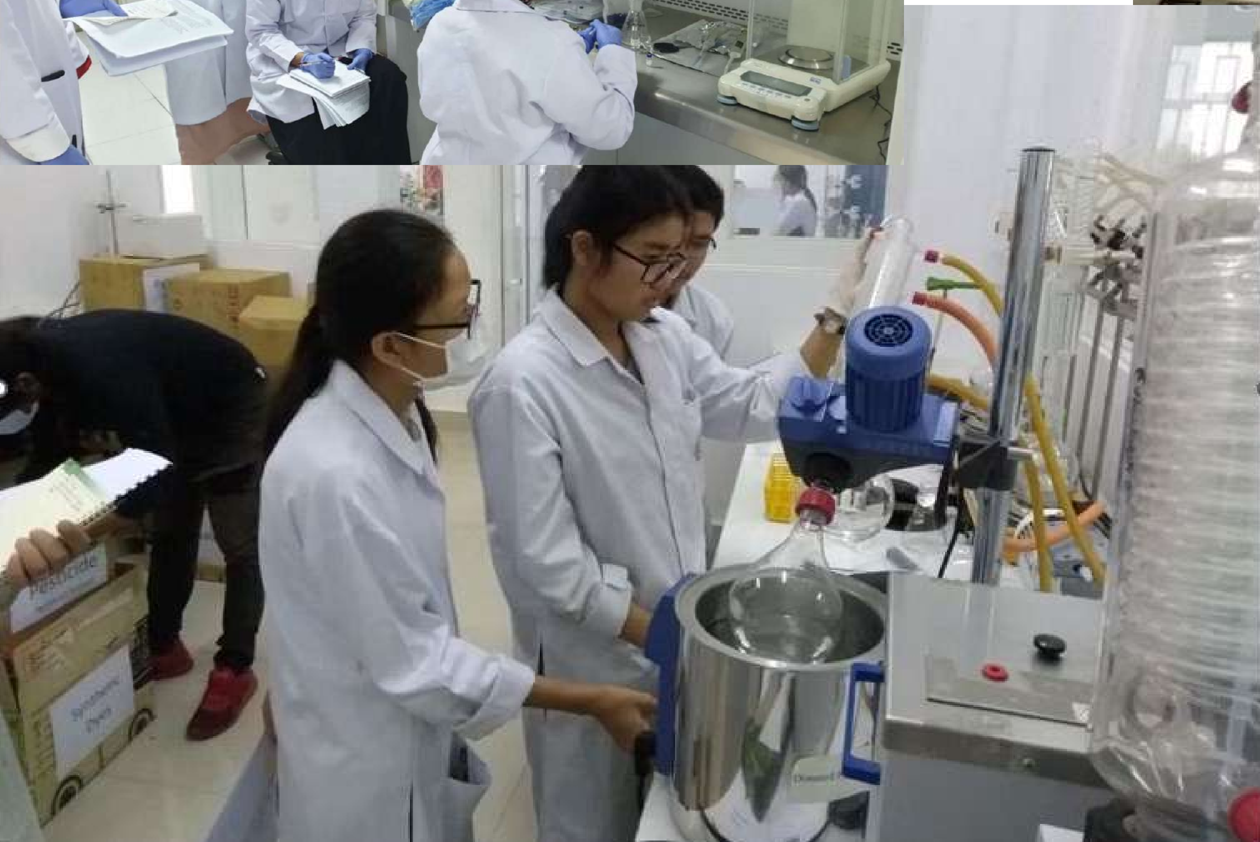
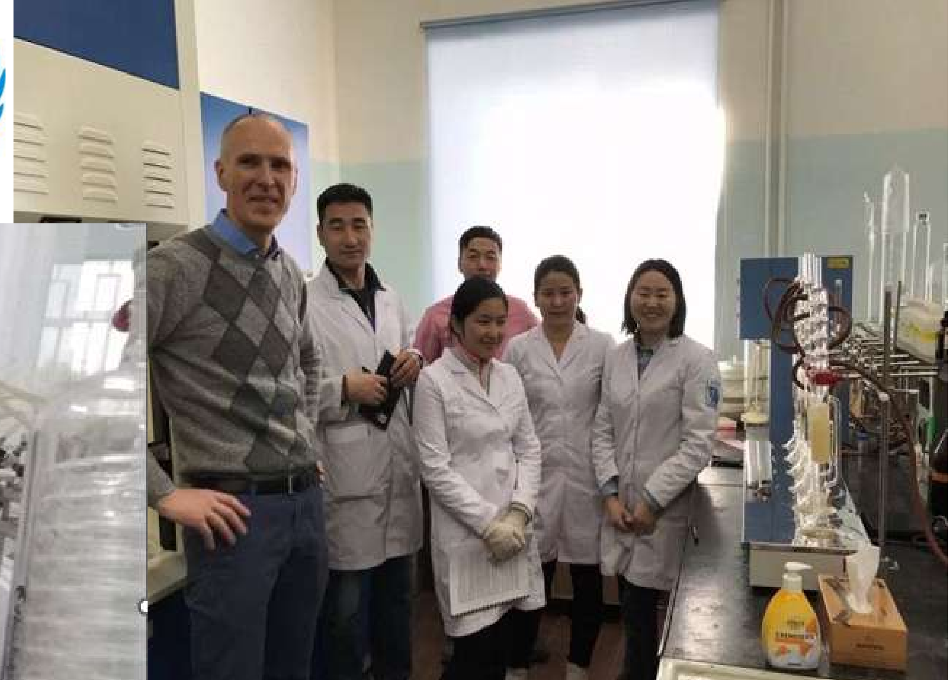
Overview of the outputs and outcomes of the UNEP/GEF POPs GMP project

Experts presentations

Final meeting of the UNEP/GEF POPs GMP projects
in the Asia and the Pacific region

Bangkok, Thailand 4-5 April 2023


Capacity Building in Mongolia, Cambodia, Philippines and Indonesia

Jacob de Boer, Rianne van Dijk, Jacco Koekkoek, Martin van Velzen

On-site Training Overview

- Mongolia
- Cambodia
- Philippines
- Indonesia

- Two days theory training
- Five days praticial training

- Ca. 10-20 participants, often more during theoretical training

- Topics: QA/QC
- GC/ECD and/or GC/MS
- Extraction and cleanup
- Integration and calculations, software

Cambodia

28 March-5 April 2019, Phnom Penh, 9 participants

GC/MS and GC/ECD

- Power failures
- Staff underqualified
- Some no basic chemistry knowledge
- No regular program

Philippines

4 and 5 December 2017 and 13 August – 17 August 2018, Quezon City, 12 participants
GC/ECD

- Lab still in development
- Dioxin lab is also planned
- Fume hoods insufficient capacity
- Issues with ordering standards
- No regular program

Mongolia

Ulaanbataar, 6 and 14 February 2017, 11 participants,
25 participants at one extra lecture
GC/ECD

- Benches full with bottles
- Sand/dust on the benches
- GC not continiously running
- Column deterioration
- No regular program

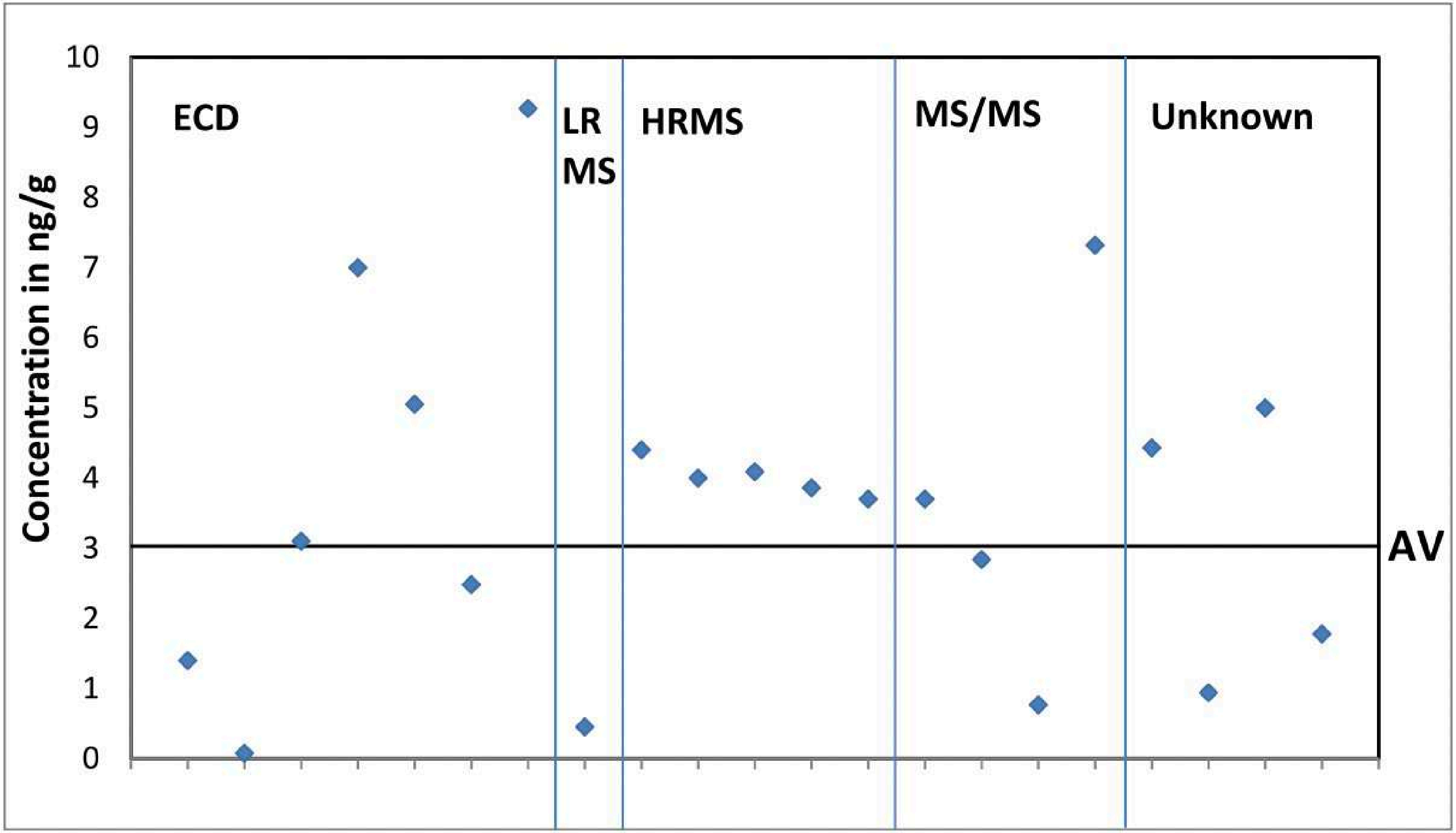
Indonesia

- 4-12 April 2019, Serpong, 14 participants and
- 1 from Myanmar, 40 at theoretical training
- GC/ECD and GC/MS

- Clean labs, free from dust
- Air-conditioned labs
- Good discussions
- Dioxin lab on premises
- More attention for safety is needed

ECD-MS

Dieldrin in sediment (ILS4)



Concluding remarks

- Regular POP analysis program in labs is a prerequisite for good quality
- GC/MS and maintenance thereof is essential for growing list of POPs
- Problems with ordering standards and service of instrumentation
- Often underqualified staff with lack of experience in POPs
- Business plans often lacking
- SOPs were often not used
- Safety issues
- Background problems (dust)
- Environmental labs may not always get a priority treatment from their governments

Summary of interlaboratory assessments (four rounds)

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In full collaboration with Jacob de Boer and Ike van der Veen, E&H VU

Interlaboratory Assessments

4 rounds: 2010/2011, 2012/2013, and 2016/2017, 2018/2019

— Objective tool to test and communicate performance of a laboratory

— A test sample is sent to all laboratories interested and they report amounts found in their lab and their methodology

— Time-limited; preferentially every two years

Published papers on interlaboratory assessments

- **OCPs/BFRs**: de Boer, J., I. van der Veen, and H. Fiedler (2022). Global interlaboratory assessments on PCBs, organochlorine pesticides and brominated flame retardants in various environmental matrices 2017/2019. Chemosphere, **295**, 133991. DOI: 10.1016/j.chemosphere.2022.133991
- **dl-POPs:** Fiedler, H., I. van der Veen, and J. de Boer (2022). Interlaboratory assessments for dioxin-like POPs (2016/2017 and 2018/2019). Chemosphere, **288**, 132449. DOI: 10.1016/j.chemosphere.2021.132449
- **PFAS:** van der Veen, I., H. Fiedler, and J. de Boer (2023). Assessment of the per- and polyfluoroalkyl substances analysis under the Stockholm Convention - 2018/2019. Chemosphere, **313**, 137549. DOI: 10.1016/j.chemosphere.2022.137549
- **Assessment for UNEP/GMP-funded countries:** Fiedler, H., I. van der Veen, and J. de Boer (2022). Assessment of four rounds of interlaboratory tests within the UNEP-coordinated POPs projects. Chemosphere, **288**(Pt 2), 132441. DOI: 10.1016/j.chemosphere.2021.132441.
- **Assessment of 2nd and 3rd rounds for PFAS**: Fiedler, H., I. van der Veen, and J. de Boer (2020). Global interlaboratory assessments of perfluoroalkyl substances under the Stockholm Convention on persistent organic pollutants. Trac-Trends in Analytical Chemistry, **124**, 115459. DOI: ARTN 115459, 10.1016/j.trac.2019.03.023. (not open access)

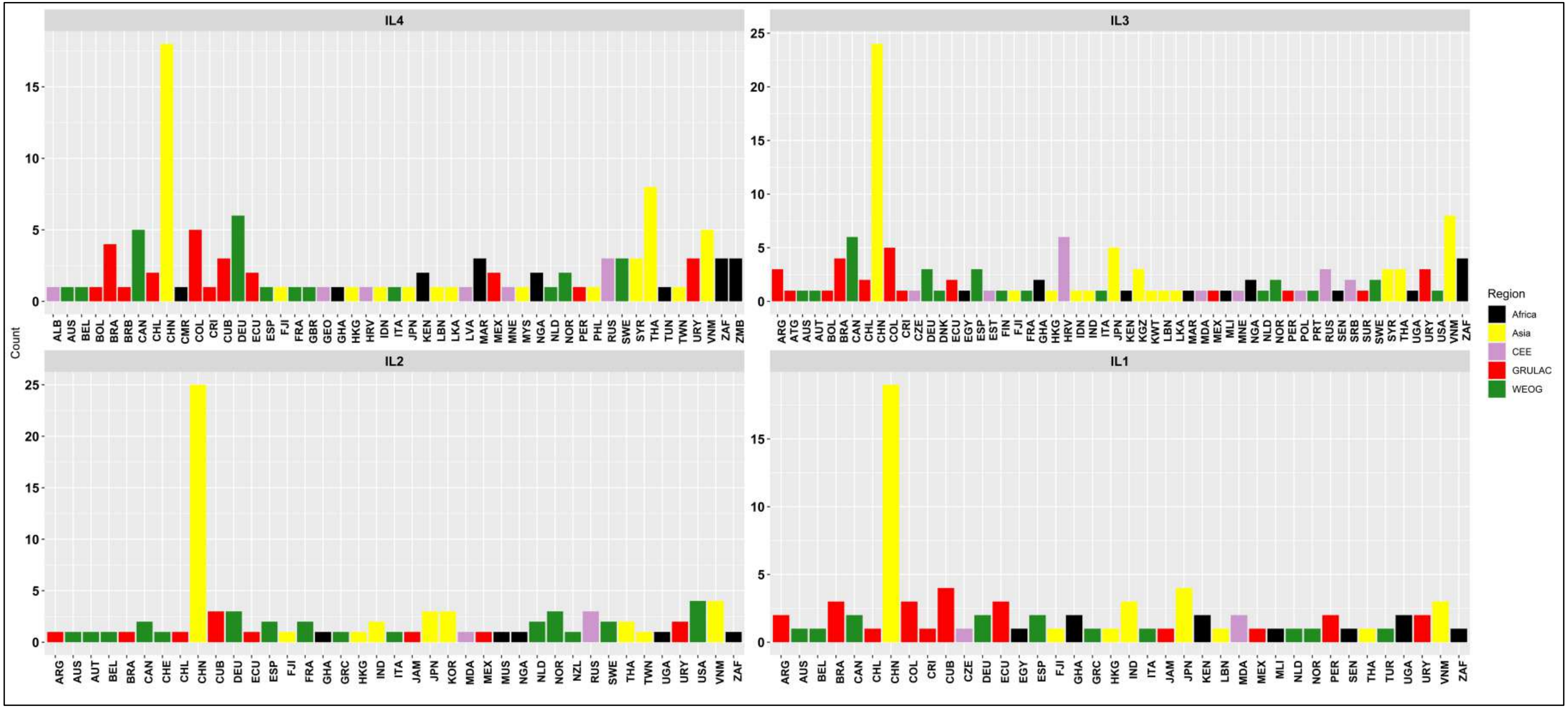
Participating laboratories by country and round

Region	#Labs
Africa	37
Asia	104
CEE	29
GRULAC	67
WEOG	57
Total	**294**

Round	IL1	IL2	IL3	IL4
All labs in the round	104	111	175	148
Labs delivered results	83	93	133	116
Labs not delivering results	21	18	42	32
Labs not registering	190	183	119	146

Region/Part.	1x P	2x P	3x P	4x P	Total
Africa	11	6	5	1	23
Asia	46	18	10	15	89
CEE	16	1	2	1	20
GRULAC	21	14	5	5	45
WEOG	25	13	9	4	51
Grand Total	**119**	**52**	**31**	**26**	**228**

Labs per country and round of interlab



Number of laboratories per country and round

AFR	IL4	IL3	IL2	IL1	Overall
CMR	1	0	0	0	1
EGY	0	1	0	1	2
GHA	1	2	1	2	6
KEN	2	1	0	2	5
MAR	3	1	0	0	4
MLI	0	1	0	1	2
MUS	0	0	1	0	1
NGA	2	2	1	0	5
SEN	0	1	0	1	2
TUN	1	0	0	0	1
UGA	0	1	1	2	4
ZAF	3	4	1	1	9
ZMB	3	0	0	0	3

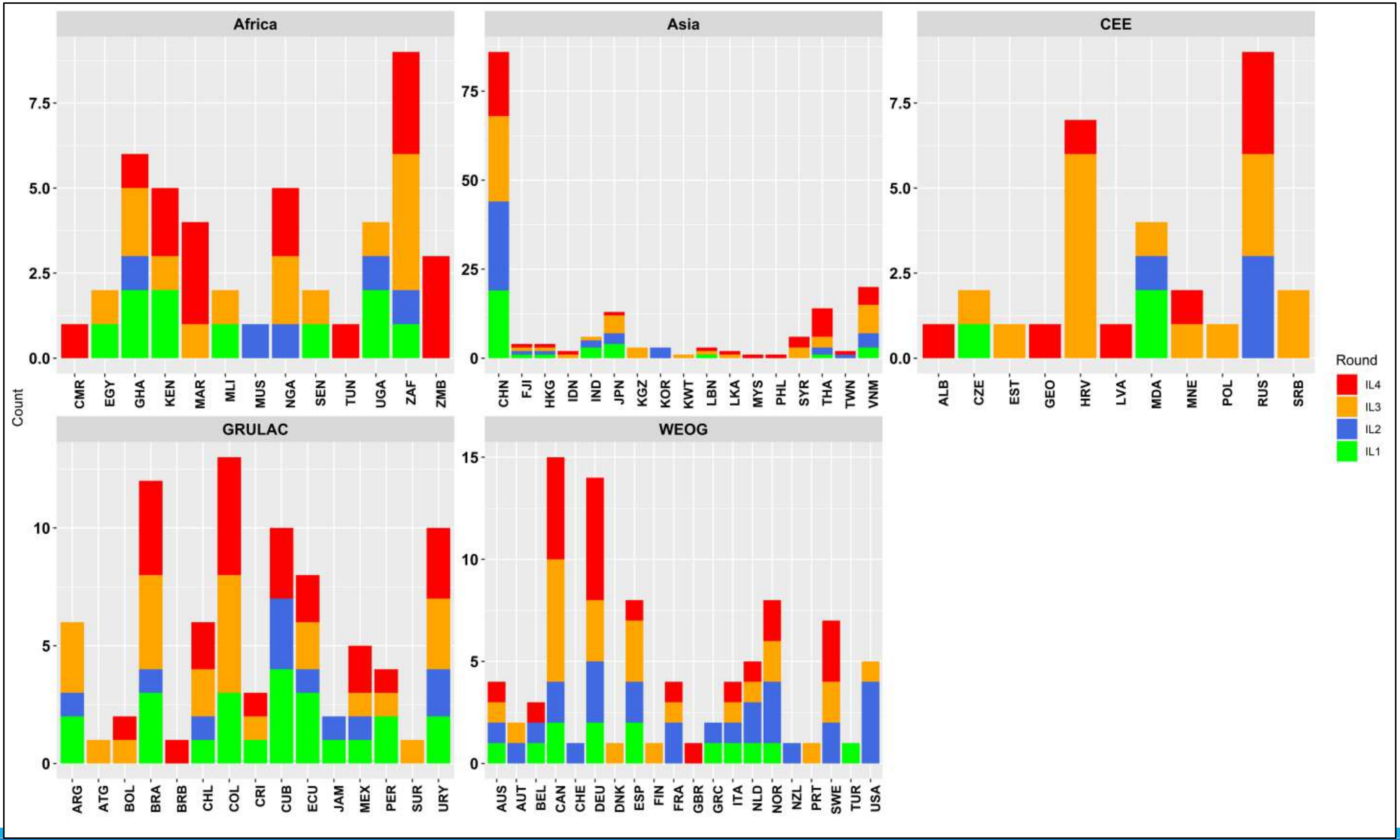
CEE	IL4	IL3	IL2	IL1	Overall
ALB	1	0	0	0	1
CZE	0	1	0	1	2
EST	0	1	0	0	1
GEO	1	0	0	0	1
HRV	1	6	0	0	7
LVA	1	0	0	0	1
MDA	0	1	1	2	4
MNE	1	1	0	0	2
POL	0	1	0	0	1
RUS	3	3	3	0	9
SRB	0	2	0	0	2

Asia	IL4	IL3	IL2	IL1	Overall
CHN	18	24	25	19	86
FJI	1	1	1	1	4
HKG	1	1	1	1	4
IDN	1	1	0	0	2
IND	0	1	2	3	6
JPN	1	5	3	4	13
KGZ	0	3	0	0	3
KOR	0	0	3	0	3
KWT	0	1	0	0	1
LBN	1	1	0	1	3
LKA	1	1	0	0	2
MYS	1	0	0	0	1
PHL	1	0	0	0	1
SYR	3	3	0	0	6
THA	8	3	2	1	14
TWN	1	0	1	0	2
VNM	5	8	4	3	20

GRULAC	IL4	IL3	IL2	IL1	Overall
ARG	0	3	1	2	6
ATG	0	1	0	0	1
BOL	1	1	0	0	2
BRA	4	4	1	3	12
BRB	1	0	0	0	1
CHL	2	2	1	1	6
COL	5	5	0	3	13
CRI	1	1	0	1	3
CUB	3	0	3	4	10
ECU	2	2	1	3	8
JAM	0	0	1	1	2
MEX	2	1	1	1	5
PER	1	1	0	2	4
SUR	0	1	0	0	1
URY	3	3	2	2	10

WEOG	IL4	IL3	IL2	IL1	Overall
AUS	1	1	1	1	4
AUT	0	1	1	0	2
BEL	1	0	1	1	3
CAN	5	6	2	2	15
CHE	0	0	1	0	1
DEU	6	3	3	2	14
DNK	0	1	0	0	1
ESP	1	3	2	2	8
FIN	0	1	0	0	1
FRA	1	1	2	0	4
GBR	1	0	0	0	1
GRC	0	0	1	1	2
ITA	1	1	1	1	4
NLD	1	1	2	1	5
NOR	2	2	3	1	8
NZL	0	0	1	0	1
PRT	0	1	0	0	1
SWE	3	2	2	0	7
TUR	0	0	0	1	1
USA	0	1	4	0	5

Participation by lab and country for each region



Overview on data table

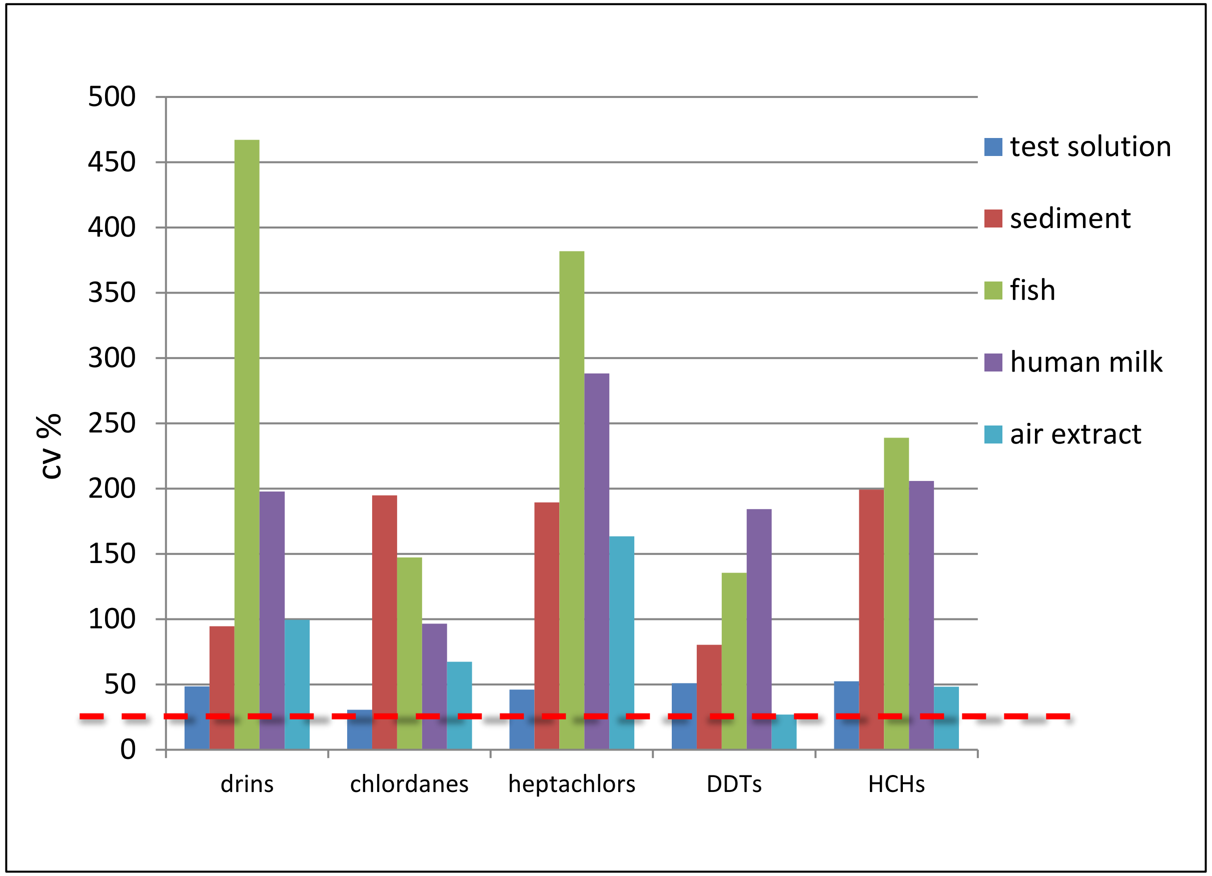
Matrix	POP_Subgroup	POP_Group	Rd	POP	L001	L002	L003	L004	L005	L006	//	L296	L297	L298	L301	L302	L303	L304	L306
TS	PCDD/PCDF	dl-POPs	IL1	1,2,3,4,6,7,8-HpCDD	S	S	S	S	S	NR		NR	NR	NR	NR	NR	NR	NR	NR
Ash	PCDD/PCDF	dl-POPs	IL1	1,2,3,4,6,7,8-HpCDD	NR	NR	S	S	S	NR		NR	NR	NR	NR	NR	NR	NR	NR
				//															
TS	Chlordanes	OCP	IL2	a-Chlordane	S	S	NR	S	S	NR									NR
Sed	Chlordanes	OCP	IL2	a-Chlordane	NR	NR	NR	U	S	NR									NR
Fish	Chlordanes	OCP	IL2	a-Chlordane	Q	S	NR	Q	S	NR									NR
				//															
HM	DDT	OCP	IL1	DDTs (LB)	U	U	NR	Q	NR	NR									NR
TS	DDT	OCP	IL1	DDTs (LB)	S	Q	S	S	Q	S									NR
Sed	DDT	OCP	IL1	DDTs (LB)	NR	NR	Q	S	U	S									NR
				//															
TS	ndl-PCB	PCB	IL2	PCB(6) (LB)	NR	NR	NR	NR	S	S									NR
Sed	ndl-PCB	PCB	IL2	PCB(6) (LB)	NR	NR	NR	S	S	S									NR
HM	PCDD/PCDF/PCB	dl-POPs	IL4	TEQ(total) (LB)	S	NR	NR	Q	NR	NR									NR
Air	PCDD/PCDF/PCB	dl-POPs	IL4	TEQ(total) (LB)	NR	NR	U	S	NR	NR									NR
				//															
TS	PCDD/PCDF/PCB	dl-POPs	IL1	TEQ(total) (UB)	S	S	S	S	NR	NR									NR
Ash	PCDD/PCDF/PCB	dl-POPs	IL1	TEQ(total) (UB)	NR	NR	S	S	NR	NR									NR
TS	PCDD/PCDF/PCB	dl-POPs	IL2	TEQ(total) (UB)	S	S	S	S	S	NR		NR	NR	NR	NR	NR	NR	NR	NR

339 607	cells, of these
298 032	Not reported (NR)
25 192	Satisfactory results (S)
3 991	Questionale (Q(
10 305	Unsatisfactortory (U)
584	Consistent (C)
1 503	Inconsistent (I)

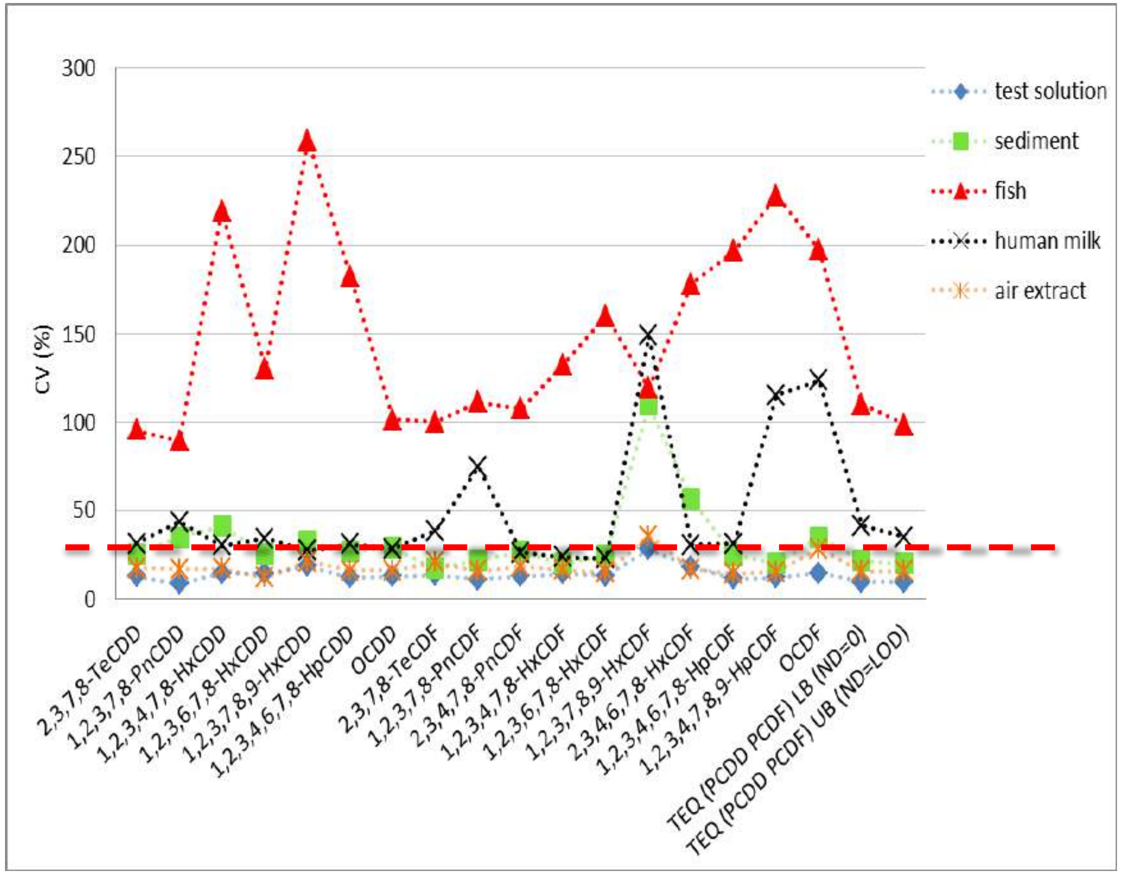
41 575 z-scores

Performance of laboratories in IL4

Organochlorine pesticides

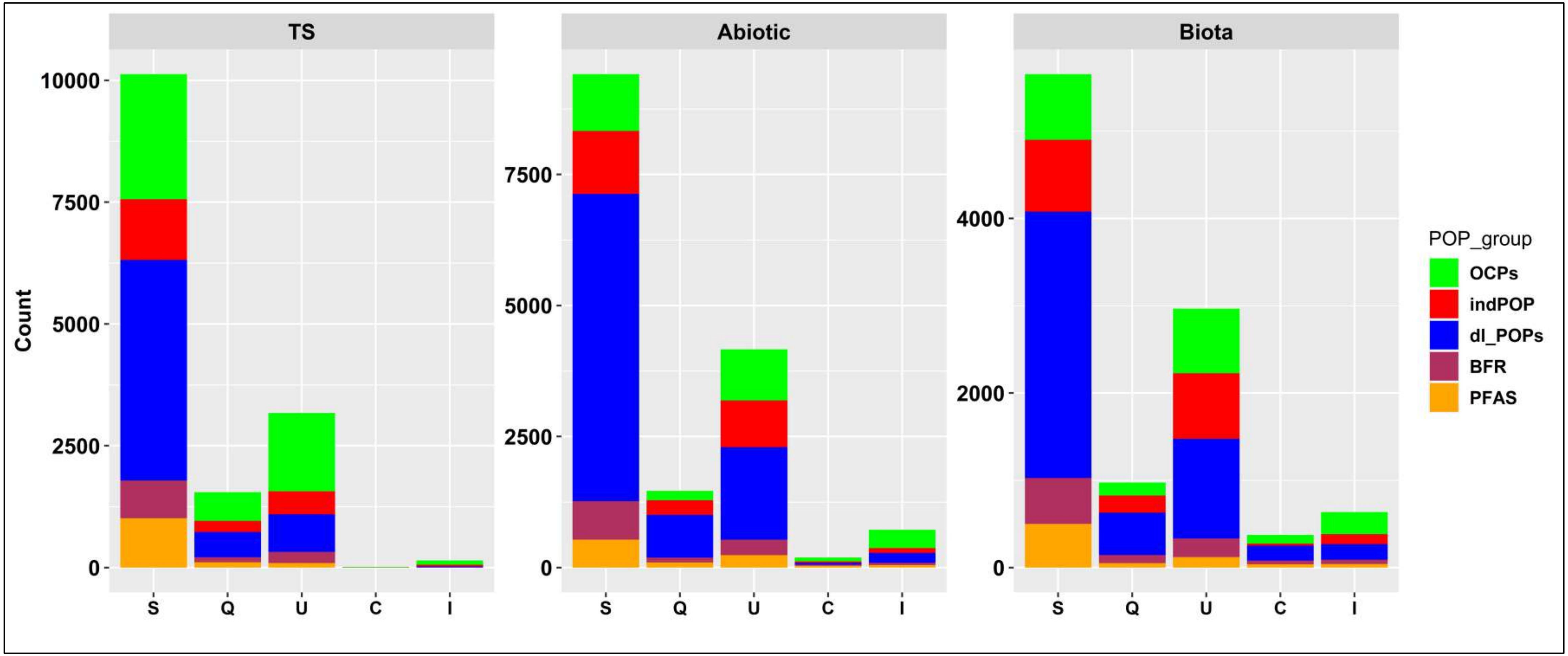


Polychlorinated dioxins and furans



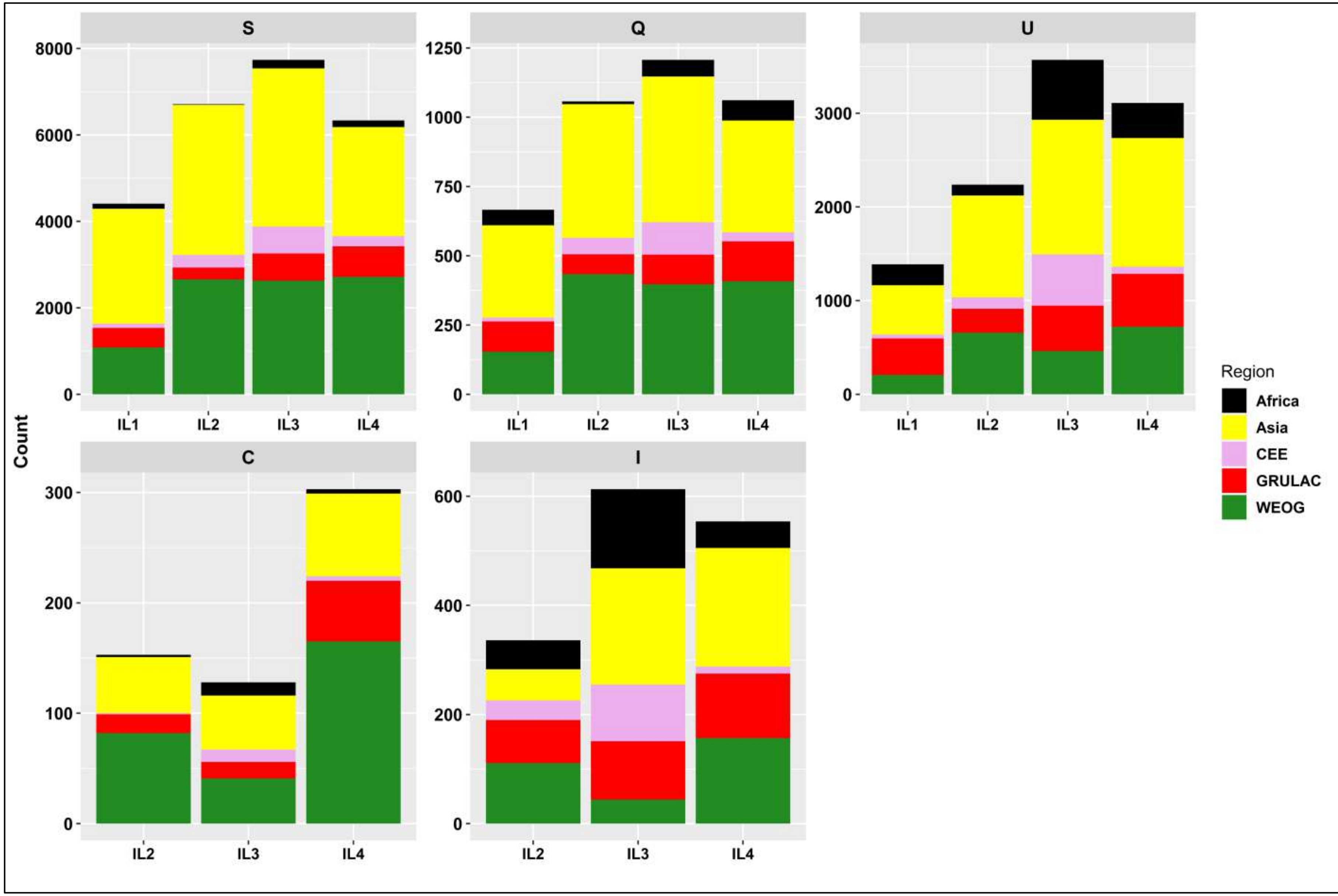
Coefficient of variation (CV) should be <25%

Matrix- and POP-dependent performance

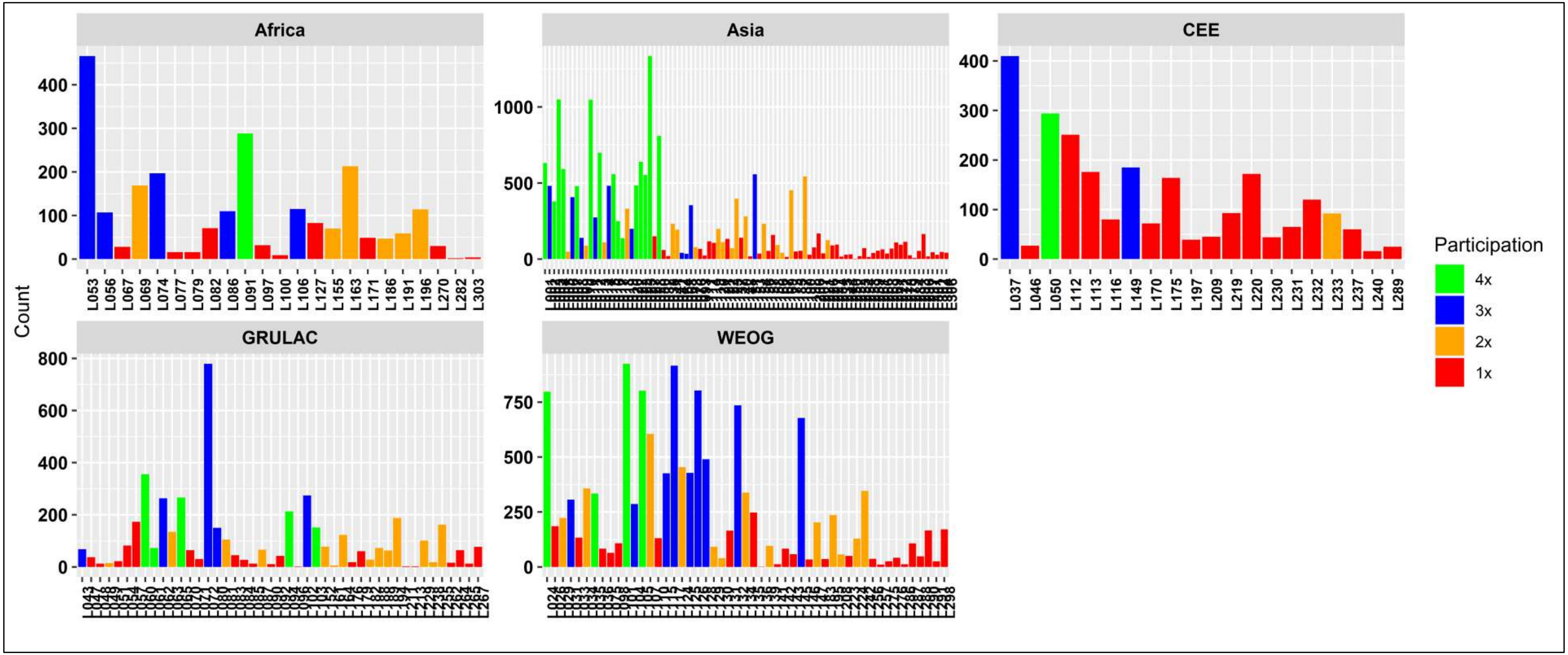


Y-axis= number of z-scores

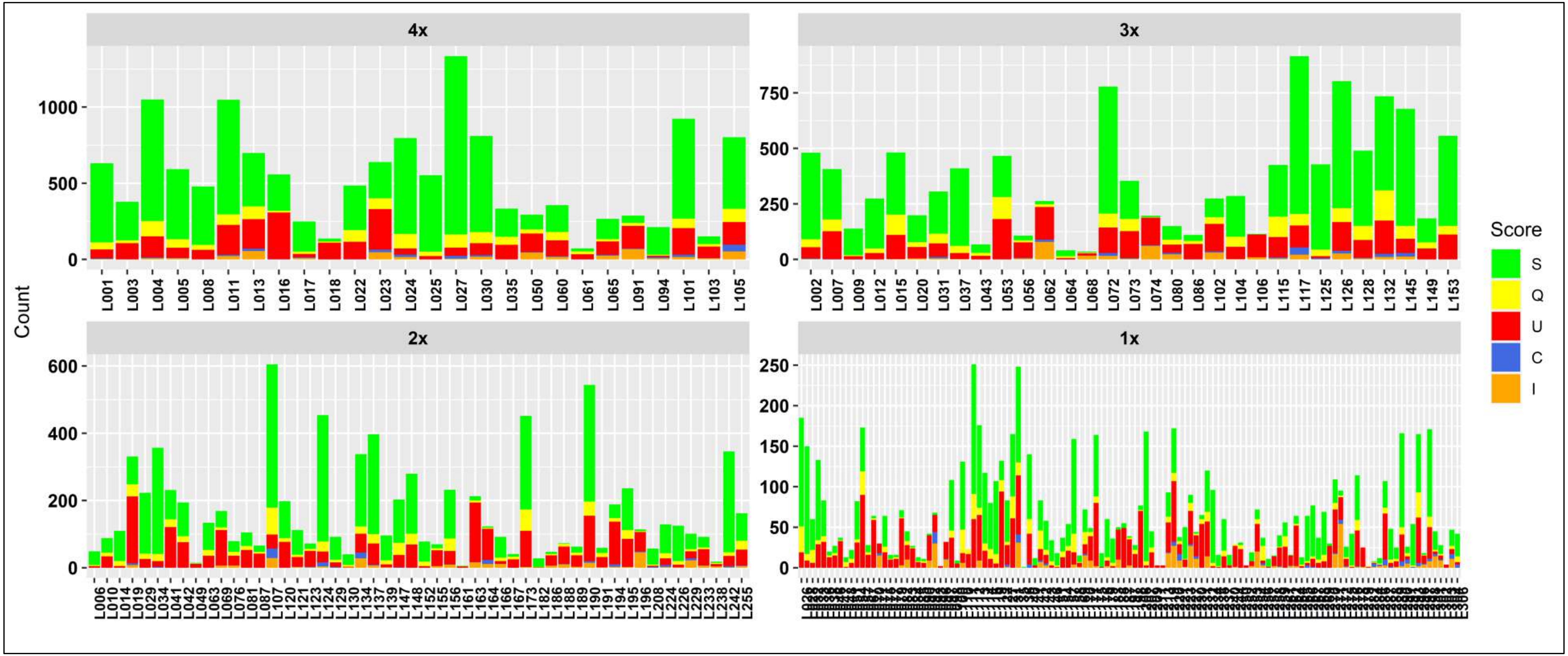
Overview by z-score and region (n=41 575)



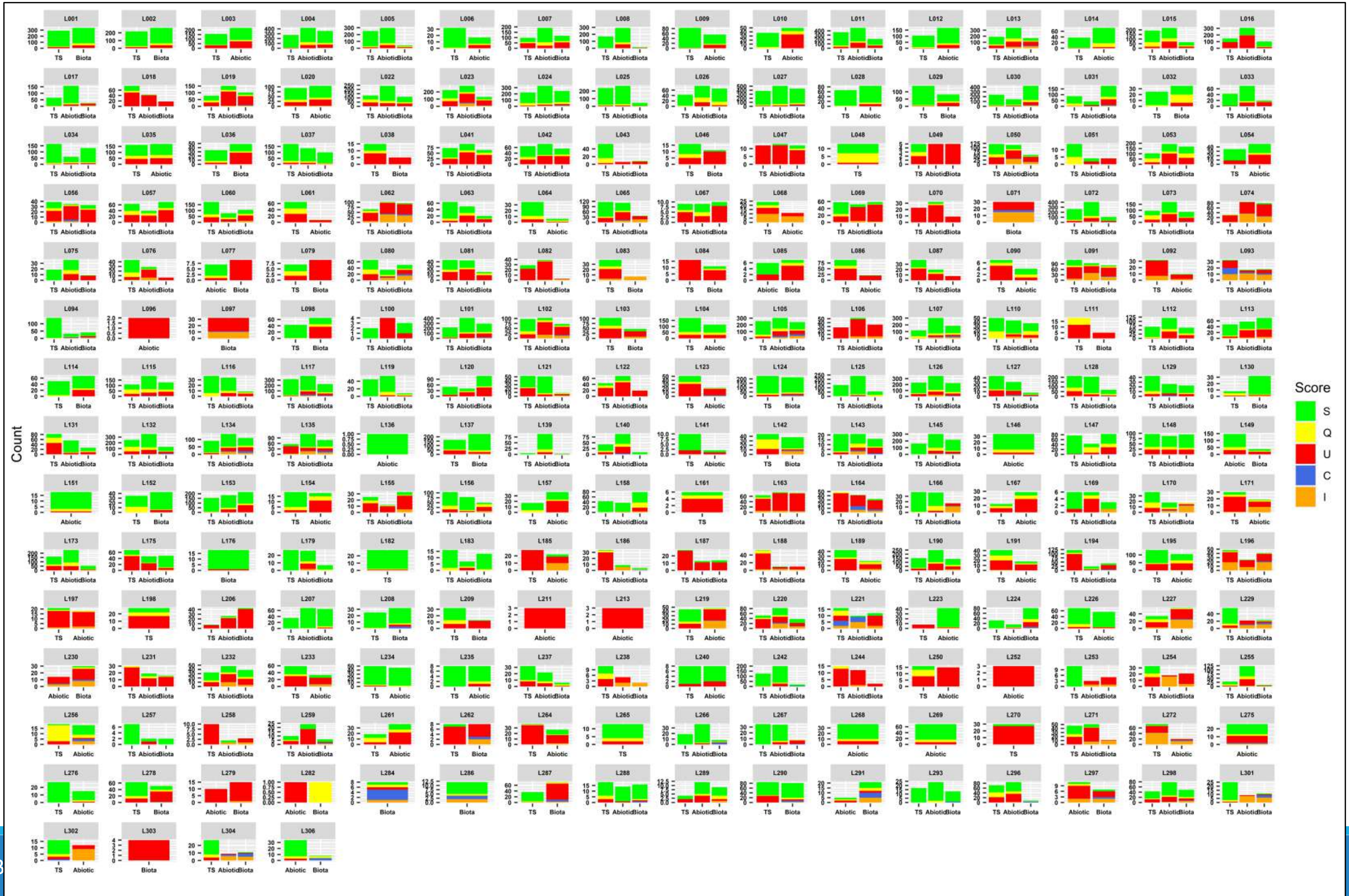
z-scores (sum) by laboratory across all rounds



Quality of the z-scores by number of participation

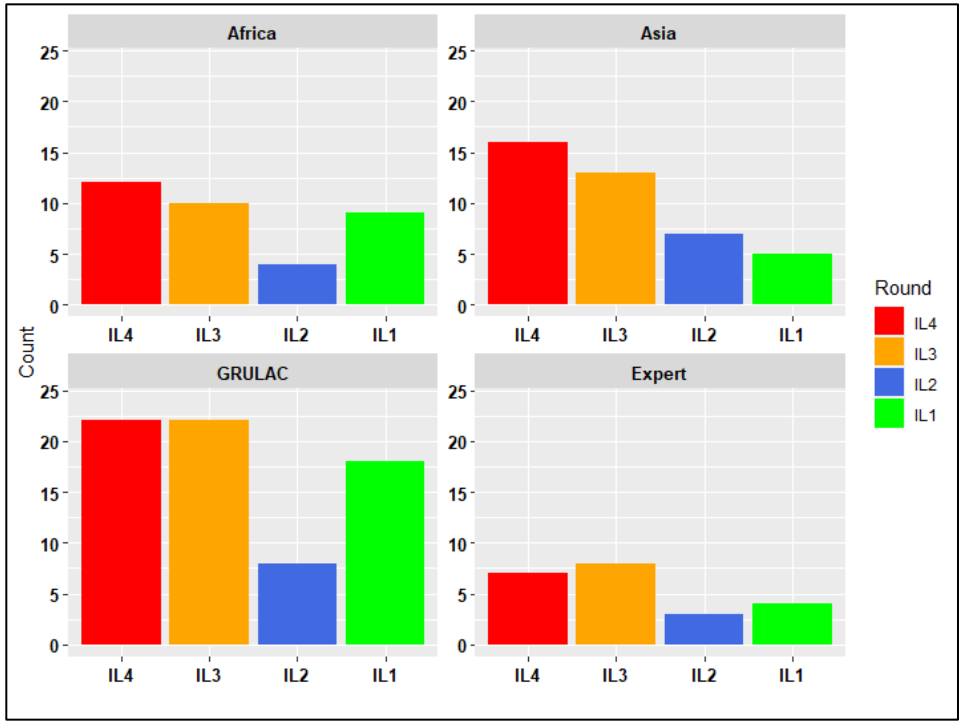


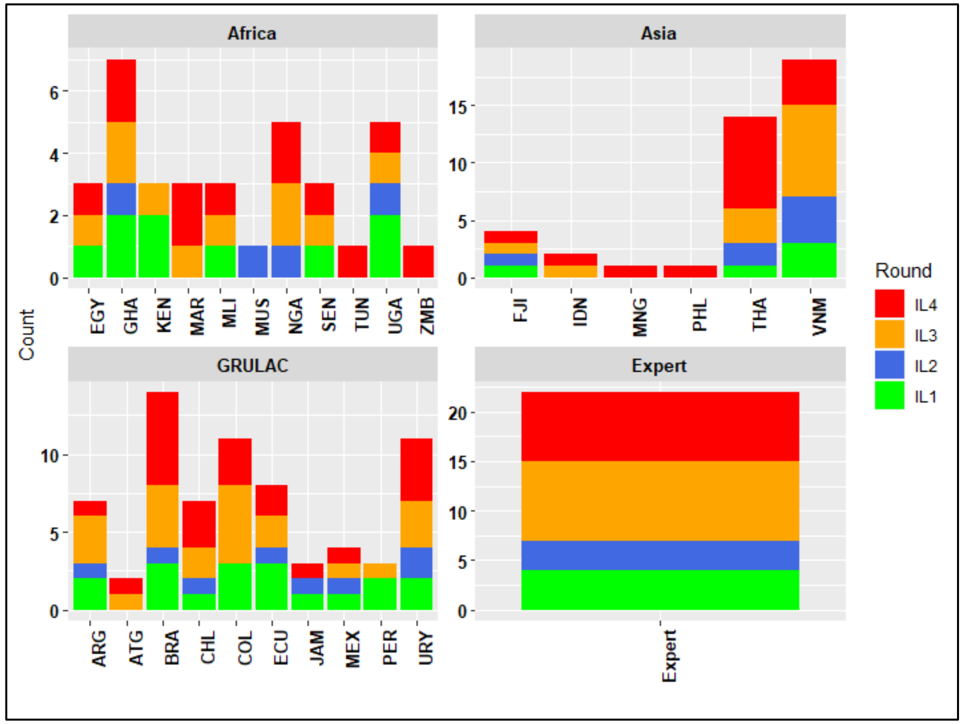
All labs, all per-forman-ces



UNEP-supported laboratories by region

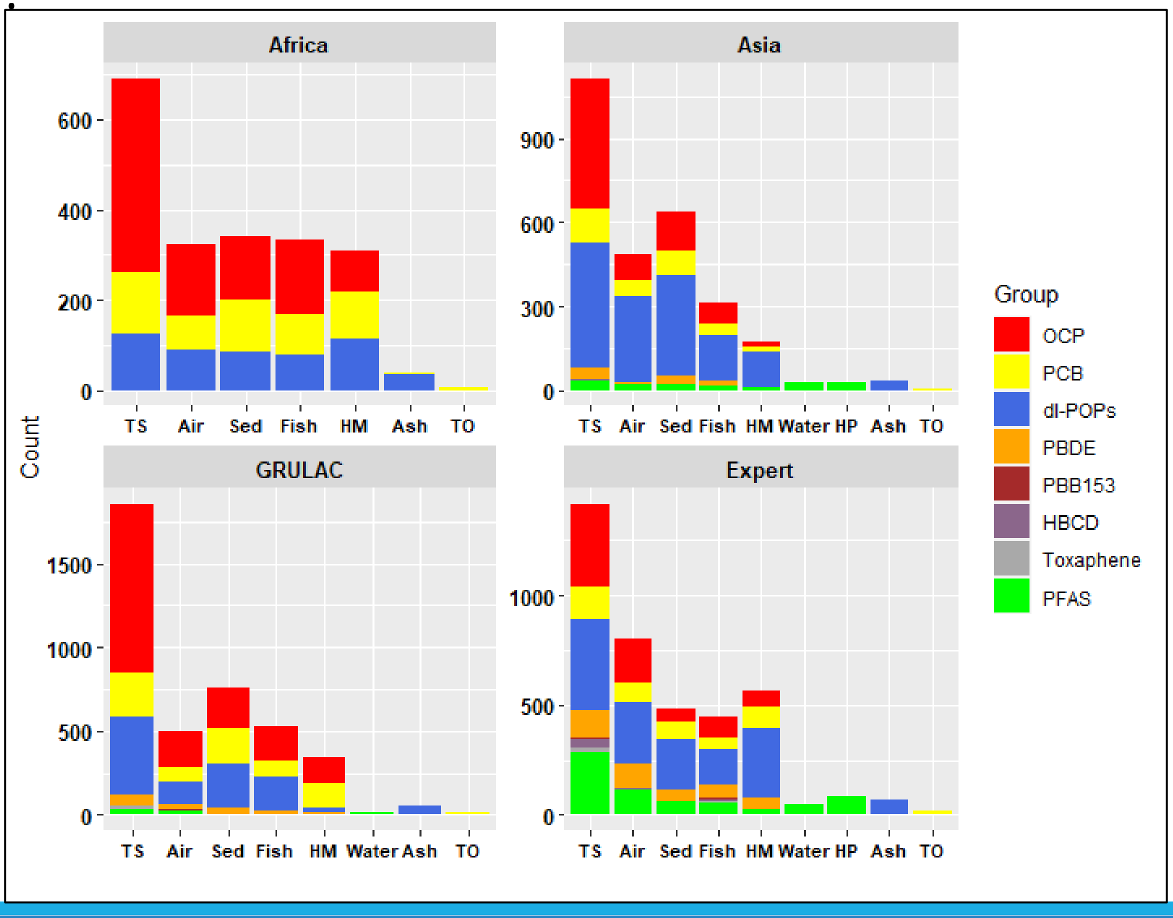
Region	IL1 (N=36)	IL2 (N=22)	IL3 (N=53)	IL4 (N=57)	Overall (N=168)
Africa	9 (25.0%)	4 (18.2%)	10 (18.9%)	12 (21.1%)	35 (20.8%)
Asia	5 (13.9%)	7 (31.8%)	13 (24.5%)	16 (28.1%)	41 (24.4%)
GRULAC	18 (50.0%)	8 (36.4%)	22 (41.5%)	22 (38.6%)	70 (41.7%)
Expert	4 (11.1%)	3 (13.6%)	8 (15.1%)	7 (12.3%)	22 (13.1%)



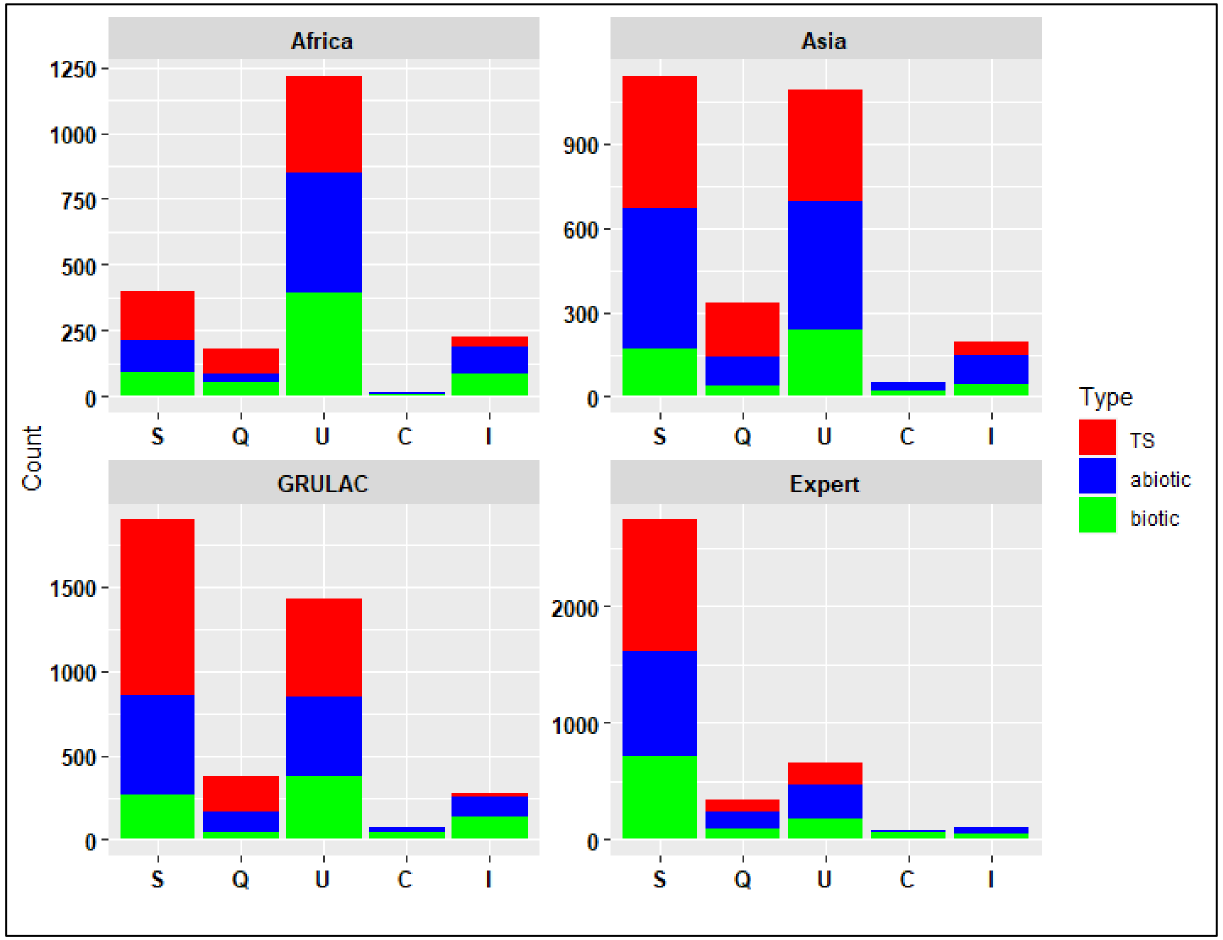


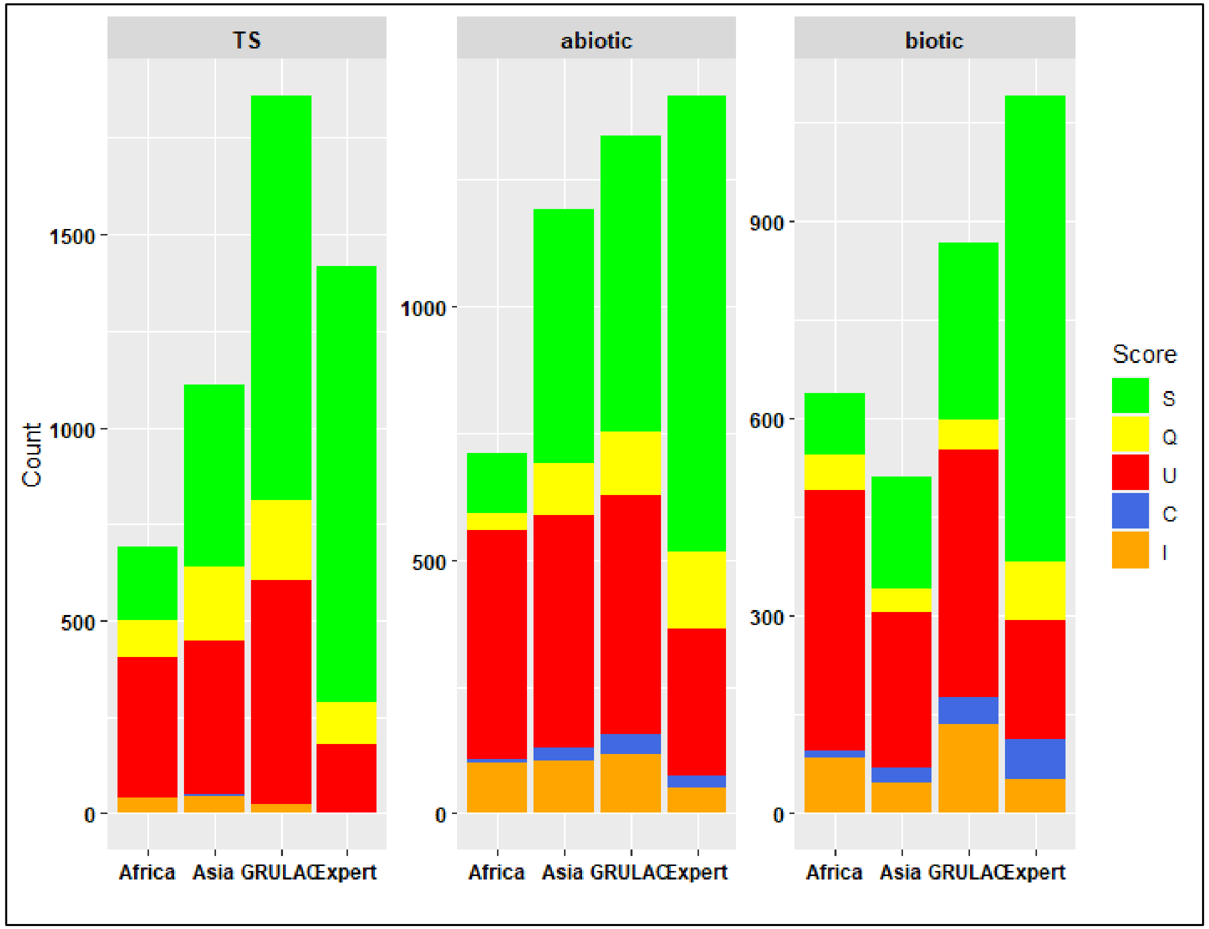
Quality of z-scores by POP group (by lab, n=168)

31% of the z-scores (12 835) were from either UNEP-supported countries and expert laboratories:
8 912 were from laboratories in countries supported by UNEP projects and 3 923 were from expert laboratoriesNo for PFAS in Africa and very low in GRULAC, no capacity for PBDE, PBB153, HBCD in Africa

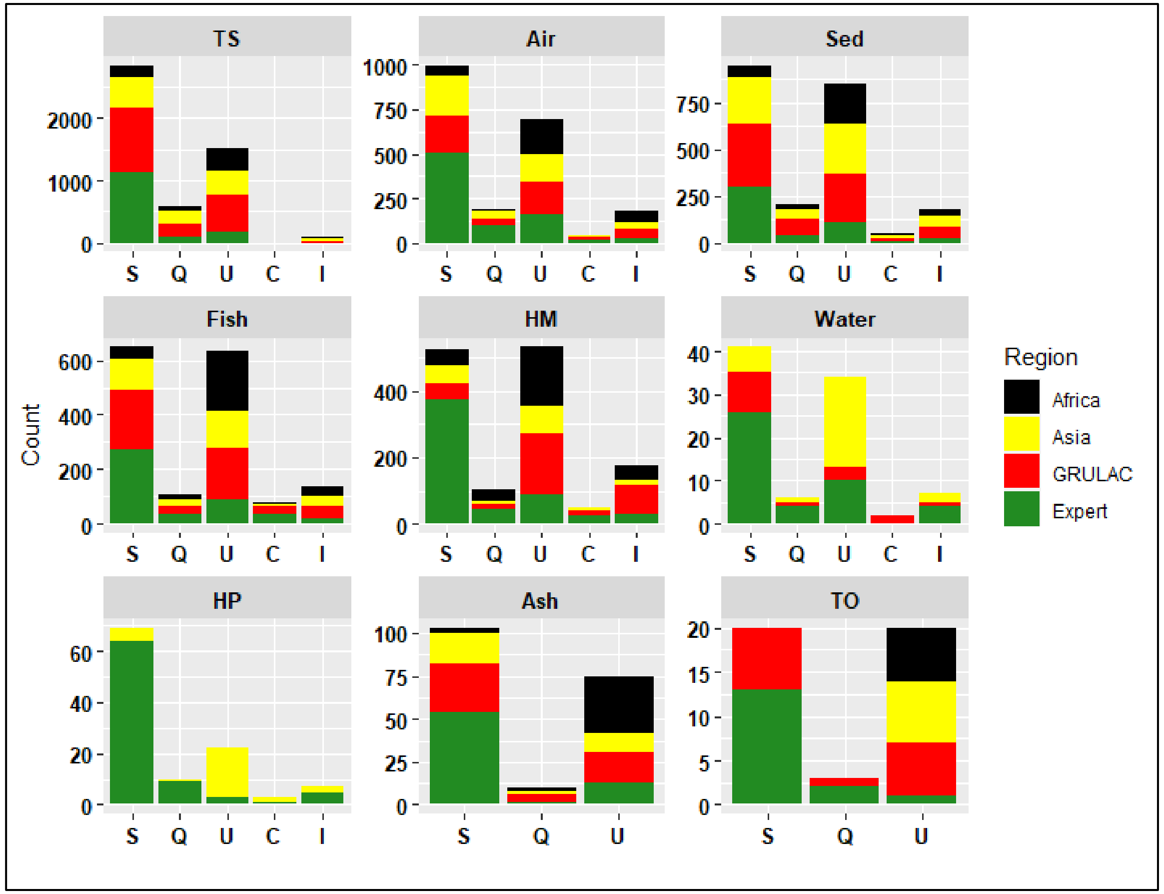


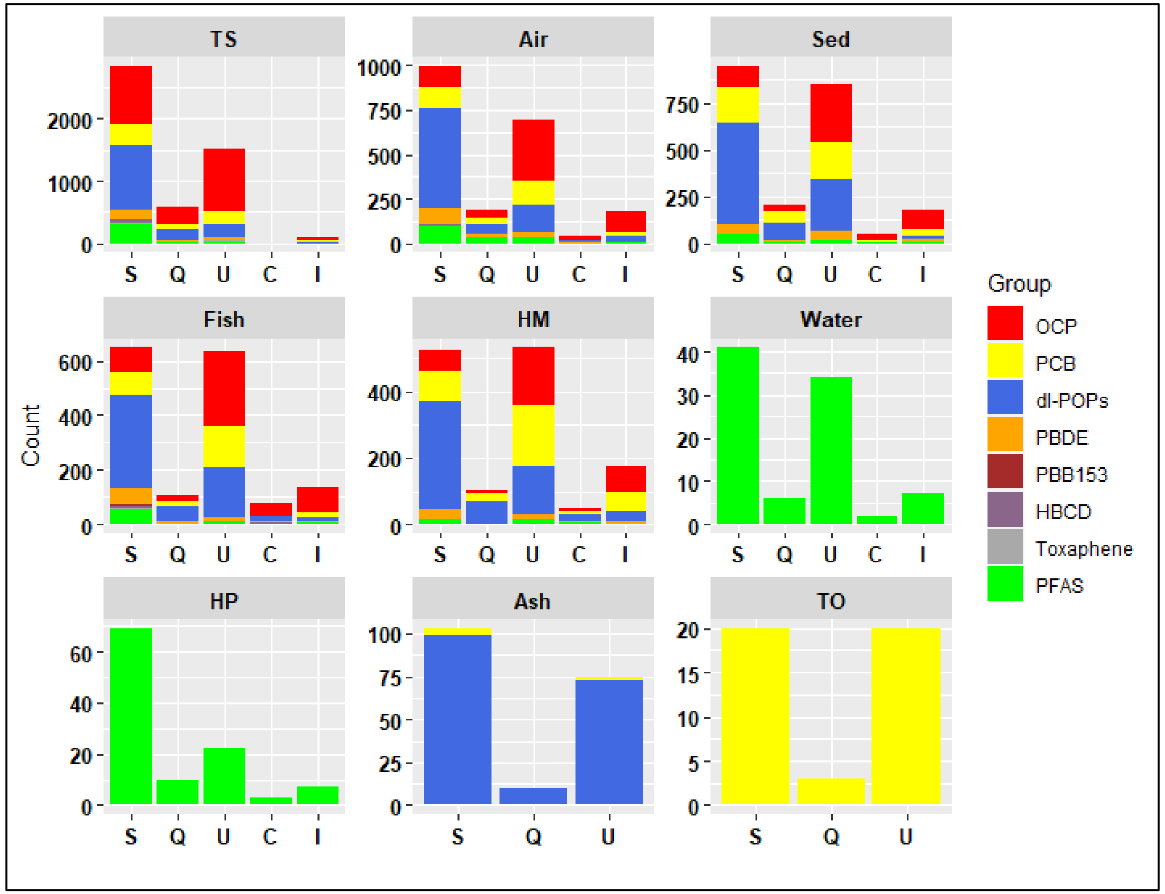
Quality of the z-scores according to region/matrix



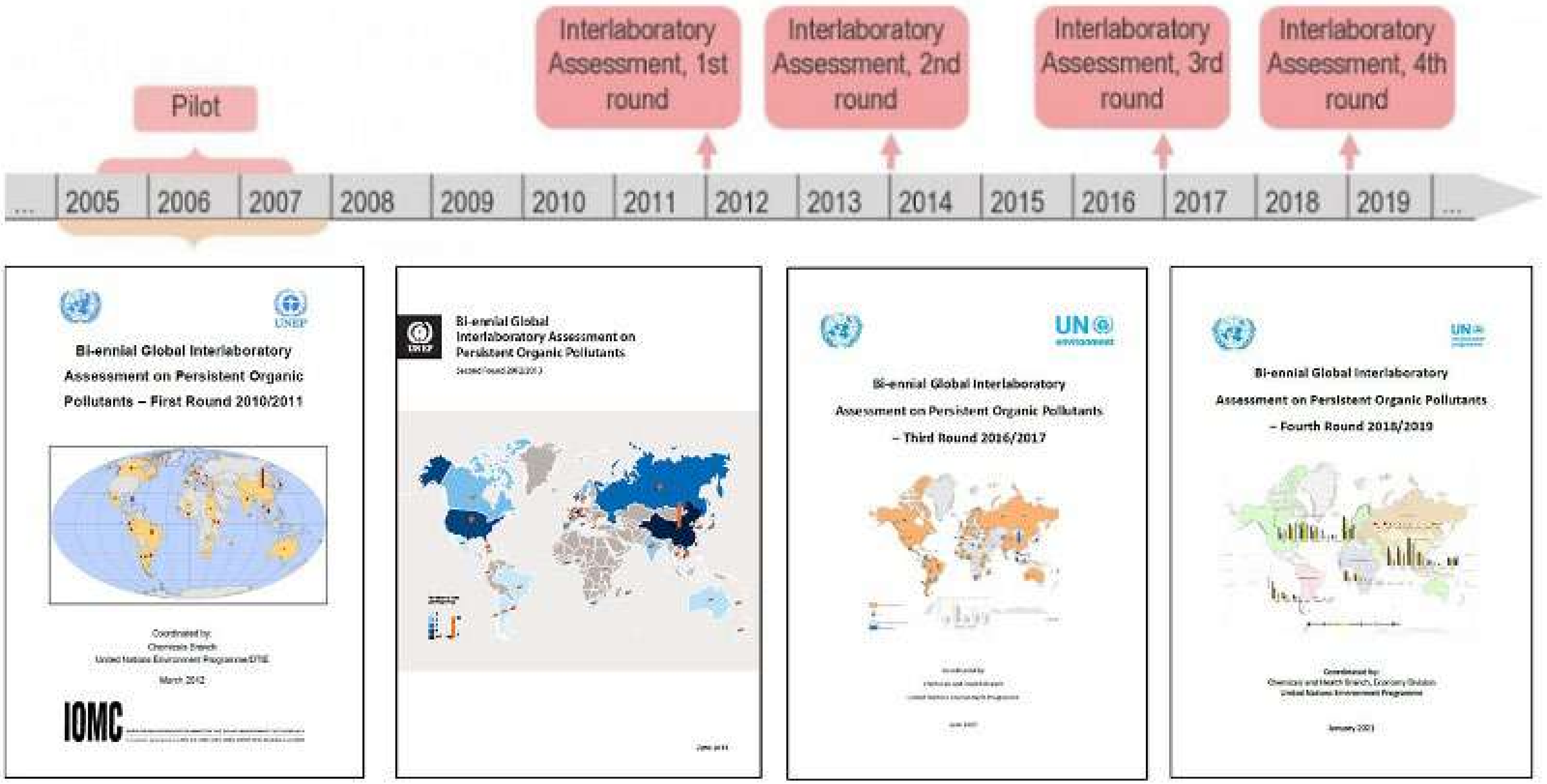


Distribution and quality of z-scores for all matrices in the regions and for POP groups





Summary reports



https://www.unep.org/explore-topics/chemicals-waste/what-we-do/persistent-organic-pollutants/pops-interlaboratory

- Africa for dl-POPs, PBDE, and PFAS lacks capacity; Latin American countries for PFAS and PBDE.
- Overall, performance for dl-POPs and to lesser extend PBDE and PFAS satisfactory.
- More than 60% of the z-scores for OCP and PCB were not satisfactory.
- Human milk and fish posed the biggest challenge to the laboratories.
- Regular – and successful – participation in interlaboratory assessments remains essential.

Thank you !

Results of the GMP2 study on POPs in national samples Asia - Pacific

Jacob de Boer, Rianne van Dijk

Overview study

Countries:

- Cambodia
- Fiji
- Indonesia
- Lao
- Mongolia
- Philippines
- Thailand
- Vietnam
- Samoa

Target compounds:

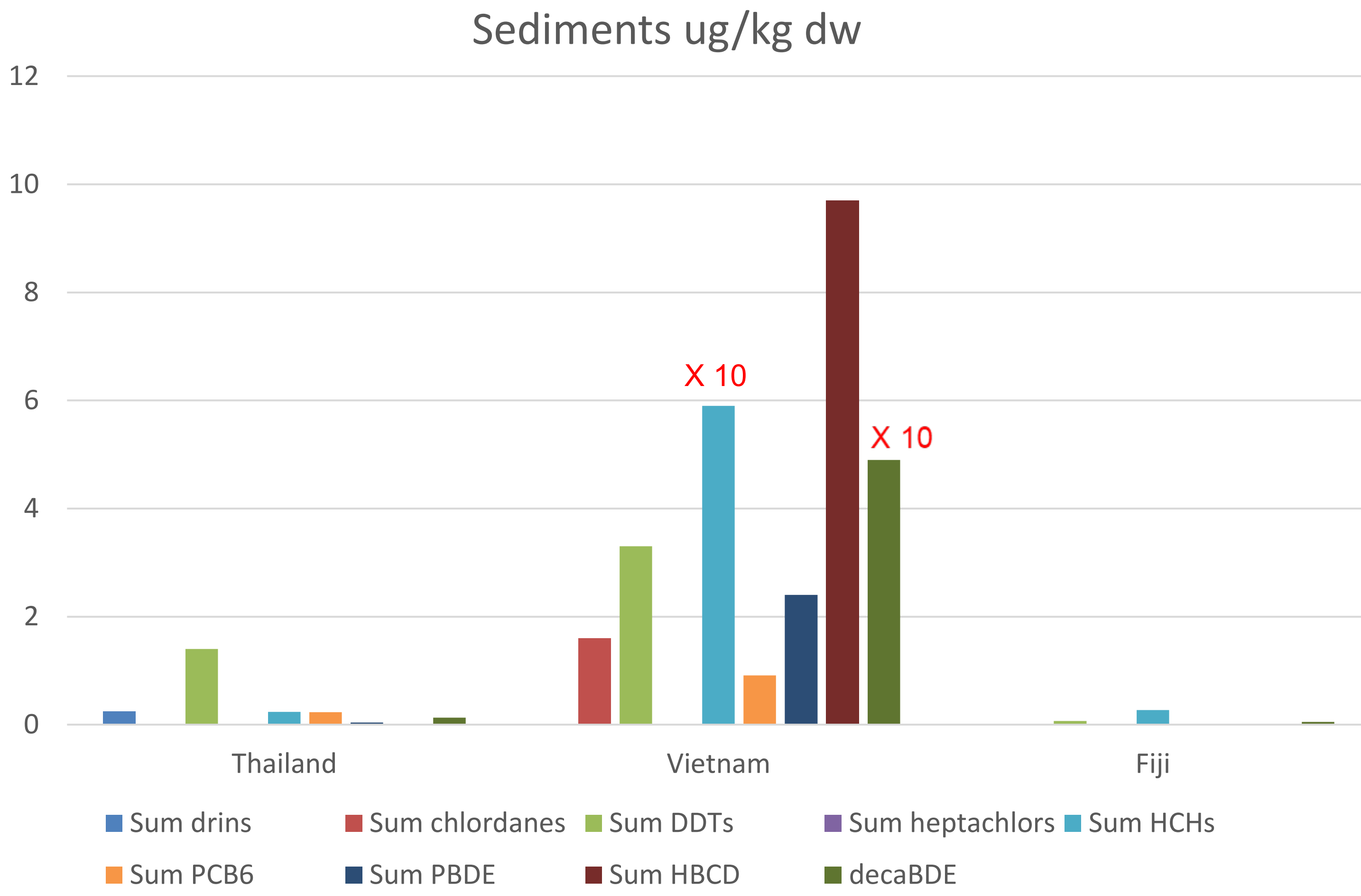
- PCB, OCPs, BFRs
- Toxaphene

- Mirror study:

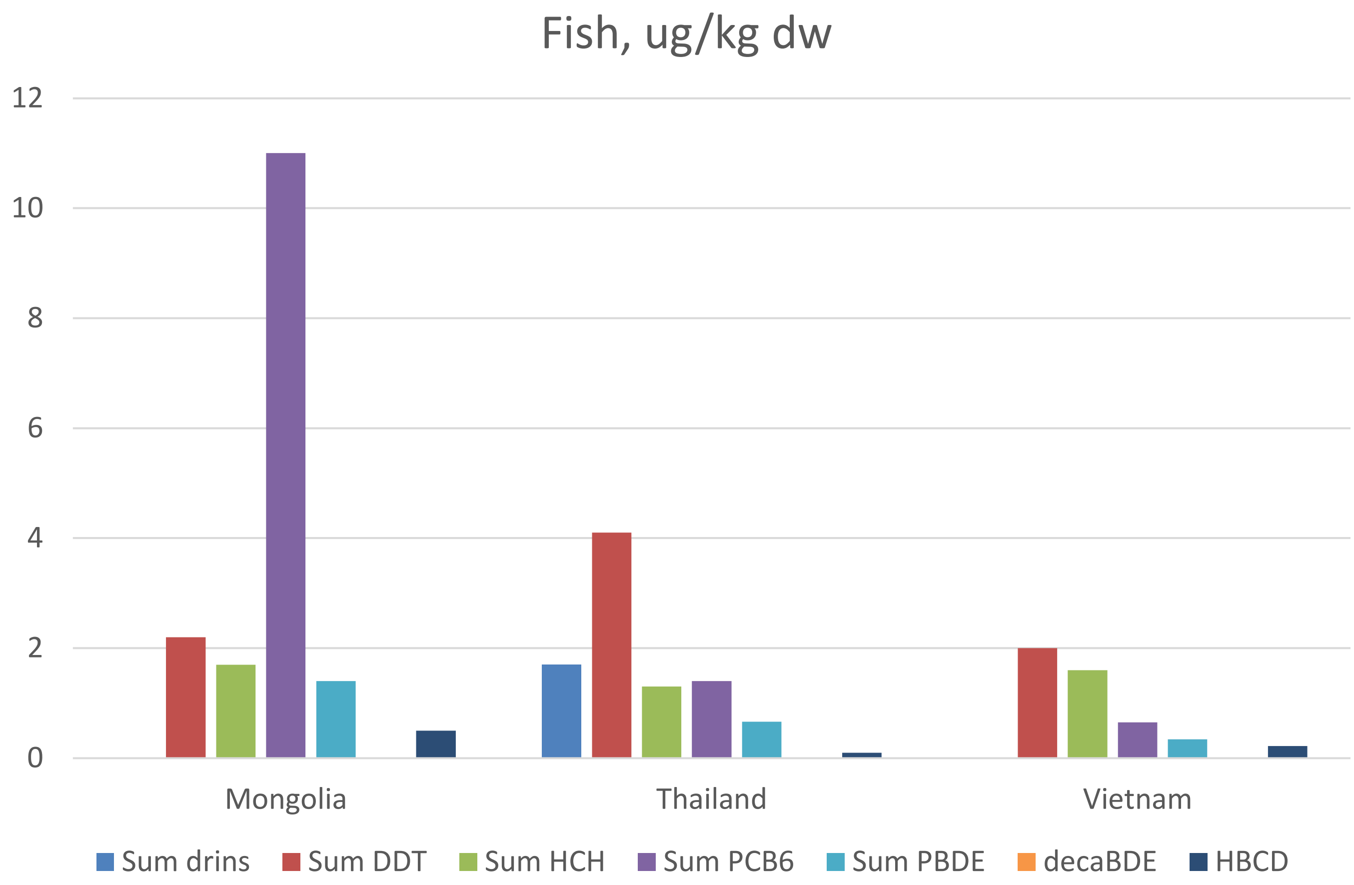
Samples received from five countries

Only one country has sent own data

POPs in Sediments Asia Pacific (Max. concentrations)



POPs Fish Asia/Pacific (Max. concentrations)



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Fiji

General

- No mirror study participation
- Sent 3 sediments

POP levels

- HCB 0.02 ug/kg dw
- Sum DDT 0.02-0.07 ug/kg dw
- Sum HCH 0.25-0.27 ug/kg dw
- All other POPs <LOD

Mongolia

General

- No mirror study participation
- Sent 1 beef, 4 fish, 1 mutton, 1 horse meat, 1 pork, 2 chickens (imported and local), 4 soil, 4 butter, 3 local eggs, 1 imported eggs, 1 sea buckthorn, 1 flax seed

POP levels

- In one fish:
- HCB 1.5 ug/kg dw
- Sum DDT 2.2 ug/kg (mainly DDE)
- Sum PCB6 11 ug/kg dw
- Sum PBDE: 1.4, HBCD 0.5 ug/kg
- In mutton: Sum PBDE 0.6 ug/kg
- In butter: decaBDE 0-3 ug/kg dw
- Most other POPs in biota <LOD

Mongolia - Soil

Code	PeCBz	HCB	Sum DDT	Sum HCH	Sum PCB6
16a	18	0.91	9880*	2.4	0.67
16b	4.7	0.08	76*	521	0.09
16c	24	2.9	32*	6300	1.2
16d	74	8.2	62*	45010	4.5

* Mainly p,p'-DDT

μg/kg dw

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Thailand

General

- No mirror study participation
- Sent 4 fish, 4 beef, 4 sediment, 4 chicken egg, 2 duck egg

POP levels

- OCP/PCB in fish, beef, sediment 0-1 ug/kg dw, in eggs <LOD
- PBDE, PBB, HBCD, toxaphene, chlordane, mirex all <LOD

Samoa

General

- No mirror study participation
- Sent 1 egg sample (pool of 8)

POP levels

- p,p'-DDE 0.17 ug/kg dw
- Sum HBCD 0.30 ug/kg dw
- All other POPs <LOD

Vietnam

General

- **Participated in mirror study**
- Sent 4 fish, 2 chicken, 8 sediments, 2 butter, 2 egg
- Mirror study results:
- Only PBDE in sediment
- 34 correct results out of 64
- decaBDE often too high

POP levels

- One sediment: HCH 59 ug/kg dw
- Sediments: decaBDE 1-43 ug/kg, HBCD: 0-10 ug/kg dw
- Sum HCH and Sum DDT (mainly DDE) 1-3 ug/kg dw
- All other POPs <1 ug/kg - <LOD

Concluding remarks

- **No samples received** from Cambodia, Indonesia, Lao, Philippines
- **Disappointing participation** in mirror study (only Vietnam participated)
- Challenges in sending samples
- Generally low to very low POP concentrations found, especially Fiji, West Samoa, Thailand
- Very high Sum HCH and Sum DDT levels in soil Mongolia (point source)
- Mirex, PBB, toxaphene and endosulfan almost always low - <LOD

Summary of data generated by MTM Örebro University

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dl-POPs In full collaboration with Esteban Abad, CSIC

Published papers on interlaboratory assessments

Air with PAS/PUFs: Abad, E., M. Abalos, and H. Fiedler (2022). Air monitoring with passive samplers for dioxin-like persistent organic pollutants in developing countries (2017-2019). Chemosphere **287**, 131931. doi: 10.1016/j.chemosphere.2021.131931.

Camoiras Gonzalez, P., M. Sadia, A. Baabish, S. Sobhanei, and H. Fiedler (2021). Air monitoring with passive samplers for perfluoroalkane substances in developing countries (2017-2019). Chemosphere **282**, 131069. doi: 10.1016/j.chemosphere.2021.131069.

Fiedler, H., E. Abad, and J. de Boer (2023a). Preliminary trends over ten years of persistent organic pollutants in air - Comparison of two sets of data in the same countries. Chemosphere, 138299. doi: 10.1016/j.chemosphere.2023.138299.

Water: Baabish, A., S. Sobhanei, and H. Fiedler (2021). Priority perfluoroalkyl substances in surface waters - A snapshot survey from 22 developing countries. Chemosphere **273**, 129612. doi: 10.1016/j.chemosphere.2021.129612.

Human milk: Fiedler, H. and M. Sadia (2021). Regional occurrence of perfluoroalkane substances in human milk for the global monitoring plan under the Stockholm Convention on Persistent Organic Pollutants during 2016-2019. Chemosphere **277**, 130287. doi: 10.1016/j.chemosphere.2021.130287

Fiedler, H., M. Sadia, T. Krauss, A. Baabish, and L.W.Y. Yeung (2022d). Perfluoroalkane acids in human milk under the global monitoring plan of the Stockholm Convention on Persistent Organic Pollutants (2008-2019). Frontiers of Environmental Science & Engineering **16**, 132. doi: ARTN 132 10.1007/s11783-022-1541-8.

Fiedler, H., X. Li, and J. Zhang (2023c). Persistent organic pollutants in human milk from primiparae - correlations, global, regional, and national time-trends. Chemosphere **313**, 137484. doi: 10.1016/j.chemosphere.2022.137484.

Published papers on interlaboratory assessments

National samples and assessment

Sadia, M., L.W.Y. Yeung, and H. Fiedler (2020). Trace level analyses of selected perfluoroalkyl acids in food: Method development and data generation. Environ Pollut **263**, 113721. doi: 10.1016/j.envpol.2019.113721.

Fiedler, H., M. Sadia, A. Baabish, and S. Sobhanei (2022c). Perfluoroalkane substances in national samples from global monitoring plan projects (2017-2019). Chemosphere **307**, 136038. doi: 10.1016/j.chemosphere.2022.136038.

Fiedler, H., M. Abalos, J. Parera, E. Abad, N. Lohmann, F. Neugebauer, H. Rottler, and M. Horstmann (2023b). Dioxin-like POPs in national samples from global monitoring plan projects (2017-2019). Chemosphere, 138386. doi: 10.1016/j.chemosphere.2023.138386.

Fiedler, H., A. Baabish, and M. Sadia (2022a). Multivariate analysis of abiotic and biota samples for three perfluoroalkane acids. Frontiers in Analytical Science **2**. doi: 10.3389/frans.2022.954915.

Surenjav, E., J. Lkhasuren, and H. Fiedler (2022). POPs monitoring in Mongolia - Core matrices. Chemosphere **297**, 134180. doi: 10.1016/j.chemosphere.2022.134180

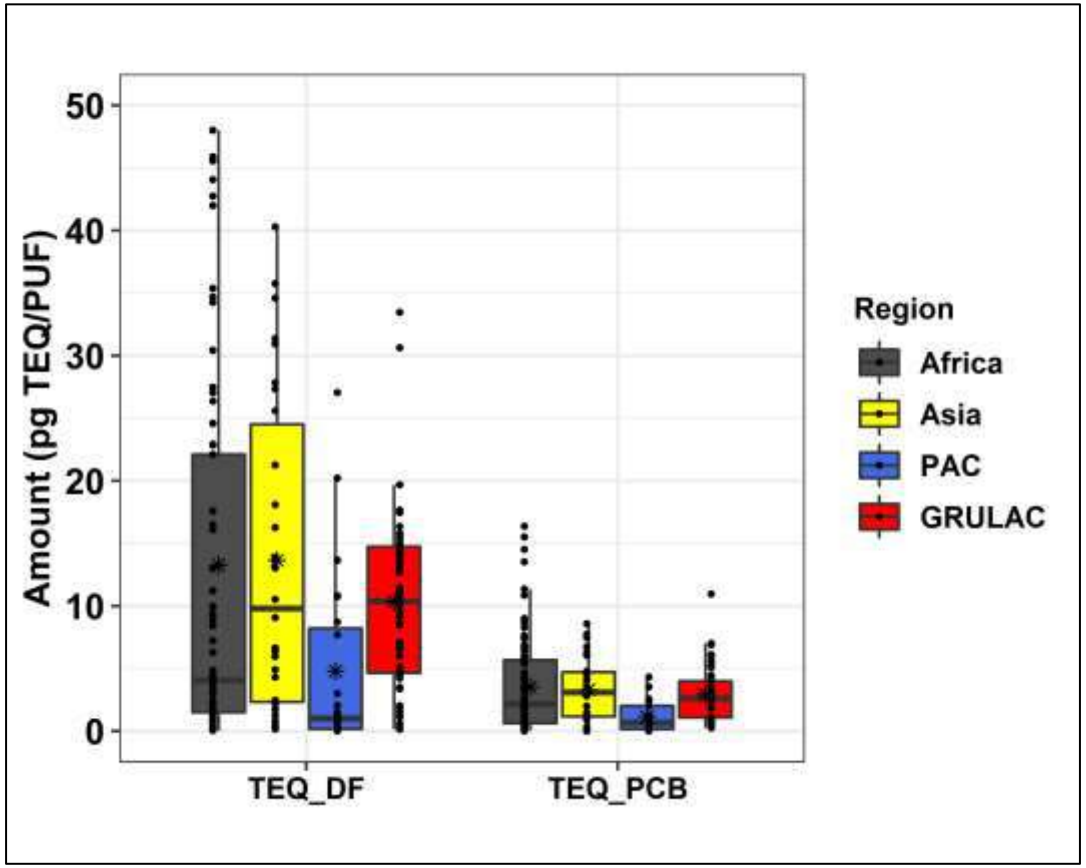
Surenjav, E. and H. Fiedler (2023 in preparation). POPs in the Mongolian Environment. submitted

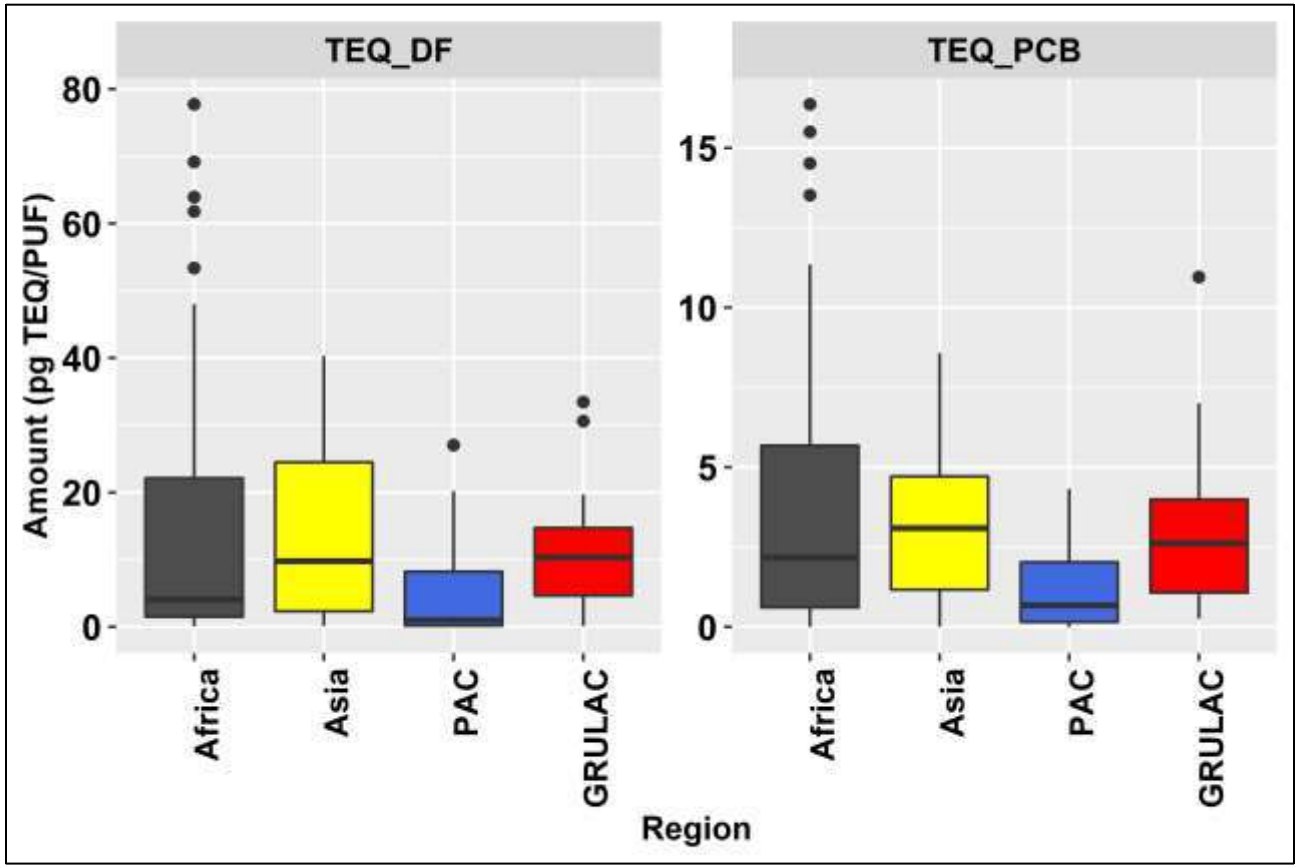
PAS/PUFs: dl-POPs: samples and descriptive statistics

	Africa (N=89)	Asia (N=30)	PAC (N=23)	GRULAC (N=53)	Overall (N=195)
Region	89 (45.6%)	30 (15.4%)	23 (11.8%)	53 (27.2%)	195 (100%)
Year					
Y2017	62 (69.7%)	9 (30.0%)	11 (47.8%)	26 (49.1%)	108 (55.4%)
Y2018	22 (24.7%)	13 (43.3%)	10 (43.5%)	27 (50.9%)	72 (36.9%)
Y2019	5 (5.6%)	8 (26.7%)	2 (8.7%)	0 (0%)	15 (7.7%)

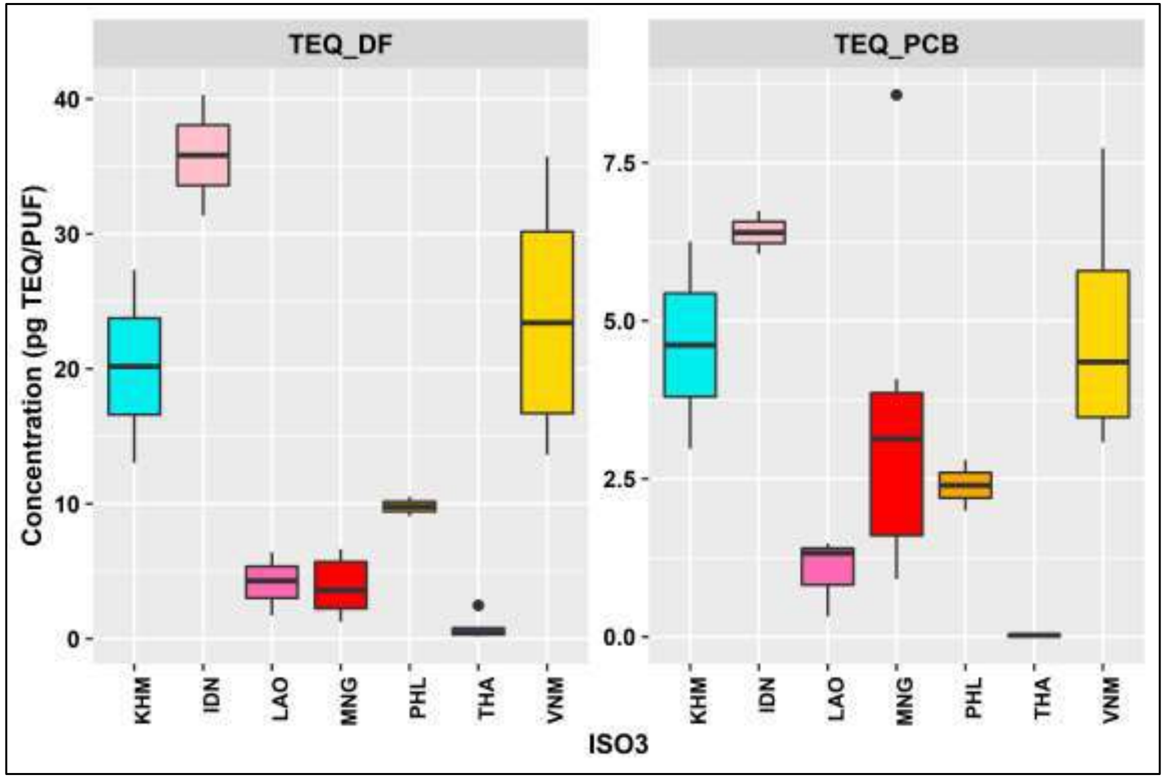
	Africa (N=89)	Asia (N=30)	PAC (N=23)	GRULAC (N=53)	Overall (N=195)
TEQ_DF					
Mean (SD)	13.3 (18.3)	13.6 (12.6)	4.79 (7.34)	10.4 (6.98)	11.5 (14.2)
Median [Min, Max]	4.07 [0.0552, 77.7]	9.80 [0.162, 40.3]	1.01 [0.0005, 27.0]	10.4 [0.141, 33.5]	6.41 [0.0005, 77.7]
TEQ_PCB					
Mean (SD)	3.53 (3.78)	3.30 (2.55)	1.15 (1.23)	2.94 (2.16)	3.05 (3.07)
Median [Min, Max]	2.17 [0.0004, 16.4]	3.10 [0.003, 8.57]	0.675 [0.002, 4.32]	2.62 [0.253, 11.0]	2.34 [0.0004, 16.4]

Air dl-POPs regional summaries

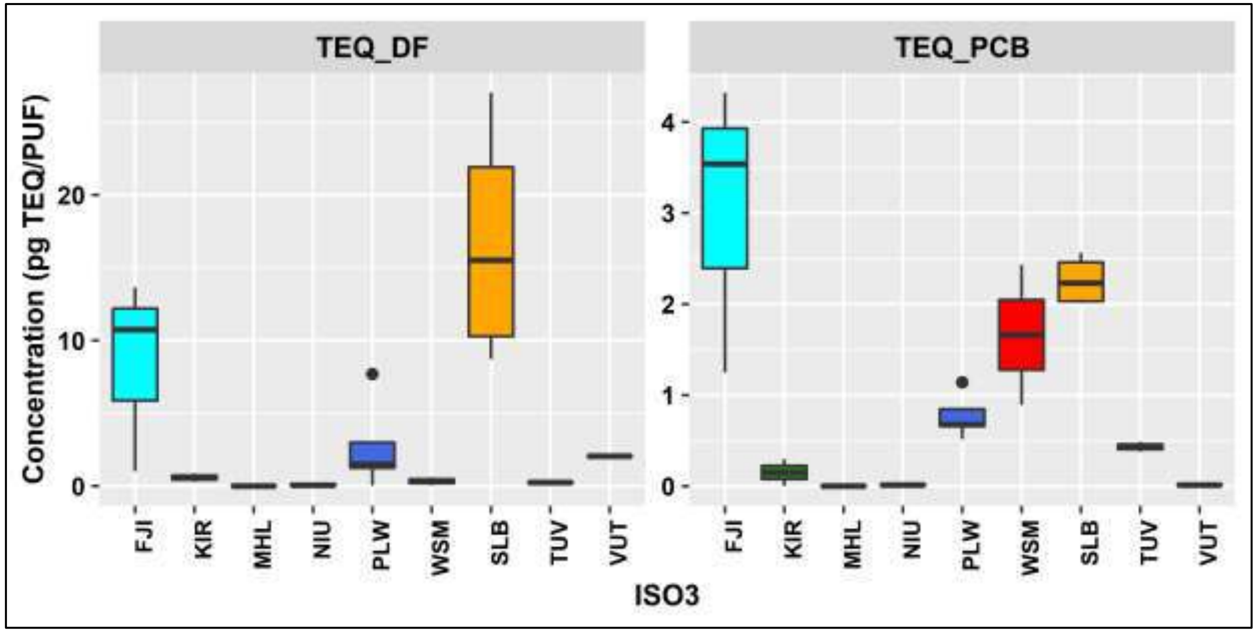




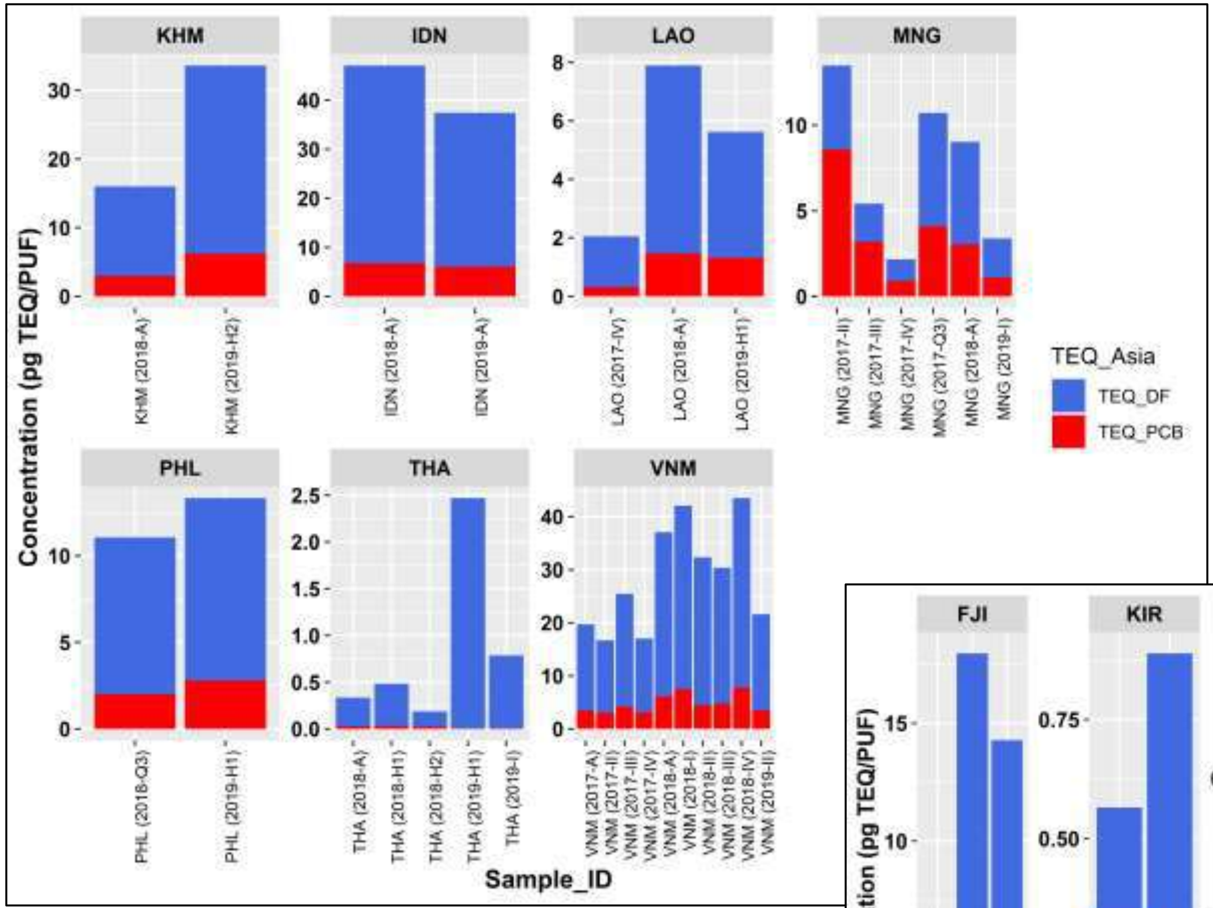
TEQs in PAS/PUFs: Occurrence by country

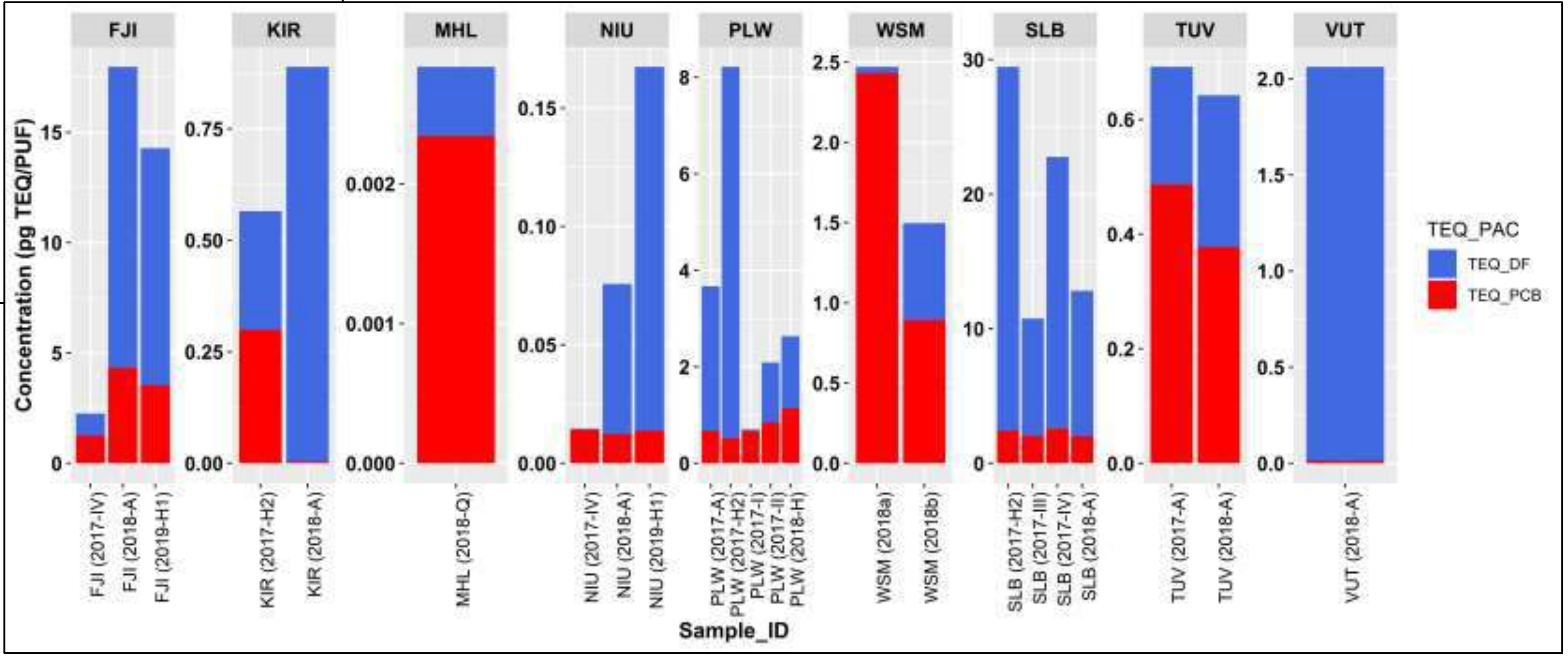


Number of PUFs analyzed varied highly (from 1 sample to 8; generating 10 results)



TEQs in PAS/PUFs by country



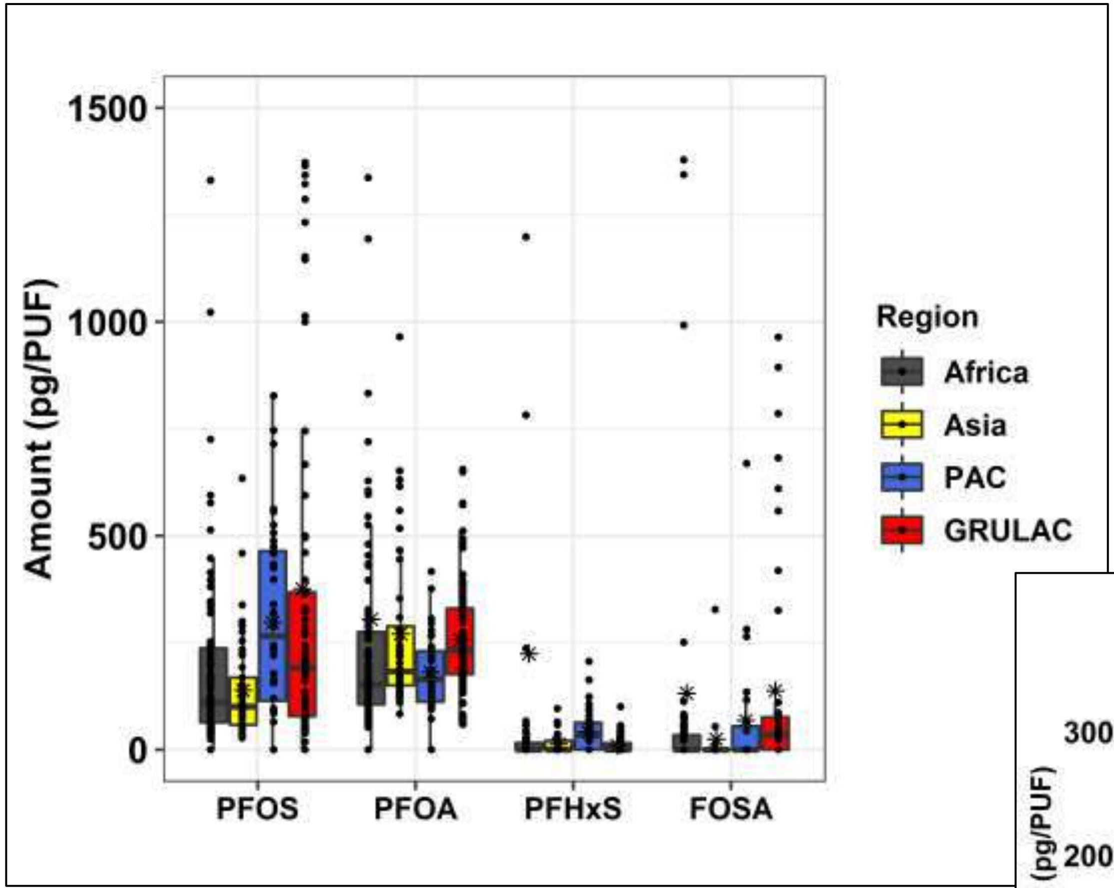


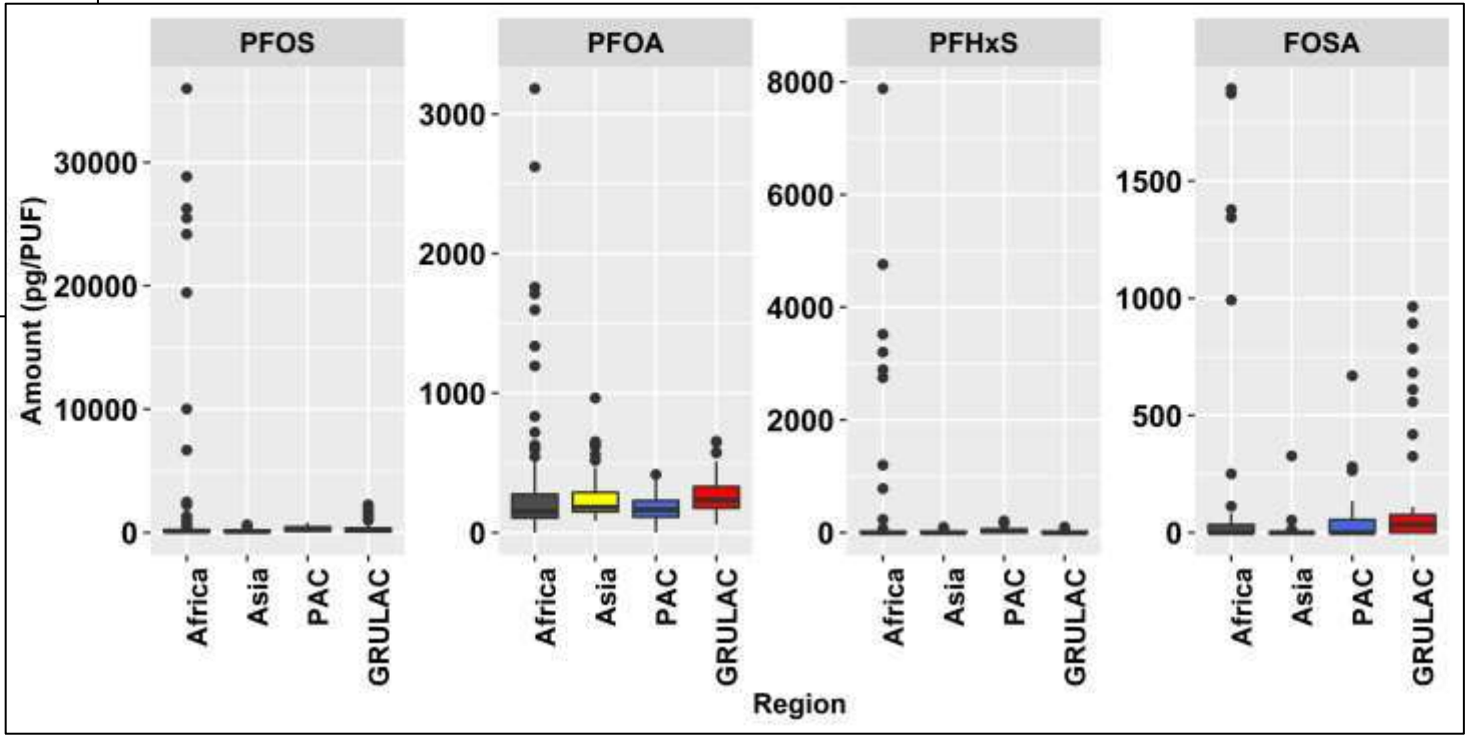
PFAS in air

	Africa (N=127)	Asia (N=46)	PAC (N=43)	GRULAC (N=101)	Overall (N=317)
Region	127 (40.1%)	46 (14.5%)	43 (13.6%)	101 (31.9%)	317 (100%)
Year					
Y2017	57 (44.9%)	9 (19.6%)	15 (34.9%)	47 (46.5%)	128 (40.4%)
Y2018	63 (49.6%)	29 (63.0%)	26 (60.5%)	52 (51.5%)	170 (53.6%)
Y2019	7 (5.5%)	8 (17.4%)	2 (4.7%)	2 (2.0%)	19 (6.0%)

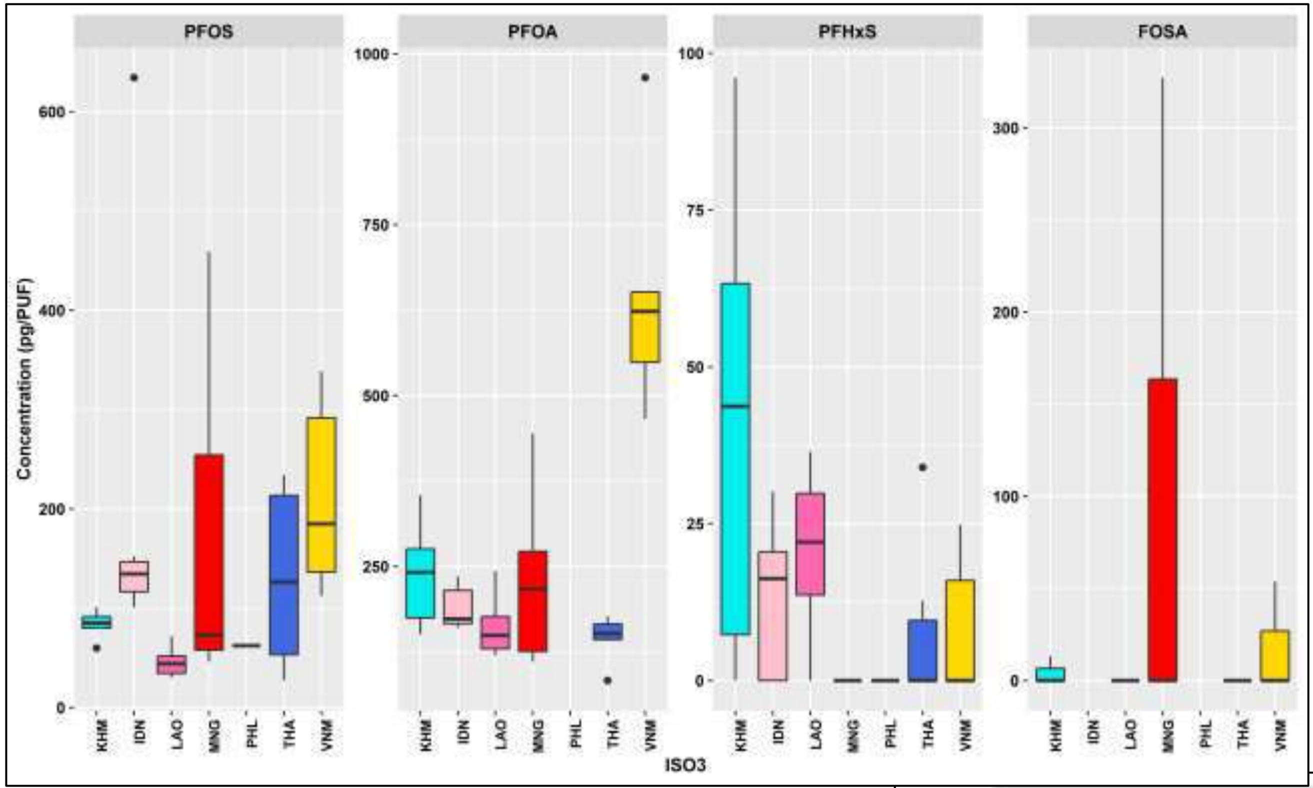
	Africa (N=127)	Asia (N=46)	PAC (N=43)	GRULAC (N=101)	Overall (N=317)
PFOS					
Mean (SD)	1640 (5940)	139 (122)	297 (219)	376 (497)	847 (3860)
Median [Min, Max]	110 [0, 36000]	101 [27.3, 634]	266 [0, 827]	192 [0, 2260]	136 [0, 36000]
Missing	5 (3.9%)	1 (2.2%)	3 (7.0%)	10 (9.9%)	19 (6.0%)
PFOA					
Mean (SD)	305 (464)	271 (194)	181 (86.5)	257 (125)	268 (313)
Median [Min, Max]	153 [0, 3180]	183 [83.1, 965]	165 [0, 417]	233 [58.9, 655]	192 [0, 3180]
Missing	10 (7.9%)	2 (4.3%)	5 (11.6%)	5 (5.0%)	22 (6.9%)
PFHxS					
Mean (SD)	224 (980)	13.4 (20.7)	41.6 (48.5)	9.72 (18.6)	101 (628)
Median [Min, Max]	0 [0, 7880]	0 [0, 96.1]	34.7 [0, 206]	0 [0, 101]	0 [0, 7880]
Missing	2 (1.6%)	2 (4.3%)	0 (0%)	1 (1.0%)	5 (1.6%)
FOSA					
Mean (SD)	132 (414)	24.6 (81.8)	68.5 (155)	138 (260)	112 (315)
Median [Min, Max]	0 [0, 1890]	0 [0, 327]	0 [0, 669]	34.9 <[0, 964]	0 [0, 1890]
Missing	63 (49.6%)	30 (65.2%)	20 (46.5%)	56 (55.4%)	169 (53.3%)

PFAS in air by region





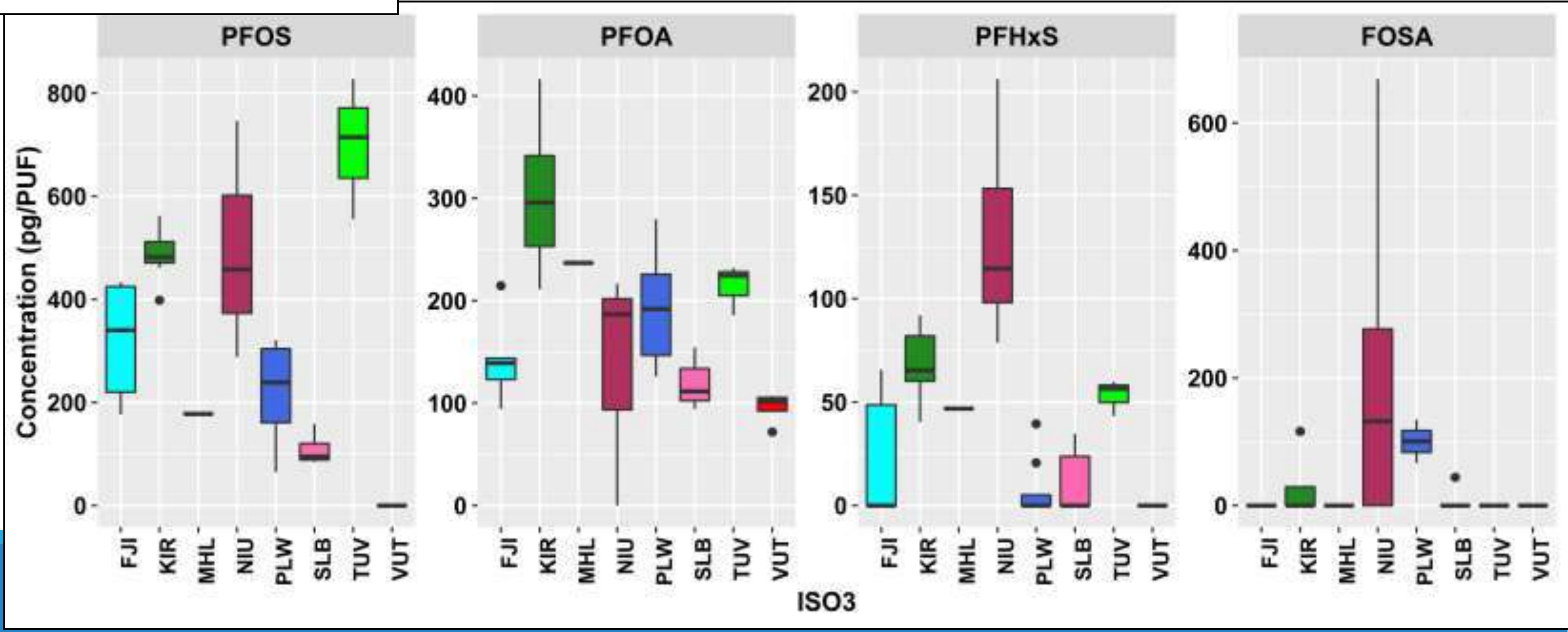
PFAS in PAS/PUFs by country



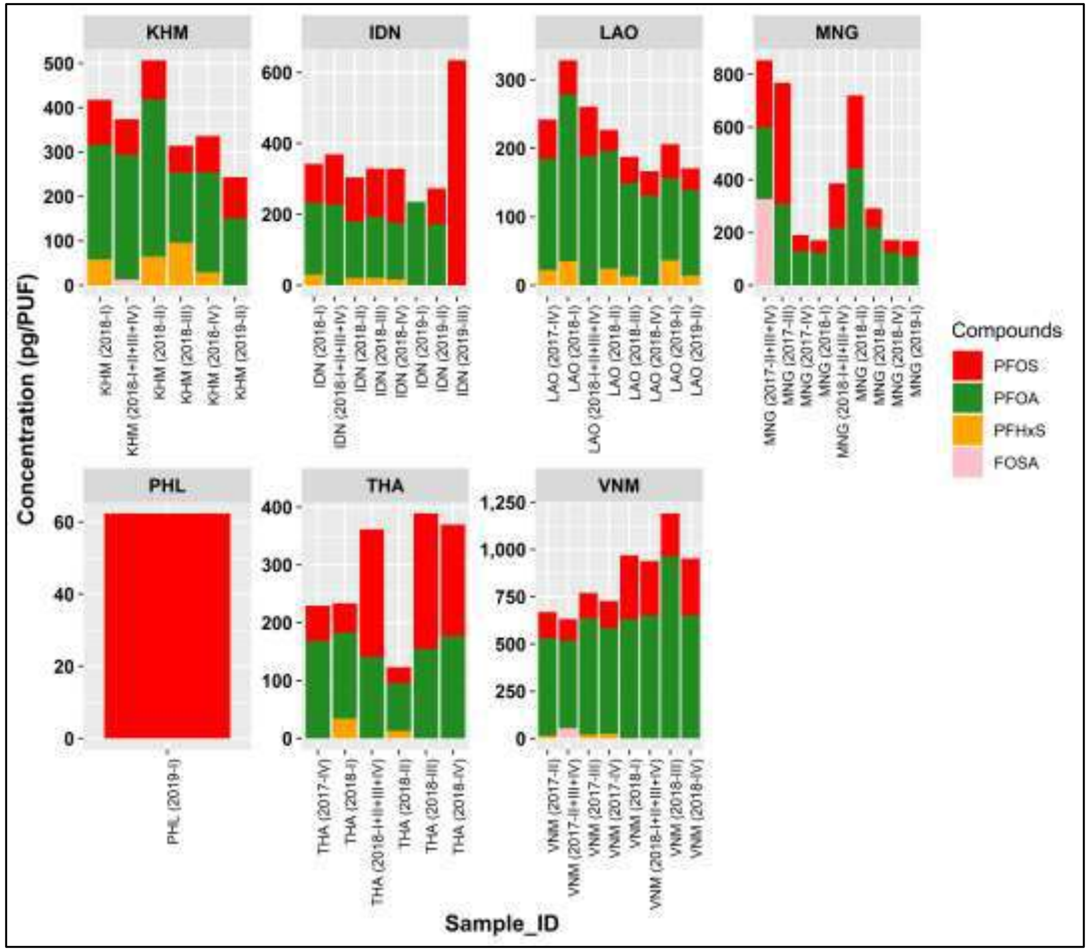
Concentations:

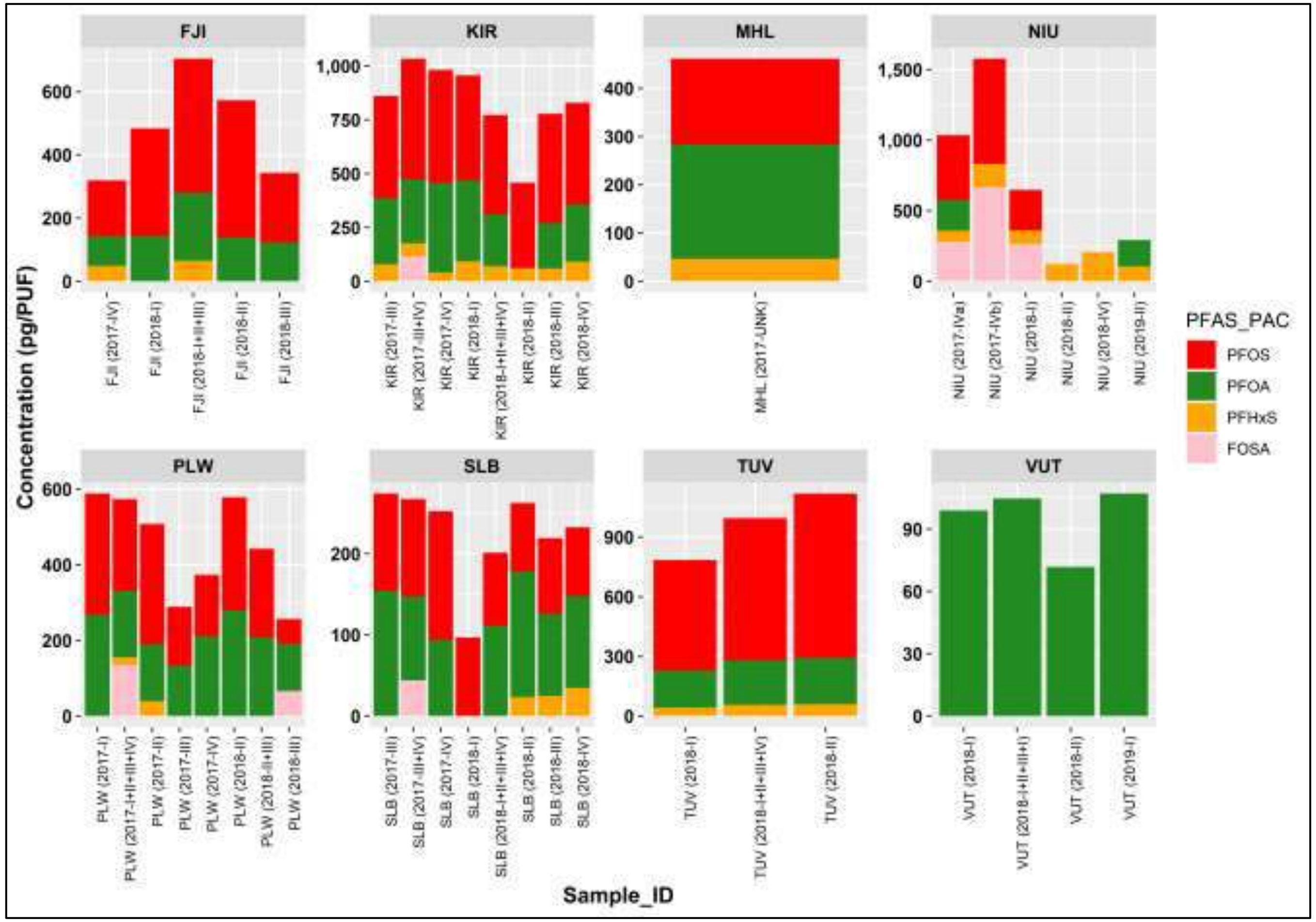
PFOS > PFOA > PFHxS

FOSA punctual

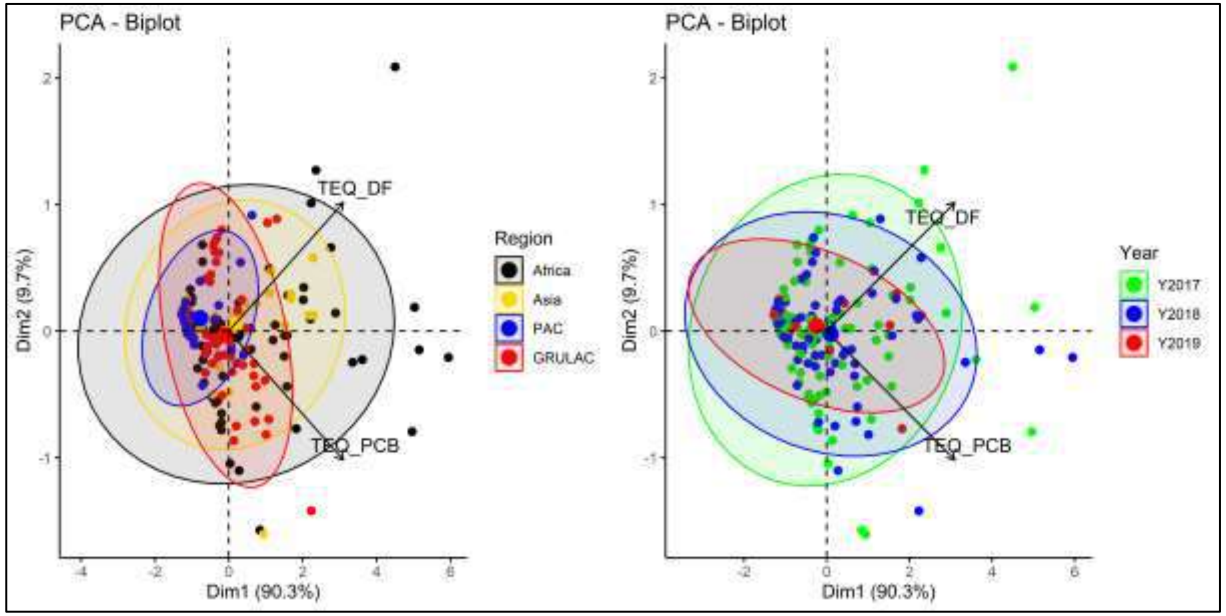


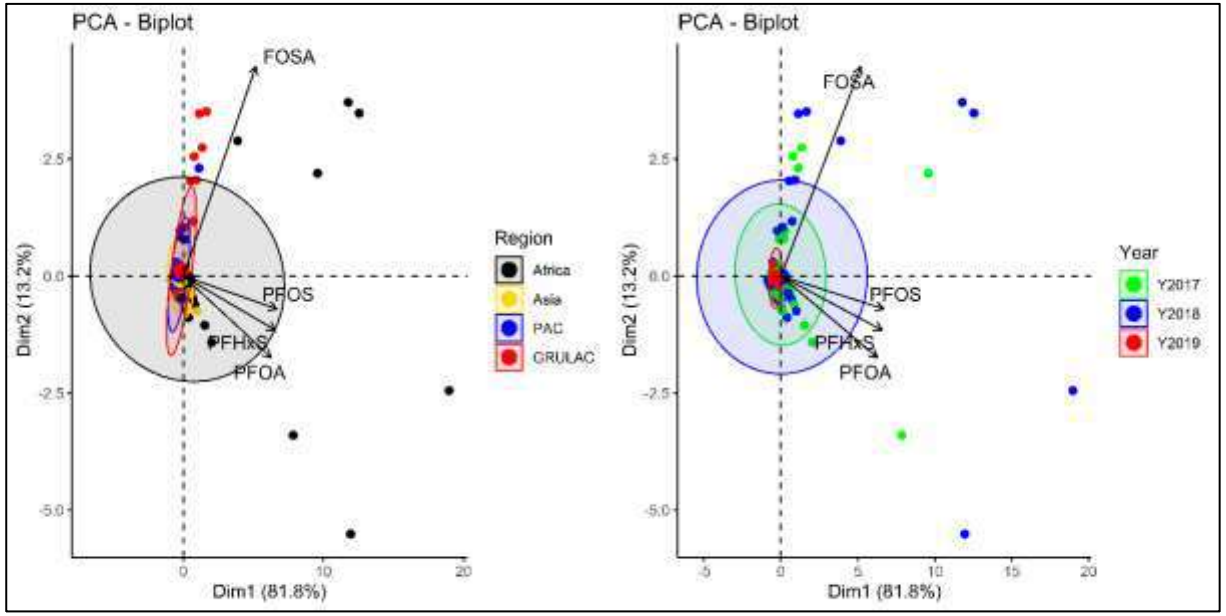
PFAS in PAS/PUF by country

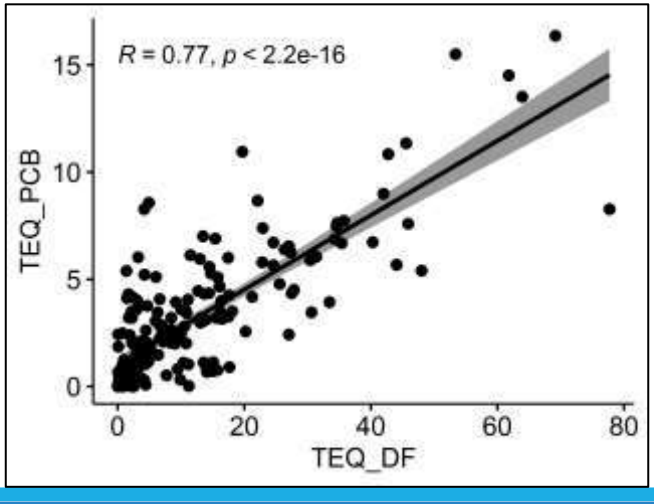




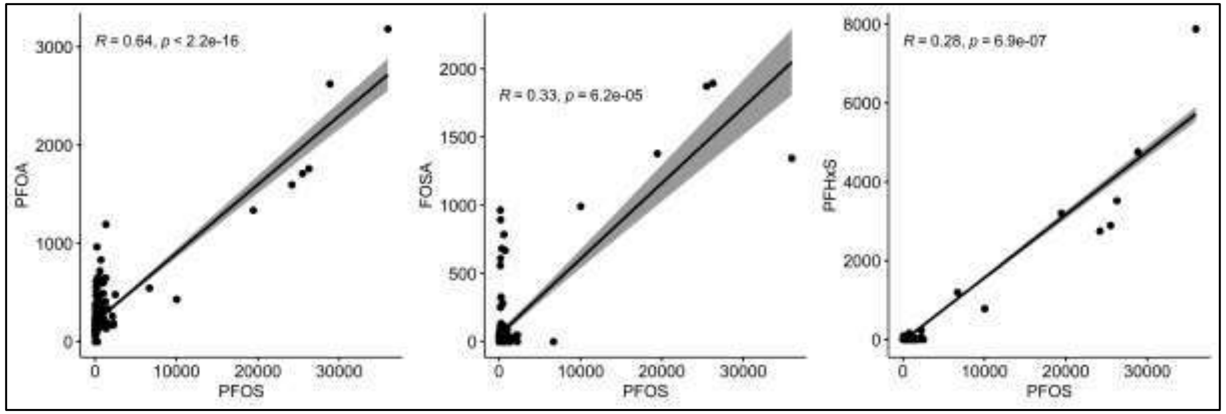
dl-POPs and PFAS: PCA biplots



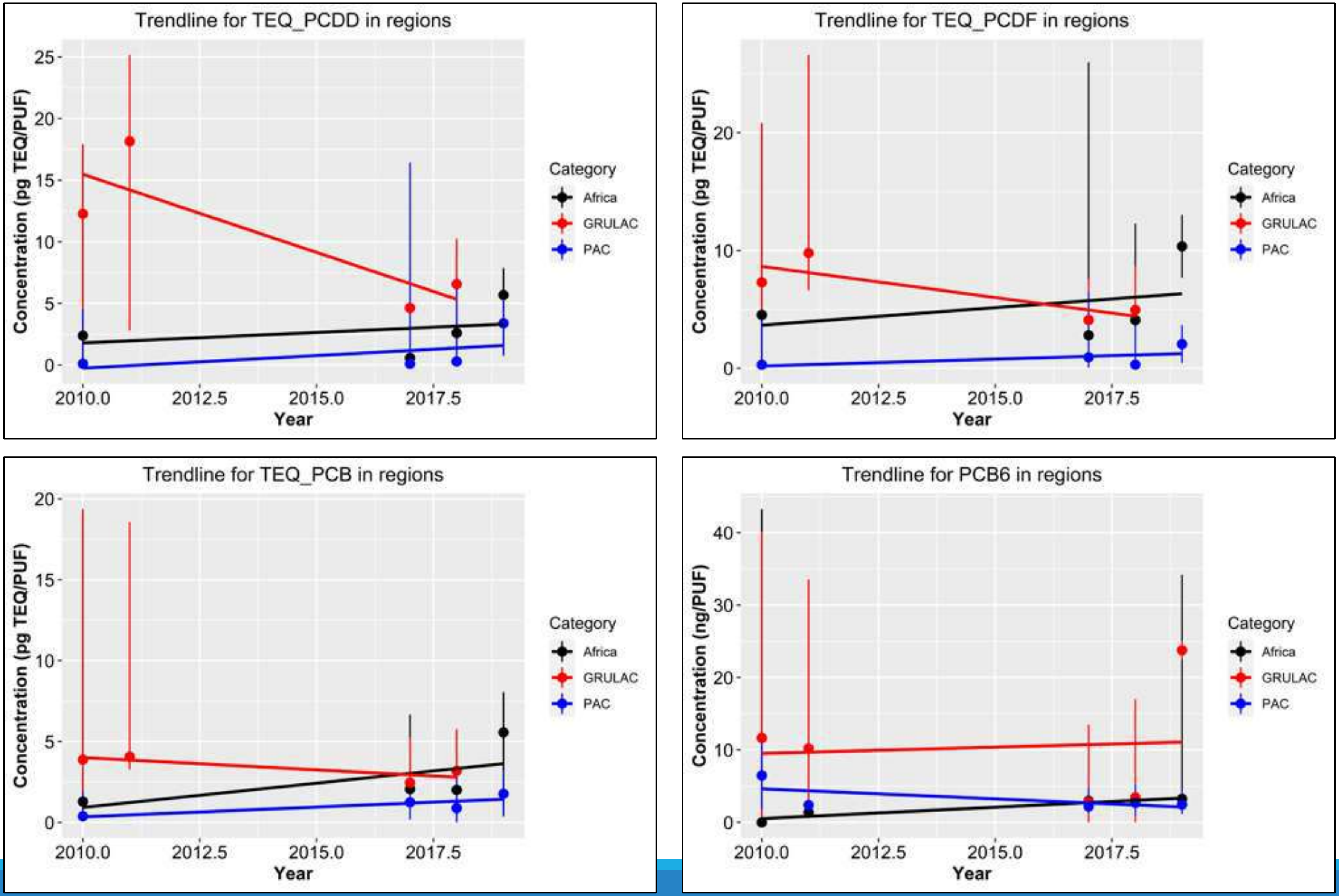




No distinct difference by region nor year
Suggestion: Monitoring not necssary every year, rather at defined intervals

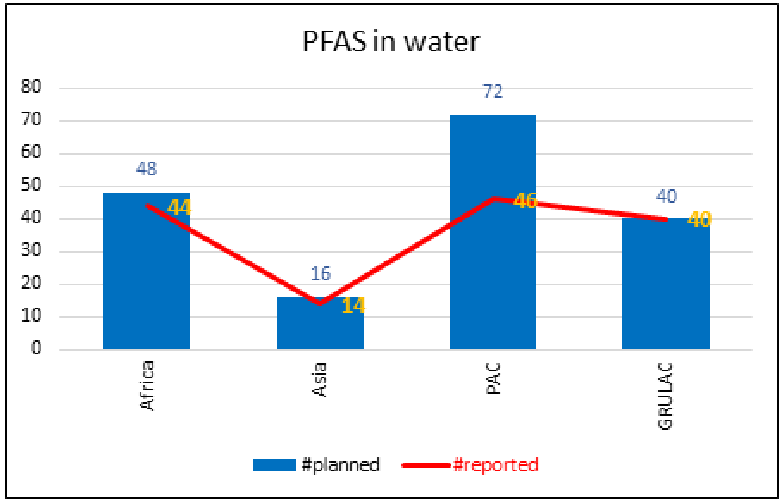


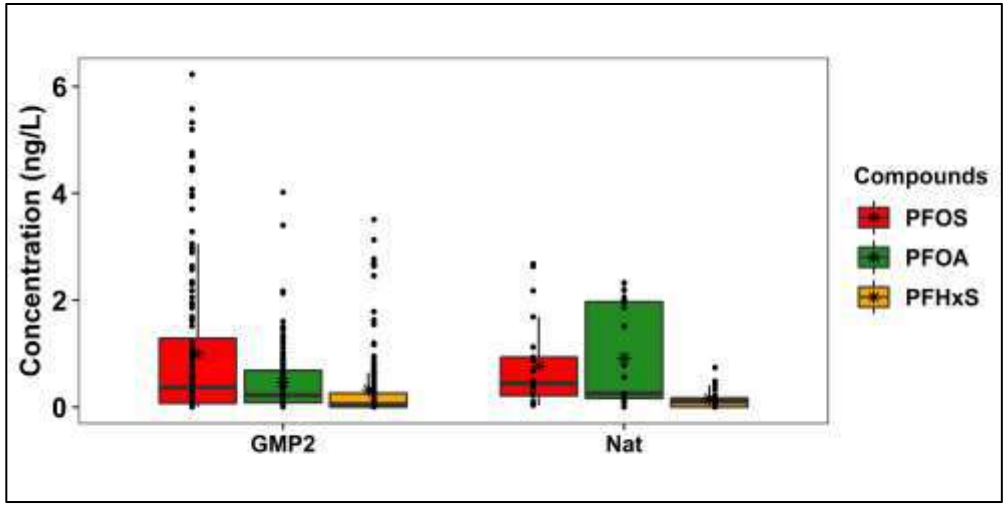
GMP1 vs. GMP2



Trends may differ by region and POP

Water: Samples planned vs reported - assessed



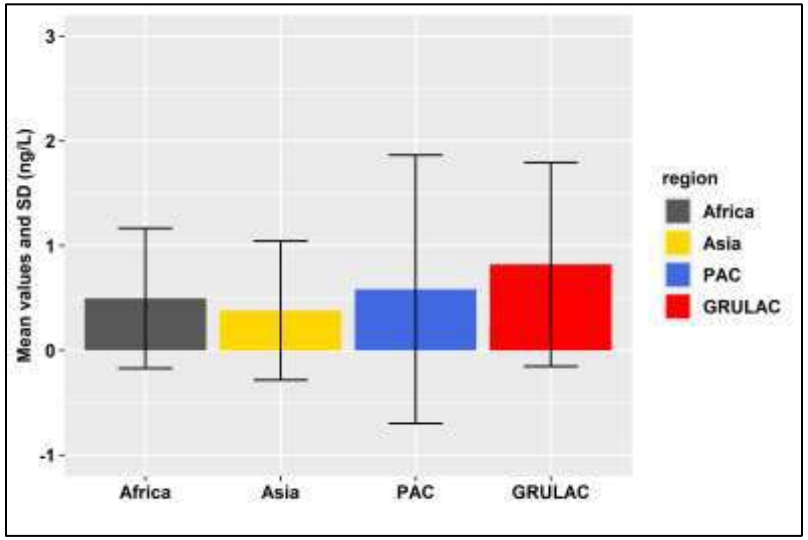


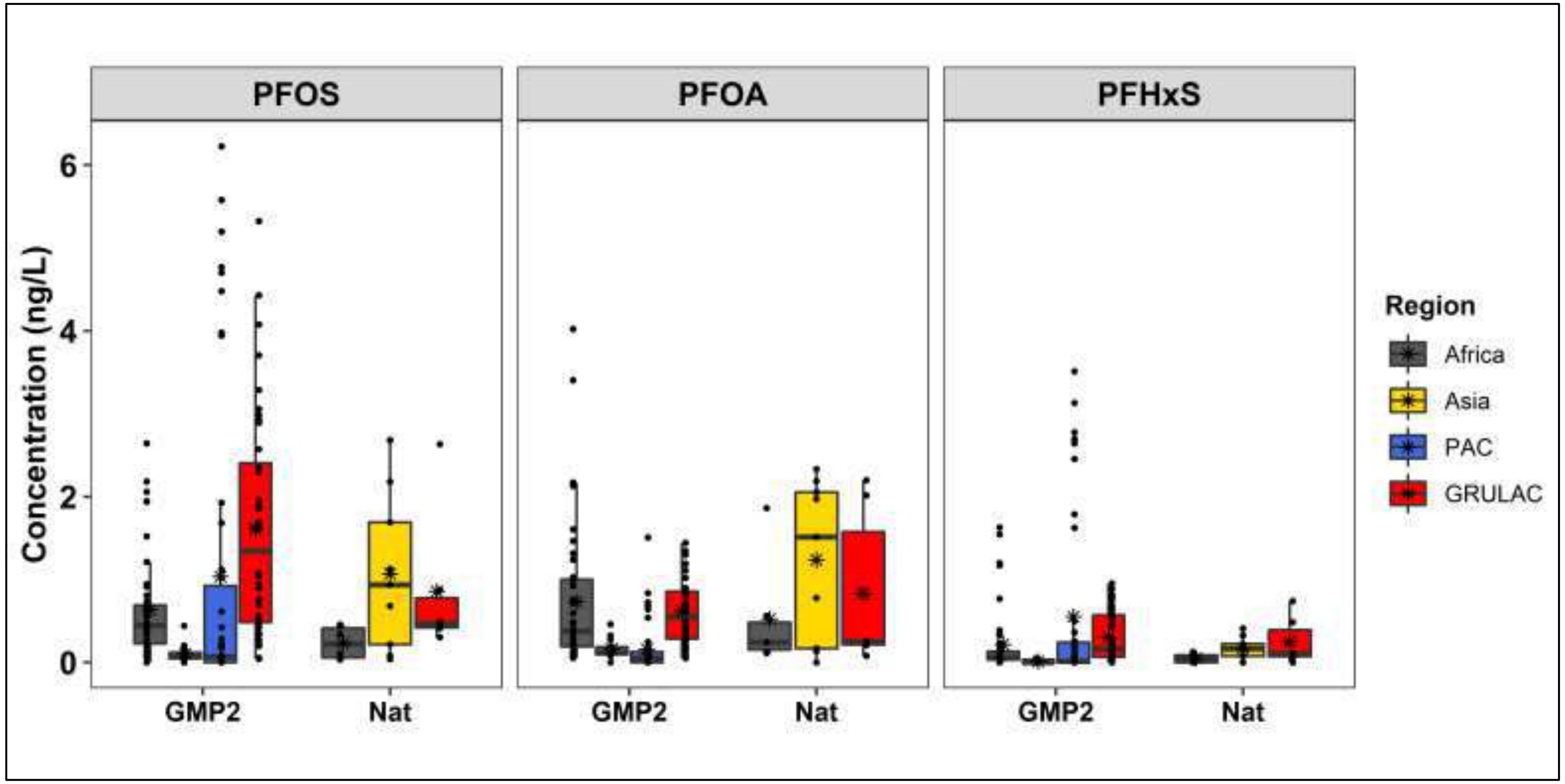
Region	ISO3	GMP2	Nat
Africa		**6**	**2**
Egypt	EGY	X	
Ghana	GHA	X	
Kenya	KEN	X	
Nigeria	NGA		X
Senegal	SEN	X	
Tunisia	TUN	X	
Uganda	UGA		X
Zambia	ZMB	X	
GRULAC		**5**	**2+1**
Argentina	ARG	X	
Antigua Barbuda	ATG		X
Brazil	BRA	X	
Ecuador	ECU	X	
Jamaica	JAM	X	X
Mexico	MEX	X	
Uruguay	URY		X

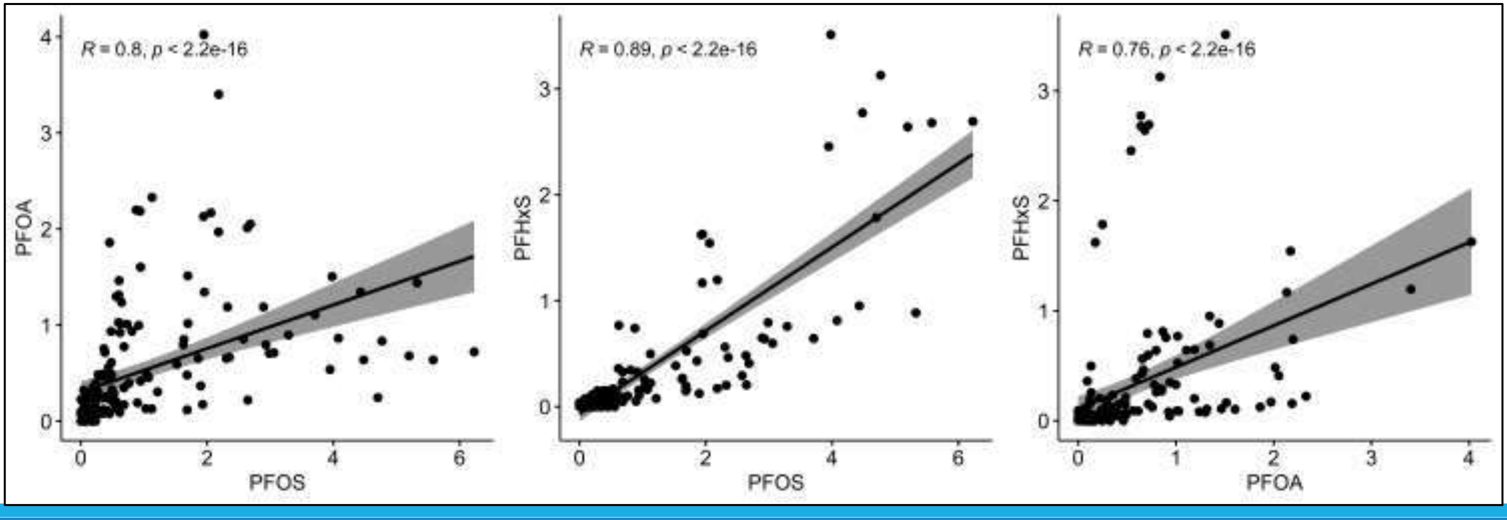
Region	ISO3	GMP2	Nat
Asia		**2**	**2+2**
Indonesia	IDN		X
Mongolia	MNG	X	X
Thailand	THA		X
Vietnam	VNM	X	X
PAC		**9**	**0**
Fiji	FJI	X	
Kiribati	KIR	X	
Marshall Islands	MHL	X	
Niue	NIU	X	
Palau	PLW	X	
Solomon Islands	SLB	X	
Tuvalu	TUV	X	
Vanuatu	VUT	X	
Samoa	WSM	X	

- National samples tend to have higher concentrations than GMP2 samples
- National samples tend to have PFOA>PFOA

PFAS in water by region



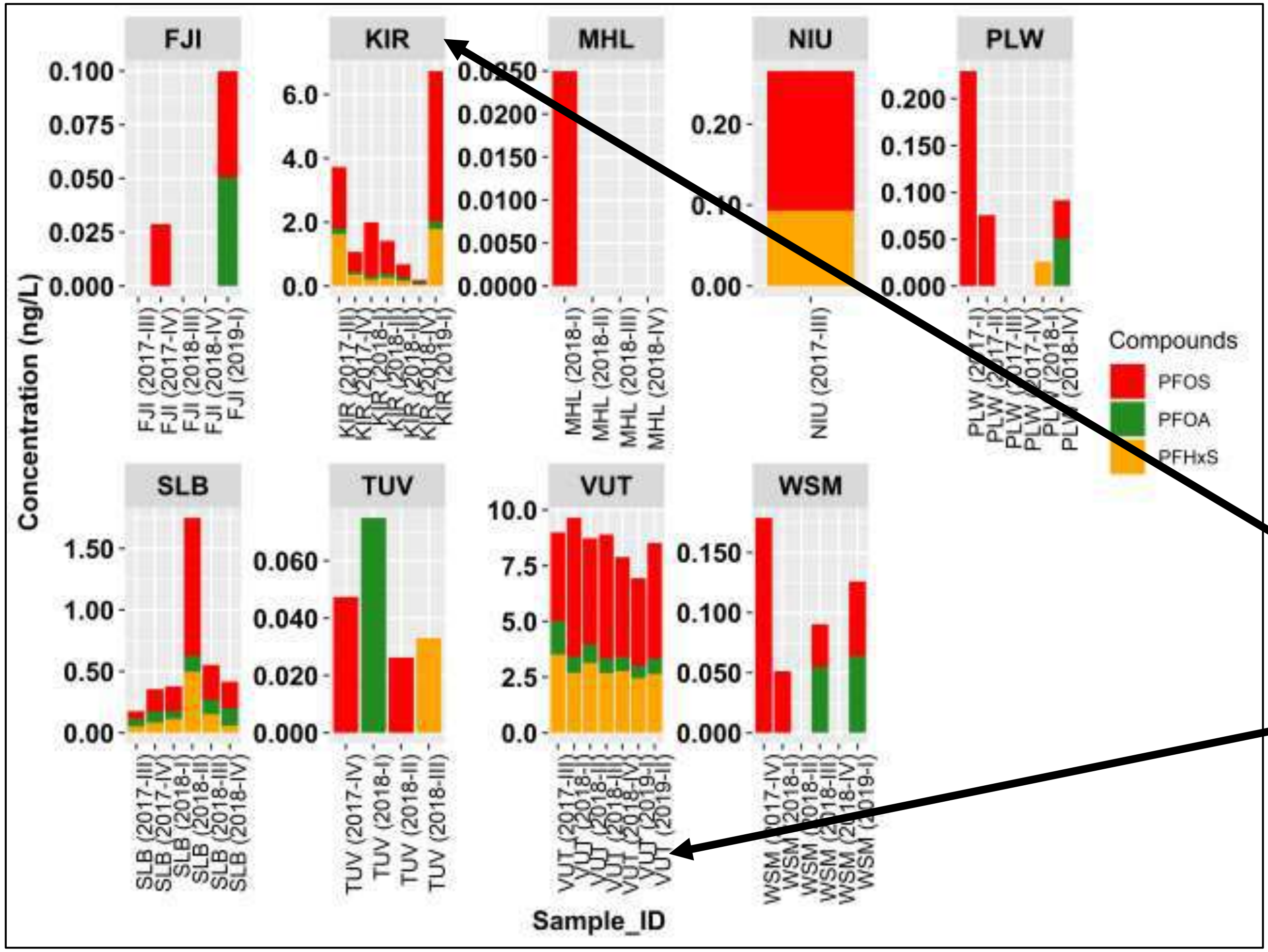


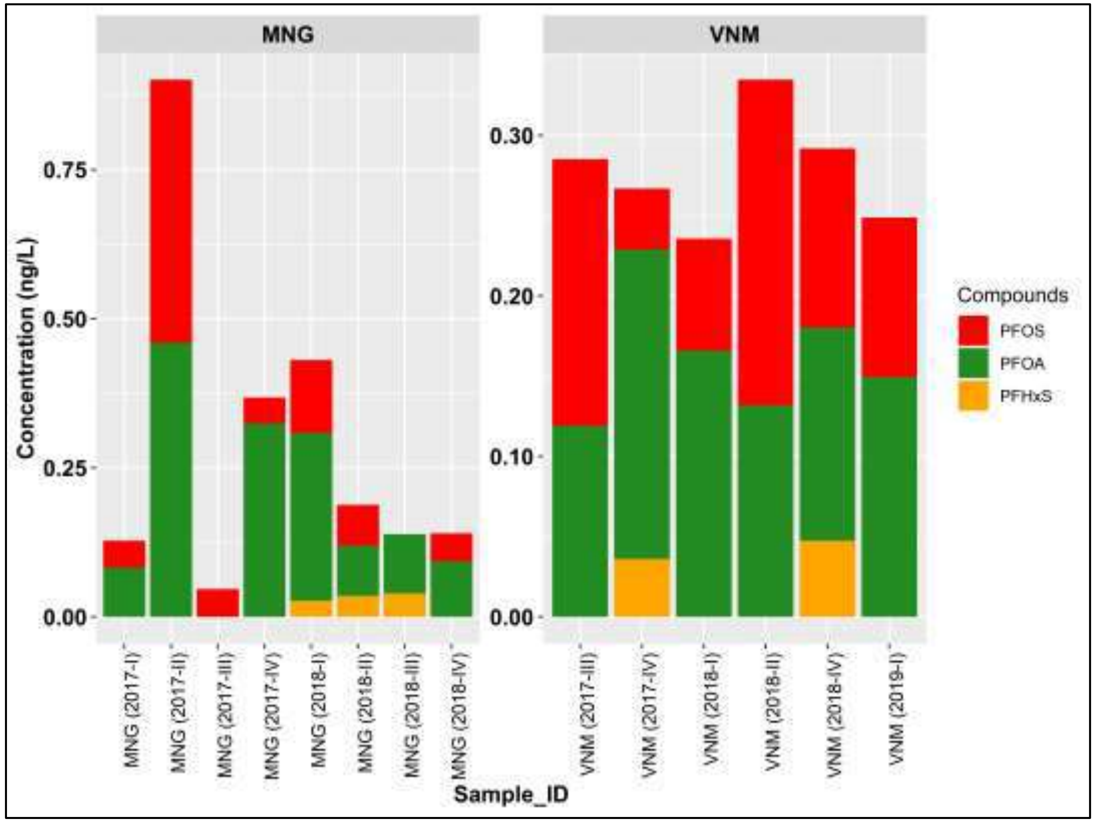


High variation of mean values in PAC

High/moderate correlations between PFOS, PFOA and PFHxS

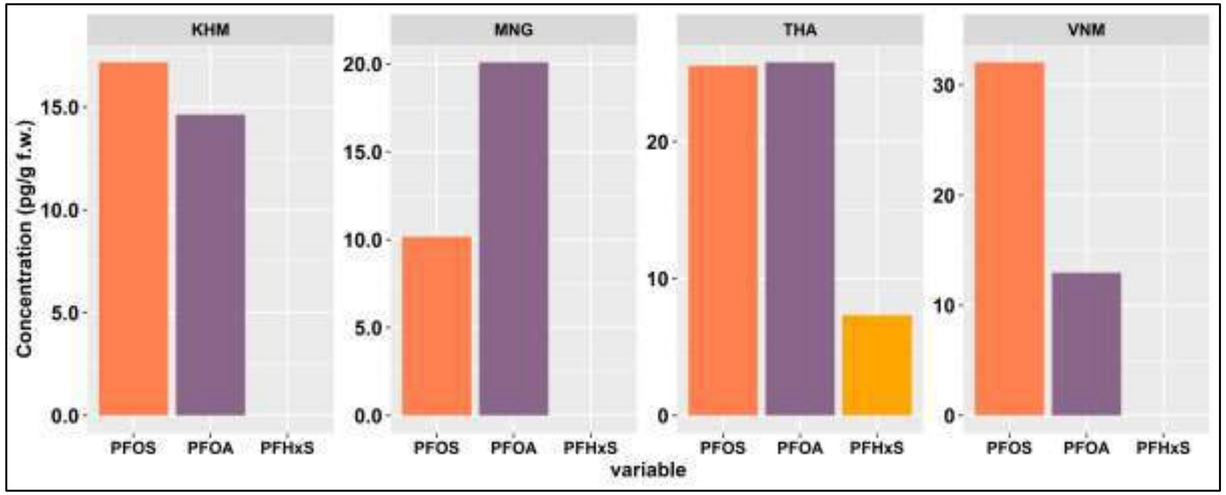
Individual samples by country

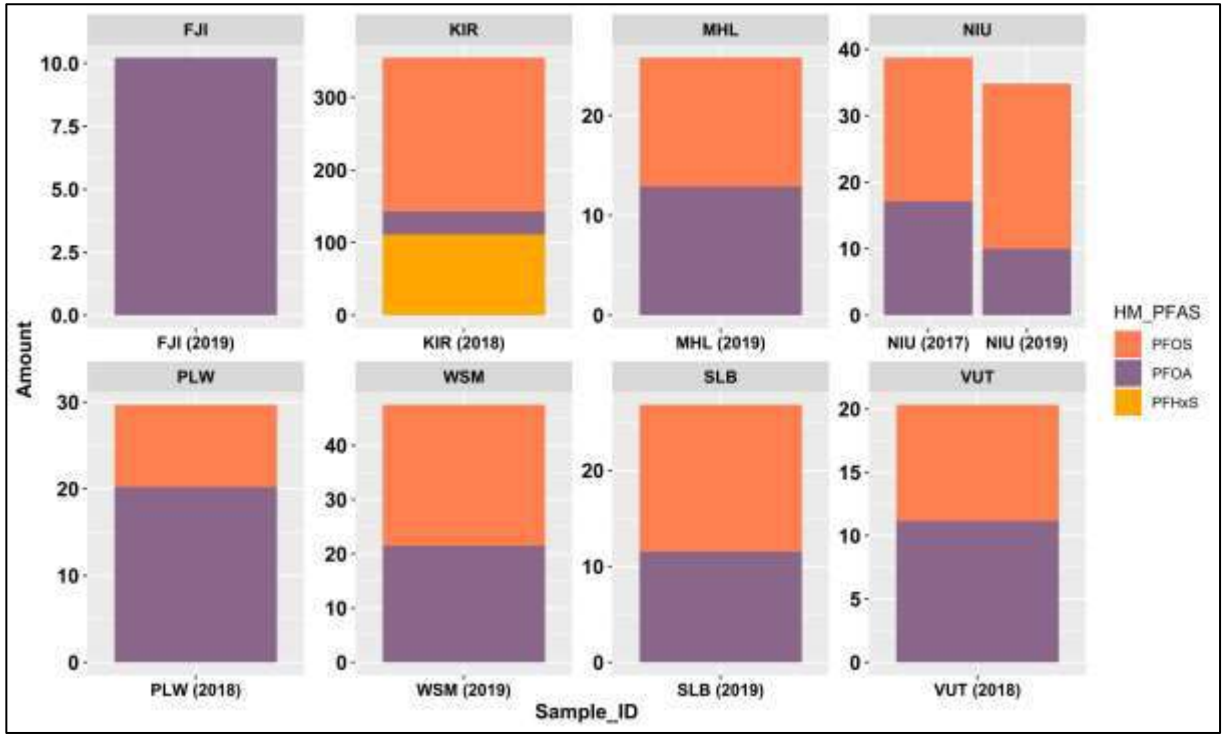




Highest values from GMP2 samples

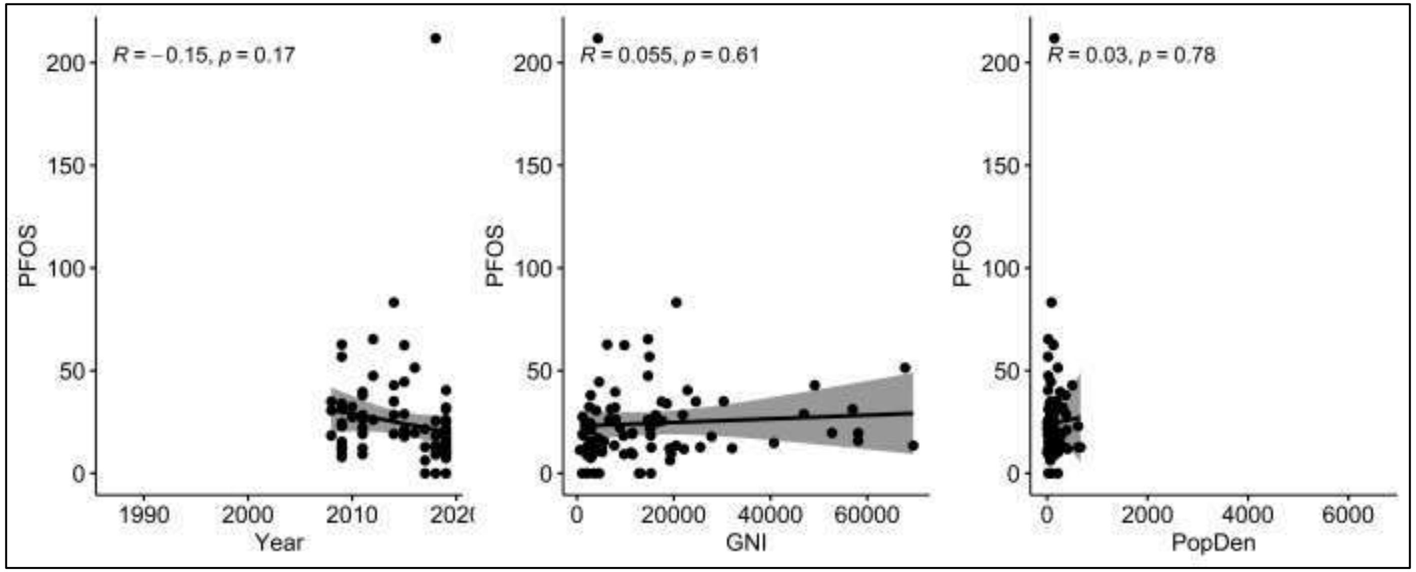
PFAS in human milk

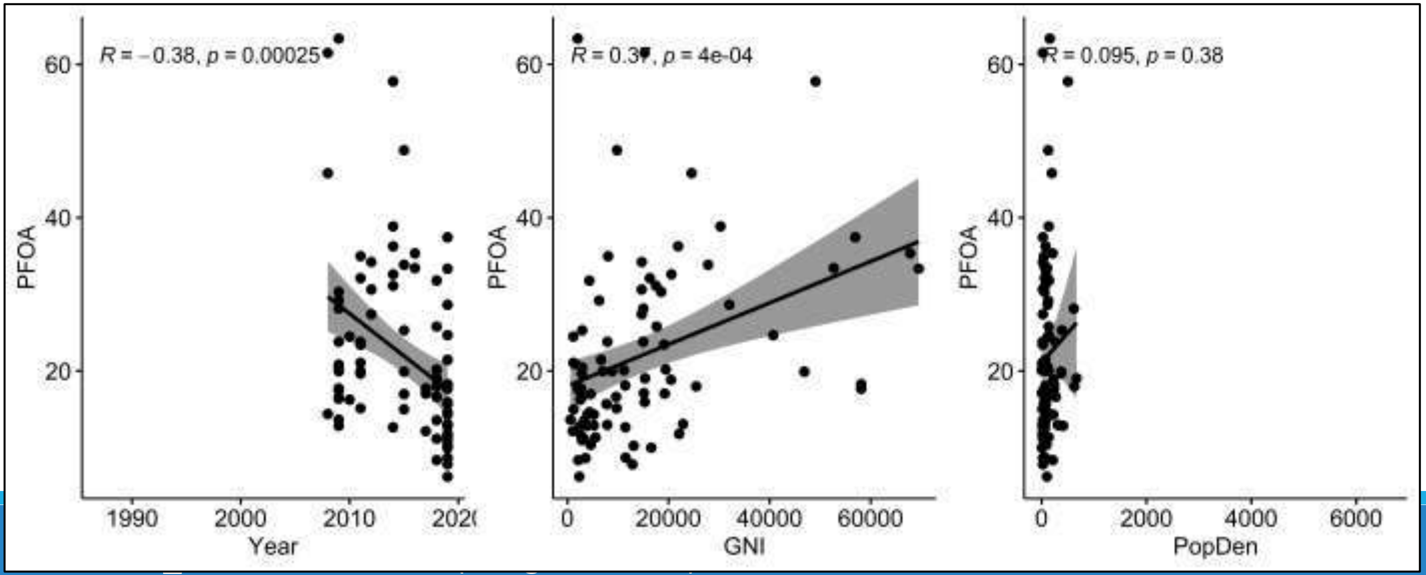


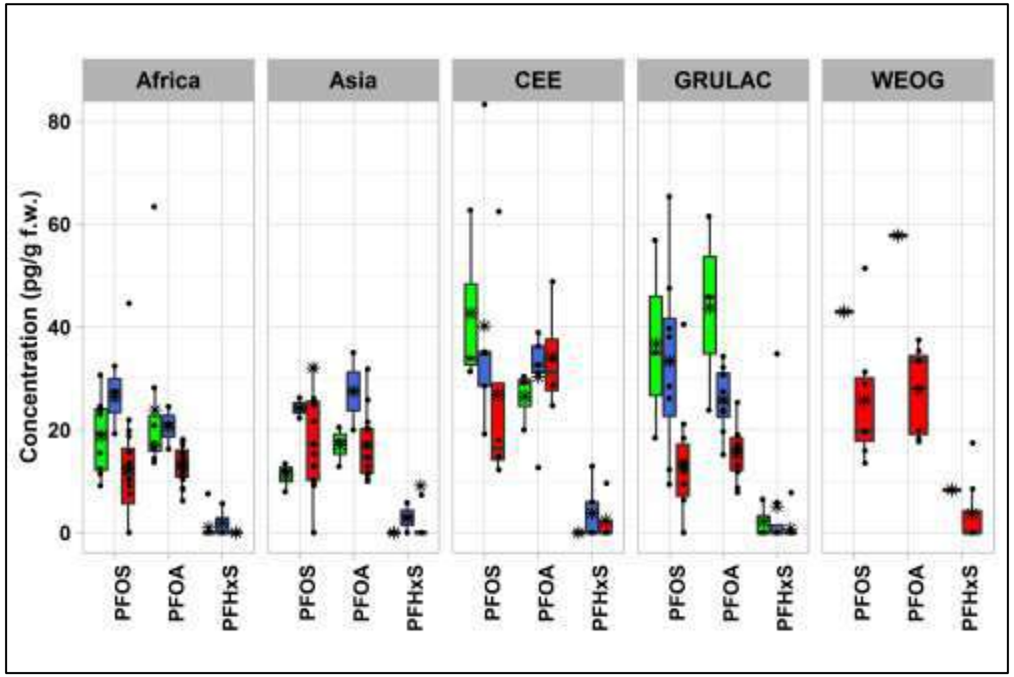


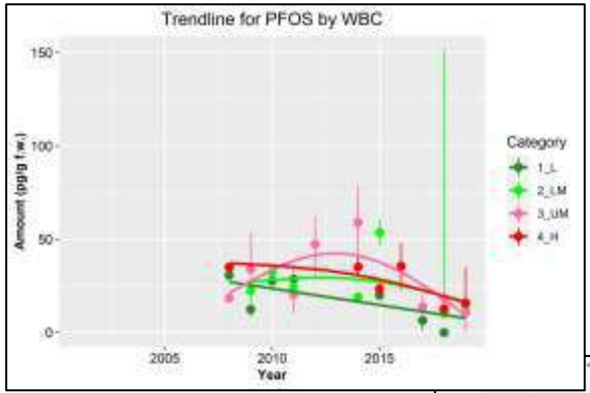
- PFHxS detected only in four samples; one of them KIR
- KIR had the highest PFOS and PFOA among all samples
  PFOA not prominent

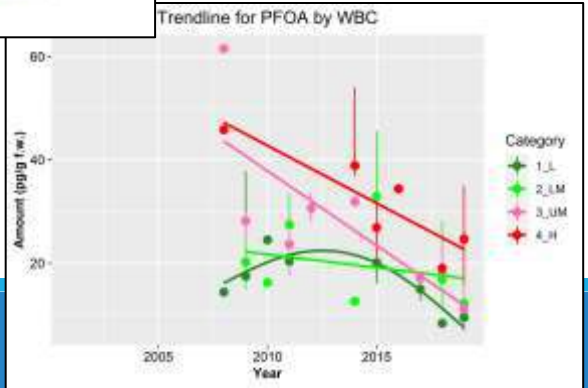
PFAS in human milk







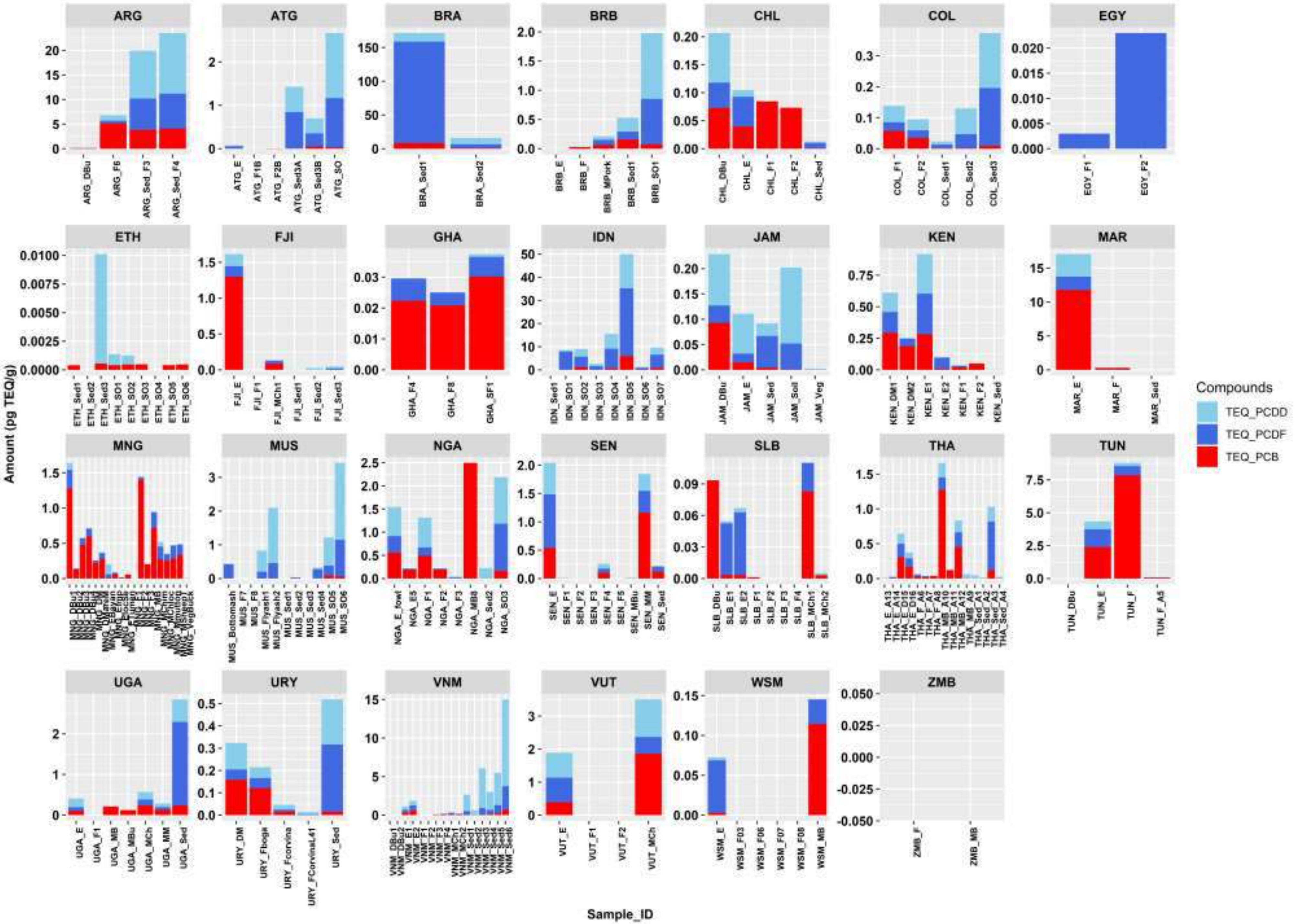




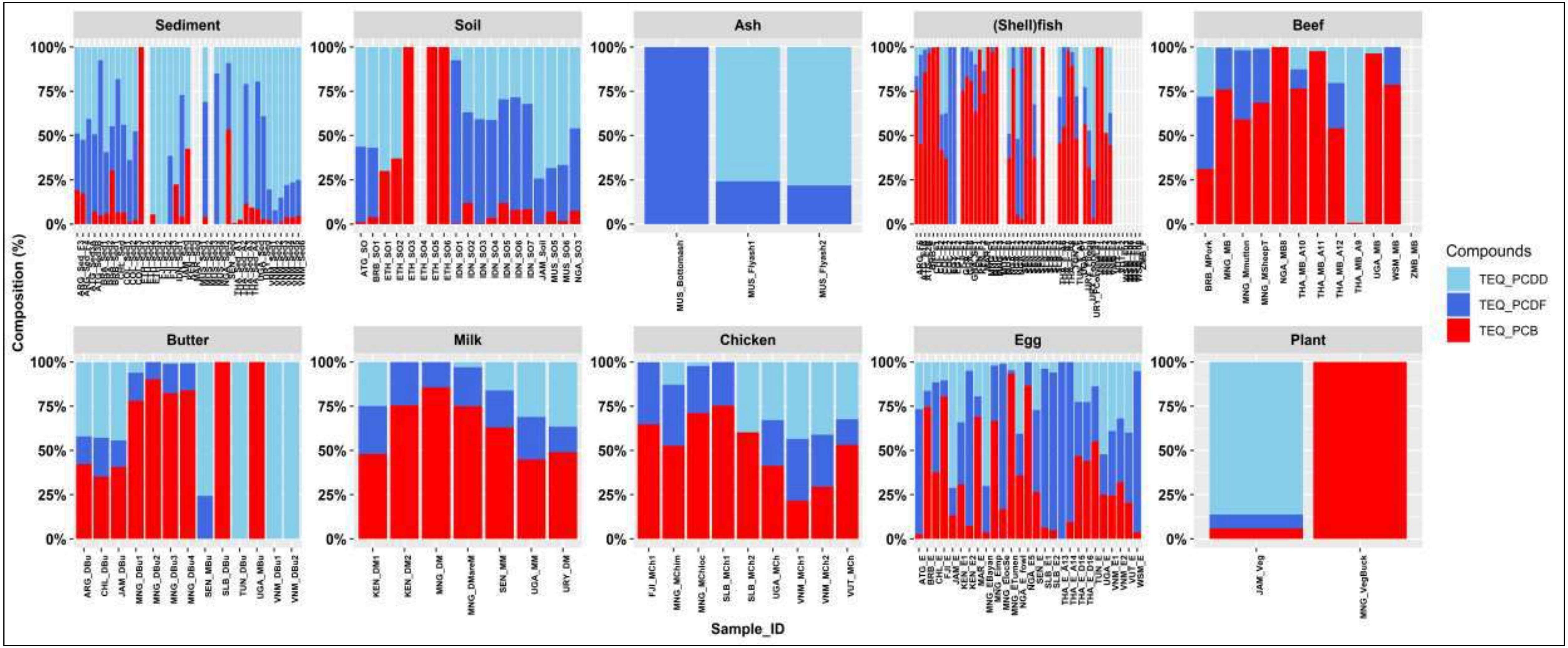
TEQs in national samples (n=185)

Region/ Country	abiotic			biota							Subtotal
	Sediment	Soil	Ash	(Shell)fish	Beef	Butter	Milk	Chicken	Egg	Plant	
Africa	**12**	**9**	**3**	**22**	**3**	**3**	**4**	**1**	**8**		**65**
EGY				2							2
ETH	3	6									9
GHA				3							3
KEN	1			2			2		2		7
MAR	1			1					1		3
MUS	4	2	3	2							11
NGA	1	1		3	1				2		8
SEN	1			5		1	1		1		9
TUN				2		1			1		4
UGA	1			1	1	1	1	1	1		7
ZMB				1	1						2
Asia	**11**	**7**		**10**	**7**	**6**	**2**	**4**	**10**	**1**	**58**
IDN	1	7									8
MNG				3	3	4	2	2	4	1	19
THA	4			3	4				4		15
VNM	6			4		2		2	2		16
GRULAC	**13**	**3**		**11**	**1**	**3**	**1**		**4**	**1**	**37**
ARG	2			1		1					4
ATG	2	1		2					1		6
BRA	2										2
BRB	1	1		1	1				1		5
CHL	1			2		1			1		5
COL	3			2							5
JAM	1	1				1			1	1	5
URY	1			3			1				5
PAC	**3**			**11**	**1**	**1**		**4**	**5**		**25**
FJI	3			1				1	1		6
SLB				4		1		2	2		9
VUT				2				1	1		4
WSM				4	1				1		6
Total	**39**	**19**	**3**	**54**	**12**	**13**	**7**	**9**	**27**	**2**	**185**

TEQs in national samples (scale)

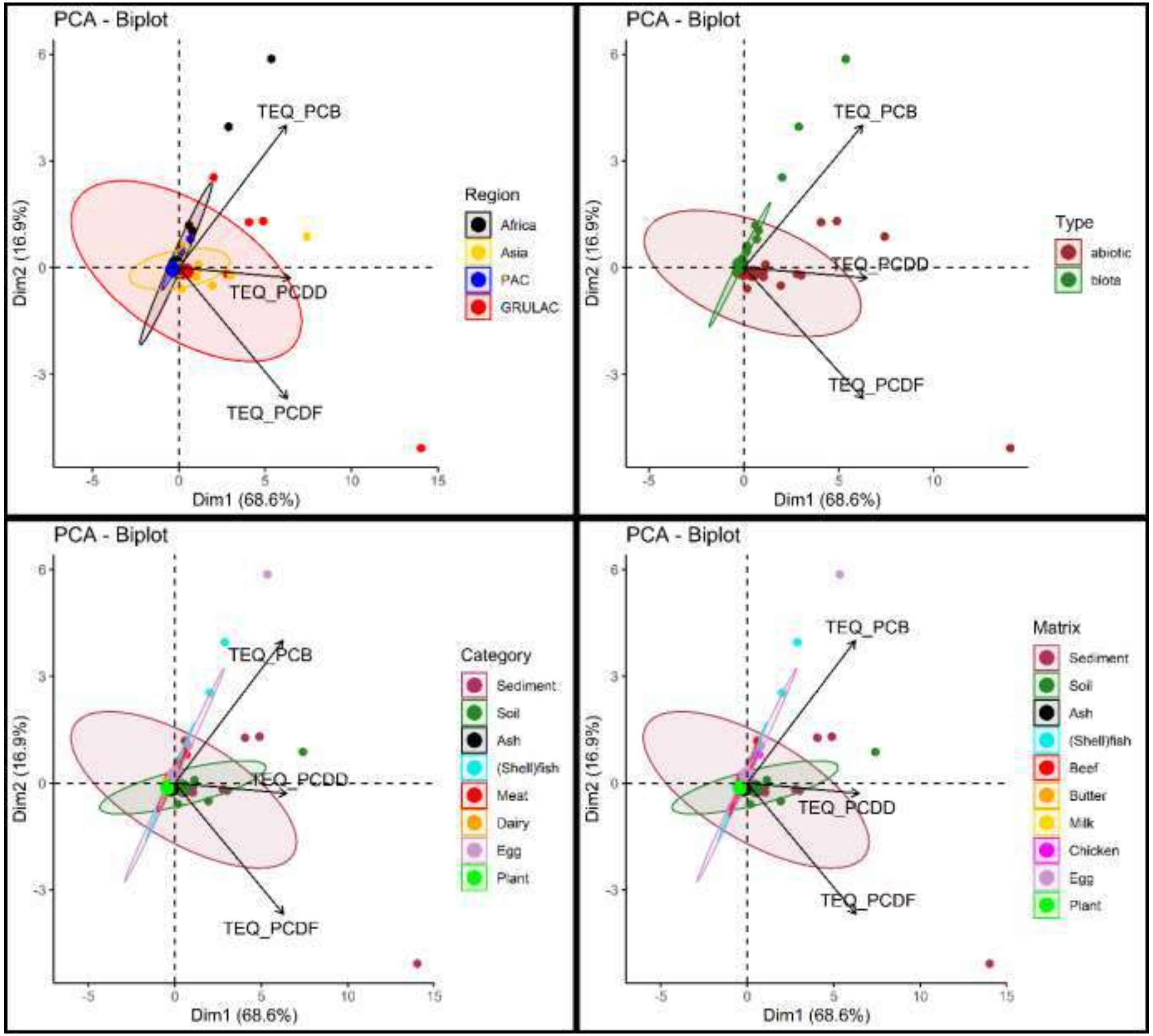


dl-POPs in national samples (pattern)



PCA of 3 TEQs in national samples

- Abiotic matrices larger ranges than biota samples;
- Biota of animal origin are the primary matrix of dl-POPs contamination. Often, values level off, contamination is low.
- Findings are independently of geographic location.
- Prevalence of matrix types - and not regions or geography - as the main driving factor for the scale and pattern (TEQ distribution) of dl-POPs.
- It is recommended to differentiate into the three listed POPs, namely, PCDD, PCDF, and dl-PCB.
- Dominance of dl-PCB especially in (shell)fish and beef. For eggs, pathways of exposure other than feed, may have an impact on the scale and the TEQ distribution. For eggs, not for chicken meat, an impact from soil can be derived.

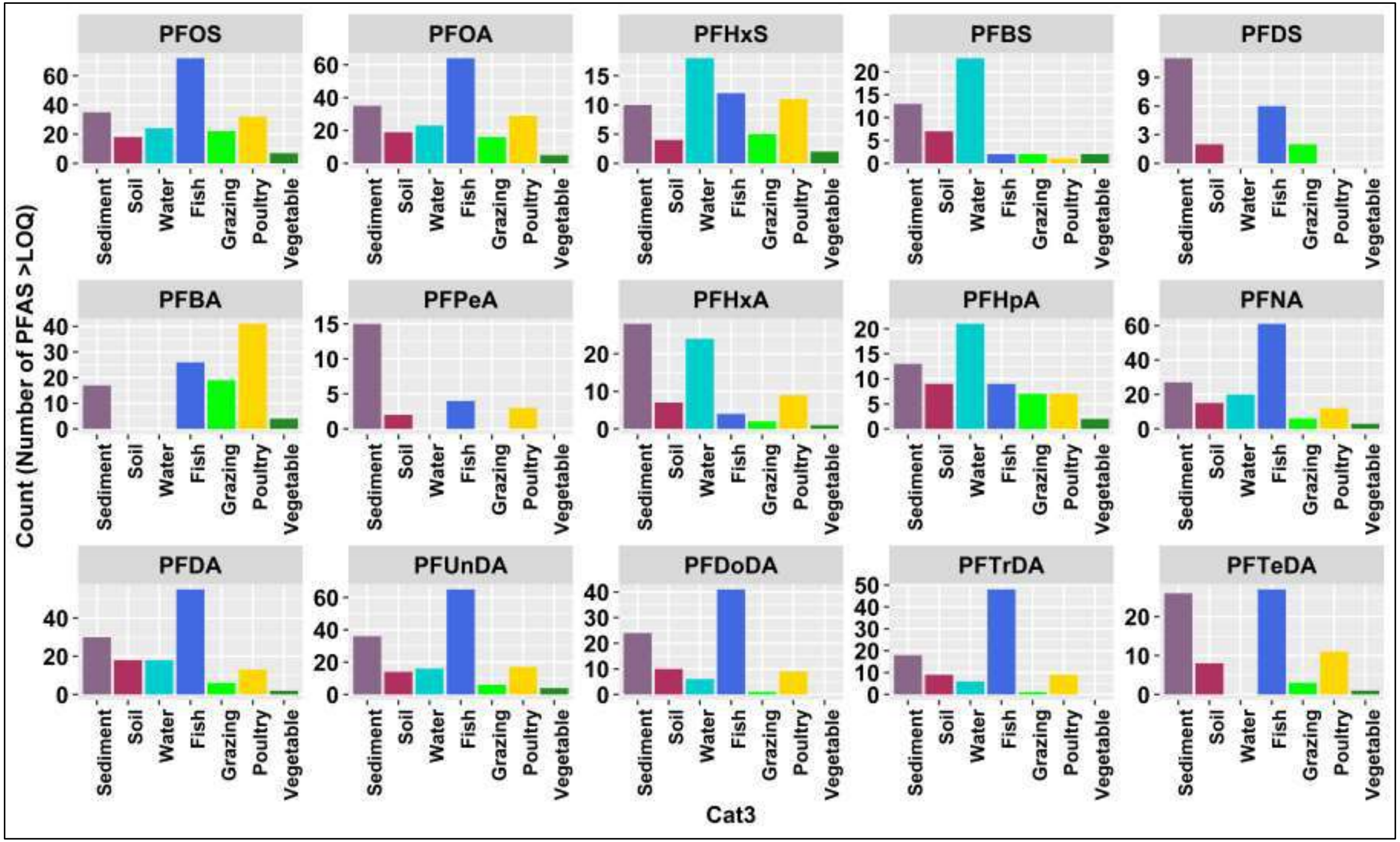


PFAS in national samples

Overview

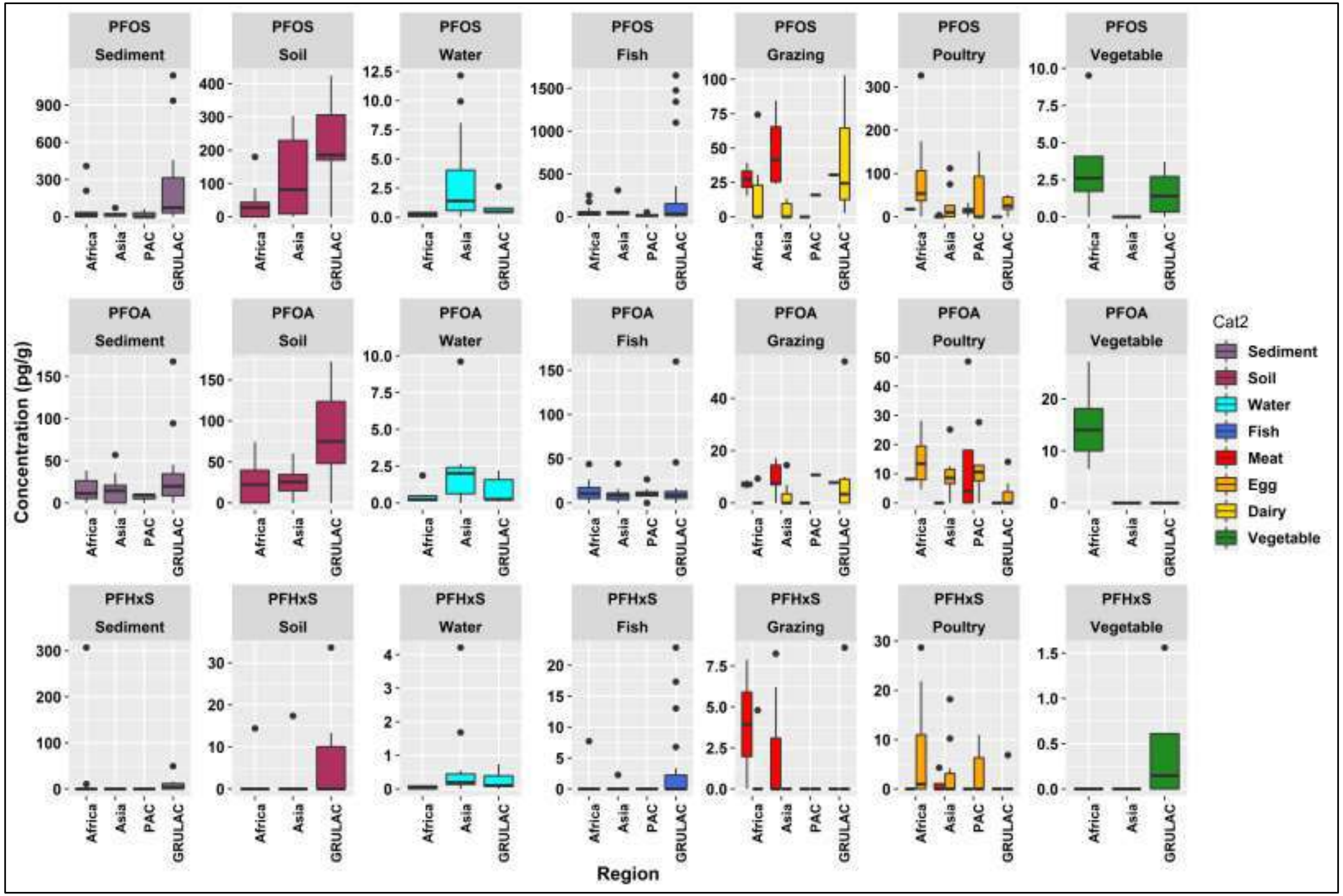
Country	Beef	Butter	Chicken	Fish	Milk	Sediment	Soil	Vegetable	Water	Subtotal
Africa	2	2	9	21	4	16	9+1	5	6	75
EGY				2						2
ETH						6	6			12
GHA				5		2				7
KEN			2	2	2					6
MAR			1	1		1				3
MUS				2		4	2+1*	3		12
NGA	1		2	3		1	1		1	9
SEN		1	1	4	1	1		2		10
TUN			1	1						2
UGA	1	1	2	1	1	1			5	12
Asia	7	6	12+2	12	2	11	11	1	12	76
IDN						1	7		6	14
MNG	3	4	6	4	2**		4	1	2	26
THA	4		2+2***	4		4			2	18
VNM		2	4	4		6			2	18
GRULAC	1	4	18	27	2	17	6	4	6	85
ARG		1		1		1				3
ATG			2	5		2	2		2	13
BRA		1	1	4	1	3				10
BRB			13	5		4	3	1		26
CHL		1	2	2		1				6
COL				4		3				7
JAM	1	1		1		1	1	3	2	10
URY				5	1	2			2	10
PAC	1	1	9	16		3				30
FJI			2	3		3				8
SLB		1	4	4						9
VUT			2	2						4
WSM	1		1	7						9
Total	11	13	50	76	8	47	27	10	24	266

Detection frequency of PFAS in national samples



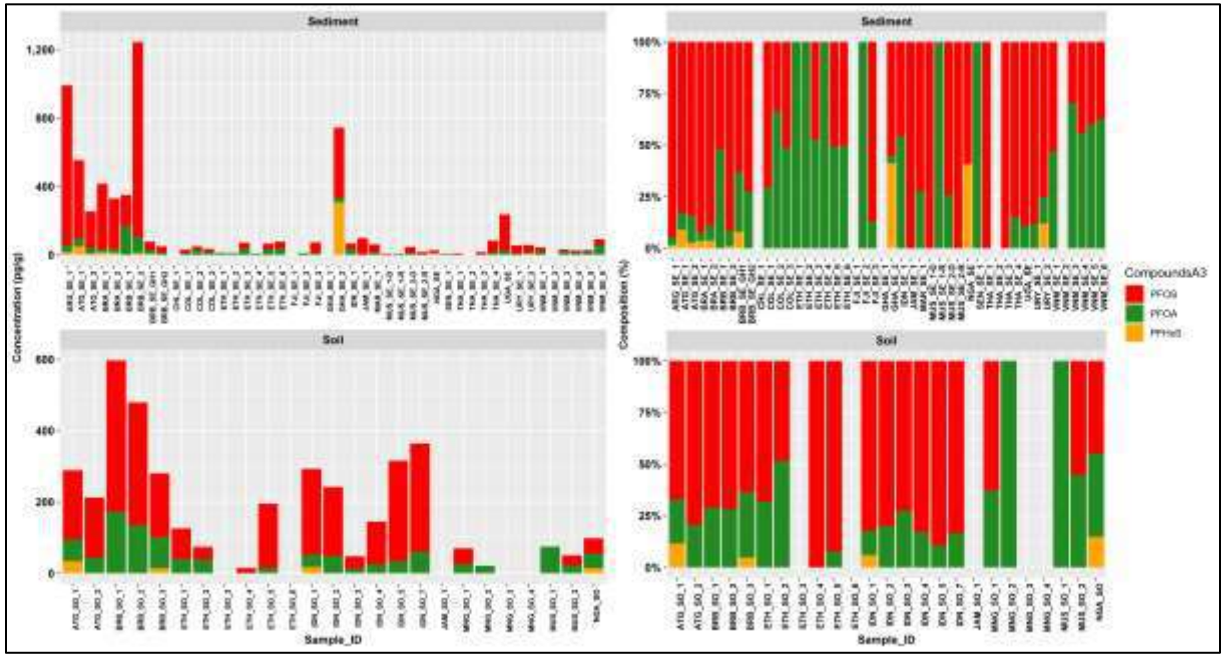
- For 15 PFAS: very different scales and pattern
- PFOS and PFOA dominating the pattern in all samples
- PFHxS did not play a major role
- Presence in terrestrial biota ”newly” discovered

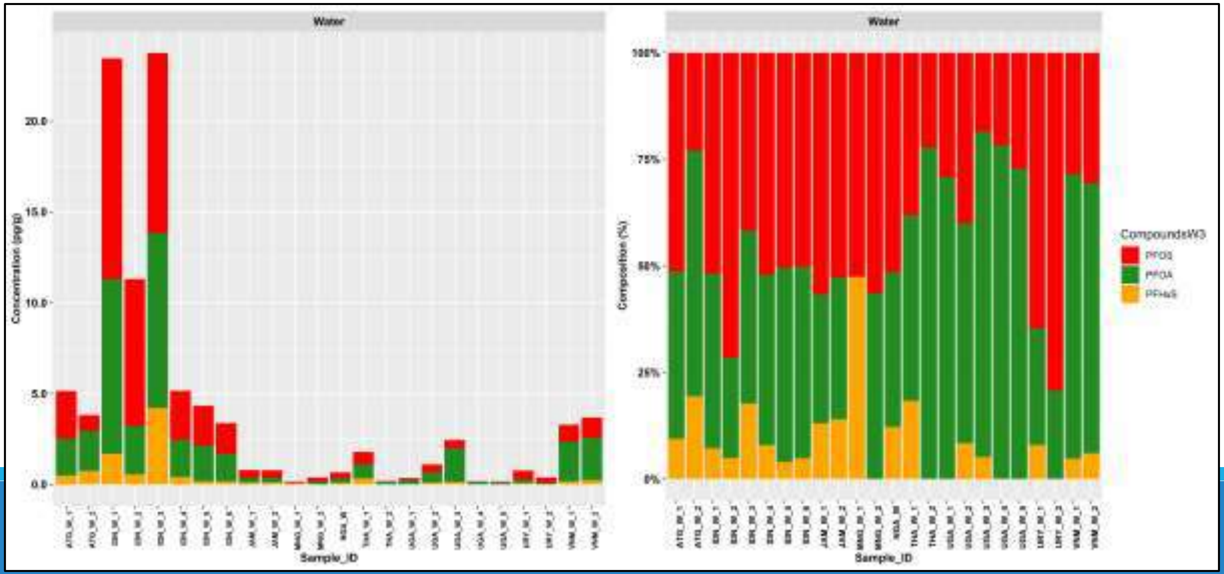
SC three PFAS in national samples

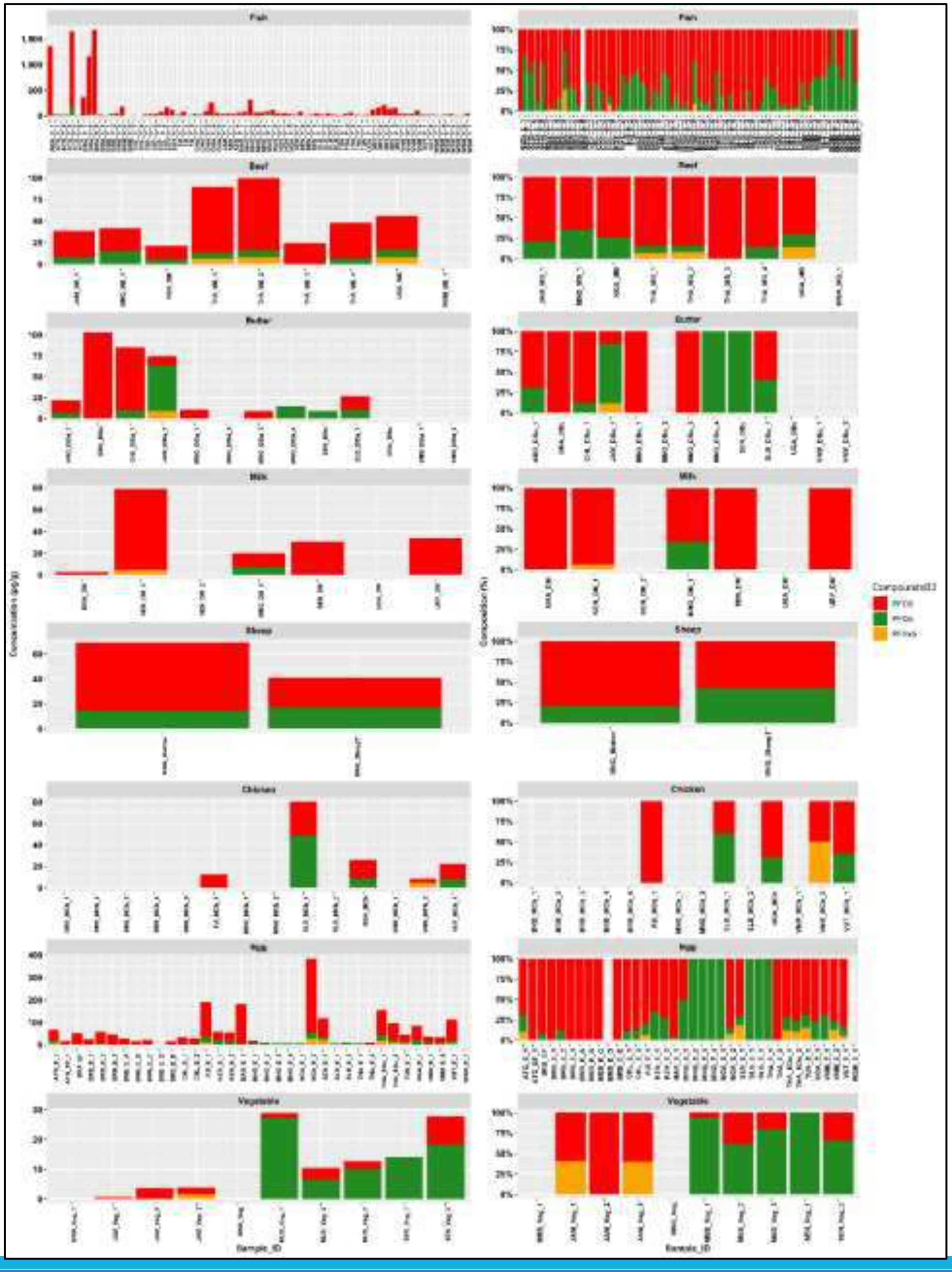


Region /Country	Asia/IDN	Asia/MNG
Matrix	Soil	Mare Milk
Sample_ID	IDN_SO_6	MNG_DM_2
L_PFOS	7 009	<6.2
br_PFOS	1 587	<1.2
ΣPFOS	8 596	<6.2
PFOA	987	229
PFHxS	86	<5.6
PFBS	121	<5.6
PFDS	<6.2	<6.2
PFBA	<6.2	<6.2
PFPeA	260	<6.2
PFHxA	265	<6.2
PFHpA	267	<6.2
PFNA	227	<6.2
PFDA	753	<6.2
PFUnDA	118	<6.2
PFDoDA	212	<6.2
PFTrDA	21.7	<6.2
PFTeDA	57.5	<6.2

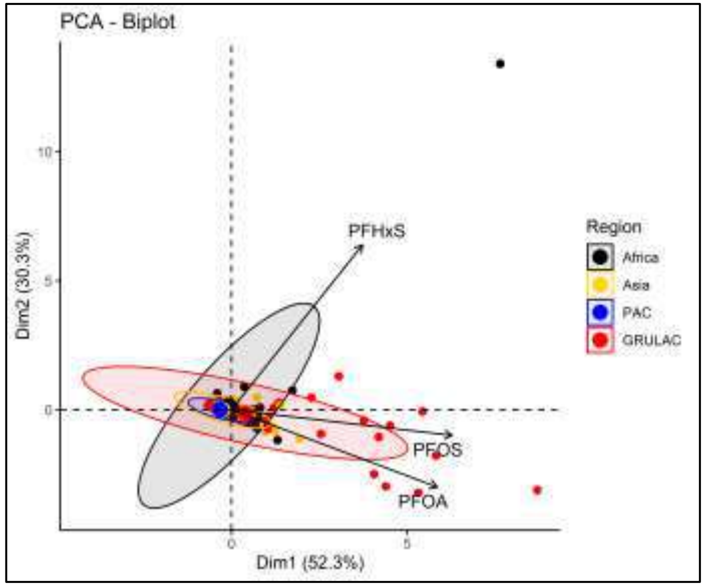
Scale and pattern 3 SC PFAS

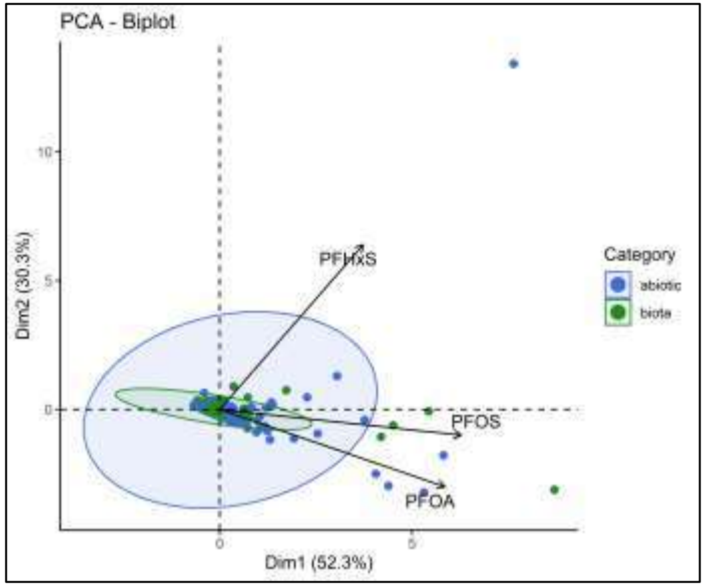


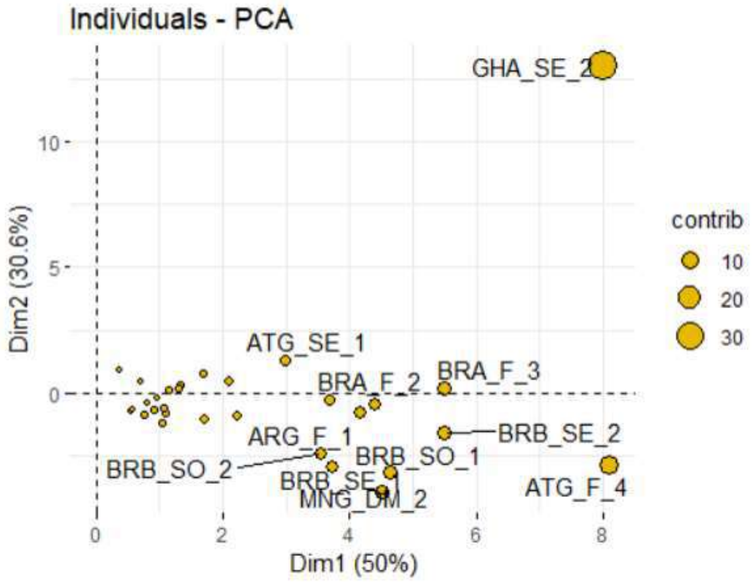




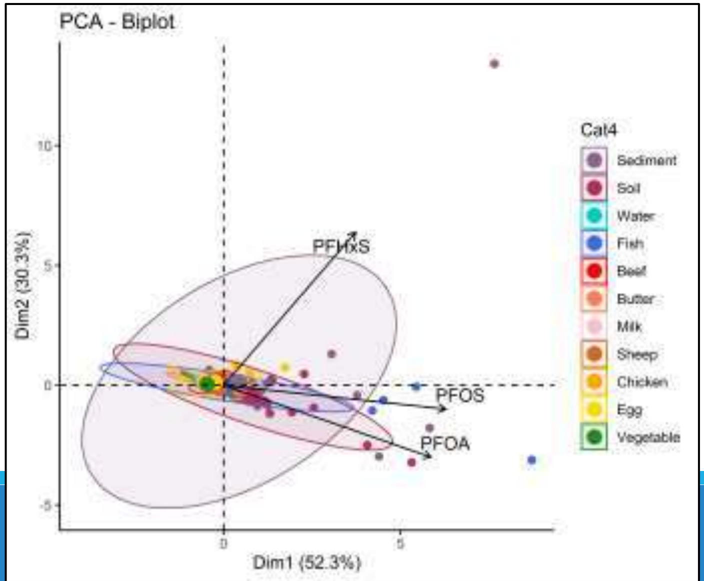
PCA biplots for PFAS in national samples

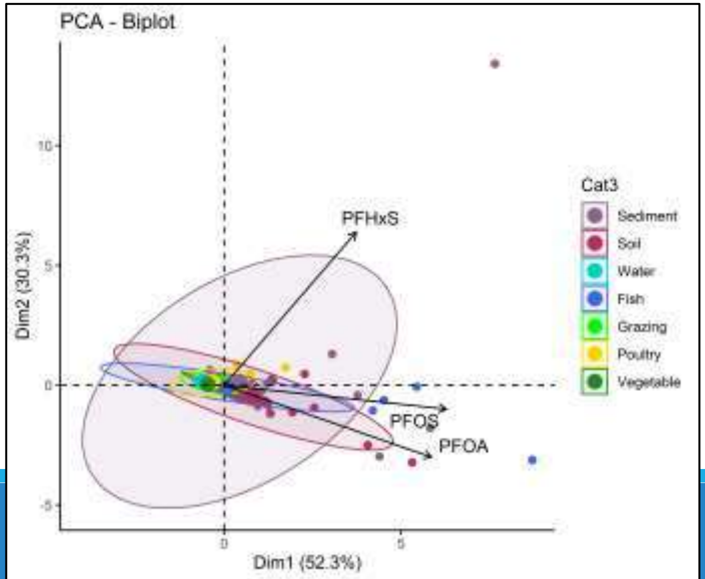






- First two dimensions explain 84% of the variation





Thank you !

FREIBURG

Bangkok, 04-05 April 2023



Final Meeting of the UNEP/GEF projects
“Implementation of the POPs Monitoring Plan in the Asian Region” and
“Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in Pacific Region”

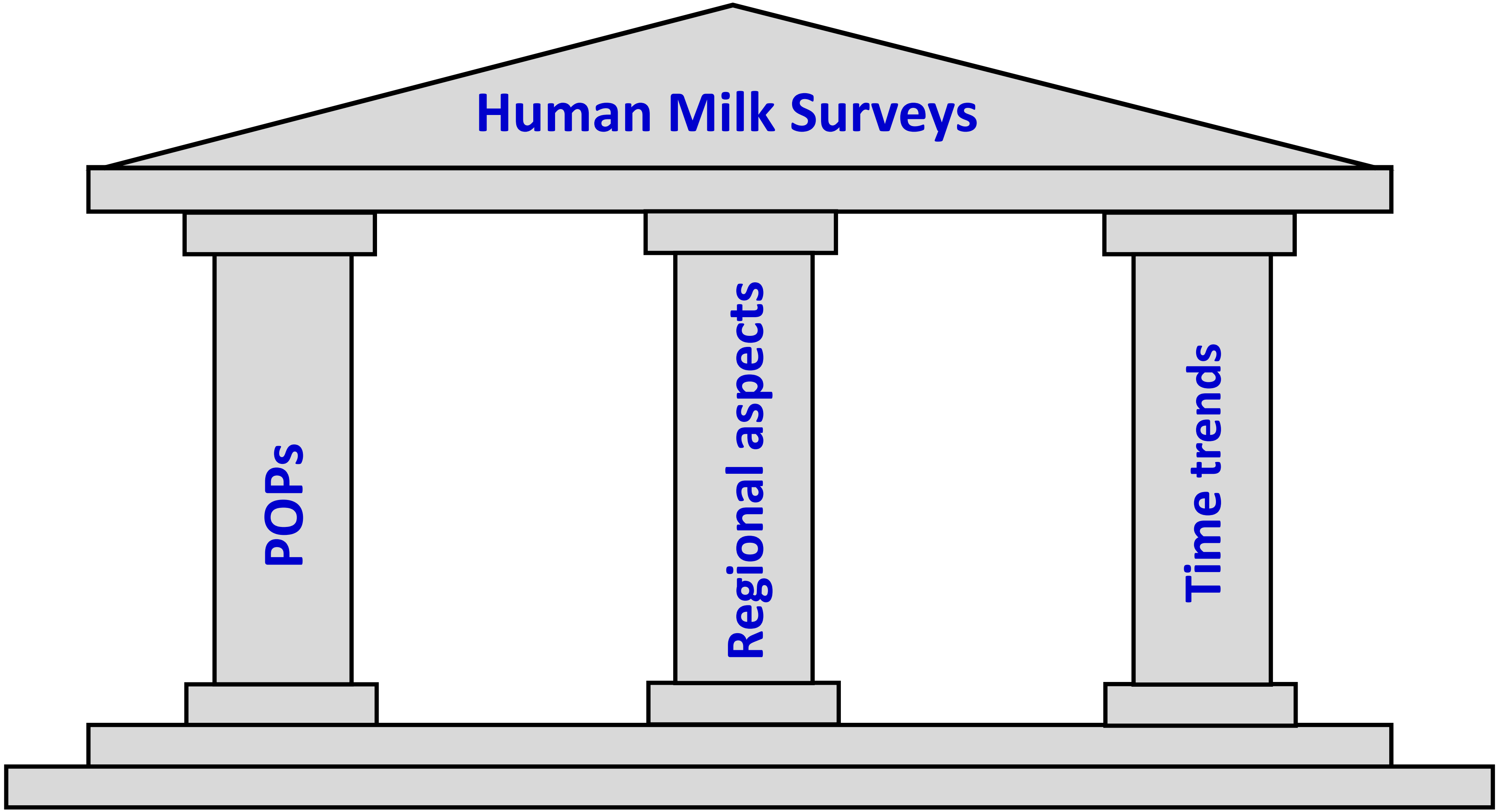
4-5 April 2023, Bangkok, Thailand

Key findings on levels of POPs in the Asia-Pacific Region: Human milk survey

Ralf Lippold
Rainer Malisch
CVUA Freiburg, Germany

CVUA FREIBURG

Three pillars



- 30 listed POPs
- 2 proposed POPs

- Countries
- UN-Regions
- Global

Art. 16:
Effectiveness evaluation

Key message A – Efficient and effective tool with global coverage as key contributor to the GMP

Coordinator	Round	Period	N (countries)	Coverage of POPs
WHO	1	1987-1988	19	PCB, PCDD/PCDF
WHO	2	1992-1993	19	PCB, PCDD/PCDF
WHO	3	2000-2003	26	21 POPs
Joint WHO/UNEP	4	2005-2007	13	21 POPs
Joint WHO/UNEP	5	2008-2012	45	22 POPs
UNEP	6	2014-2015	17	22 POPs
UNEP	7	2016-2019	43	30 listed + 2 proposed POPs

Concept of the WHO- and/or UNEP-coordinated exposure studies:

- ✓ collection of (usually 50) individual samples from mothers fulfilling protocol criteria;
- ✓ preparation of **pooled** (physically averaged) **samples considered to be representative for a country/subgroup**;
- ✓ analysis of the pooled samples in reference laboratories contributes to reliability and reduces uncertainty
- ➢ **Cost-effective concept: Analysis of one or few pooled representative human milk samples is far less expensive than the analysis of a high number of individual samples, particularly for PCDD/PCDF or CPs**

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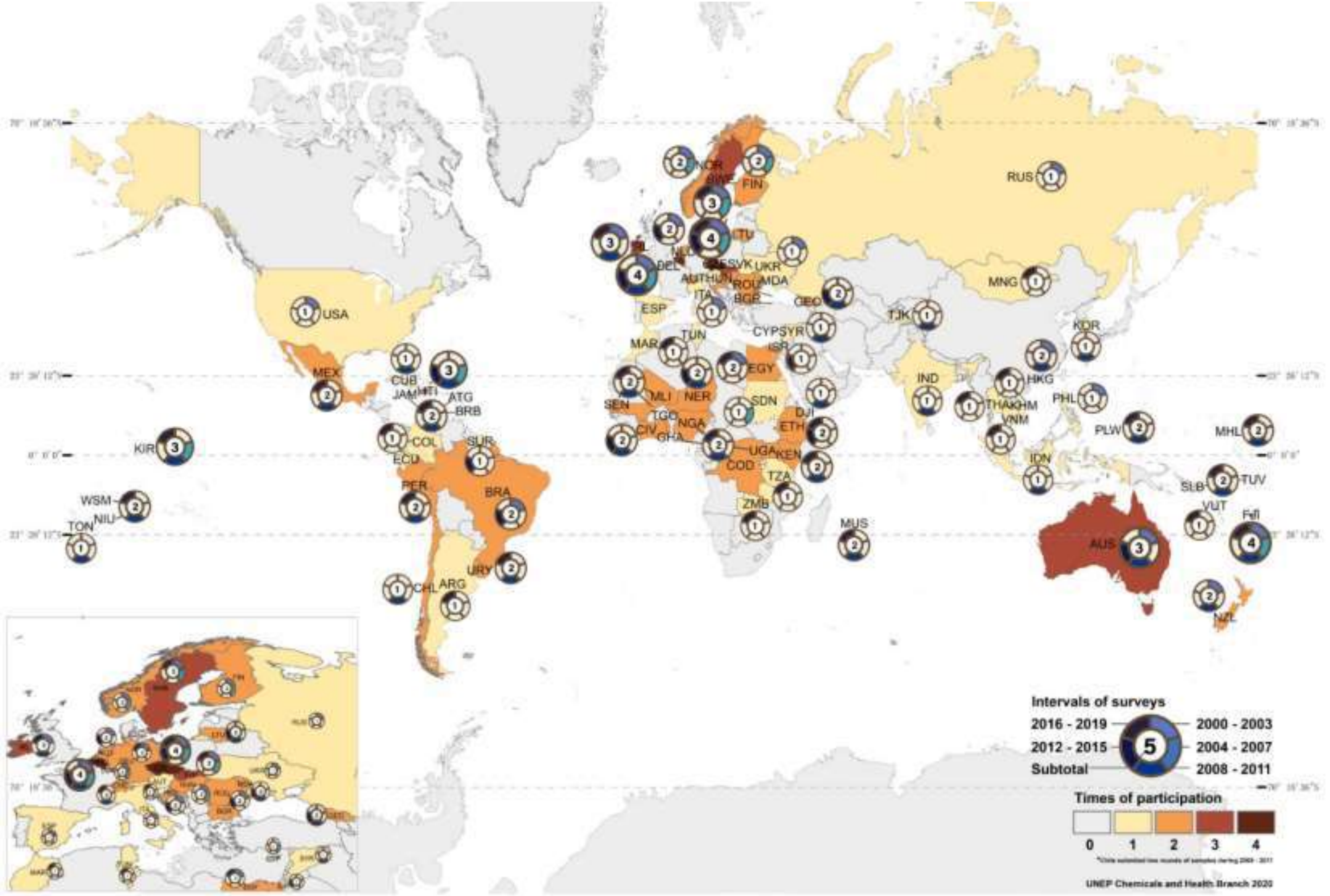
Key message A – Efficient and effective tool with global coverage as key contributor to the GMP



2000 – 2019:
82 countries

Key message B – Relative importance (“ranking”) of chemicals

		COP No	Year	Parameter	Parent POPs	Transformation products	No of analytes
			2001	**1. Initial 12 POPs**			
1	1			Aldrin	Aldrin		1
2	2			Chlordane	cis- and trans-chlordane	cis- and trans-nonachlor, oxychlordane	5
3	3			DDT	p,p'-DDT, o,p'-DDT	p,p'-DDE, o,p'-DDE, p,p'-DDD, o,p'-DDD	6
4	4			Dieldrin	Dieldrin		1
5	5			Endrin	Endrin	Endrin ketone	2
6	6			Heptachlor	Heptachlor	Heptachlorepoxide	2
7	7			Hexachlorbenzene (HCB)	Hexachlorbenzene		1
8	8			Mirex	Mirex		1
9	9			Polychlorinated biphenyls (PCB)	ΣPCB6 (6 "indicator congeners"): 28, 52, 101, 138, 153, and 180		6
					PCB with TEFs* (12 congeners): 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, and 189		12
10	10			Toxaphene	Congeners P26, P50, P62		3
11	11			Polychlorinated dibenzo-p-dioxins (PCDD)	2,3,7,8-substituted PCDD (7 congeners)		7
12	12			Polychlorinated dibenzofurans (PCDF)	2,3,7,8-substituted PCDF (10 congeners)		10

* PCB with TEFs (Toxic Equivalency Factors) assigned by WHO in 1998

		COP No	Year	Parameter	Parent POPs	Transformation products	
		COP-4	2009	**2. New POPs**			
13	1			Alpha hexachlorocyclohexane (alpha-HCH)	alpha-HCH		1
14	2			Beta hexachlorocyclohexane (beta-HCH)	beta-HCH		1
15	3			Gamma hexachlorocyclohexane (gamma-HCH), common name: Lindane	gamma-HCH		1
16	4			Chlordecone	Chlordecone		1
17	5			Pentachlorobenzene	Pentachlorbenzene		1
18	6			Hexabromobiphenyl (HBB)	PBB 153		1
19	7			Tetra- and pentabromodiphenyl ether	PBDE 47, 99; optional: PBDE 100		2
20	8			Hexa- and heptabromodiphenyl ether	PBDE 153, 154, 175/183 (co-eluting)		3
21	9			Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF)	PFOS (linear and branched isomers)		
		COP-5	2011	**3. new POPs**			
22	1			Technical endosulfan and related isomers	alpha-, beta-endosulfan, endosulfan sulfate		4
		COP-6	2013	**4. new POPs**			
23	1			Hexabromocyclododecane (HBCD)	alpha-, beta-, gamma-HBCD		3
		COP-7	2015	**4. new POPs**			
24	1			Hexachlorobutadiene	HCBD		1
25	2			Pentachlorophenol + salts		[Pentachloranisole (PCA)]	2
26	3			Polychlorinated naphthalenes	[PCN *(congeners to be decided)*]		21
		COP-8	2017	**5. new POPs**			
27	1			Decabromodiphenylether (DecaBDE)	PBDE-209		1
28	2			Short-chained chlorinated paraffins (SCCPs)	[SCCP] *)		thousands
(24)	3			Hexachlorbutadiene	HCBD		(1)
		COP-9	2019	**6. new POPs**			
29	1			Dicofol	[Dicofol]		1
30	2			PFOA and salts	PFOA		
				Proposed for listing			
31				Medium-chained chlorinated paraffins (MCCPs)			thousands
32				Perfluorhexane sulfonic acid	PFHxS		
							101

[POP]: to be decided. Presently, the analytical methods still need further development before analytes can be recommended.

Reference laboratories:

CVUA Freiburg, Germany
University Örebro, Sweden

- **30 listed POPs**
- **2 proposed POPs**
- 101 chlorinated/ brominated analytes without CPs; thousands for CPs

No multi-method for simultaneous determination – about half a dozen of different analytical methods necessary

Unique characteristic among the core matrices of the GMP:

results for the full set of 32 POPs of interest available for samples of the 2016-2019 period

including

- decabromodiphenyl ether [PBDE-209] and short-chain chlorinated paraffins [SCCP] as listed in 2017
- dicofol and perfluorooctanoic acid [PFOA] as listed in 2019,
- medium-chain chlorinated paraffins [MCCP] and perfluorohexane sulfonic acid [PFHxS] as proposed for listing

➢ **“ranking” based on increasing or decreasing concentrations possible for *chlorinated/brominated POPs (ng/g lipid)***
(Separate: Dioxin-like compounds: pg/g lipid; PFAS: pg/g fresh weight or ng/L)

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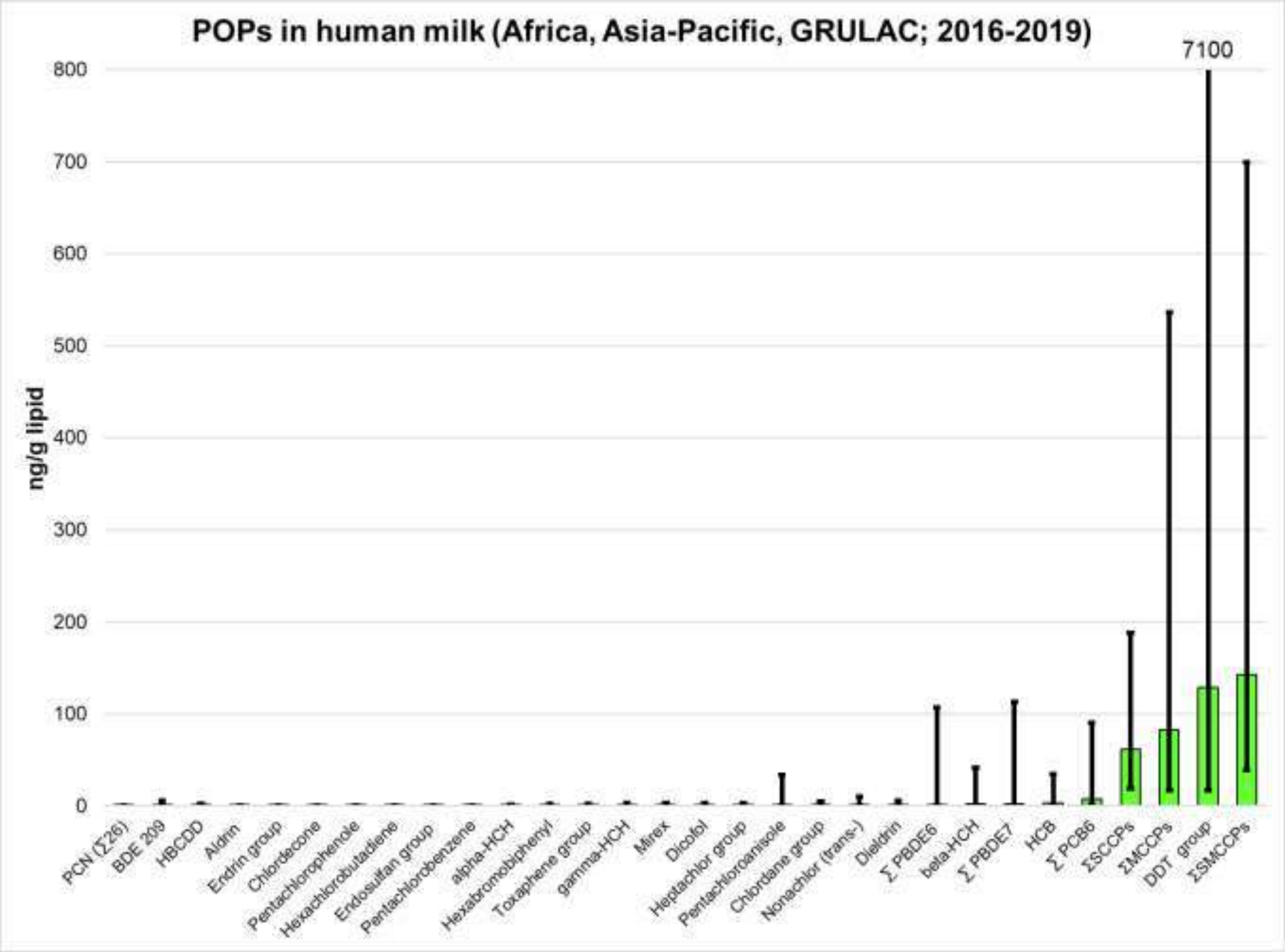
Key message B – Relative importance (“ranking”) of chemicals

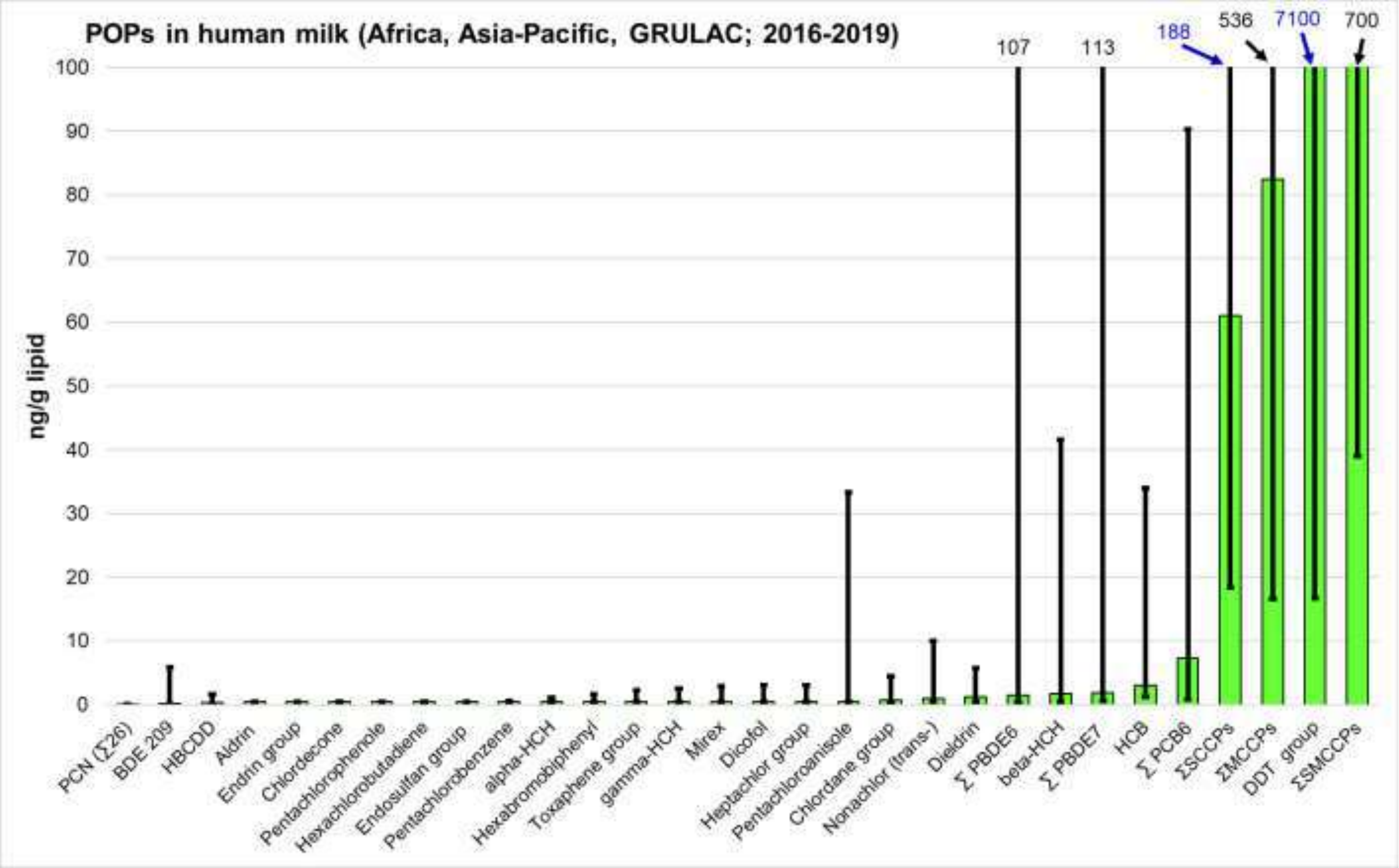


Range of concentrations of lipophilic chlorinated and brominated POPs in human milk (ng/g lipid) from 36 countries in the period 2016-2019
(median with error bars indicating the minimum and maximum)
(without dioxin-like chemicals [pg TEQ/g lipid])

Chlorinated and brominated POPs (1):

- By far highest concentrations found for **DDT** and **chlorinated paraffins**
  - Maximum found for **DDT** *(7100 ng/g lipid)* a factor of 10 higher than for **CPs** *(700 ng/g lipid for the sum of SCCP and MCCP)*
  - However, median of **CP** concentrations *(143 ng ∑ SMCCP/g lipid)* higher than median of **DDT** concentrations *(128 ng/g lipid)*
  - High CP concentrations caused predominantly by **MCCPs** *(median 83 ng/g lipid; maximum 536 ng/g lipid)*, with **SCCP** concentrations of 61 ng/g lipid as median and 188 ng/g lipid as maximum.
- **PCB** as next following group in the ranking of decreasing levels on average an order of magnitude lower concentrations than the **CP** concentrations *(median 7.31 ng **NDL-PCB** /g lipid, maximum 90 ng/g lipid)*

Key message B – Relative importance (“ranking”) of chemicals



Chlorinated and brominated POPs (2):

- **∑ PBDE$_6$** (and ∑ PBDE$_7$ including BDE-209, **beta-HCH, HCB:** median between 1 ng/g and 10 ng/g lipid, maximum up to 100
- Range below 5 ng/g lipid: seen as **background concentrations**
- Concentrations of **many POPs** frequently below LOQ (0.5 ng/g lipid)

Range of concentrations of lipophilic chlorinated and brominated POPs in human milk (ng/g lipid) from 36 countries in the period 2016-2019
(median with error bars indicating the minimum and maximum)
(without dioxin-like chemicals [pg TEQ/g lipid])

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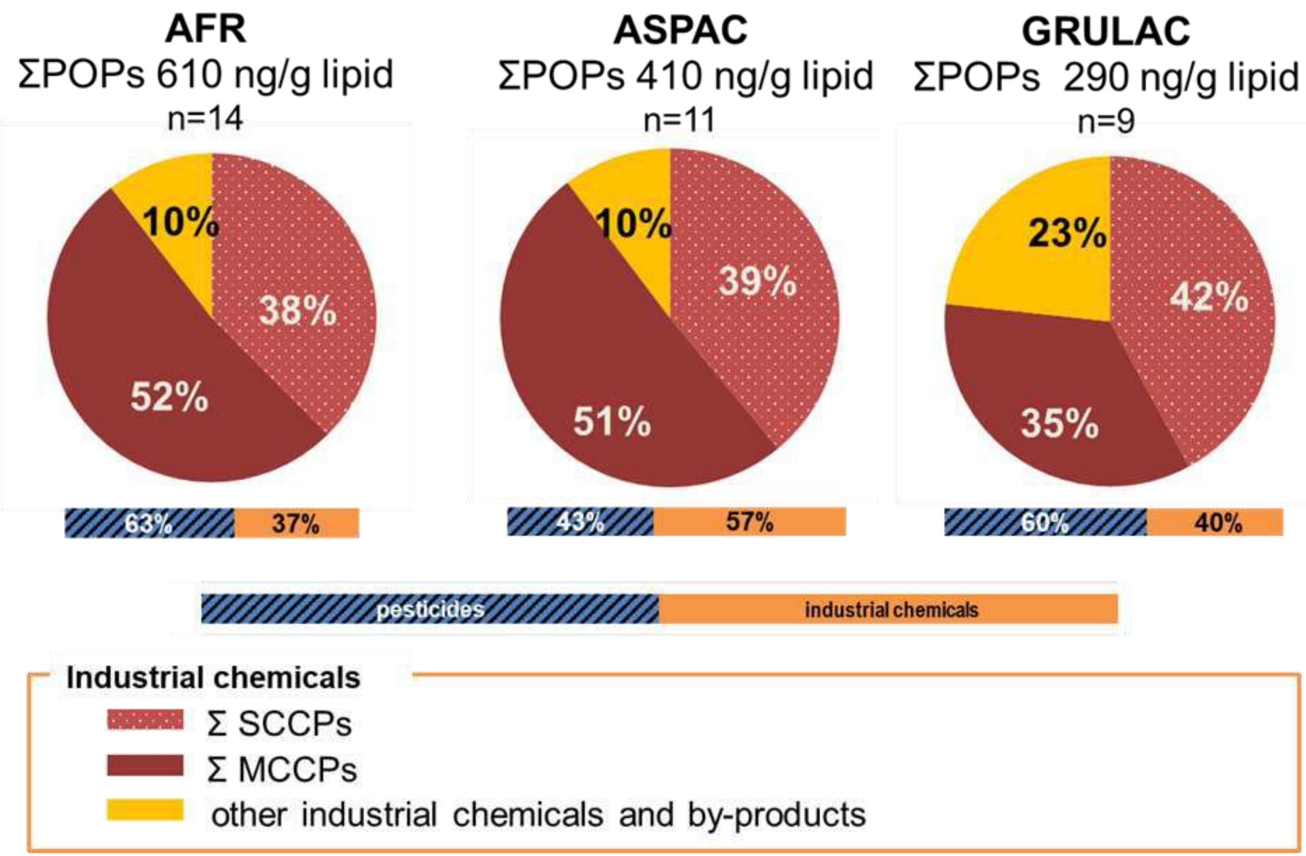
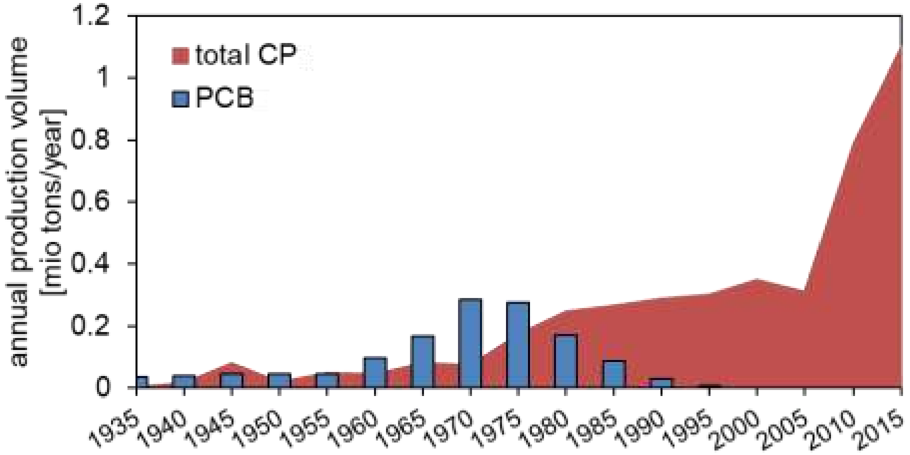
Key message B – Relative importance (“ranking”) of chemicals



- **SCCPs** and **MCCPs dominated** the share of POPs grouped as industrial chemicals and by-products in most areas
- **Cause for follow-up studies and for further (or, in the case of MCCPs, any) regulatory efforts.**



Median sum of all POPs in pooled human milk samples 2016-2019

- *Pesticides: aldrin, chlordane, chlordecone, DDT, dicofol; dieldrin, endosulfan, endrin, heptachlor, α-HCH, β-HCH; γ-HCH; mirex, pentachlorobenzene, pentachlorophenol (including pentachloroanisole) and toxaphene;*
- *(Other) Industrial chemicals and by-products: hexabromobiphenyl (HBB), HBCDD, HCB, hexachlorobutadiene; PBDE; PCB, PCDD, PCDF and PCN.*


WHO- and UNEP-coordinated human milk studies 2000 – 2019: findings of chlorinated paraffins

Kerstin Krätschmer[1,2,*], Walter Vetter[2], Jiří Kalina[3] and Rainer Malisch[1]

[1] State Institute for Chemical and Veterinary Analysis (CVUA), Freiburg, Germany.
[2] University of Hohenheim, Institute of Food Chemistry, Stuttgart, Germany.
[3] RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

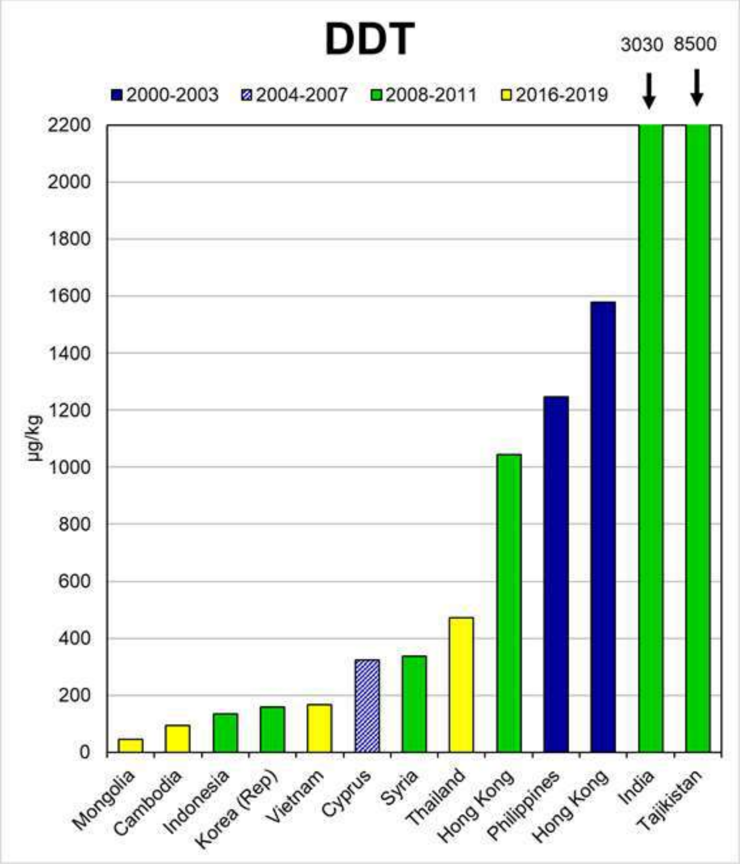
In: **Persistent Organic Pollutants in Human Milk**

Eds. Malisch, R., Fürst, P. and Šebková, K

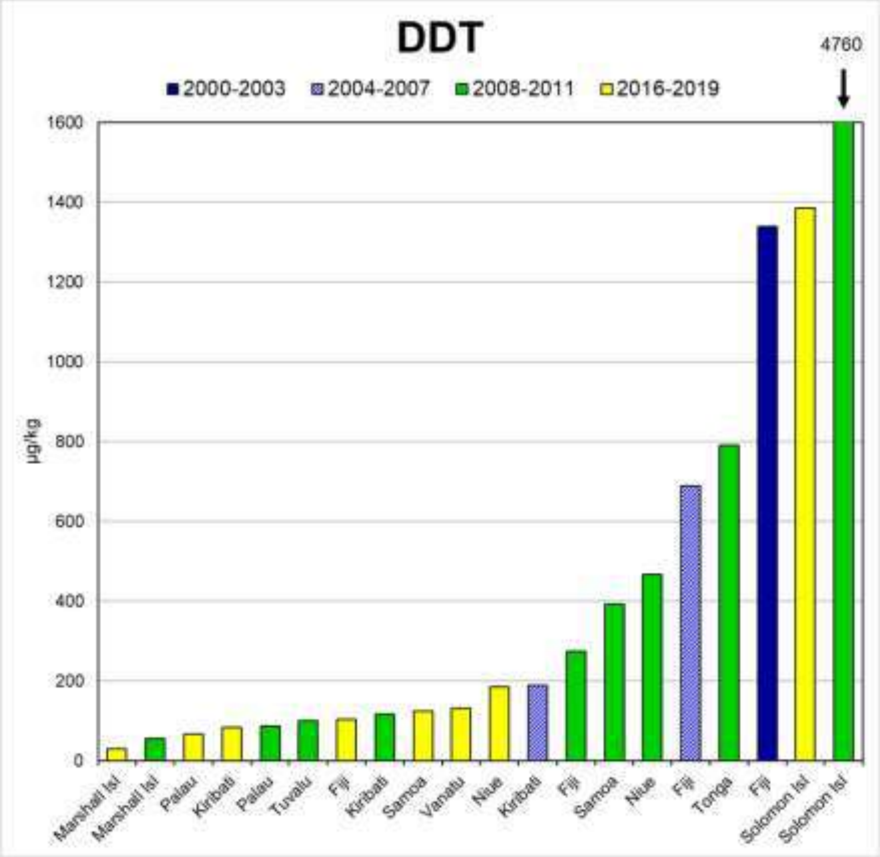
(in preparation)

Key message C – Regional differentiation

- Countries assigned to one of the five UN regions
- For some POPs a wide range found between countries in UN regions
- Upper third of frequency distribution might give more reason for follow-up studies than lower third



Asia



Pacific Islands

- ➢ Concentrations have to be seen in context with sampling period
- ➢ Comprehensive data set available for assessments of importance of a certain POP in a certain country/region at a certain time
- ➢ *compendium:*
  PERSISTENT ORGANIC POLLUTANTS IN HUMAN MILK
  RAINER MALISCH, PETER FÜRST AND KATEŘINA ŠEBKOVÁ
- ➢ Selected examples and conclusions in "Key message E - time trends"

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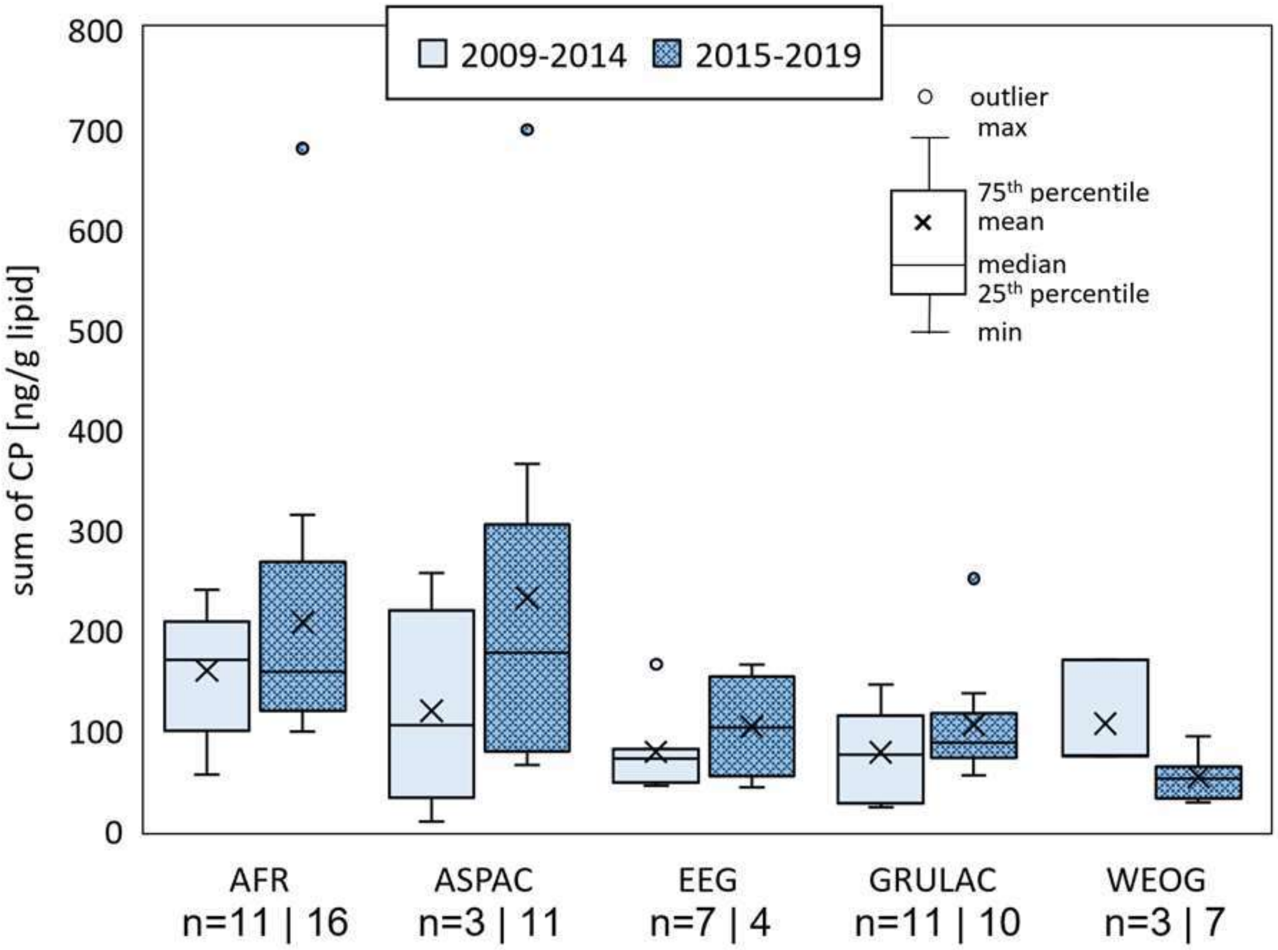
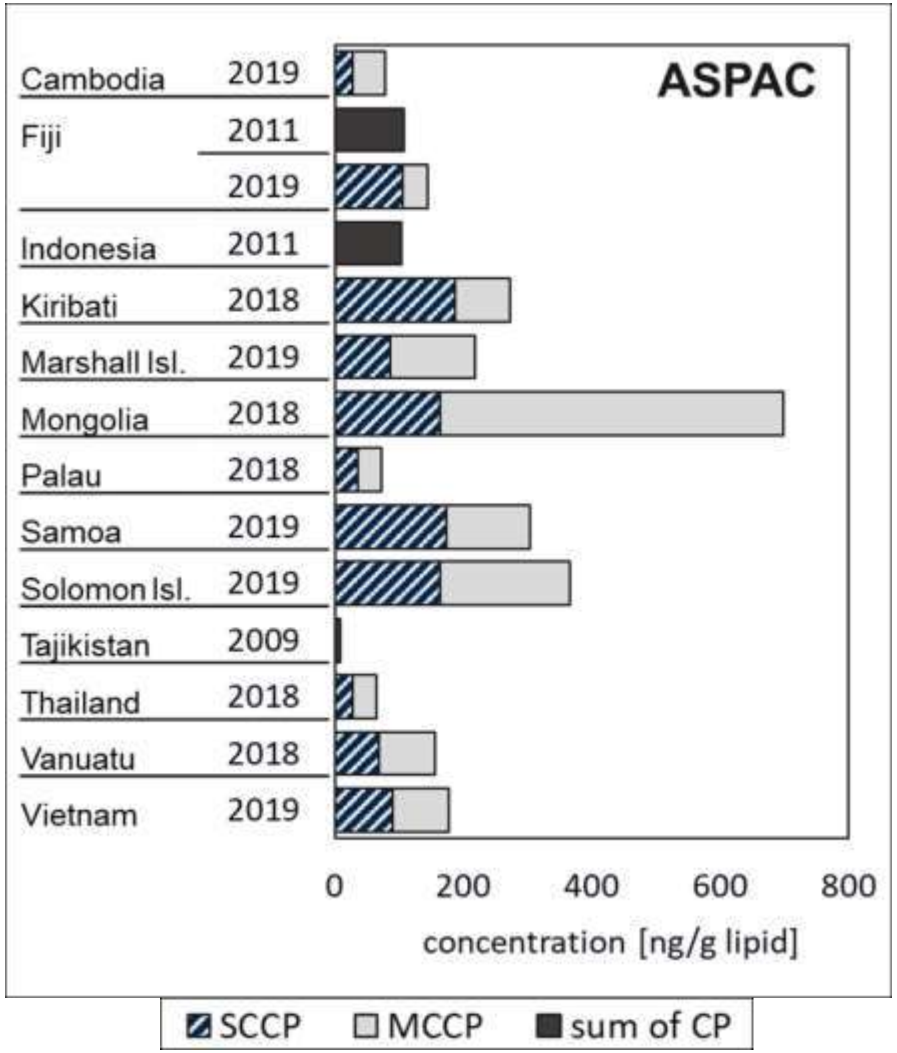
Key message C – Regional differentiation

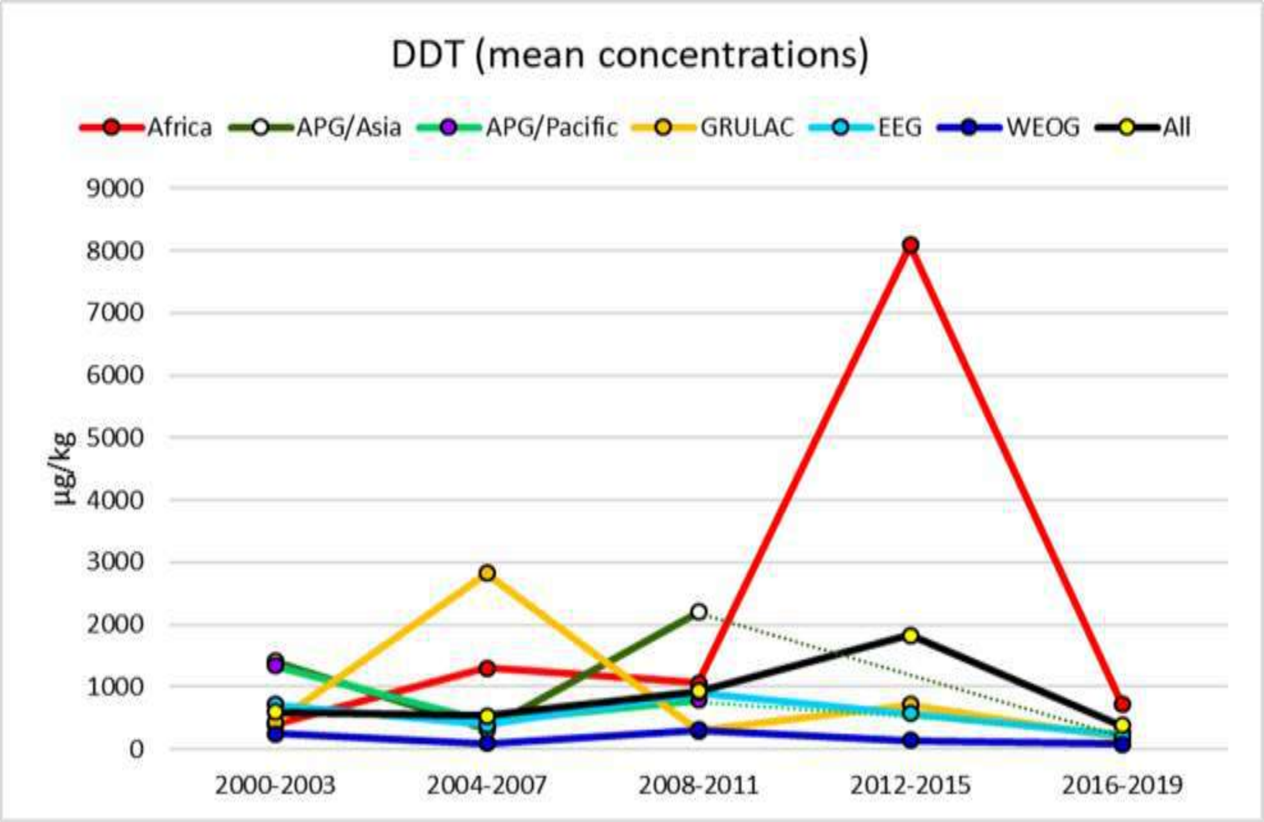




Range of sum of CP determined in pooled human milk samples from the 2009-2019 period

Key message D – Time Trends

With regard to participation of different countries in different rounds, conclusions on time trends cannot easily be drawn from the general data base

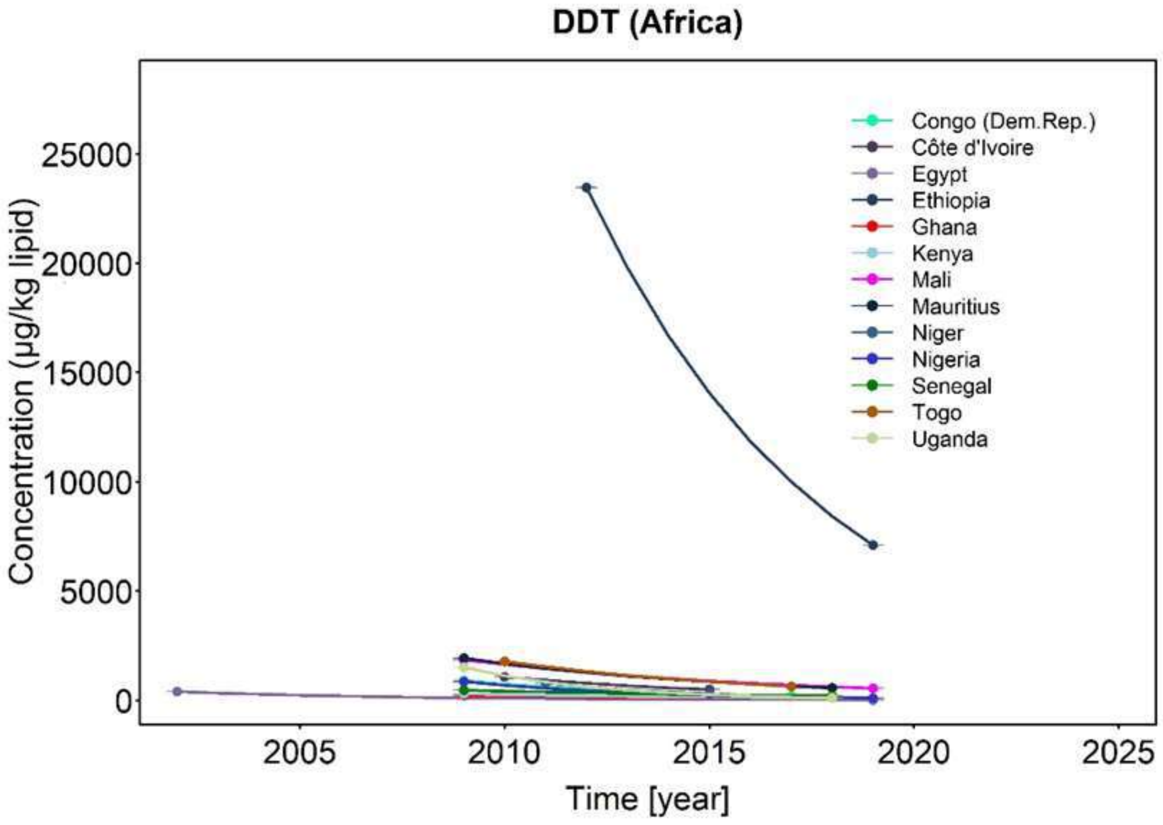


Time trends for mean concentrations of DDT in human milk (expressed as µg DDT complex /kg lipid)

General estimation of time trends based on all results of the 2000-2019 period – example DDT

- Decrease observed from 2000-2003 period to 2016-2019 period in all regions
- Considerable differences among regions and a great variation among the rounds
  - *In Africa: variation caused by results of Ethiopia in comparison to other countries in two periods:*
    - *2012-2015: 23.500 µg/kg lipid,*
    - *2016-2019: 7.100 µg/kg,*

Key message D – Time Trends



Reduction rates should be seen also in context with the concentration range **(differentiation of levels above or in the range of the background contamination):**

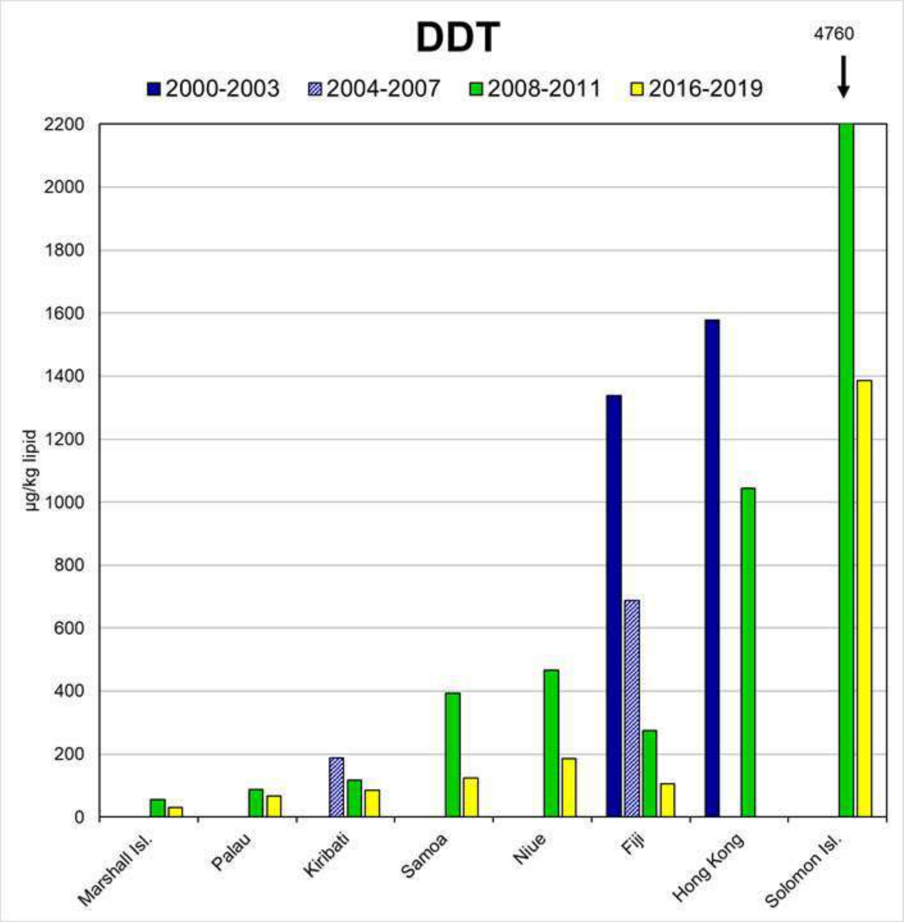
- If **high levels** are found, **sources** might be detected which could be eliminated.
- However, **at low background** levels, other factors, e.g. contamination of feed and food by air via long-range transport and subsequent bioaccumulation, cannot be influenced locally.

Key message D – Time Trends

More precise approach:

estimation of time trends based on results of countries with repeated participation over time

(example: DDT in Asia-Pacific Group)



Overview of the development of DDT concentrations in human milk (expressed as µg DDT complex /kg lipid) over time in countries of the Asia-Pacific Group with repeated participation between 2000 and 2019)

- **In all countries, decrease observed in comparison to previous surveys**

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Key message D – Time Trends

Important:

- Trends can be derived if the trend test (significance of the Theil-Sen estimator) is positive on 95% confidence level of significance (i.e. p-values < 0.05).
- As Theil-Sen p is never below 0.05 for less than 5 data points and for most countries only less than 5 data points were available, statistically significant trends could be derived only for regions (combining data from countries) and few countries.
- For many countries, only two or three data points are available. In these cases, the observed changes of the concentrations are statistically not significant and indicate tendencies.

TIME TRENDS IN HUMAN MILK DERIVED FROM WHO- AND UNEP-COORDINATED EXPOSURE STUDIES

PERSISTENT ORGANIC POLLUTANTS IN HUMAN MILK

EDS. MALISCH, R., FÜRST, P. AND ŠEBKOVÁ, K.

(IN PREPARATION)

PART 4: Assessments

CHAPTER 1: POLYCHLORINATED BIPHENYLS, POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS

Rainer Malisch [1*], Alexander Schächtele [1], FX Rolaf van Leeuwen [2], Gerald Moy [3], Angelika Tritscher [4], Kateřina Šebková [5], Jana Klánová [5] and Jiří Kalina [5]

[1] State Institute for Chemical and Veterinary Analysis of Food (Chemisches und Veterinäruntersuchungsamt, CVUA), Freiburg, Germany

[2] World Health Organization (WHO) European Centre for the Environment and Health at the National Institute of Public Health and the Environment, Bilthoven, The Netherlands, coordinating the human milk study from 2000 to 2003

[3] World Health Organization, Global Environment Monitoring System / Food Contamination Monitoring and Assessment Programme (GEMS / Food), Geneva, Switzerland, coordinating the human milk study from 2004 to 2008

[4] World Health Organization, Department of Food Safety and Zoonoses, Geneva, Switzerland, coordinating the human milk study from 2009 to 2011

[5] RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

CHAPTER 2: DDT, BETA-HCH AND HCB

Rainer Malisch [1*], Björn Hardebusch [1], Ralf Lippold [1], FX Rolaf van Leeuwen [2], Gerald Moy [3], Angelika Tritscher [4] Kateřina Šebková [5], Jana Klánová [5] and Jiří Kalina [5]

[1] State Institute for Chemical and Veterinary Analysis of Food (Chemisches und Veterinäruntersuchungsamt, CVUA), Freiburg, Germany

[2] World Health Organization (WHO) European Centre for the Environment and Health at the National Institute of Public Health and the Environment, Bilthoven, The Netherlands, coordinating the human milk study from 2000 to 2003

[3] World Health Organization, Global Environment Monitoring System / Food Contamination Monitoring and Assessment Programme (GEMS / Food), Geneva, Switzerland, coordinating the human milk study from 2004 to 2008

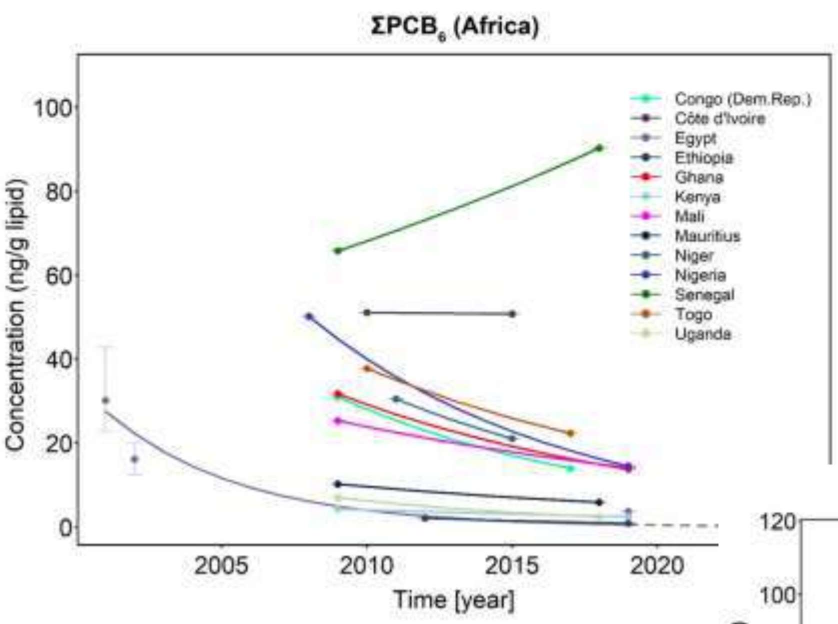
[4] World Health Organization, Department of Food Safety and Zoonoses, Geneva, Switzerland, coordinating the human milk study from 2009 to 2011

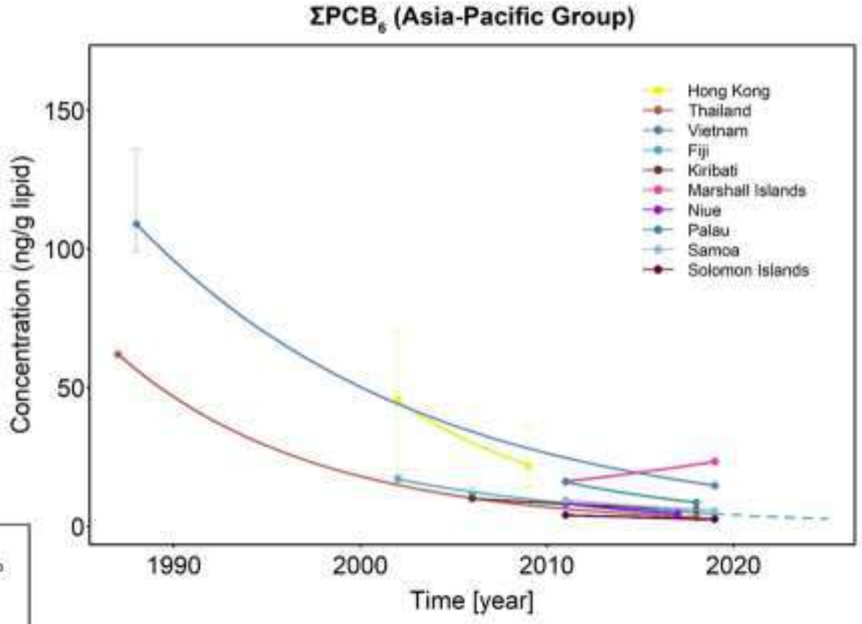
[5] RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

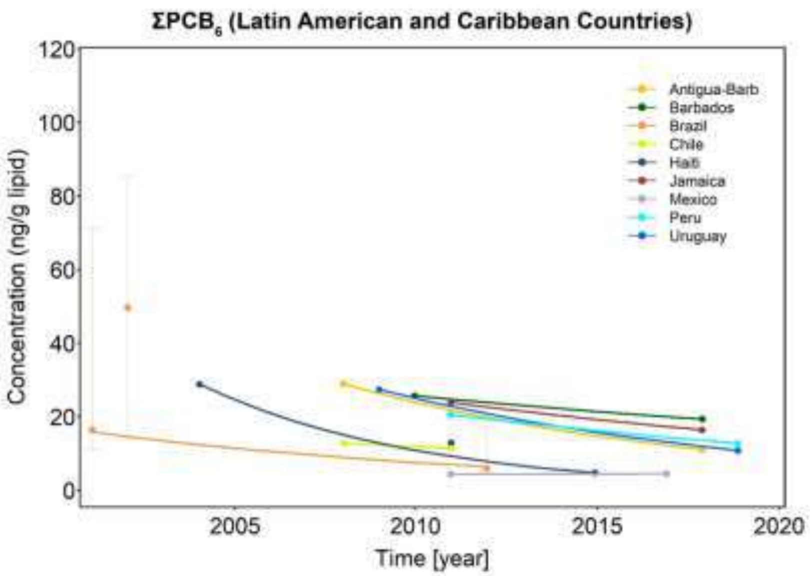
Key message D – Time Trends

UN Regional Groups	N of countries	Overall decrease rate (%) per 10 years (Theil-Sen method)		
		DDT	beta-HCH	HCB
Africa	13	74	83	11
Asia-Pacific	8	80	98	67
Latin America and Caribbean	9	50	52	31
Eastern Europe	6	39	63	47
Western Europe and Others	8	39	63	45
Global / median of 5 UN Regional Groups	44	58	84	57

Key message D – Time Trends







Temporal tendencies of indicator PCB concentrations (ng ΣPCB_6 /g lipid) for Africa, Asia-PAC and GRULAC countries with repeated participation between 1987 and 2019 using the Theil-Sen method

Key message D – Time Trends

For time trend analysis of ΣPCB6 between 1987 and 2019, results of 247 pooled samples were available.

On a global level, the decrease rate of PCB over 10 years was 71% calculated by the Theil-Sen method with use of all individual samples

UN Regional Groups	N of countries	Overall decrease rate (%) per 10 years (Theil-Sen method)
Africa	13	50
Asia-Pacific	10	65
Latin America and Caribbean	9	34
Eastern Europe	11	53
Western Europe and Others	14	63
Global / median of 5 UN Regional Groups	57	71

Overall decrease rates (%) of PCB concentrations in human milk in the five UN Regional Groups and worldwide

Key message D – Time Trends

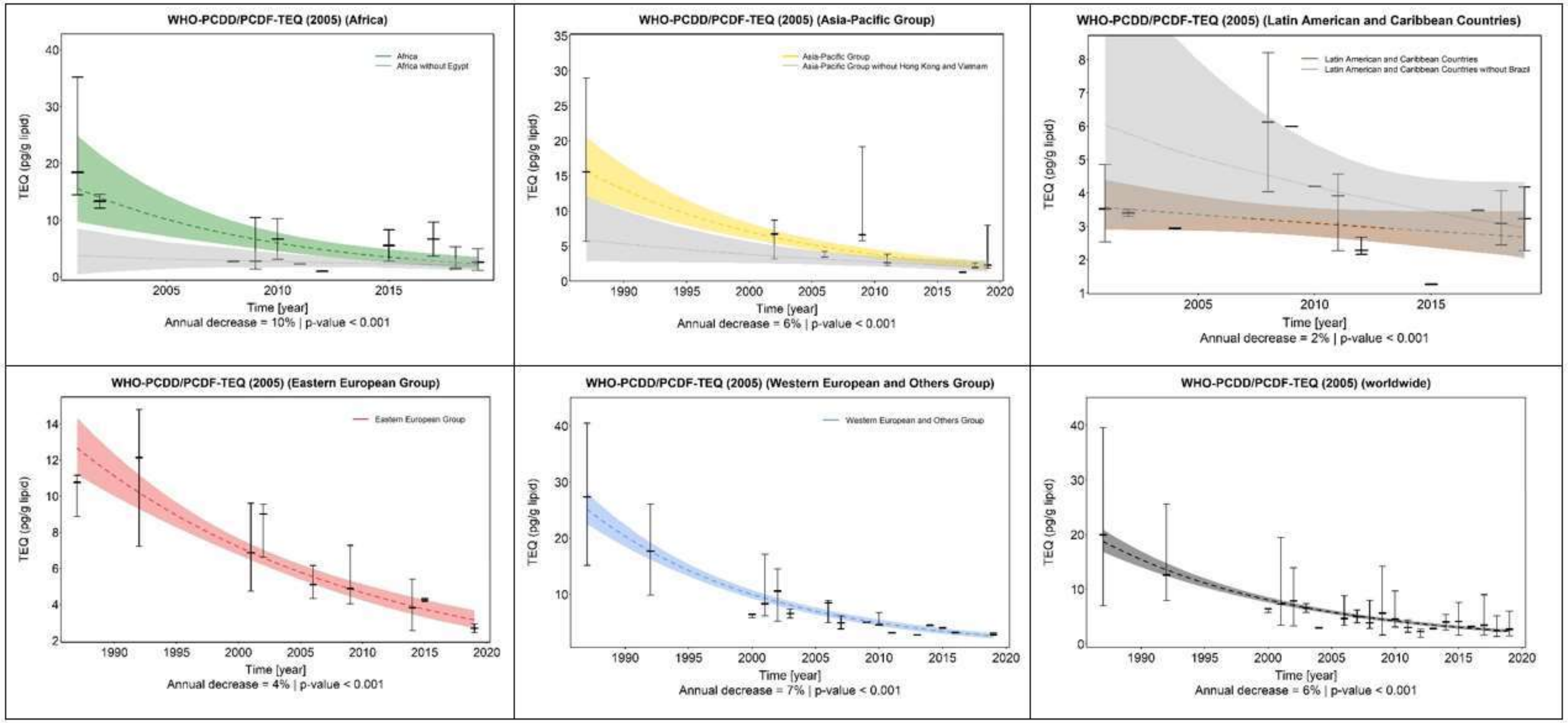


Figure 17: Theil-Sen exponential trends of WHO-PCDD/PCDF-TEQ concentrations (pg WHO-PCDD/PCDF-TEQ2005 / g lipid) in the 5 UN regions and worldwide

Time trends of dioxin-like compounds between 1987 and 2019:

- ✓ **Significant reductions were already achieved in the 1990s**
- ✓ **Global decrease rate per 10 years:**
  - ➢ **WHO-PCDD/PCDF-TEQ: 48%**
  - ➢ **Total TEQ (WHO_{2005}-TEQ): 50%**

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Key message D – Time Trends

OVERALL CONCLUSIONS AND KEY MESSAGES OF THE WHO/UNEP-COORDINATED HUMAN MILK STUDIES ON PERSISTENT ORGANIC POLLUTANTS

Rainer Malisch [1*], Alexander Schächtele [1], Ralf Lippold [1], Björn Hardebusch [1], Kerstin Krätschmer [1], FX Rolaf van Leeuwen [2], Gerald Moy [3], Angelika Tritscher [4], Kateřina Šebková [5], Jana Klánová [5], Jiří Kalina [5], Martin van den Berg [6], Walter Vetter [7], Peter Fürst [8], Gamini Manuweera [9] and Jacqueline Alvarez [9]

Table 7: Overall decrease (%) of total CP concentrations in the 5 UN Regional Groups and worldwide (computed using all individual samples). Negative decreases are to be read as increase. (n = number of samples)

UN Regional Groups	n	Overall decrease per 10 years [%]	p-value
African	27	-6.3	0.663
Asia-Pacific	15	-179	0.009
Latin American and Caribbean	21	9.5	0.737
Eastern European	11	-197	0.007
Western European and Others	10	63	0.001
global	84	-29	< 0.001

Median **decrease** per 10 years:

- 58% for DDT,
- 84% for beta-HCH,
- 57% for HCB,
- 32% for PBDE
- 48% for PFOS
- 70% for PCB
- 48% for PCDD and PCDF (expressed as toxic equivalents).

In contrast, **CP** as "emerging POPs" **increasing tendencies** in some UN Regional Groups. On a global level, statistically significant increase of total CP concentrations in human milk of 30% over 10 years

PERSISTENT ORGANIC POLLUTANTS IN HUMAN MILK

EDS. MALISCH, R., FÜRST, P. AND ŠEBKOVÁ, K.

(IN PREPARATION)

PART 5: SUMMARY AND CONCLUSIONS

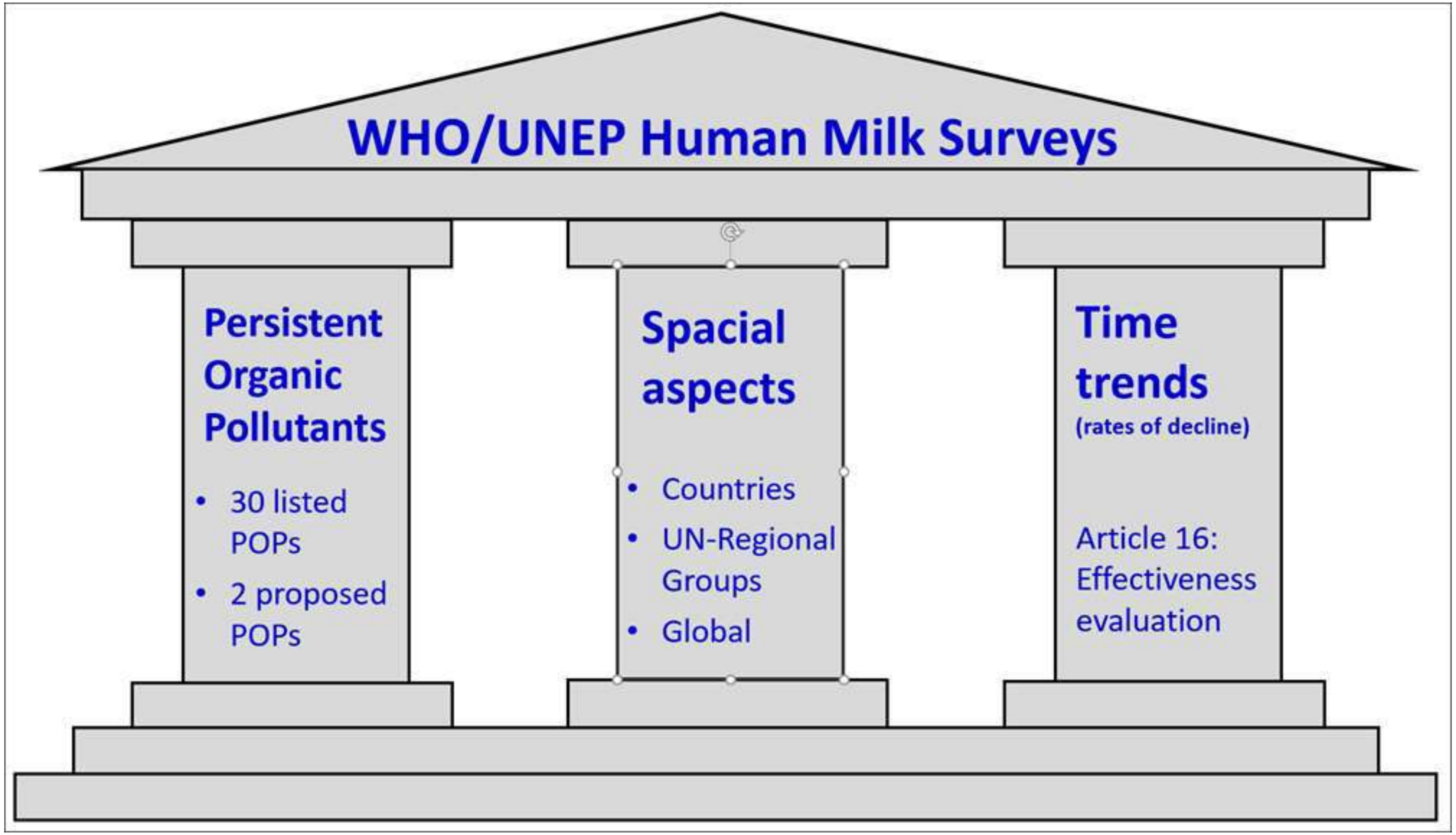
Key message D – Time Trends

Summary - overall conclusions:

- **WHO/UNEP-coordinated exposure studies** generate valuable monitoring data on the presence of POPs for **temporal studies** as important components of the **effectiveness evaluation (Art. 16)**
- **Complex picture for the individual chemicals**
- **With regard to participation of different countries in different rounds, conclusions on time trends cannot easily be drawn from the general data base**
- **More precise approach:**
  estimation of time trends based on results of countries with repeated participation over time
- **Globally, 10-years decreasing rates in range 50%-80% for DDT, beta-HCH, HCB, PCB and dioxin-like compounds with variation between UN regions**
- **Country-specific data in most cases not statistically significant**
- **Reduction rates** should be seen also **in context with the concentration range (differentiation of levels above or in the range of the background contamination).** If high levels are found, sources might be detected which could be eliminated. However, at low background levels, other factors, e.g. contamination of feed and food by air via long-range transport and subsequent bioaccumulation, cannot be influenced locally.

Key messages - Conclusions

Key contributor to GMP – assessments of three pillars



Key messages – Acknowledgement

The comprehensive work over three decades was only possible due to the cooperation and support of many institutions and their staff:

- WHO
- UNEP
- Countries
- National coordinators
- Funding bodies (GEF, others)
- Laboratories

CVUA FREIBURG

CVUA

FREIBURG

Chemisches und
Veterinäruntersuchungsamt
Freiburg

UNEP GEF GMP project

Contributions of the UNEP/WHO human milk survey to understanding human exposure to POPs

4 April 2023

Monitoring nutrition and food safety (MNF)

Department of Nutrition and Food Safety (NFS)

World Health Organization

The WHO Nutrition and Food Safety Department

The NFS Vision

A world free from all forms of malnutrition and foodborne diseases, within safe and supportive societies and healthy environments

The NFS Mission

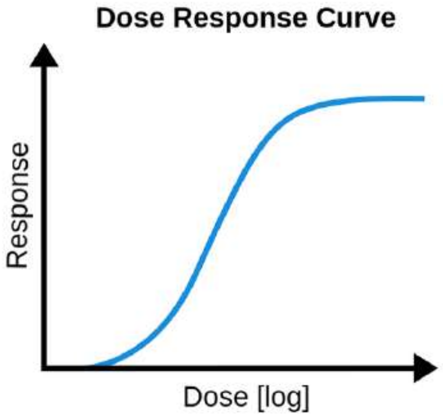
Work with Member States and partners to prioritize, plan, implement, monitor and regularly evaluate multisectoral efforts to ensure universal access to effective nutrition actions, safe food and healthy diets, through strengthening health systems and building forward better food systems which recognize the interdependence of the health of humans, animals and the wider environment

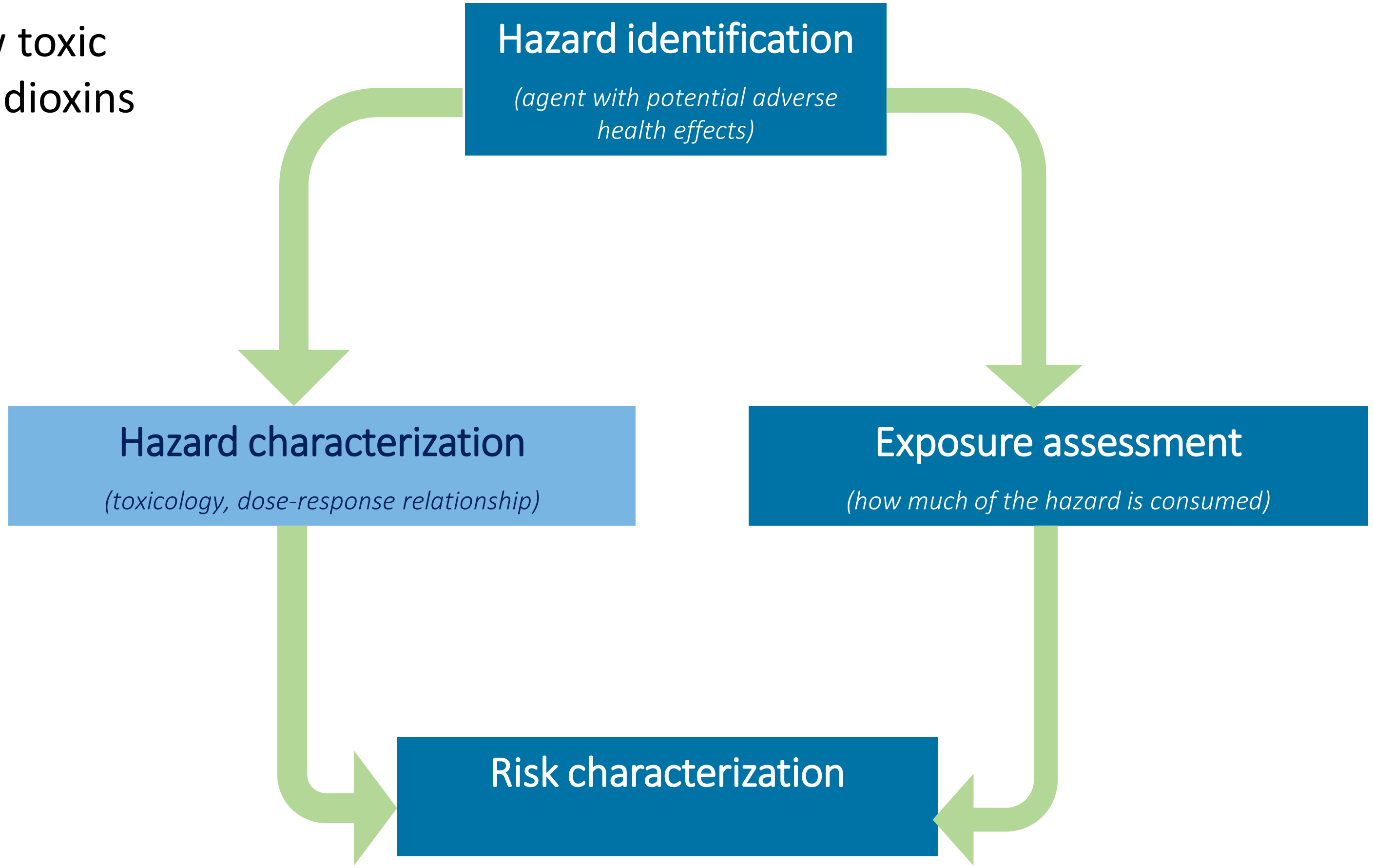
SUSTAINABLE DEVELOPMENT GOALS

World Health Organization

Risk assessment: hazard characterization

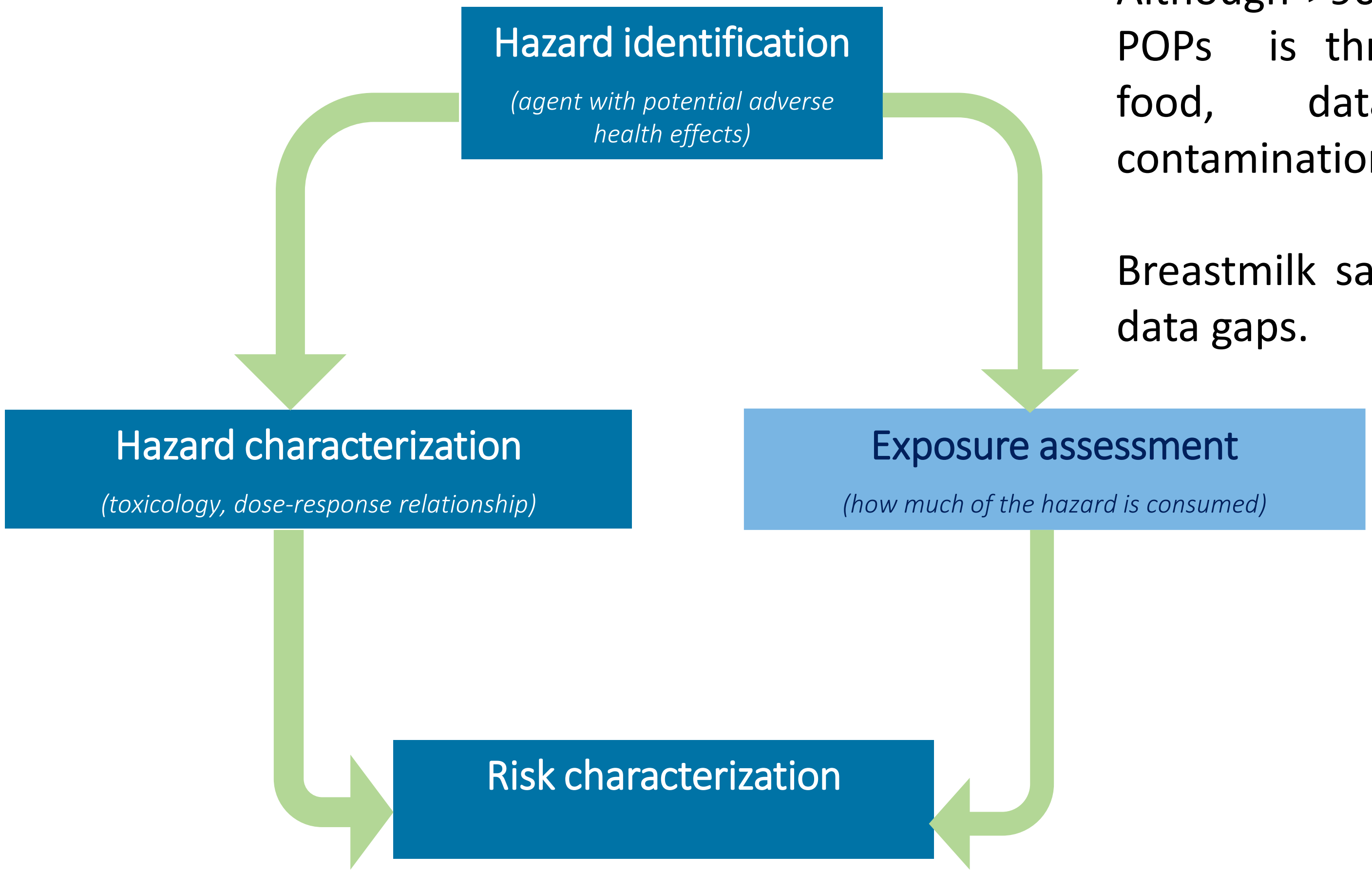
WHO will soon publish new toxic equivalency factors 2022 for dioxins





World Health Organization

Risk assessment: exposure assessment



Although >90% of exposure to POPs is through is through food, data on food contamination are scarce.

Breastmilk sampling addresses data gaps.

Burden of foodborne disease

WHO published in **2015** for the first time estimates of the global burden of foodborne disease.

Dioxins' effects on **fertility** and on **thyroid function** were considered in this context, and these 2 endpoints alone shows that this exposure can contribute significantly to foodborne disease burden in some parts of the world.

WHO expects to publish the second estimates of the global burden of foodborne disease in **2025**.

Dioxins' effects on **cancer** will be added.

World Health Organization

Conclusion

Thanks for UNEP outstanding contribution to public health.

Keep up the good work on GMP1, GMP2… and GMP3!

World Health Organization

Thank you

Please reach out: ingenbleekl@who.int

World Health Organization

Thanks

WHO

20, Avenue Appia
1211 Geneva

Switzerland

World Health Organization

Final Meeting: 4894 GMP Asia and 6978 GMP Pacific

Jitendra K Sharma
UN Environment Programme

Date:
April 3, 2023

Objectives

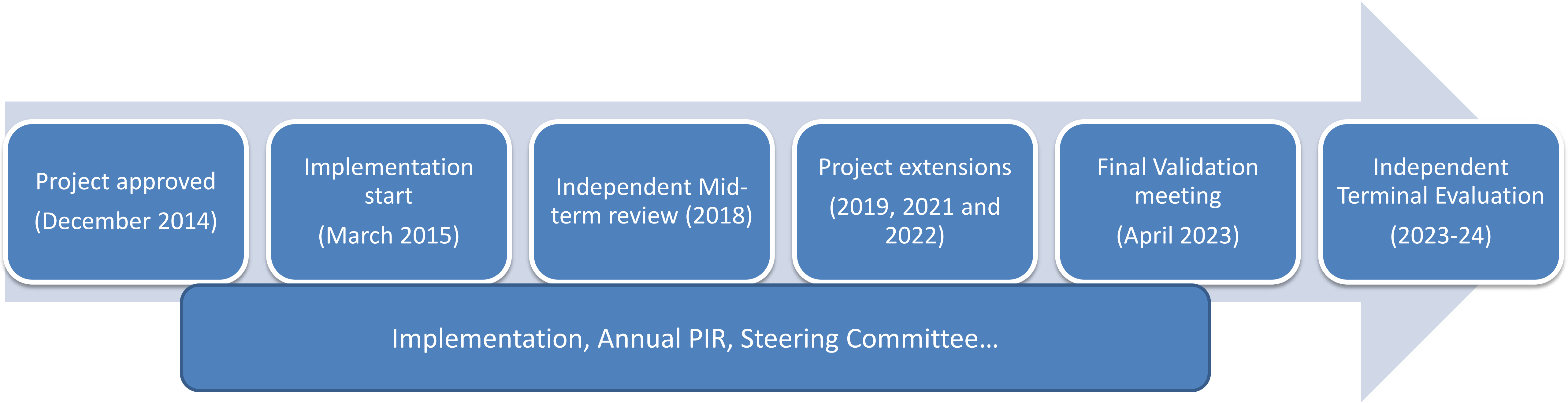
General Objective

To ensure that the project achieves its objectives in line with the work plan and/or logframe.

Specific objectives

- Assess countries progress in implementation of the planned project activities for the entire duration of project against project workplan/logframe;
- Review progress of the project regarding implementation of planned activities in line with the overall project plan;
- Deliberate on gaps and challenges identified during the project implementation;
- Planning for project closure and co-financing
- Planning to ensure sustainability of project activities through national and regional interventions
- Recommendations for future plans

Processes and Milestones



GEF Project Implementation Report (PIR)

4894 GMP Asia

Outcome Level Progress Rating
2022 – Satisfactory
2021 – Satisfactory
2020 – Highly Satisfactory
2019 – Moderately Satisfactory
2018 – Moderately Satisfactory
2017 – Moderately Satisfactory
2016 – Moderately Satisfactory

Implementation Output Level Progress Rating
2022 – Satisfactory
2021 – Satisfactory
2020 – Satisfactory
2019 – Moderately Satisfactory
2018 – Moderately Satisfactory
2017 – Moderately Satisfactory
2016 – Moderately Satisfactory

6978 GMP Pacific

Outcome Level Progress Rating
2022 – Satisfactory
2021 – Satisfactory
2020 – Satisfactory
2019 – Moderately Satisfactory
2018 – Moderately Satisfactory
2017 – Moderately Satisfactory
2016 – Satisfactory

Implementation Output Level Progress Rating
2022 – Satisfactory
2021 – Satisfactory
2020 – Satisfactory
2019 – Moderately Satisfactory
2018 – Moderately Satisfactory
2017 – Moderately Satisfactory
2016 – Satisfactory

Financial Progress

4894 GMP Asia

Total Budget: $3,936,000

Total Expenditure: $3,310,990

Expected co-finance: $13,164,900

Reported co-finance: $9,145,097

6978 GMP Pacific

Total Budget: $1,995,000

Total Expenditure: $1,366,762

Expected co-finance: $6,448,604

Reported co-finance: $4,480,000

Key mid-term recommendations

To UNEP for current project

- ✓ Ensure good communications with countries to prevent any further delays in implementation
- ✓ Ensure that communications are in appropriate languages
- ✓ Increase the level of engagement with policy- and decision-makers at national level to secure ongoing support for POPs monitoring and support national efforts to control POPs
- ✓ Ensure countries receive full reports of their data together with an explanation of the chemicals found and supporting information that will help country decision-makers to improve sound management of chemicals, and reduce POPs sources and contamination.
- ✓ Given the shortage of time to complete the planned activities, perhaps a longer extension could be considered. However, this decision will need to weigh up the risks of such an approach in terms of falling out of synch with activities in other regions and feeding into the process to develop the 3rd GMP phase monitoring report, which is already under way

Key mid-term recommendations

To Countries

- ✓ Intensify efforts to complete collection of samples, especially the core matrices, to the required standard on time and ensure samples are dispatched to the analysing laboratories in a timely manner.
- ✓ Ensure 6-monthly reports are provided to UNEP.

Key mid-term recommendations

For future project

- ✓ Secure ongoing financial support for capacity building and POPs monitoring in the region
- ✓ Ensure that an appropriate level of staff resources are available to implement the project from the start
- ✓ Ensure that existing expertise in the region is engaged / consulted regarding future POPs monitoring projects e.g. China, Japan, Republic of Korea and a UNU/Shimadzu project for PFOS Monitoring in water
- ✓ Consider including some of the high-quality Asian laboratories into the 'expert group'
- ✓ Identify a suitable regional hub that can help to coordinate project activities in the region
- ✓ Pay attention to the sustainability of the project and engagement with national policy/decision-makers from the beginning of the project and throughout
- ✓ Consider addressing the lack of capacity in POPs monitoring in Central and Western Asia
- ✓ Develop qualifying criteria for participating laboratories. Training should not be provided to laboratories that have no prospect on utilizing it to continue monitoring POPs
- ✓ Develop a robust project framework with SMART indicators
- ✓ Ensure that the impact of the project is measured as well as delivery of activities

Expected Outcomes of final meeting

Endorsement of project reports and deliverables;

Commitment of co-finance reporting

Confirmed support during the terminal evaluations of the project

Recommendations on ensuring sustainability of the project

Thank You

Contact Us

For any questions or clarifications

Jitendra K Sharma

Programme Management Officer/
GEF Task manager

GEF Chemicals and Waste Unit,
Chemicals and Health Branch
Industry and Economy Division
UN Environment Programme

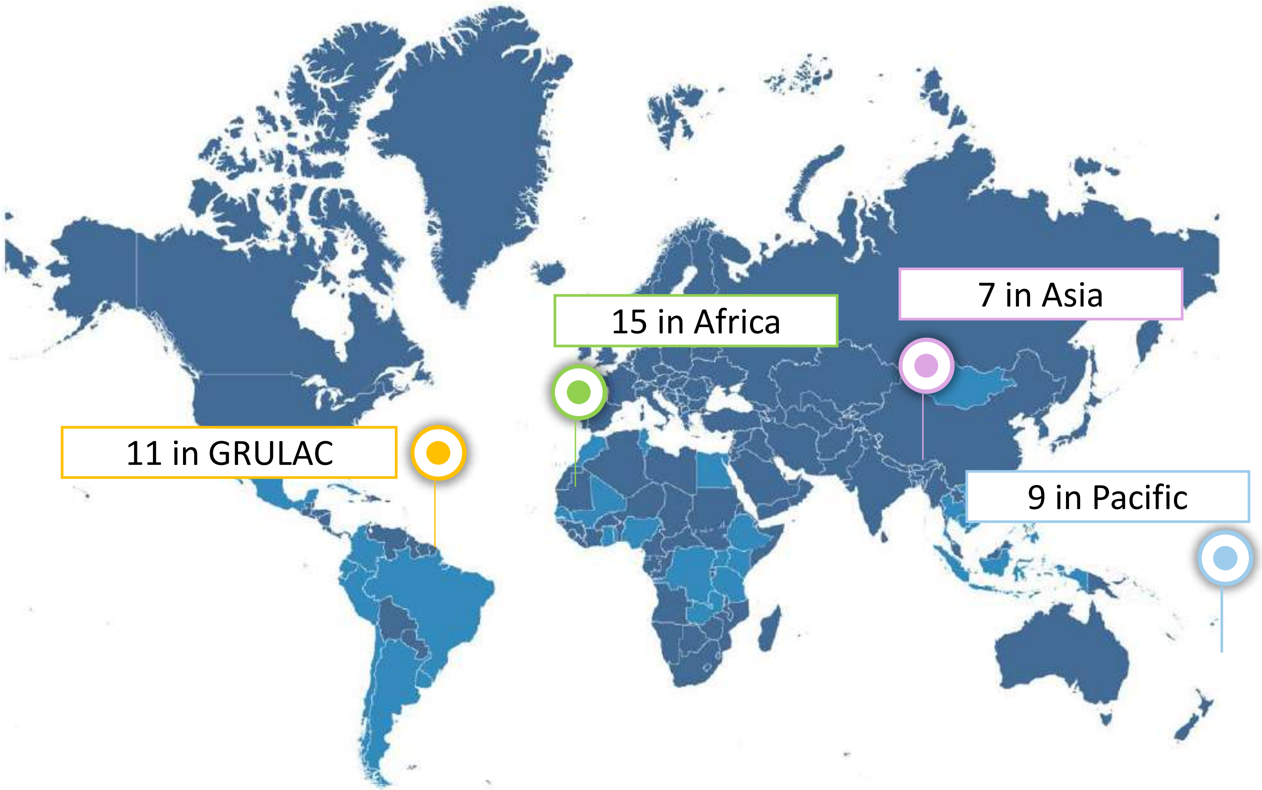
Jitendra.sharma@un.org

Overview of the UNEP/GEF POPs GMP projects in the Asia and the Pacific region

Final Meeting of the UNEP/GEF projects “Implementation of the POPs Monitoring Plan in the Asian Region” and “Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in Pacific Region”

Haosong Jiao, Associate Programme Management Officer
Chemicals and Health Branch, Industry and Economy Division

Overview



- UNEP/GEF GMP1 project (2008-2012) based on the success of two GEF pilot test projects
- UNEP/GEF GMP2 project (2016-present) following decision SC-6/23 and the success of the UNEP/GEF GMP1 project to support **data generation** and **capacity building.**

30 POPs analyzed in over 900 samples of air, water, human milk and matrices of national interest in 42 countries.

Over 20 years of human milk data covering 82 countries globally.

Over 50,000 data points generated.

Training in 27 national laboratories.

289 laboratories registered in the interlaboratory assessments with 228 reported data.

UN environment programme

Summary: Data generation

Major source of data on POPs in human milk for the Asia and the Pacific region: 12 countries from 2016-2019, a total of 22 countries since 2000.

Contributed **62%** of the data on air to DWH from 2016-2019 for the Asia and the Pacific region and is the unique source of data for 14 countries.

Contributed **75%** of the data on air to DWH from 2016-2019 for the Asia and the Pacific region and is the unique source of data for 11 countries.

- Data gap exists in developing countries
- Optimization of monitoring activities to enhance sustainability

UN environment programme

Trainings in national labs

Region	No. of trainings panned	No. of trainings completed	No. of countries participated
Asia	6	5	8*
Pacific Islands	1	2*	9
Global total	**29**	**26**	**37**

**Upon request, a hands-on training for air and water sampling was given to all project countries in the Pacific Islands Region*
** LAO PDR, Malaysia and Myanmar joined the training in Indonesia*
** Senegal and Mali jointed the same training*
- *Due to COVID-19, some trainings were delivered virtually*

*** Donation of instrument from UQ to Fiji and long-term capacity building*

Interlaboratory assessments

- *2016-2017: 135 labs submitted results, 52 from Asia and the Pacific region*
- *2018-2019: 117 labs submitted results, 44 from Asia and the Pacific region*
- *Laboratory databank: In total, 256 laboratories analyzing POPs registered.*

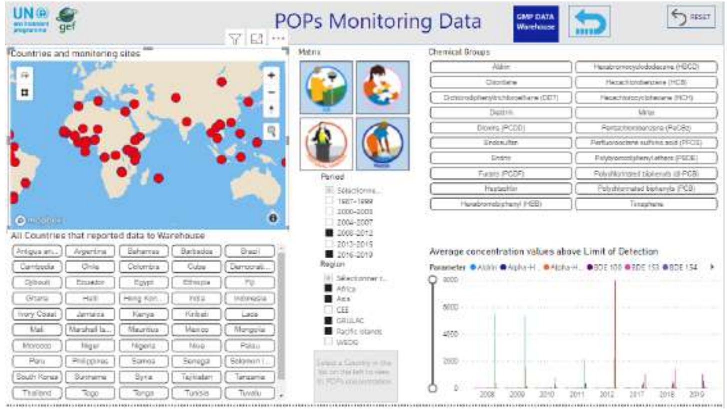
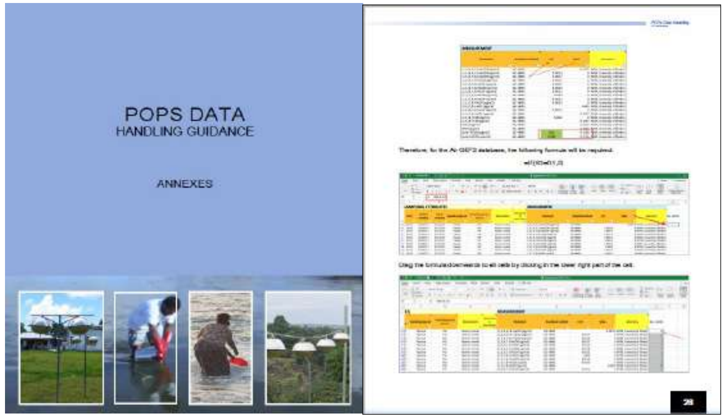
Sharing and explaining of results: Reports

- Data generated were shared with project countries and the GMP Data Warehouse for the preparation of regional and global monitoring reports. A dashboard was developed to share the results with broader stakeholders.
- Two regional reports
- Three sectoral reports on the results of POPs monitoring in air, water and human milk
- Two reports summarizing the results of interlaboratory assessments, and an overview of the organization and outcomes of four Interlaboratory Assessments.
- Assessment reports on regional initiatives and national capacities for sustainable monitoring of Persistent Organic Pollutants.
- Assessment report on optimizing spatial-temporal coverage of POPs monitoring results at the national, regional and global levels.
- Assessment report on synergies between interlaboratory assessments and national/international certificate and accreditation mechanisms.
- Regional roadmaps on sustainable monitoring of POPs.
- Etc.

Sharing and explaining of results: Workshops

- Regional virtual meeting on analytical results of air and water, October 2021.
- Regional virtual meeting on analytical results of human milk and national samples and preparation of project final reports, November 2021.
- Final result workshop for the third round interlaboratory assessment, Beijing, China, 6–7 April 2017.
- Final result workshop for the fourth round interlaboratory assessment, online, 21–22 July.
- Virtual side event during the tenth meeting of the Conference of the Parties to the Stockholm Convention (SC COP10): Tracing POPs in the environment strategic partnerships, knowledge management and capacity building at the global scale, 28 July 2021.

Further support to countries on data usage for informed decision-making

Data and knowledge sharing	Data handling and management	Integration and usage
		

- Training on data handling and interpretation in selected countries in the Pacific region, linking with GMP national reports and NIPs.
- E-course on data handling and management.
- Additional activities proposed by countries based on the results generated under the project:
    - Additional analysis in national laboratory;
    - Analysis of additional matrices of national interest etc.

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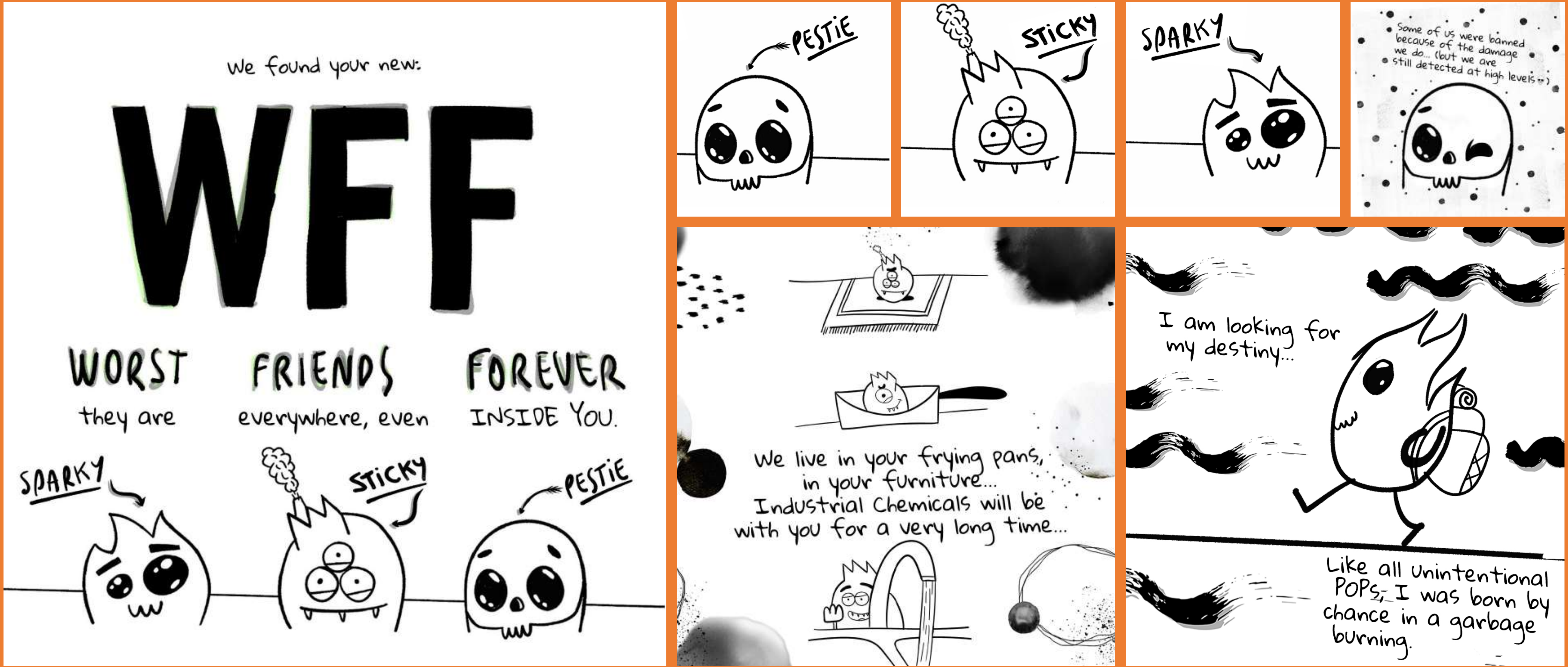
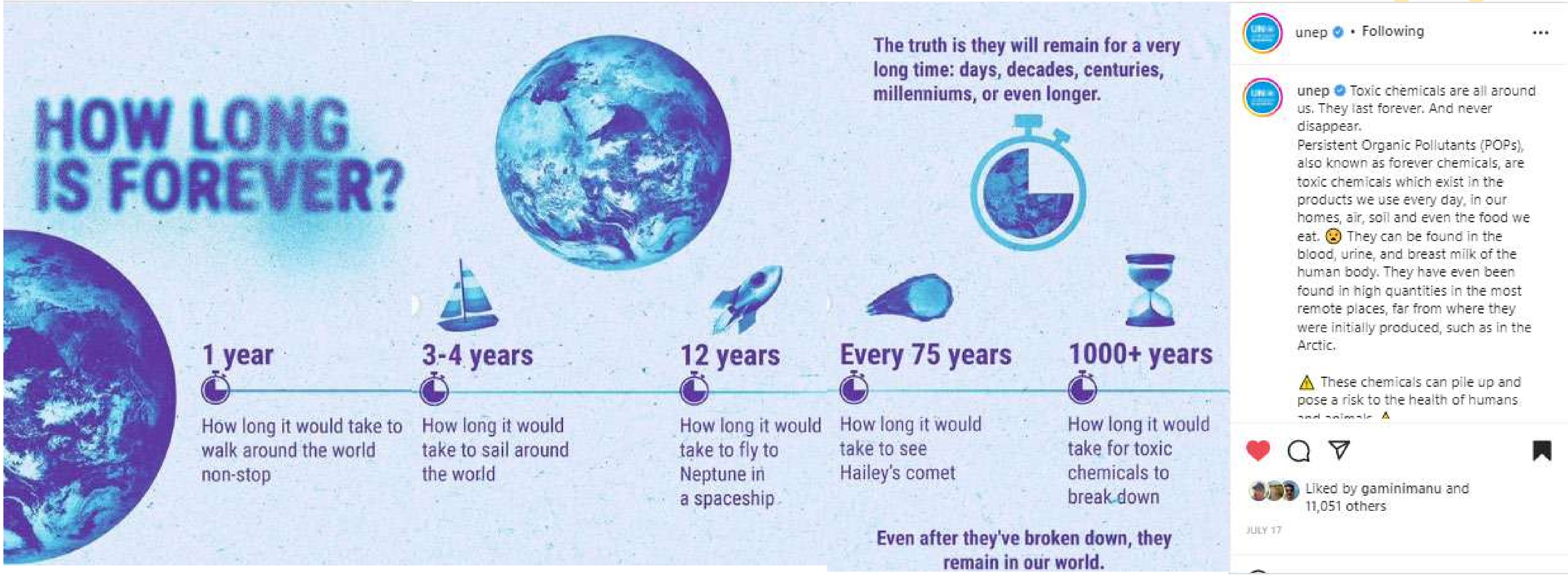
Stakeholder engagement to support sustainable monitoring of POPs for informed policy- and decision- making

- Consultation meetings (e.g. Brisbane meeting in 2019, Geneva meeting in 2022, and today)
- Activities during the COP
  - From data to action: Informed decision-making for Stockholm Convention implementation, Geneva, 7 June 2022.
  - UNEP statement informing the COP about the progress and findings (e.g. SC/COP11/INF 9).
  - Measuring the effectiveness of the Stockholm Convention including through GMP: assessment, insight and outlook – data for decision making, 3 May 2023.
- Presentations at relevant meetings with stakeholders
  - Workshops on developing, reviewing, and updating NIPs under the Stockholm Convention.
  - Meetings of the global coordination group for the persistent organic pollutants global monitoring plan.
- Communication
  - Media conference, 28 April 2023
  - Communication campaign under #BeatChemicalPollution

UN environment programme



UN environment programme



UN environment programme

Thanks

- Project Partners
    - 42 countries in 4 regions
    - Executing partner in GRULAC: BCCC-SCRC-LATU
    - Expert laboratories:
        - MTM-Orebro, Sweden
        - Department of Environment and Health, Vrije Universiteit, Netherlands
        - Chemisches und Veterinaeruntersuchungsamt Freiburg, Germany
        - Research Centre for Toxic Compounds in the Environment, Czech Republic
        - Spanish National Research Council, Spain
        - Entox, University of Queensland, Australia
        - Environmental Monitoring of POPs in East Asian Countries (POPsEA) Japan
    - Other partners: BRS Secretariat, WHO etc.
    - Experts for the preparation of technical reports
- Donor
- UNEP colleagues

UN environment programme

Thank you

Haosong Jiao
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www.unep.org

POPs listed under the Stockholm Convention

2004

Pesticide	Industrial	Uninten.
Aldrin		
Chlordane		
DDT		
Dieldrin		
Endrin		
Heptachlor		
Mirex		
Toxaphene		
HCB	HCB	HCB
	PCB	PCB
		Dioxins
		Furans

We are here

COP4 2009

Pesticide	Industrial	Uninten.
Chlordecone		
α-HCH		
beta-HCH		
Lindane		
PeCB	PeCB	PeCB
PFOS	PFOS	
	HBB	
	tetraBDE, pentaBDE	
	hexaBDE, heptaBDE	

COP5 2011

Pesticide
Endosulfan

COP6 2013

Industrial	Uninten.
HBCD	
PCN	PCN

COP7 2015

Industrial	Uninten.
HCBD	HCBD

COP8 2017

Pesticide	Industrial
PCP	
	SCCP
	DecaBDE

COP9 2019

Pesticide	Industrial
Dicofol	
	PFOA

COP10 2022

Industrial
PFHxS

Proposed for listing - Under Review

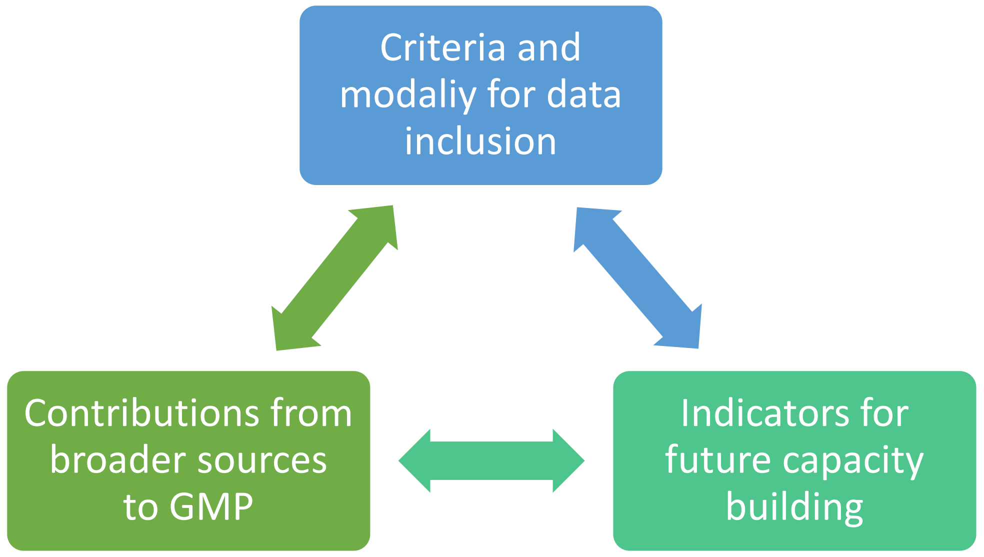
Pesticide	Industrial	Uninten.
	Dechlorane Plus	
	MCCPs	
	UV-328	
	LC-PFCAs	LC-PFCAs
Methoxychlor		
Chlorpyrifos		

Findings

- Legacy POPs are still around, in many countries at elevated levels in both environmental and human samples. Even though decreasing trends were observed, continuing monitoring is essential to stay fully aware of the exposure and to guide necessary actions needed.
- An optimized monitoring system should be considered to select representative sites, decide the duration and intervals for monitoring of certain POPs in specific matrices, to support global coverage of data in a cost-efficient manner.
- To fully understand the existence of POPs and decide how to protect humans and the environment accordingly, further monitoring including hotspot monitoring and source tracking is needed.
- More countries are interested in knowing more about exposure to POPs, not only one background site. Results of background monitoring can be followed by supplementary local or hotspot monitoring to track the source.
- Experience gained through two rounds of GEF projects put us in a good position to continue supporting sustainable monitoring of POPs.

Future considerations

- An optimized monitoring system to:
  - Support global minimum coverage of data for the effectiveness evaluation.
  - Address the increasing demands of the growing list of POPs.
  - Respond to increasing needs at the national level for informed decision making.
- Development of criteria to enable inclusion of broader sources of data, guide future capacity building.



UN environment programme 50 1972-2022

Assessment

- Large gaps of reporting – both by regions and by POPs– which will be even more intense with the growing list of POPs to ensure satisfactory spatial-temporal coverage of quality and comparable data.
- A number of countries reported having POPs monitoring activities or programmes while their data is not included in GMP DWH
- Hundreds of publications were available since 2005 on passive and active sampling of airboune POPs.
- A number of labs from developing countries repeatedly participated in 4 rounds of interlab assessment and provided satisfactory results.

Assessment

- Revision of criteria in the GMP guidance may be warranted to promote awareness and recognition of other available and credible data.

- Enabling countries and regions to contribute to POPs monitoring with the best available capacity to strengthen ownership and commitment.

- Strong needs for data interpretation and usage to support national decision making, including for relevant articles of the Stockholm Convention.

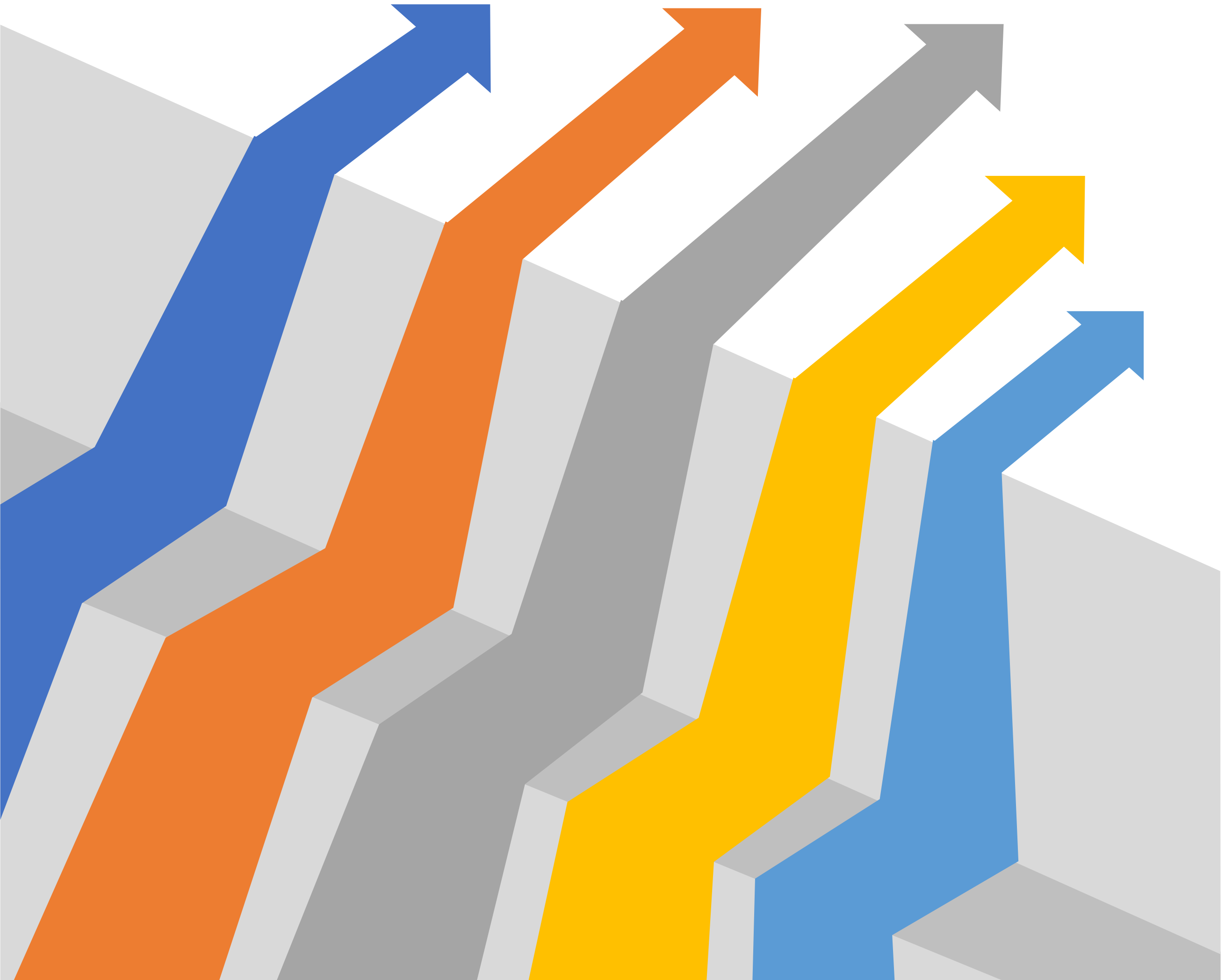
- Inclusive, communicative and integrated GMP which also contributes to science-policy interface, climate change, biodiversity loss etc.

Contributions of the GEF projects to the Stockholm Convention Global Monitoring Plan and the effectiveness evaluation of the Convention

Final Meeting of the UNEP/GEF projects "Implementation of the POPs Monitoring Plan in the Asian Region" and "Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in Pacific Region", 4–5 April 2023

Kei Ohno Woodall, Secretariat of the Basel, Rotterdam and Stockholm Conventions

2024: 20th anniversary of the entry into force of the Stockholm Convention



Synergies with the Basel and Rotterdam Conventions

Triple COPs since 2013.

Science-based decision making!

12+19=31 POPs listed. POPs Review Committee and other expert groups. **From Science to Action.**

186 Parties to the Convention

National Implementation Plans, national reports

Stakeholders support

Industry, civil society, academia
Donors, technical assistance, regional centers

Effectiveness evaluation

Global Monitoring Plan (GMP) for POPs

POPs listed under the Stockholm Convention

Elimination

14 Pesticides:

Aldrin, Chlordane, Chlordecone, Dicofol, Dieldrin, Endosulfan, Endrin, Heptachlor, Alpha/beta/gamma HCH, Mirex, PCP, Toxaphene

13 Industrial POPs:

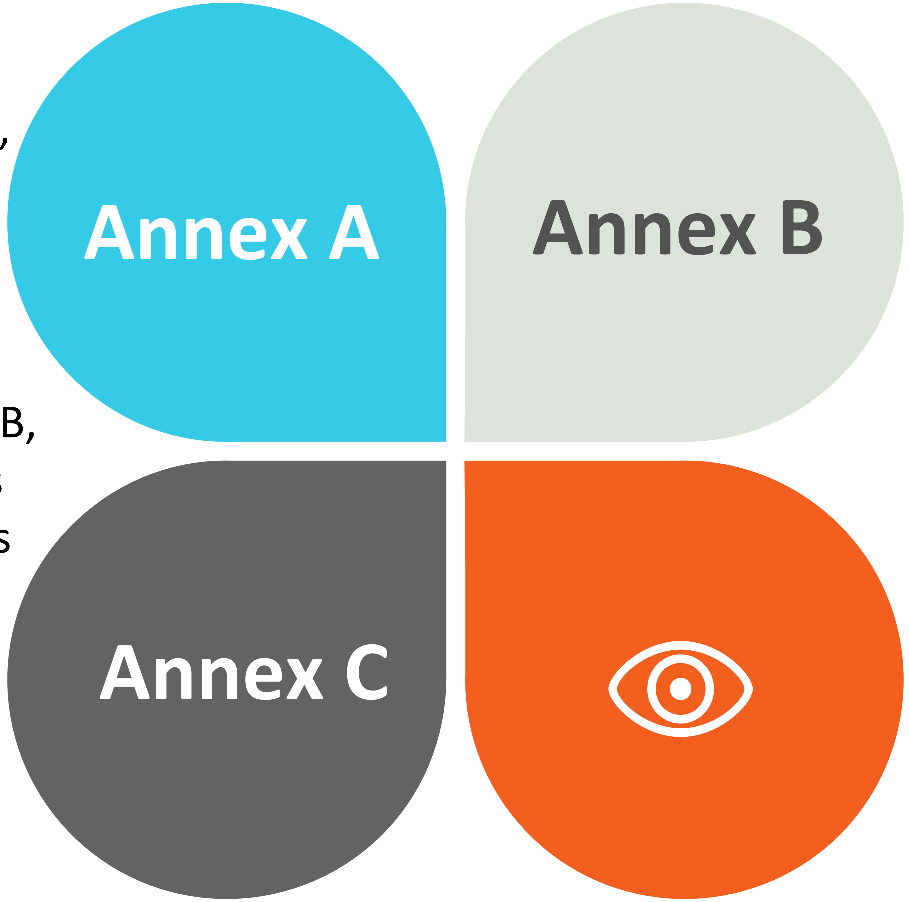
C-DecaBDE, C-OctaBDE, C-PentaBDE, HBB, HBCDD, HCBD, PCB, PCN, PFHxS, its salts and PFHxS-related compounds, PFOA, its salts and PFOA-related compounds, SCCPs, HCB*, PeCB*

**Also used as pesticides*

Unintentional releases

7 U-POPs:

HCB, HCBD, PeCB, PCB, PCDD/PCDF, PCN



Restriction

1 Pesticide: DDT

1 Industrial POP: PFOS, its salts and PFOSF

**Annex B chemicals have "Acceptable purposes" for which Parties can continue production/use if registered.*

Under review

Article 8, Annex D, E, F,
POPs Review Committee (POPRC)

Year 1: Proposal / Annex D screening

↓

Year 2: Annex E risk profile

↓

Year 3: Annex F risk management evaluation / recommendation

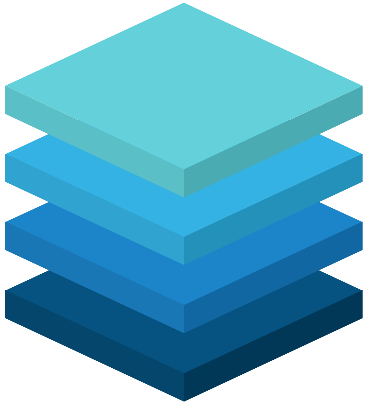
↓

Year 4: COP decision

Article 16: Effectiveness evaluation

- COP-1 in 2005 initiated the establishment of **arrangements to provide comparable monitoring data on the presence of the POPs** as well as their **regional and global environmental transport**.

- The arrangements (=GMP):

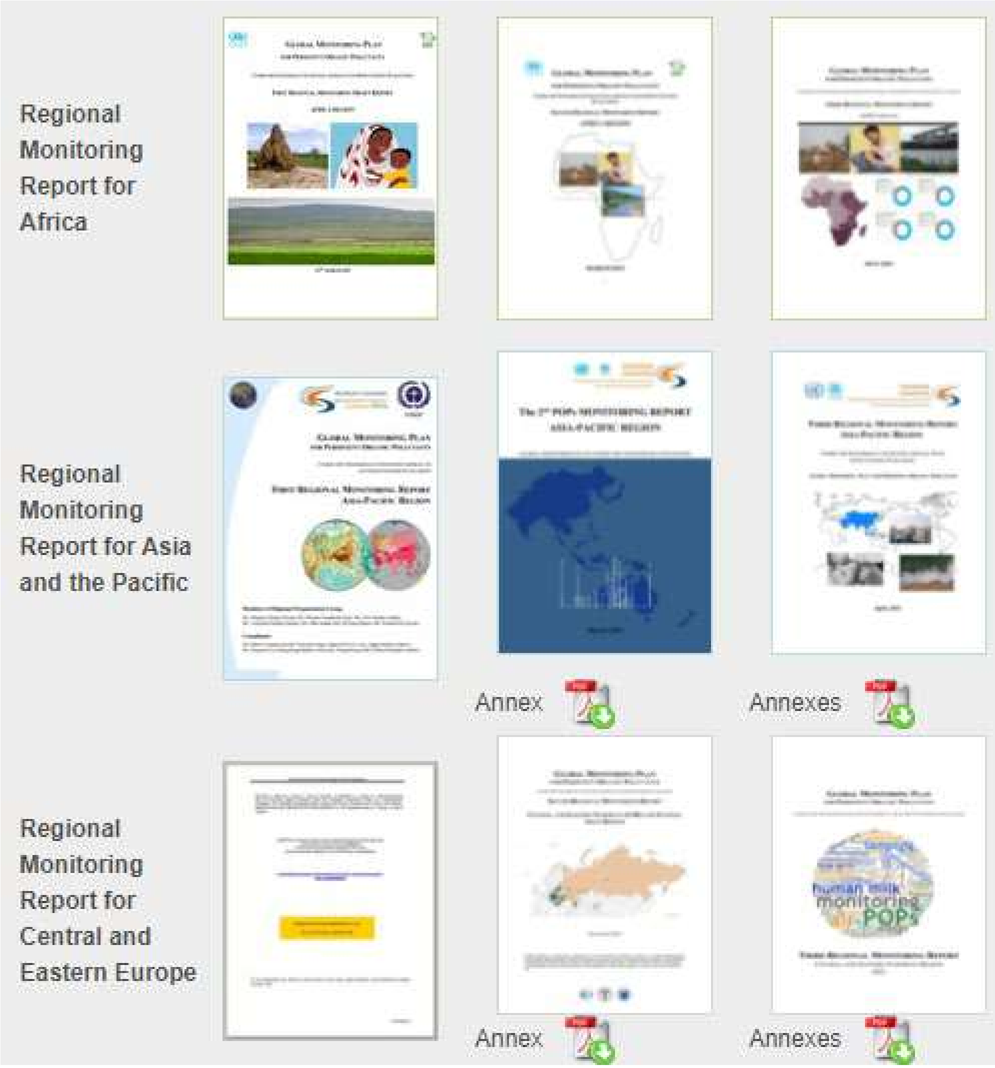


  - Should be implemented by Parties on a **regional basis** when appropriate, in accordance with their technical and financial capabilities, **using existing monitoring programmes and mechanisms** to the extent possible and promoting harmonization of approaches

  - May be supplemented taking into account the differences between regions and their capabilities to implement monitoring activities

  - Shall include **reports to the COP** on the results of the monitoring activities on a regional and global basis at intervals to be specified by the COP

Third round of regional monitoring reports

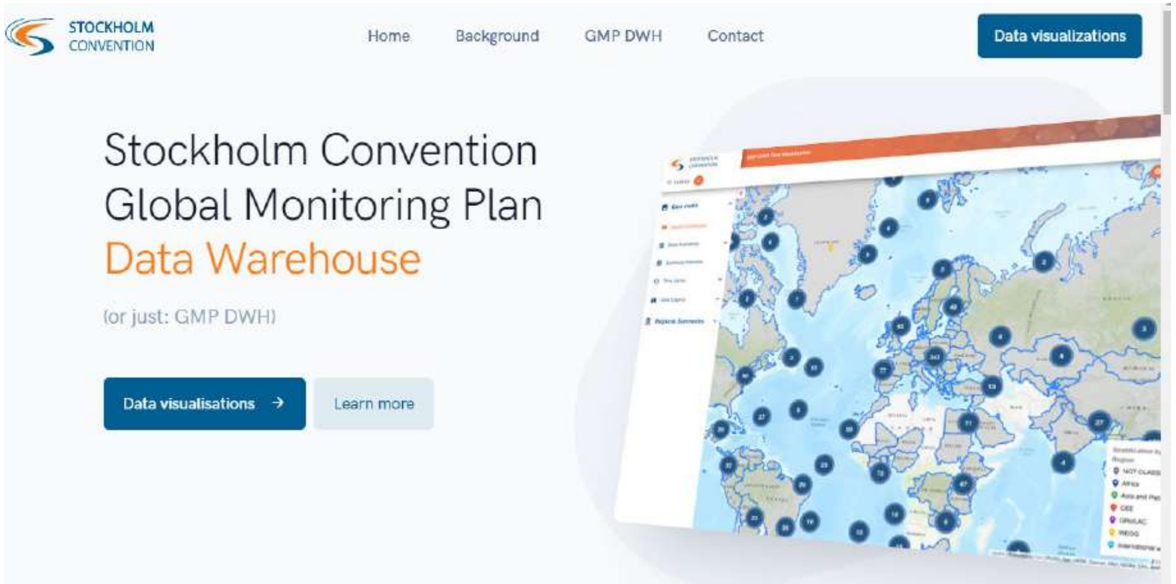


UNEP/POPS/COP.10/INF/41

http://chm.pops.int/tabid/525

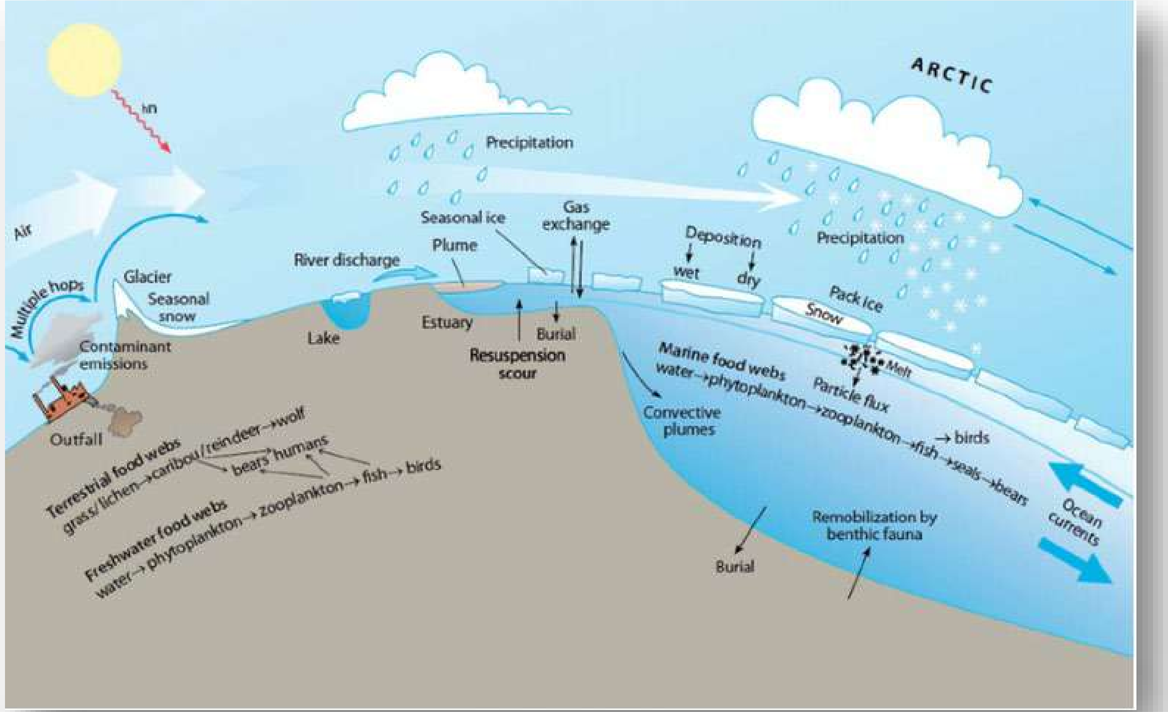
GMP DataWarehouse

https://www.pops-gmp.org/



Note: GMP DWH was launched at the Stockholm COP-10 (5 June 2022). GMP DWH now contains most updated information from 2019–2021 equipped with a data visualization tool.

Long-range environmental transport



Kallenborn, R., et al. 2012. “The influence of climate change on the global distribution and fate processes of anthropogenic persistent organic pollutants”. J. Environ. Monit., 2012, 14, 2854.

- POPRC-16: Established an intersessional work on LRET
- POPRC-17 and POPRC-18: Considered the draft on LRET
  - Requested the intersessional working group to further develop the draft document for Committee on its consideration of LRET
- Long-range environmental transport (UNEP/POPS/POPRC.18/9)
- Draft document on long-range environmental transport (UNEP/POPS/POPRC.18/INF/21)
- Comments and responses relating to the draft document (UNEP/POPS/POPRC.18/INF/22)

POPRC-19 meeting: 9–13 October 2023, Rome

Consideration on EE and GMP at COP-11 in 2023

Documents

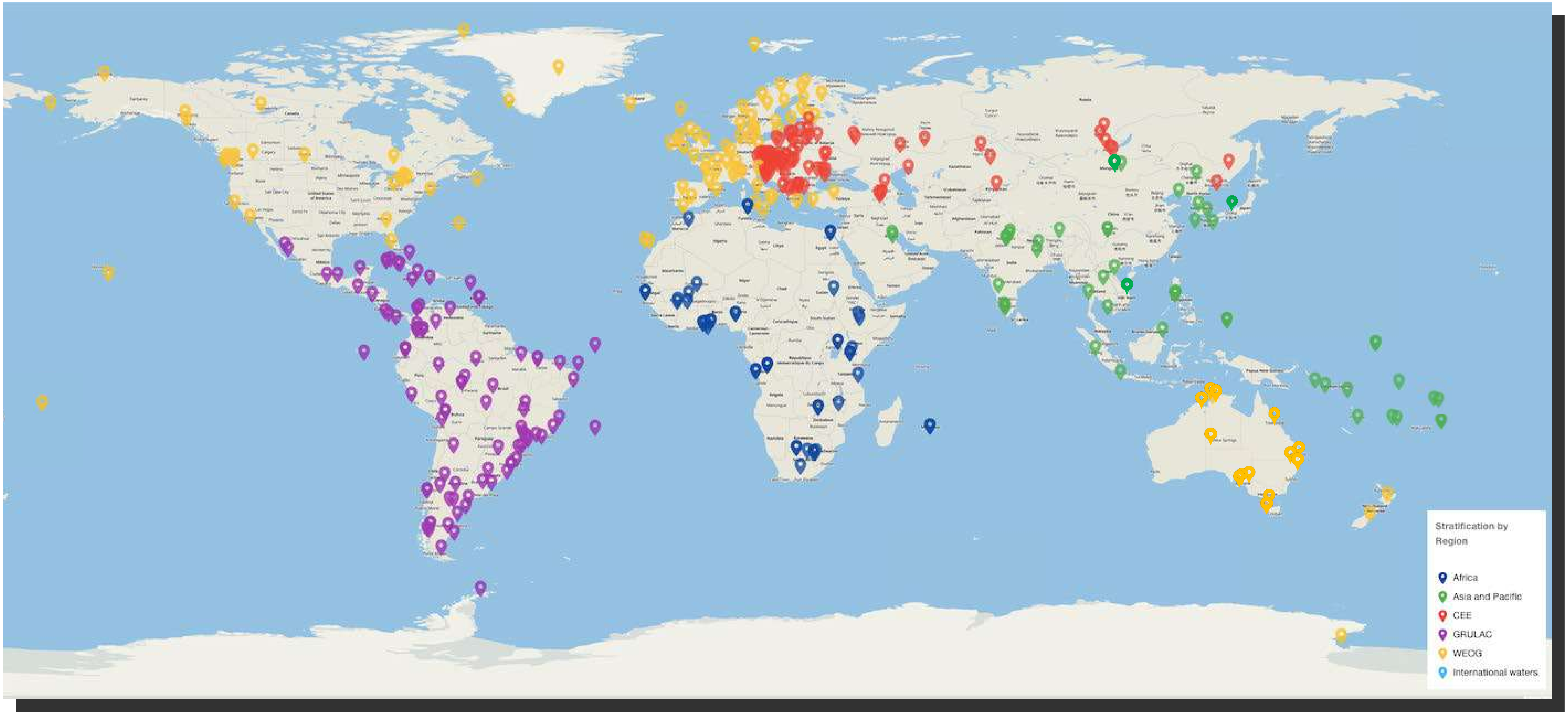
- UNEP/POPS/COP.11/19 – EE
- UNEP/POPS/COP.11/19/Add.1 – EE-2 report
- UNEP/POPS/COP.11/20 – GMP
- UNEP/POPS/COP.11/20/Add.1 – GMP-3 report
- UNEP/POPS/COP.11/INF/36 – EE-2 full report
- UNEP/POPS/COP.11/INF/37 – EEC meeting reports
- UNEP/POPS/COP.11/INF/38 – GMP-3 full report
- UNEP/POPS/COP.11/INF/39 – GCG meeting report
- UNEP/POPS/COP.11/INF/9 – UNEP report on activities to support the GMP
- UNEP/POPS/COP.10/INF/42 – Updated guidance on GMP for POPs

Draft decision on GMP

- Take note of the GCG meeting report and UNEP's report on activities to support GMP
- Welcome the GMP-3 report and conclusions and recommendations
- Request the ROG and GCG to continue to implement the GMP according to the revised TOR
- Request the Secretariat to continue to support the work of the ROG and GCG; support raining and capacity building; inform expert groups of the work and data available under the GMP; facilitate cooperation with relevant monitoring efforts under UNFCCC, CBD, etc.
- Encourage Parties to consider the conclusions and recommendations in GMP-3 report; monitor the core media of air and human breast mild or blood; initiate monitoring of PFOS in water; support further development and long-term implementation of GMP

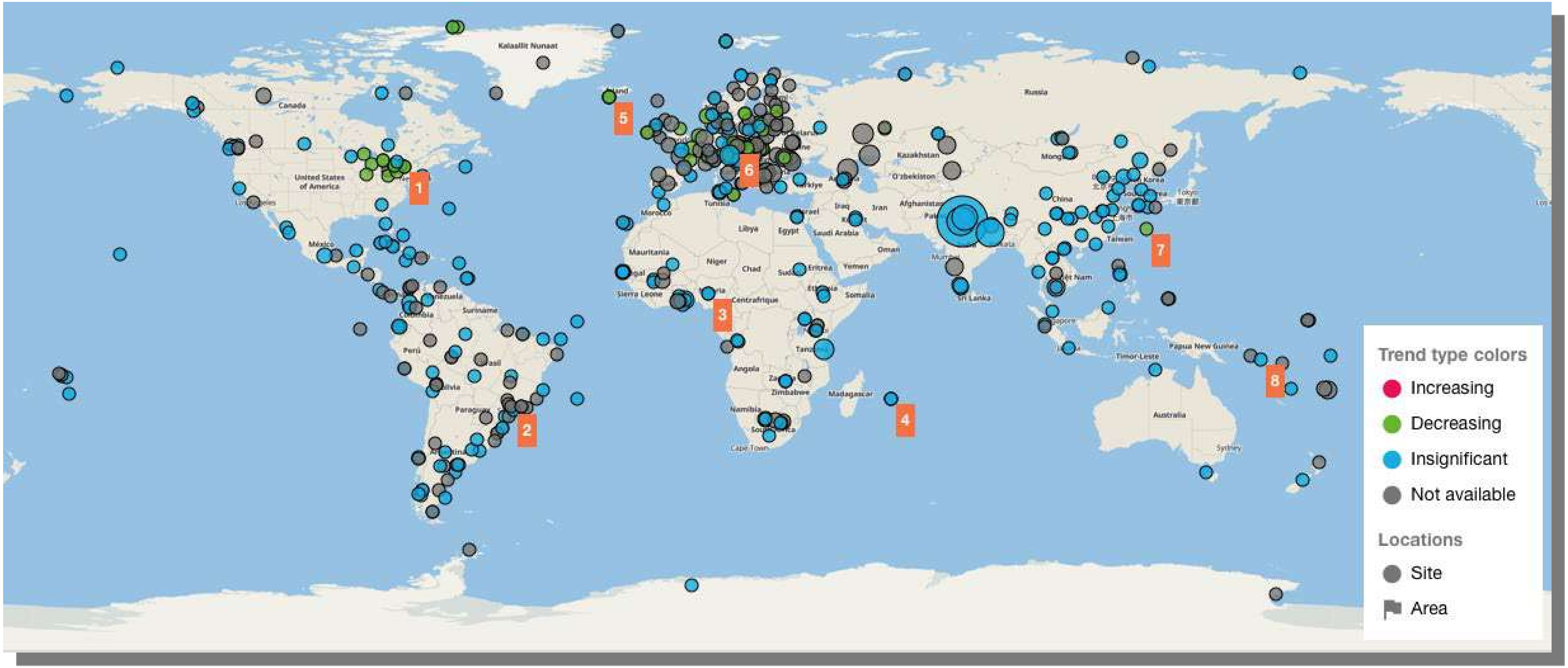
Global air monitoring stations contributed to the third global monitoring report

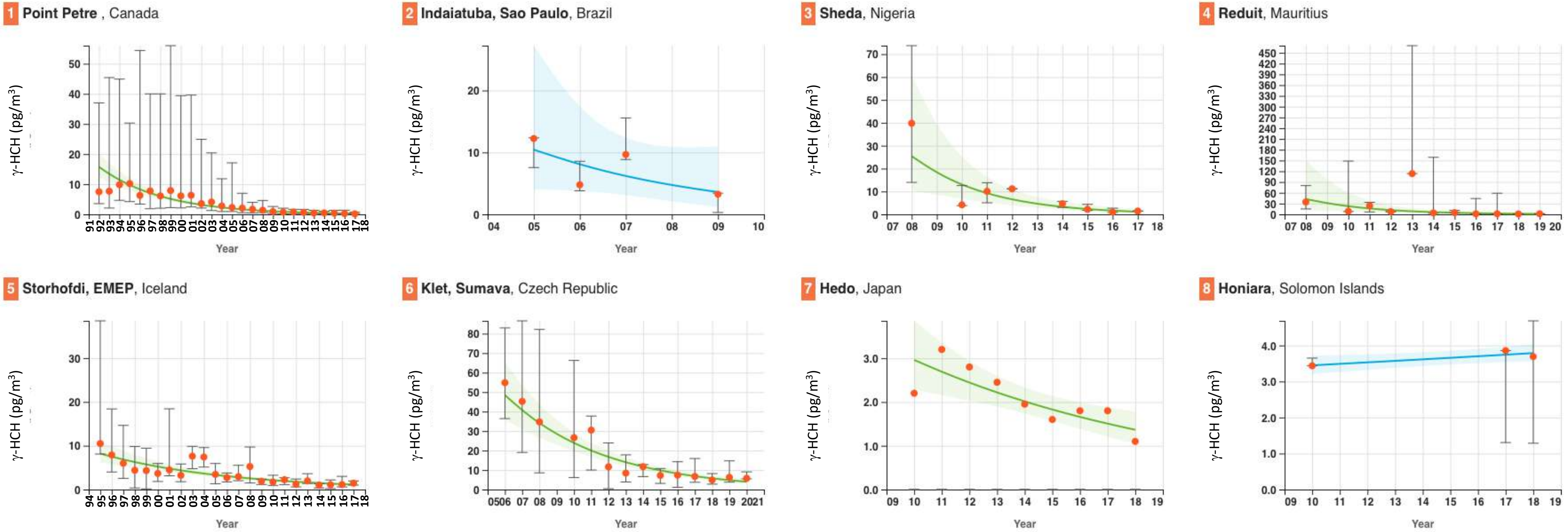
(Passive air sampling sites)



Global temporal trends of air concentrations of lindane (1991–2021).

● increasing, ● decreasing, ● insignificant, ● not available

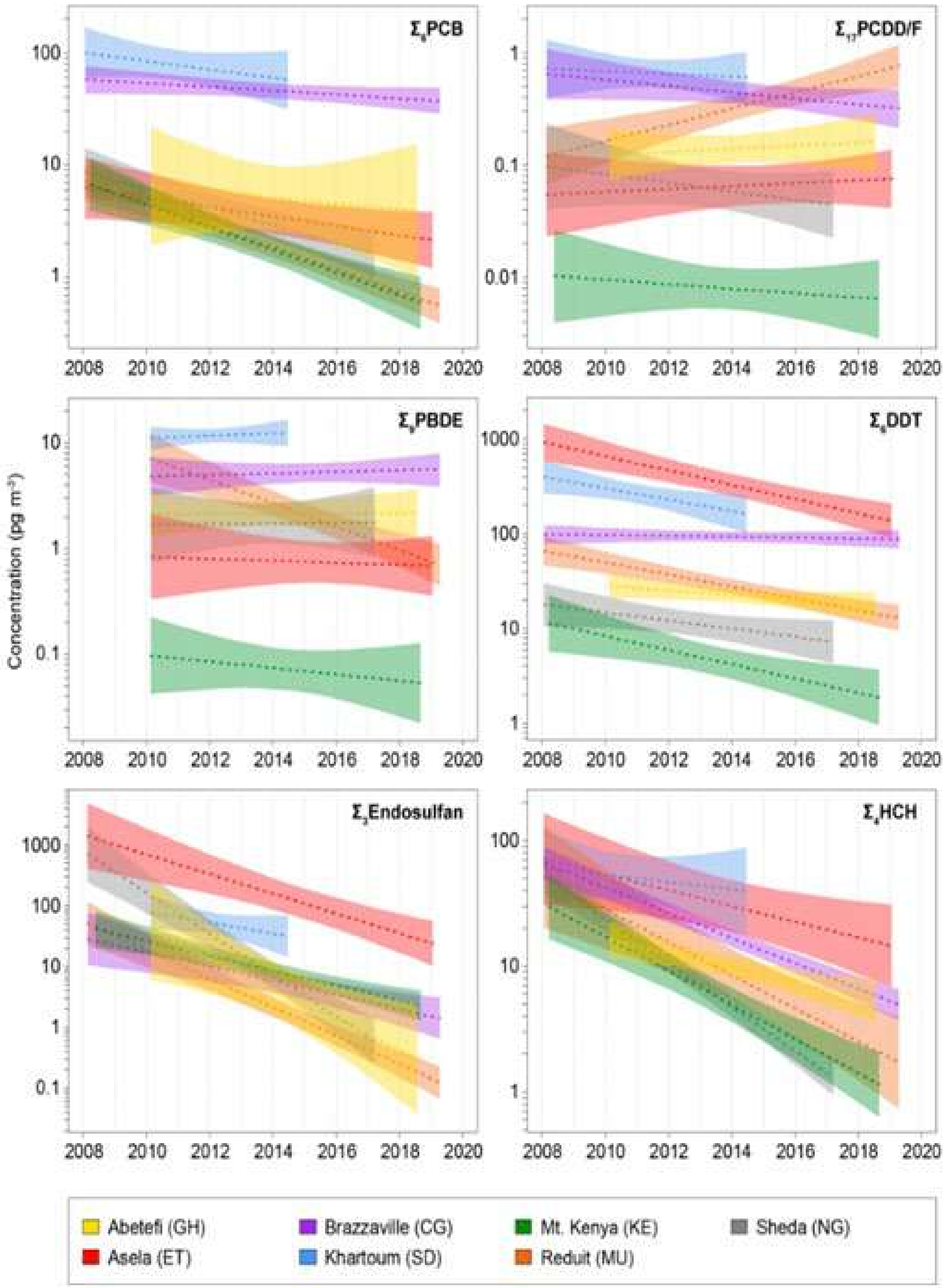


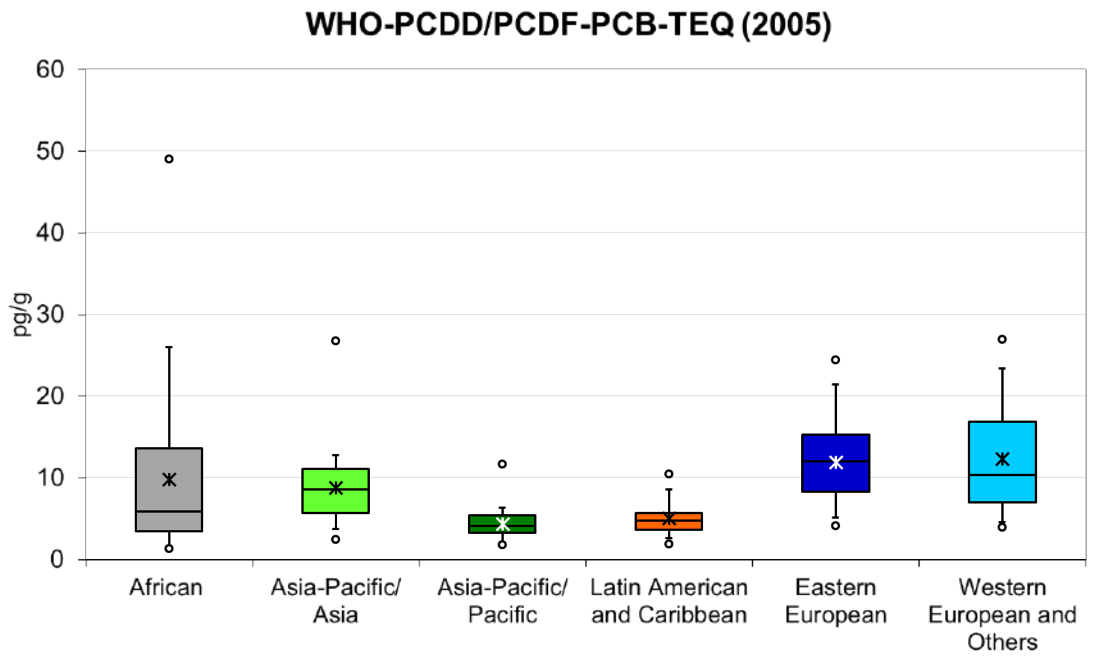


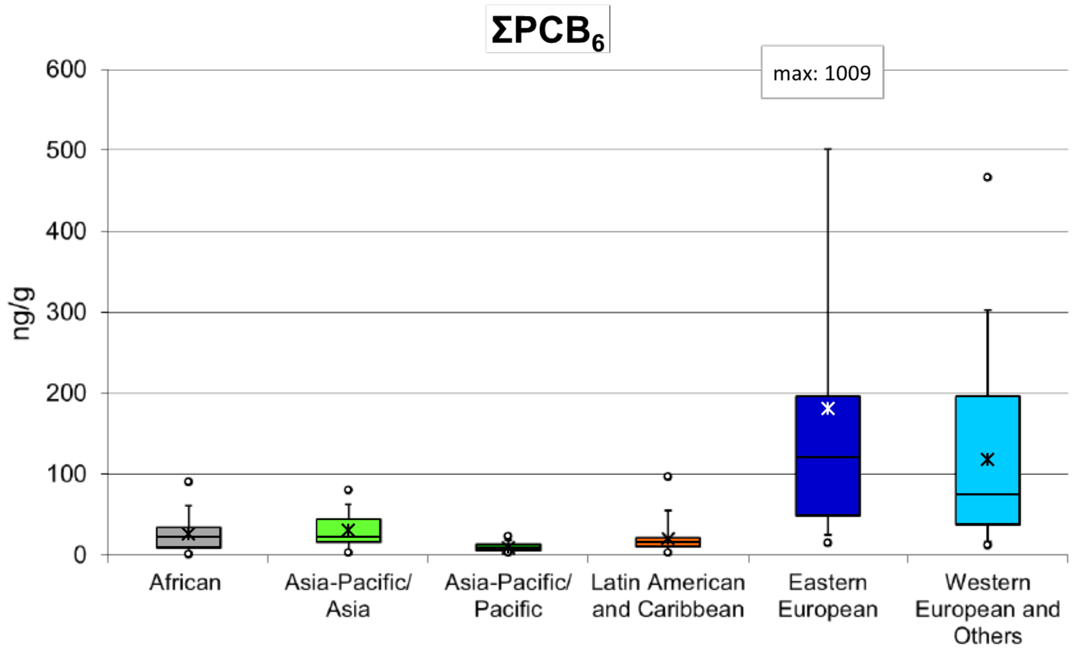
Temporal trends of air concentrations of lindane at 8 sites: Brazil, Canada, Czechia, Iceland, Japan, Mauritius, Nigeria, Solomon Islands (1991–2021).

Temporal trends of air concentrations of POPs in the African region (2008–2020).

The figures indicate decreasing trend of air concentrations of PCB; dioxins and furans (PCDD/PCDF); polybrominated diphenyl ethers (PBDE); DDT; endosulfan; hexachlorocyclohexane (HCH).

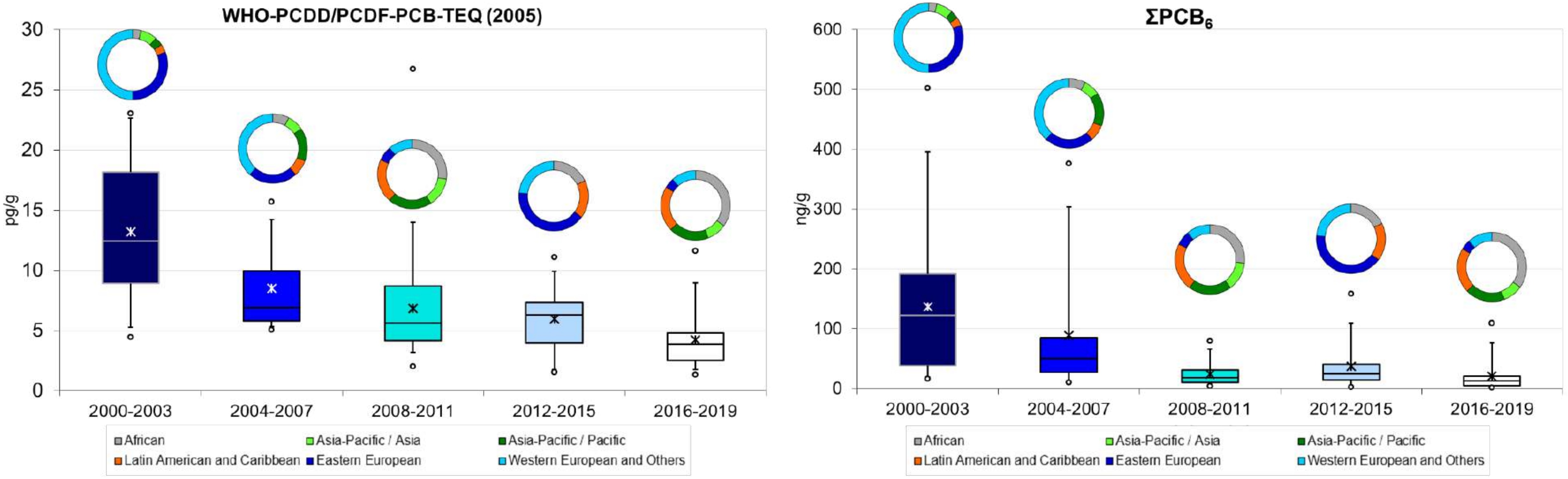






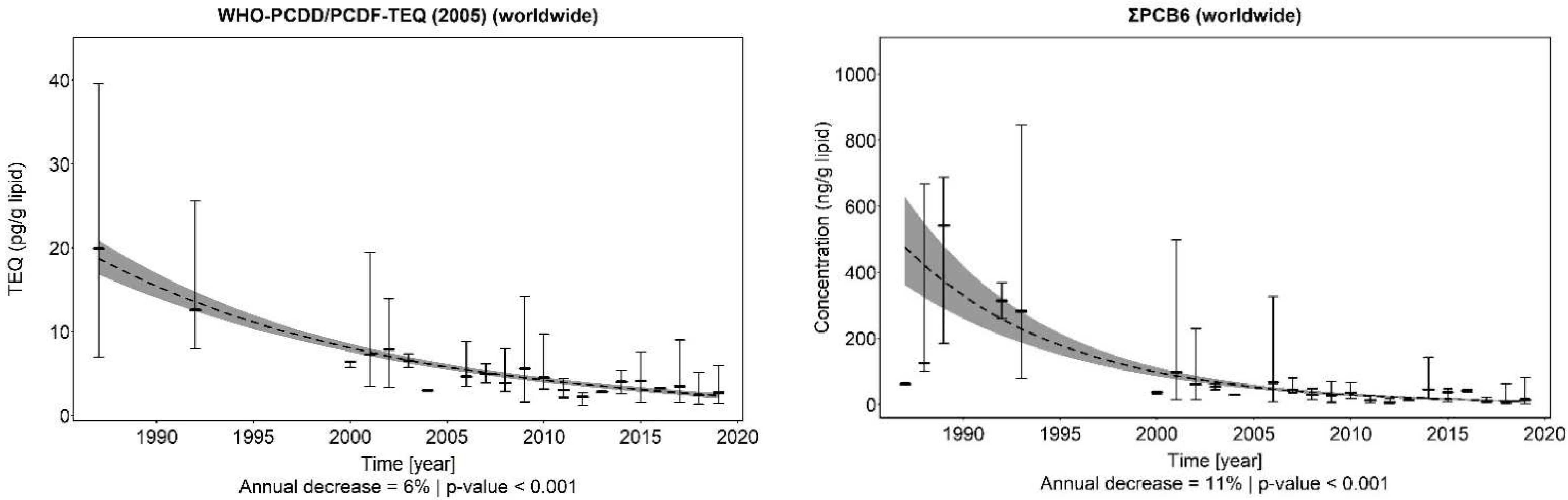
Median and range of WHO-PCDD/PCDF-TEQ concentrations (pg/g lipid) and indicator PCB (ΣPCB_6) concentrations (ng/g lipid) in human milk by region (2000–2019).

(n=232. Box plot: Minimum and maximum as circles; Whiskers: 5th and 95th percentile; Lower (25–50%) and upper (50–75%) quartiles separated by the line for the median as box and mean as asterisk. Source: Malisch et al. in press, a.)



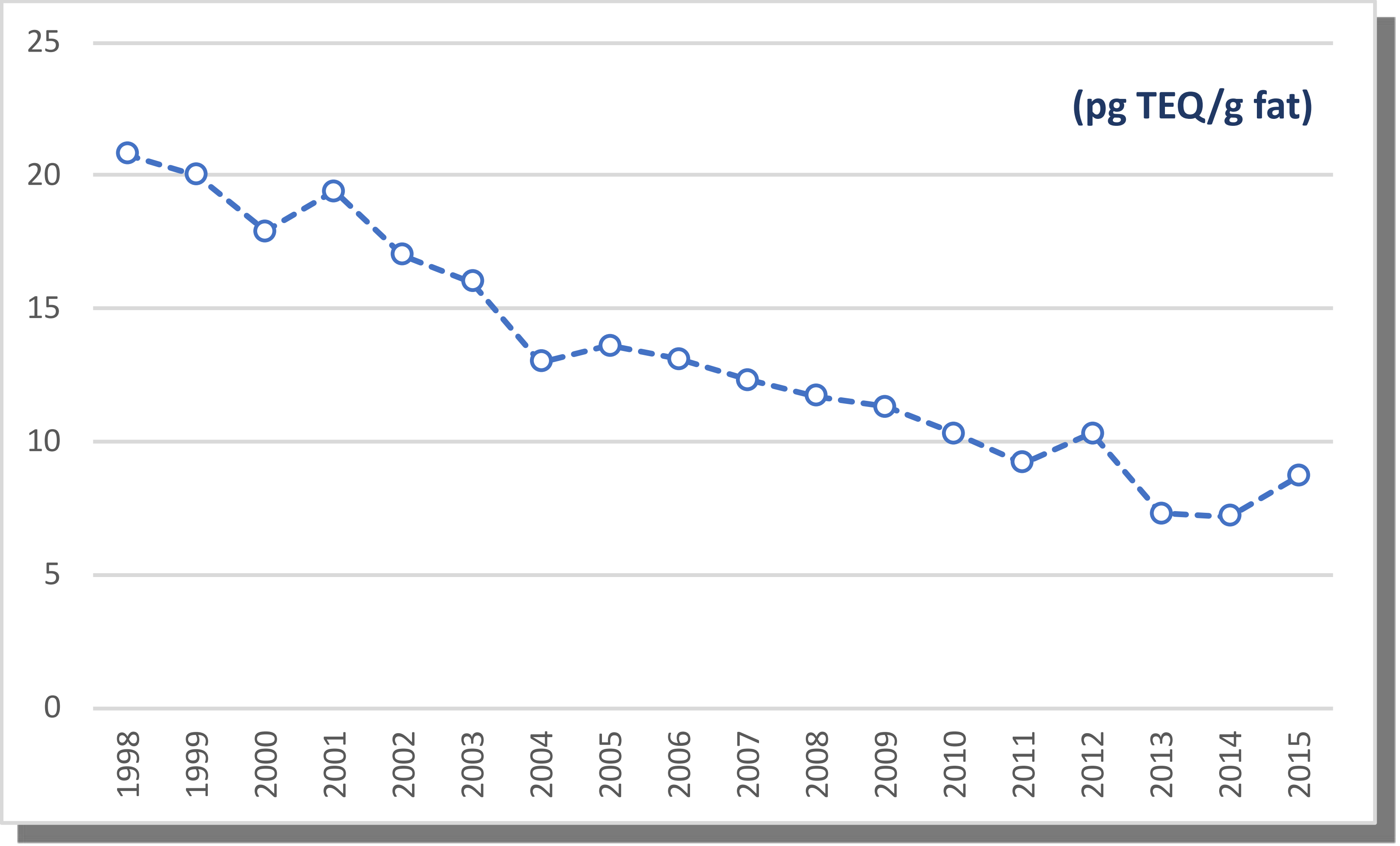
Median and range of WHO-PCDD/PCDF-TEQ concentrations (pg/g lipid) and indicator PCB (ΣPCB_6) concentrations (ng/g lipid) in human milk (5 rounds in 2000–2019).

(Country results with aggregated data. Box plot: Minimum and maximum as circles; Whiskers: 5th and 95th percentile; Lower (25–50%) and upper (50–75%) quartiles separated by the line for the median as box and mean as asterisk. Source: Malisch et al. in press, a).



Global Theil-Sen exponential exponential trends of WHO-PCDD/PCDF-TEQ concentrations (pg/g lipid) and indicator PCB (ΣPCB_6) concentrations (ng/g lipid) in human milk.

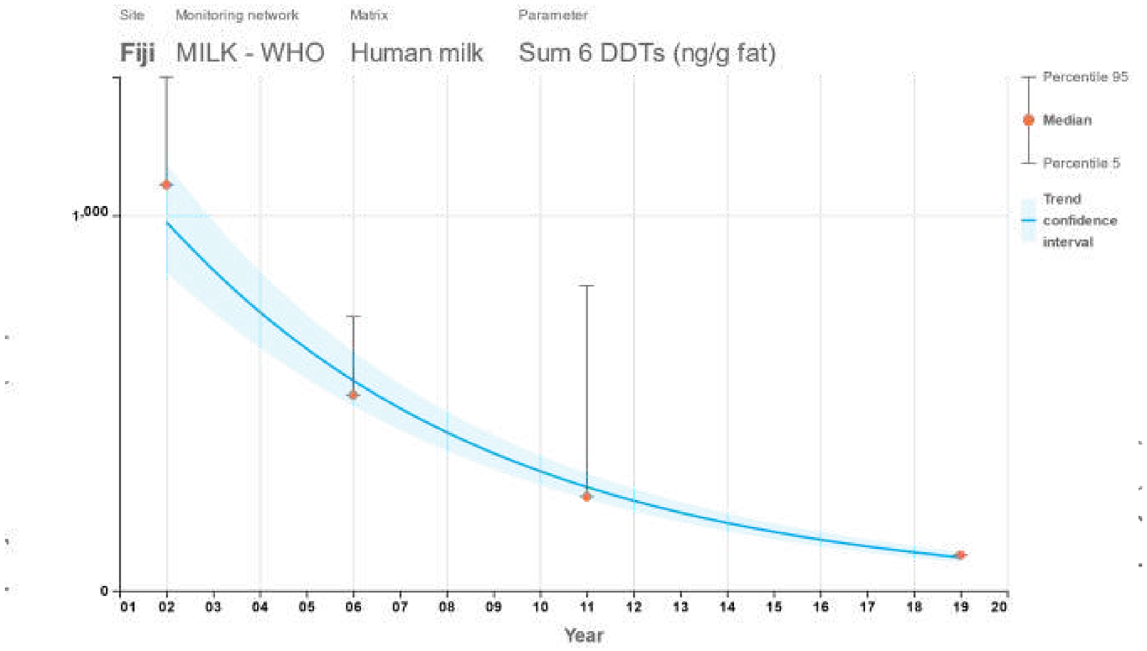
(Third Global Monitoring Report).



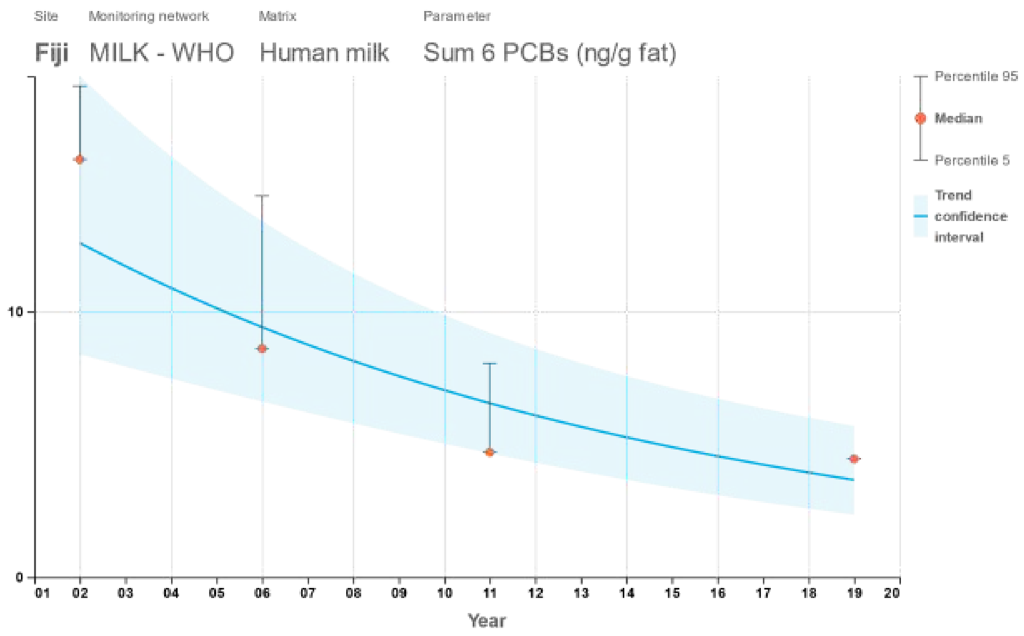
Temporal trend (1998–2015) of dioxin concentrations (pg TEQ/g fat) in human milk in Japan).

(Averages of each year's data are plotted. Dioxins: sum of PCDD (7 isomers), PCDF (10 isomers) and dl-PCB (12 isomers). Source: Third regional monitoring report for Asia-Pacific).

DDT

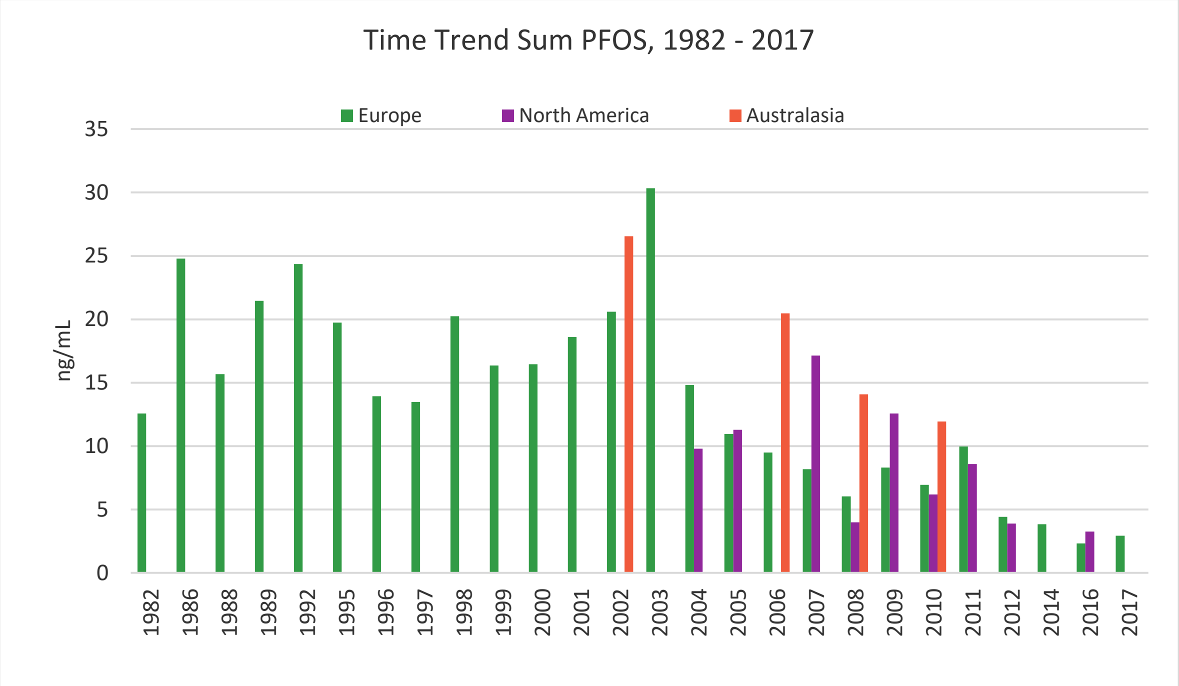


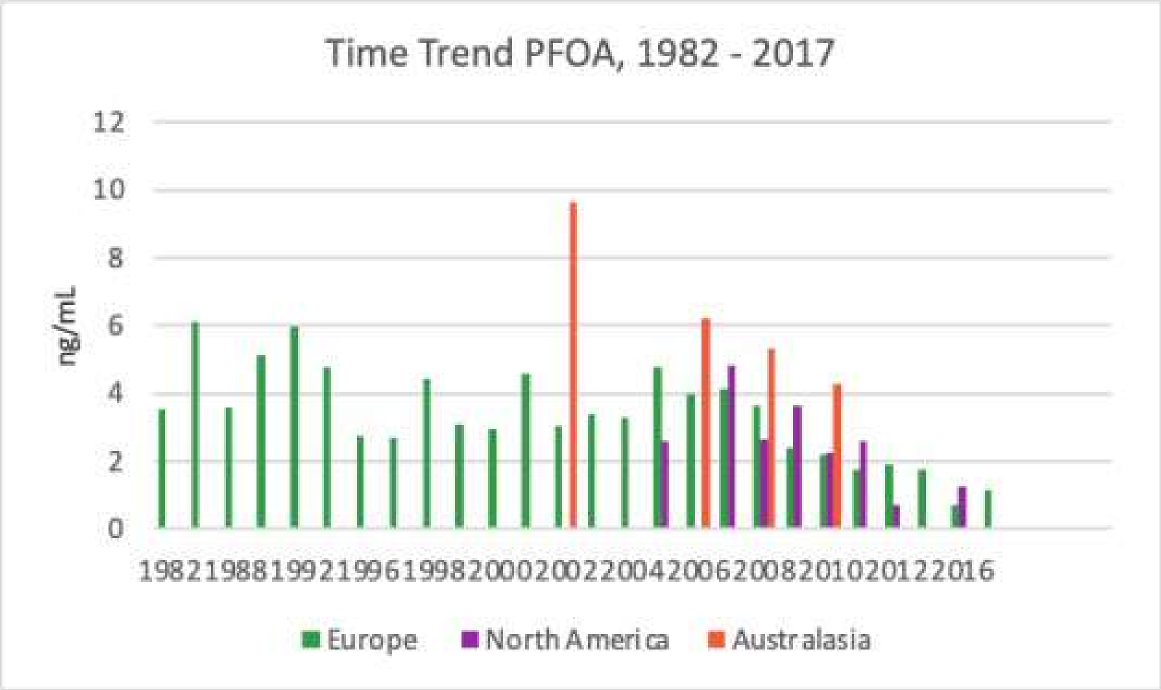
PCB



Temporal trend (2002–2019) of DDT (6 isomers), PCB (6 isomers), and p,p'-DDT concentrations (ng/g fat) in human milk in Fiji.

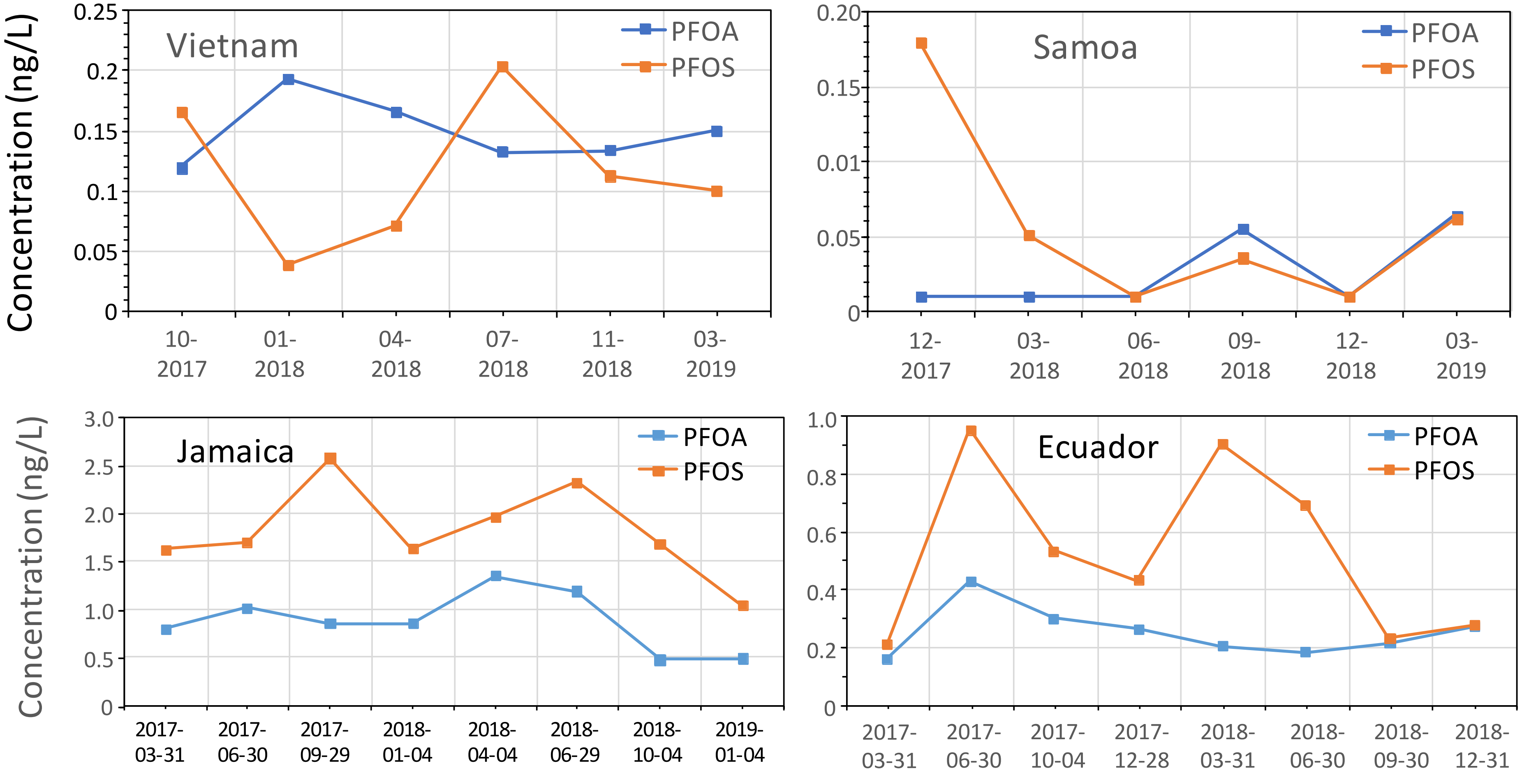
(Source: Third regional monitoring report for Asia-Pacific.)





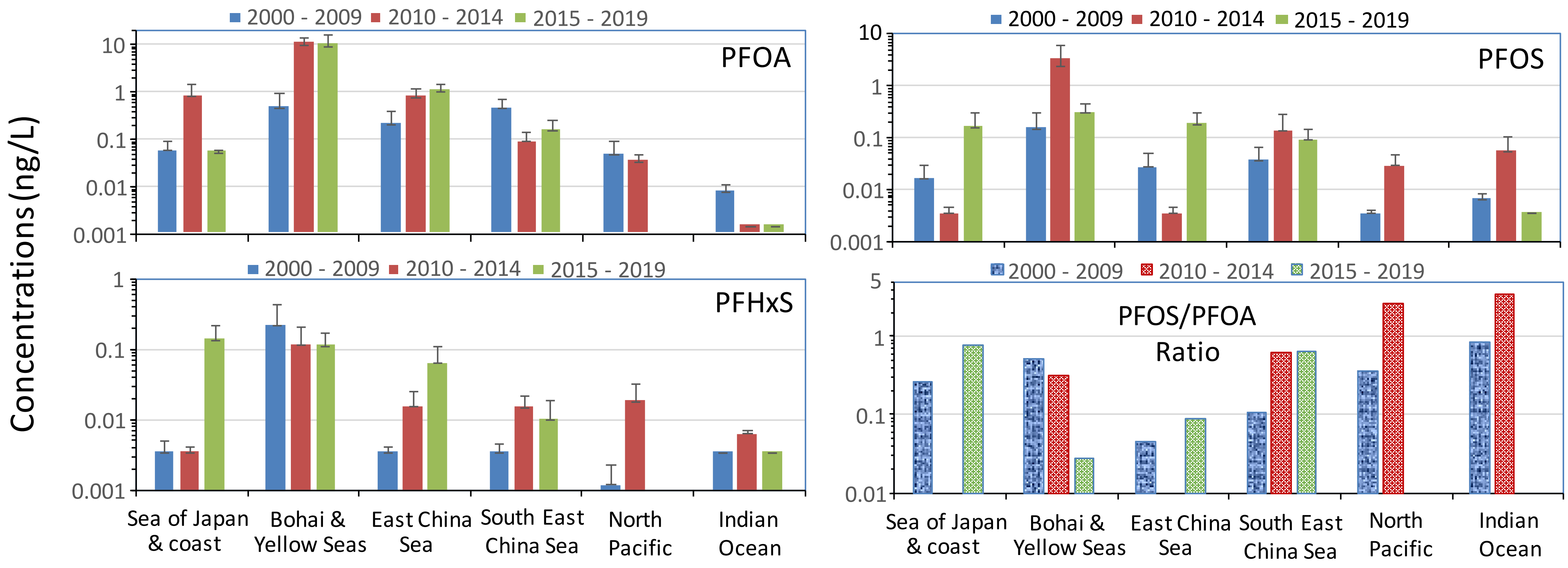
Temporal trend (1982–2017) of PFOS and PFOA concentrations (ng/mL) in human blood in Europe, North America, Australasia

(Source: Third regional monitoring report for WEOG.)



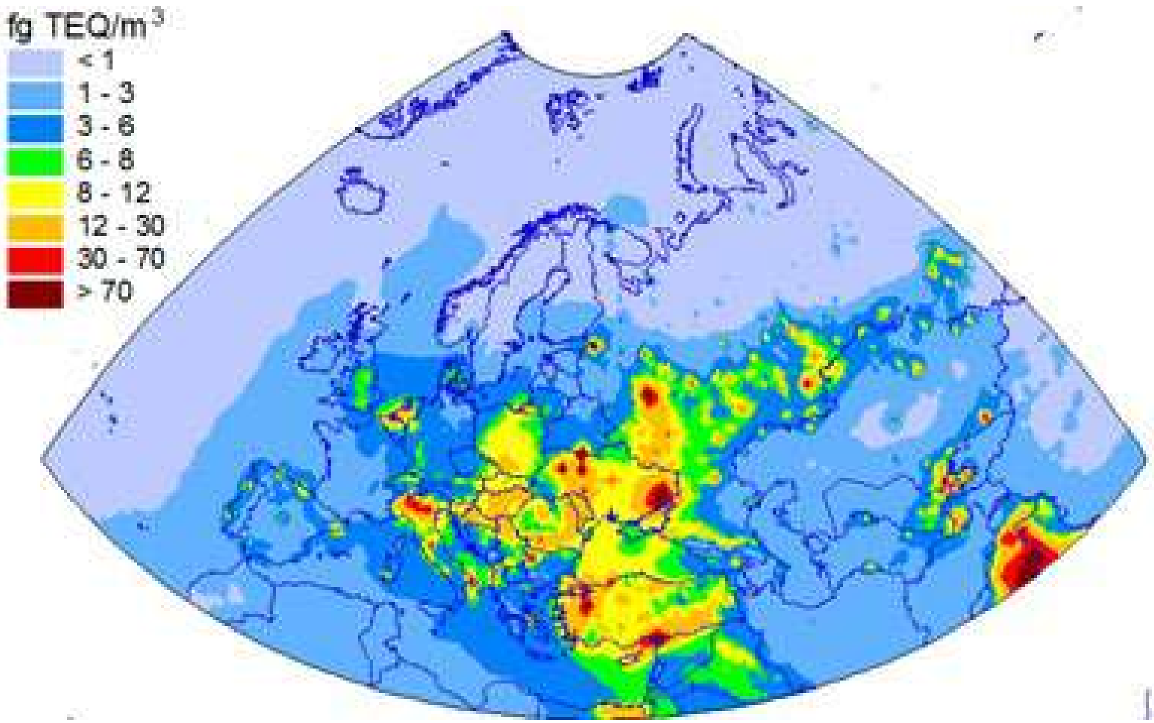
Temporal trends (2017–2019) of PFOA and PFOS concentrations (ng/L) in surface waters of Viet Nam (Song Nam Dinh River), Samoa (Vaisigano River-Lelata Point), Jamaica (Hunts Bay River estuary, Kingston) and Ecuador (Daule and Babahoyo River Junction, Guayaquil).

(Sampling was conducted at the same location approximately every 3 months. Symbols represent single samples. Values of 0.01 ng/L represent non-detectable concentrations. Source: Baabish et al. 2021.)

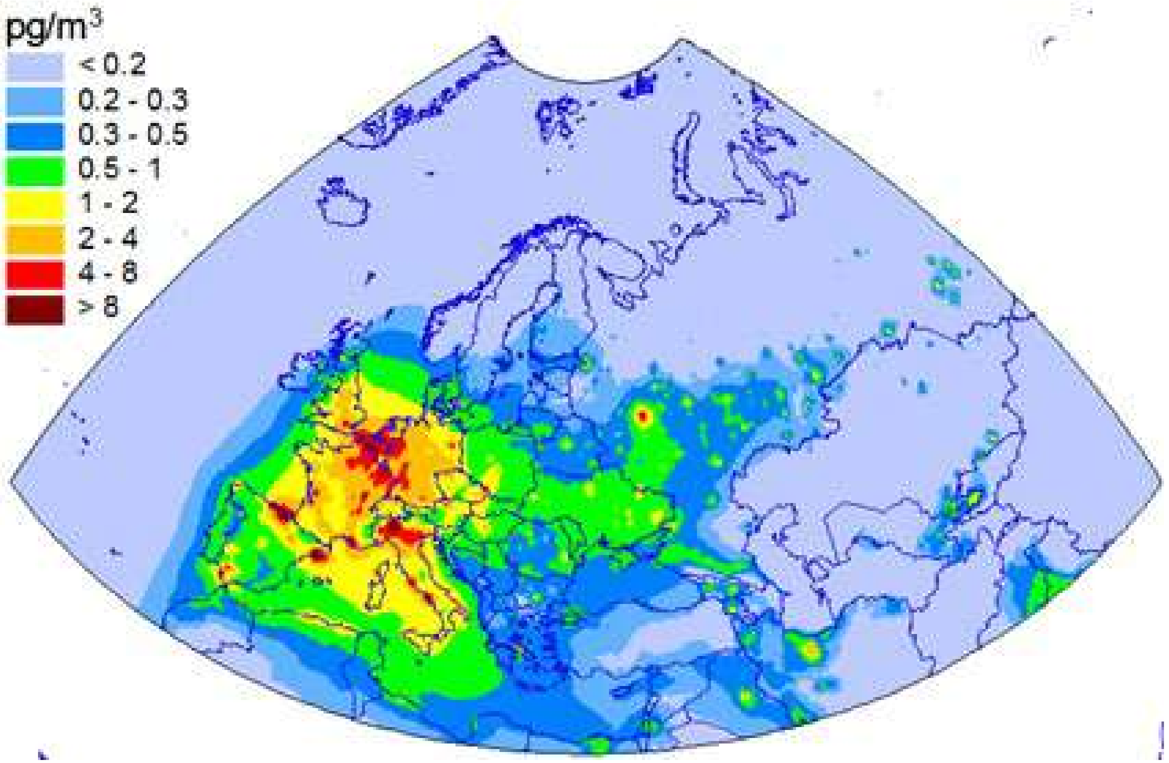


Temporal trends (2000–2009, 2010–2014, 2015–2019) of PFOA, PFOS, PFHxS median concentrations (ng/L) and PFOS/PFOA ratios in coastal seas and ocean waters of the Asia-Pacific region).

PCDD/PCDF



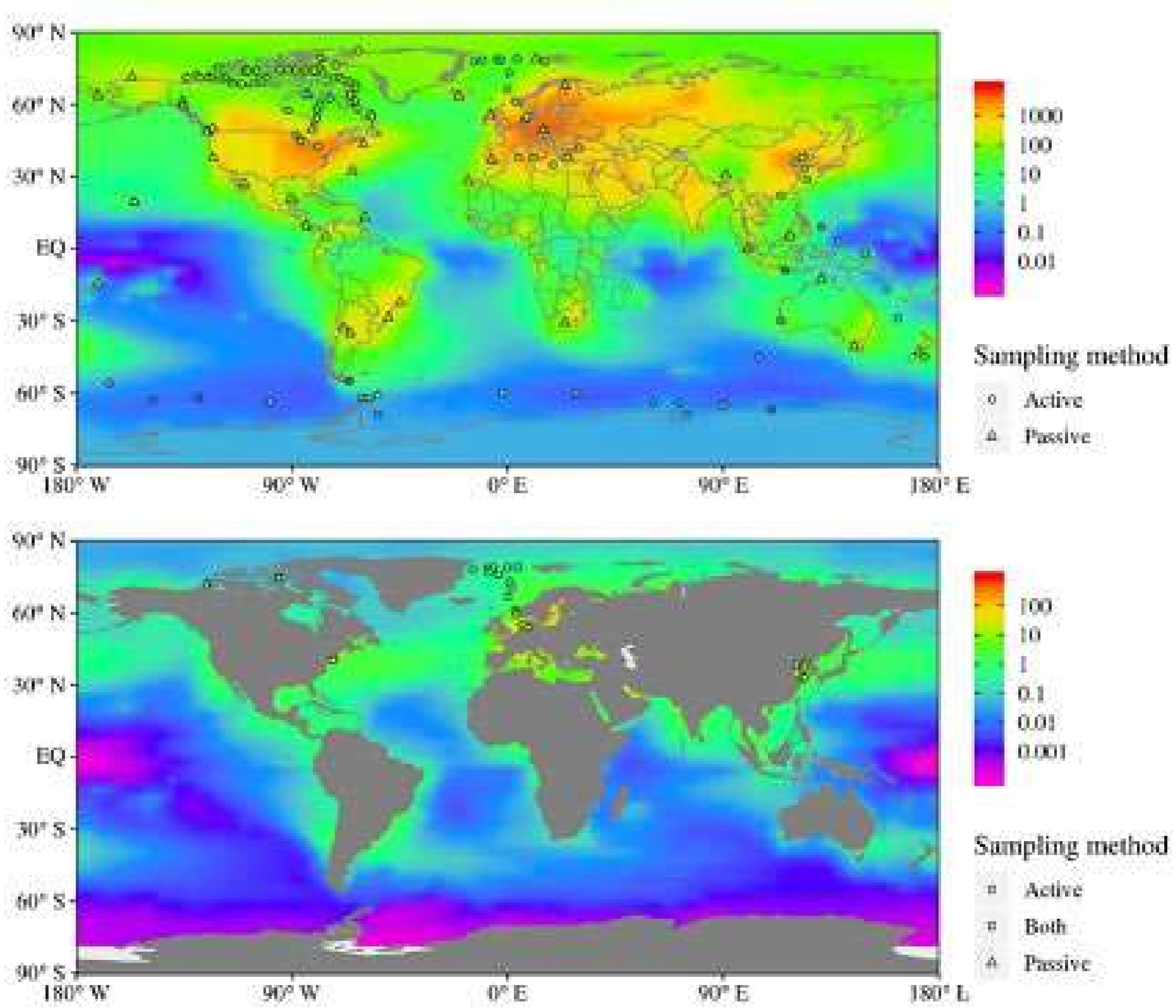
PCB-153



Spatial distribution of modelled annual mean concentrations of PCDD/PCDF and PCB-153 (2018).

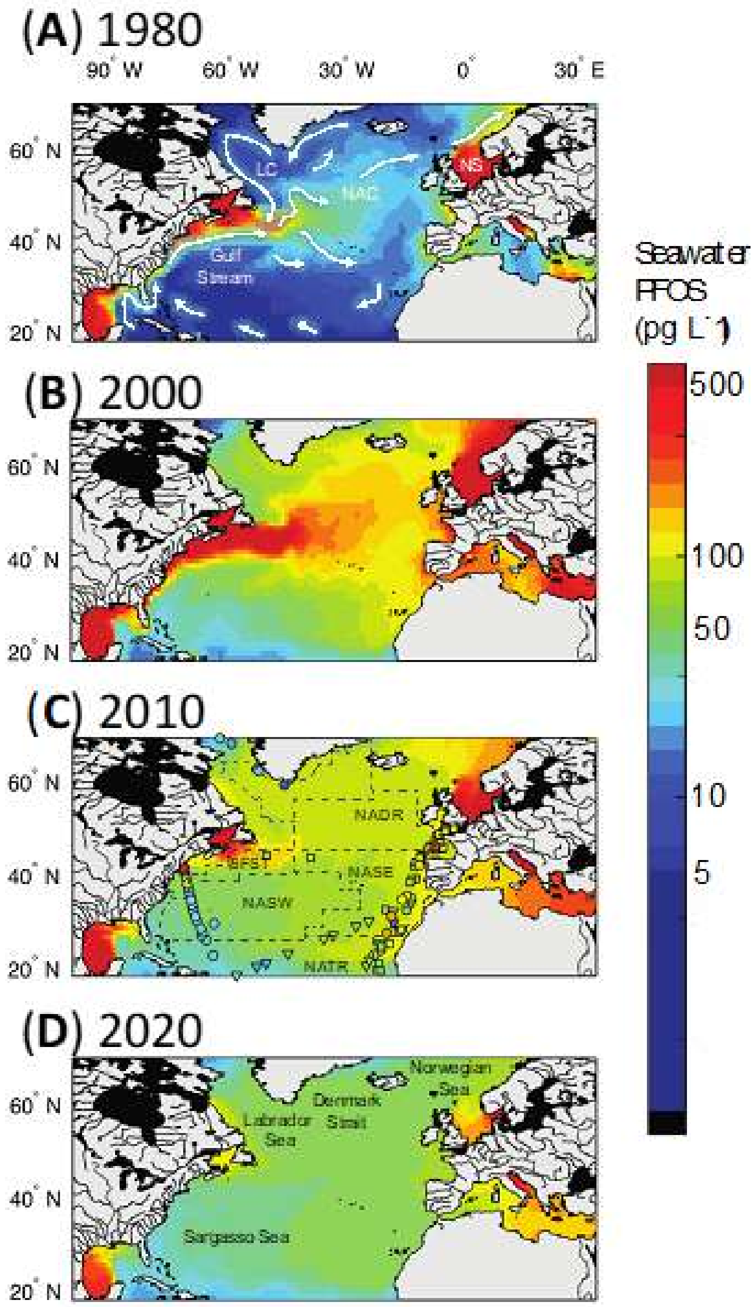
Long-range environmental transport shown in a model

Tris-(1-chloro-2-propyl) phosphate (TCPP) in air (pg/m^3) and in seawater (ng/L)



Modelled (color gradient) and observed (plots) concentrations of TCPP in air (top panel) and seawater (bottom panel) under the preferred scenario for TCPP emissions to air (26.5 kt/y) and water (13.3 kt/y) with environmental degradation half-lives (60 hours in air and 7200 hours in water).

Modelled values are annual mean concentrations.

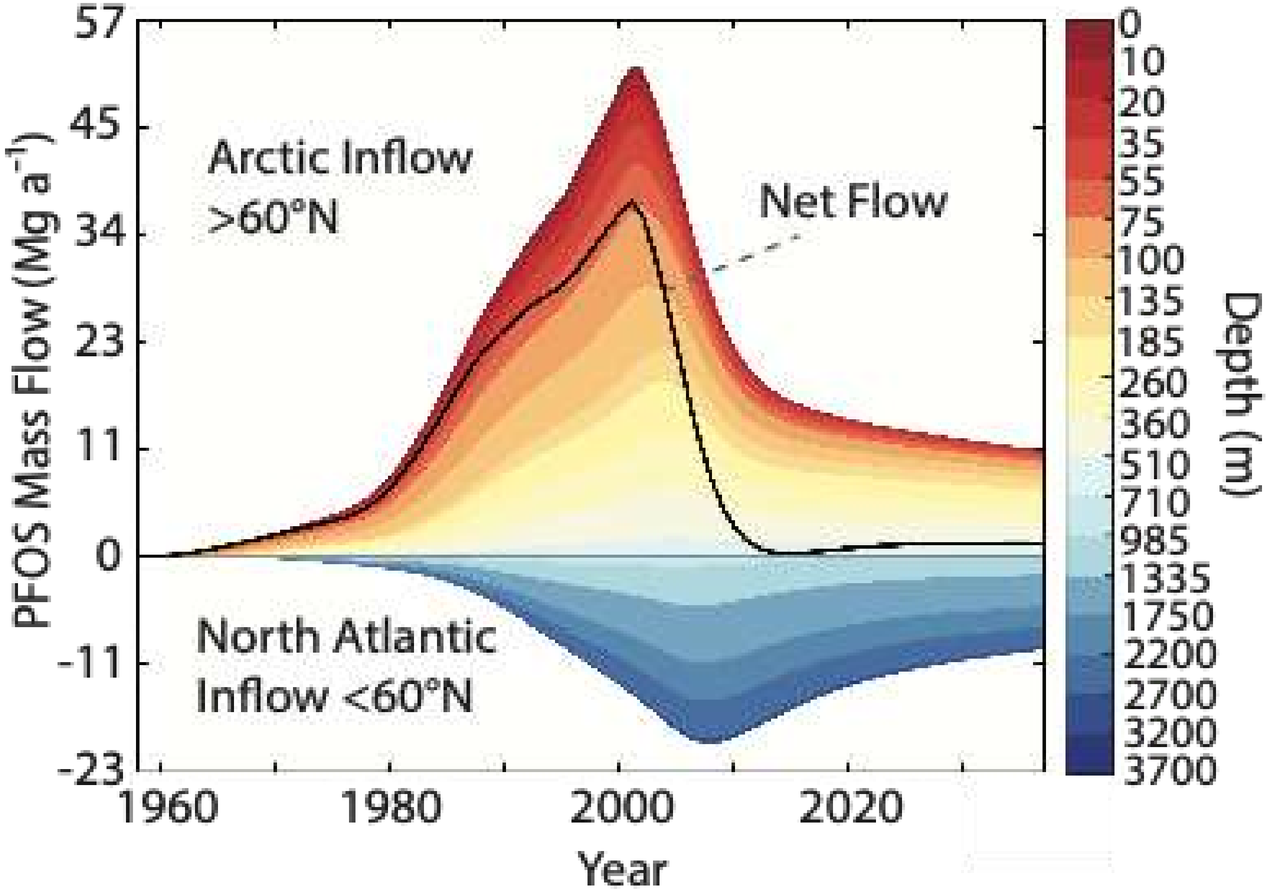


Modelled temporal evolution of surface water PFOS concentrations (pg/L) in the North Atlantic Ocean (1980–2020)

Depth: 10m

Major surface currents are indicated by white arrows in Panel (A).

Panel (C) shows modelled surface concentrations for 2010 compared to observations from 2009–2011.



Modelled PFOS circulation above and below 60°N at various seawater depths (1958–2038).

(Blue shading indicates deeper waters while red, orange, and yellow shading indicates surface or subsurface waters. Net flow is indicated by the solid black line, with positive numbers representing flow into the Arctic region (above 60°N) and negative numbers indicating flow into the North Atlantic (below 60°N).)

GMP-3 report – key conclusions and recommendations

- The ability of the Convention to determine on-the-ground effectiveness of actions to reduce global burden of POPs critically relies on **continuation of international & national monitoring programmes**.

- In general, **POPs concentrations are declining and are starting to level off** where regulatory action was taken decades ago. It is noted however, that in some cases, such as hexachlorobenzene, there are slight increases, likely due to release from secondary sources and the effects of **climate change**.

- It is important that data and samples are **maintained in a coordinated and sustainable way**, such as through **environmental specimen banks**, and that programmes operate **efficiently and collaboratively** to address challenges.

- Encourage, and where appropriate, support **continued participation of countries in relevant monitoring activities** conducted at the national level, such as the **human milk survey**, in order to further strengthen the evidence and identification of trends.

GMP-3 report – key conclusions and recommendations

- **Existing programmes need to continue** in order to determine trends.
- **Coordinating with other programmes**, such as ad hoc surveillance work on indoor air and urban and industrial emissions, as well as **development of environmental fate and exposure models**, would enable more comprehensive understanding of exposure and effectiveness of actions to protect human health and the environment.
- Opportunities exist to **link with climate science and biodiversity** to better understand and interpret monitoring data in a broader context.
- Future GMP assessments of **PFAS in water** should consider using the successful study design of the **UNEP/GEF GMP II project**.
- The **UNEP/GEF GMP project** should be repeated prior to the next global assessment, ideally in a larger number of sites, but at a minimum at the same sites as those used in 2017–2019.
- There is a need to establish environmental monitoring in the **South, West and Central Asia to expand** the monitoring network to cover all of the **Asia-Pacific region**.
- More detailed assessment of LRET in the Asia-Pacific region, including **back trajectory analysis, modelling studies and compilation of the emission source information**, is needed to analyze POP trend data and to clarify their LRET and possible source regions.

GMP and EE timeline

Every 6 years

2021 — Finalized 3rd regional monitoring reports
Submitted to COP-10

2022 — Draft GMP-3 report
Submitted to EE committee in Jan 2022

2023 — Final GMP-3 report
Submit to COP-11; 2nd full Effectiveness evaluation

2025 — 4th regional monitoring reports in preparation

2027 — Finalize 4th regional monitoring reports
Submit to COP-13
Begin preparation of 4th Global monitoring report (GMP-4)

2028 — Draft Global monitoring report GMP-4
Submit to EE committee in Jan 2028

2029 — Final GMP-4 report
Submit to COP-14; 3rd Effectiveness evaluation

Acknowledgement

The global implementation of GMP-3 was made possible thanks to the generous contributions from the **EU, Japan, Norway, Sweden.**

Strategic monitoring partnerships include: Arctic Monitoring and Assessment Programme (**AMAP**), Global Atmospheric Passive Sampling Network (**GAPS**), POPs Monitoring Project in East Asian countries Project (**POPsEA**), European Monitoring and Evaluation Programme (**EMEP**), Integrated Atmospheric Deposition Network (**IADN**), Great Lakes Basin Monitoring programme, and the Monitoring Network for POPs in Europe, Africa and Asia (**MONET**) and global AquaMONET of the Research Centre for Toxic Compounds in the Environment (**RECETOX**).

Many thanks to **UNEP/GEF GMP2 projects**; **UNEP/WHO Human Milk Survey** financed by GEF; State Institute for Chemical and Veterinary Analysis of Food (**CVUA**), Germany, for the analytical work on human milk samples; **MTM Research Centre, Örebro University**, Sweden, for the analysis and provision of data on perfluorinated chemicals in human milk; national coordinators of the WHO/UNEP exposure study; experts of the ROGs and GCG of the Stockholm Convention GMP and strategic partners.

Thank you!

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and Stockholm conventions
11-13 chemin des Anémones
CH 1219 Châtelaine, Geneva
Tel.: +41 22 917 8201
Email: kei.ohno@un.org

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GMP Data Warehouse and the 4th cycle of the GMP implementation - upcoming challenges

Head of the National Centre for Toxic Compounds and of
the Stockholm Convention Regional Centre in the Czech Republic (SCRC)
RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

Kateřina Šebková, Ph.D
katerina.sebkova@recetox.muni.cz

Final Meeting of the UNEP/GEF projects "Implementation of the POPs Monitoring Plan in the Asian Region" and "Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in Pacific Region", Bangkok, 4-5 April 2023

RECETOX, host of the SCRC Czech Republic, in Brief

The RECETOX is a leading Czech research institute covering a broad range of basic and applied research on toxic compounds in the environment and their effect on human health.

Functions of RECETOX:

- Research activities
- Education programmes
- Open-Access Research Infrastructure
- Science to Policy and Society platforms (National Centre for Toxic Compounds, **Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology**)
- Application of research results

RECETOX
Faculty of Science
Masaryk University
Brno, Czech Republic

Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology, RECETOX, Czech Republic

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Stockholm Convention
Regional Centre

- Hosted by RECETOX + uses its capacity
- established in 2007
- endorsed in 2009 + successfully evaluated in 2013, 2015 and 2019 (mandates extended for 4 additional years)
- provides support to the Stockholm Convention on POPs contracting Parties (countries) in its geographical region of the Central and Eastern Europe and beyond*.
- chemicals management and management of wastes containing toxic chemicals by providing training, capacity building, expertise support in a number of fields

* Work also covers additional international instruments related to chemicals management – i.e. SAICM, Basel, Rotterdam and Stockholm Conventions), and Minamata Convention on Mercury

GEF-GMP2 projects partner = providing air sampling materials (PAS) and training to selected project countries

SCRC CZ at the COP 10 in Geneva – 5 June 2022

- **Side-event „Trends in POP levels globally and how could they contribute to solving the triple planetary crisis?"**
  - 80 delegates from all around the world
  - presenters: Rainer Malisch, Ramon Guardans, Kateřina Šebková and Abiola Olanipekun
  - How does pollution influence climate change and biodiversity (loss)
  - 20 year of tracing POPs in humans
  - **Official launch of the GMP Data Warehouse and presentation of data including GEF GMP2 project results**

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Official Lauch of the GMP data warehouse visualizations

https://www.pops-gmp.org

- visualization available 24/7 online
- core matrices of the Stockholm Convention on POPs (air, human tissues, water)
- harmonized data and information structure
- POPs data format: annually aggregated concentrations
- largest pool of global POPs data available in an user friendly manner

- GMP DWH updates defined by the Stockholm Convention - 6 year interval
- content third regional reports (GMP3) - release for approval by the global expert community in May 2021
- user-friendly access to the POPs monitoring data to all stakeholders and the broad public

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GMP DWH past

Work mandated by decision SC-6/23, carried in accordance with

Chapter 6 of the Guidance on the Global Monitoring Plan for Persistent Organic Pollutants relevant to data handling (UNEP/POPS/COP.6/INF/31) in the period 2012-2014.

Supervision by

Stockholm Convention Secretariat under the guidance of the GMP Global Coordination Group and Regional Organization Groups

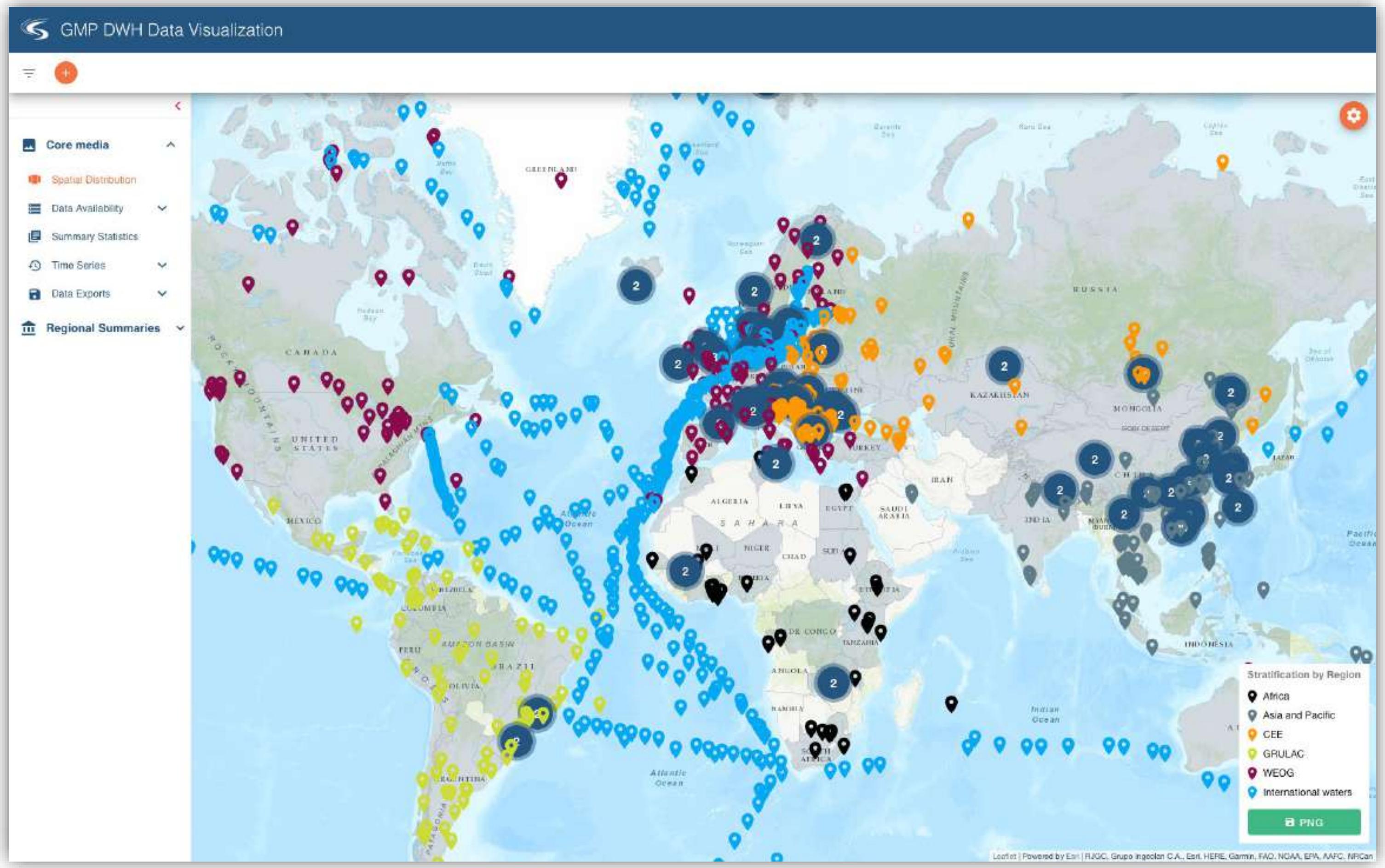
Performed by

Stockholm Convention Regional Centre in the Czech Republic hosted at RECETOX through the RECETOX research infrastructure, Masaryk University, Brno, Czech Republic with support of the EU iGOSP project of ERA Planet

Past summary

Global Monitoring Plan Data warehouse (**GMP DWH**) launched first version in 2011, upgraded in 2014 (via SC 6/23) for second reporting round, available on www.pops-gmp.org until 1 June 2022.

Data Visualizations now:



Spatial Distribution Module

https://data.pops-gmp.org/2020/all/#/gmp3/spatial-distribution

FORMAT: 5 modules

- Spatial distribution
- Data availability
- Summary statistics
- Trend analysis
- Data exports

CONTENT

4 core media

30 listed chemicals (POPs)

314 chemical parameters

111 monitoring networks/projects

126 countries

779 sites + a total of 1159 water sites and ocean cruises

time range: 1967-2021

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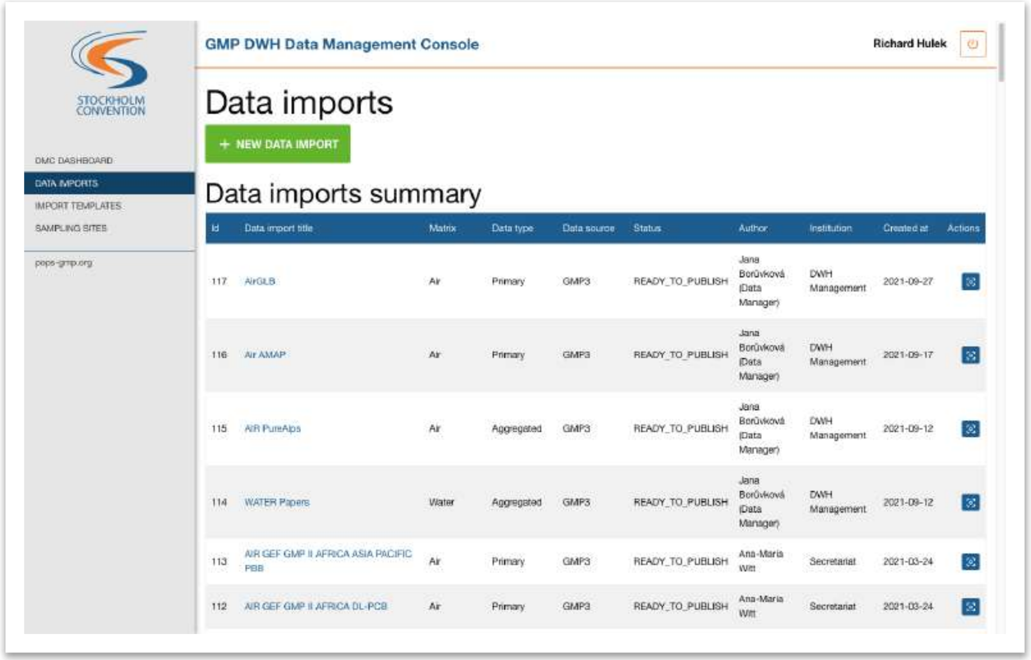
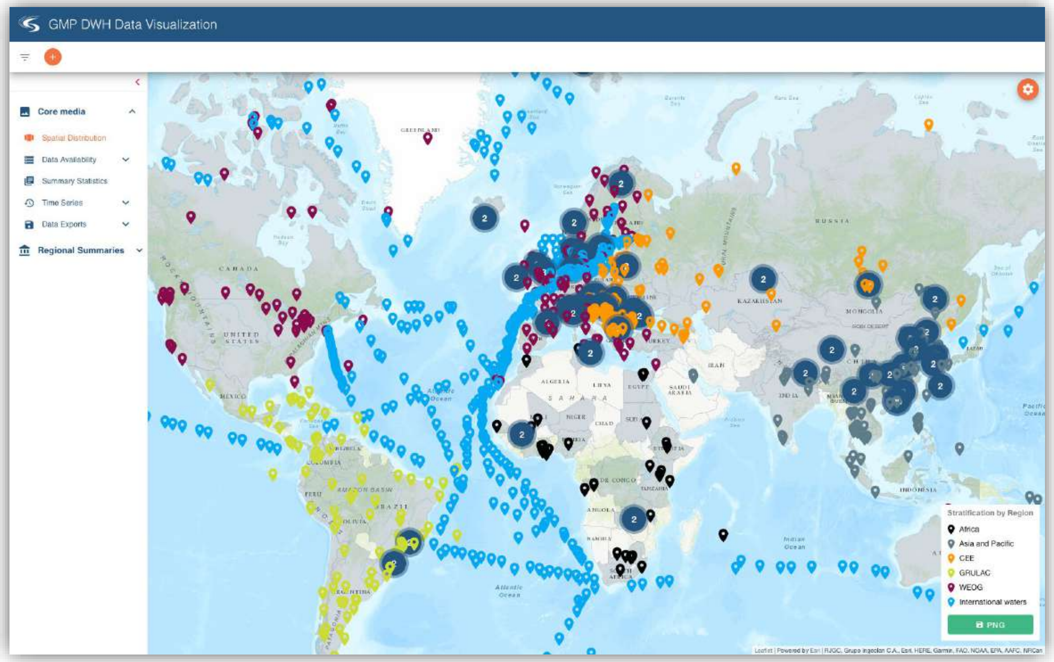
GMP DWH new services…





GMP DWH Data Management Console
https://dmc.pops-gmp.org
authorized access for experts only at the moment of data imports (next in 2025)

GMP DWH Data Visualizations
https://data.pops-gmp.org/2020/all/#/gmp3/spatial-distribution
available 24/7

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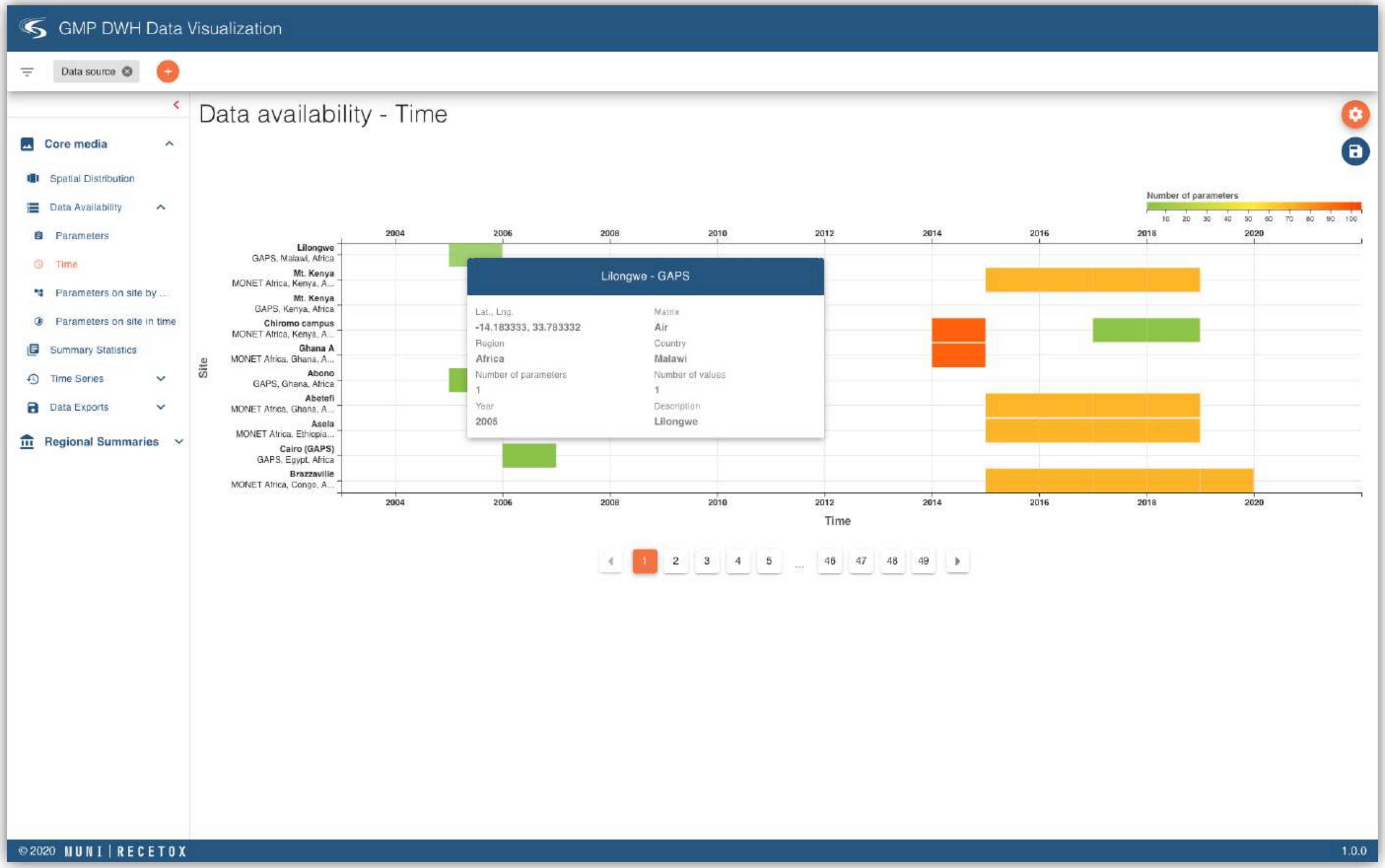
Data Availability Module



Data Availability Module

- time series
- chemical parameter
- matrices on site
- parameters on site in time

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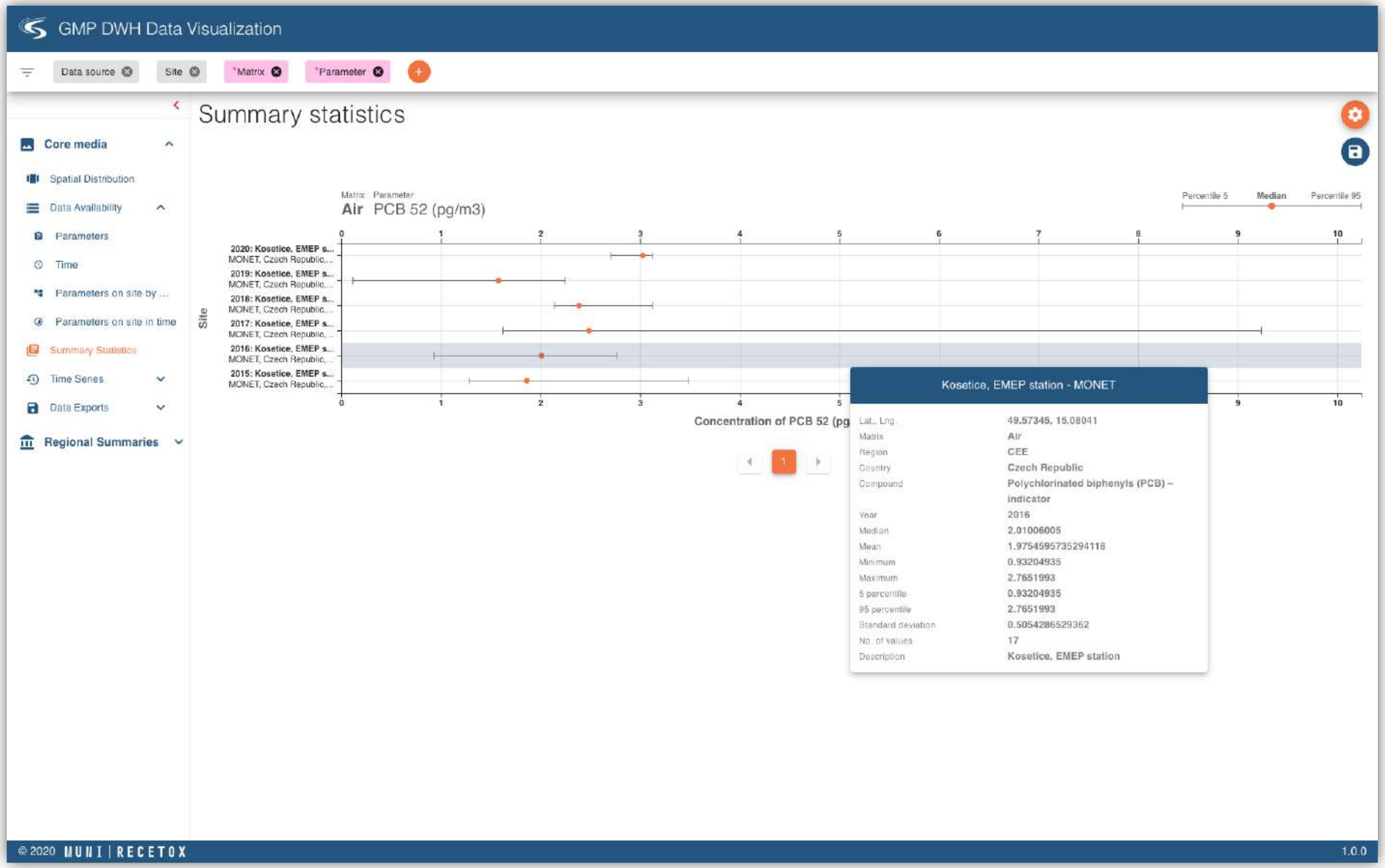
Summary Statistics Module



Summary Statistics Module

multiple sites or single site (per parameter)

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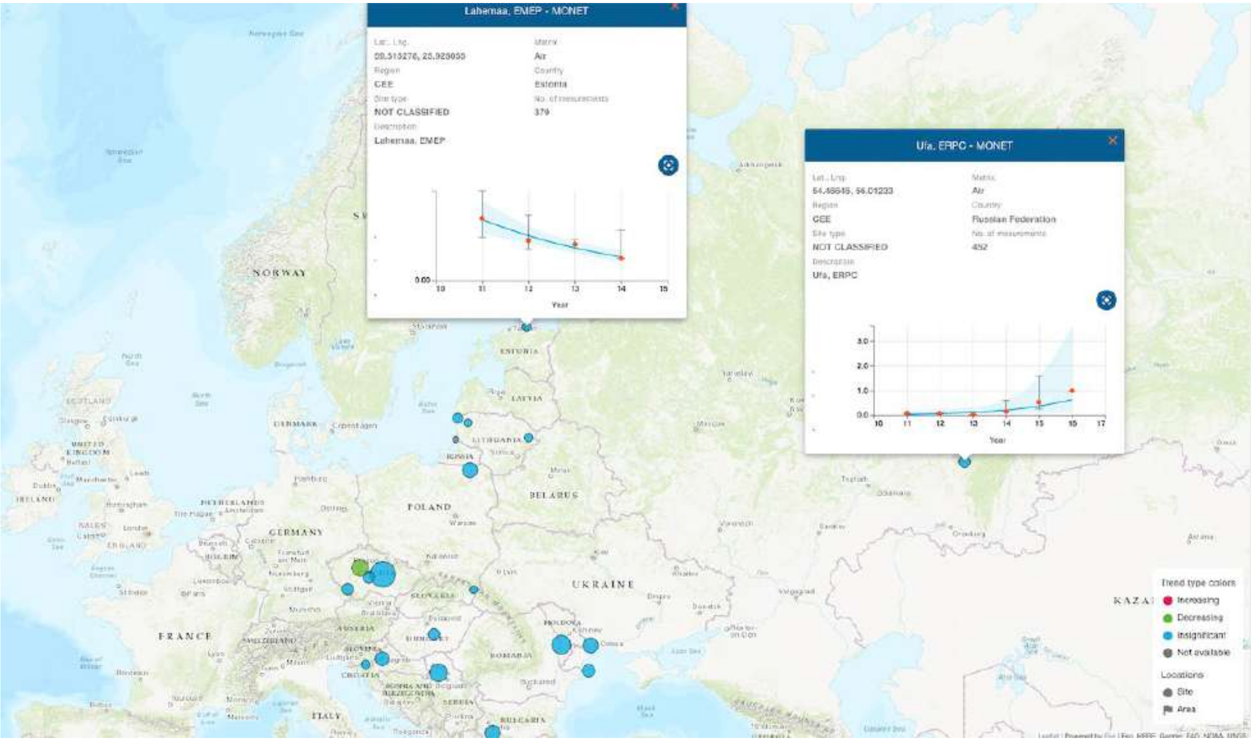
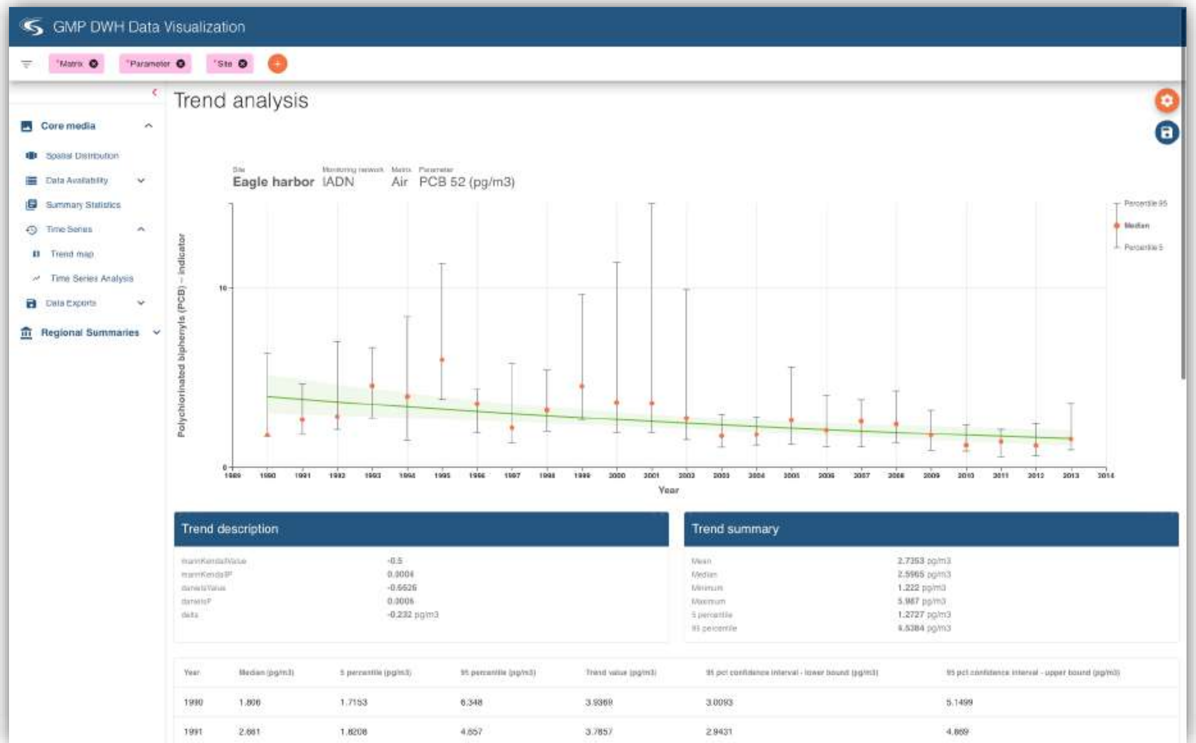
Trend analysis

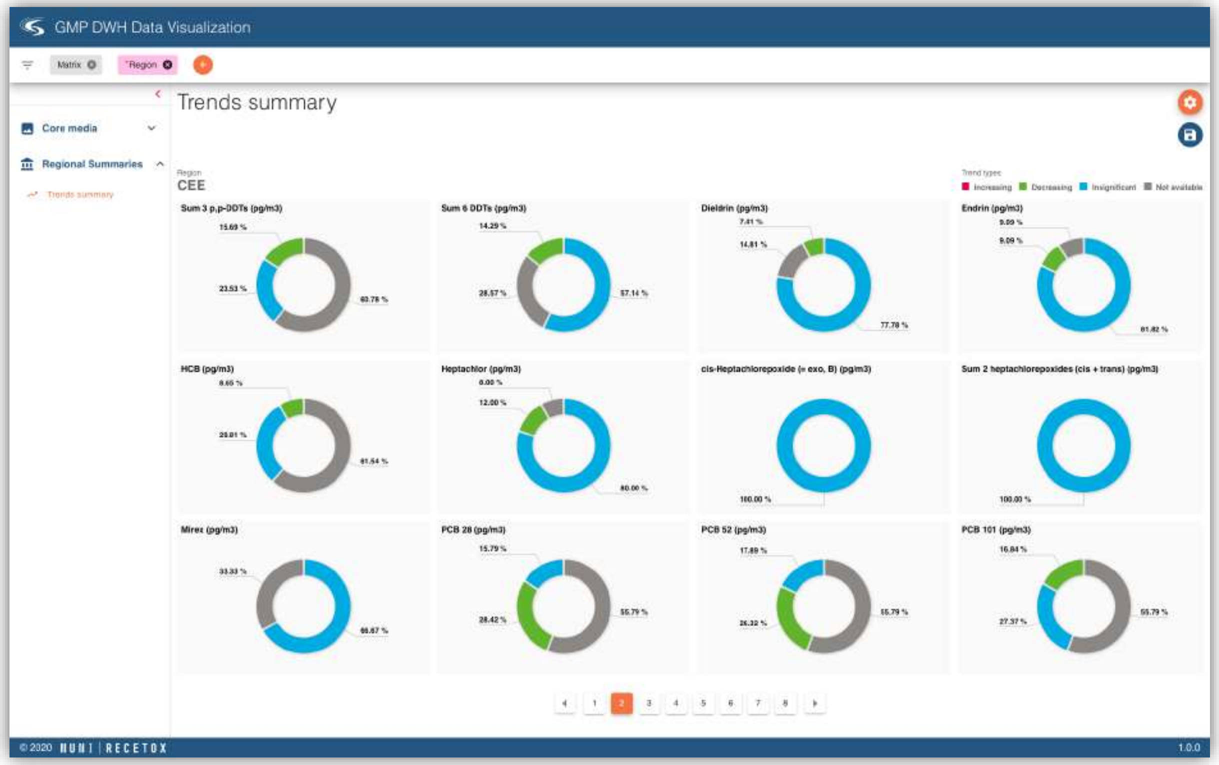


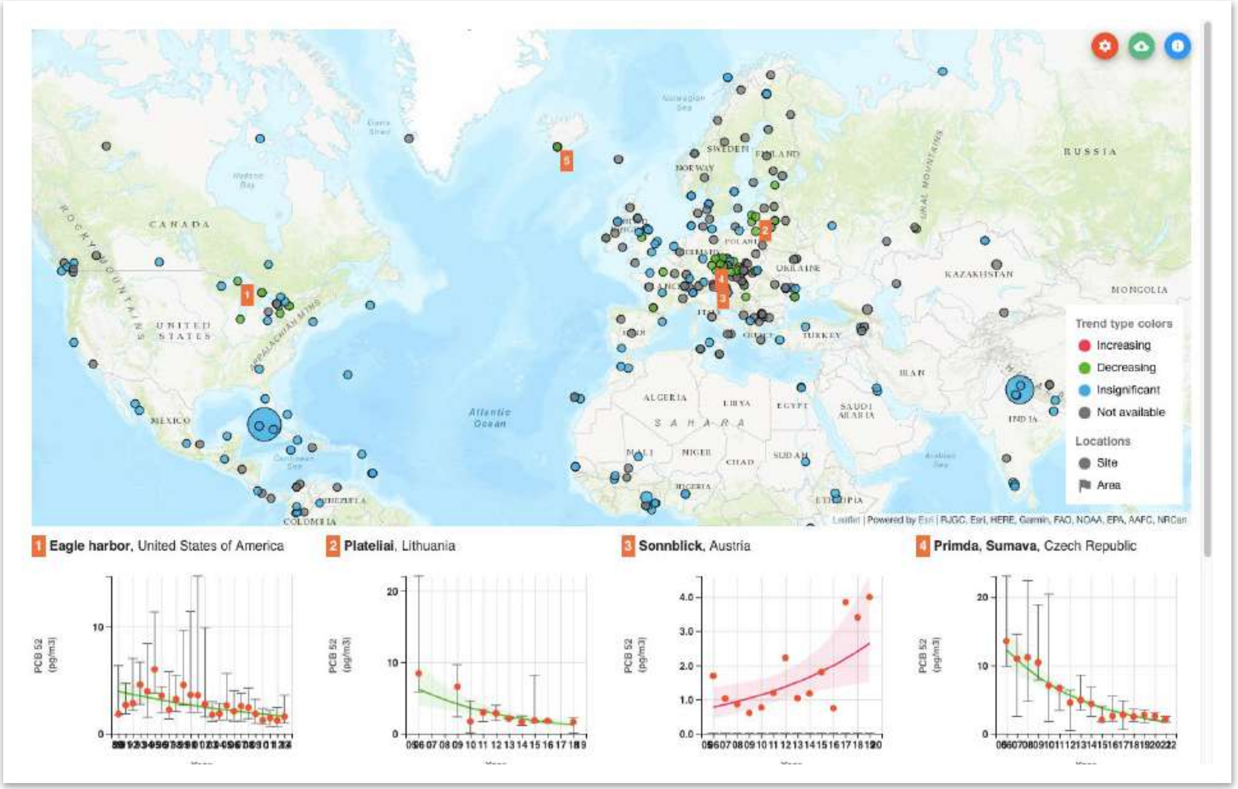
Trend analysis
multiple sites in map, detail on a site



Trend analysis module
single site, trend characteristics and description

GMP DWH new tools for decision makers





GMP DWH Visualizations
Trend analysis - Regional Summaries

GMP DWH Data Visualizations
trend in maps and trend exports

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trend maps and charts are shown in several regional POPs monitoring reports and in the global one, too

GMP DWH present and future

Further work will be mandated by upcoming COP 11 (May 2023) in line with Global Monitoring Plan - roadmap/implementation plan

Expectations

- GMP DWH to continue provide a repository/visualization on POPs monitoring activities and support elaboration of GMP4 regional reports (due for SC COP13 in 2027, additional dataset covering 2020-2025/6) and of the GMP4 global report (due for SC COP15)
- IT technology for data management console (DMC) and visualizations re-fit for 2025
- coverage of GMP guidance document as updated (update for COP10)
- data imports to start 2025 the latest

GMP DWH present and future

Further work will be mandated by upcoming COP 11 (May 2023) in line with Global Monitoring Plan - roadmap/implementation plan

Expectations

GMP DWH to continue provide a repository/visualization on POPs monitoring activities and support elaboration of GMP4 regional reports (due for SC COP13 in 2027, additional dataset covering 2020-2025/6) and of the GMP4 global report (due for SC COP15

IT technology re-fit for 2025

coverage of GMP guidance document as updated

Challenges

data availability for some matrices?

continuation of some multi regional activities - air - i.e. MONET or GAPS - confirmed, for others unclear

Challenges towards GMP-4

POPs air sampling in outside GMP partner networks very limited, if any

MONET network (operated by RECETOX/SCRC CZ) ready to support sampling/analysis if desired

AQUA MONET - passive sampling of water

GEF GMP2 project - grab sampling

Goal = to have samples collected (at least) and available data for GMP4 reports, otherwise almost no new data post 2019

Thank you for your kind attention!