

From ecotoxicology to stress ecology: pollutants and pathogens in terrestrial wildlife

Renaud Scheifler, Eve Afonso, Michaël Cœurdassier, Clémentine Fritsch, Patrick Giraudoux, Francis Raoul... et al.

JOURNEES RONGEURS DU CBGP
26-27 septembre 2016

More than 120 millions of natural and anthropogenic substances

Fichier Édition Affichage Historique Marque-pages Outils ?

CAS, Chemical Abstracts Service H... x

www.cas.org

Rechercher

Débuter avec Firefox À la une Chrono-Env UFC CNRS

ACS | Journals | C&EN | CAS | Languages

Site Search GO

Log In To: SciFinder GO

Products Content Training Contact Us News About CAS

f 762

42

1.4K

YOUR NEXT BREAKTHROUGH STARTS HERE

At CAS, we organize, analyze and share information that drives scientific discoveries. We facilitate your research to fuel tomorrow's innovation.

Together, we will do great things.

More >>

CAS CHANGED CHEMISTRY RESEARCH.

IT'S ABOUT TO HAPPEN AGAIN.

SciFinderⁿ is coming.

Available Spring 2017

LEARN MORE

Scientists

Patent Experts

No one else has more...

1 2 0,4 1 4,7 7 5

ORGANIC AND INORGANIC SUBSTANCES TO DATE

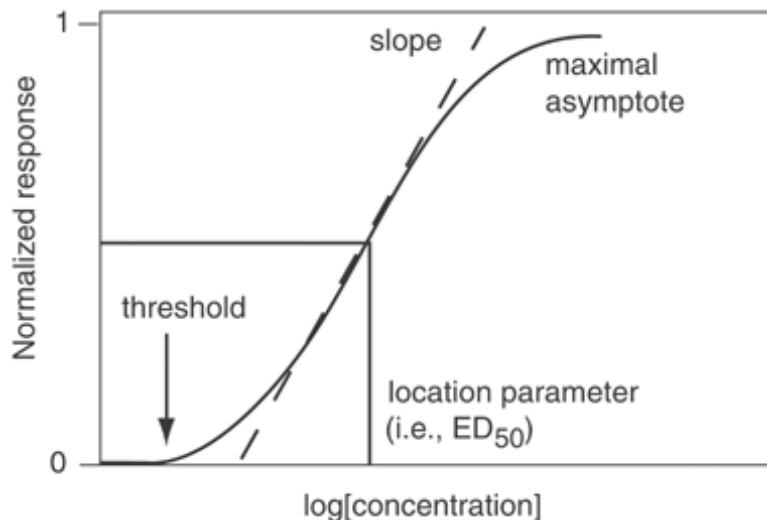
A global team of scientists is continually adding substance information from the world's disclosed chemistry to the CAS REGISTRYSM, the gold standard for chemical substance information.

Document : 100% Images : 9/9 Chargés : 116 Ko Vitesse : 4.41 Ko/s Durée : 27.175

10:05 22/09/2016

Ecotoxicology: the laboratory-based paradigm

Standardized lab tests used to underpin decisions on registration of chemicals and derivation of environmental quality criteria (EQC)



Mono-specific dose-response curve

Plan du site | À propos de ce site | Avis juridique | Cookies | Contact | Recherche [français (fr)]

Commission européenne

ENTREPRISES ET INDUSTRIE

Commission européenne > Entreprises et industrie > Tous les sujets > Produits chimiques > REACH

Rechercher

Entreprises et industrie

Produits chimiques

REACH

- How does REACH work?
- > Registration
- > Evaluation
- > Authorisation
- > Restrictions
- > Enforcement
- Review and studies
- Nanomaterials
- Waste
- Fees and charges
- Competent Authorities (Caracal)

REACH est le règlement sur l'enregistrement, l'évaluation, l'autorisation et les restrictions des substances chimiques. Il est entré en vigueur le 1er juin 2007. REACH rationalise et améliore l'ancien cadre réglementaire de l'Union européenne (UE) sur les produits chimiques.

Les principaux objectifs de REACH sont d'assurer un niveau élevé de protection de la santé humaine et l'environnement contre les risques que peuvent poser les produits chimiques, la promotion de méthodes d'essai alternatives, la libre circulation des substances au sein du marché intérieur et de renforcer la compétitivité et l'innovation.

REACH fait porter à l'industrie la responsabilité d'évaluer et de gérer les risques posés par les produits chimiques et de fournir des informations de sécurité adéquates à leurs utilisateurs. En parallèle, l'Union européenne peut prendre des mesures supplémentaires concernant des substances extrêmement dangereuses, quand une action complémentaire au niveau européen se révèle nécessaire.

Informations importantes [en](#) pour les entreprises, en particulier les PME.

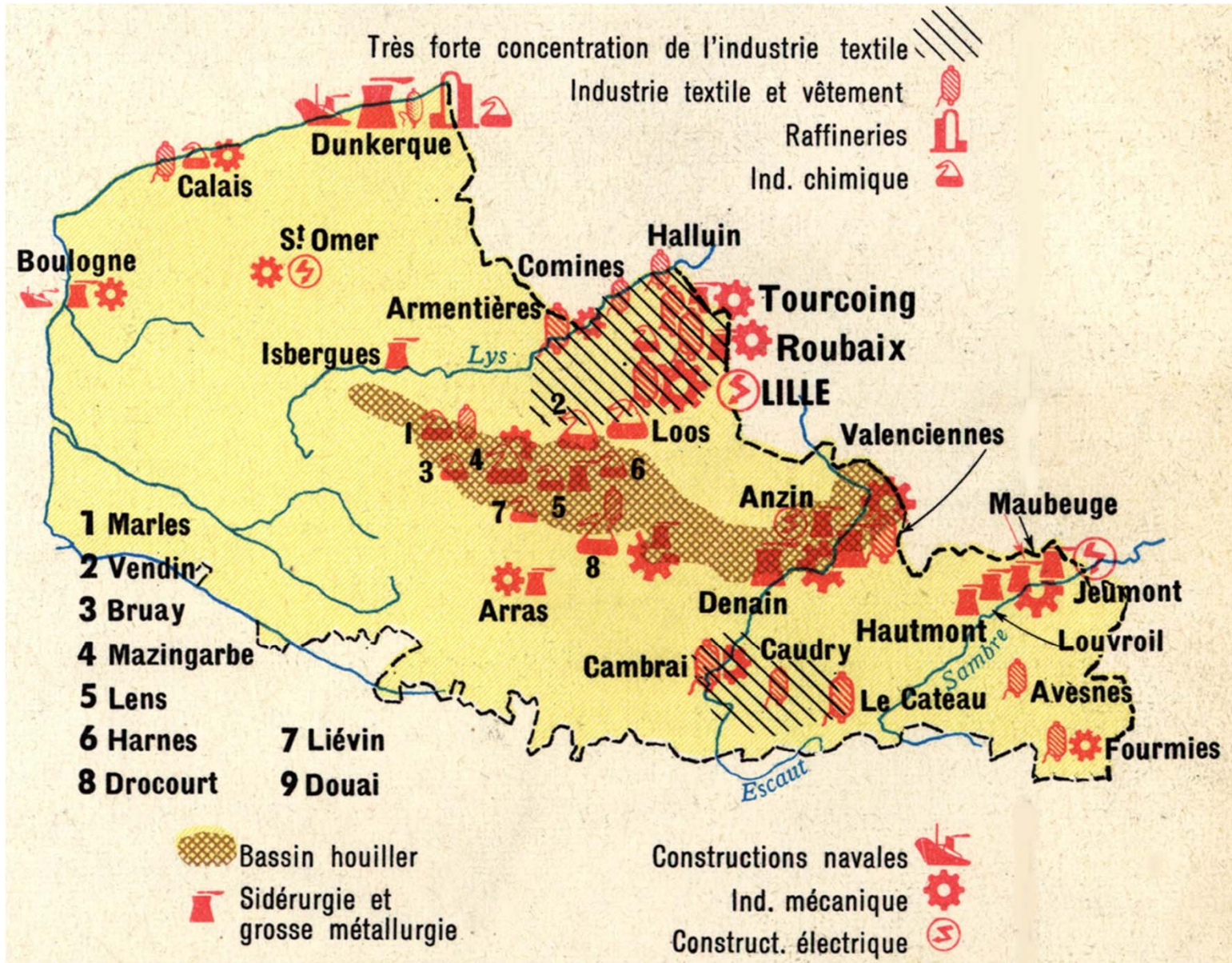
[Règlement REACH, nanomatériaux, documents d'orientation, archives en](#)

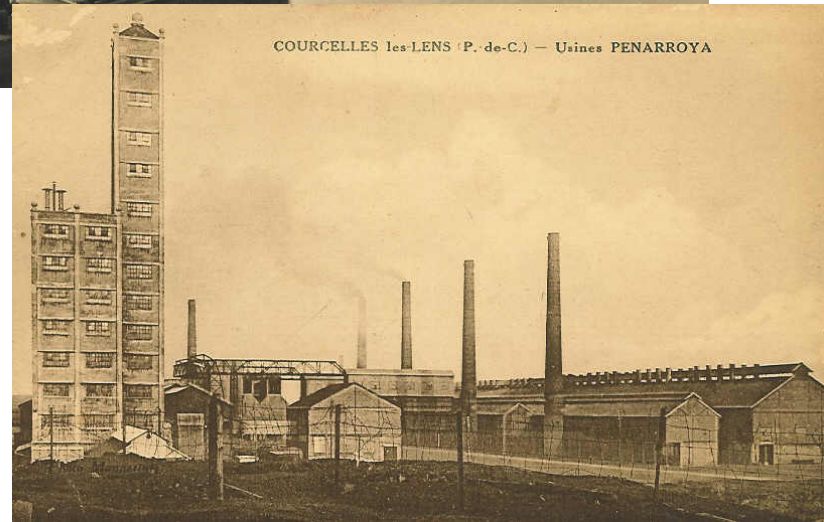
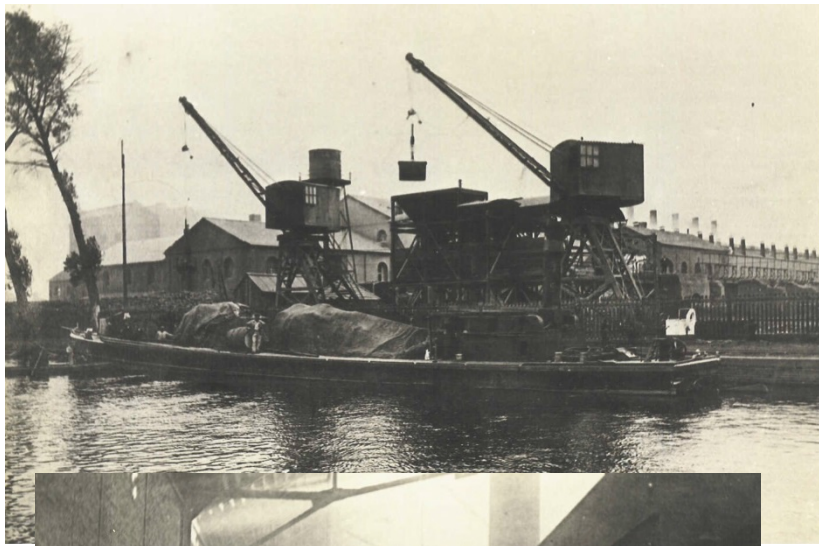
Strong social demand

Ecotoxicology: a second framework is the study of toxic chemicals and ecological responses in the field

- Point source emitting a single chemical or a simple mixture of chemicals
- Gradient of pollution of the field
- Study of ecological variables as a function of distance from the source
- Hypothesis: high concentrations close to the source are associated to adverse effects
- Data may be used to derive critical concentrations in relation to effects in the field

Study site: Metaleurop Nord, a former Pb and Zn smelter





1894 : Installation à Noyelles-Godault d'une fonderie de Zn et d'un four à Pb par **Malfidano**

Destruction pendant la guerre 1914 - 1918

1920 : Reconstruction par la Société **Pennaroya**

1988 : Création de Metaleurop SA et **Metaleurop Nord**

2003 : Fermeture de Metaleurop Nord

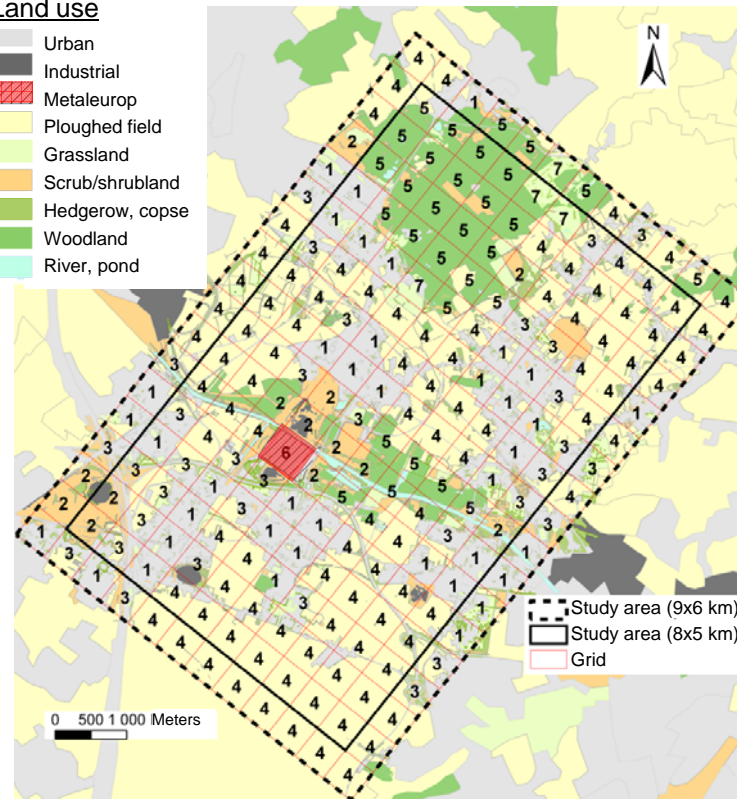
Sampling strategy: 30 squares of 25 ha along a pollution gradient
in urban, agricultural, and forest areas



Land use

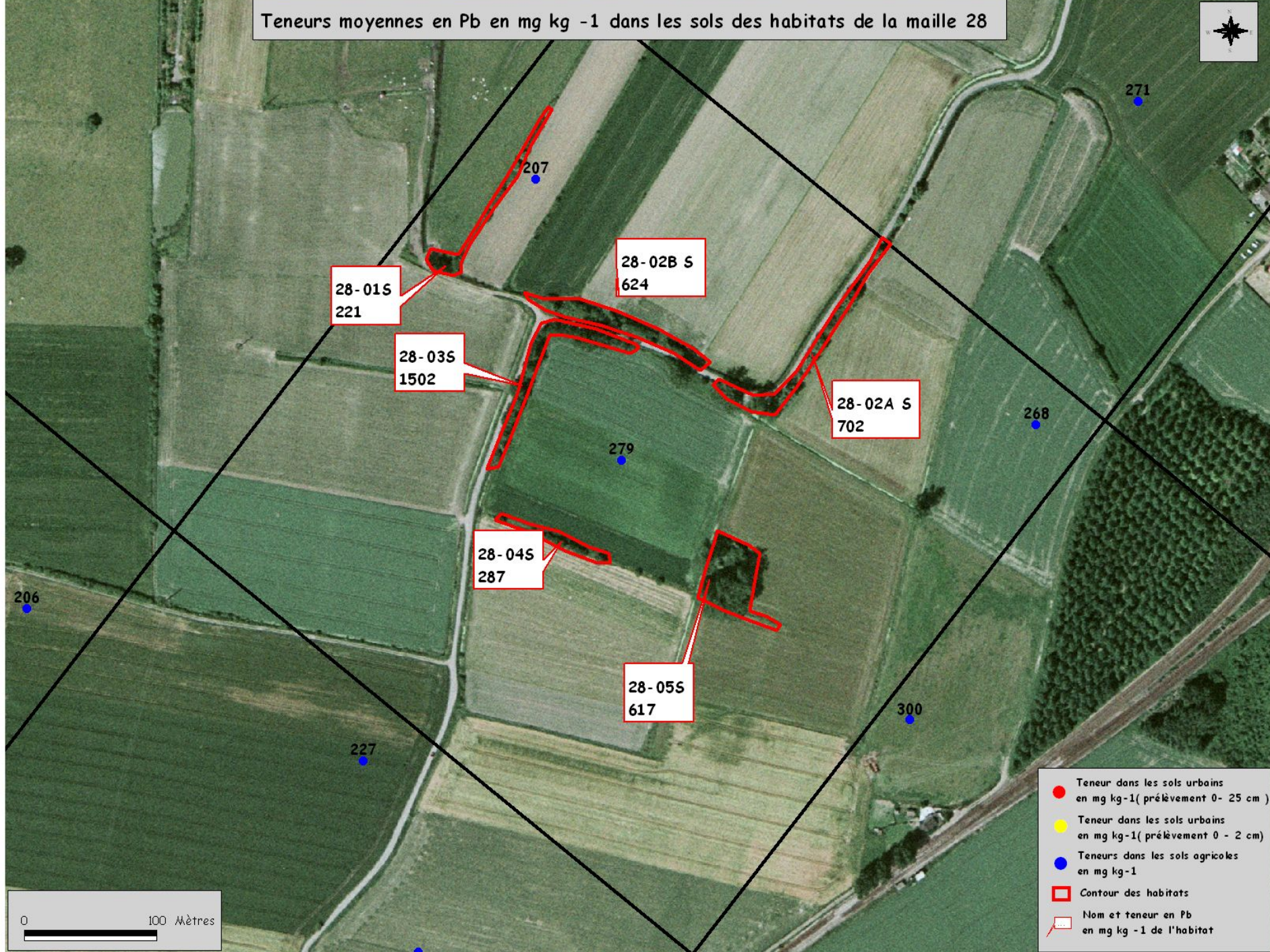
- Urban
- Industrial
- Metaleurop
- Ploughed field
- Grassland
- Scrub/shrubland
- Hedgerow, copse
- Woodland
- River, pond

LANDSCAPE

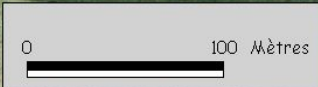


1	Urban areas
2	Scrub/ shrublands
3	Mixed urban areas + other
4	Agricultural areas
5	Woodlands
6	Metaleurop
7	Mixed woodlands + grasslands

Teneurs moyennes en Pb en mg kg⁻¹ dans les sols des habitats de la maille 28



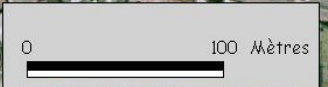
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0- 25 cm)
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0 - 2 cm)
- Teneurs dans les sols agricoles en mg kg⁻¹
- ▭ Contour des habitats
- ▭ Nom et teneur en Pb en mg kg⁻¹ de l'habitat



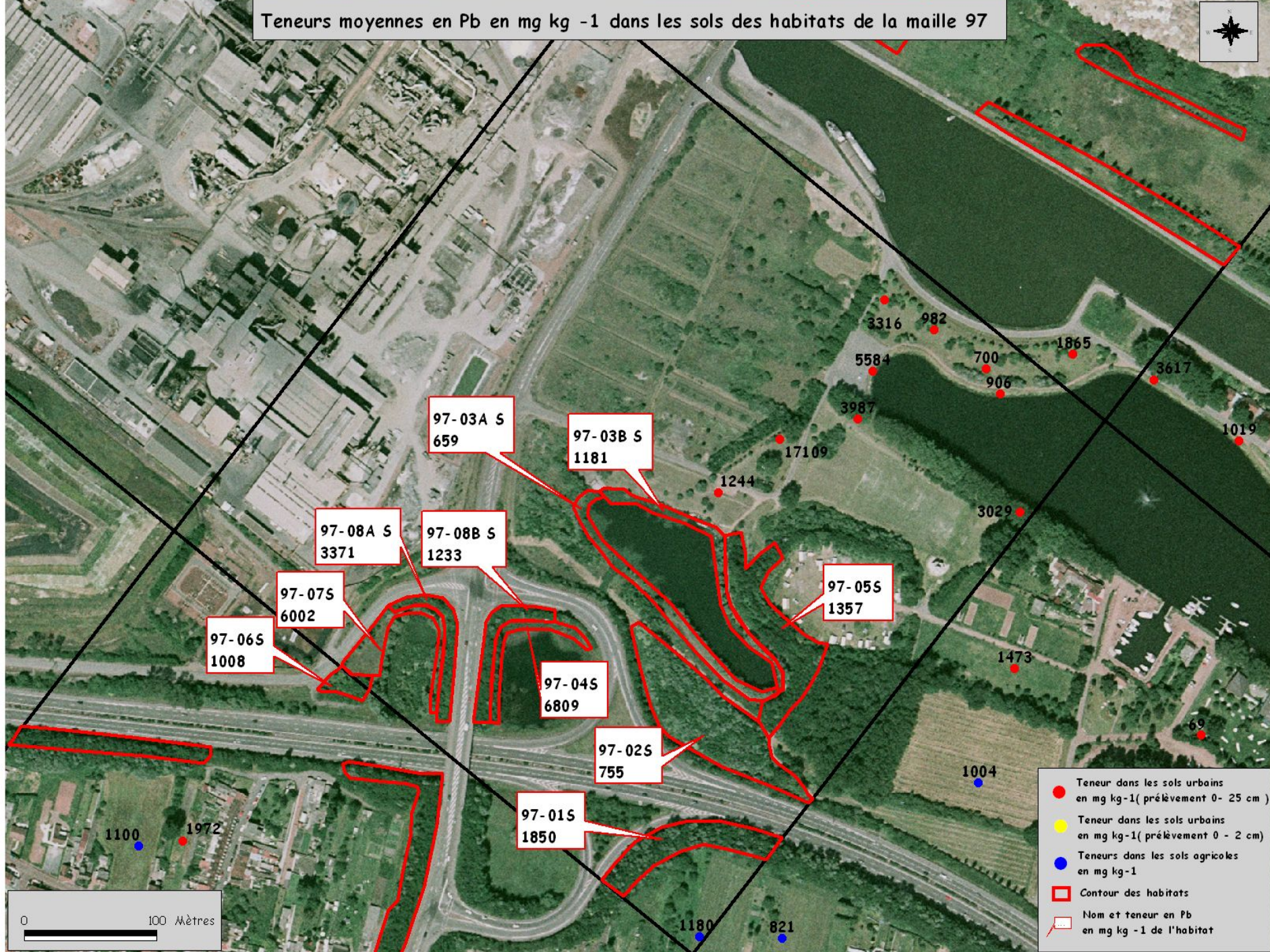
Teneurs moyennes en Pb en mg kg⁻¹ dans les sols des habitats de la maille 96



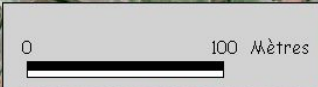
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0 - 25 cm)
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0 - 2 cm)
- Teneurs dans les sols agricoles en mg kg⁻¹
- ▭ Contour des habitats
- ▭ Nom et teneur en Pb en mg kg⁻¹ de l'habitat



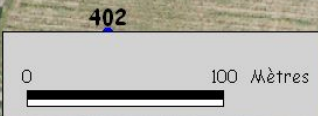
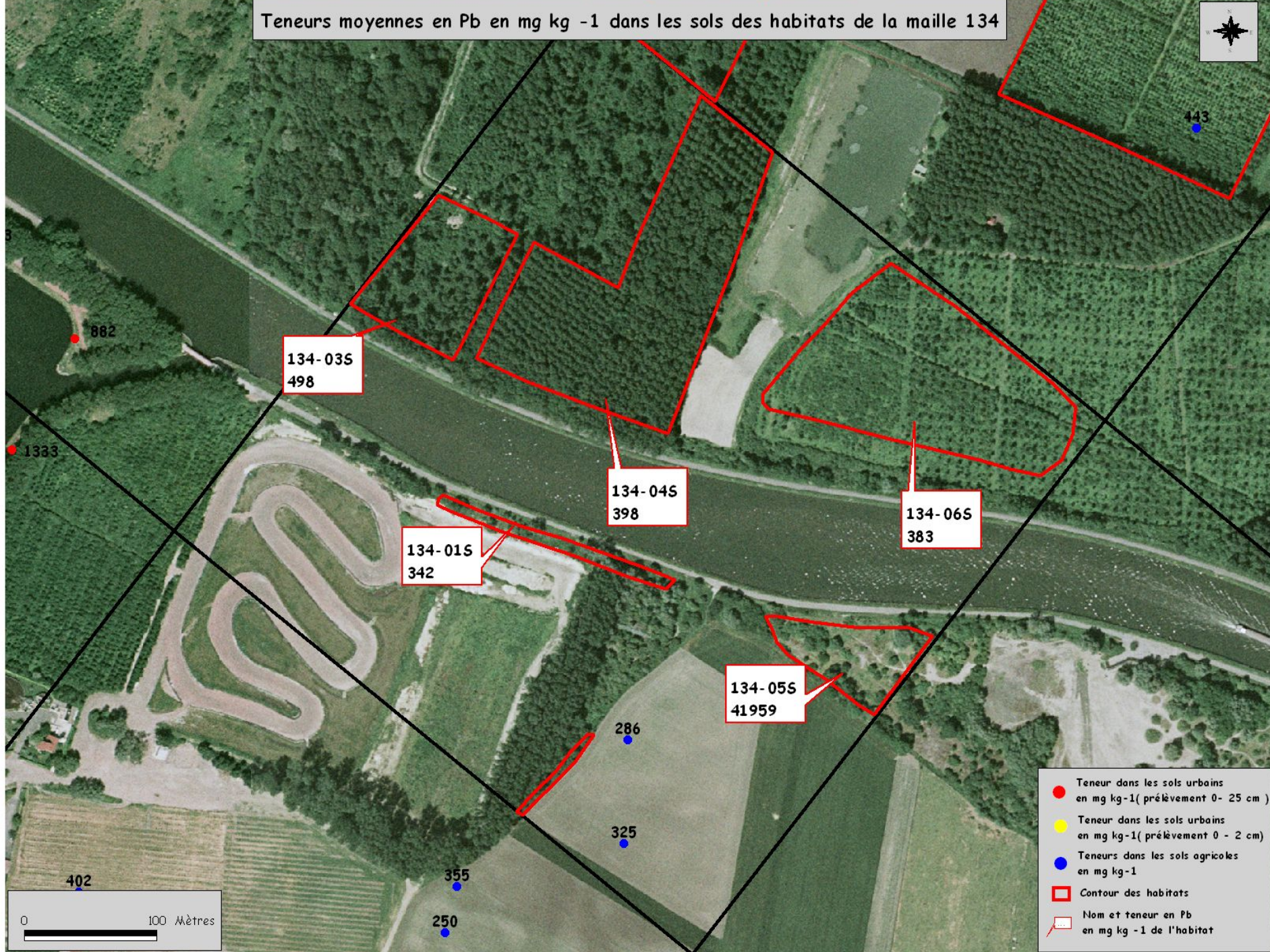
Teneurs moyennes en Pb en mg kg⁻¹ dans les sols des habitats de la maille 97



- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0- 25 cm)
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0 - 2 cm)
- Teneurs dans les sols agricoles en mg kg⁻¹
- ▭ Contour des habitats
- ▭ Nom et teneur en Pb en mg kg⁻¹ de l'habitat



Teneurs moyennes en Pb en mg kg⁻¹ dans les sols des habitats de la maille 134



- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0- 25 cm)
- Teneur dans les sols urbains en mg kg⁻¹ (prélèvement 0 - 2 cm)
- Teneurs dans les sols agricoles en mg kg⁻¹
- ▭ Contour des habitats
- ▭ Nom et teneur en Pb en mg kg⁻¹ de l'habitat

134-035
498

134-045
398

134-065
383

134-015
342

134-055
41959

443

882

1333

286

325

402

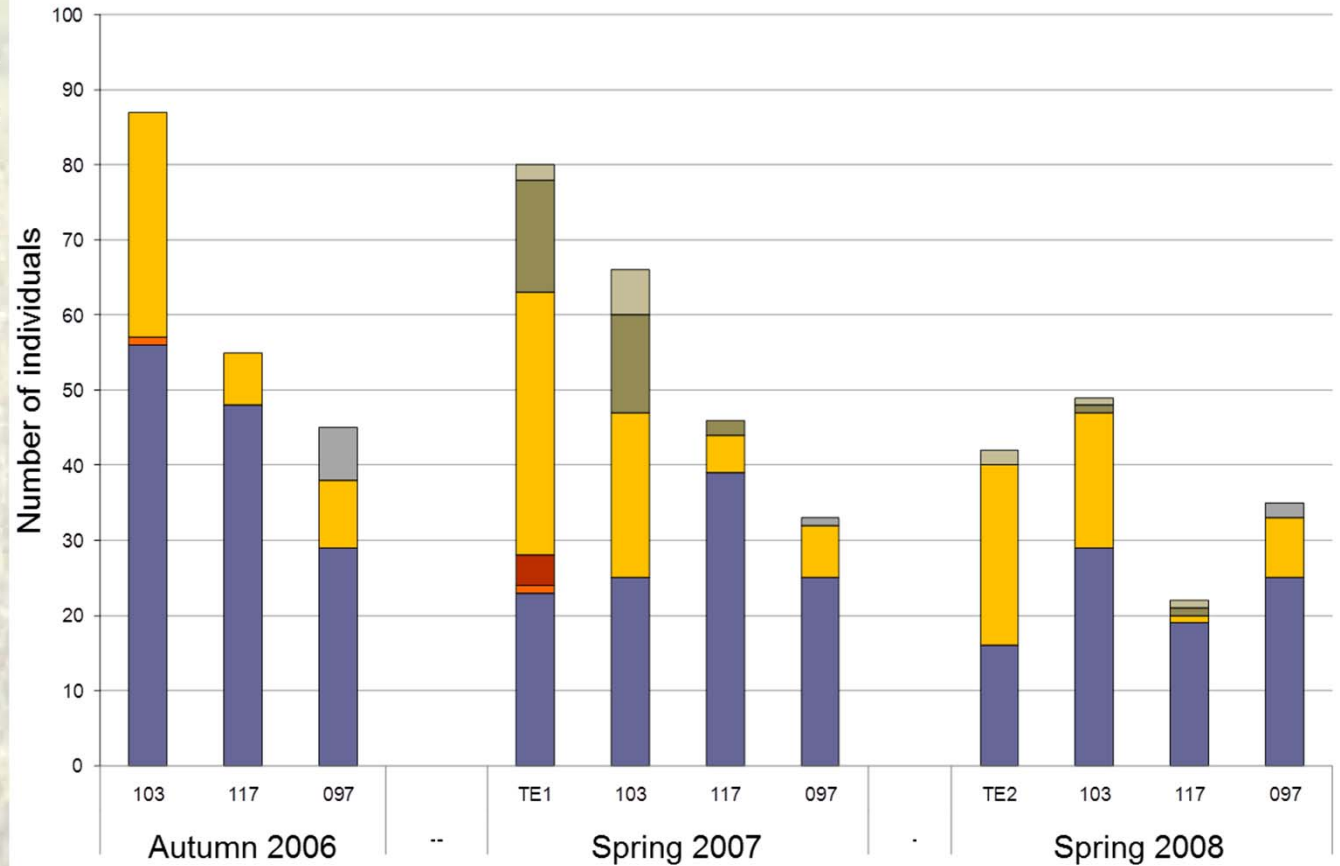
355

250

11 small mammal species on the site... with complex interannual variations

Number of individuals captured (n) and capture success (% captures: n/100 trap-nights)

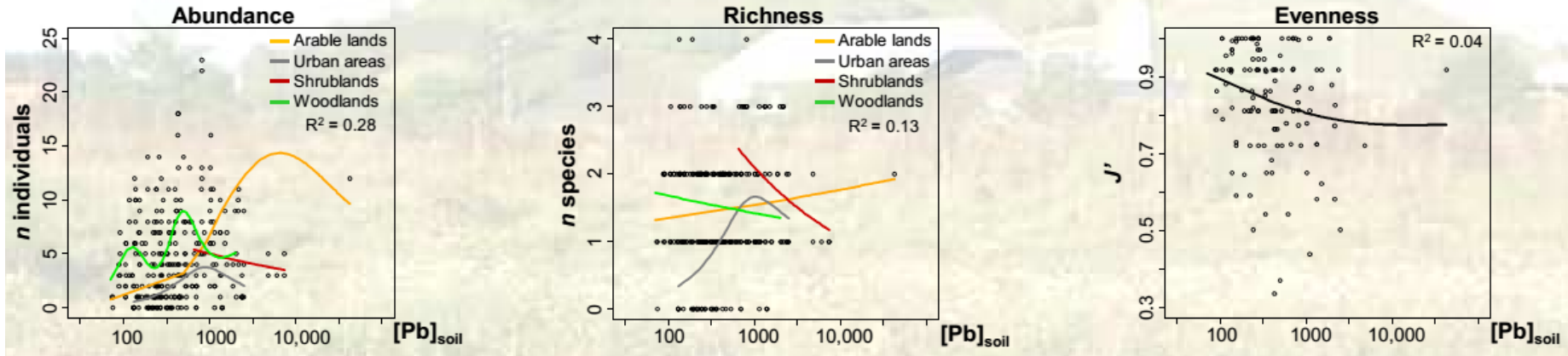
	n	Capture success
 <i>Apodemus sylvaticus</i> (Apsy)	859	9.94
 <i>Micromys minutus</i> (Mimi)	5	0.06
 <i>Mus musculus</i> (Mumu)	5	0.06
 <i>Myodes glareolus</i> (Mygl)	254	2.94
 <i>Microtus agrestis</i> (Miag)	9	0.10
 <i>Microtus arvalis</i> (Miar)	9	0.10
 <i>Microtus subterraneus</i> (Misu)	2	0.02
 <i>Crocidura leucodon</i> (Crle)	12	0.14
 <i>Crocidura russula</i> (Crru)	164	1.90
 <i>Sorex araneus</i> (Soac)	11	0.13
 <i>Sorex minutus</i> (Somi)	8	0.09



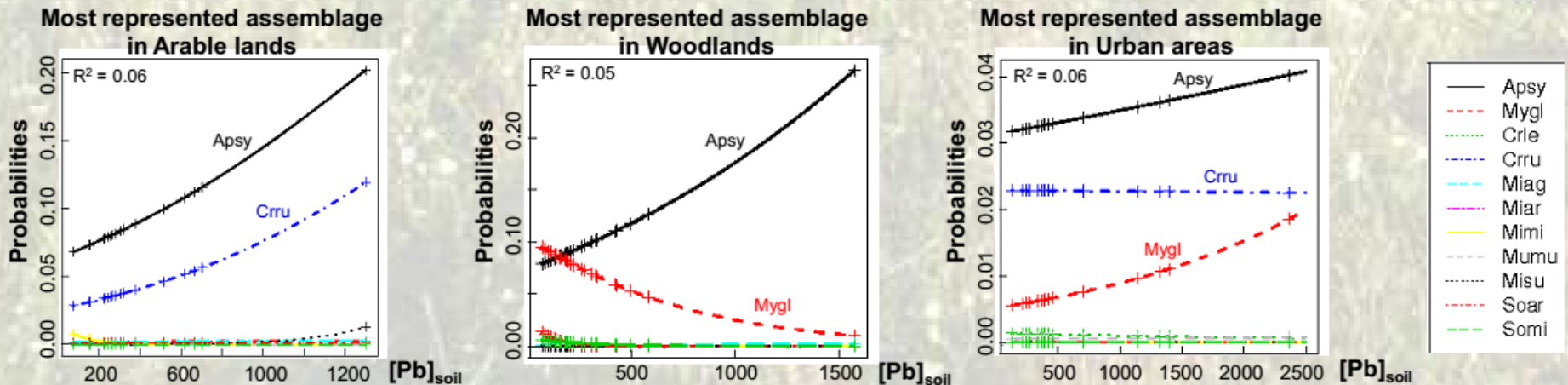
-  *Sorex minutus*
-  *Sorex araneus*
-  *Crocidura russula*
-  *Myodes glareolus*
-  *Microtus subterraneus*
-  *Microtus agrestis*
-  *Apodemus sylvaticus*

The dominance of the wood mouse increases along the pollution gradient

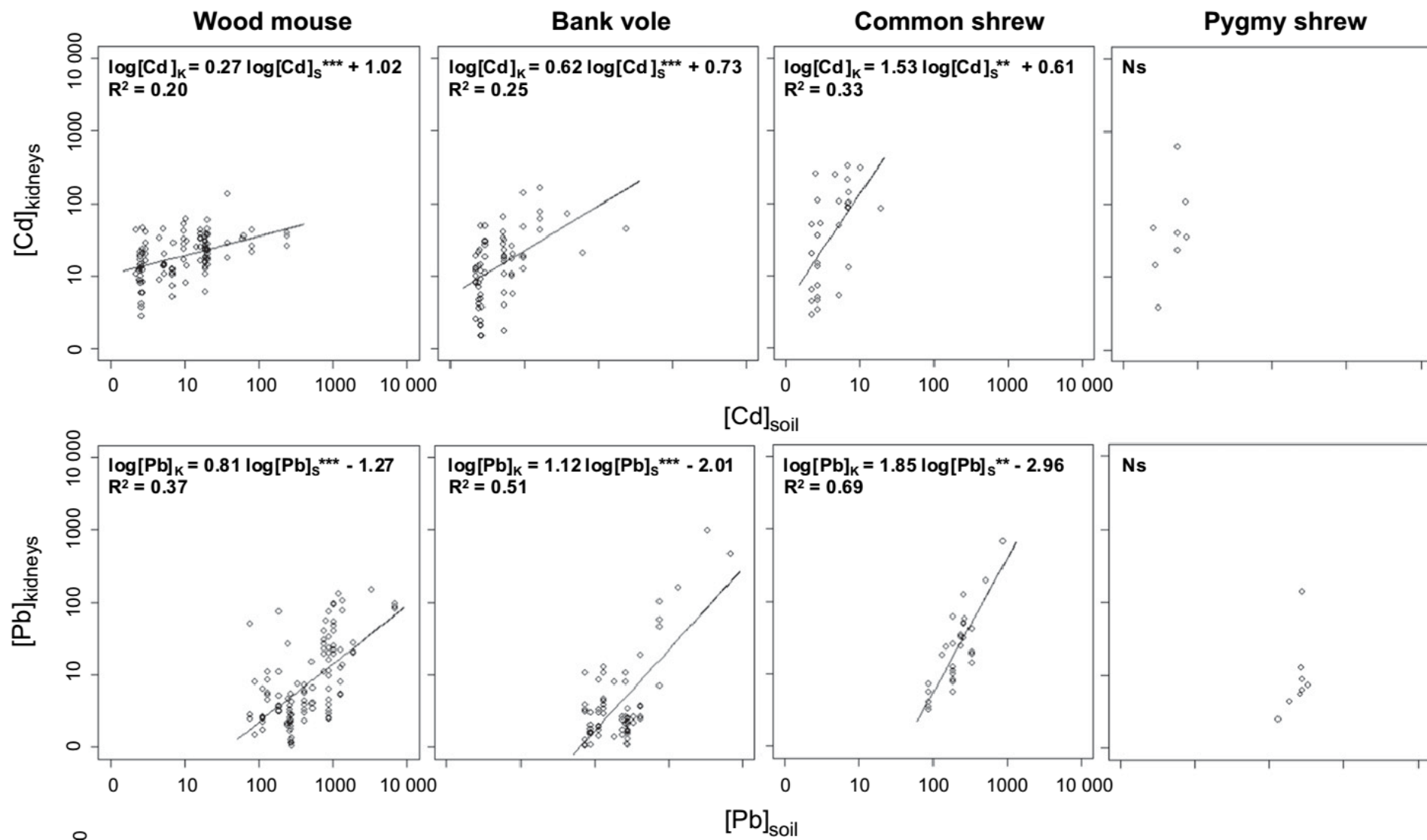
Variations of structure parameters of assemblages with pollution



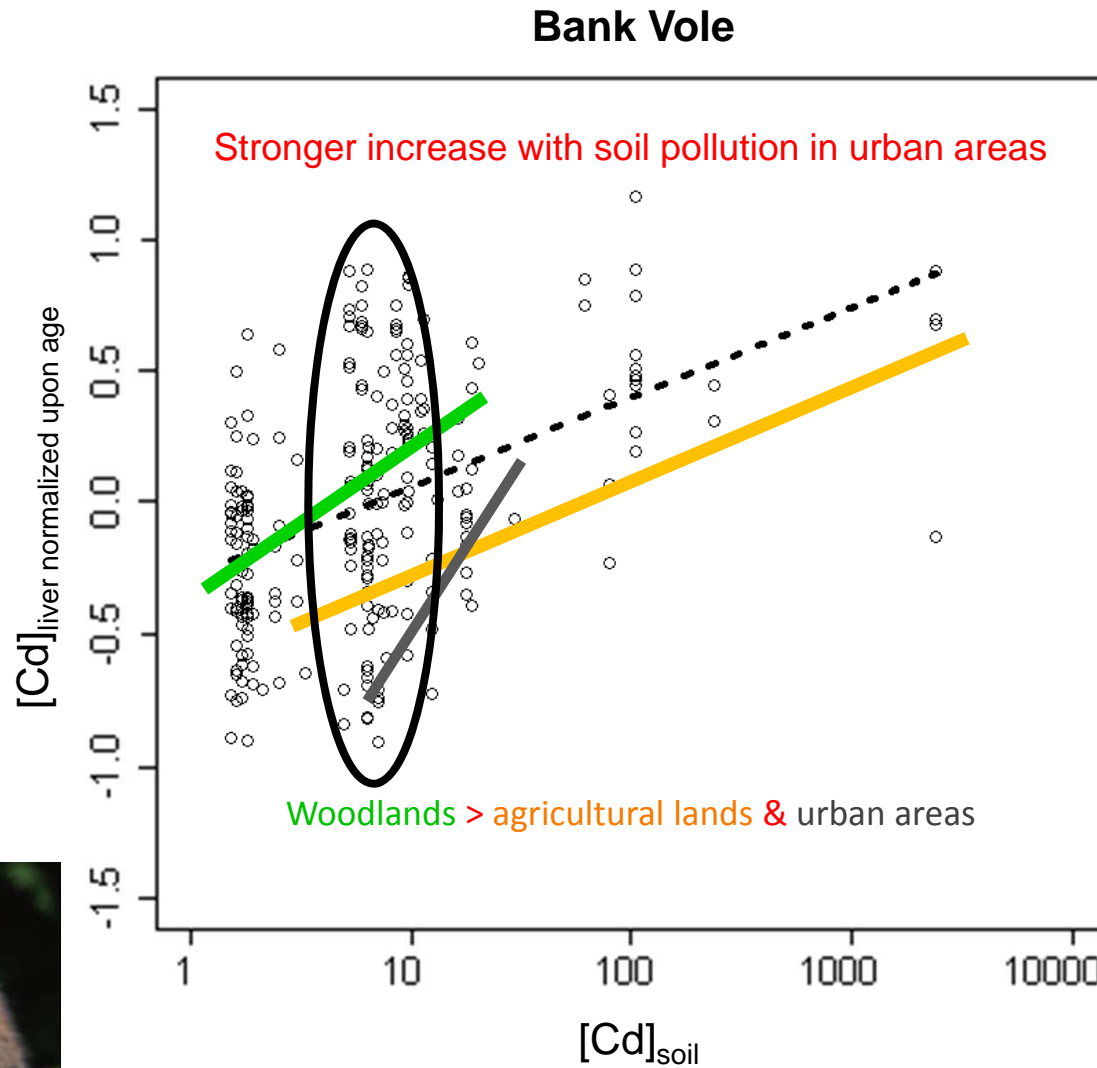
Probabilities of occurrences of species along [Pb] gradient for some assemblages on which [Pb] had an effect



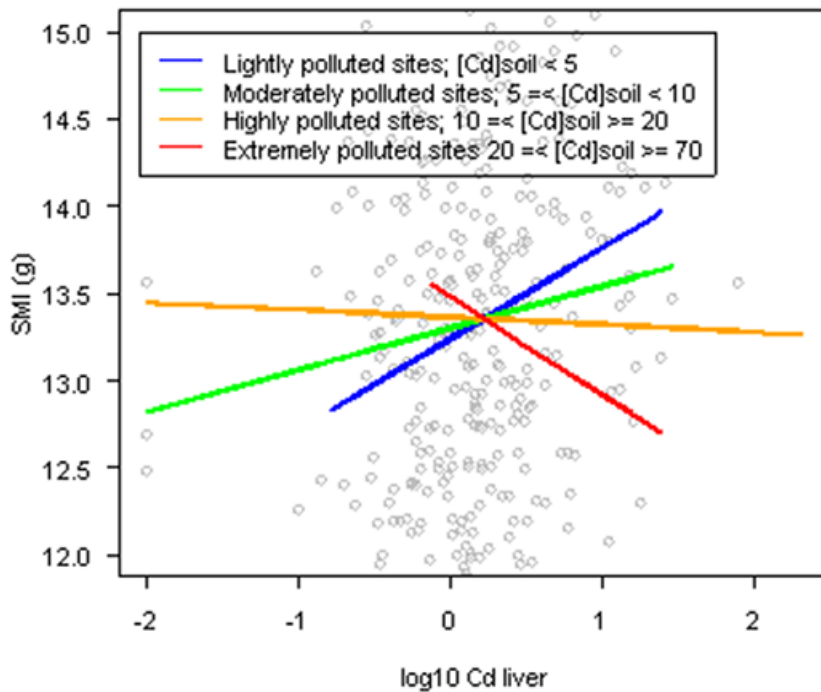
Accumulation of trace metals varies according to species



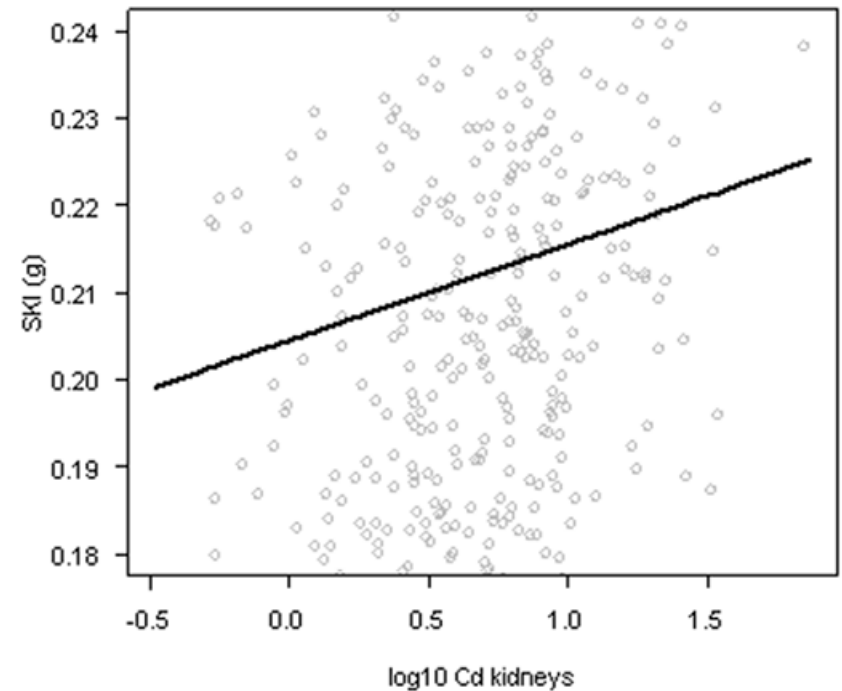
Accumulation of trace metals varies according to landscape



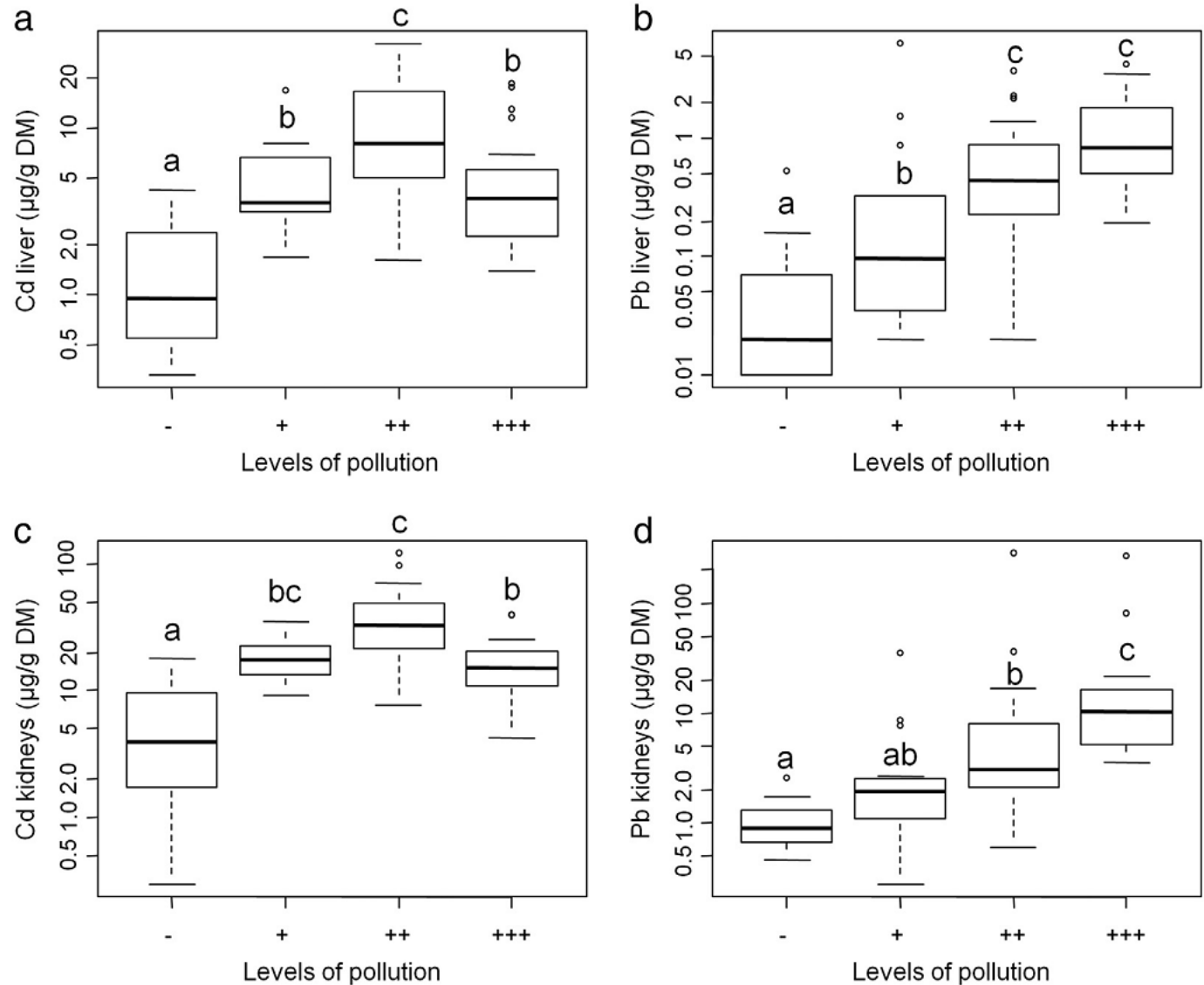
Body condition decreases at high to very high concentrations in the tissues



The increase of the kidney index suggests histopathology

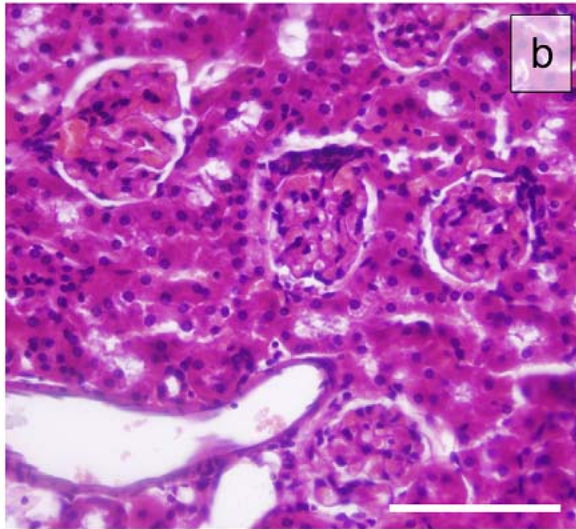
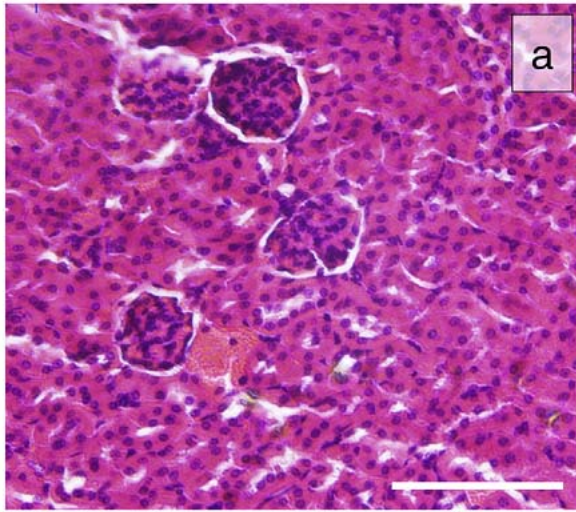


Over time (2006-2012), accumulation pattern changed: [Pb] increase along the pollution gradient while [Cd] show a bell-shaped curve

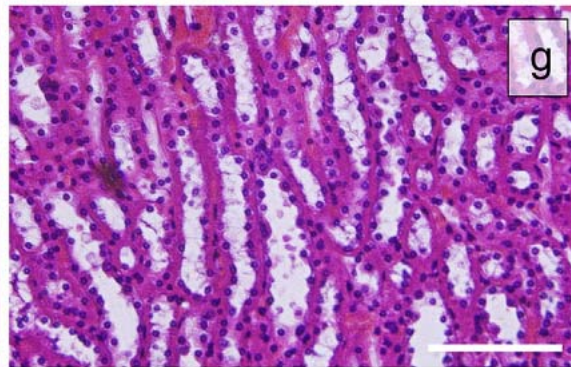
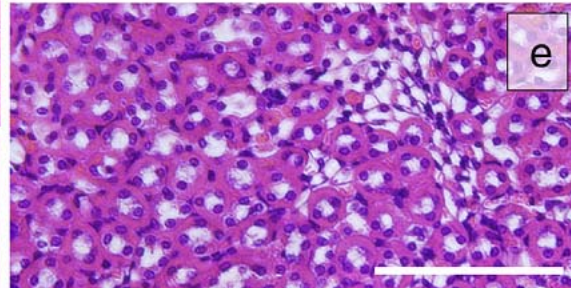
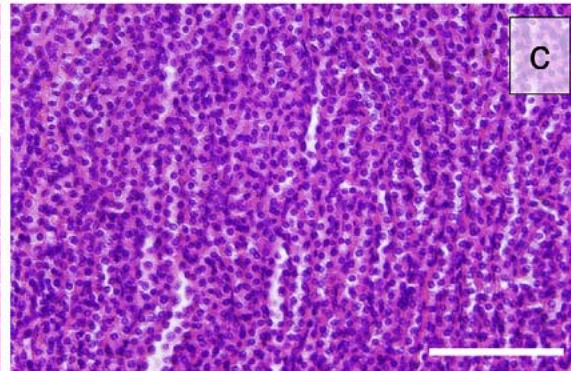


Histological alterations were observed in the kidneys

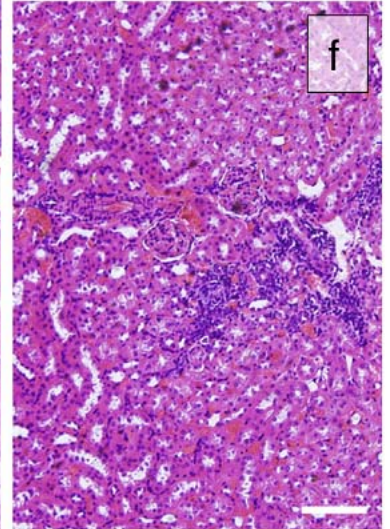
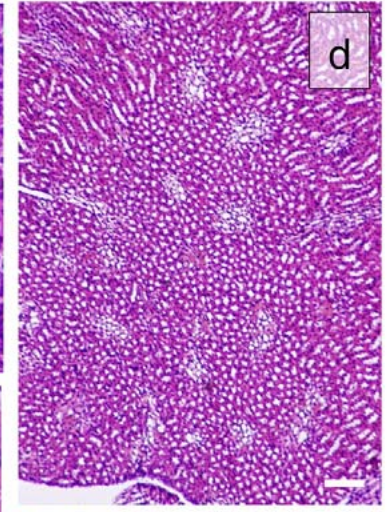
Glomerular hyperplasia (b)



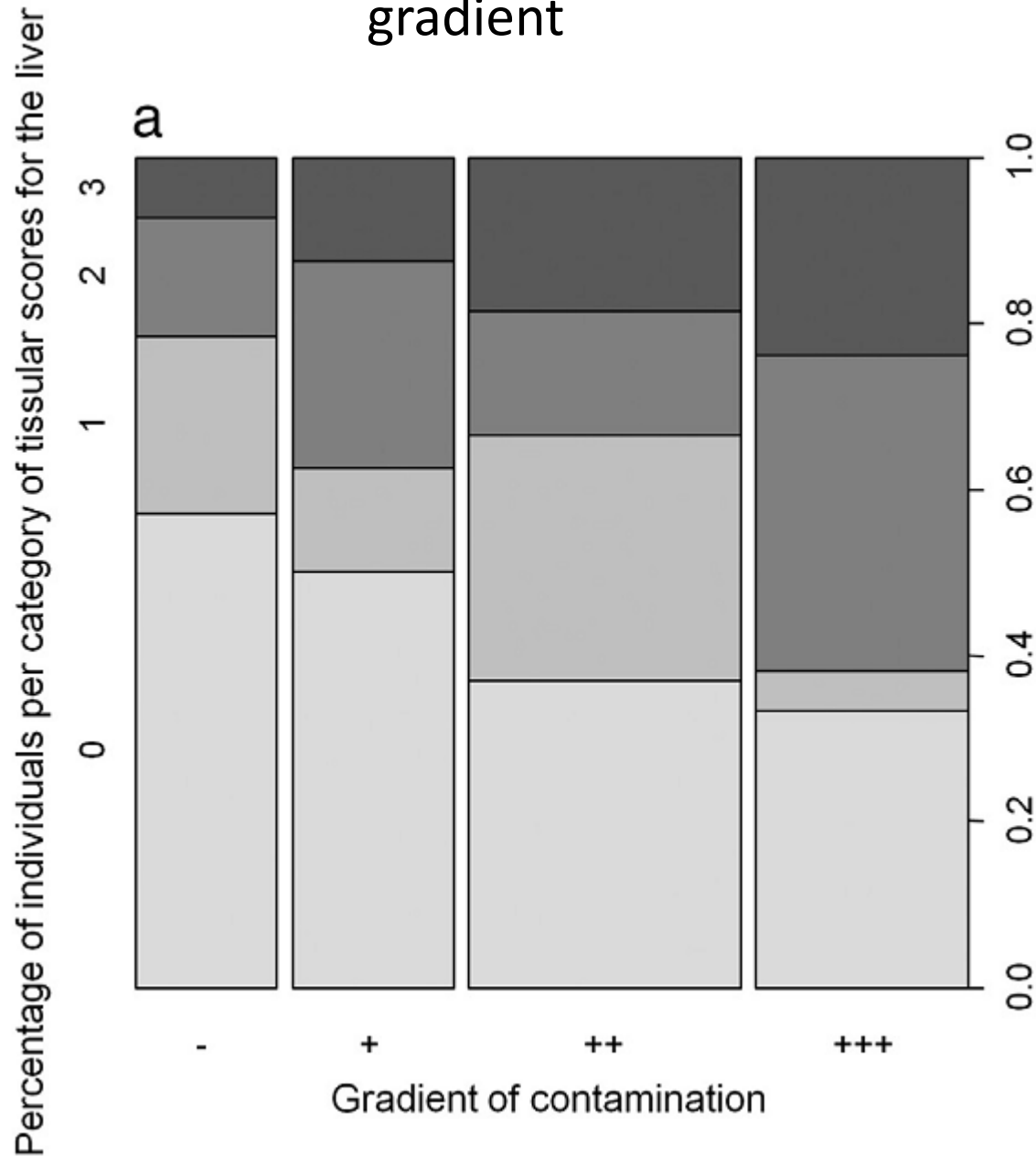
Tubular necrosis (d)



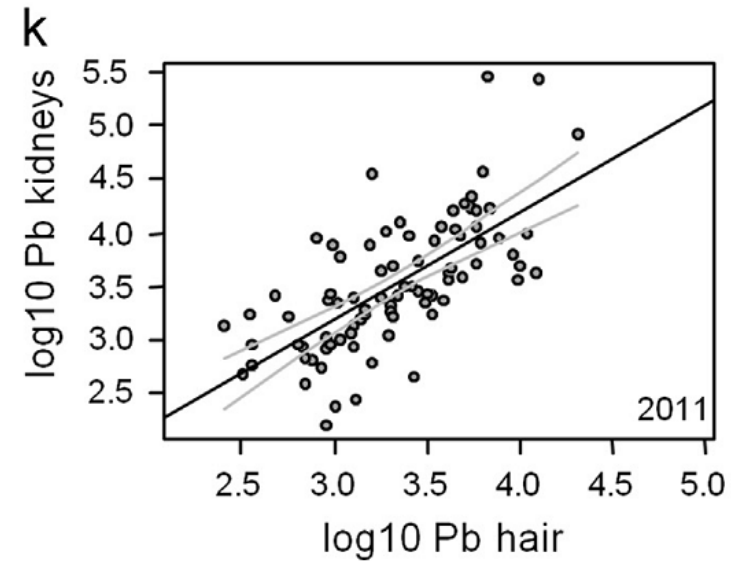
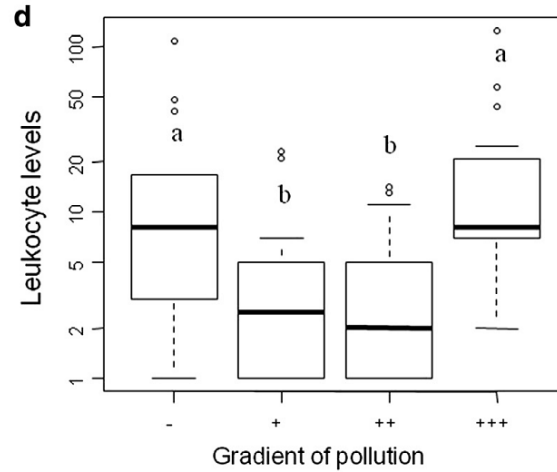
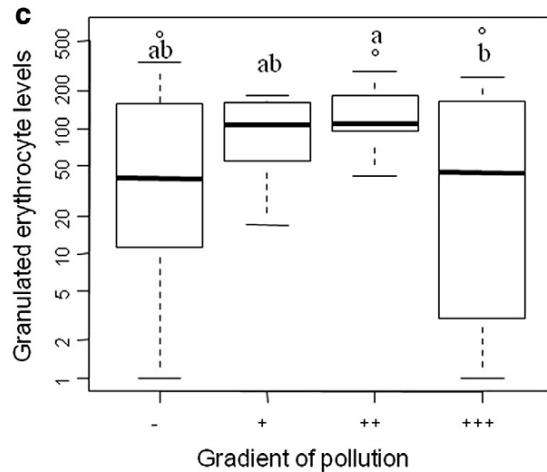
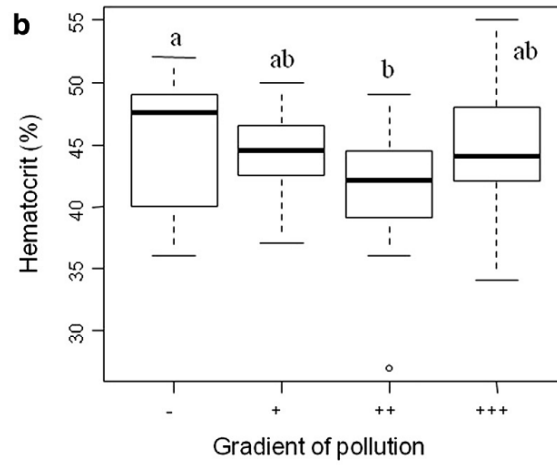
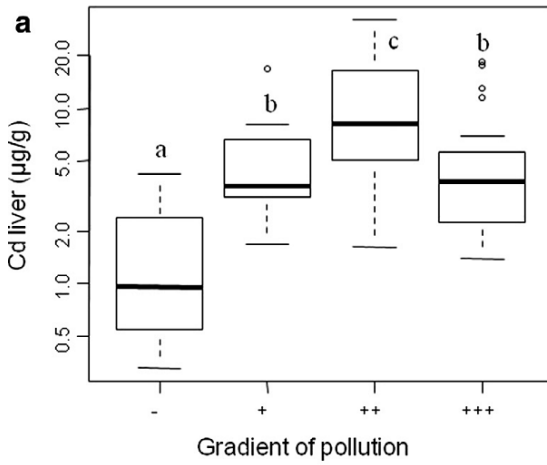
Inflammation and lymphocyte infiltration (f)



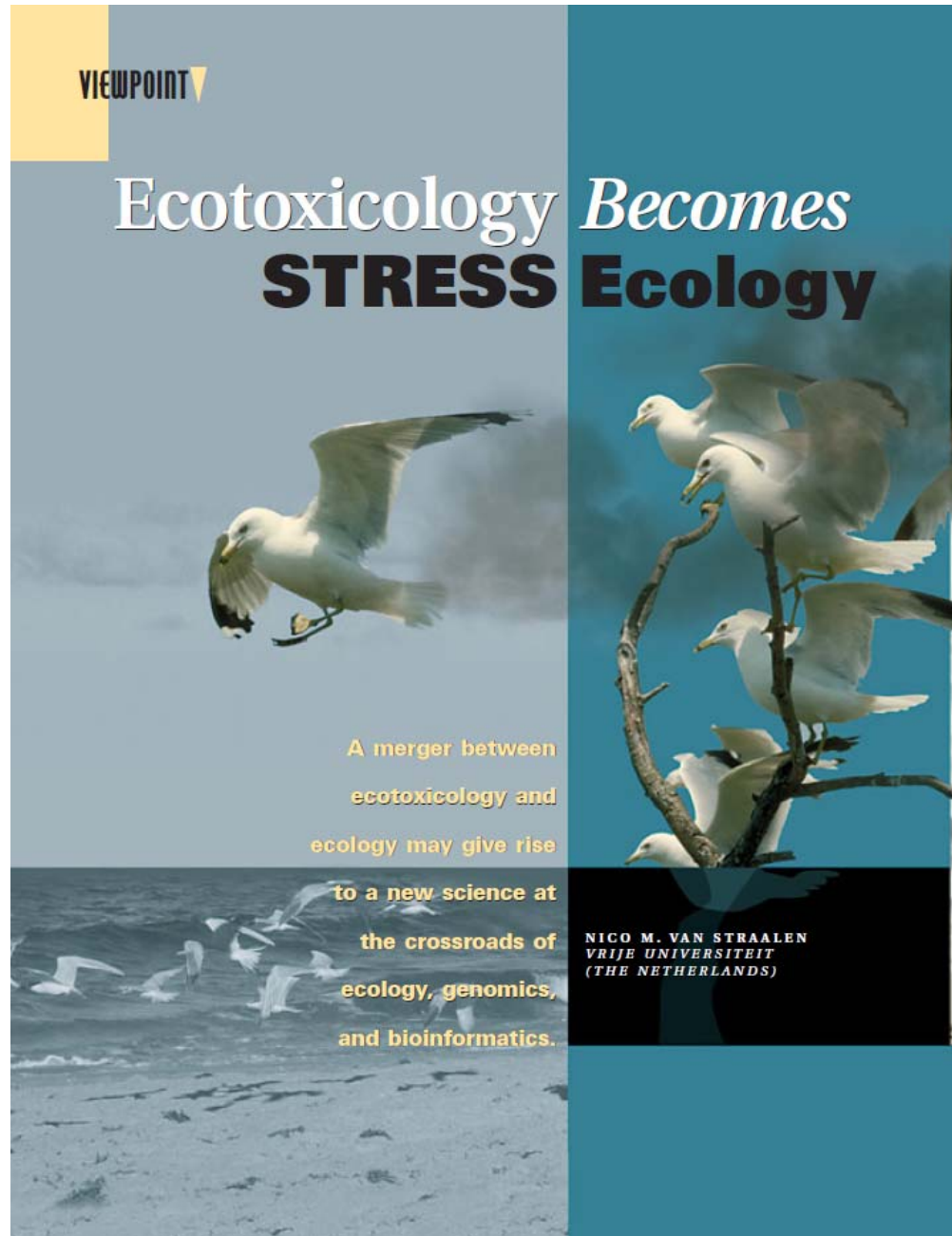
The severity of histological alterations increases along the pollution gradient



Non-invasive methods have been developed for both accumulation and effects



How to make ecotoxicology moving towards stress ecology?

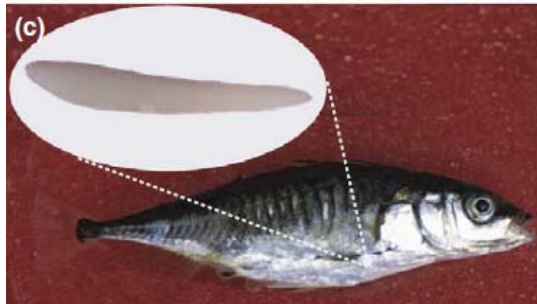
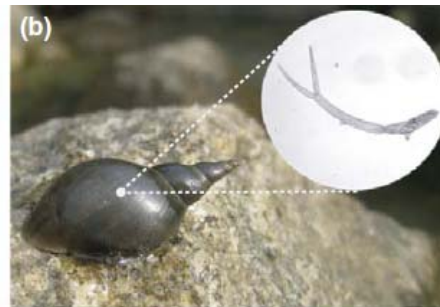


Van Straalen. 2003.
*Environmental Science &
Technology*, 37: 324A-330A.

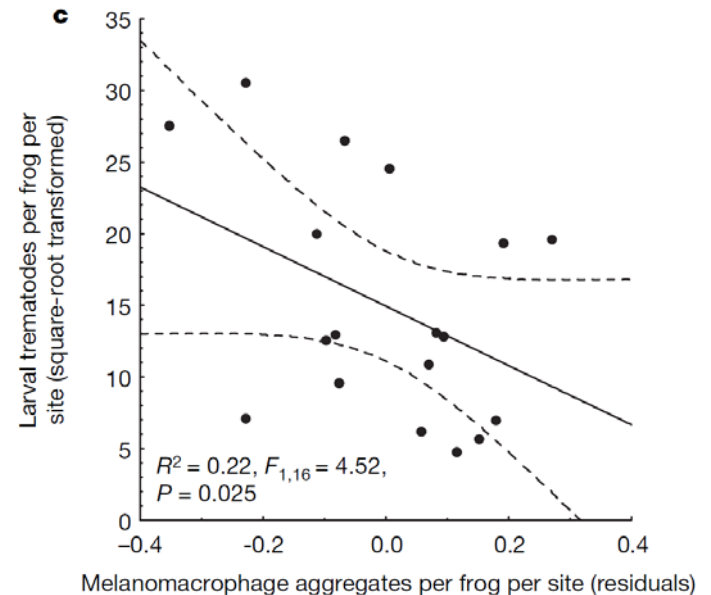
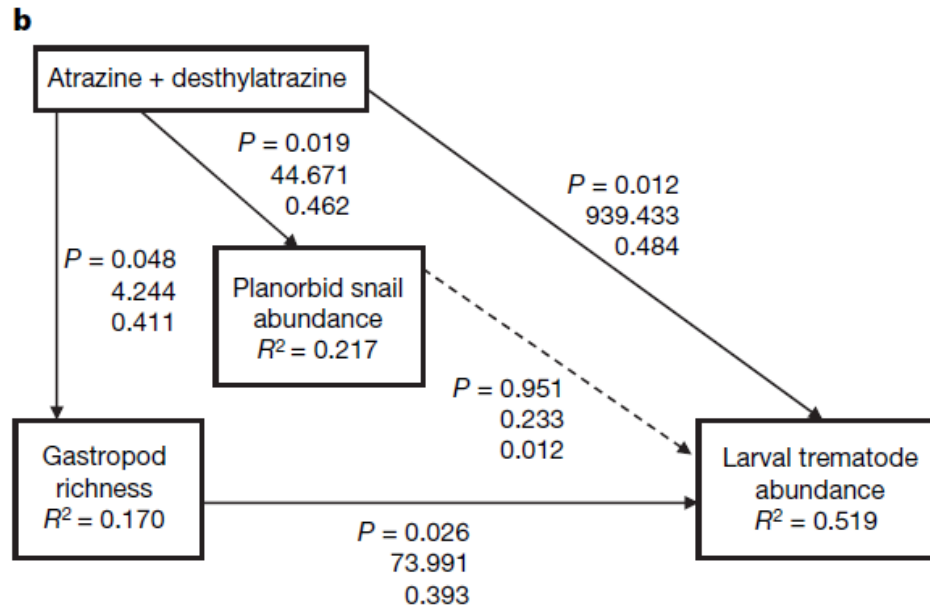
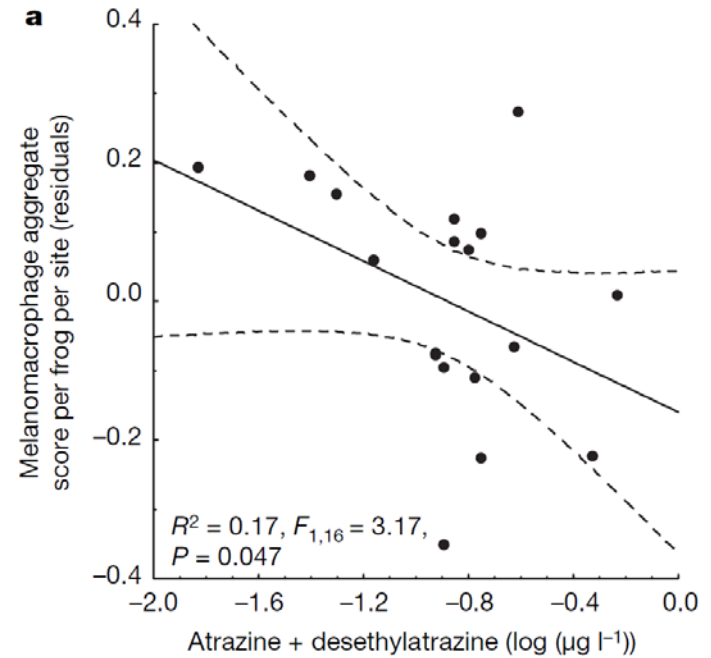
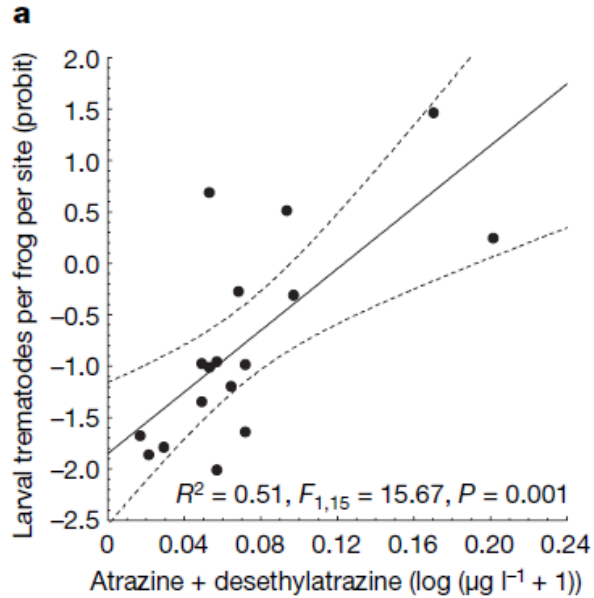
Interactions between parasites and pesticides have additive or synergistic deleterious effects

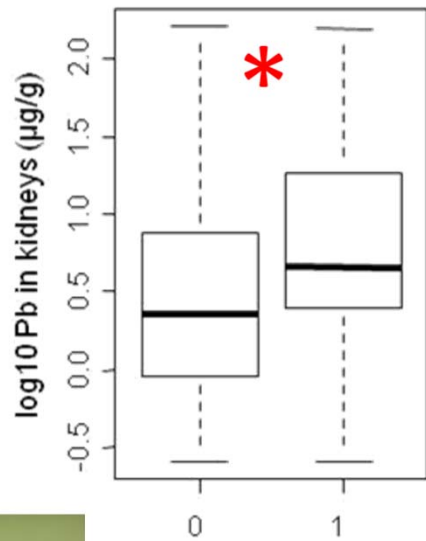
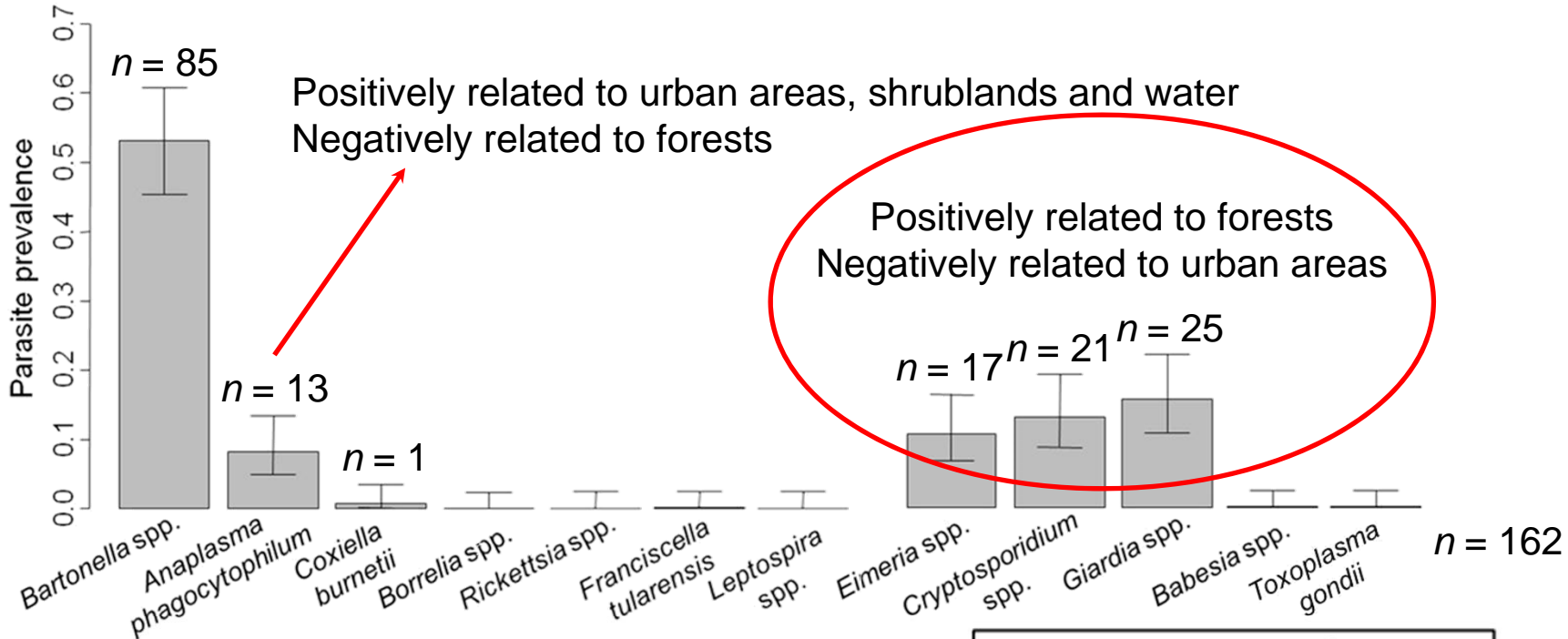
Table I. Effects of predation, parasitism and pesticide combined exposures on life history characteristics of *Daphnia magna*^{a,b}

Life history trait	Stressors	Observation	Effect
Survival	pred + par	No change	None
	par + pest	Decrease	Synergistic
	pred + par + pest	Decrease	Synergistic
Castration rate	pred + par	Increase	Additive
	par + pest	Increase	Additive
	pred + par + pest	Large increase	Synergistic
Age at maturity	pred + par	Increase	Additive
	par + pest	Increase	Additive
	pred + par + pest	Large increase	Additive
Number in brood	pred + par	Decrease	Antagonistic
Population growth	pred + par	Decrease	Synergistic
	par + pest	Decrease	Synergistic
	pred + par + pest	Large decrease	Synergistic



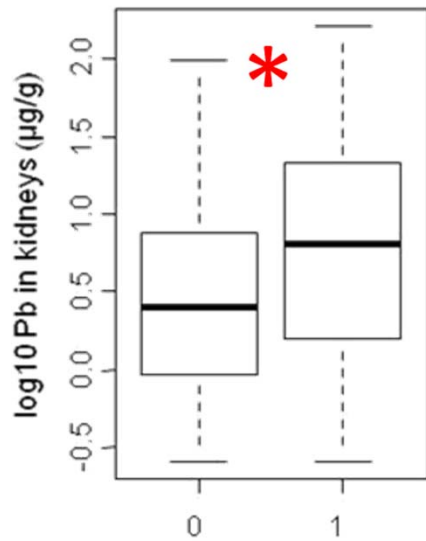
Atrazine was the best predictor of the abundance of larval trematodes in the declining northern leopard frog *Rana pipiens*





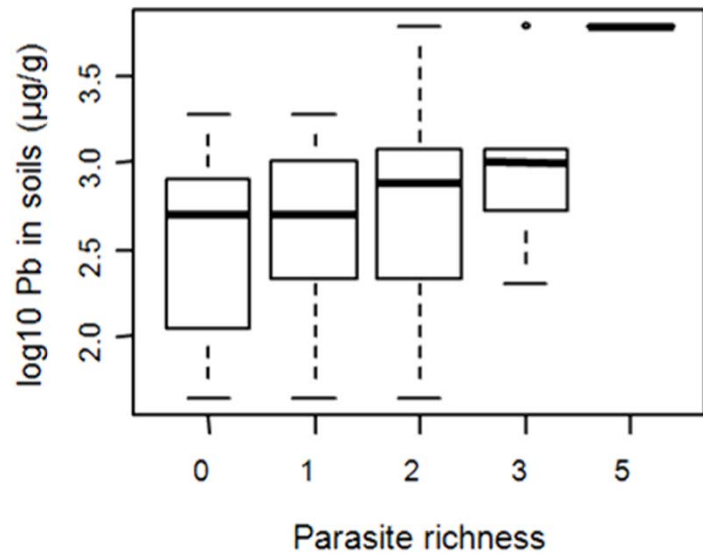
c *Giardia* spp.

(Mann-Whitney test
 $U = 823, p = 0.029$)



d *Eimeria* spp.

(Mann-Whitney test
 $U = 1204, p = 0.023$)



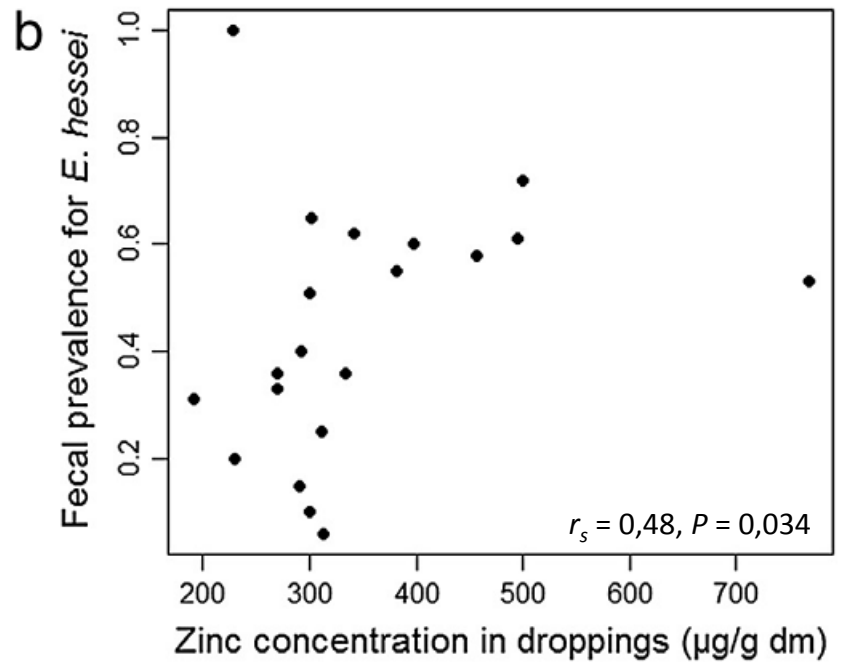
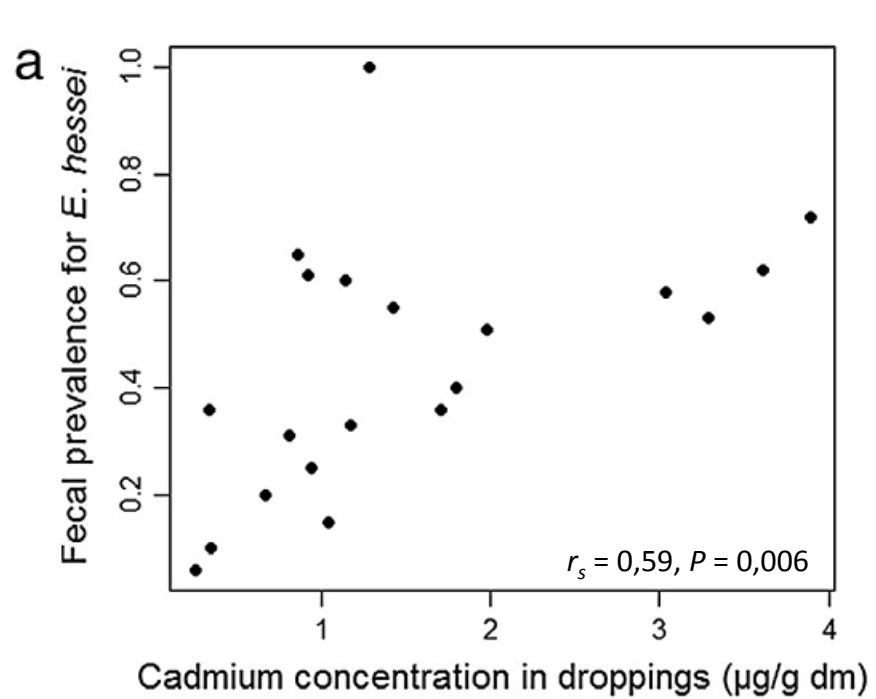
Spearman's rank correlation

For Cd_{soil} : $r_s = 0.20, p = 0.012$

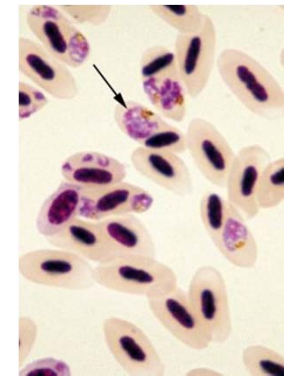
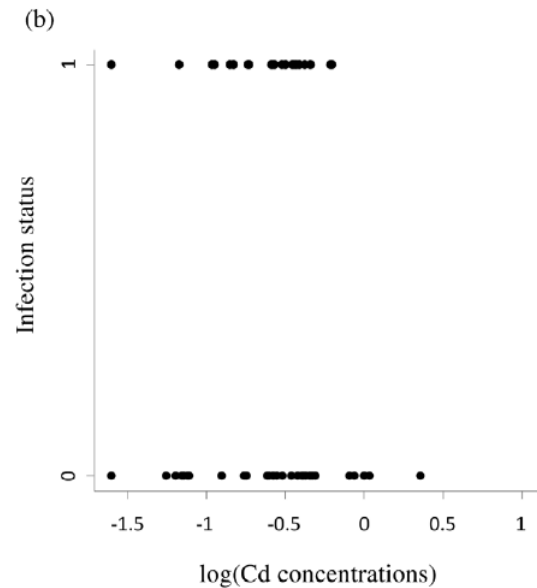
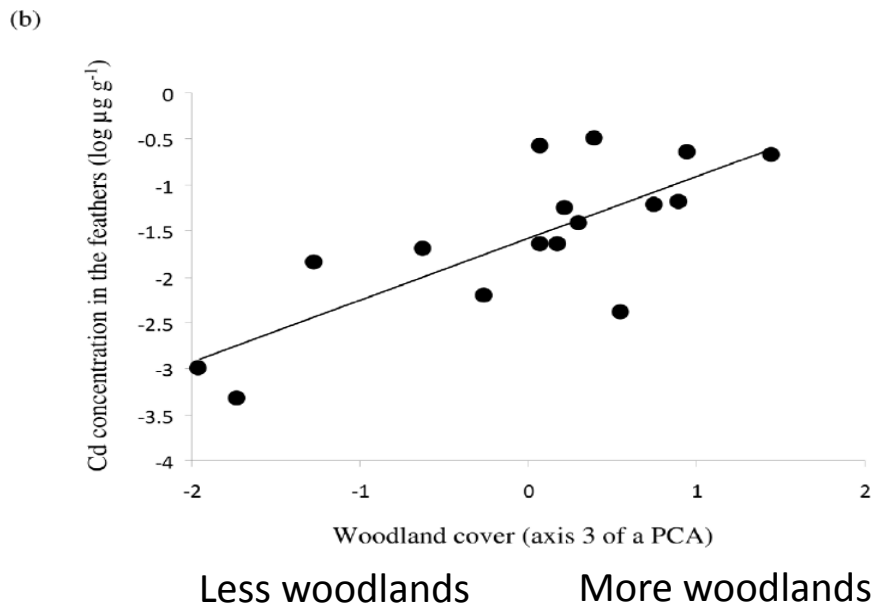
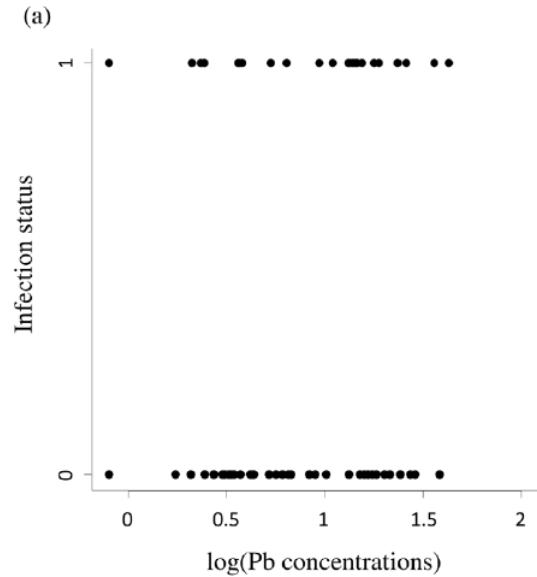
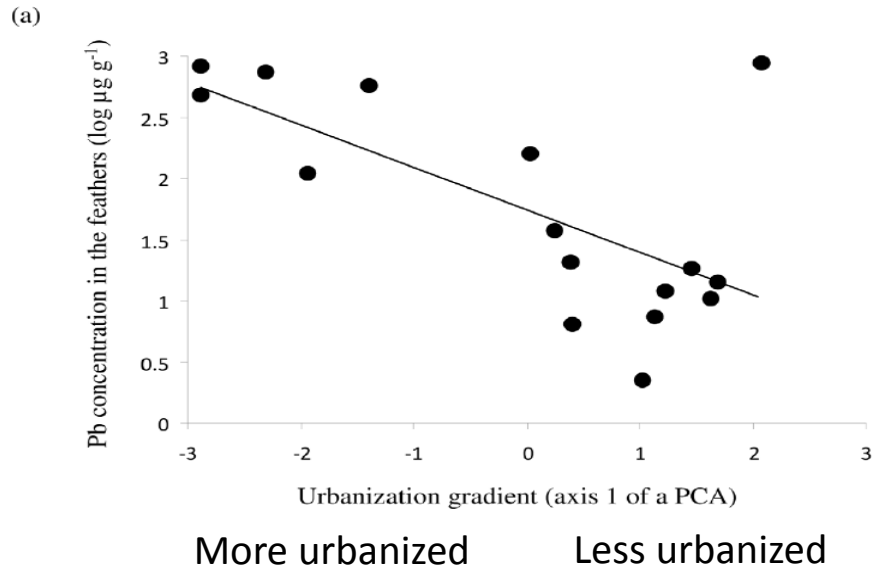
For Pb_{soil} : $r_s = 0.21, p = 0.009$



Eimeria hessei prevalence is related to metal concentrations in the lesser horseshoe bat (*Rhinolophus hipposideros*) droppings

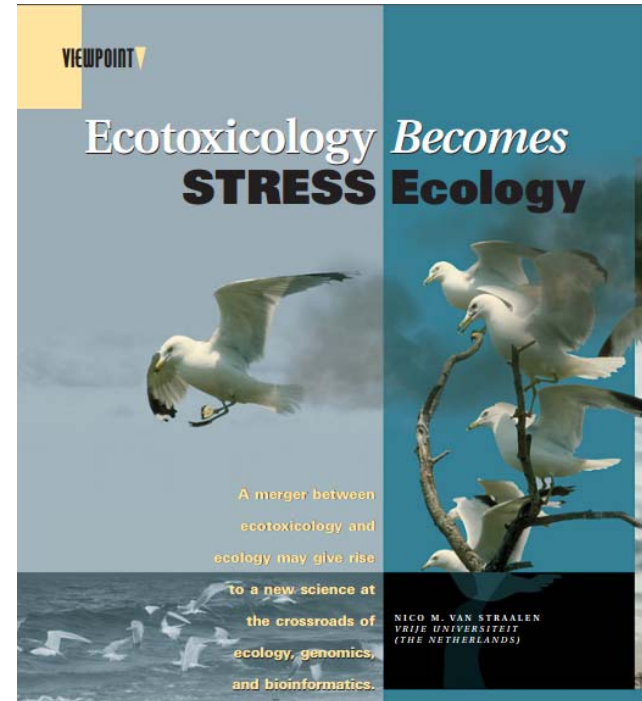


There is a complex relationship between *Plasmodium relictum*, Cd and Pb concentrations in feathers and the landscape in the house sparrow



Take-home messages and perspectives

- ✓ Ecotoxicology is moving to a more integrative systemic approach
- ✓ Rodents exhibit some (sub-)individual effects linked to their exposure to metals in Metaleurop Nord... but are pretty tolerant!
- ✓ Relationships between individual and population effects are unknown and remain a challenge in ecotoxicology



- ✓ There are (complex) relationships between metal concentrations and prevalence of some pathogens but underlying mechanisms and conservation consequences are unknown

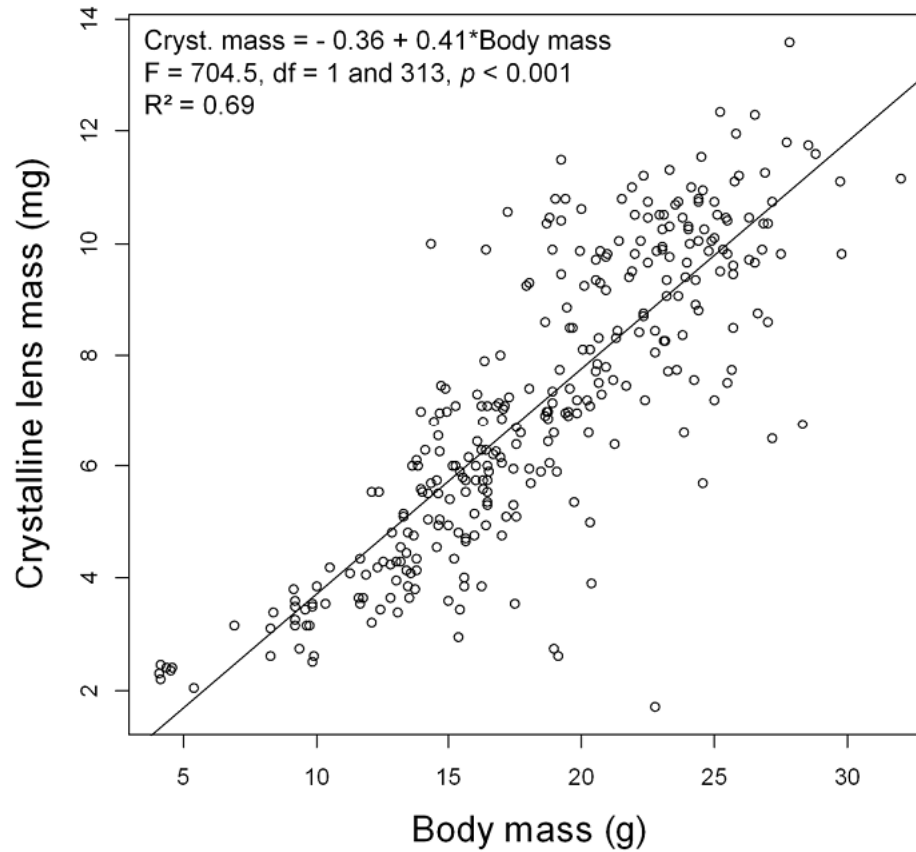


Figure III.S2. Relationship between crystalline lens mass (commonly used as an estimator of relative age) and the entire body mass (including digestive tracks and potential embryos) of wood mouse individuals ($n = 315$) from Metaleurop.