

Screening for chlorinated organic compounds and their metabolites in otter (*Lutra lutra*) scats from two areas in Sweden



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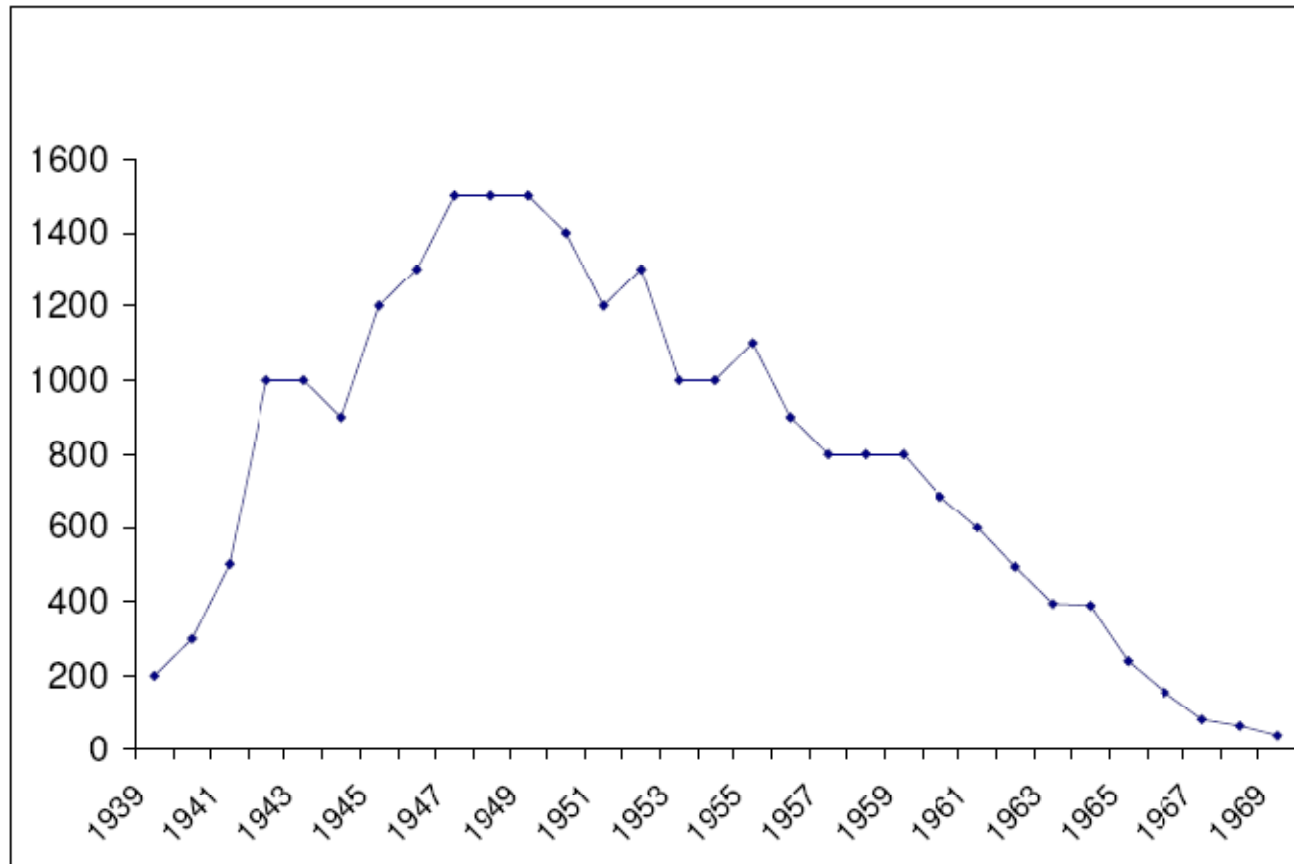
1. Stockholm University
2. Swedish Museum of Natural History
3. Brandt and Gröndal

Aim of this pilot study

- Evaluate if scats can be used as bio marker
- Compare concentration and pattern of...
 - Σ PCB
 - Σ OH-PCB
 - MeSO₂-PCB
 - Pesticides
 - PBDE...in two otter populations.
- Study the ratio: PCB / metabolites

Background

- Otter population in Sweden declined after the 1950s.



Hunting statistics, number of shot otters / year.

Environmental contaminants

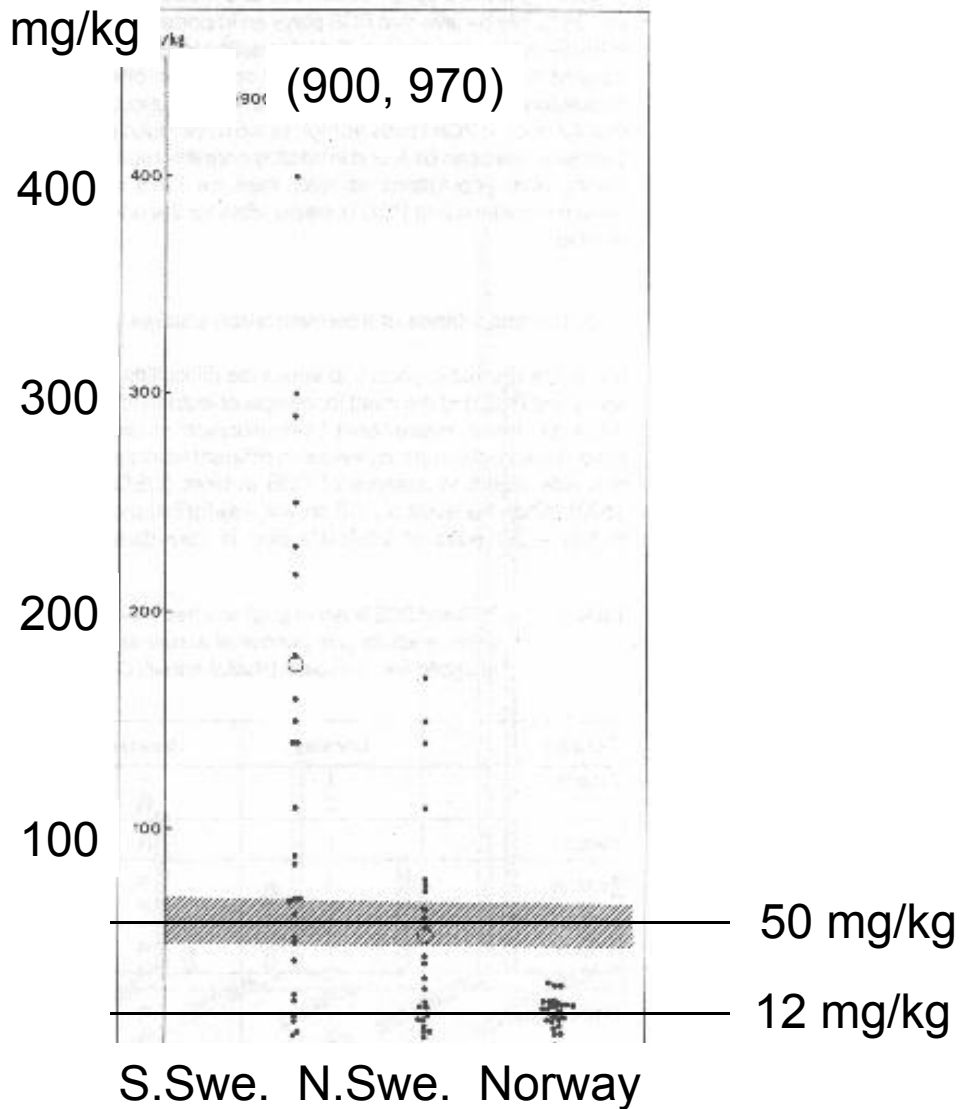
- Are probably the reason for the general decline, and it is important to monitor these.
- But how to monitor contaminants in otters? In some areas it is difficult/impossible to get hold of otter tissue, so maybe scats can be a substitute?
- Scats can be collected all year round, and one can choose what area to be studied.

Toxicity – few studies on otters, but the more on mink

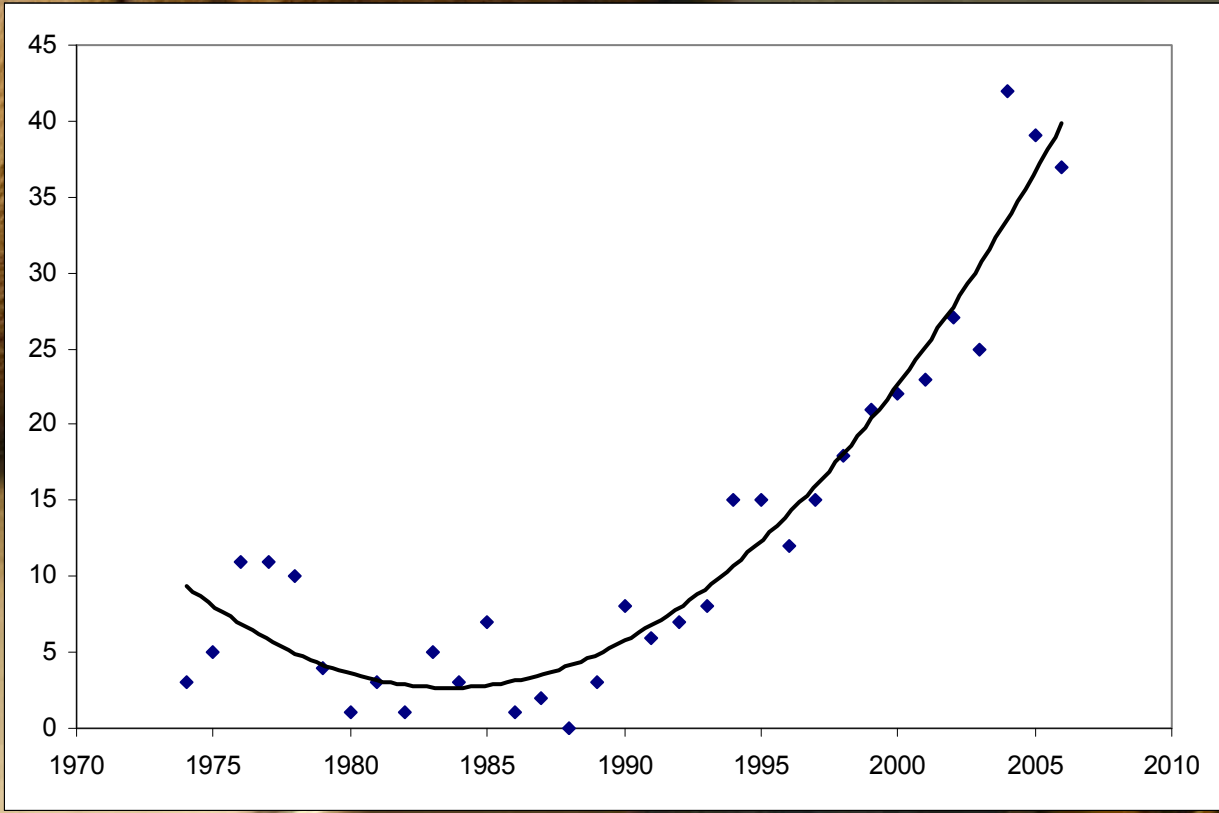
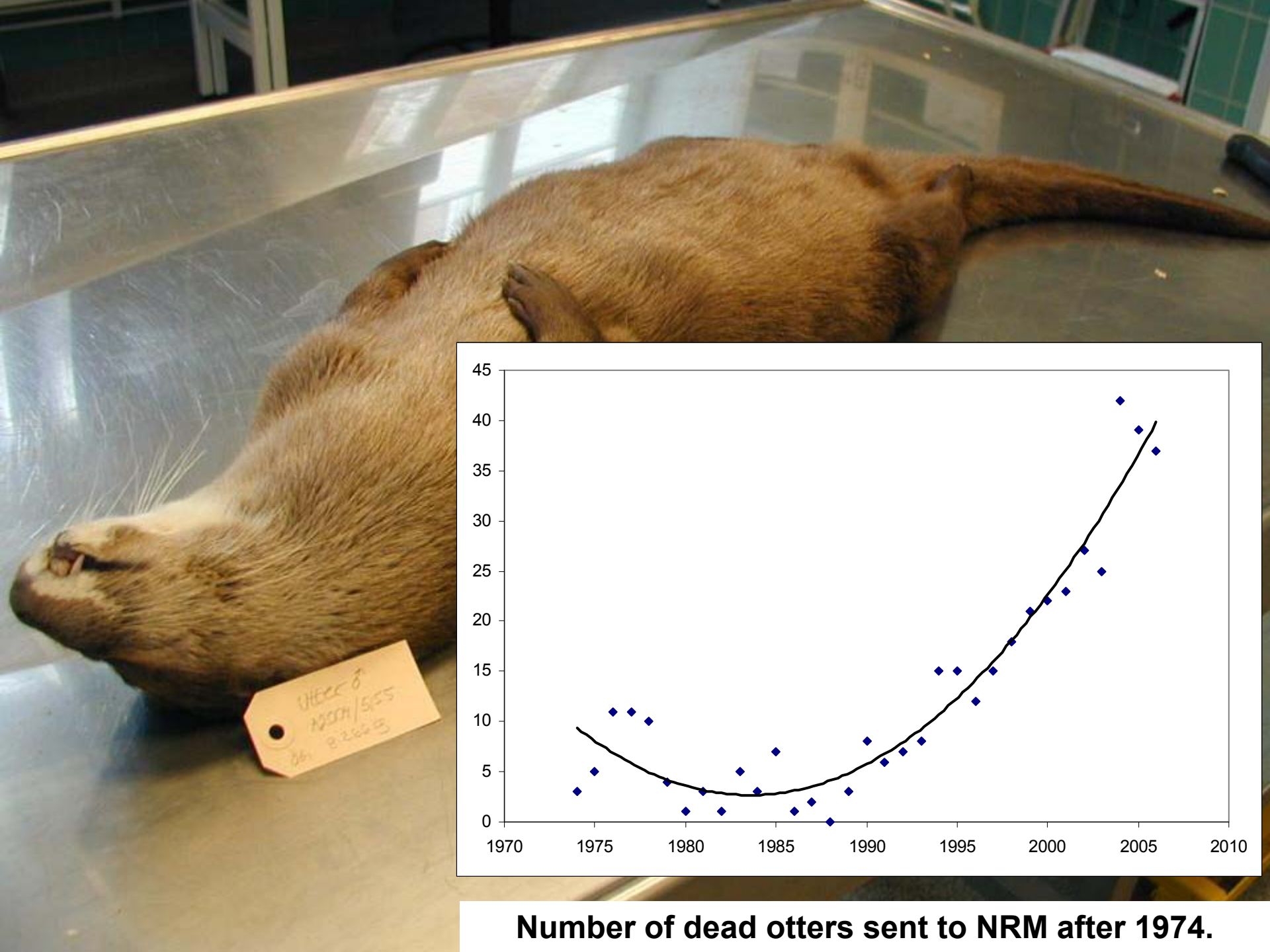
- Reproductive failure in mink:
 - **50 mg/kg** PCB (ppm) l.w. in mink muscle (Jensen *et al*, 1977)
 - **12 mg/kg** PCB (ppm) l.w. in mink muscle (Brunström *et al*, 2001)



- Otter tissue in the 1980s

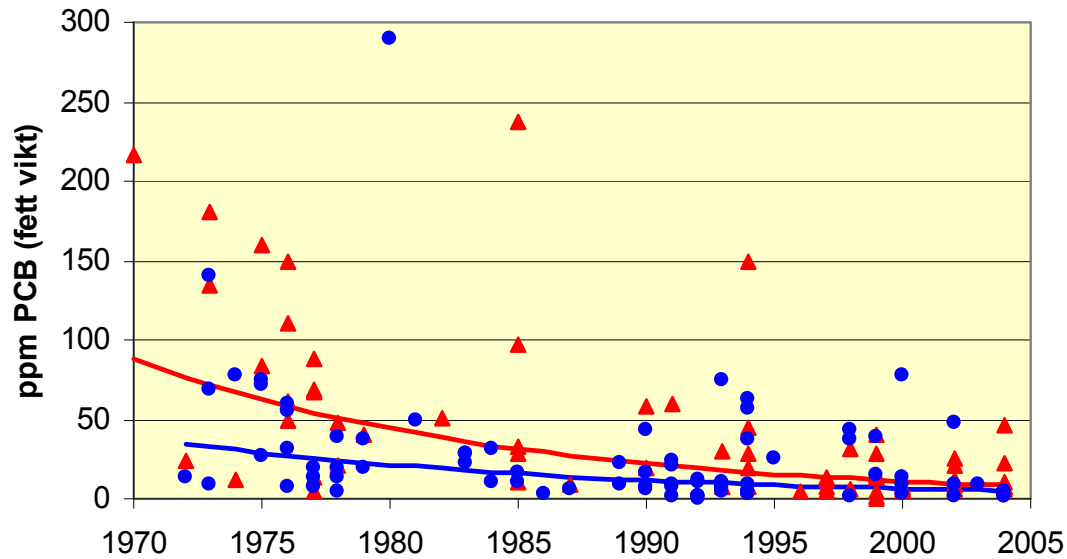


ΣPCB mg/kg (ppm) l.w. in
otter tissue.

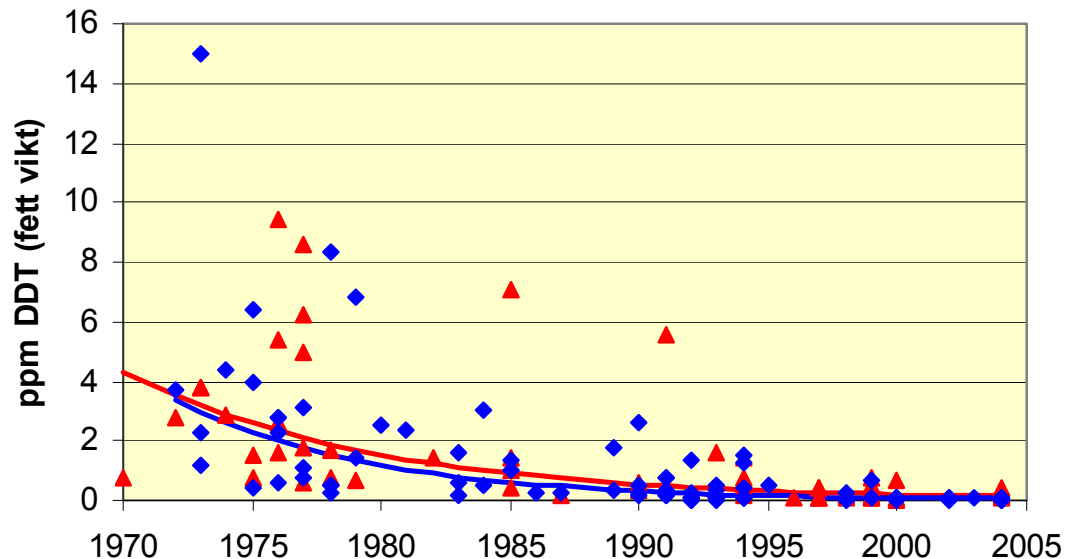


Number of dead otters sent to NRM after 1974.

sPCB and sDDT in otters from Sweden (muscle, l.w.)



PCB decreases with
- 6,5% yearly. (highest was 970 ppm in an otter, outside the diagram)



sDDT decreases with
-9,9% yearly in southern Sweden, and 13,3 in northern Sweden (or rather, DDE).

Red = southern Sweden. Blue = northern Sweden.

This pilot study

Västernorrland:
20 otter scats from
2003, 2005, 2006



Södermanland:
14 otter scats
2007

Material



14 **PCB** congeners

DDT, HCH, HCB,
transnonachlor

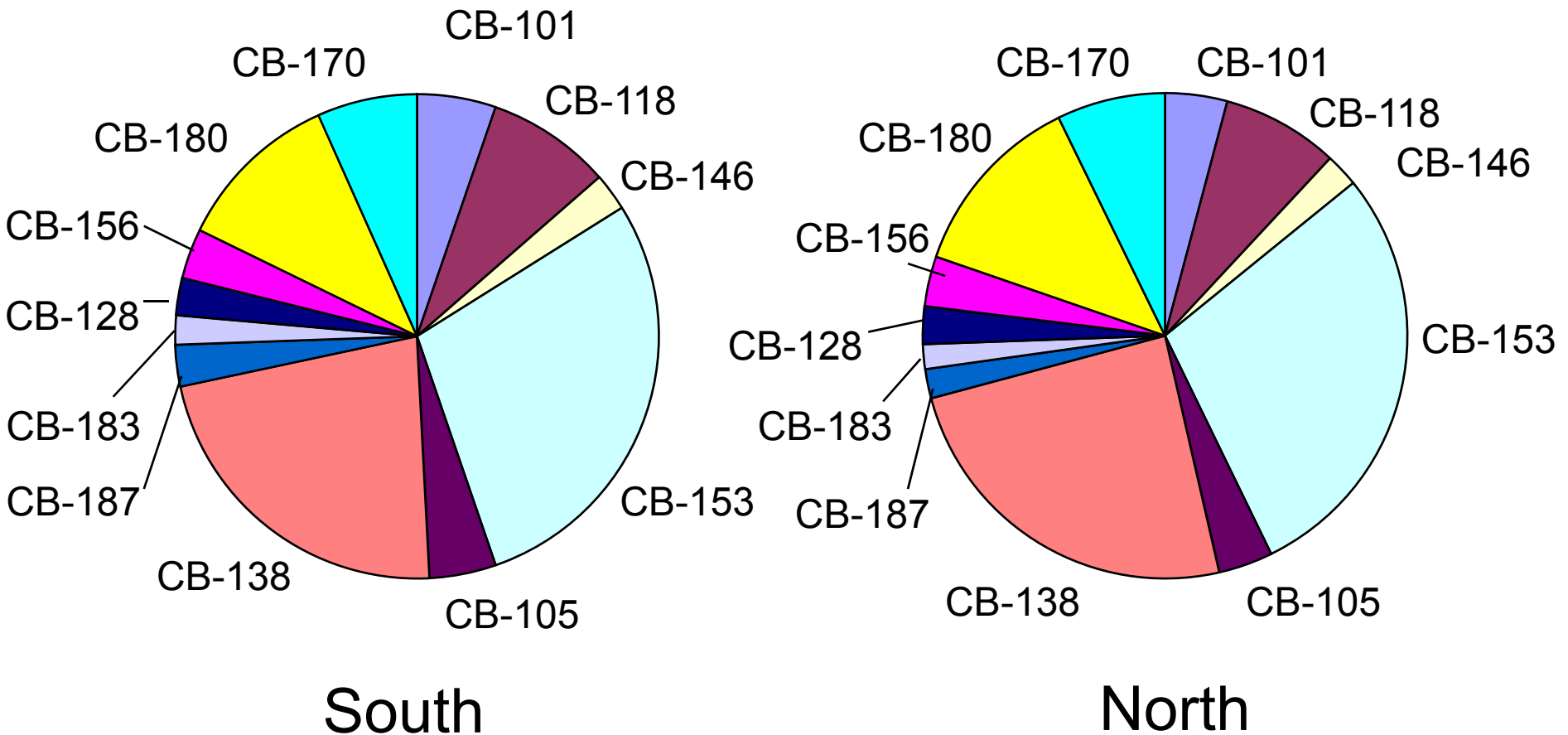
10 **OH-PCB** congeners

DDE, DDD

MeSO₂-PCB

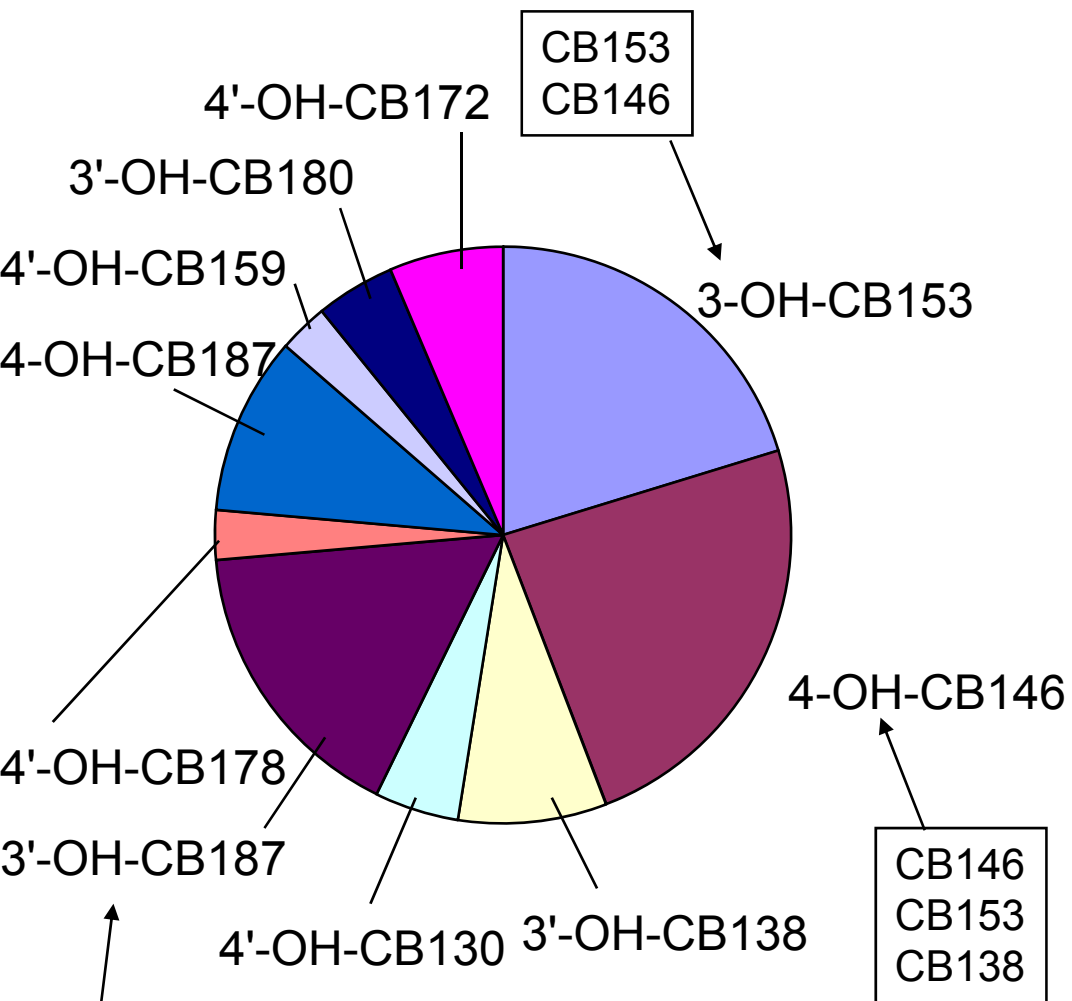
PBDEs

Results – PCB congener pattern

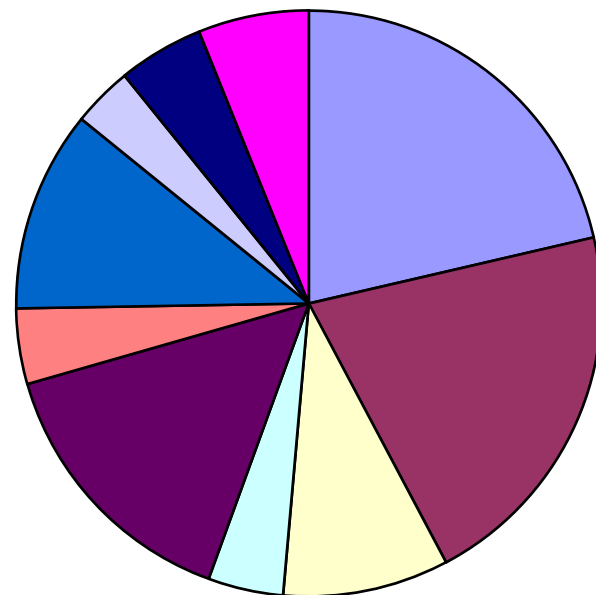


- Remarkable similarities between the two areas!

Results – OH-PCB congener pattern



South



North

Results - Σ PCB

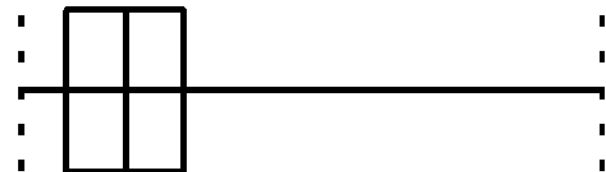
North

Västernorrland



South

Södermanland



60 1060 2060 3060 4060 5060 6060 7060
ng/g extractable matter

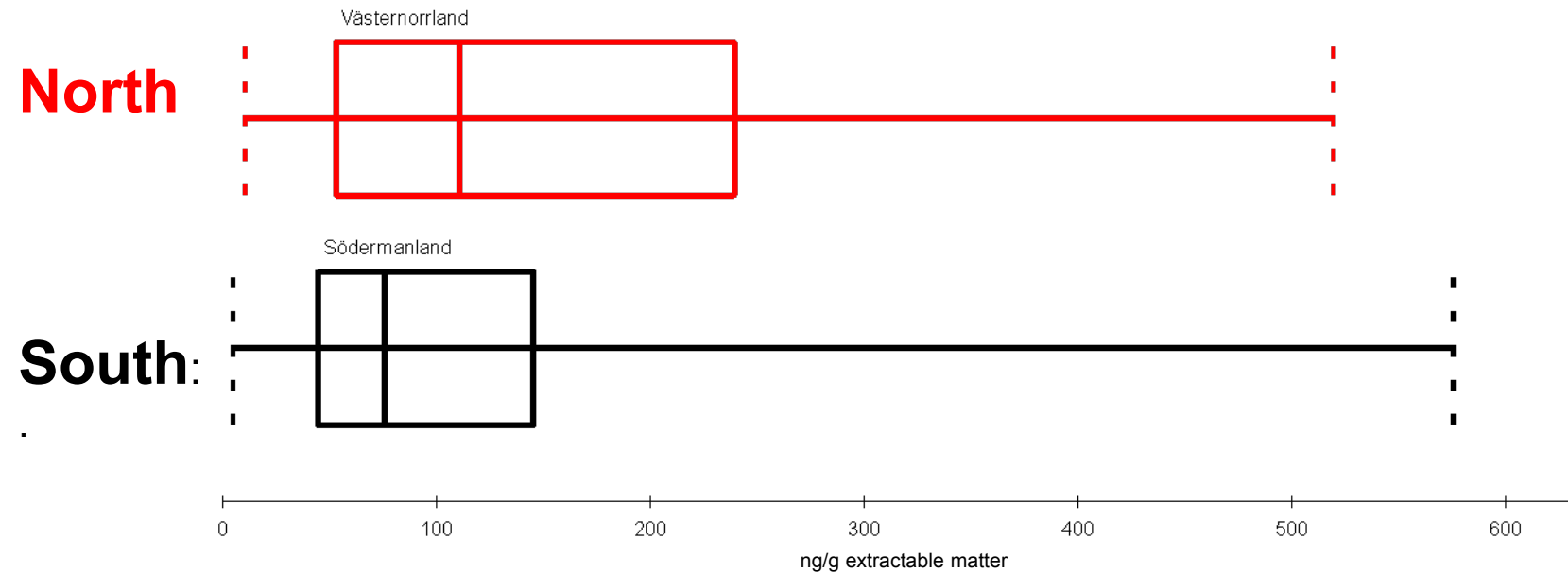
- **Levels in scats**
- ‘*Critical level*’: >16 ppm l.w. PCB in scats.
- ‘*Levels of concern*’: 9-16 ppm l.w. PCB in scats.
- ‘*Maximum allowable concentration*’: less concentration than for ‘levels of concern’ but greater the ‘no effect concentration (NOEC).
- ‘*No effect concentration*’: less than 4 ppm l.w. PCB in scats.

Based on reproduction failure in mink at **50 mg/kg** l.w. tissue concentration!

2 individuals (Västernorrland): 6-7 ppm

(Mason & MacDonald 1993)

Results – Σ OH-PCB



Results – Ratio PCB/OH-PCB

Approximately 10% of the concentration of sPCB

- No significant difference in metabolizing capacity ($p > 0,05$)

Results - Σ DDT

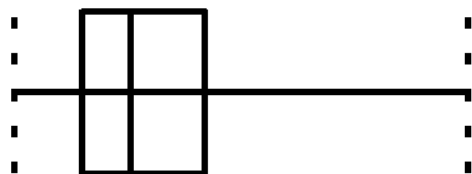
North

Västernorrland



South:

Södermanland



0 100 200 300 400 500 600 700 800
ng/g extractable matter

Preliminary conclusions

- No significant difference between the two populations in concentrations of Σ PCB, Σ OH-PCB or Σ DDT ($p>0.05$).



Discussion



- **Scats as a bio marker?**

- **Advantages:**

- Easy to collect
- Good sample sizes can be obtained
- Non-invasive
- One can actively choose what area to be investigated (not depend on traffic accidents)
- It seems like one can dry the samples and thus makes fieldwork easier

Discussion




- **Scats as a bio marker?**

- **Disadvantages:**

- Differences in age of the scat, secretion content etc varies, so very difficult to interpret
- Large variation in contaminant concentrations, demands large sample sizes
- Don't know who deposited the scat (old, young, male, female?)
- What information do we get? For ex. what comes from the otter, and what comes from undigested food items? What is relevant?
- If using scats one should probably also analyse fish from the same areas in order to better evaluate contaminant impact on otters.

Next step

- Analyse some more compounds (PBDEs, pesticides).
- Statistical analysis of individual congeners
- Analyse anal glands, intestine content ("prescats"), liver and muscle from the same individuals, to study if there is a correlation between scats and other organs.
- Compare these results with dead otters from the same areas.



Thank you 4 your attention.

Thanks to the otters!

And thanks to the Swedish EPA.

Area	West England	East England
Mean Σ PCB mg/kg (ppm) l.w.	1,44-8,47	8,07-13,97

Σ PCB Västernorrland: 1,5 ppm extr. mtrl.

Σ PCB Södermanland: 0,9 ppm extr. mtrl.

Area	West Britan	East England
Mean Σ DDT mg/kg (ppm) l.w.	1,43-4,61	2,87-12,49

Σ DDT Västernorrland: 0,15 ppm extr. mtrl.

Σ DDT Södermanland: 0,12 ppm extr. mtrl.

(Mason & MacDonald 1993.

Toxicity scats

- **Levels in scats**
- *‘Critical level’*: >16 ppm l.w. PCB in scats.
- *‘Levels of concern’*: 9-16 ppm l.w. PCB in scats.
- *‘Maximum allowable concentration’*: less concentration than for ‘levels of concern’ but greater than the ‘no effect concentration’.
- *‘No effect concentration (NOEC)’* : less than 4 ppm l.w. PCB in scats.

Based on reproduction failure in mink at 50 mg/kg l.w. tissue concentration!

Earlier studies

- **Scats**
- Σ PCB concentrations in scats from England (1989-1992)

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(Mason & MacDonald 1993, Sci. Tot. Environ. 138:127-145

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