Stockholm University

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Trends of contaminants in humans - POPs in breast milk; focus on Nordic countries

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Overview

- Human milk as a monitoring matrix.
- Globally: Temporal and spatial trends of POPs in human milk.
- Milk collection in Stockholm and Gothenburg.
- Temporal trends of PCDD/F 1972-2011 in Stockholm.
- Future studies.

Human milk

Criteria for a suitable monitoring matrix

Foto from: The Swedish Food Administration

- Accumulate the contaminant
- Representative and abundant
- Easy to collect and handle and yield enough material for analysis
- High and stable fat content for lipophilic substances
- Representative for the sampling location

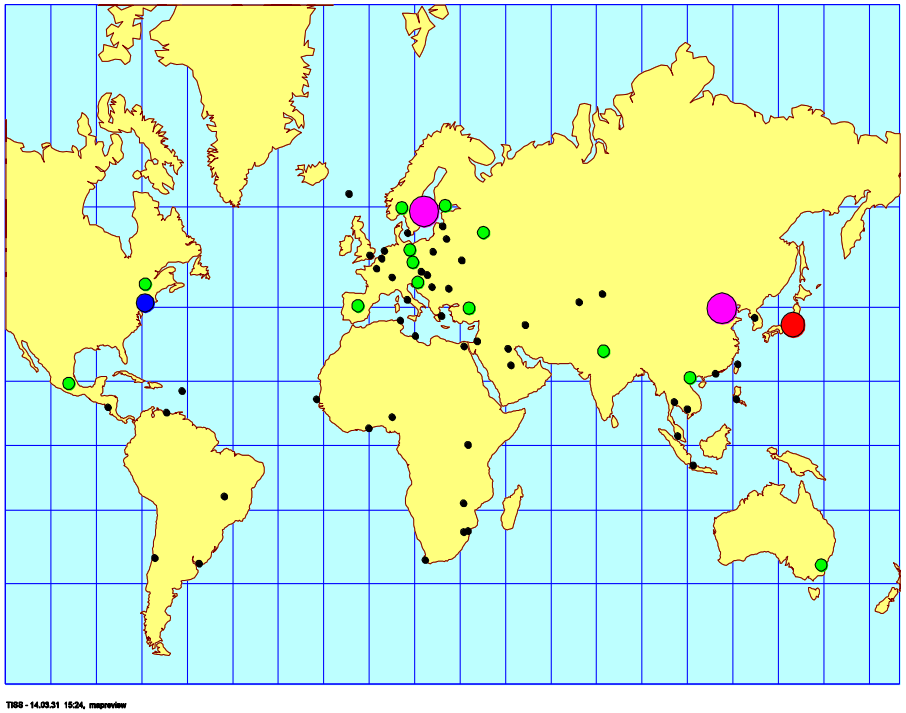
Review article

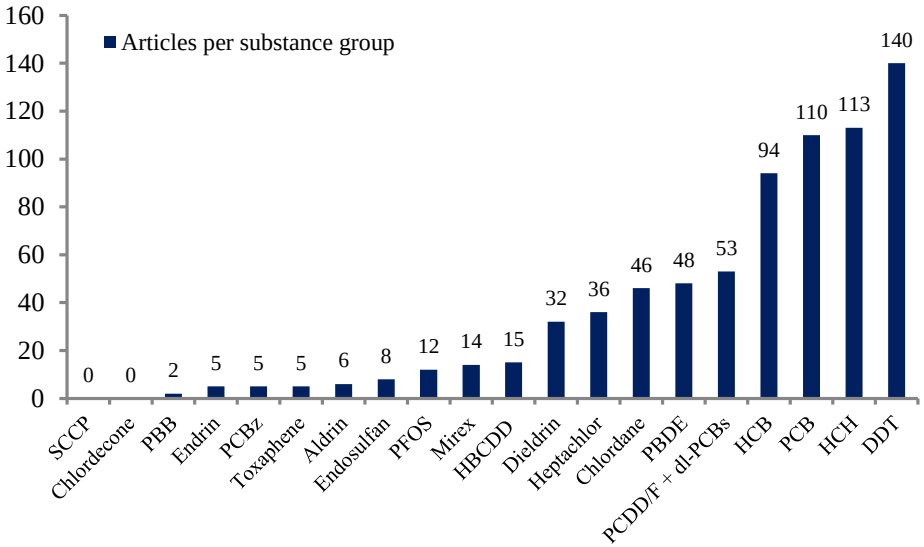
Review article criteria

- 25 SC POPs.
- Peer reviewed articles published 1995-2011.
- Minimum six donors.
- Info. about place and year of sampling required.

- Time series 5 data points.

Review article





●=1 study, ●=2-5 studies, ●=6-10 studies, ●=11-15 studies, and ●>15 studies.

Figures from: **Fång J., Nyberg E., Winnberg U., Bignert A. and Bergman Å. 2015.** Spatial and temporal trends of the Stockholm Convention POPs in mothers milk – a global review. Environ. Sci. Pollut. Res. 22:8989-9041. Available at: http://link.springer.com/article/10.1007%2Fs11356-015-4080-z

DDTs spatial trends

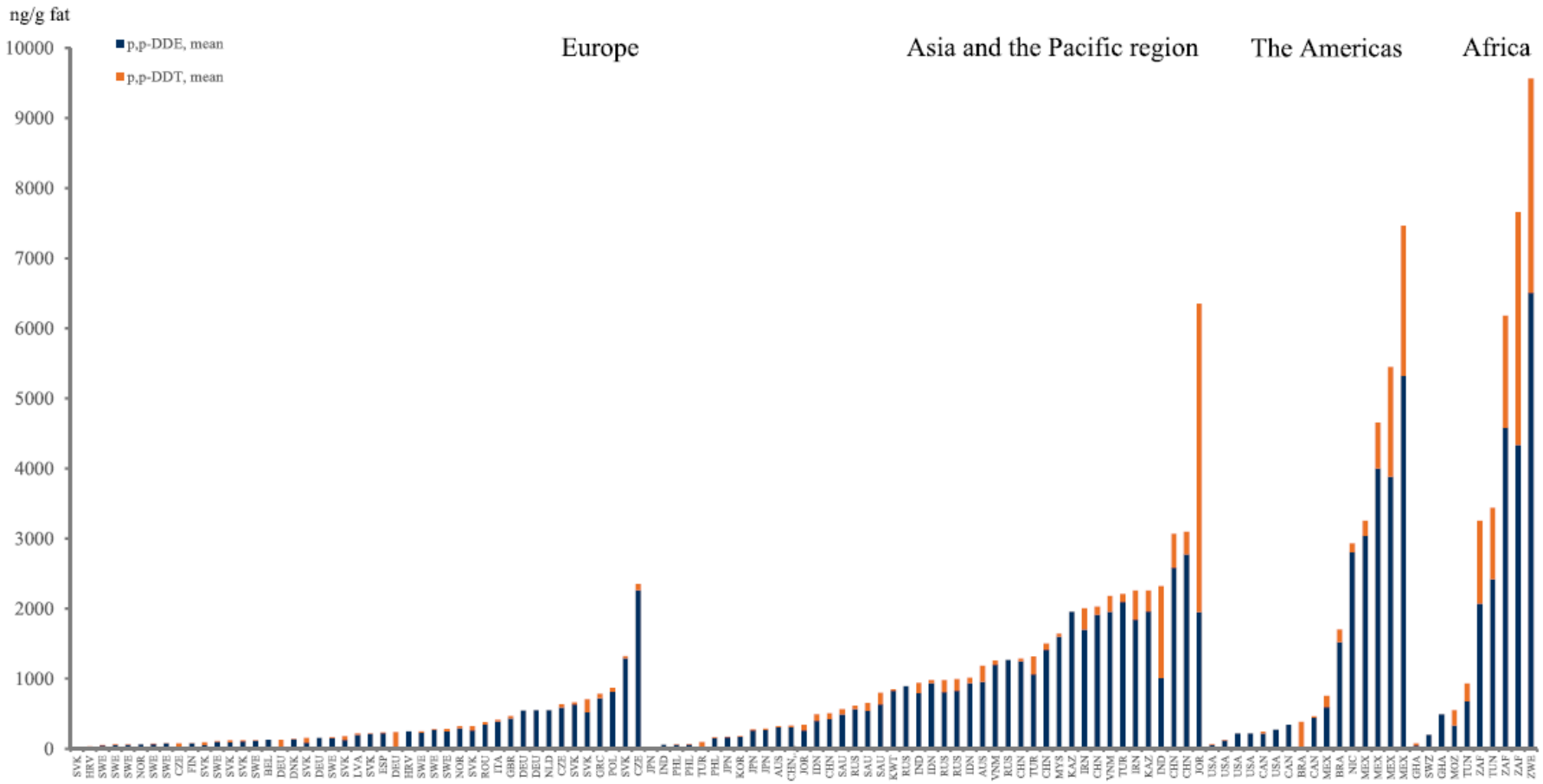
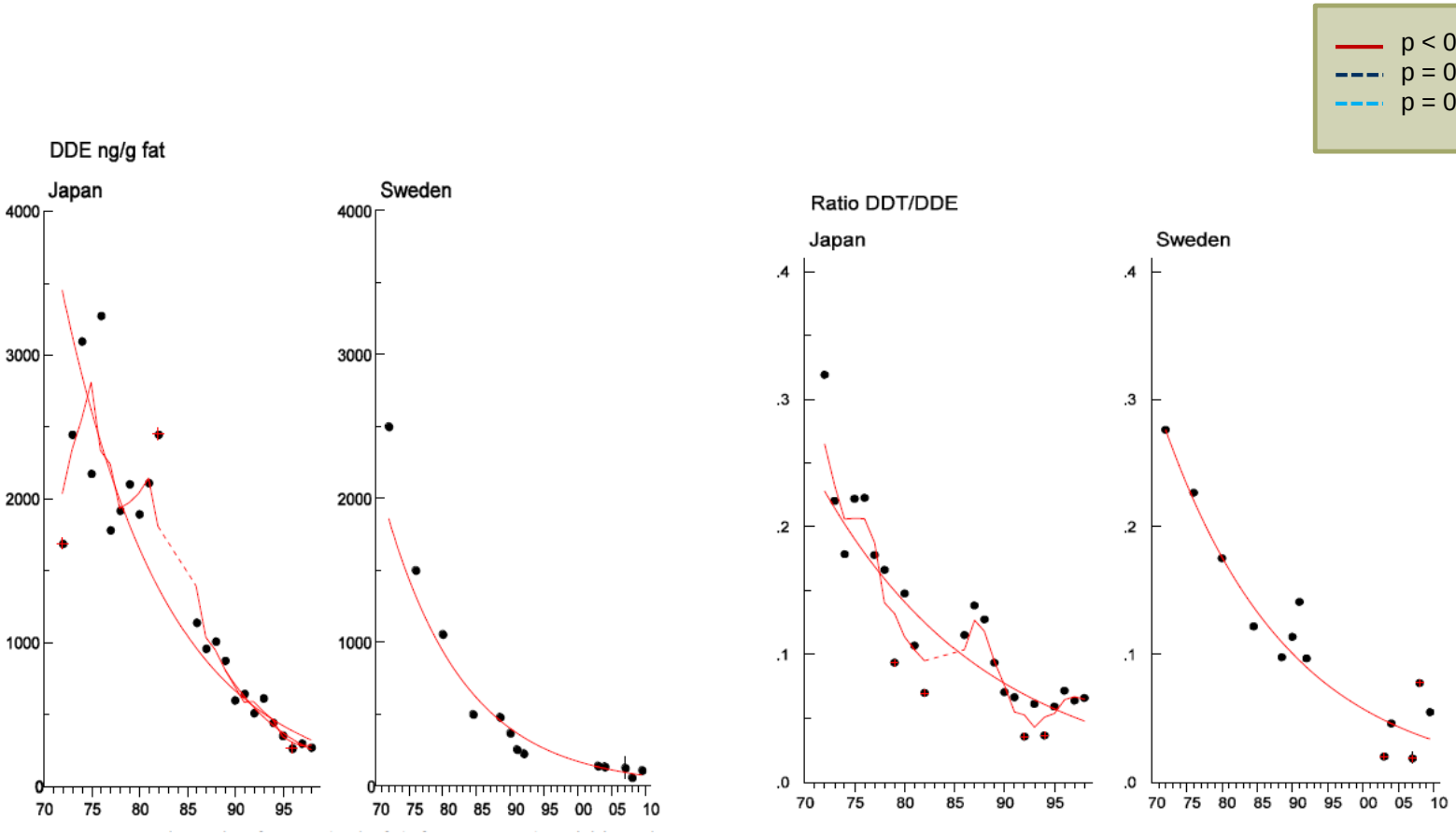


Fig. 3 The sum of p,p-DDE and p,p-DDT reported worldwide is given in the figure, where contribution p,p-DDE is represented in *dark blue* and the contribution p,p-DDT is represented in *orange*

DDTs temporal trends



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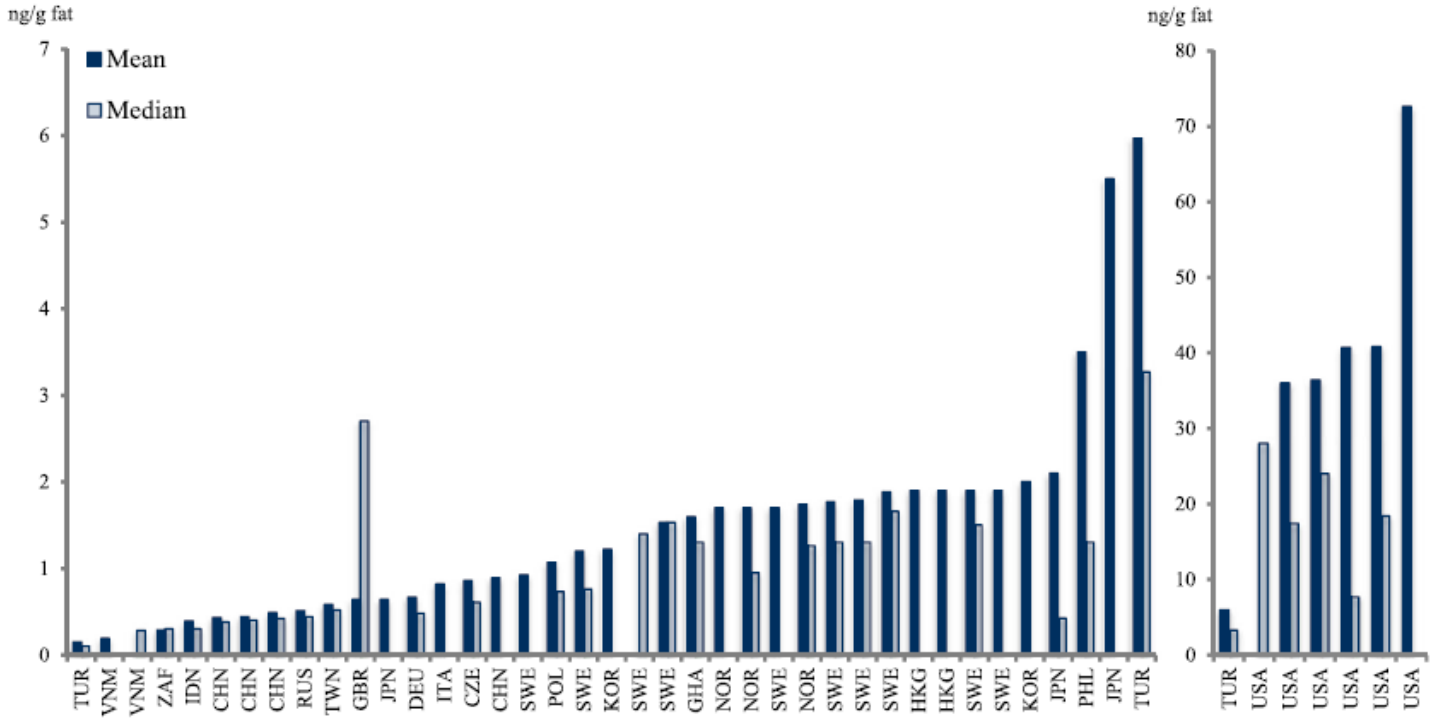
BDE-47 spatial trend



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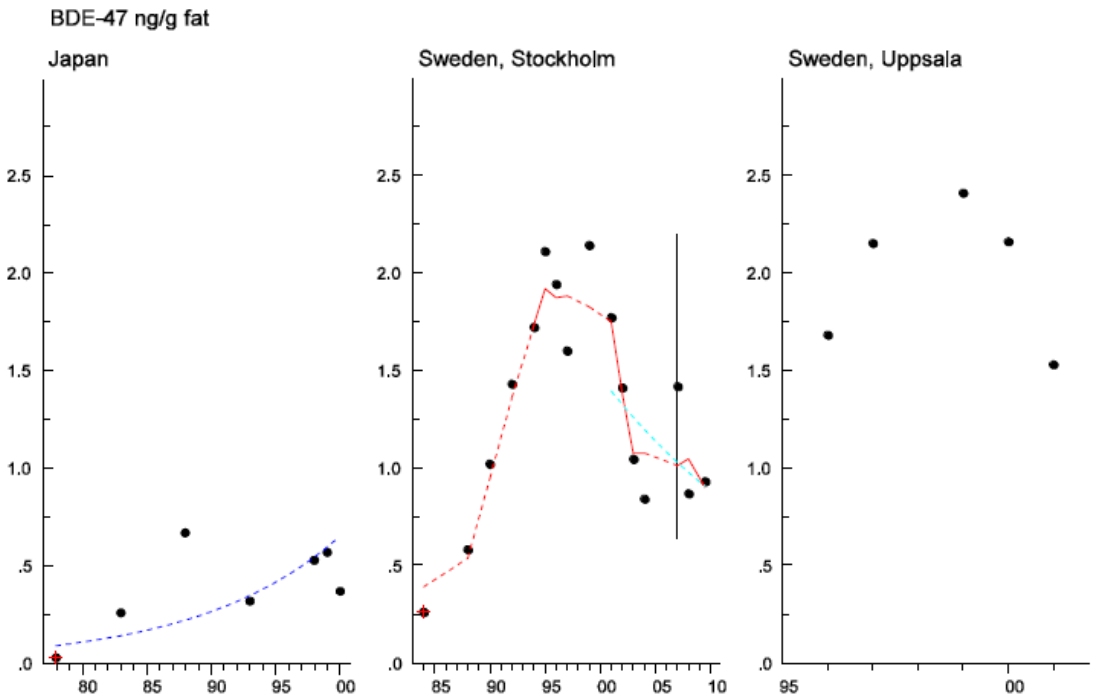
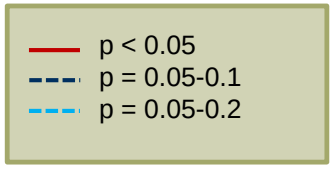
BDE-47 temporal trend





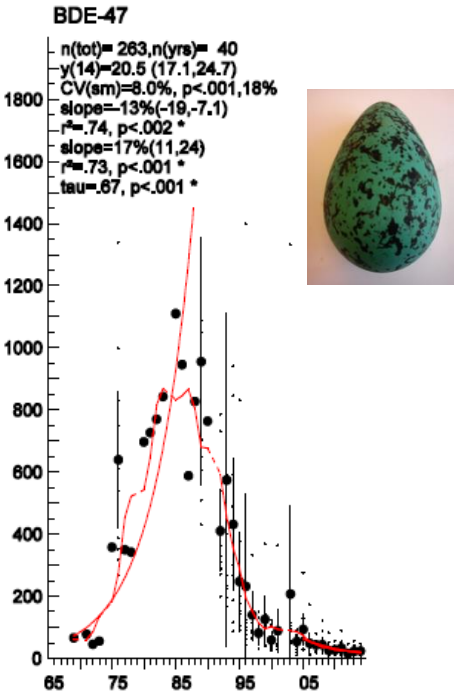


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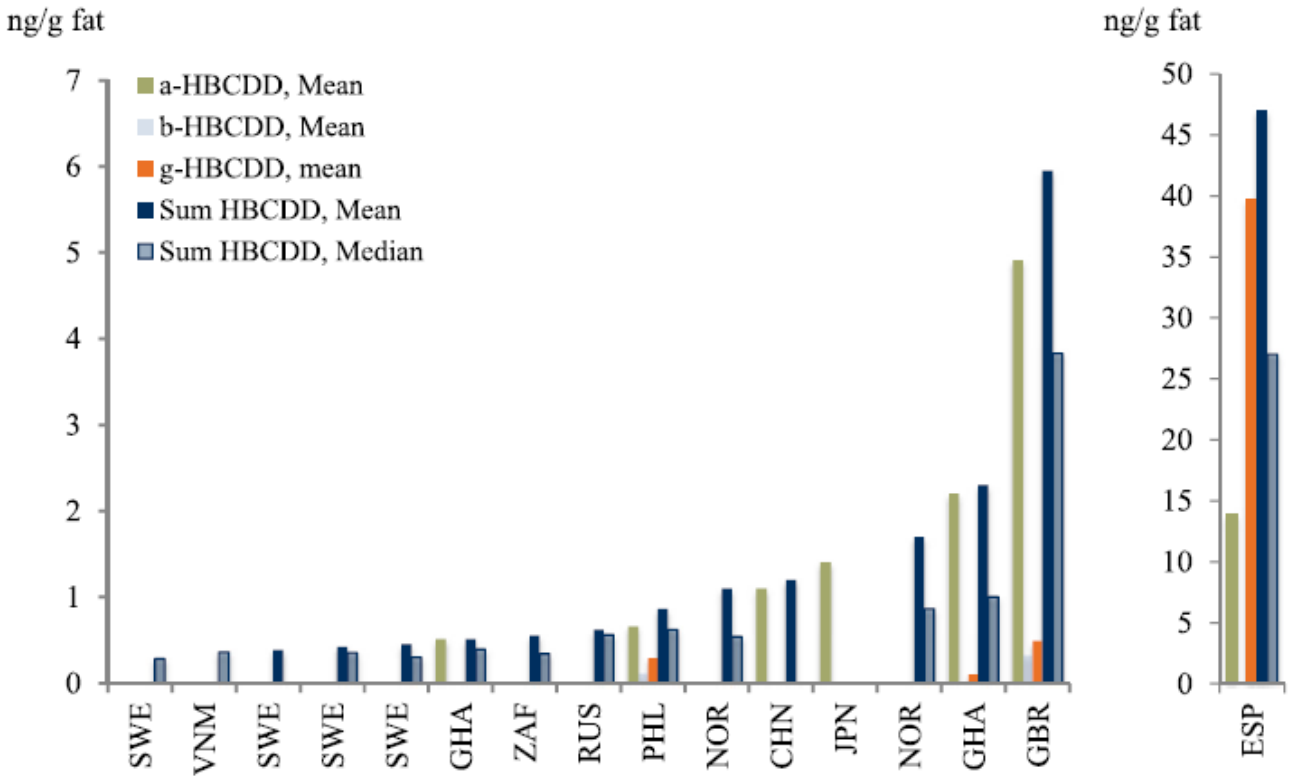
Figure from: **Bignert A., Danielsson S., Faxneld S., Nyberg E. 2016.** Comments concerning the National Swedish Contaminant Monitoring Programme in Marine Biota 2016. Report 5:2016. Swedish Museum of Natural History, Department of Environmental Research and Monitoring, Stockholm, Sweden.

HBCDD spatial trend



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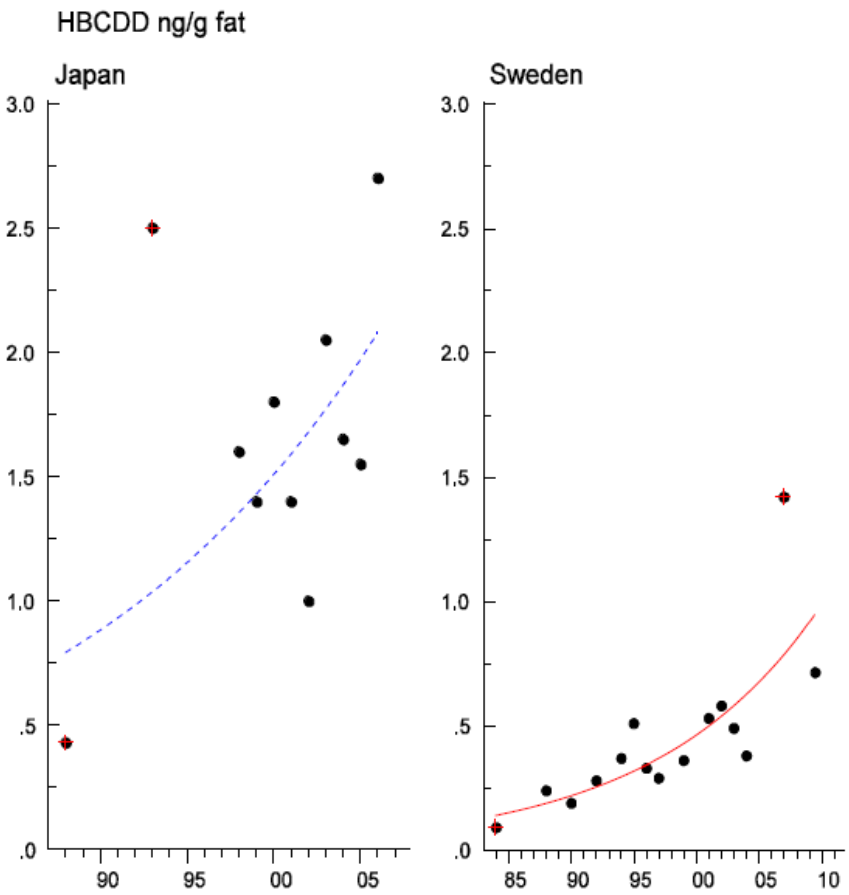
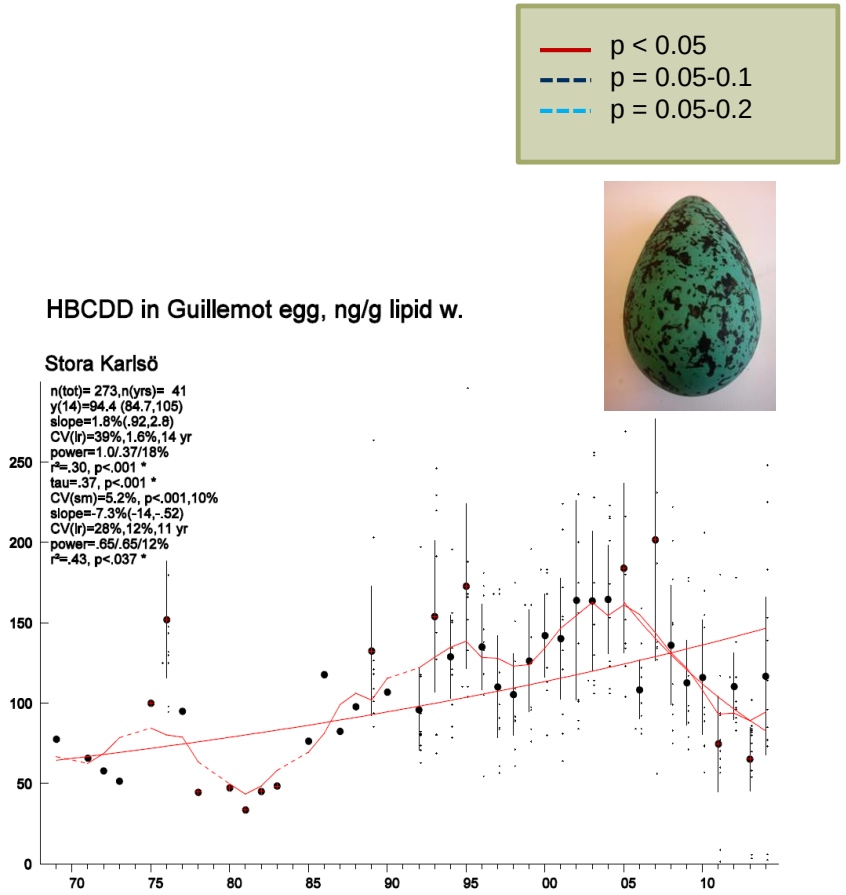
HBCDD temporal trend





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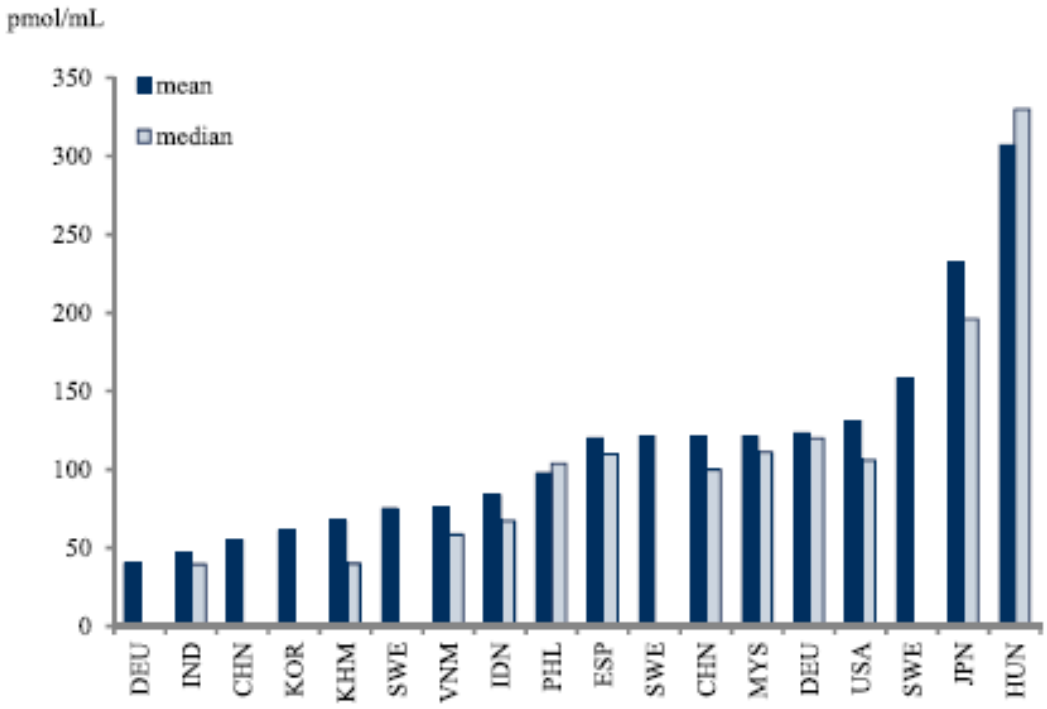
PFOS spatial trend



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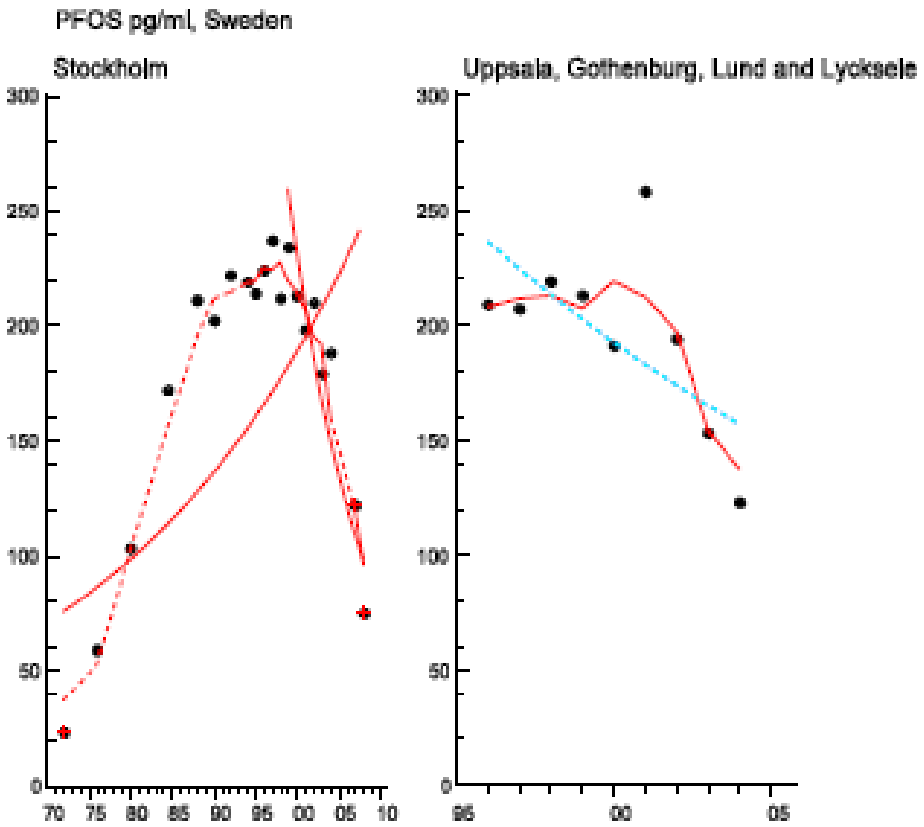

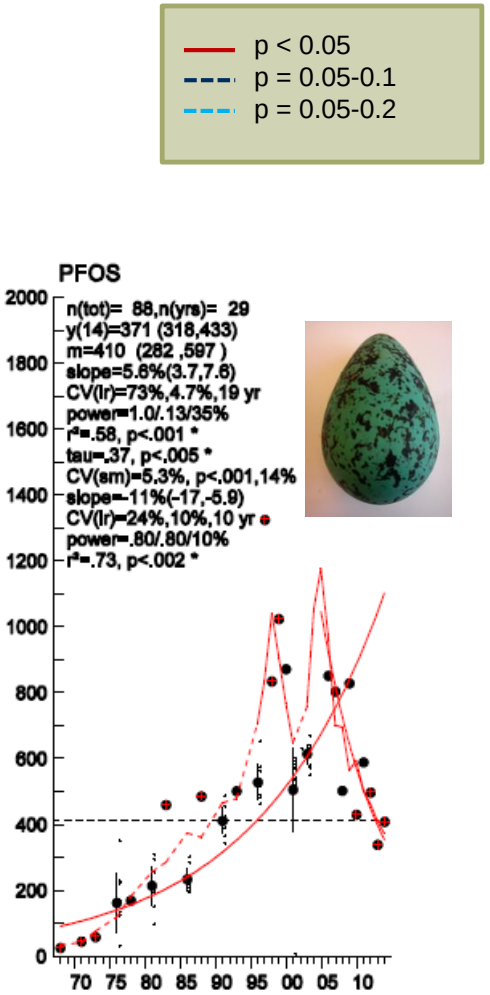

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Conclusions from the review article

- In general, the reporting of POPs differed greatly between studies e.g. sum, central tendency, basis.
- DDTs were higher in agricultural economies.
- PCBs and dioxins were higher in more industrialised regions.
- PBDEs were highest in human milk from USA.
- Decreasing concentrations over time in Japan and Sweden for DDTs, PCBs, HCHs.
- Decreasing concentrations over time in Sweden for PCDD/Fs and in Japan for heptachlorepoxide and dieldrin.
- Measures taken to reduce discharges of various contaminants have been very effective.
- No general trend for BDE-47, HBCDD and PFOS.

Background Stockholm collection

- Stratified sampling in Stockholm, Sweden, since 1967.

Samples collected by Dr Norén et al (1967-1997) focused mainly on
Healthy mothers
Non smokers
Women having their first baby
Samples collected during the first three month after delivery

Background

- The milk collection (1967-1997) is stored in the ESB at the Swedish Museum of Natural History

- 2003-2016 milk samples are bought from the Mothers' Milk Centre, which supplies milk for prematurely born babies.

PCDD/Fs and DL-PCBs

Data on sampling year, number of donating mothers in each pool, which samples that were previously analysed for PCDD/Fs and DL-PCBs and double samples analysed.

Year	Mothers	Mean age (years)	Primi parae (%)	Previously analysed [a]	Two samples
1972	75	27-28	NA[b]	YES	
1974	90	27-28	NA[b]	YES	
1976	78	27-28	NA[b]	YES	
1978	87	27-28	NA[b]		
1980	116	27-28	NA[b]	YES	
1988/89	140	30	58		
1990	60	30	65	YES	
1991	60	28	56	YES	
1992	40	29	65	YES	
1995	20	30	65		
1997	40	31	65	YES	
1999	20	31	70		
2000	10;10	30	75		YES
2001	20	30	80		
2002	10;10	30	80		YES
2003	15	31	67		
2004	10;10	30	80		YES
2007	10;10	27	100		YES
2008	9;9	28	100		YES
2009	10;10	31	100		YES
2010	10;9	30[c]	100		YES
2011	11;11	30	100		YES

[a](Noren and Meironyte, 2000)
[b]Not available
[c]Only availabe for 5 out of 19 mothers

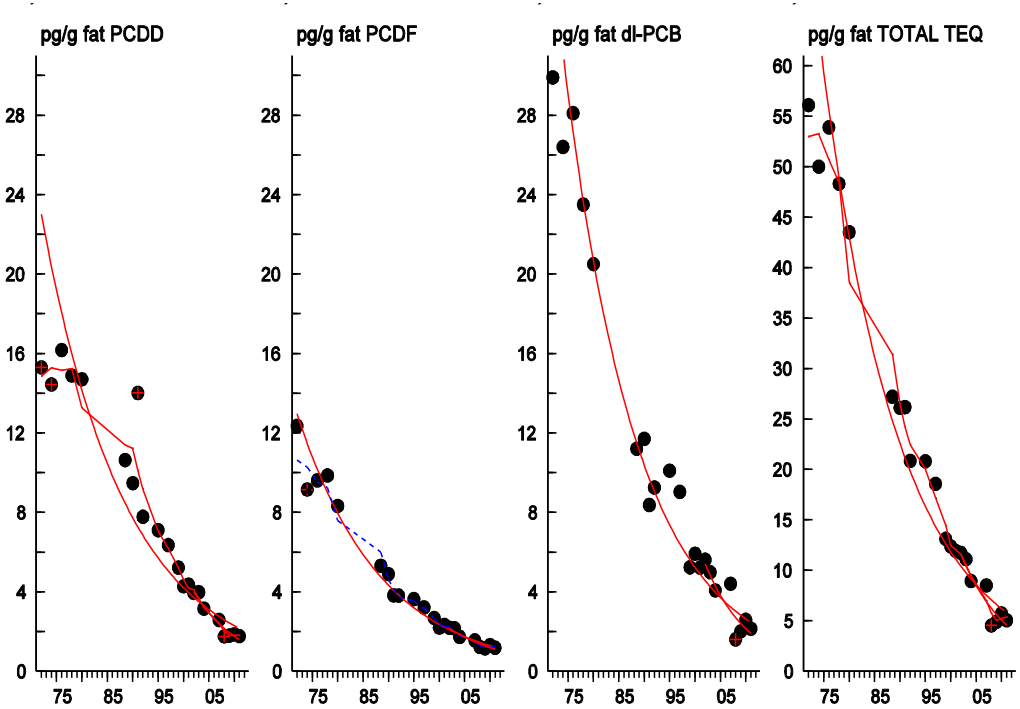
Retrospective study

- Temporal trends - last decade
- Compatibility with historical analysis

Figure from: **Fång J., Nyberg E., Bignert A., Bergman Å. 2013**. Temporal trends of polychlorinated dibenzo-p-dioxins and dibenzofurans and dioxin-like polychlorinated biphenyls in mothers' milk from Sweden, 1972–2011. Environment International 60, 224-231.

Results

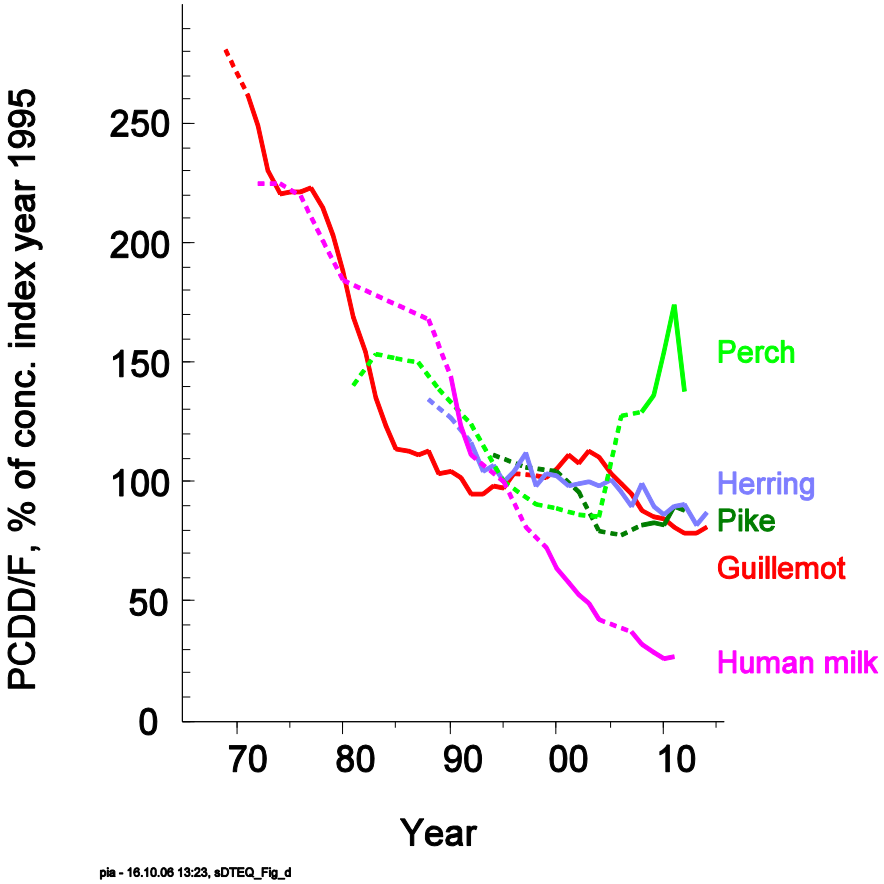
∑PCDDs, ∑PCDFs, ∑DL-PCBs and ∑TEQ



- Annual decrease over the 40 year period, 6.1% - 6.9%.
- Last ten years for ∑ PCDDs, ∑PCDFs, ∑ DL-PCBs and ∑TEQs is 10%, 7.3% ,12% and 10%, respectively.

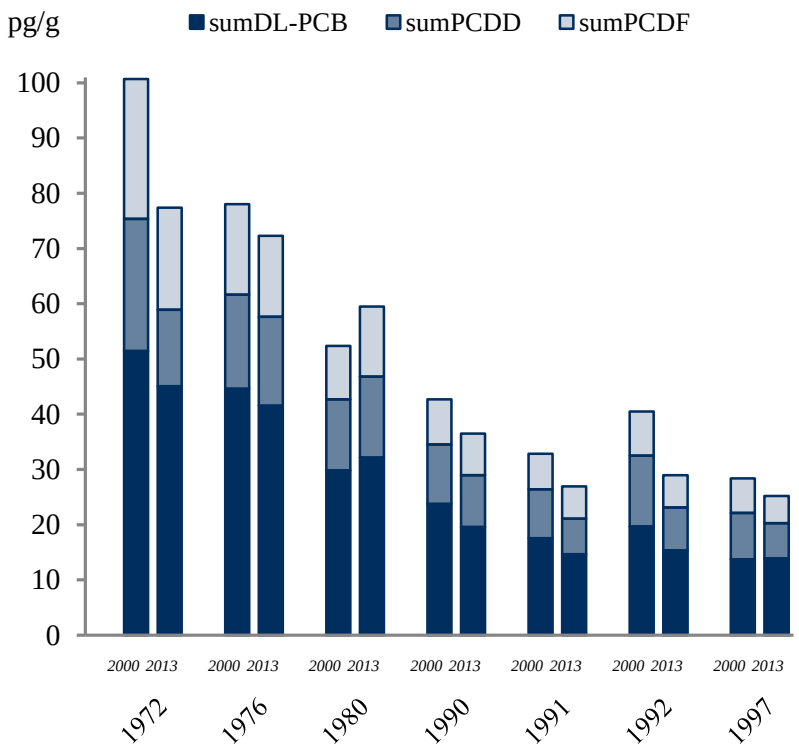
Figures from: **Fång J., Nyberg E., Bignert A., Bergman Å. 2013.** Temporal trends of polychlorinated dibenzo-*p*-dioxins and dibenzofurans and dioxin-like polychlorinated biphenyls in mothers' milk from Sweden, 1972–2011. *Environment International* 60, 224-231.

Temporal trends in biota



Results

PCDD, PCDFs and DL-PCBs previously analyzed and reported in (Norén and Meironyte, 2000) compared to those presented in this study in the same samples



- The concentration differences are small, with the highest discrepancy observed for the sample taken in 1972.
- The relative proportions of ∑PCDDs, ∑PCDFs and ∑DL-PCBs are in good agreement.

Figure from: **Fång J., Nyberg E., Bignert A., Bergman Å. 2013.** Temporal trends of polychlorinated dibenzo-*p*-dioxins and dibenzofurans and dioxin-like polychlorinated biphenyls in mothers' milk from Sweden, 1972–2011. *Environment International* 60, 224-231.

Conclusions

- Levels of PCDD/Fs and dl-PCBs are decreasing over time, even faster during the last decade.

- It is important to save samples in an Environmental Specimen Bank to enable retrospective studies to estimate time trends of levels of new and emerging contaminants.

- Good agreement with historical data and the re-analysed samples concerning PCDD/PCDF/dl PCBs.

Future studies

- Elongate previous time series (e.g. PCBs, PCDD/Fs, PBDEs, HBCDD, PFASs) in Stockholm and Gothenburg.
- Study some new brominated and perfluorinated substances (BDE-209, DBE-DBCH, diPAPs, polyethers and fluorotelomer acids).
- Study individual variation of perfluorinated substances.
- Project report to SEPA in June 2017.

Thank you!!!

•Acknowledgements

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