NORMAN Interlaboratory study (ILS) on passive sampling of emerging pollutants

STUDY RESULTS: BDEs

Chemical Monitoring On Site (CM Onsite) organised by NORMAN Association and JRC in support of CIS WFD

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Recetox, Masaryk, University, Brno, CZ

Deltares, Utrecht, The Netherlands

Content of the presentation

Sampler exposure at a single site

- what we did and have
- analytical comparability
- same sampler type for all by organiser
- different samplers from participating labs

closer look at sampling rates

no comparison with spot sampling

Pre-screening for presence of contaminants: brominated diphenyl ethers

Sampler: Altesil silicone rubber sheets 460 cm^2; 18.6.-2.7.2010

Analysed by: RECETOX, Brno

pg/sampler

	Blank 1	Blank 2	Sampler 1	Sampler 2
BDE 28	<0.5	0.6	760	620
BDE 47	6.8	7.4	9090	7300
BDE 66	0.6	0.9	311	270
BDE 100	0.8	1.0	970	830
BDE 99	6.1	6.4	4100	3500
BDE 85	<0.5	<0.4	154	133
BDE 154	<1.3	0.9	113	105
BDE 153	4.9	5.0	109	96
BDE 183	9.4	14.3	58	63
BDE 209	7.2	27.9	29	110

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Design of the exercise

Standard solution

Concentration (4)

Provided sampler

N **of t**argets in ng (3) → N per A

PRCs in any unit (3+1ref+1spiked)

(but unit equal for reference and exposed)

Estimated Cw (3)

Participants sampler

Target N in ng (3)

Estimated Cw (3)

Exposure around August 2011

Data from 14 laboratories

PRCs by 10

Prov samplers Cw by 9

Part. Samplers Cw by 6

Reported numbers	
Sampler mass	
Sampler surface area	
Target compounds	
BDE 28	BDE 100
BDE 47	BDE 153
BDE 99	BDE 154
Performance references compounds (PRCs)	
D10-biphenyl	CB030
CB001	CB050
CB002	CB055
CB003	CB078
CB010	CB104
CB014	CB145
CB021	CB204

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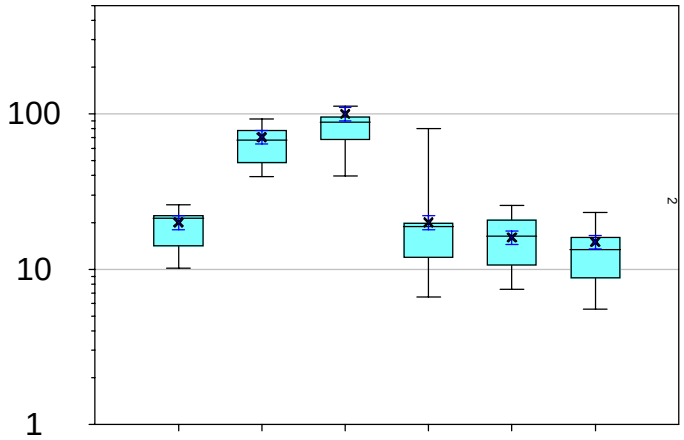
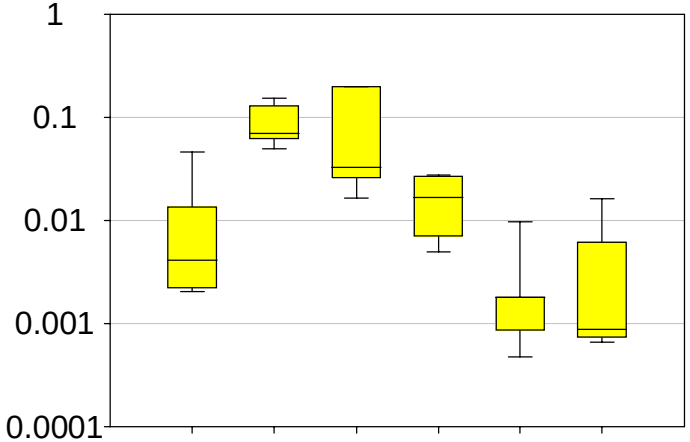
Quick overview all data in Boxplots

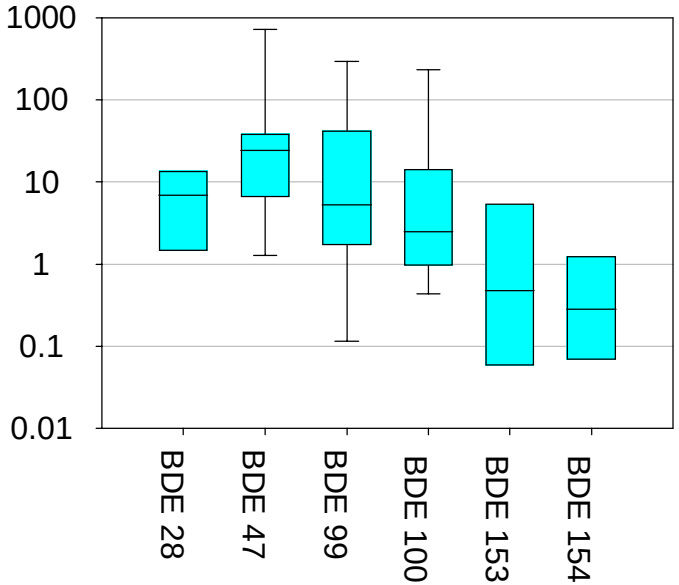
Standard solution, µg/mL



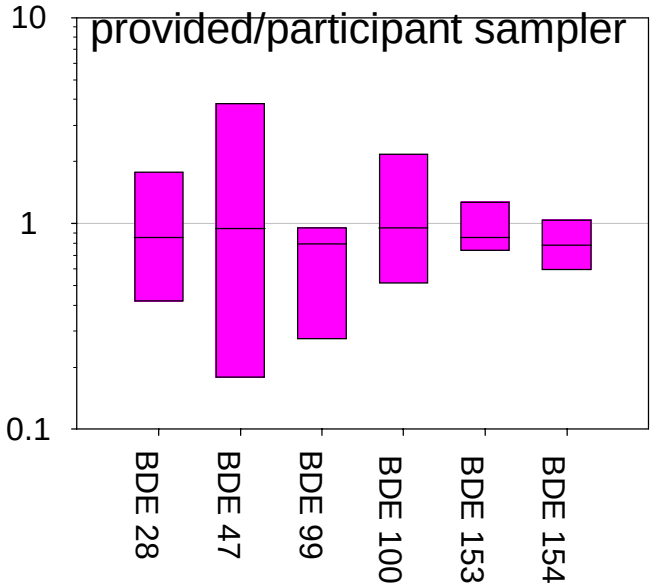
Provided sampler, ng/cm^2



Participant sampler, C_w in pg/L



Ratio of water oncentrations provided/participant sampler



Then per parameter for all labs

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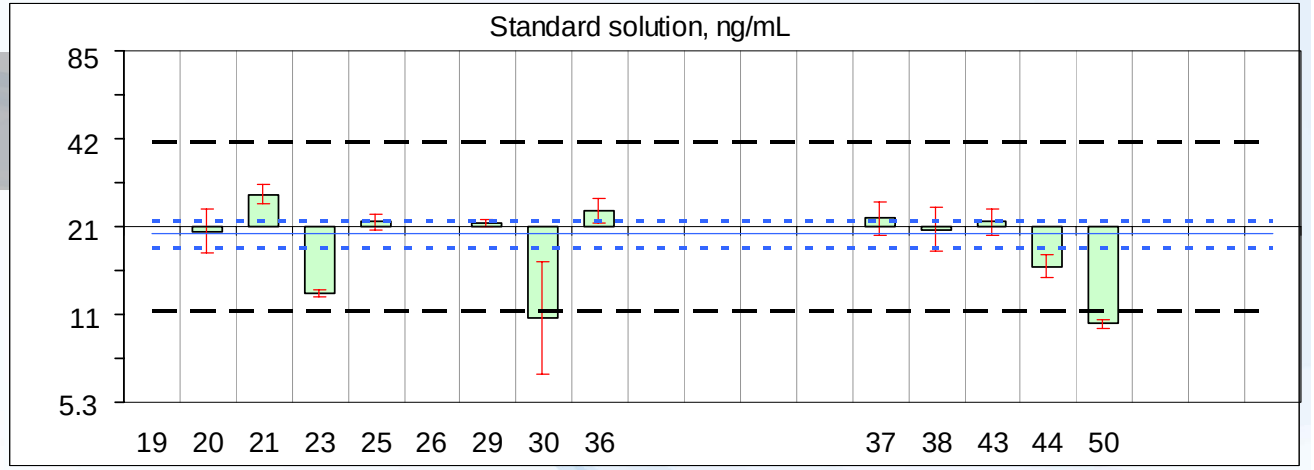
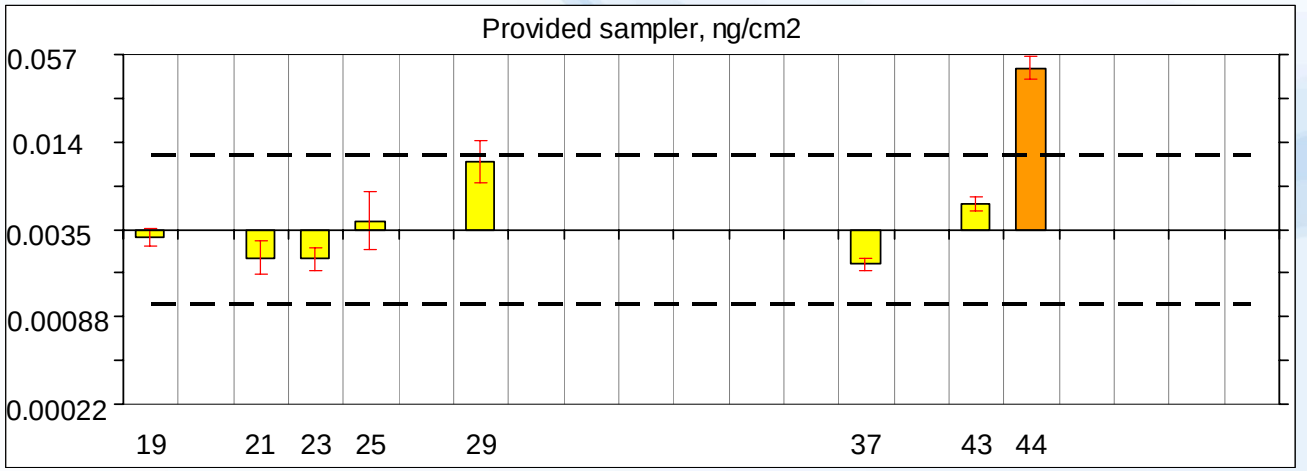
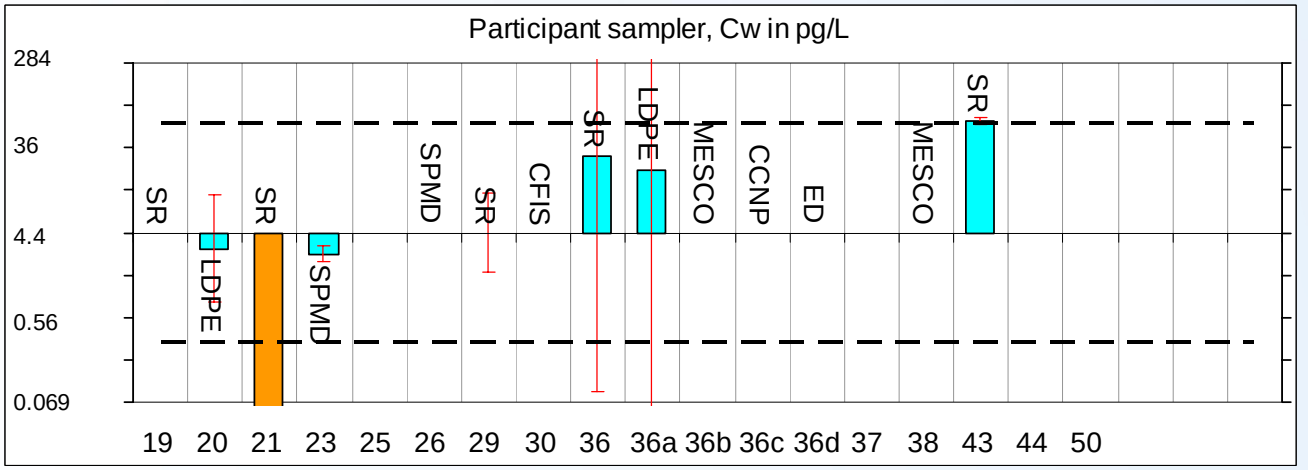
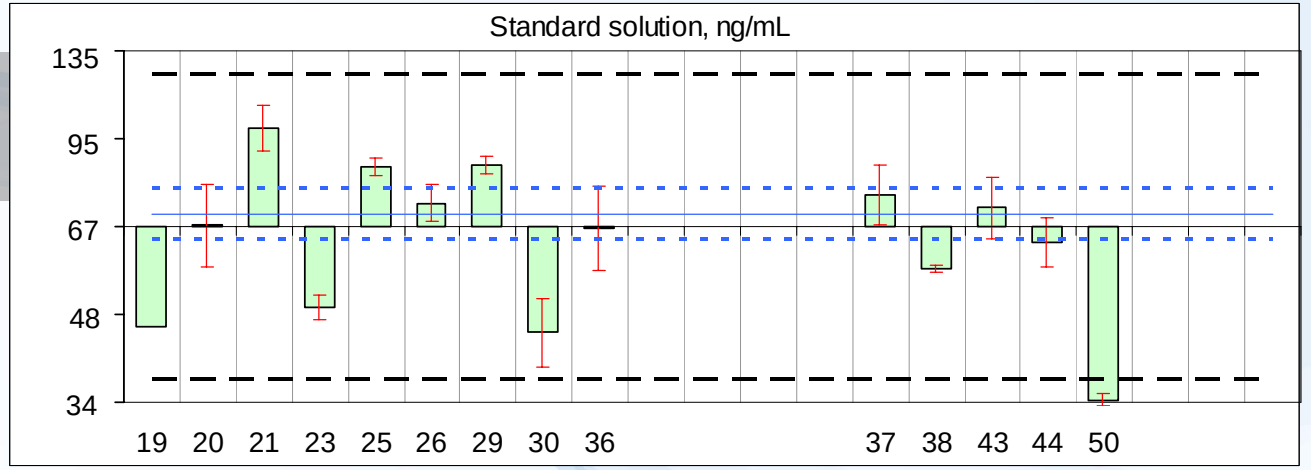
BDE28

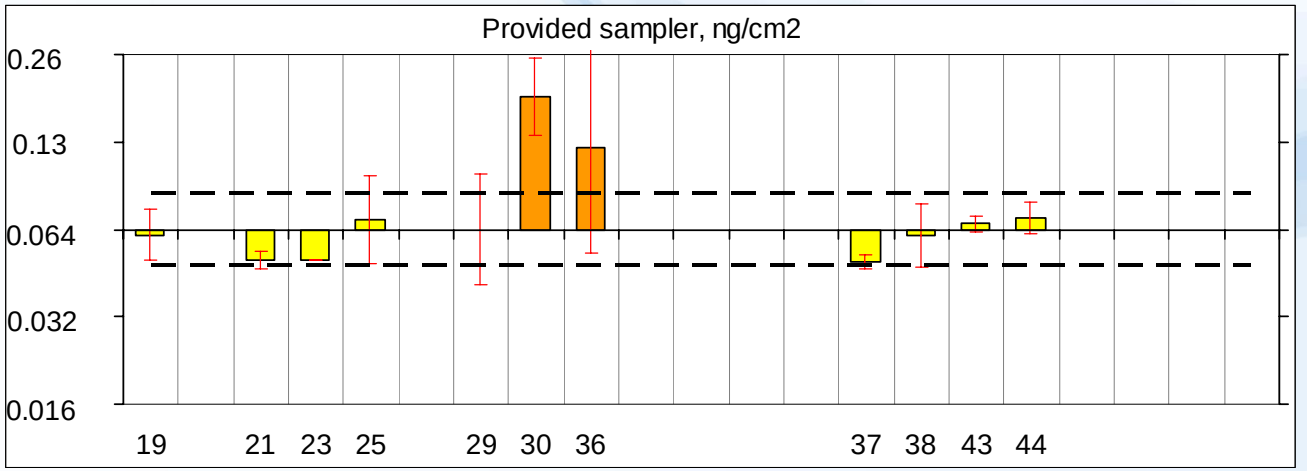

Standard solution, ng/mL
85
42
21
11
5.3
19 20 21 23 25 26 29 30 36 37 38 43 44 50

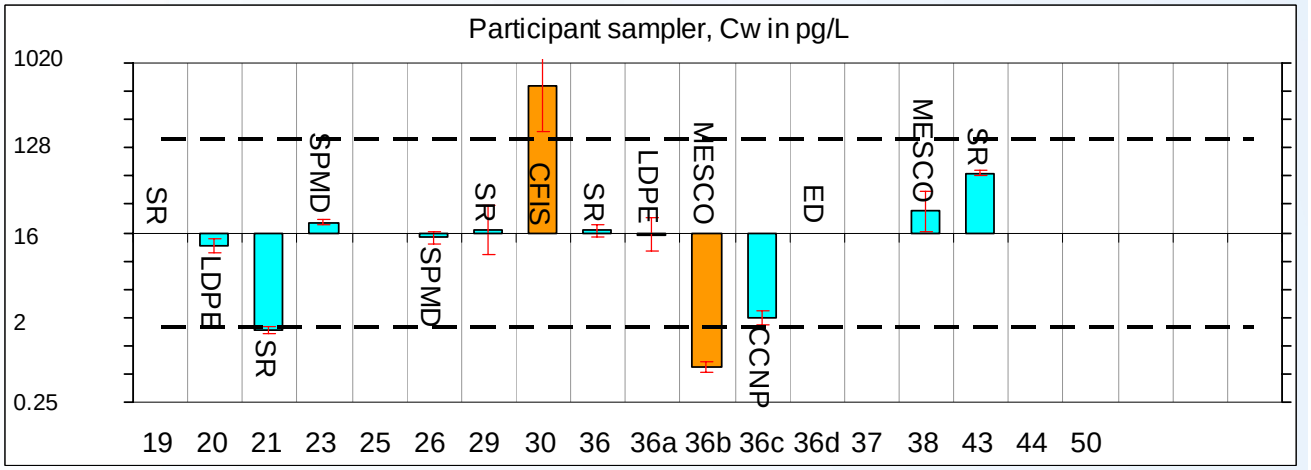

Provided sampler, ng/cm2
0.057
0.014
0.0035
0.00088
0.00022
19 21 23 25 29 37 43 44


Participant sampler, Cw in pg/L
284
36
4.4
0.56
0.069
SR
LDPE
SR
SPMD
SPMD
SR
CFIS
SR
LDPE
MESCO
CCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

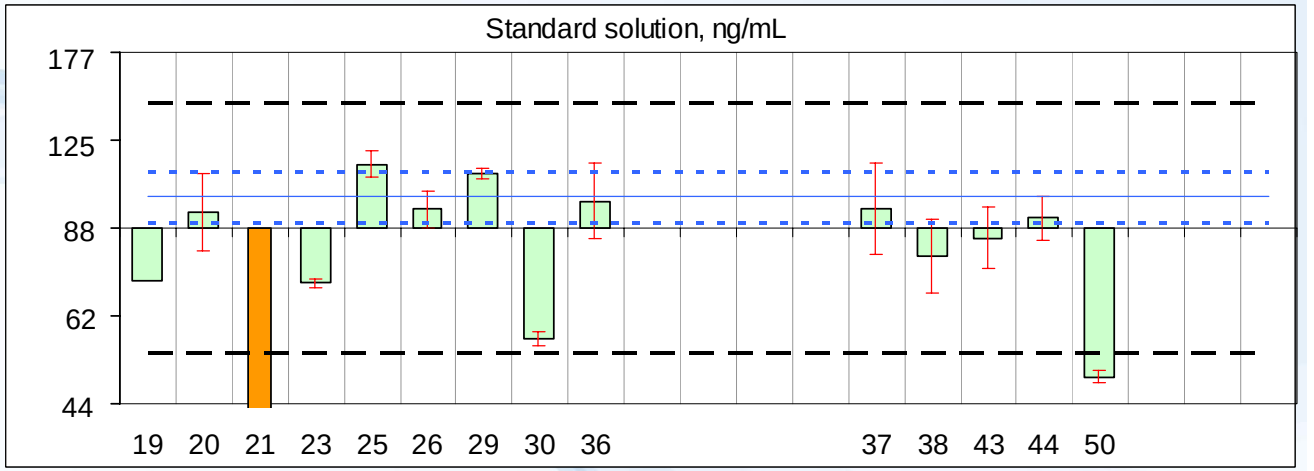
BDE47

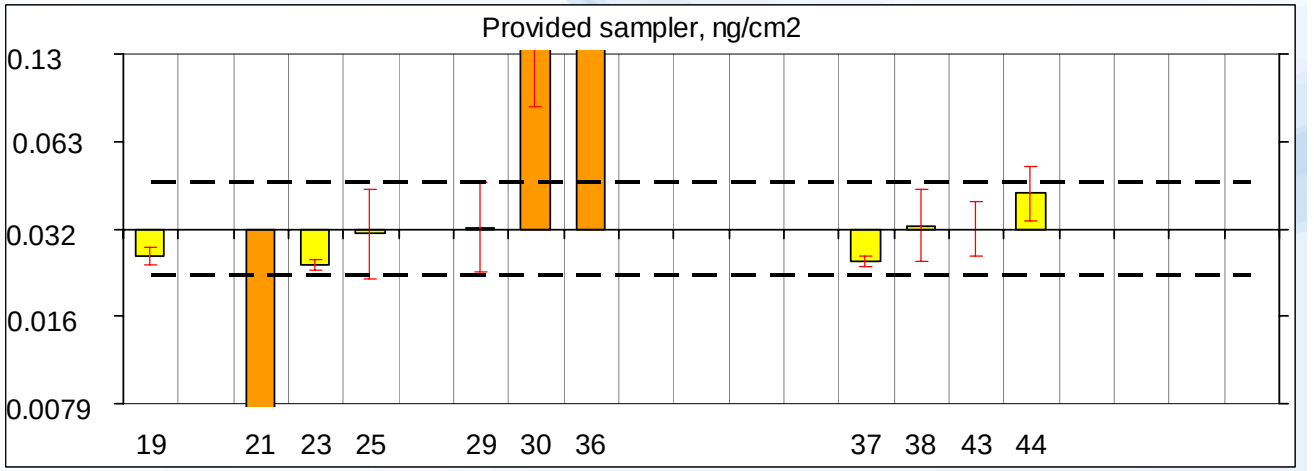

Standard solution, ng/mL
135
95
67
48
34
19 20 21 23 25 26 29 30 36 37 38 43 44 50

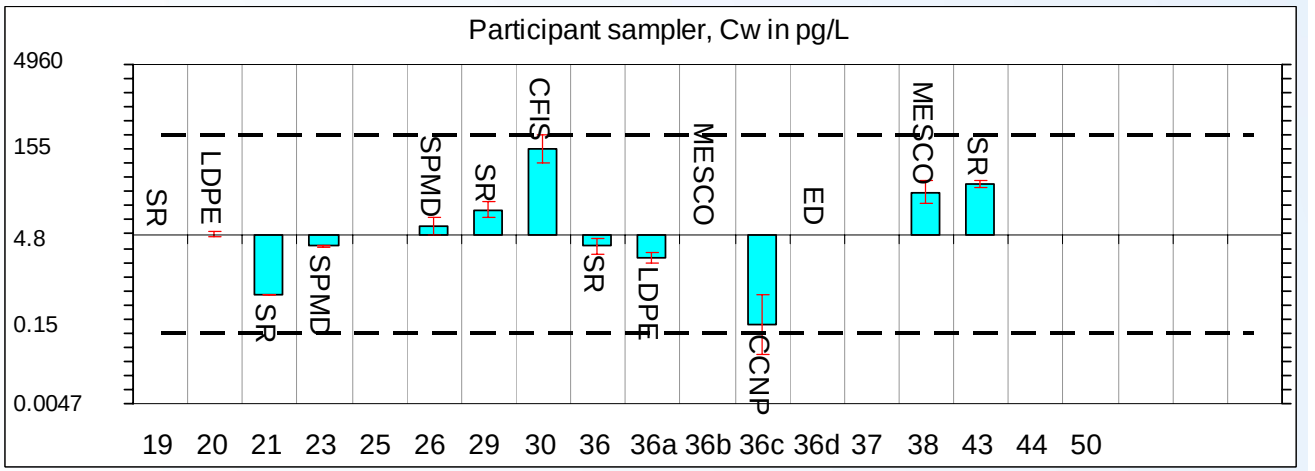

Provided sampler, ng/cm2
0.26
0.13
0.064
0.032
0.016
19 21 23 25 29 30 36 37 38 43 44


Participant sampler, Cw in pg/L
1020
128
16
2
0.25
SR
LDPE
SR
SPMD
SPMD
SR
CFIS
SR
LDPE
MESCO
CCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

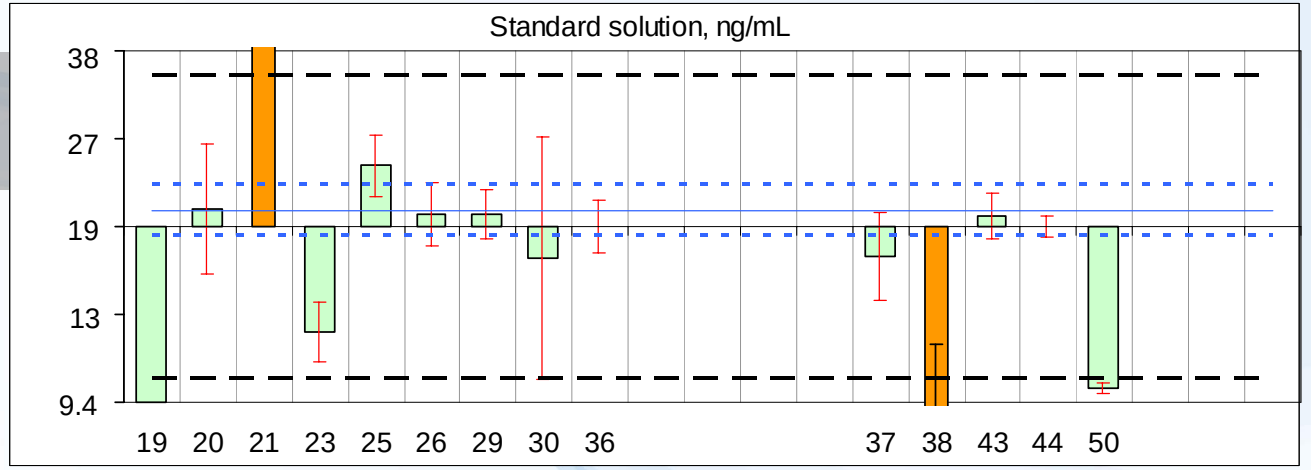
BDE99

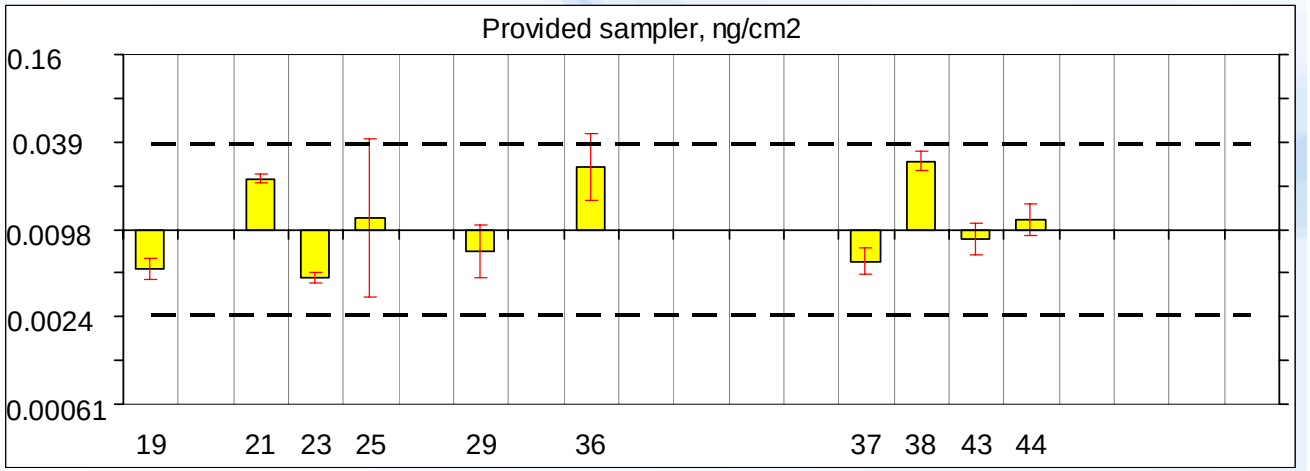

Standard solution, ng/mL
177
125
88
62
44
19 20 21 23 25 26 29 30 36 37 38 43 44 50

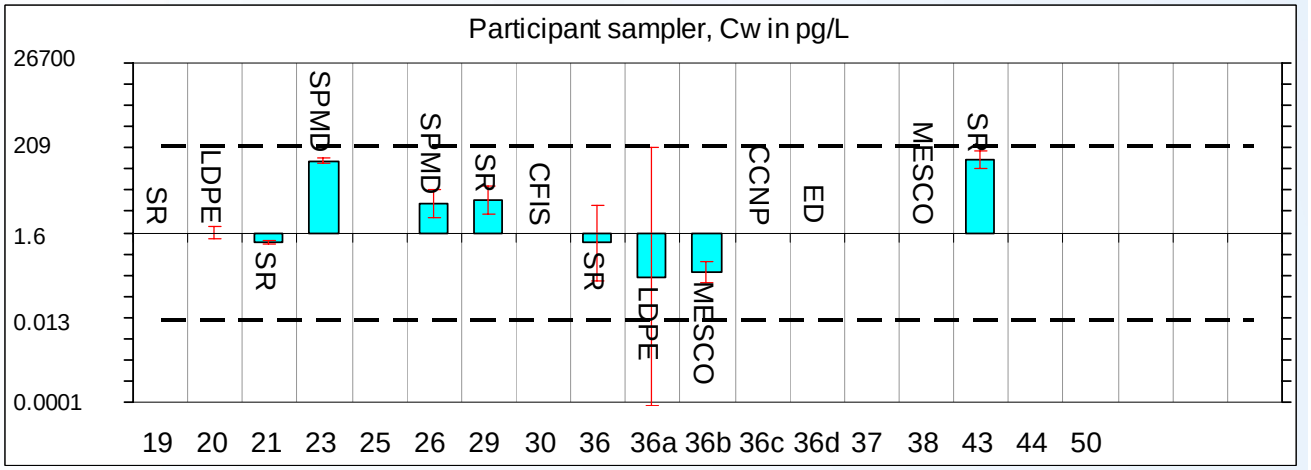

Provided sampler, ng/cm2
0.13
0.063
0.032
0.016
0.0079
19 21 23 25 29 30 36 37 38 43 44


Participant sampler, Cw in pg/L
4960
155
4.8
0.15
0.0047
SR
LDPE
SR
SPMD
SPMD
SR
CFIS
ISR
LDPE
MESCO
CCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

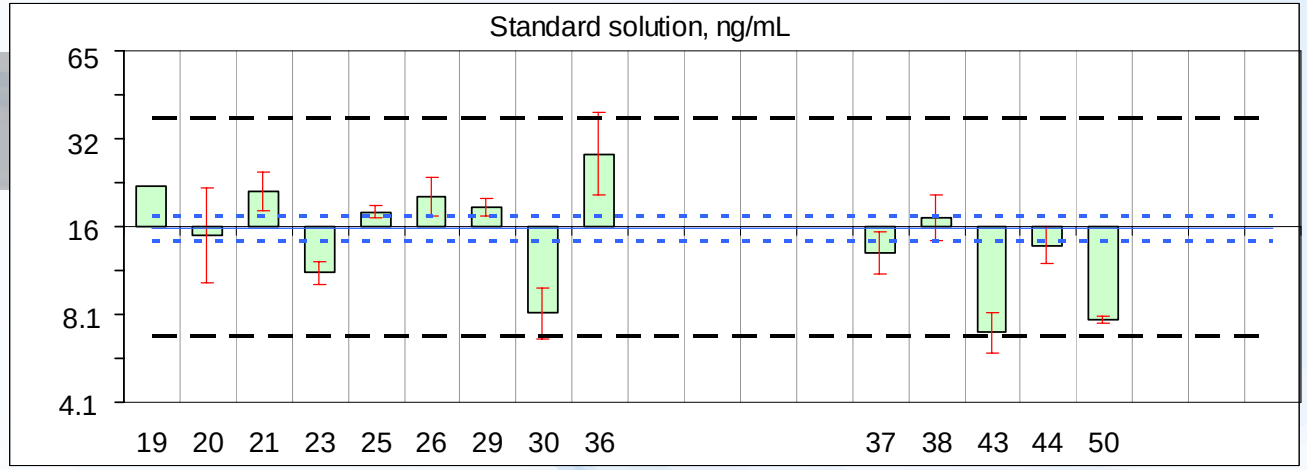
BDE100

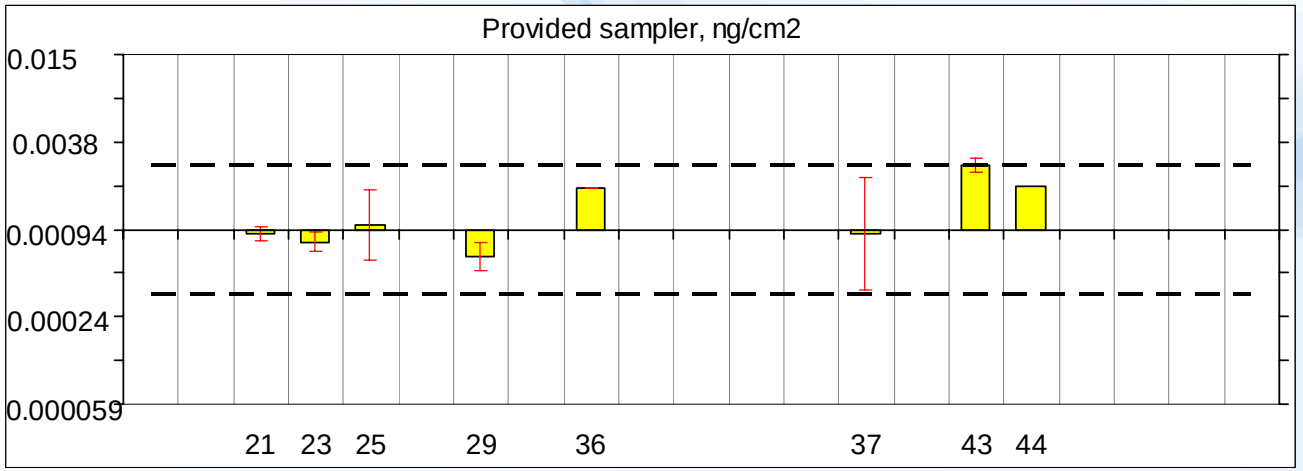

Standard solution, ng/mL
38
27
19
13
9.4
19 20 21 23 25 26 29 30 36 37 38 43 44 50

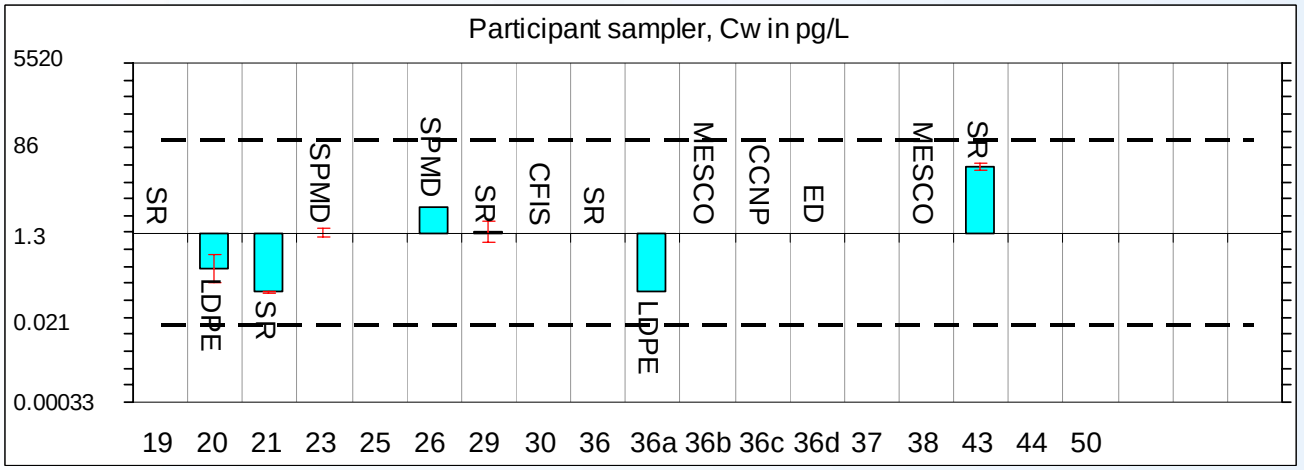

Provided sampler, ng/cm2
0.16
0.039
0.0098
0.0024
0.00061
19 21 23 25 29 36 37 38 43 44


Participant sampler, Cw in pg/L
26700
209
1.6
0.013
0.0001
SR
LDPE
SR
SPMD
SPMD
ISR
CFIS
SR
LDPE
MESCO
CCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

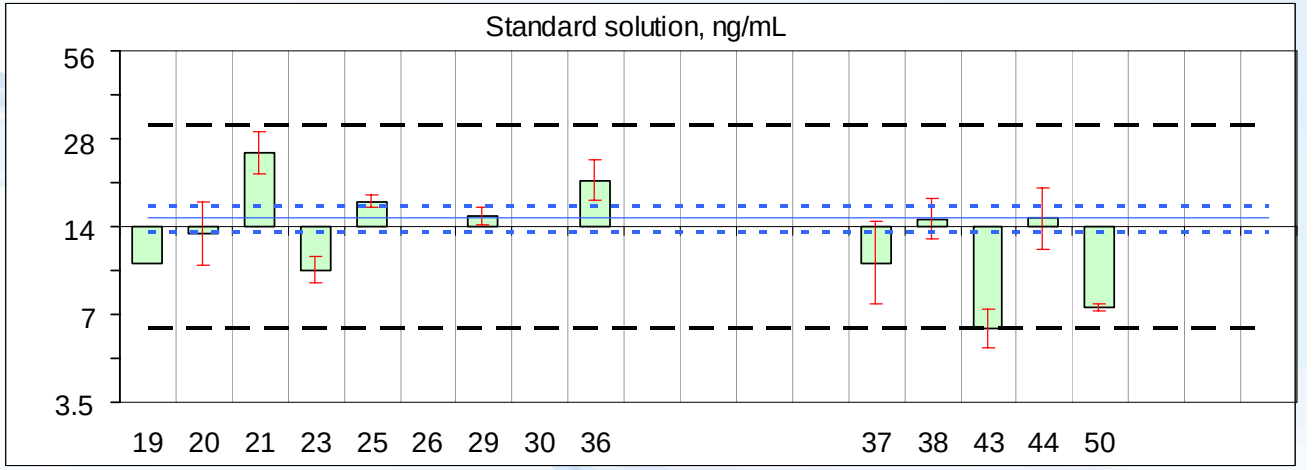
BDE 153

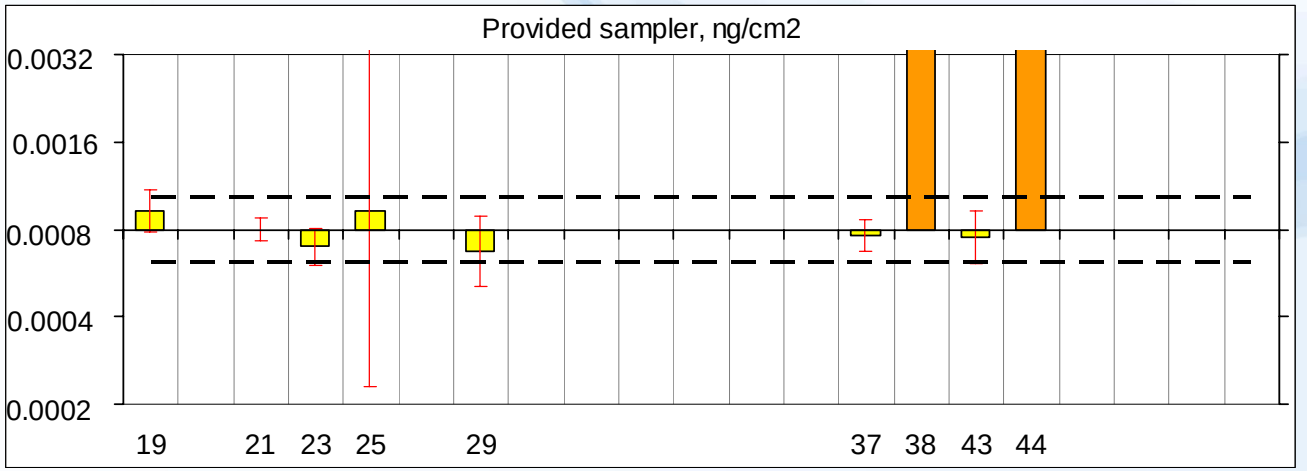

Standard solution, ng/mL
65
32
16
8.1
4.1
19 20 21 23 25 26 29 30 36 37 38 43 44 50

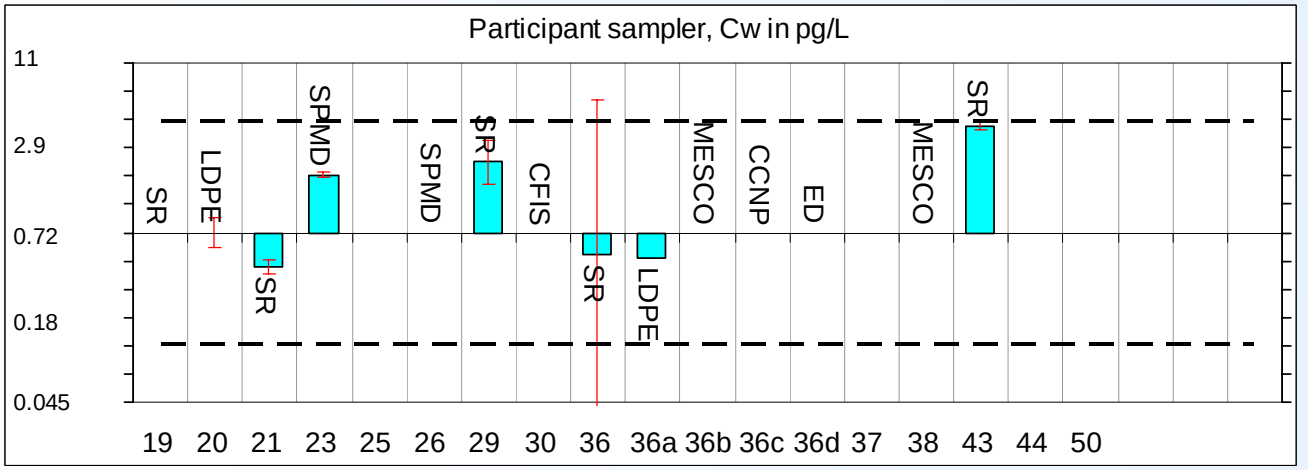

Provided sampler, ng/cm2
0.015
0.0038
0.00094
0.00024
0.000059
21 23 25 29 36 37 43 44


Participant sampler, Cw in pg/L
5520
86
1.3
0.021
0.00033
SR
LDPE
SR
SPMD
SPMD
SR
CFIS
SR
LDPE
MESCO
ICCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

BDE 154


Standard solution, ng/mL
56
28
14
7
3.5
19 20 21 23 25 26 29 30 36 37 38 43 44 50


Provided sampler, ng/cm2
0.0032
0.0016
0.0008
0.0004
0.0002
19 21 23 25 29 37 38 43 44


Participant sampler, Cw in pg/L
11
2.9
0.72
0.18
0.045
SR
LDPE
SR
SPMD
SPMD
SR
CFIS
SR
LDPE
MESCO
CCNP
ED
MESCO
SR
19 20 21 23 25 26 29 30 36 36a 36b 36c 36d 37 38 43 44 50

Variability in reported results

BDEs					
		Coefficient of variation (%)			
		Within laboratory		Between laboratory	
Variability:					
Matrix analysed:		Min.	Max.	Min.	Max.
	Standard solution	4%	11%	25%	45%
Provided sampler	NPS amount	9%	20%	13%	77%
	NPS water concentration	11%	137%	68%	>200%
Participant sampler	PPS amount	12%	68%	41%	>200%
	PPS water concentration	14%	79%	112%	>200%

NPS – provided passive sampler; PPS – participant passive sampler

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Comparing all compounds

Are differences systematic?

Higher or lower for all compound.

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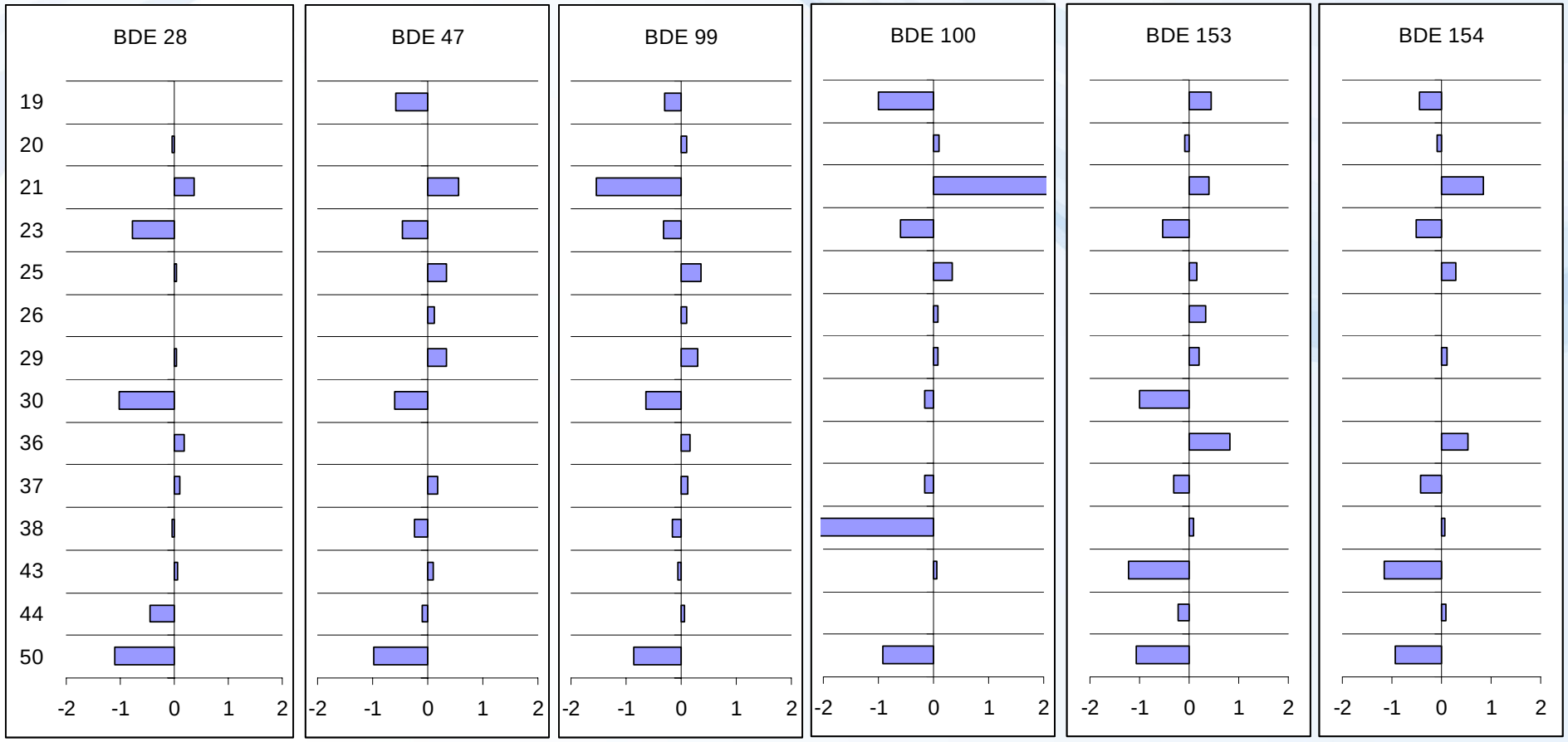
Standard solution (1=100%)



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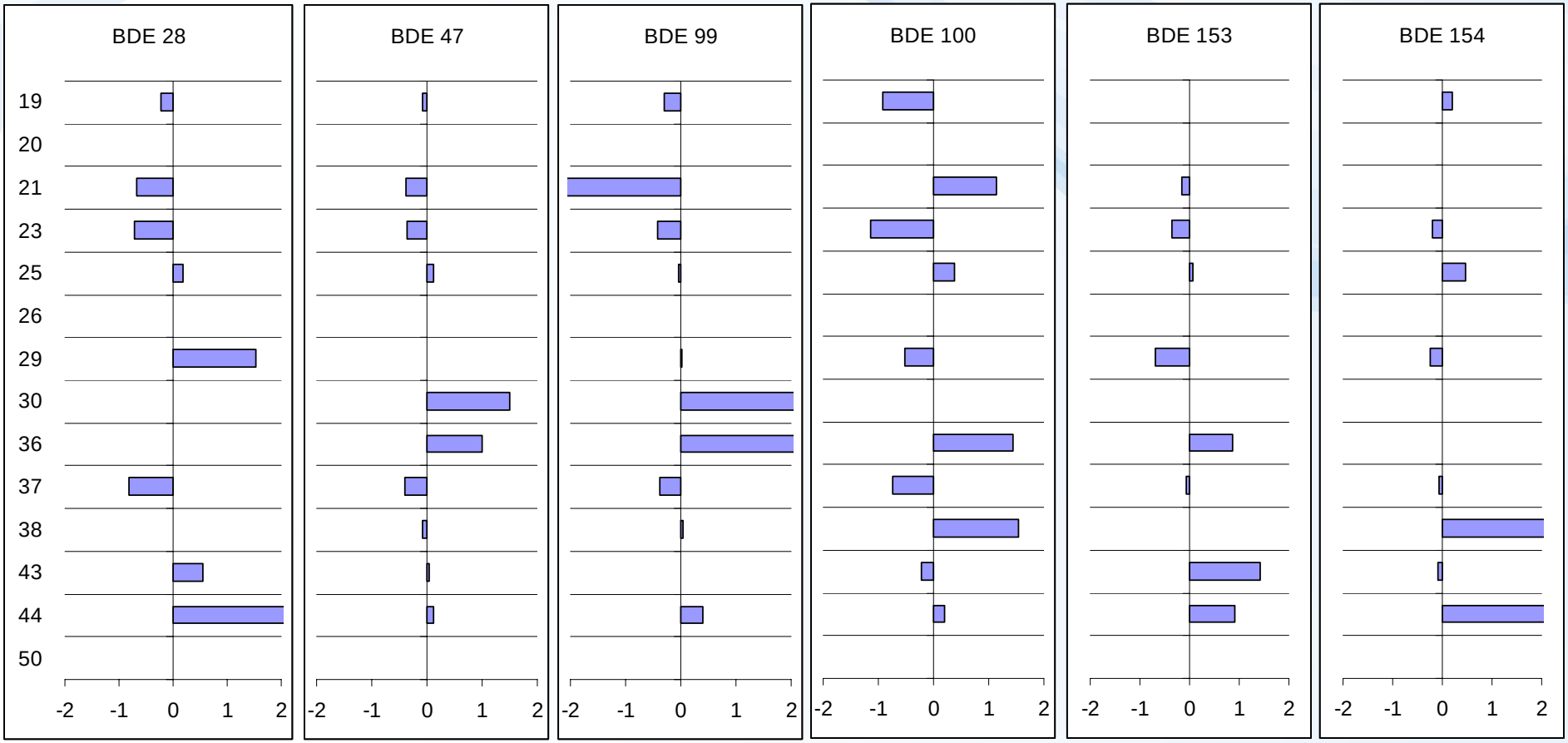
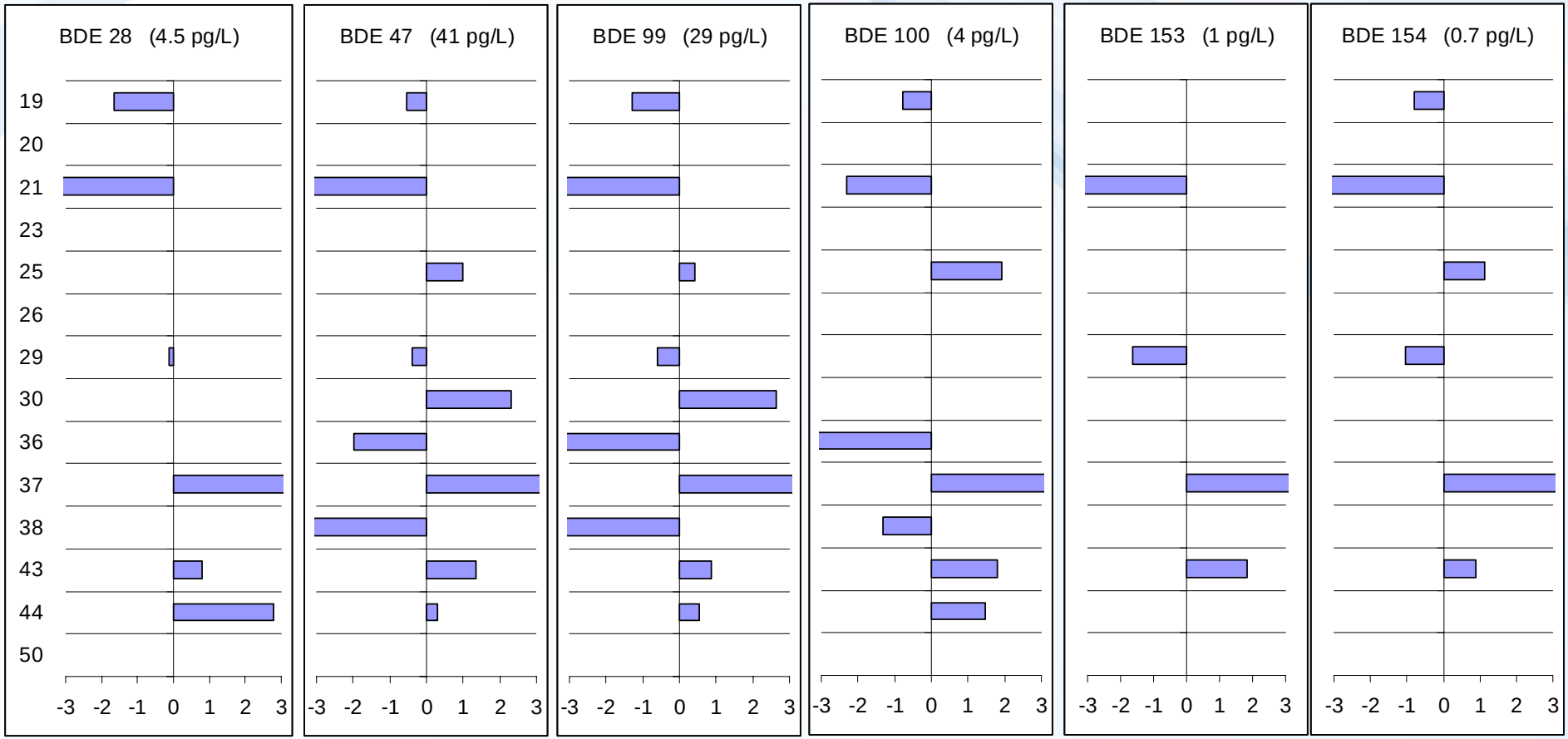
All plots provided sampler (1 is 100% deviation)



Reported C_w from provided sampler



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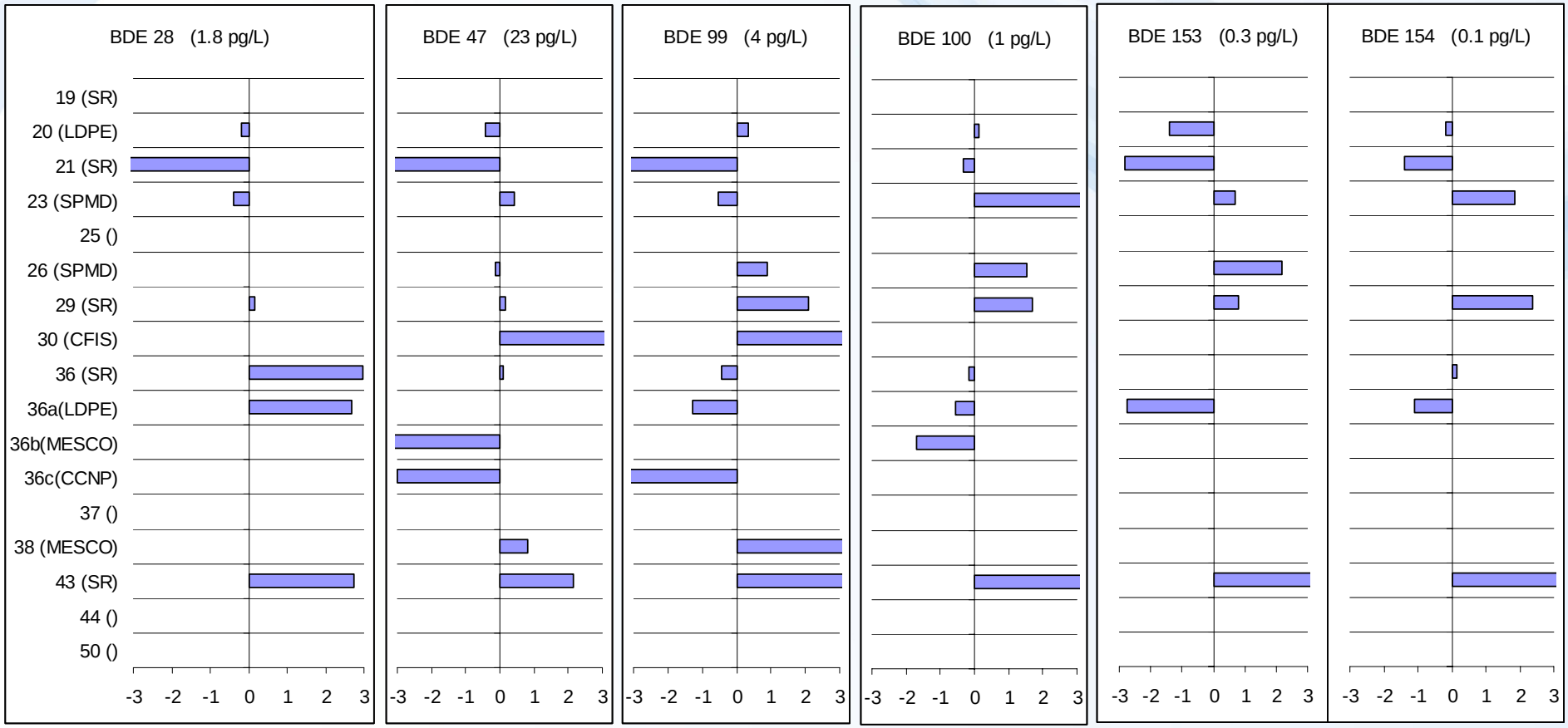
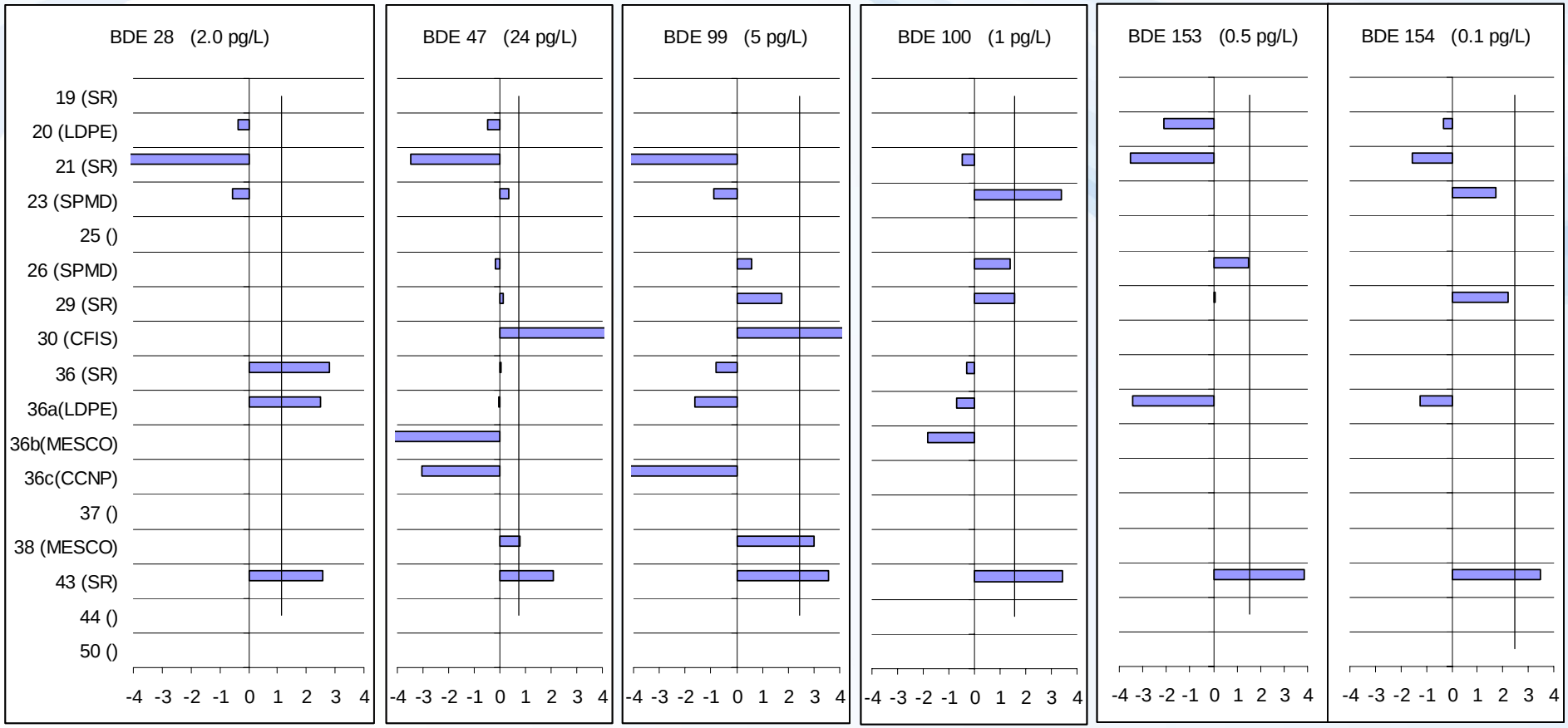
C_w from participants sampler



C_w from participants sampler with Median of Provide samplers



Comparing BDE 47

Do deviations from median correlate between:

Standard solution

Spiked sampler

Provides exposed sampler.

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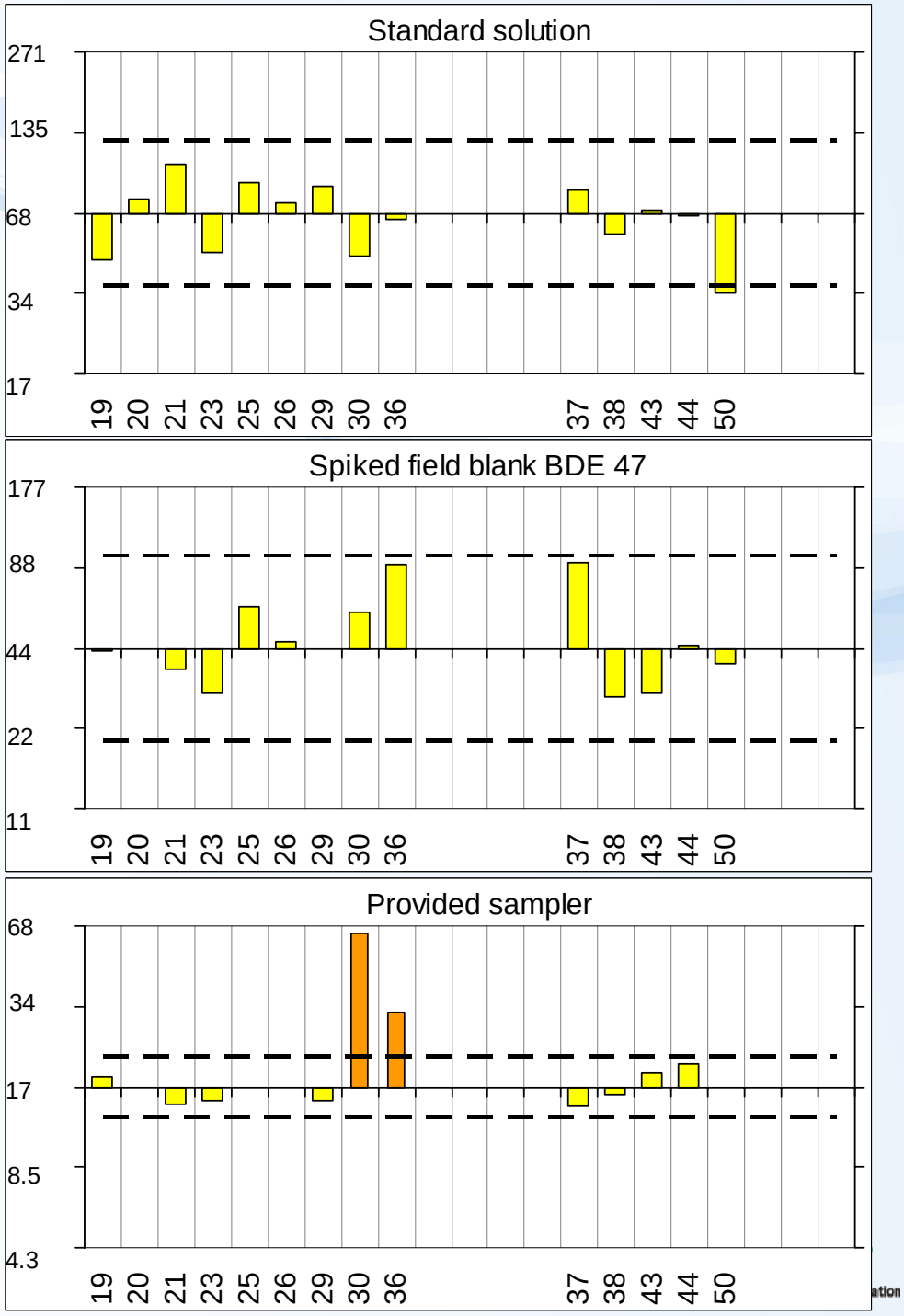
Standard solutiion

Spiked field blank

and

Provided exposed sampler



Do results of provided and participants sampler correlate?

at least if they should

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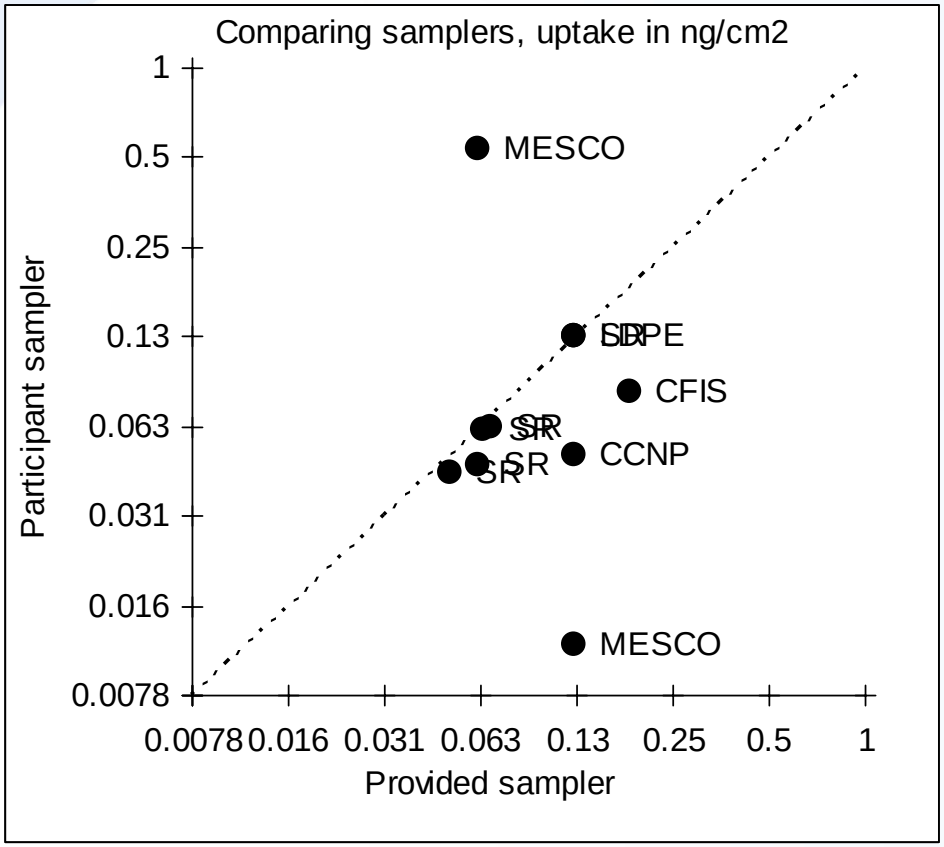
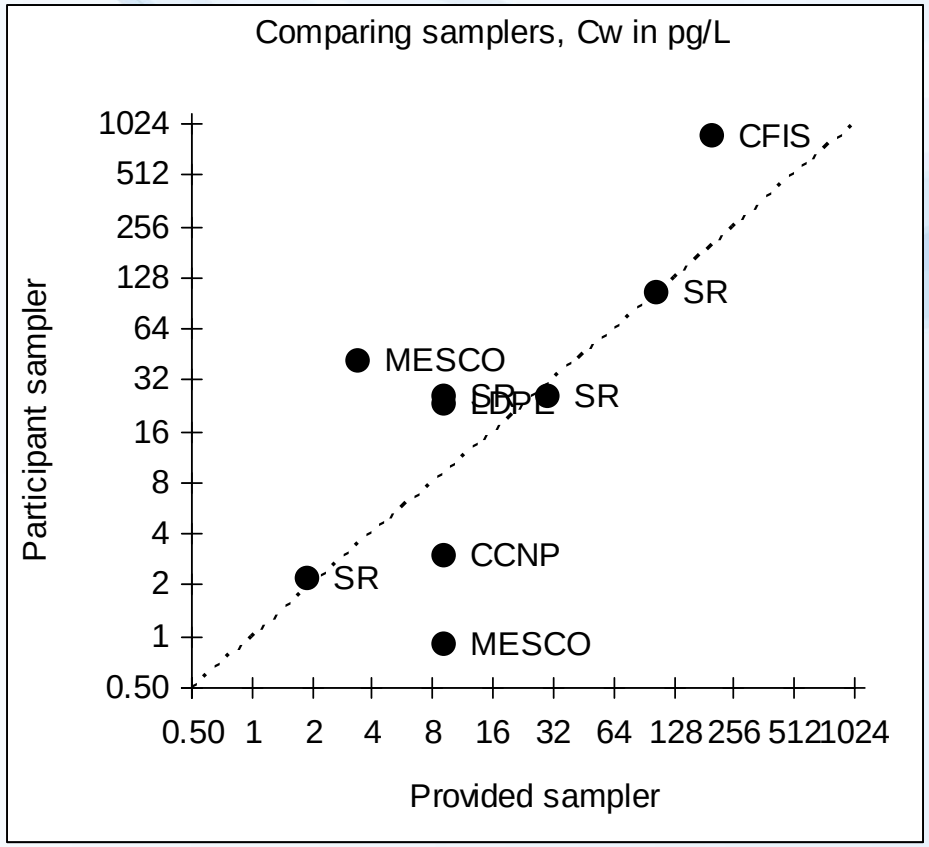
Bi-plots BDE 47





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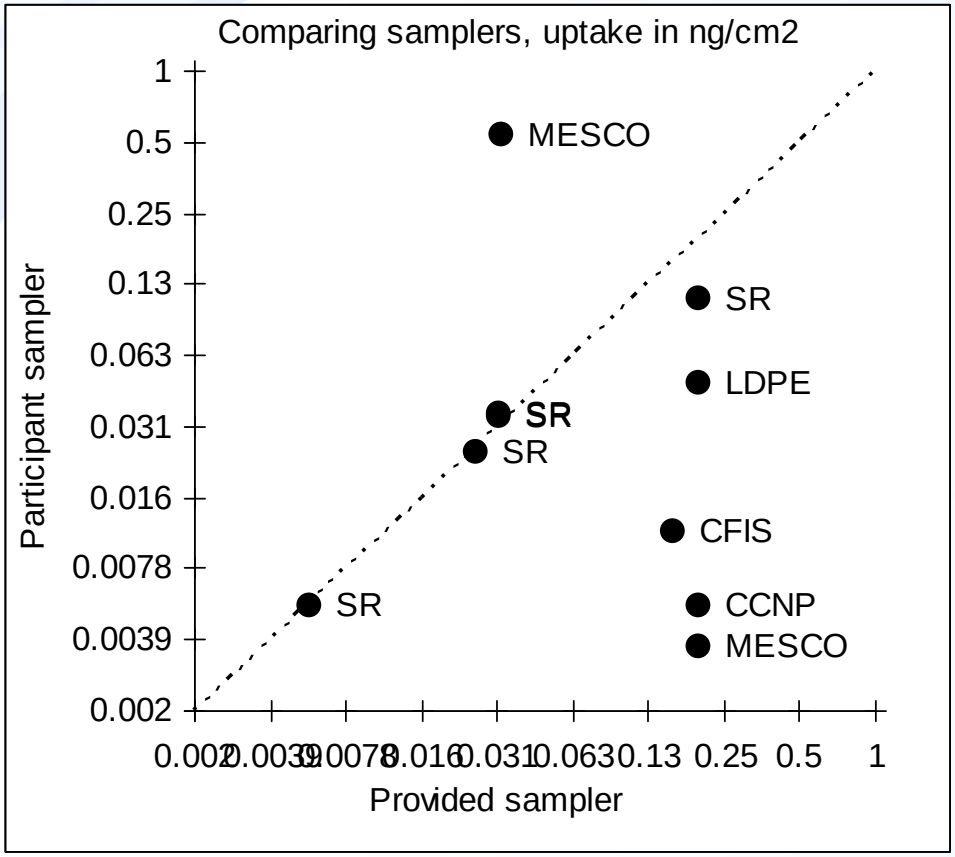
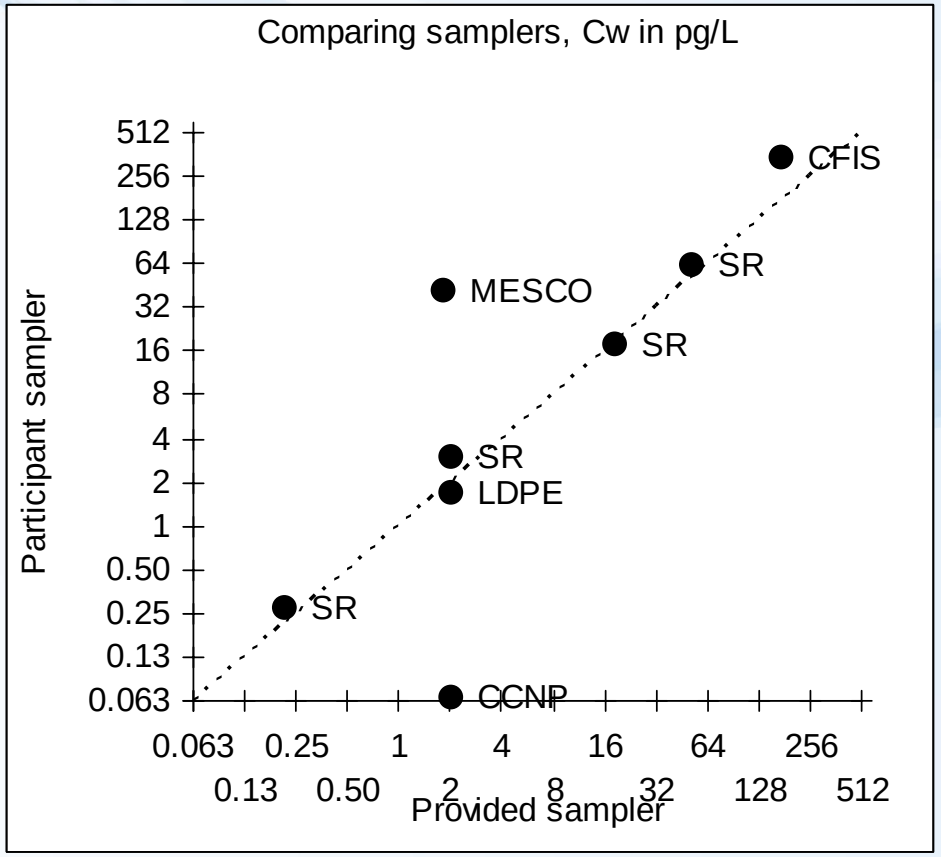
Bi-plots BDE 99





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Sampling rates

How do sampling rates compare.

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Participants R_S for provided sampler

Samplingrate used by participants:
the amount on the sampler divided
by the reported C_W

$$R_S \approx \frac{N_{\text{nps}}}{C_W}$$

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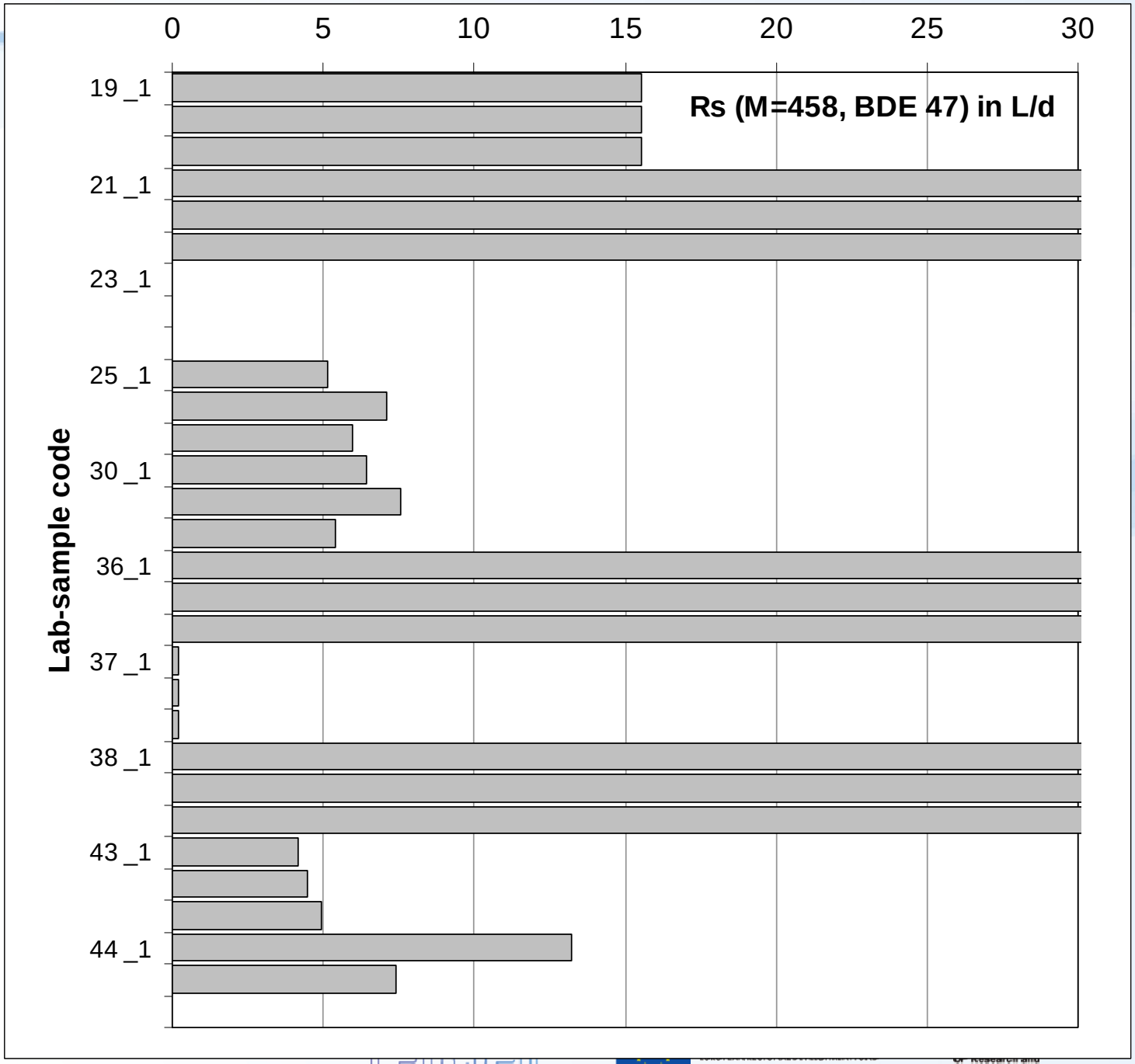
Estimations of sampling rates used by participants

RS for provided sampler as used by participants



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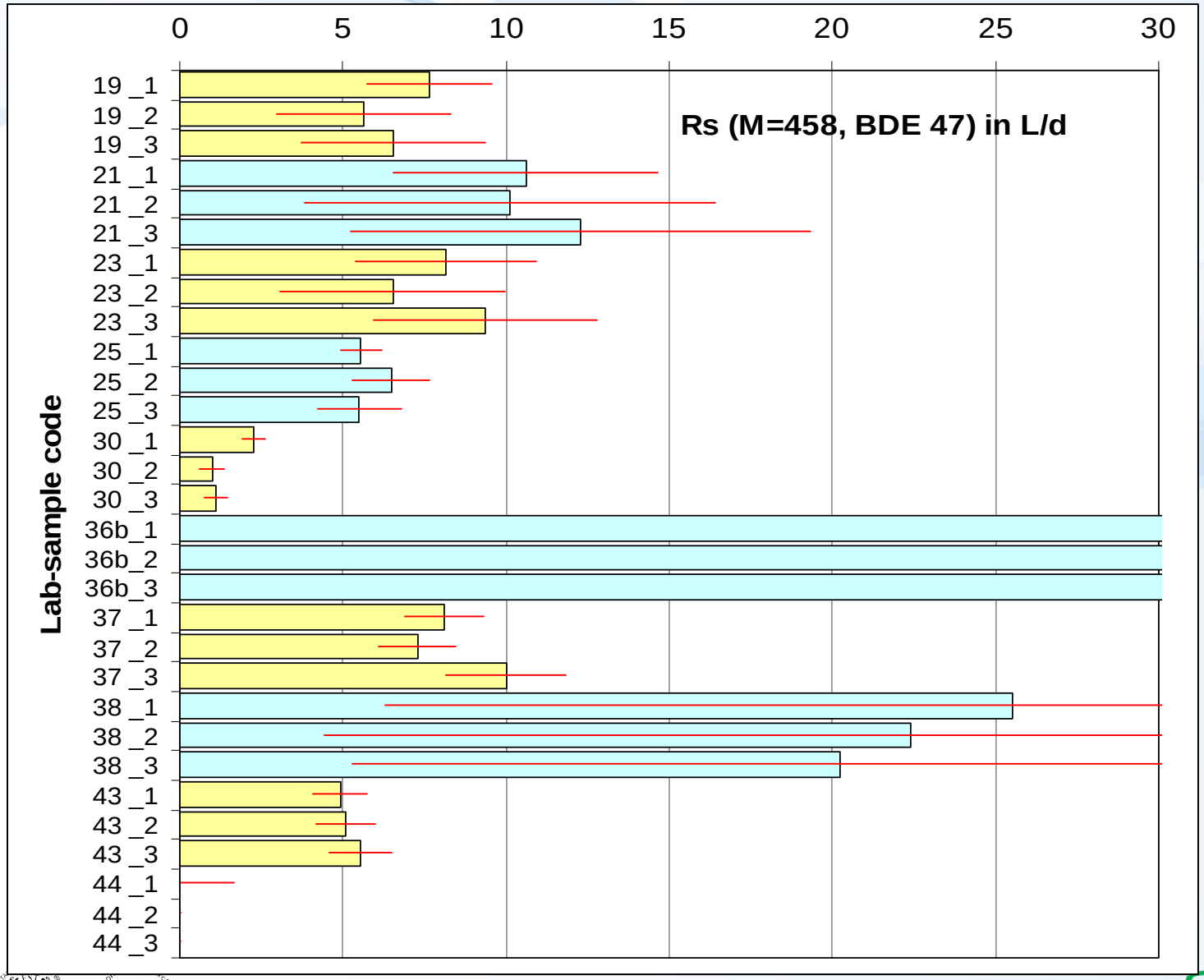
Organiser calculated sampling rates



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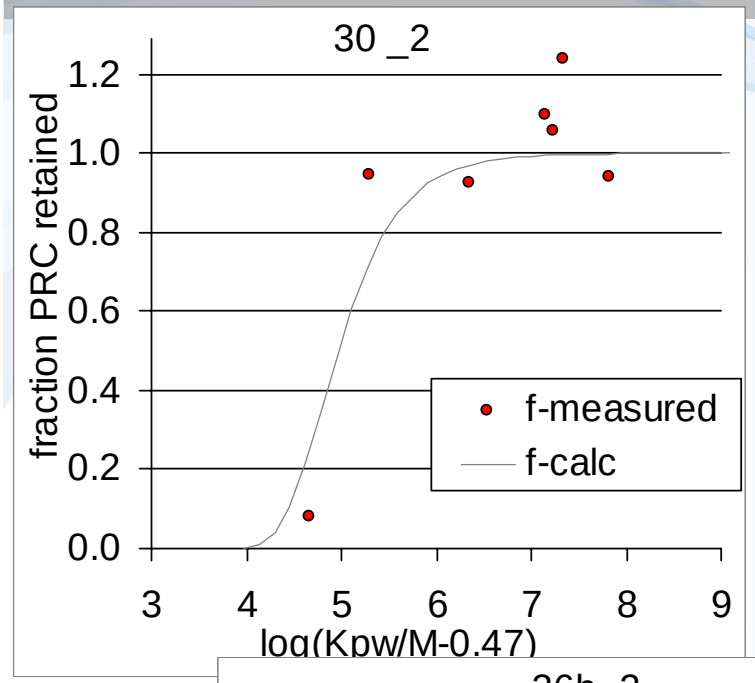
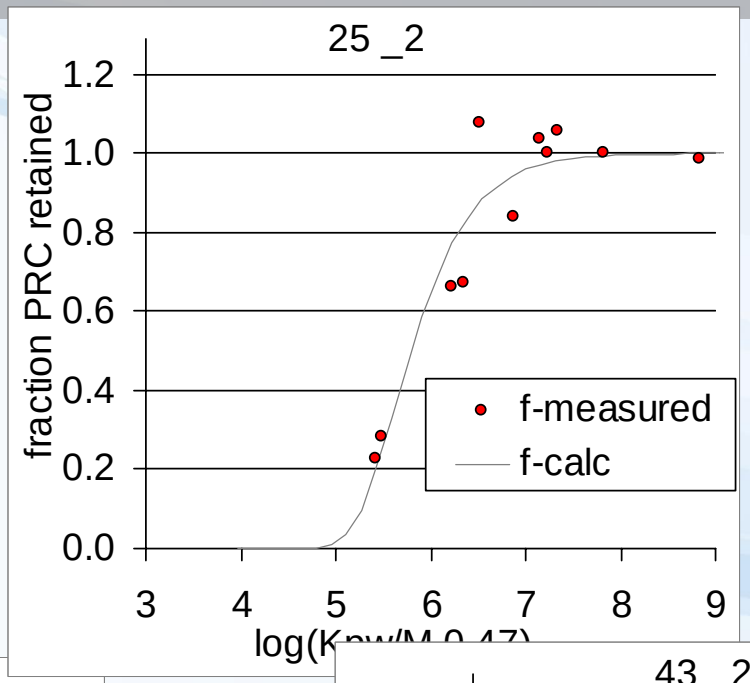
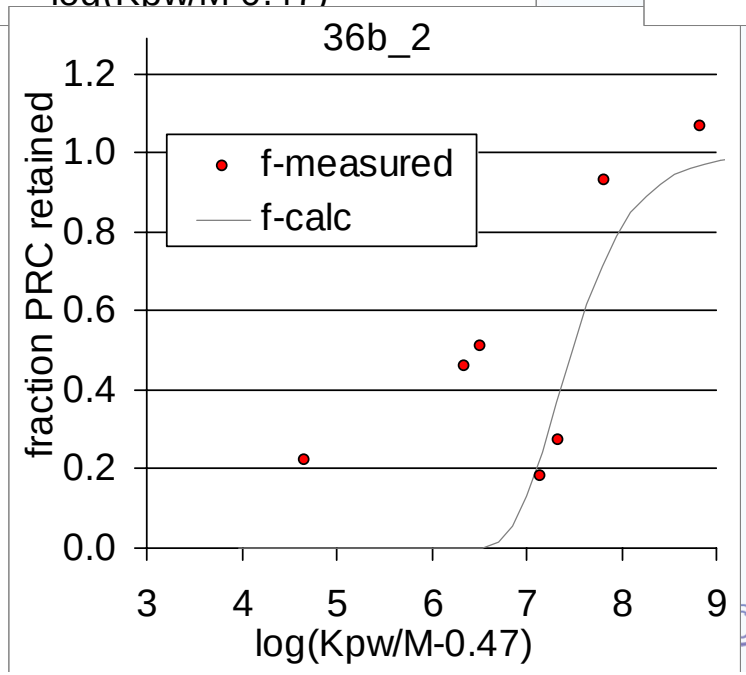
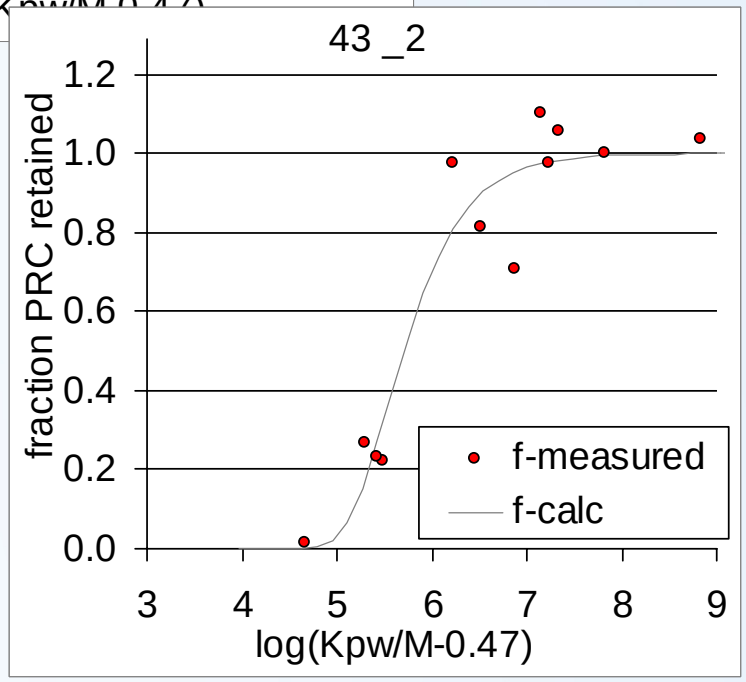
Some fits and non fits



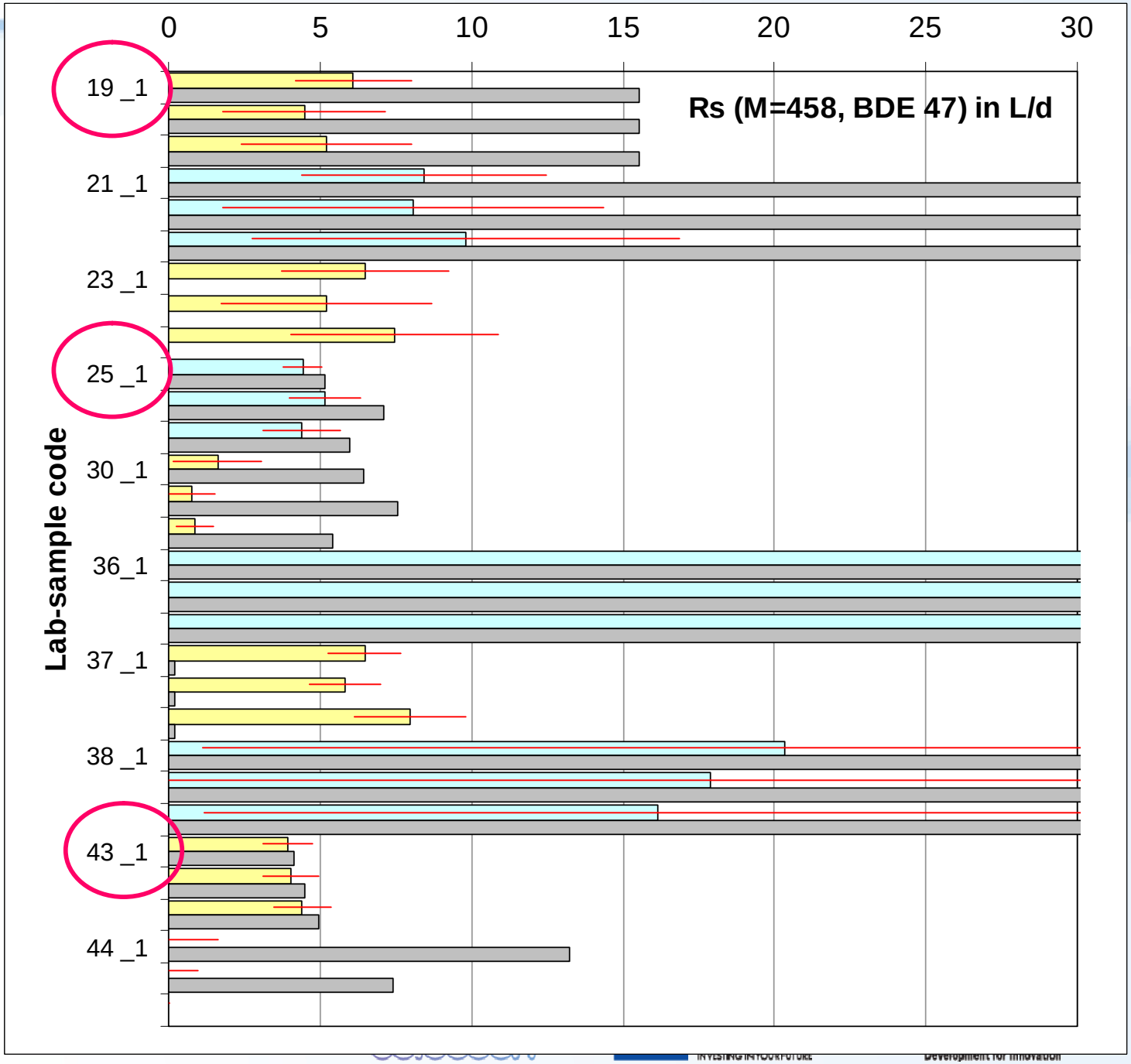




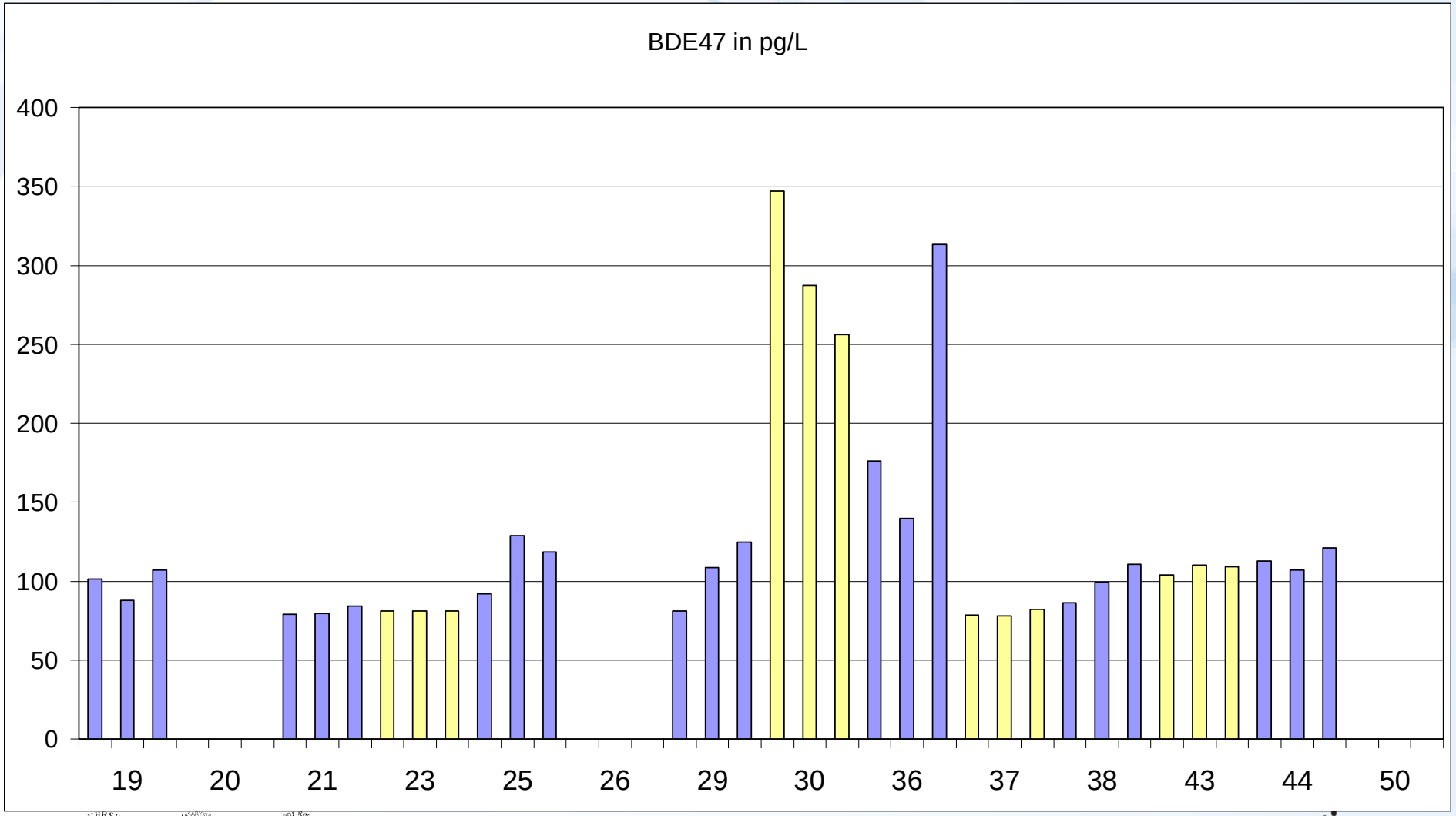


Organiser calculated sampling rates
+
Participant applied samplingrates

ICES PSTS



Calculated C_W for BDE47 using R_S with the best fit



Conclusions

- homogeneity was OK
- passive sampling works
- analyses can likely be improved
- samplingrate determination

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Thank you for your attention

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