

Supplementary Material

Per- and Polyfluoroalkyl Substances (PFAS) in Terrestrial Mammals from a Typical Chinese Agricultural Region: Non-Target Screening, Biomagnification, and Risk Assessment

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Text S1. Quality Assurance and Quality Control

Procedural blanks were included in the sequence to check background response. Additionally, a pooled quality control sample (comprising all samples), a standard sample containing 18 target PFASs and 9 ISs (20 µg/L for each PFAS and IS), and methanol blanks were placed after every eight samples to monitor repeatability and detect potential instrumental contamination. For the Orbitrap analysis, mass calibration was performed before each batch sequence. Solvent blanks were analyzed to identify the top 200 most abundant background ions, which were added to the exclusion list to minimize background disturbance. No target or suspect PFASs were detected in solvent and procedural blanks. Relative standard deviation (RSD) < 7% for the intensity of target and isotope PFAS in the quality control and standard samples. The mass error was <5 ppm for target and isotope PFAS in the quality control and standard samples. For the LC-MS/MS analysis, matrix recoveries for target PFAS ranged from 87% to 109% in the spiked samples (Table S4).

Text S2. PBT Prediction and ToxPi Score Calculation of PFAS

We included 18 attributes of PBT [1–5] which can be classified into three categories: persistence (P), bioaccumulation (B), and toxicity (T). The persistence (P) of PFASs, including three attributes of Biowin1, Biowin3, and Biowin5 [4,6], were obtained from BIOWIN v4.10 in

EPI Suite v4.11. The bioaccumulation (B) of PFASs, including two attributes: the bioconcentration factor (BCF), and LogKow (octanol–water partition coefficient, Kow), were obtained from BCFBAF v3.01 and KOWWIN v1.68 in EPI Suite v4.11, respectively.

The toxicity (T) of PFASs encompassed both ecotoxicological and human health effects. Ecotoxicological effects included three attributes: Fish LC₅₀ (96 h), Daphnid LC₅₀ (48 h), and Green Algae EC₅₀ (96 h), all obtained from ECOSAR v2.0 (Table S5). Human health effects consisted of ten attributes: carcinogenicity, developmental toxicity, mutagenicity, endocrine-disrupting effect, hepatotoxicity, skin irritation/corrosion, eye irritation/corrosion, skin sensitization, repeated dose toxicity, and oral rat LD₅₀, obtained from VEGA v1.2.0 and T.E.S.T. v5.1.1. A value of zero was assigned when toxicity attributes from qualitative models were not available. Specifically, carcinogenicity, developmental toxicity, mutagenicity, endocrine disrupting effect, and skin sensitization were represented by the average values of qualitative endpoints (0 = negative/inactive or 1 = positive/active) from their respective models. Repeated dose toxicity was represented by the no-observed-adverse-effect level (NOAEL). Log transformation was applied on the attributes of BCF, Fish LC₅₀ (96 h), Daphnid LC₅₀ (48 h), Green Algae EC₅₀ (96 h), NOAEL, and oral rat LD₅₀ to achieve a more normal distribution. Each normalized attribute was then multiplied by its weight, and the weighted values were summed to calculate the ToxPi score of each PFAS (Equation (S1)).



$$\text{ToxPi score} = \sum \text{Attributes}_{\text{normalized}} \times \text{weight} \quad (\text{S1})$$

Table S1. Details of abbreviations, names, formulas and logKow values for 18 PFAS and 9 isotope-labeled internal standards.

	Abbreviation	Name	Chemical	CAS	logKow
Target PFAS	PFBA	Perfluorobutanoic acid	C ₄ HF ₇ O ₂	375-22-4	2.14
	PFPeA	Perfluoropentanoic acid	C ₄ HF ₉ CO ₂	2706-90-3	2.81
	PFHxA	Perfluorohexanoic acid	C ₆ HF ₁₁ O ₂	307-24-4	3.48
	PFHpA	Perfluoroheptanoic acid	C ₇ HF ₁₃ O ₂	375-85-9	4.15
	PFOA	Perfluorooctanoic acid	C ₈ HF ₁₅ O ₂	335-67-1	4.81
	PFNA	Perfluorononanoic acid	C ₉ HF ₁₇ O ₂	375-95-1	5.48
	PFDA	Perfluorodecanoic acid	C ₁₀ HF ₁₉ O ₂	335-76-2	6.15
	PFUnDA	Perfluorododecanoic acid	C ₁₀ HF ₂₁ CO ₂	2058-94-8	6.82
	PFDoDA	Perfluorododecanoic acid	C ₁₂ HF ₂₃ O ₂	307-55-1	7.49
	PFTrDA	Perfluorotridecanoic acid	C ₁₃ HF ₂₅ O ₂	72629-94-8	8.16
	PFTeDA	Perfluorotetradecanoic acid	C ₁₃ HF ₂₇ CO ₂	376-06-7	8.83
	PFHxDA	Perfluorohexadecanoic acid	C ₁₅ H ₂ F ₃₁ CO ₂	67905-19-5	10.17
	PFODA	Perfluorooctadecanoic acid	C ₁₇ H ₂ F ₃₅ CO ₂	16517-11-6	11.51
	PFBS	Perfluorobutanesulfonic acid	C ₄ F ₉ SO ₃ H	375-73-5	1.82
	PFPeS	Perfluoropentanesulfonic acid	C ₅ F ₁₁ SO ₃ H	2706-91-4	2.49
	PFHxS	Perfluorohexanesulfonic acid	C ₆ F ₁₃ SO ₃ H	355-46-4	3.16
	PFHpS	Perfluoroheptanesulfonic acid	C ₇ F ₁₅ SO ₃ H	375-92-8	3.82
	PFOS	Perfluorooctanesulfonic acid	C ₈ F ₁₇ SO ₃ H	1763-23-1	4.49
Internal Standards	¹³ C ₄ -PFBA	Perfluoro-n-[1,2,3,4- ¹³ C ₄]butanoic acid	[¹³ C] ₄ HFO ₂	na	na
	¹³ C ₂ -PFHxA	Perfluoro-n-[1,2- ¹³ C ₂]hexanoic acid	[¹³ C] ₂ C ₄ HF ₁₁ O ₂	na	na
	¹³ C ₄ -PFOA	Perfluoro-n-[1,2,3,4- ¹³ C ₄]octanoic acid	[¹³ C] ₄ C ₄ HF ₁₅ O ₂	na	na
	¹³ C ₅ -PFNA	Perfluoro-n-[1,2,3,4,5- ¹³ C ₅]nonanoic acid	[¹³ C] ₅ C ₄ HF ₁₇ O ₂	na	na
	¹³ C ₂ -PFDA	Perfluoro-n-[1,2- ¹³ C ₂]decanoic acid	[¹³ C] ₂ C ₈ HF ₁₉ O ₂	na	na
	¹³ C ₂ -PFUnDA	Perfluoro-n-[1,2- ¹³ C ₂]undecanoic acid	[¹³ C] ₂ C ₉ HF ₂₁ O ₂	na	na
	¹³ C ₂ -PFDoA	Perfluoro-n-[1,2- ¹³ C ₂]dodecanoic acid	C ₁₀ [¹³ C] ₂ HF ₂₃ O ₂	na	na
	¹⁸ O ₂ -PFHxS	Sodium Perfluoro-1-hexane[¹⁸ O ₂]sulfonate Sodium	C ₆ HF ₁₃ [¹⁸ O] ₂ OS	na	na
	¹³ C ₄ -PFOS	Perfluoro-1-[1,2,3,4- ¹³ C ₄]-octanesulfonate	[¹³ C] ₄ C ₄ HF ₁₇ O ₃ S	na	na

The logKow values were calculated using EPI Suite v 4.11 (<https://www.epa.gov/tsca-screening-tools/epi-suite-tetm-estimation-program-interface>). na: not available.

Table S2. Details of 59 sampled mammals.

Mammals	Muscle Fat Content (%)	Muscle Moisture Content (%)	Body Weight (g)
Hare (N = 20)			
R1	0.99	74.3	2280
R2	1.11	75.8	2970
R3	1.91	74.0	1890
R4	0.90	75.9	2320
R5	1.07	74.0	1860
R6	1.55	73.0	2460
R7	1.73	73.8	2660
R8	1.28	76.2	1880
R9	1.69	71.1	2110
R10	0.95	75.3	1840
R11	1.13	74.6	1920
R12	1.72	74.8	2780
R13	1.40	75.6	2650
R14	1.14	75.4	2400
R15	1.79	73.8	2030
R16	1.01	73.6	2420
R17	1.16	74.3	1980
R18	1.27	74.6	2070
R19	1.64	73.7	2050
R20	1.02	73.9	1910

Table S2. Cont.

Mammals	Muscle Fat Content (%)	Muscle Moisture Content (%)	Body Weight (g)
Hedgehog (<i>N</i> = 20)			
H1	3.12	74.2	437
H2	5.20	75.7	402
H3	2.28	75.8	304
H4	3.24	71.8	391
H5	10.14	60.9	252
H6	3.41	74.6	447
H7	4.90	73.6	294
H8	3.79	74.2	156
H9	8.27	71.5	374
H10	2.85	74.4	333
H11	9.41	67.9	360
H12	7.39	70.6	298
H13	9.11	70.2	375
H14	5.50	70.8	407
H15	4.58	76.2	440
H16	8.49	69.0	415
H17	10.32	69.0	304
H18	3.42	73.3	414
H19	2.61	74.5	369
H20	4.27	72.7	284
Weasel (<i>N</i> = 19)			
W1	0.91	72.6	524
W2	4.60	69.5	554
W3	4.72	71.1	545
W4	1.75	75.5	537
W5	4.04	69.8	418
W6	3.98	64.5	464
W7	0.88	76.0	484
W8	2.06	75.5	465
W9	2.10	75.1	498
W10	3.36	71.5	500
W11	4.79	73.0	445
W12	1.76	74.8	734
W13	4.74	71.9	748
W14	3.17	74.4	749
W15	3.31	72.2	606
W16	3.70	72.4	774
W17	3.11	73.1	555
W18	3.80	68.1	589
W19	2.68	71.1	407

Table S3. Precursor and product ions of target PFAS and ISs in MRM mode.

Compound	Precursor (<i>m/z</i>)	Product (<i>m/z</i>)	Declustering Potential (V)	Collision Energy (V)	Retention Time (min)
PFBA	213	169	-40	-13	2.7
PFPeA	263	219/69	-40	-10/-50	3.9
PFHxA	313	269/119	-45	-13/-27	5.1
PFHpA	363	319/169	-30	-14/-24	5.4
PFOA	413	369/169	-40	-14/-24	6.1
PFNA	463	419/169	-35	-16/-24	6.9
PFDA	513	469/219	-40	-18/-26	7.5
PFUnDA	563	519/319	-70	-16/-28	7.8
PFDoDA	613	569/169	-70	-18/-36	8.6
PFTTrDA	663	619/169	-65	-20/-38	9.2
PFTeDA	713	669/169	-85	-20/-38	9.4
PFHxDA	813	769/169	-90	-18/-30	10.2
PFODA	913	869/169	-40	-25/-45	10.8

Table S3. Cont.

Compound	Precursor (<i>m/z</i>)	Product (<i>m/z</i>)	Declustering Potential (V)	Collision Energy (V)	Retention Time (min)
PFBS	299	80/99	-90	-70/-38	11.0
PFPeS	349	80/99	-100	-19/63	11.5
PFHxS	399	80/99	-90	-90/-72	11.8
PFHpS	449	80/99	-100	-81/56	12.3
PFOS	499	80/99	-105	-110/-98	13.2
¹³ C ₄ PFBA	217	172	-50	-12	2.7
¹³ C ₄ PFHxA	315	270	-55	-14	5.1
¹³ C ₄ PFOA	417	372	-70	-20	6.9
¹³ C ₄ PFNA	468	423	-70	-22	7.5
¹³ C ₄ PFDA	515	470	-75	-17	7.8
¹³ C ₄ PFUnDA	565	520	-60	-15	8.6
¹³ C ₂ PFDoDA	615	570	-60	-15	9.2
¹⁸ O ₂ PFHxS	403	103	-90	-75	9.4
¹³ C ₄ PFOS	503	80	-90	-95	10.2

Table S4. The method detection limit (MDL) and the matrix spiked recoveries of PFASs were determined through LC-MS/MS analysis.

Compound	MDL (ng/g, Wet Weight)	The Matrix Spiked Recoveries (10 ng/Matrix)
PFBA	0.012	73.1–117
PFPeA	0.004	67.1–114
PFHxA	0.018	79.3–117
PFHpA	0.002	86.7–103
PFOA	0.003	77.5–107
PFNA	0.001	78.2–117
PFDA	0.001	85.8–109
PFUnDA	0.001	66.3–94.6
PFDoDA	0.001	72.3–92.3
PFTrDA	0.001	79.5–108
PFTeDA	0.002	65.3–85.5
PFHxDA	0.002	70.5–92.4
PFODA	0.001	74.8–111
PFBS	0.001	78.9–116
PFPeS	0.025	68.6–107
PFHxS	0.002	86.7–118
PFHpS	0.001	85.5–105
PFOS	0.017	105–124

Table S5. Details on the criteria and attributes used to calculate the ToxPi Score of PFASs.

Criteria	Attributes	Unit	Scaling	Weight	Software	Model	
Persistence	Biowin1	unitless	-x	1/9	EPI Suite v4.11	BIOWIN v4.10	
	Biowin3	unitless	-x	1/9		BIOWIN v4.10	
	Biowin5	unitless	-x	1/9		BIOWIN v4.10	
Bioaccumulation	Log <i>BCF</i>	unitless	x	1/6	EPI Suite v4.11	BCFBAF v3.01	
	Log <i>K_{ow}</i>	unitless	x	1/6		KOWWIN v1.68	
Toxicity	Ecotoxicological effects	Fish LC50 (96 h)	mg/L	-log 10(x)	1/18	ECOSAR v2.2	ECOSAR v2.2
		Daphnid LC50 (48 h)	mg/L	-log 10(x)	1/18		ECOSAR v2.2
		Green Algae EC50 (96 h)	mg/L	-log 10(x)	1/18		ECOSAR v2.2
	Human health effects	Carcinogenicity	unitless	x	1/60	VEGA v1.2.4	CAESAR v2.1.10
		Developmental toxicity	unitless	x	1/60	VEGA v1.2.4	CAESAR v2.1.8
		Mutagenicity	unitless	x	1/60	VEGA v1.2.4	CAESAR v2.1.14
		Endocrine disrupting effect	unitless	x	1/60	VEGA v1.2.4	IRFMN v1.0.0
		Hepatotoxicity	unitless	x	1/60	VEGA v1.2.4	IRFMN v1.0.1
		Skin irritation/corrosion	unitless	x	1/60	VEGA v1.2.4	CONCERT/SarPy v1.0.0
		Eye irritation/corrosion	unitless	x	1/60	VEGA v1.2.4	CONCERT/SarPy v1.0.0
		Skin sensitization	unitless	x	1/60	VEGA v1.2.4	CAESAR v2.1.7
		Repeated dose toxicity	mg/kg	-log 10(x)	1/60	VEGA v1.2.4	IRFMN-CORAL v1.0.1
		Oral rat LD50	mg/kg	-log 10(x)	1/60	T.E.S.T. v5.1.2	T.E.S.T. v5.1.2

Table S6. Criteria for identification of PBT substances.

Property	PBT Criteria
P	BIOWIN 1 < 0.5
	BIOWIN 3 < 2.25
	BIOWIN 5 < 0.5
B	BCF > 2000 L/kg
	log Kow > 4.5
T	LC/EC 50 < 0.1 mg/L
	meets the criteria for classification as carcinogenic, mutagenic, toxic to reproduction, or other toxicity (> 0.5) ^a
	Oral rat LD50 < 300 mg/kg ^b

^a The criteria is determined as more than half of the models showing positive results; ^b The criteria is derived from Category 3 (danger substances) of GHS Classification Criteria for acute toxicity; Other criteria were derived from Annex XIII and III to REACH Regulation.

Table S7. Descriptive statistics of detection frequency (DF) and [mean (range), ng/g wet weight] for PFAS calculated in terrestrial samples (n = 59).

Compounds	Hare (N = 20)		Hedgehog (N = 20)		Weasel (N = 19)	
	DF (%)	Mean (min–max)	DF (%)	Mean (min–max)	DF (%)	Mean (min–max)
PFBA	80	0.024 (n.d. –0.046)	78.9	0.049 (n.d. –0.174)	75	0.019 (n.d. –0.051)
PFPeA	100	0.047 (0.007 –0.097)	100	0.145 (0.034–0.326)	100	0.034 (0.011–0.092)
PFHxA	50	0.024 (n.d. –0.056)	63.2	0.034 (n.d. –0.123)	70	0.026 (n.d. –0.051)
PFHpA	0	n.d.	36.8	0.006 (n.d. –0.037)	15	0.002 (n.d. –0.009)
PFOA	85	0.045 (n.d. –0.087)	100	0.108 (0.036 –0.24)	95	0.128 (0.06–0.225)
PFNA	20	0.001 (n.d. –0.002)	52.6	0.001 (n.d. –0.003)	45	0.001 (n.d. –0.002)
PFDA	65	0.002 (n.d. –0.005)	84.2	0.002 (n.d. –0.007)	40	0.001 (n.d. –0.002)
PFDoDA	20	0.001 (n.d. –0.004)	52.6	0.001 (n.d. –0.003)	10	0.001 (n.d. –0.002)
PFUnDA	75	0.001 (n.d. –0.005)	89.5	0.002 (n.d. –0.005)	45	0.001 (n.d. –0.002)
PFTrDA	75	0.001 (n.d. –0.003)	68.4	0.001 (n.d. –0.003)	25	0.001 (n.d. –0.002)
PFTeDA	10	0.002 (n.d. –0.005)	10.5	0.002 (n.d. –0.006)	5	0.002 (n.d. –0.004)
PFHxDA	40	0.011 (n.d. –0.068)	100	0.010 (0.004 –0.021)	100	0.006 (0.002–0.016)
PFODA	50	0.01 (n.d. –0.048)	100	0.01 (0.004–0.017)	100	0.006 (0.001–0.012)
PFPeS	65	0.041 (n.d. –0.090)	94.7	0.096 (n.d. –0.204)	85	0.04 (n.d. –0.073)
PFOS	80	0.022 (n.d. –0.033)	100	0.061 (0.042–0.098)	90	0.03 (n.d. –0.042)

n.d. = not detected.

Table S8. Concentration (ng/g, ww) of target 15 PFAS in the terrestrial species collected from the agricultural growing area.

PFAS (ng/g)	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFDODA	PFUnDA	PFTTrDA	PFTeDA	PFHxDA	PFODA	PFPeS	PFOS
Hare (N = 20)															
R1	0.026	0.026	0.056	n.d.	0.038	n.d.	0.002	0.003	0.002	0.002	0.004	0.068	0.048	0.076	0.033
R2	n.d.	0.022	n.d.	n.d.	0.038	n.d.	n.d.	n.d.	0.002	0.002	0.005	0.024	0.026	n.d.	0.023
R3	0.029	0.033	n.d.	n.d.	0.023	n.d.	n.d.	0.003	n.d.	n.d.	n.d.	0.024	0.017	0.051	0.028
R4	0.016	0.023	0.021	n.d.	0.020	0.001	0.002	n.d.	0.001	0.002	n.d.	0.018	0.022	n.d.	0.021
R5	0.021	0.035	0.023	n.d.	0.026	n.d.	0.001	n.d.	0.002	0.001	n.d.	n.d.	0.018	n.d.	N.D.
R6	0.033	0.047	0.028	n.d.	0.087	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.016	0.018	n.d.	0.024
R7	0.026	0.045	0.021	n.d.	0.043	n.d.	0.002	n.d.	0.001	n.d.	n.d.	n.d.	0.004	0.039	0.028
R8	0.031	0.037	0.030	n.d.	0.050	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.020	0.016	0.029	0.020
R9	n.d.	0.097	n.d.	n.d.	0.064	n.d.	0.002	0.004	0.001	n.d.	n.d.	0.016	0.010	0.066	0.031
R10	0.046	0.091	0.051	n.d.	0.068	0.002	0.004	0.004	0.005	0.003	n.d.	0.014	0.012	0.071	n.d.
R11	0.020	0.021	n.d.	n.d.	0.074	n.d.	0.005	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.090	0.022
R12	n.d.	0.007	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.054	0.028
R13	n.d.	0.009	n.d.	n.d.	0.062	n.d.	n.d.	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.035	n.d.
R14	0.018	0.020	0.047	n.d.	n.d.	n.d.	n.d.	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.037	n.d.
R15	0.038	0.071	0.043	n.d.	n.d.	0.001	0.002	n.d.	0.001	n.d.	n.d.	n.d.	n.d.	0.087	0.024
R16	0.026	0.063	n.d.	n.d.	0.049	n.d.	0.001	n.d.	0.001	n.d.	n.d.	n.d.	n.d.	n.d.	0.029
R17	0.025	0.074	n.d.	n.d.	0.062	0.001	0.002	n.d.	0.001	n.d.	n.d.	n.d.	n.d.	n.d.	0.019
R18	0.032	0.056	0.030	n.d.	0.067	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.042	0.018
R19	0.030	0.070	n.d.	n.d.	0.050	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.020
R20	0.029	0.086	n.d.	n.d.	0.067	n.d.	0.001	n.d.	0.001	n.d.	n.d.	n.d.	n.d.	0.027	0.024
Hedgehog (N = 20)															
H1	0.051	0.088	0.029	n.d.	0.060	0.001	n.d.	n.d.	n.d.	n.d.	n.d.	0.009	0.011	0.065	0.027
H2	0.038	0.078	n.d.	n.d.	0.218	0.001	n.d.	n.d.	n.d.	n.d.	n.d.	0.009	0.009	0.043	0.022
H3	0.023	0.037	n.d.	n.d.	0.060	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.004	0.012	0.041	0.033
H4	0.009	0.014	0.030	n.d.	0.130	n.d.	n.d.	n.d.	0.001	n.d.	n.d.	0.004	0.006	0.037	0.042
H5	0.023	0.030	n.d.	n.d.	0.140	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.006	0.007	0.049	0.032
H6	0.018	0.024	n.d.	0.094	0.092	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.003	0.005	0.073	0.028
H7	n.d.	0.069	0.025	n.d.	0.178	n.d.	0.001	n.d.	0.001	n.d.	n.d.	0.005	0.005	0.037	0.025
H8	0.017	0.092	0.030	n.d.	0.132	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.003	0.003	0.036	0.037
H9	0.020	0.019	0.041	0.006	0.079	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.004	0.003	0.049	0.038
H10	0.023	0.019	0.022	0.007	0.151	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.003	0.003	0.049	0.024
H11	0.016	0.015	0.051	n.d.	0.143	0.002	0.002	0.002	0.001	0.002	0.004	0.016	0.008	0.059	0.034
H12	n.d.	0.015	n.d.	n.d.	0.190	0.001	0.002	n.d.	0.001	0.002	n.d.	0.007	0.009	n.d.	0.039
H13	0.014	0.020	0.029	n.d.	0.161	0.001	n.d.	n.d.	0.002	0.001	n.d.	0.010	0.008	0.029	0.036
H14	0.013	0.018	0.039	n.d.	0.118	n.d.	0.002	n.d.	0.001	n.d.	n.d.	0.005	0.005	0.043	0.029
H15	n.d.	0.020	0.022	n.d.	0.117	0.002	0.002	0.002	0.002	n.d.	n.d.	0.005	0.004	n.d.	0.033
H16	0.019	0.037	0.042	n.d.	0.225	0.001	0.001	n.d.	n.d.	0.001	n.d.	0.005	0.004	0.046	0.042
H17	0.031	0.044	0.041	n.d.	0.170	0.001	0.002	n.d.	0.002	n.d.	n.d.	0.005	0.004	0.029	0.035
H18	0.013	0.014	0.029	n.d.	0.113	n.d.	0.002	n.d.	n.d.	n.d.	n.d.	0.003	0.003	n.d.	0.028
H19	0.013	0.011	0.021	n.d.	0.074	n.d.	n.d.	n.d.	n.d.	0.001	n.d.	0.002	0.003	0.026	n.d.
H20	n.d.	0.011	n.d.	n.d.	n.d.	0.001	n.d.	n.d.	0.001	n.d.	n.d.	0.002	0.001	0.029	n.d.

Table S8. *Cont.*

PFAS (ng/g)	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFDODA	PFUnDA	PFTrDA	PFTeDA	PFHxDA	PFODA	PFPeS	PFOS
Weasel (N = 19)															
W1	0.083	0.169	0.040	n.d.	0.092	0.001	0.002	0.001	0.002	0.003	0.006	0.021	0.017	0.168	0.051
W2	0.097	0.154	n.d.	n.d.	0.036	n.d.	0.002	n.d.	0.001	n.d.	0.002	0.013	0.012	0.166	0.054
W3	0.056	0.141	n.d.	n.d.	0.047	n.d.	0.002	n.d.	0.002	n.d.	n.d.	0.012	0.010	0.180	0.043
W4	0.079	0.228	n.d.	n.d.	0.120	0.001	0.004	0.001	0.004	0.002	n.d.	0.008	0.007	n.d.	0.042
W5	n.d.	0.157	0.123	n.d.	0.105	n.d.	0.003	n.d.	0.002	0.002	n.d.	0.006	0.010	0.204	0.097
W6	n.d.	0.235	0.118	0.010	0.070	0.002	0.006	0.002	0.004	0.002	n.d.	0.007	0.009	0.180	0.098
W7	n.d.	0.203	0.033	0.007	0.146	0.002	0.002	0.003	0.003	0.002	n.d.	0.009	0.009	0.052	0.064
W8	n.d.	0.208	0.023	0.008	0.071	0.001	0.002	0.001	0.003	n.d.	n.d.	0.008	0.006	0.061	0.056
W9	0.174	0.316	n.d.	0.037	0.107	0.002	0.005	0.001	0.003	n.d.	n.d.	0.010	0.004	0.026	0.047
W10	0.156	0.326	0.080	0.024	0.193	0.003	0.007	0.003	0.005	0.002	n.d.	0.009	0.005	0.099	0.060
W11	0.027	0.034	0.031	n.d.	0.082	0.001	0.002	n.d.	0.002	n.d.	n.d.	0.021	0.017	0.132	0.054
W12	0.026	0.070	n.d.	n.d.	0.073	n.d.	n.d.	n.d.	0.002	n.d.	n.d.	0.016	0.007	0.046	0.048
W13	0.034	0.081	0.024	n.d.	0.041	n.d.	0.002	0.001	0.002	n.d.	n.d.	0.007	0.010	0.102	0.048
W14	0.034	0.093	n.d.	0.003	0.094	n.d.	0.002	n.d.	0.002	n.d.	n.d.	0.008	0.009	0.027	0.044
W15	0.028	0.045	n.d.	n.d.	0.084	n.d.	0.001	n.d.	0.002	n.d.	n.d.	0.004	0.007	0.083	0.059
W16	0.025	0.066	0.022	n.d.	0.092	n.d.	0.002	n.d.	0.001	n.d.	n.d.	0.004	0.007	0.062	0.077
W17	0.028	0.055	0.046	n.d.	0.173	0.001	n.d.	n.d.	n.d.	n.d.	n.d.	0.006	0.005	0.078	0.060
W18	0.018	0.045	0.034	n.d.	0.180	n.d.	0.002	0.002	n.d.	n.d.	n.d.	0.005	0.007	0.043	0.083
W19	0.022	0.130	0.018	0.012	0.240	0.001	n.d.	0.003	0.002	n.d.	n.d.	0.010	0.006	0.091	0.079

n.d. = not detected.

Table S9. Stable isotope ratios for three terrestrial species in this study.

Species	$\delta^{15}\text{N}$ (‰) ^a	$\delta^{13}\text{C}$ (‰)
Hare	1.08 ± 2.21	-23.7 ± 2.68
Hedgehog	6.66 ± 0.99	-23.0 ± 1.14
Weasel	6.86 ± 1.52	-20.3 ± 1.96

^a mean ± SD.**Table S10.** BMF values of PFAS in the hare–weasel and hedgehog–weasel food chain.

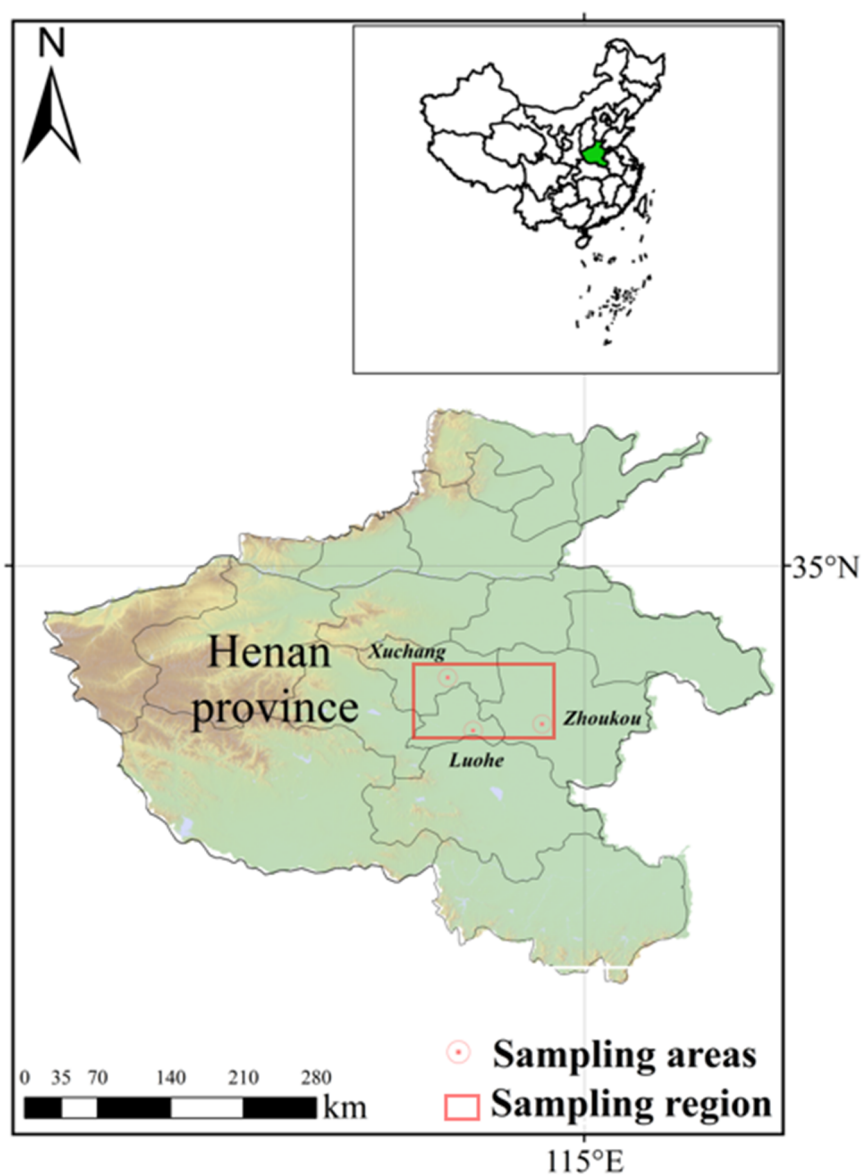
Compound	BMF	
	Hare To Weasel	Hedgehog to Weasel
PFBA	2.02	2.60
PFPeA	3.11	4.31
PFHxA	1.42	1.28
PFHpA	4.38	2.65
PFOA	2.41	0.84
PFNA	1.50	1.25
PFDA	1.49	2.10
PFDoDA	1.11	1.69
PFUnDA	1.67	2.45
PFTTrDA	1.13	1.40
PFTeDA	0.98	1.08
PFHxDA	0.90	1.77
PFODA	0.87	1.52
PFPeS	2.31	2.42
PFOS	2.79	2.01

Table S11. Persistence, bioaccumulation, ecotoxicological effects, and human health effects of PFASs used to calculated the ToxPi scores.

Persistence						Bioaccumulation		Toxicity										
						Ecotoxicological Effects				Human Health Effects								
	Biowin1	Biowin3	Biowin5	log _{BCF}	log _{K_{OW}}	Fish LC50 (96 h)	Daphnid LC50 (48 h)	Green Algae EC50 (96 h)	Carcinogenicity	Developmental Toxicity	Mutagenicity	Endocrine Disrupting Effect	Hepatotoxicity	Skin Irritation/Corrosion	Eye Irritation/Corrosion	Skin Sensitization	Repeated Dose Toxicity	Oral rat LD50
unit	unitless	unitless	unitless	unitless	unitless	mg/L	mg/L	mg/L	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless	mg/kg	mg/kg
PFBA	-0.17	2.15	0.51	1.173	2.14	1.32E+03	7.61E+02	5.97E+02	0.621	0	0	0	0	0	0	0.79	1.17E+02	1.78E+03
PFPeA	-0.38	1.83	0.47	1.812	2.81	4.09E+02	2.50E+02	2.54E+02	0.516	0	0	0	0	0	0	1	9.42E+01	1.56E+03
PFHxA	-0.59	1.51	0.42	2.448	3.48	1.22E+02	7.93E+01	1.04E+02	0.736	0	0	0	0	0	0	1	7.55E+01	7.79E+02
PFHpA	-0.79	1.19	0.37	3.049	4.15	3.54E+01	2.45E+01	4.14E+01	0.736	0	0	0	0	1	0	1	6.06E+01	2.22E+02
PFOA	-1.00	0.86	0.33	3.574	4.81	1.01E+01	7.44E+00	1.62E+01	0.736	0	0.25	0	0	1	0	1	4.86E+01	1.76E+02
PFNA	-1.21	0.54	0.28	3.961	5.48	2.84E+00	2.22E+00	6.26E+00	0.599	0	0	0	0	1	0	0.27	3.90E+01	1.75E+02
PFDA	-1.42	0.22	0.24	4.137	6.15	7.88E-01	6.56E-01	2.39E+00	0.535	0	0	0	0	1	0	0	3.13E+01	4.79E+02
PFUnA	-1.62	-0.10	0.19	4.04	6.82	2.17E-01	1.92E-01	9.01E-01	0.535	0	0	0	0	1	0	0	2.51E+01	4.48E+02
PFDoDA	-1.83	-0.43	0.14	3.731	7.49	5.90E-02	5.60E-02	3.38E-01	0.535	0	0	0	0	1	0	0	2.01E+01	1.07E+03
PFTTrDA	-2.04	3.20	0.10	3.381	8.16	1.60E-02	1.60E-02	1.26E-01	0.484	0	0	0	0	1	0	0	1.61E+01	1.07E+03
PFTeDA	-2.25	-1.07	0.05	2.943	8.83	4.30E-03	4.60E-03	4.70E-02	0.484	0	0	0	0	1	0	0	1.30E+01	1.07E+03
PFHxDA	-2.66	-1.72	-0.04	1.749	10.17	3.10E-04	3.70E-04	6.30E-03	0.524	0	0	0	0	1	0	0	8.33E+00	1.07E+03
PFODA	-3.08	-2.36	-0.14	0.548	11.51	2.20E-05	3.00E-05	8.40E-04	0.524	0	0	0	0	0	0	0	5.36E+00	1.07E+03
PFPeS	-0.57	1.26	0.13	1.484	2.49	1.05E+03	6.25E+02	5.60E+02	0.736	0	0	0	0	0	1	1	3.22E+00	3.39E+02
PFOS	-1.19	0.29	-0.01	3.23	4.49	2.37E+01	1.69E+01	3.26E+01	0.75	0.5	0.25	0	0	0	0	0.25	1.66E+00	2.36E+02

Table S12. ToxPi scores, exposure, and risk indexes (RIs) of PFAS in samples of wild mammals.

Compound	Exposure _{normalized}	ToxPi Score	RI	Priority	Rank
PFOA	0.6837	0.4982	0.3406	High	1
PFPeA	1.0000	0.2199	0.2199	High	2
PFPeS	0.5064	0.2516	0.1274	High	3
PFOS	0.2645	0.4548	0.1203	High	4
PFHxDA	0.1622	0.5537	0.0898	Medium	5
PFHxA	0.2275	0.3370	0.0767	Medium	6
PFODA	0.1173	0.6163	0.0723	Medium	7
PFBA	0.4142	0.1306	0.0541	Medium	8
PFHpA	0.0163	0.4124	0.0067	Low	9
PFDA	0.0076	0.4884	0.0037	Low	10
PFUnDA	0.0056	0.5868	0.0033	Low	11
PFTeDA	0.0009	0.6645	0.0006	Insignificant	12
PFDoDA	0.0010	0.5821	0.0006	Insignificant	13
PFTrDA	0.0004	0.5295	0.0002	Insignificant	14
PFNA	0.0000	0.3907	0.0000	Insignificant	15

**Figure S1.** Map of the sampling areas and study region.

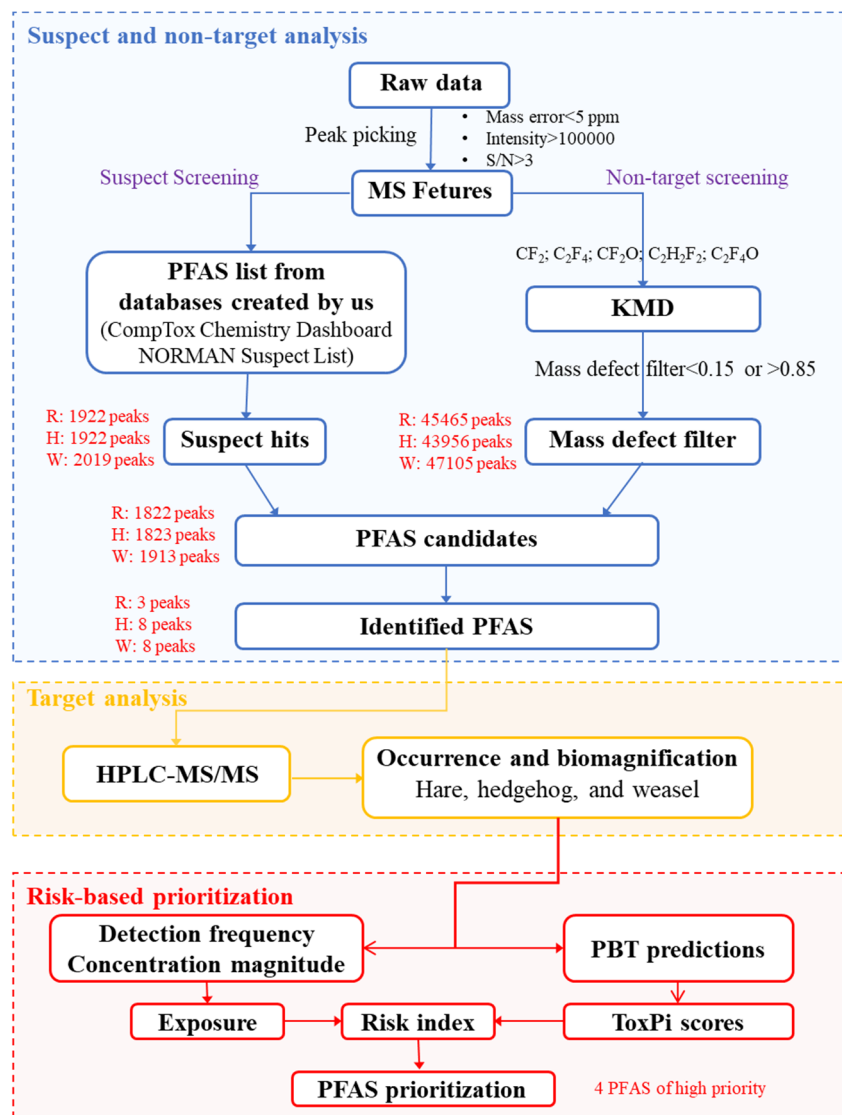


Figure S2. Workflow for target, suspect and non-target screening of PFAS and risk-based prioritization. R, H, and W represent samples of hare, hedgehog, and weasel, respectively.

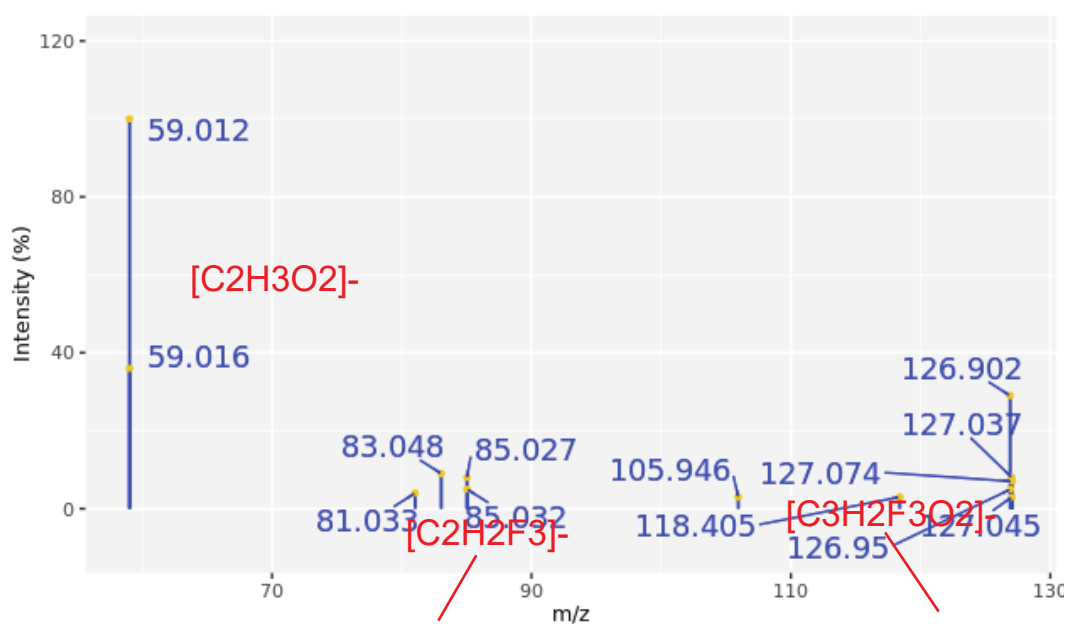


Figure S3. MS/MS spectrum of $C_3H_3F_3O_2$.

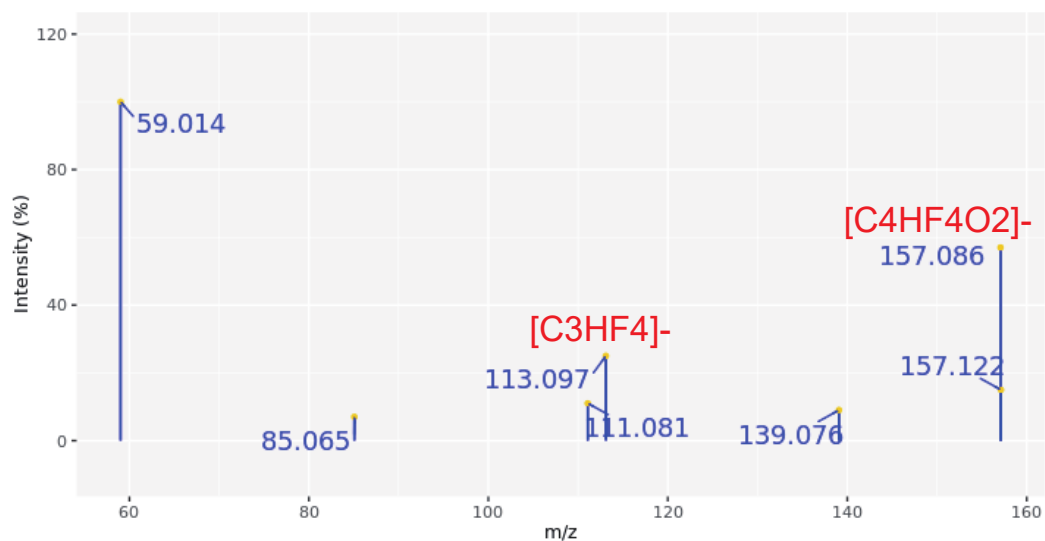


Figure S4. MS/MS spectrum of $C_4H_2F_4O_2$.

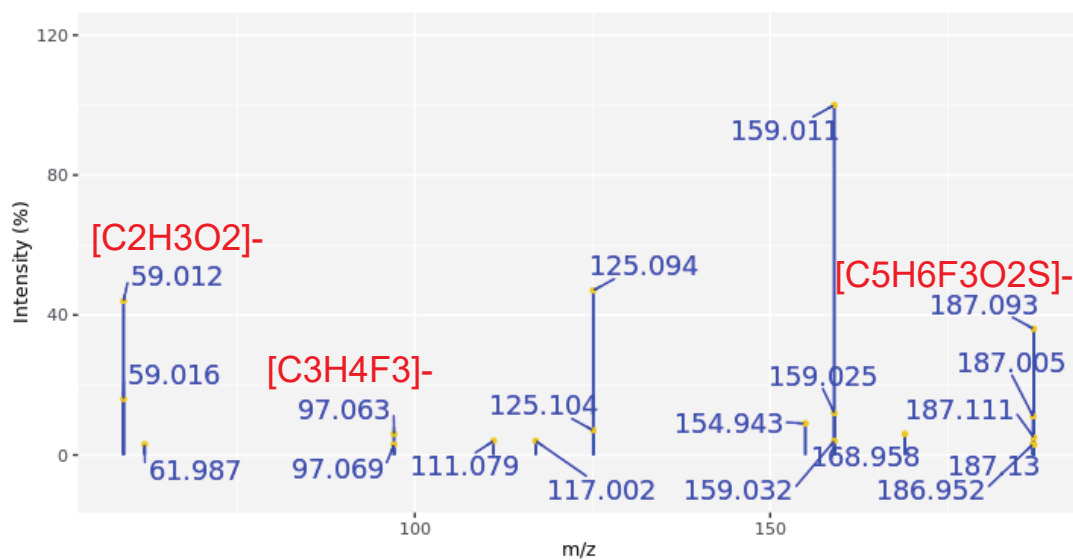


Figure S5. MS/MS spectrum of $C_5H_7F_3O_2S$.

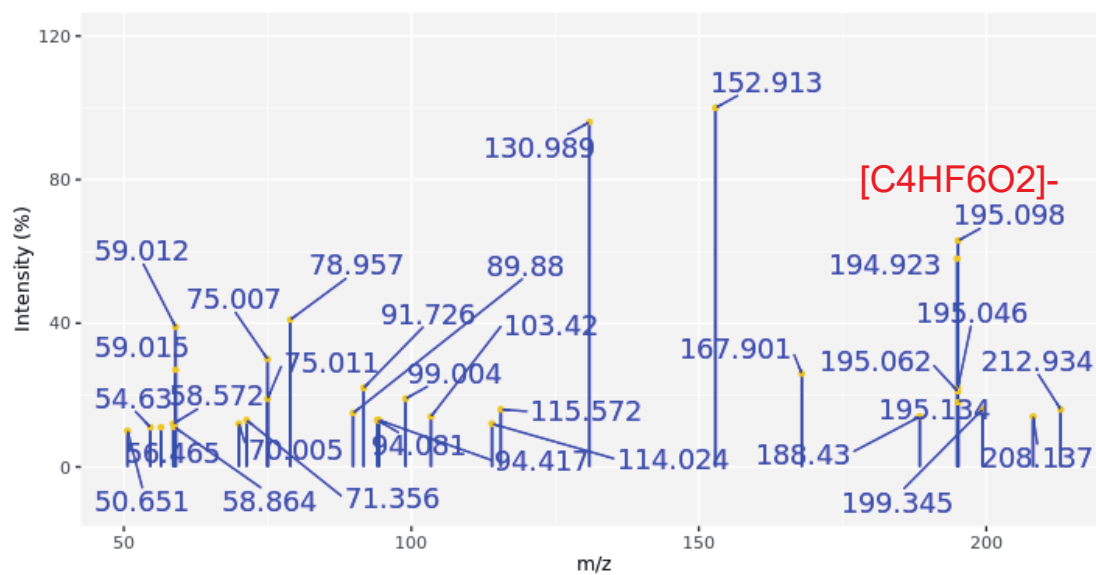


Figure S6. MS/MS spectrum of $C_4H_2F_6O_2$.

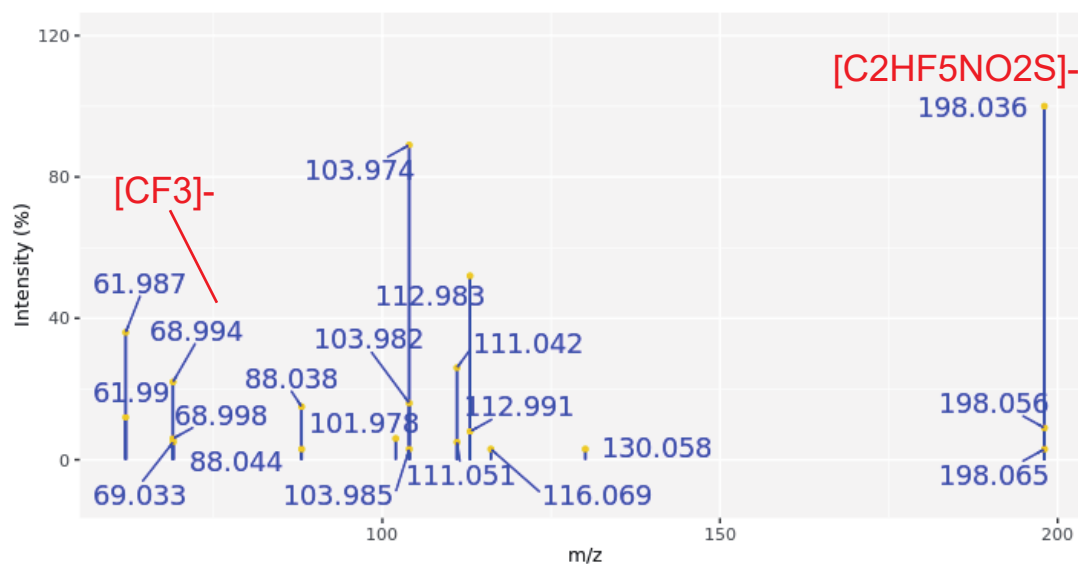


Figure S7. MS/MS spectrum of $C_2H_2F_5NO_2S$.

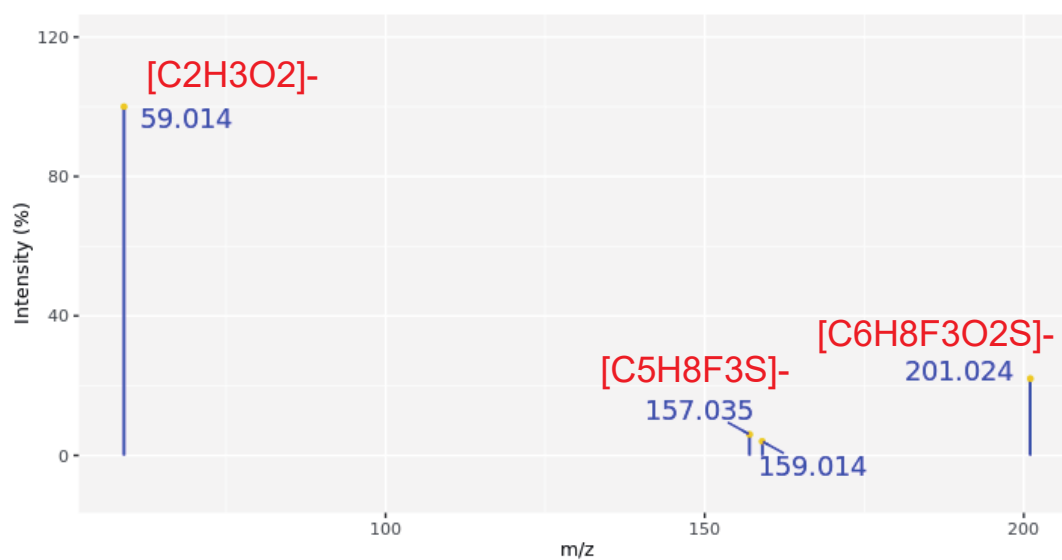


Figure S8. MS/MS spectrum of $C_5H_3F_5O_4$.

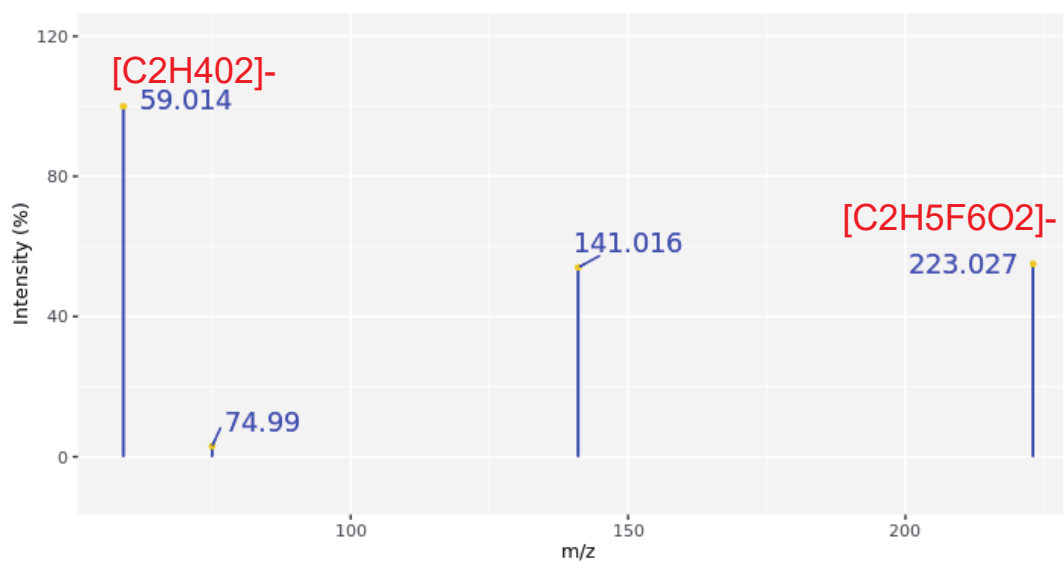


Figure S9. MS/MS spectrum of $C_6H_6F_6O_2$.

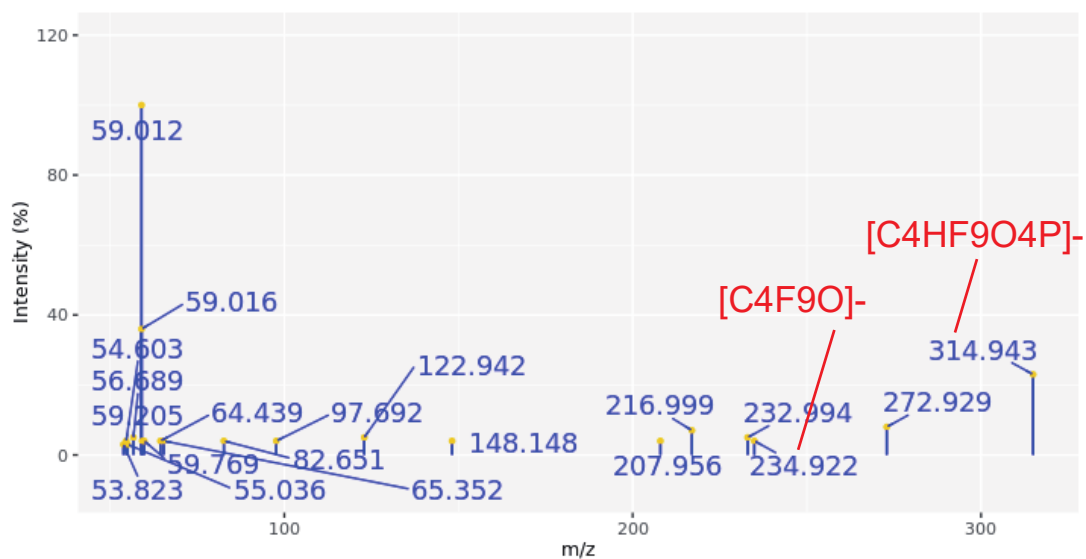


Figure S10. MS/MS spectrum of $C_4H_2F_9O_4P$.

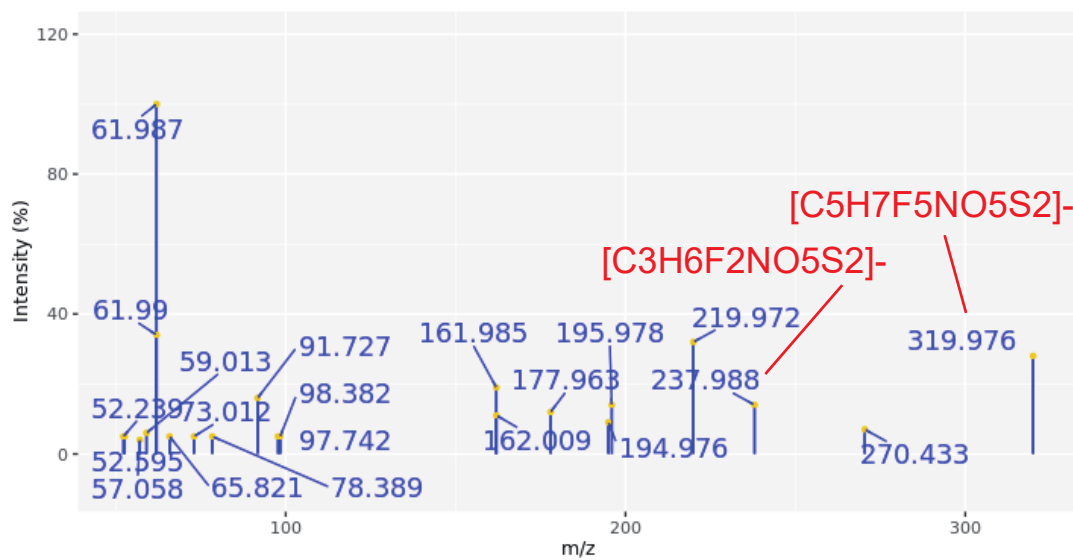


Figure S11. MS/MS spectrum of $C_5H_8F_5NO_5S_2$.

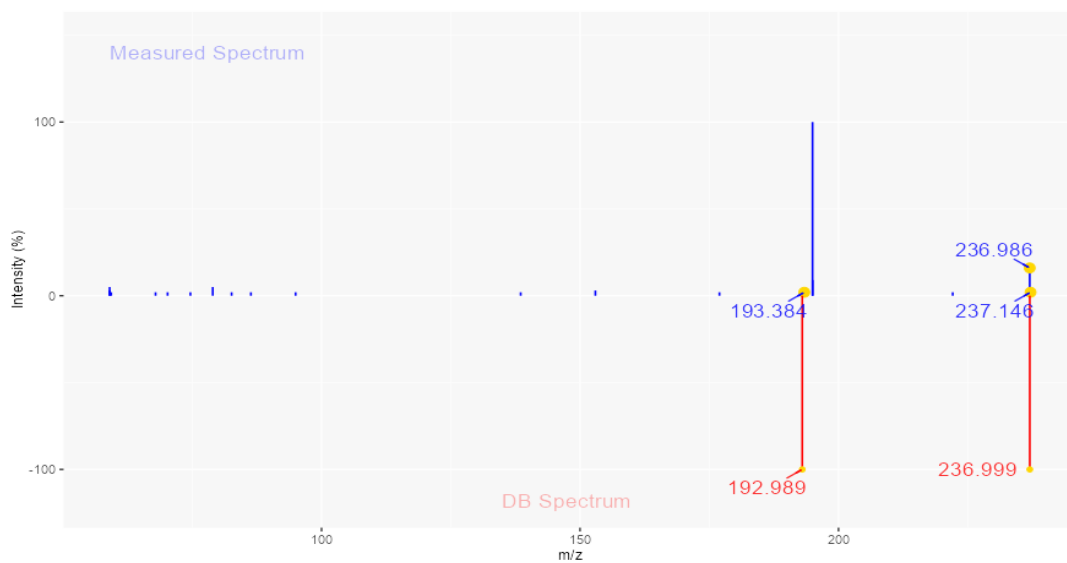


Figure S12. MS/MS spectrum of $C_6H_4F_6O_3$.

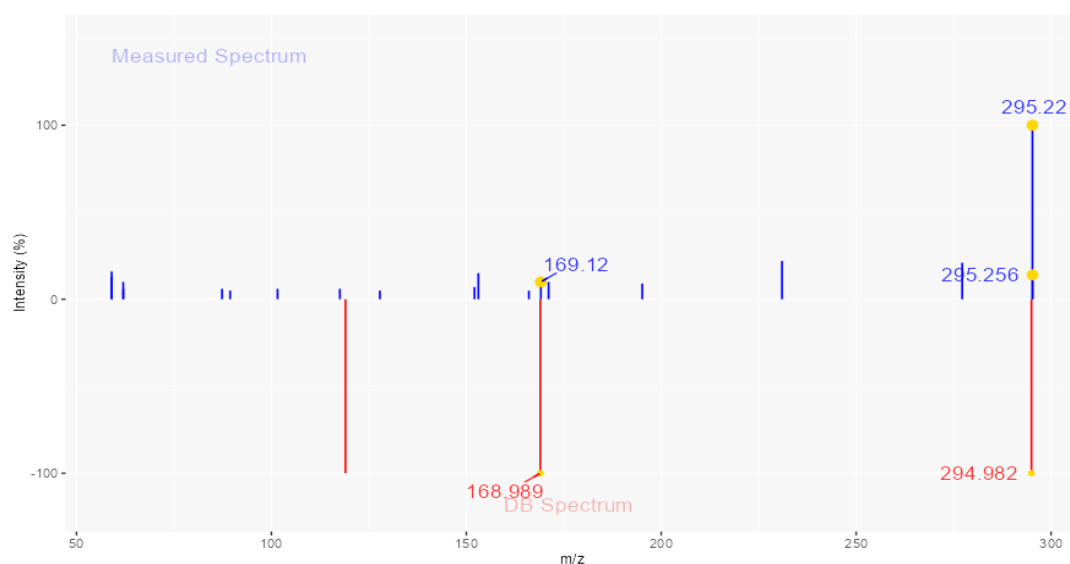


Figure S13. MS/MS spectrum of $C_6H_2F_{10}O_2$.

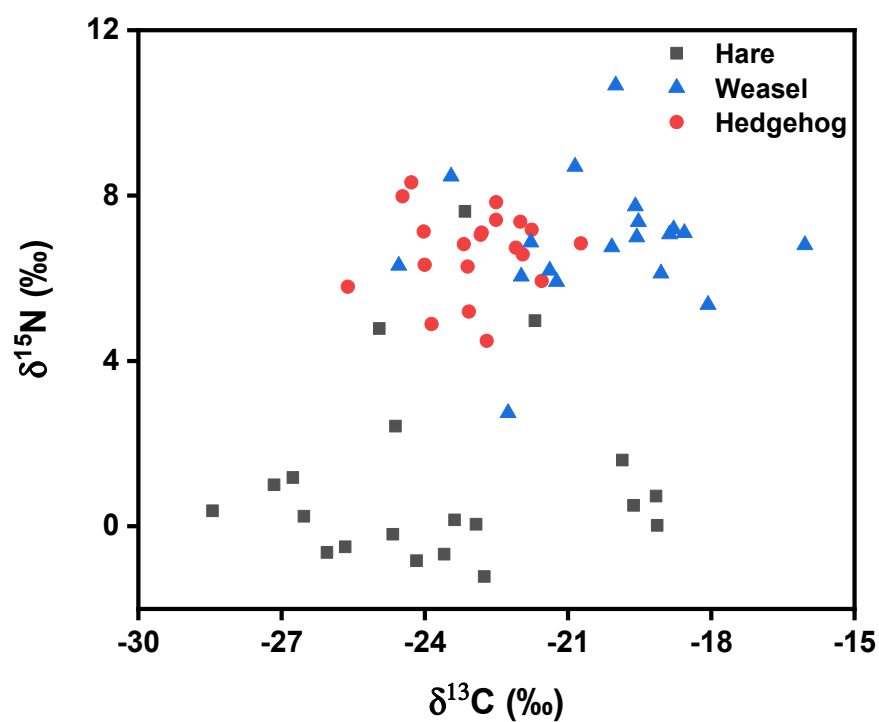


Figure S14. Correlations between carbon stable isotopes ($\delta^{13}C$) and nitrogen stable isotopes ($\delta^{15}N$) in three terrestrial mammal species.

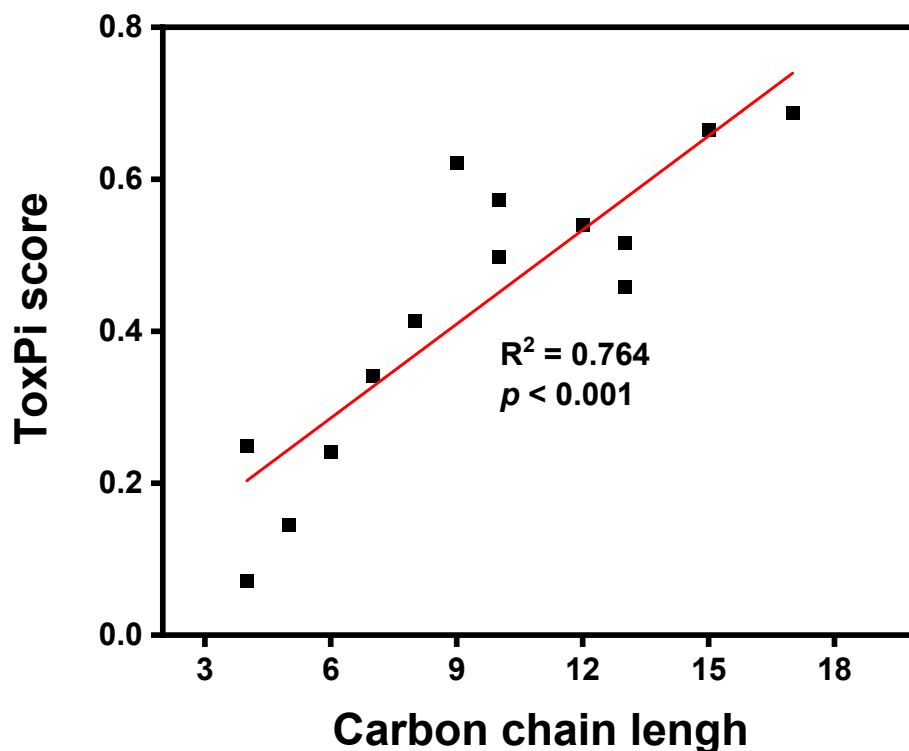


Figure S15. The relationship between ToxPi scores and the number of carbon atoms.

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