Differences in PCB accumulation between male and female moles (*Talpa europaea*) in an area with heterogeneous soil contamination

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Background

The Krimpenerwaard is an area in the province of Zuid-Holland, the Netherlands, where more than 6000 ditches were filled with different types of waste in the 20th century, to create larger pasture fields. However, filling with waste is now recognized as an environmental problem, with known accumulation of contaminants in the food web.

At present, an active management plan is executed, which consists of capping the suspected ditch fills with a layer of clean soil of local origin, and monitor the effectiveness of this capping. As part of this monitoring scheme, European moles (Fig. 1) were caught and analysed for PCB content in the liver fat. Monitoring took place during several campaigns (2005, 2007, 2009 and 2012), both before (=T0, 2005 and 2007) and after (=T1, 2009 and 2012) capping of the ditch fills. Reference sites were sampled as well in each year.

Objective

The PCB content in liver fat showed considerable variation between individuals during the T0 and T1 monitoring campaigns. Objective is to untangle the sources of this variation, to improve our monitoring scheme. To do so, we used multiple linear regression models to identify the best variables that could explain the PCB content. Metrics from each individual mole, and from the characteristics of each site, were used in this multiple regression analysis.

Figure 1. The European mole

Dataset

Table 1. Number of male and female moles caught in each sampling campaign, for reference sites and capped ditch sites.

site	2005	2007	2009
Reference site males	4	2	7
Reference site females	1	2	12
Capped site males	11	18	5
Capped site females	8	4	10

The data of 2012 just became available, and could not be incorporated in the analysis. Table 1 shows that a different number of males and females were caught at each monitoring campaign. Mostly adults, but also sub-adults and juveniles were caught.

23 PCB congeners were measured in the liver fat. The logPCB23 was used as response variable in the multiple linear regression.

Acknowledgements

Moles from reference sites only, T0 and T1 combined

Model selected with 3 predicting variables (Figs. 1 and 2):
1. sex (estimate -0.906, p<0.001)
2. body weight (estimate 0.026, p=0.008)
3. type of contamination (wood ditch filling, estimate -0.533, p =0.043)
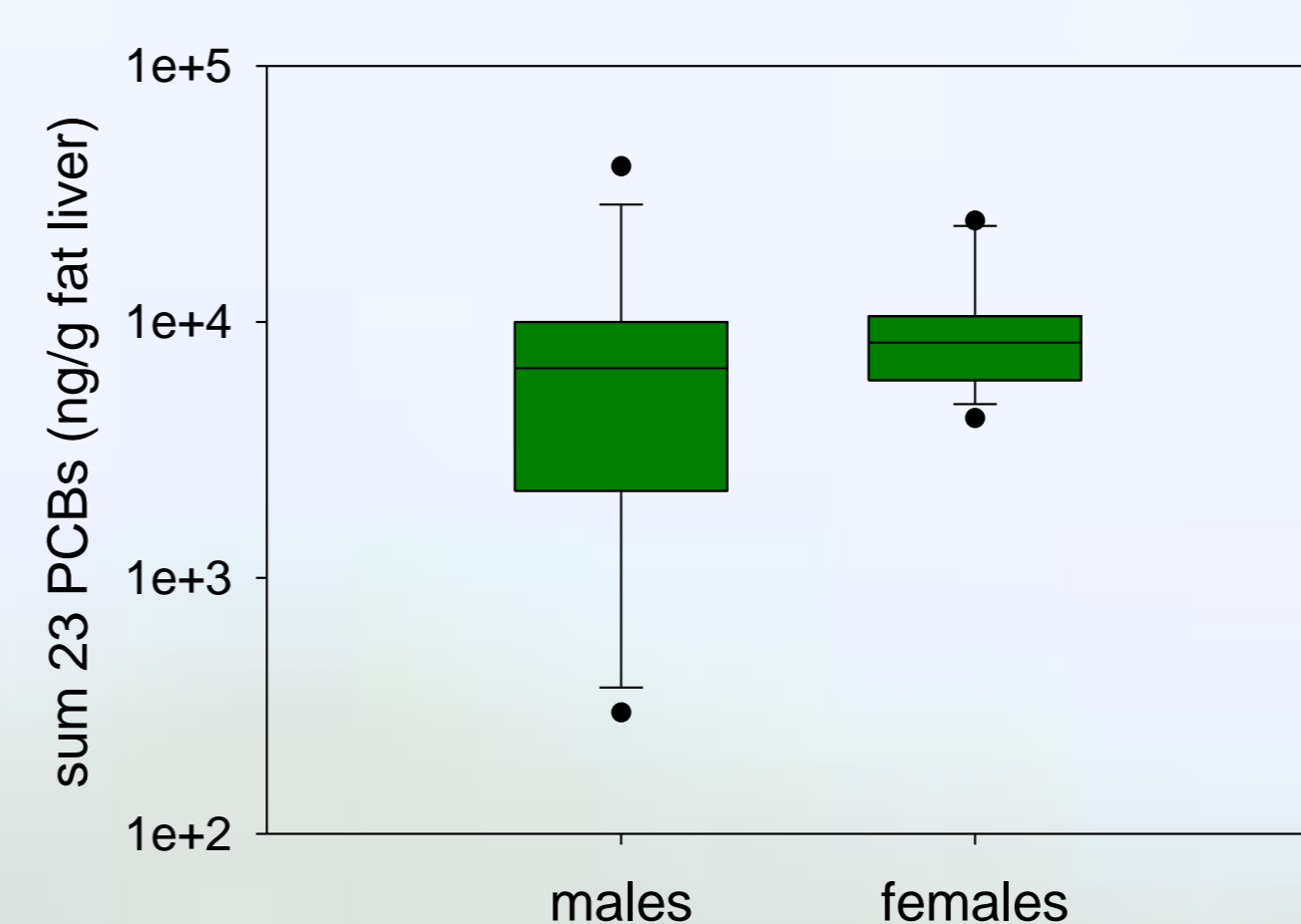- 30% of variance in dataset explained
- model p = 0.041

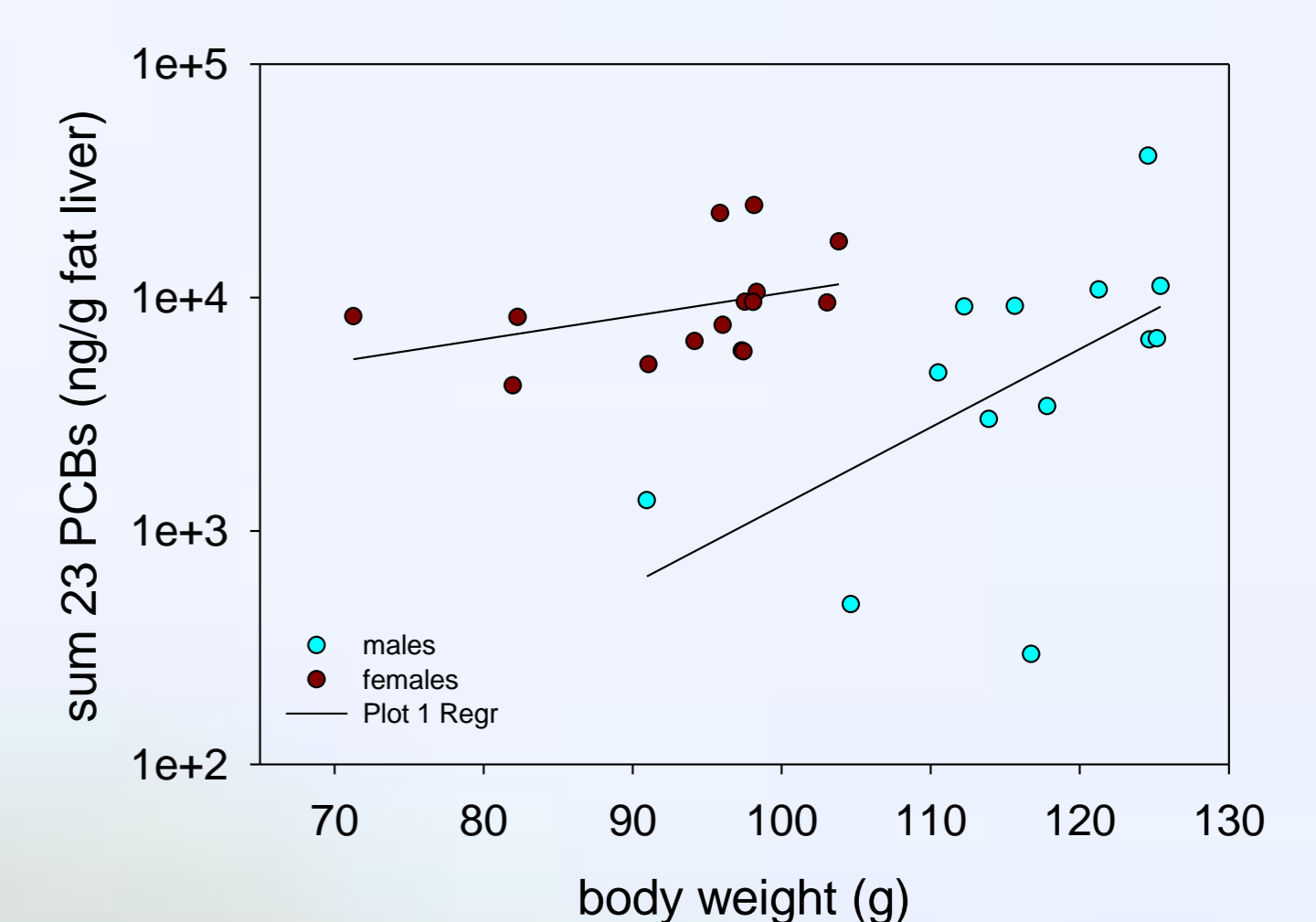**Figure 2.** Boxplot PCB concentration in moles from reference sites

Figure 3. PCB concentration related to body weight

Moles from all sites in T1 monitoring

Model selected with 5 predicting variables (Figs. 4 and 5):
1. type of ditch fill
2. sex (estimate -0.413, p = 0.085)
3. liver weight (estimate 0.195, p = 0.291)
4. body length (estimate -0.464, p = 0.0770
5. body weight (estimate 0.0211, p = 0.191)
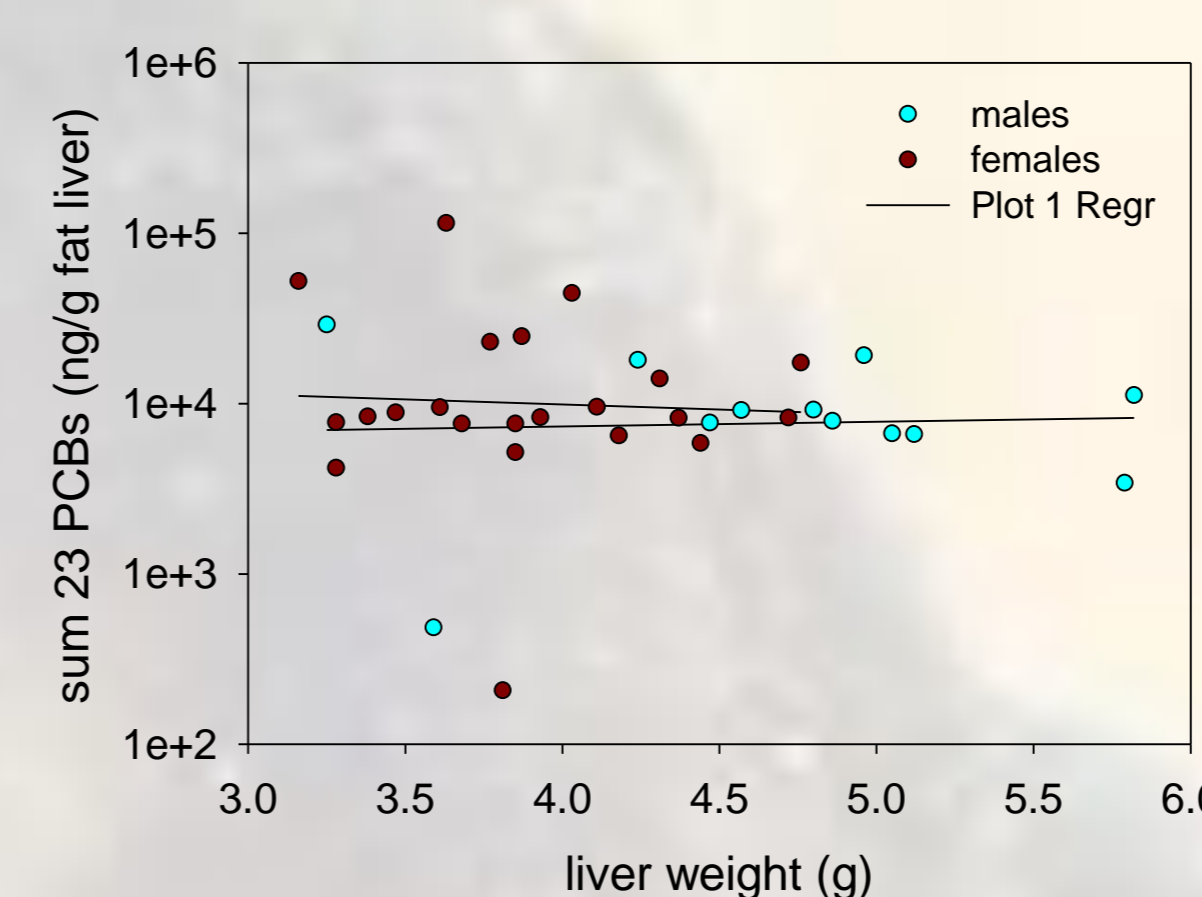- 35% of variance in dataset explained
- model p = 0.010

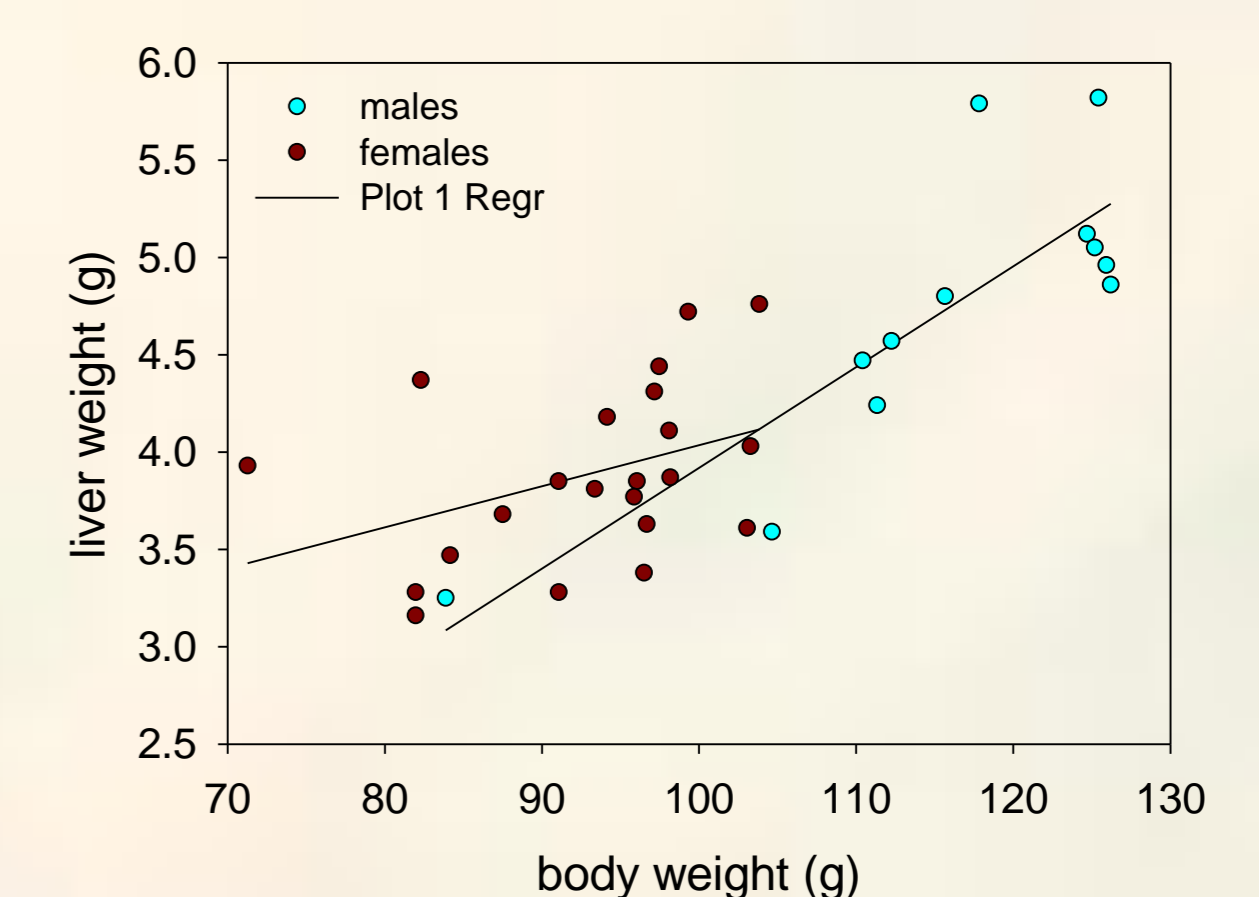**Figure 4.** PCB concentration related to liver weight

Figure 5. Liver weight related to body weight

Conclusions

- PCB content in moles on reference sites can be predicted by body weight (corresponding to age) and sex of the mole
- Despite being reference sites, contamination turned out to be present at some locations.
- PCB content in moles in T1 can be predicted by type of ditch fill, sex, and several variables related to size and age. Despite a cap of 40 cm clean soil, the underlying ditch fill is still available for bioaccumulation in the food web.
- Most of the variation in PCB content is still not explained.
- Why do females have higher PCB concentrations in liver fat?
  - Different behaviour, with higher exposure?
  - Differences in liver weight to body weight?
  - Other explanations?