



Targeted and Non-Targeted Analysis Reveal the Per- and Polyfluoroalkyl Substance (PFAS) Profiles in Hudson Bay Polar Bears

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NCP Project
M-05

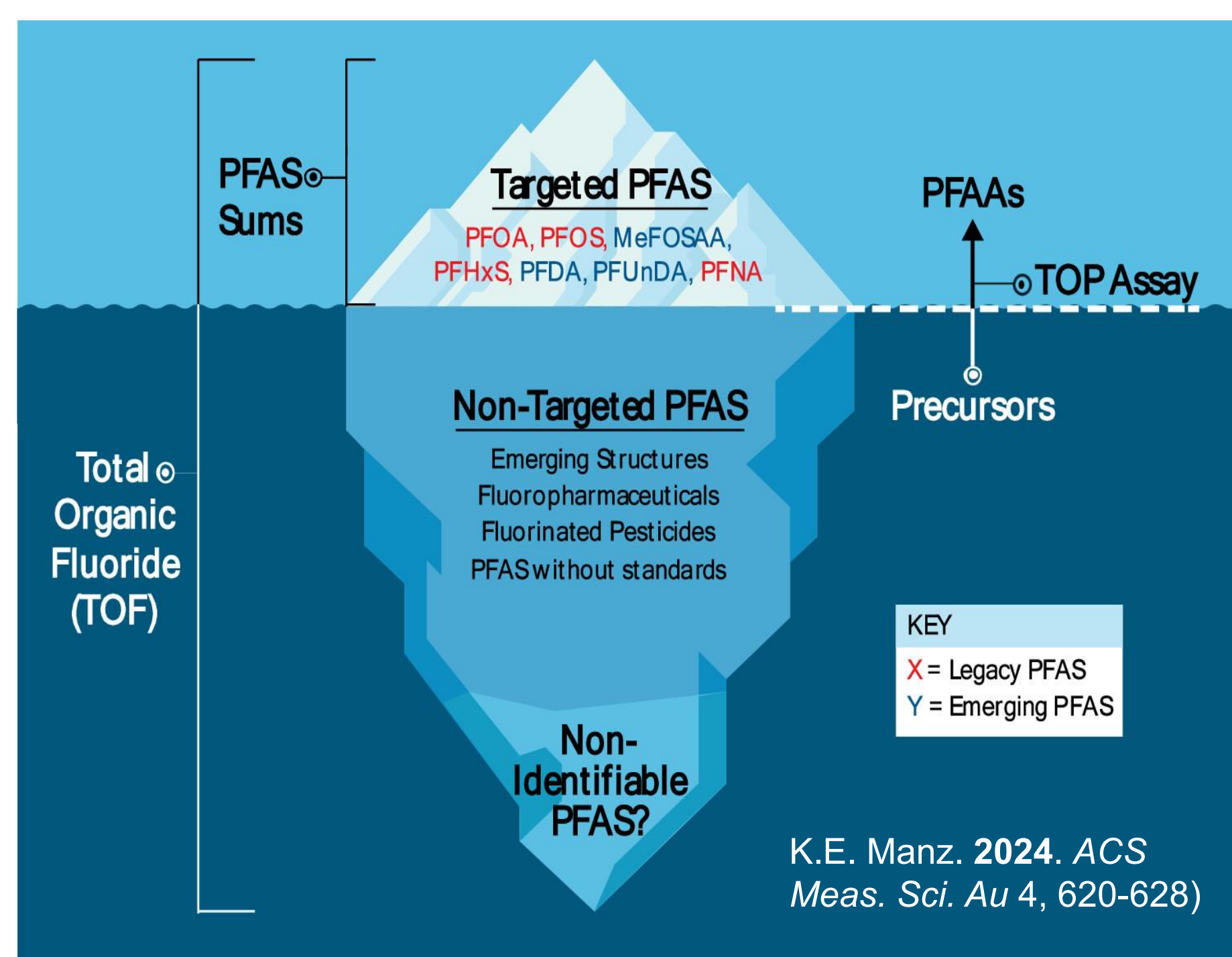
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Introduction



- PFAS are a large group of anthropogenic chemicals that have been widely used for over 70 years due to their unique properties
- There is widespread environmental contamination of mainly legacy longer-chain PFAS in the Arctic
- Perfluorooctanesulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorooctanoic acid (PFOA) and longer-chain PFCAs are regulated under the Stockholm Convention on POPs



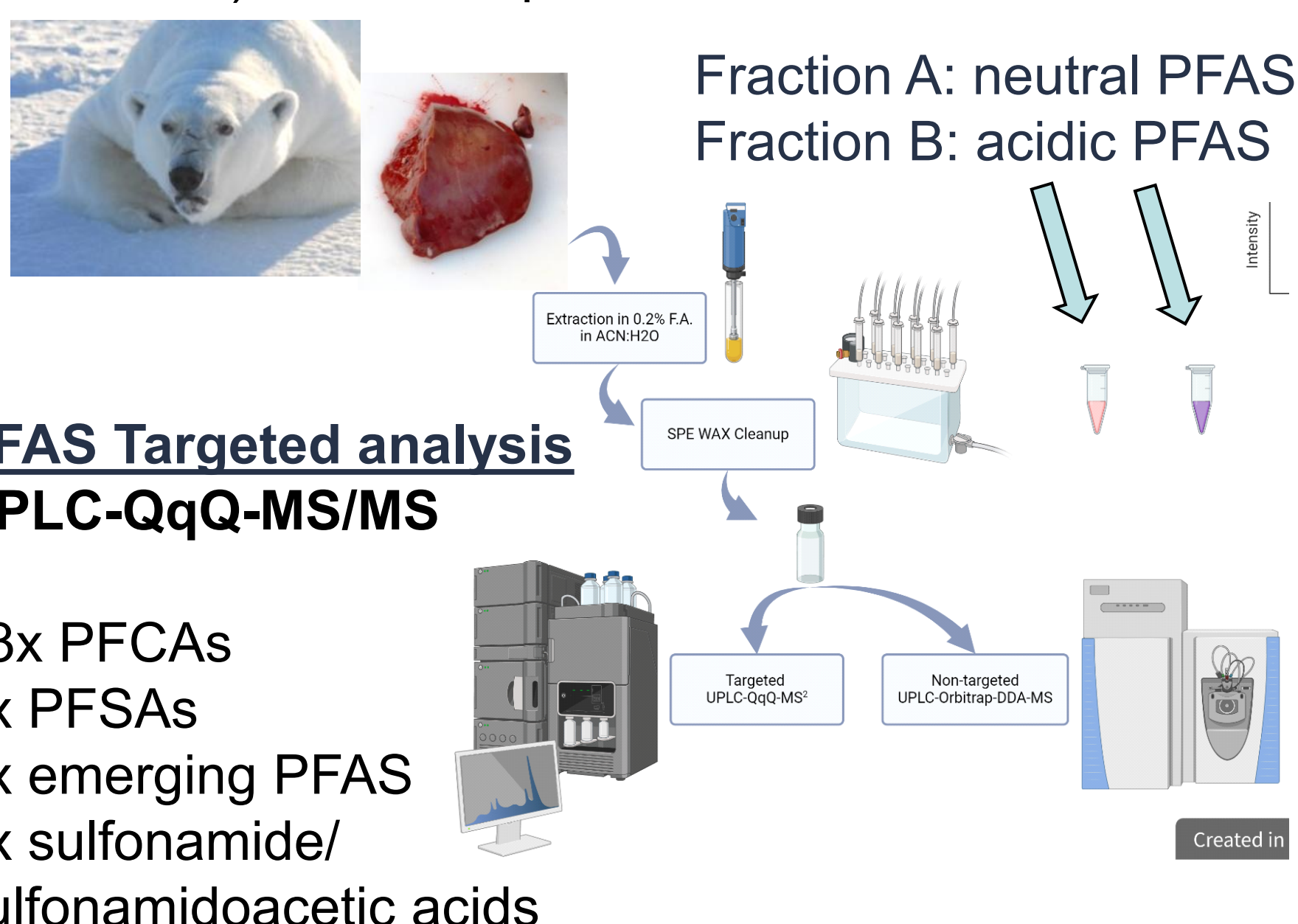
- Thousands of new alternative PFAS replacements but there are in the order of 6% (or 30-40) PFAS that are routinely monitored in the environment including in the Arctic
- Non-targeted analysis (NTA) has become extremely necessary to identify previously unknown PFAS in environmental samples

Study objective:

Development of a combined method to determine targeted, legacy and alternative PFAS as well as PFAS NTA with application for PFAS profiling in the liver of Hudson Bay polar bears

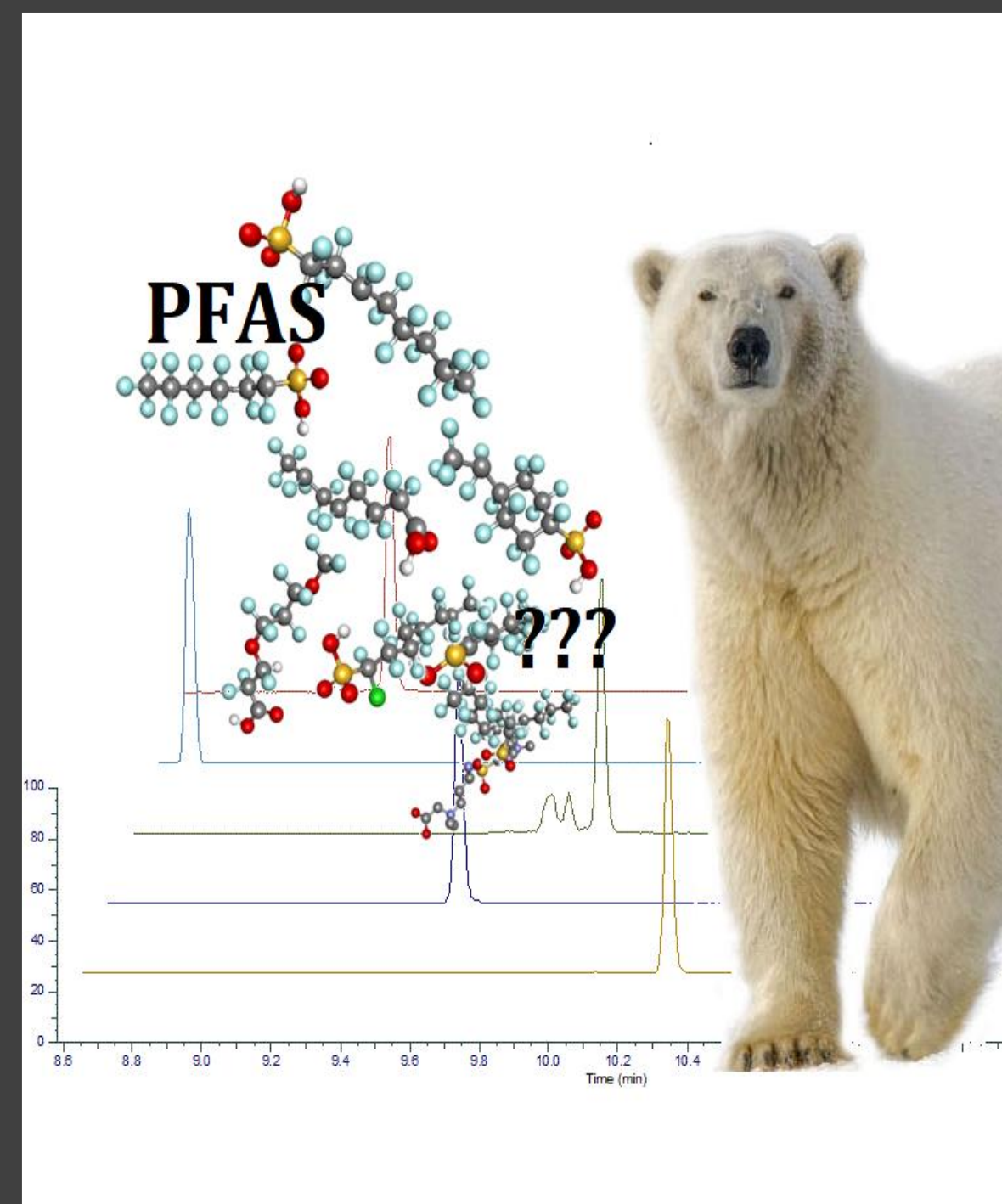
Methods

Liver samples from n=20 (adult male) SHB (Sanikiluaq) and WHB (Rankin Inlet, Whale Cove and Arviat) bears sampled in 2019-2020



PFAS Non-Targeted analysis (NTA)
UPLC-Q-Exactive-HRMS
(CompoundDiscoverer 3.3)

Highlights / Conclusions



43 PFAS were identified (Table 1) and all of these PFAS were identified using ESI(-)

PFASs accounted of 50 % to 74 % of the total of 32 quantifiable PFAS

- Except for FOSA which was detected in neutral fraction#1, all other PFAS listed in Table 1 were detected in (acidic) fraction#2
- Cationic and zwitterionic PFAS in sample fractions by ESI(+) were not detected in polar bear liver
- In all the samples, PFOS dominated the PFAS composition and other than linear PFOS there were also three branched PFOS isomer peaks detected (Figure 1).
- The combined results from targeted analysis and NTA showed the presence of 32 PFAS in polar bear liver samples

The results showed that more legacy and alternative PFAS were present in these polar bear liver samples than previously thought

Still substantial knowledge gaps to bridge regarding PFAS analysis and inclusion of an increasing number of non-polymeric and polymeric PFAS which now total some 4700 PFAS that are known to be produced and used

Acknowledgements

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Results

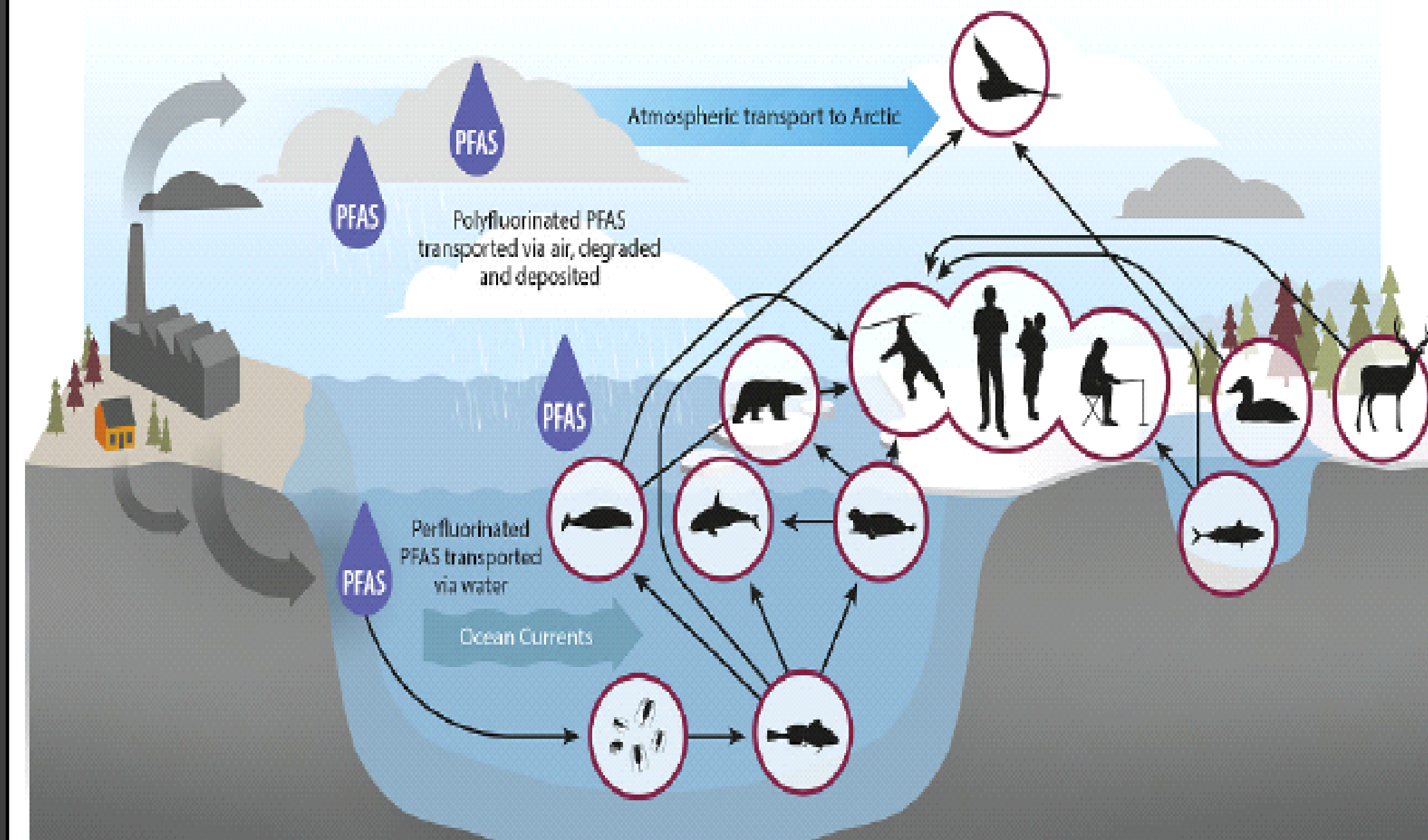


Table 1: PFAS concentrations (ng/g wet weight) in polar bear liver samples from Hudson Bay

No.	Comp. Name*	C.L.**	RT(min)	Polar Bear Liver	
				Conc. Range	Detected rate (%)
1	PFBS	1a	6.32	ND-0.71	70
2	PPHxA	1a	7.22	—	0
3	isoPFHpA	3a	7.50	—	0
4	PPHpA	1a	8.06	ND-3.55	55
5	PPHxS	1a	8.12	3.92-16.16	100
6	NaDONA	1a	8.15	—	0
7	6:2 FTSA	3c	8.67	0.01-0.52	100
8	H-PFDA	3c	8.73	-0.96-0.91	35
9	PPEtCHxS	1a	8.61	0.45-1.63	100
10	PFOA	1a	8.67	2.79-51.61	100
11	PPHpS	2a	8.70	1.70-28.00	100
12	isoPFOS(3)	3a	8.88	0.09-1.19	100
13	H-PFUnDA	3c	8.90	2.04-40.50	100
14	isoPFOS(2)	3a	8.99	9.97-104.69	100
15	isoPFOS(1)	3a	9.05	9.78-162.27	100
16	PFNA	1a	9.17	46.63-306.96	100
17	L-PFOS	1a	9.17	117.04-1932.17	100
18	H-PFDS	3c	9.17	0.63-8.94	100
19	CL-PFOS	3c	9.24	ND-0.25	50
20	PFOG	3c	9.35	—	0
21	9-Cl-PFOS	1a	9.43	ND-0.42	40
22	isoPFNS	3a	9.43	—	0
23	isoPFDA	3a	9.47	ND-4.22	95
24	PFDA	1a	9.59	13.48-255.05	100
25	PFNS	2a	9.58	ND-2.24	70
26	H-PFDoA	3c	9.59	0.45-9.86	100
27	isoPFDS(2)	3a	9.79	—	0
28	N-MeFOGAA	1a	9.82	—	0
29	isoPFDS(1)	3a	9.84	0.39-4.20	100
30	isoPFUnDA	3a	9.86	0.03-2.88	100
31	L-PFDS	1a	9.93	0.06-1.34	100
32	PFUnDA	1a	9.96	20.72-181.08	100
33	N-EtFOGAA	1a	10.01	—	0
34	H-PFTeDA	3c	9.96	0.33-5.19	100
35	PFDoA	1a	10.27	1.22-13.19	100
36	H-PFTeDA	3c	10.28	—	0
37	FOGA	1a	10.30	2.18-54.25	100
38	PFTeDA	1a	10.56	3.11-24.52	100
39	PFDoS	2c	10.52	—	0
40	H-PFPeDA	3c	10.56	—	0
41	PFTeDA	1a	10.81	0.09-2.15	100
42	PFPeDA	2c	11.03	ND-1.00	75
43	PPHxDA	1a	11.24	ND-0.18	50

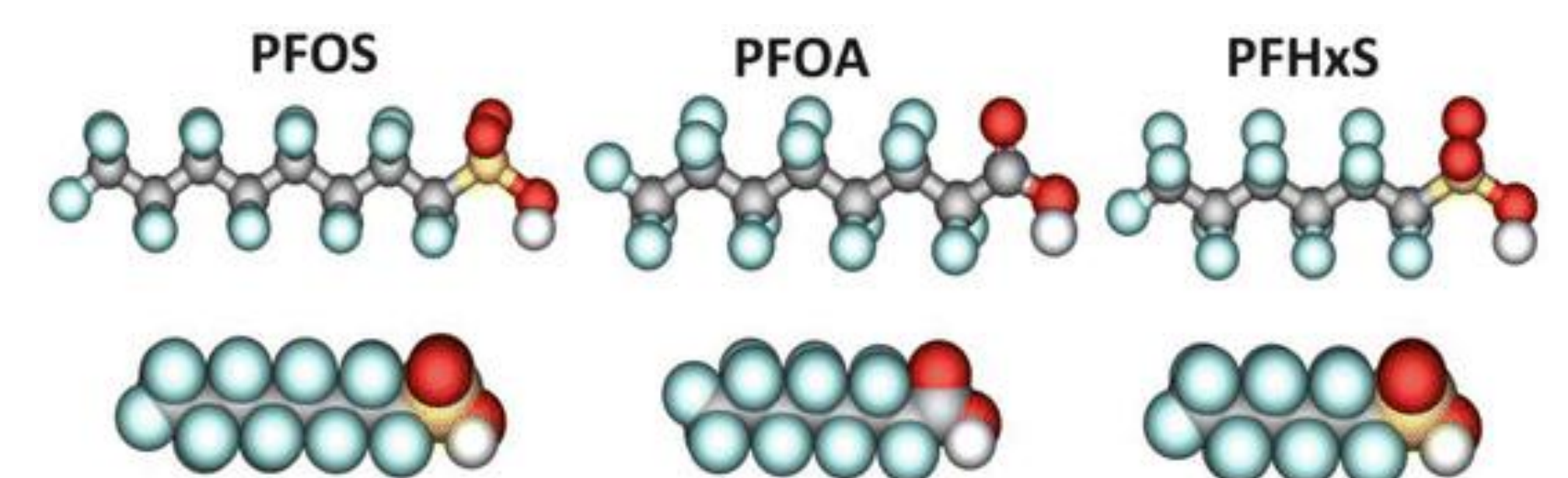
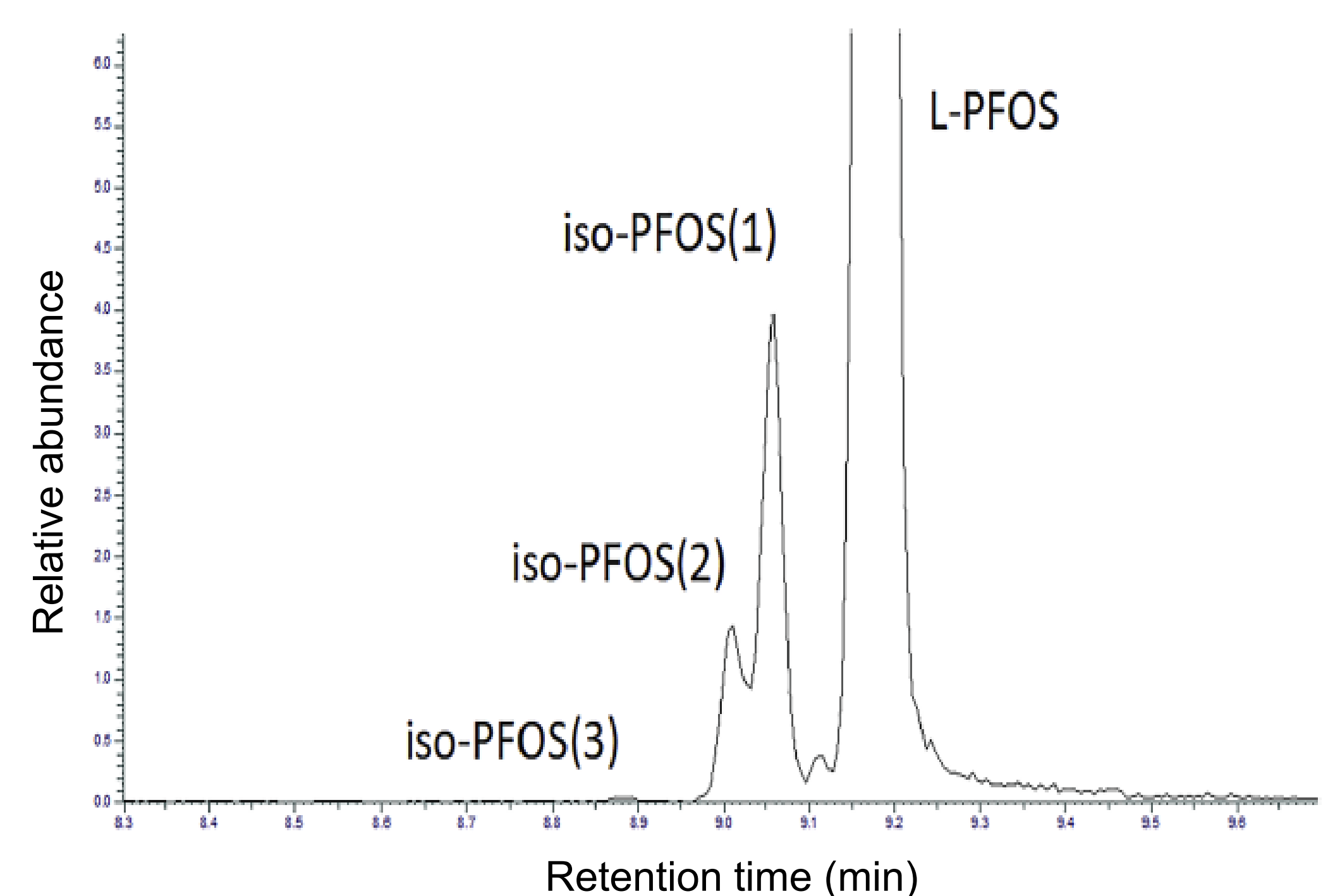


Figure 1: An extracted ion chromatogram of linear and branched PFOS (m/z 498.9302) isomers in a representative sample of a polar bear liver samples



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