-5	Whole blood	Japan	<LOQ (0.00323 ug/mL)	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(59) YNU-1	Whole blood	Japan	E	E	E	E
Sea Eagle	(60) YNU-2	Whole blood	Japan	E	E	E	E
Sea Eagle	(61) YNU-3	Whole blood	Japan	E	E	E	E
Sea Eagle	(62) YNU-4	Whole blood	Japan	E	E	E	E
Sea Eagle	(63) YNU-5	Whole blood	Japan	E	E	E	E
Sea Eagle	(64) YNU-6	Whole blood	Japan	E	E	E	E
Sea Eagle	(65) YNU-7	Whole blood	Japan	E	E	E	E
Sea Eagle	(66) YNU-8	Whole blood	Japan	E	E	E	E
Sea Eagle	(67) YNU-9	Whole blood	Japan	E	E	E	E
Sea Eagle	(68) YNU-10	Whole blood	Japan	E	E	E	E
Sea Eagle	(69) YNU-11	Whole blood	Japan	E	E	E	E
Sea Eagle	(70) YNU-12	Whole blood	Japan	E	E	E	E
Sea Eagle	(71) YNU-13	Whole blood	Japan	E	E	E	E
Sea Eagle	(72) YNU-14	Whole blood	Japan	E	E	E	E
Sea Eagle	(73) YNU-15	Whole blood	Japan	E	E	E	E
Sea Eagle	(74) YNU-16	Whole blood	Japan	E	E	E	E
Sea Eagle	(75) YNU-17	Whole blood	Japan	E	E	E	E

Sea Eagle	(76) YNU-18	Whole blood	Japan	0.0117	X	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(77) YNU-19	Whole blood	Japan	0.0077	X	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(78) YNU-20	Whole blood	Japan	0.0150	<LOQ (0.00128 ug/mL)	0.0062	0.0021
Sea Eagle	(79) YNU-21	Whole blood	Japan	0.0044	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)
Sea Eagle	(80) YNU-22	Whole blood	Japan	0.0038	<LOQ (0.00128 ug/mL)	<LOQ (0.00335 ug/mL)	<LOQ (0.00125 ug/mL)

E = Sample lost during extraction (spilled out of tube), not reported

X = Detected, but not quantified due to poor QC

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

LOQ = Limit of quantitation

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate Values in parenthesis are LOQ

APPENDIX IX

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

Matrix	PFOS (Mean +/- RSD or PRD)	FOSA (Mean +/- RSD or RPD)	PFOA (Mean +/- RSD or RPD)	PFHS (Mean +/- RSD or RPD)
DC cormorant blood	82+/-34	77+/-29	121+/-2	NA
Common loon liver	28+/-3	52+/-4	104+/-6	60+/-18
Albatross kidney	79+/-20	57+/-5	117+/-7	70+/-20
DC cormorant egg yolk	128+/-10	67+/-15	117+/-22	73+/-5
Albatross serum	89+/-17	75+/-14	97+/-17	75+/-17
Bald eagle plasma	17+/-69	62+/-9	80+/-9	62+/-11
Cormorant liver	103+/-9	92+/-5	107+/-2	86+/-3
Blacktailed gull liver	121+/-2	63+/-2	146+/-13	20+/-20
Great egret liver	132+/-1	84+/-25	82+/-10	40+/-22
Cormorant blood	123+/-8	93+/-29	108+/-7	96+/-15
Sea gull liver	77+/-13	41+/-7	97+/-6	41+/-6
Cormorant liver	230	107+/-5	95+/-21	59+/-3
Bald eagle liver	37+/-6	63+/-5	67+/-14	35+/-27
Chicken liver	95+/-5	105+/-2	90+/-6	62+/-3
Sea eagle liver	55+/-1	21+/-1	79+/-6	29+/-3
Sea eagle liver2	87+/-16	54+/-15	90+/-14	71+/-11
Sea eagle blood	72+/-24	44+/-14	84+/-27	82+/-27

NA= Not analyzed

RPD= Relative percent difference; RSD= Relative standard deviation

PFOS = Perfluorooctanesulfonate

FOSA = Perfluorooctanesulfonamide

PFHS = Perfluorohexanesulfonate

PFOA = Perfluorooctanoate

APPENDIX X

Scientific names of bird species analyzed

Common name	Scientific name
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Herring gull	<i>Larus argentatus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Common loon	<i>Gavia immer</i>
Brown pelican	<i>Pelecanus occidentalis</i>
White pelican	<i>Pelecanus erythrorhynchos</i>
Great egret	<i>Ardea alba</i>
Snowy egret	<i>Egretta thula</i>
Wood stork	<i>Mycteria americana</i>
White-faced ibis	<i>Plegadus chihi</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Franklin's gull	<i>Larus pipixcan</i>
Northern gannet	<i>Sula bassanus</i>
Great black-backed gull	<i>Larus marinus</i>
Osprey	<i>Pandion haliaetus</i>
Red-throated loon	<i>Gavia stellata</i>
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>
Great blue heron	<i>Ardea herodias</i>
Laysan albatross	<i>Diomedea immutabilis</i>
Black-footed albatross	<i>Diomedea nigripes</i>
Polar skua	<i>Stercorarius maccormicki</i>
White tailed sea eagle	<i>Haliaeetus albicilla</i>
Caspian tern	<i>Sterna caspia</i>
Adelie penguin	<i>Pygoscelis adeliae</i>
Tree swallow	<i>Tachycineta bicolor</i>
Great Horned owl	<i>Athene sp.</i>
Chicken	<i>Gallus domesticus</i>
Spotted duck	<i>Dendrocygna guttata</i>
Kite	<i>Elanus sp.</i>