Are all relevant routes taken into account when exposing amphibian tadpoles to pesticides?

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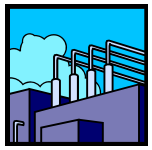
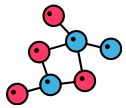
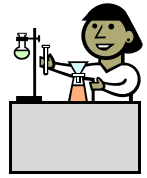
Amphibians and reptiles in the EU pesticide regulation

The process of placing pesticides on the market:



Industry → New substance (active ingredient)  → Multiple testing (incl. ecotoxicology) 

➢Reg (EU) 283/2013 setting out the data requirements for active substances (March 1st 2013):

*Effects on **terrestrial** vertebrate wildlife: "Available and relevant data (…) regarding the potential effects to (…) reptiles and amphibians shall be (…) taken into account in the risk assessment"*

➢Reg (EU) 284/2013 setting out the data requirements for plant protection products (March 1st 2013):

*Effects on other **terrestrial** vertebrate wildlife: "Where it cannot be predicted from the active substance (…) the risk to amphibians and reptiles (…) shall be addressed. The (…) studies to be provided shall be discussed with the national competent authorities"*

Amphibians vs. fish

Are amphibians really covered by fish-based toxicity assessment?

1) Are fish more sensitive to pesticides than amphibians?

fera
The Food and Environment Research Agency
Supporting Publications 2012:EN-343

EXTERNAL SCIENTIFIC REPORT

Toxicity of pesticides to aquatic and terrestrial life stages of amphibians and occurrence, habitat use and exposure of amphibian species in agricultural environments[1]

Steve Fryday and Helen Thompson

Food and Environment research Agency

Sand Hutton, York YO41 1LZ, UK

62 pesticides
93 species

→ The availale information is not enough to get relevant conclusions

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Critical Review

COMPARATIVE ACUTE AND CHRONIC SENSITIVITY OF FISH AND AMPHIBIANS: A CRITICAL REVIEW OF DATA

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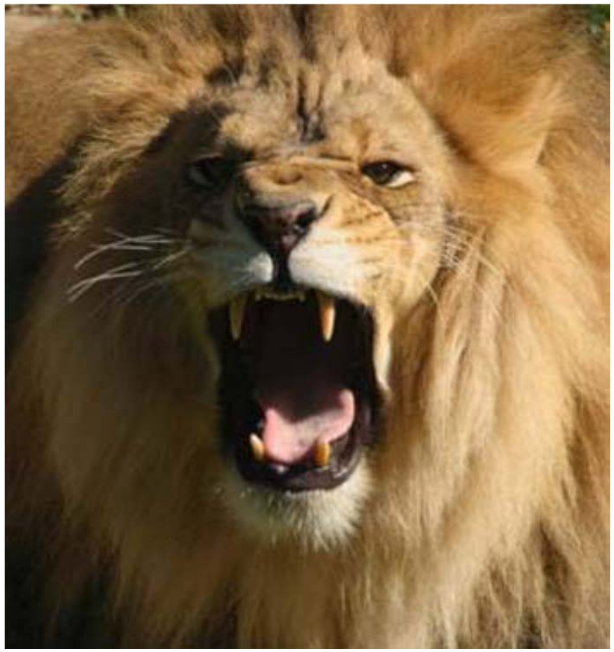
(*Submitted* 18 *June* 2012; *Returned for Revision* 7 *July* 2012; *Accepted* 16 *August* 2012)

32 pesticides
20 species

→ Amphibians are covered by fish

Risk assessment

RISK = Hazard (toxicity) x Exposure



Amphibians vs. fish

Are amphibians really covered by fish-based toxicity assessment?

2) Are fish-based exposure scenarios representative of amphibians?

Habitats

Exposure routes

Only DERMAL exposure is considered as relevant for fish

Objective

Are all relevant routes taken into account when exposing amphibian tadpoles to pesticides?

To expose amphibian tadpoles to pesticides through different routes in order to compare degree of responsiveness

Methods

Realistic scenarios based on vineyard conditions:

Rana temporaria

Common in Central Europe vineyards

- Folpet (fungicide)
- Glufosinate amm. (herbicide)
- Fenpyroximate (insecticide)

} Widely used in vineyards

- Early Spring
  - Free-swimming tadpoles
  - Medium-low crop interception
  - Recommended application rates

Pesticide applied on:
Water
Food
Sediment
All three compartments

- Concentration calculated with FOCUS:
  - 2 levels + control
  - 21 d exposure
  - Single application and further decrease in concentrations

→ Legally **safe** concentrations

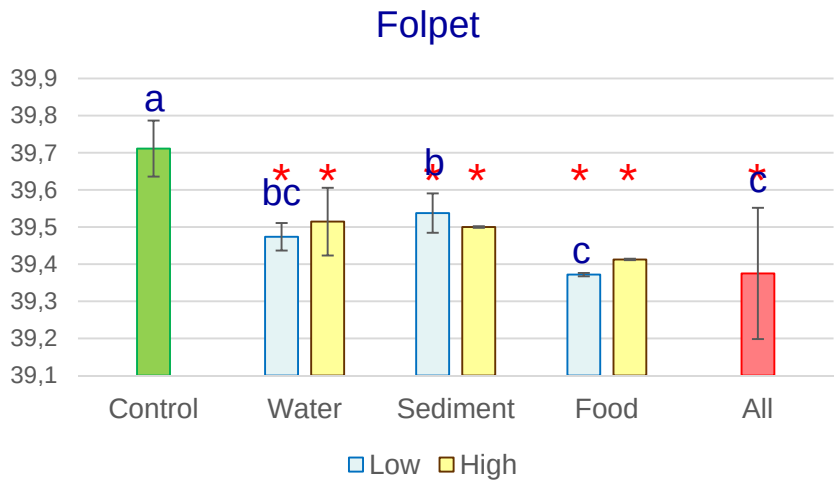
Methods

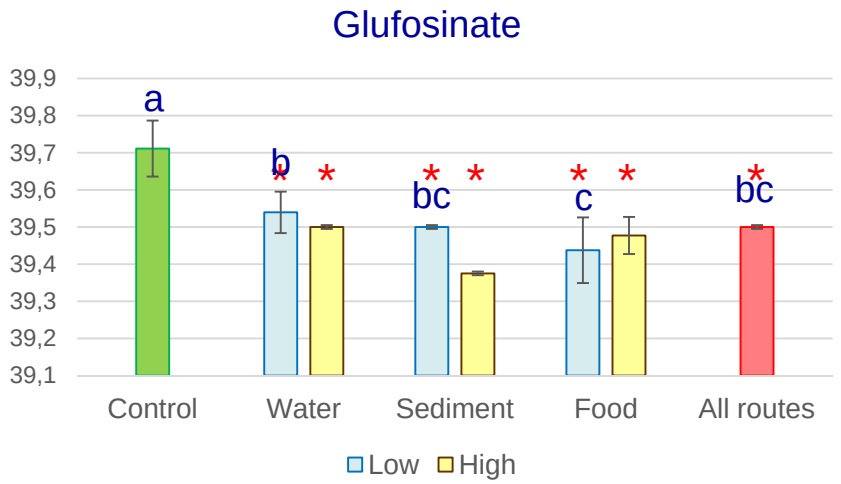
Endpoints

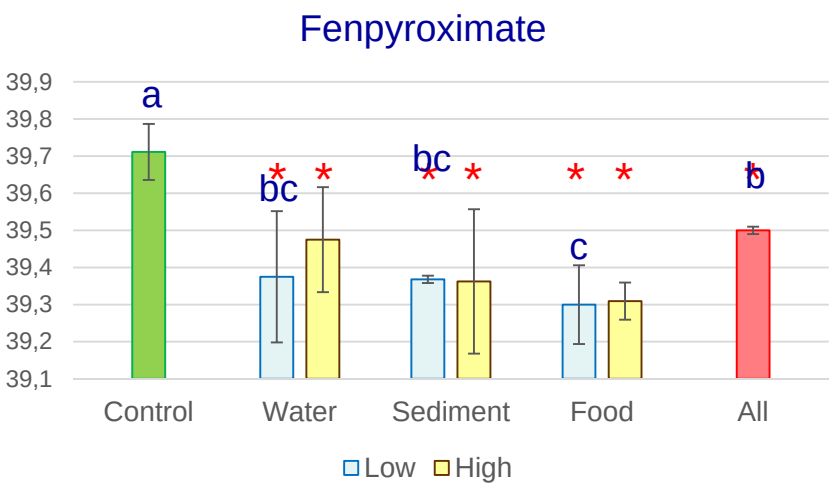
- Survivorship
  - Cumulative mortality
  - Metamorphosis rate

  No effects
- Growth and development
  - Developmental stage
  - Mass
  - Snout-vent length
  - Metamorphosis synchrony
- Abnormalities

Results – Development





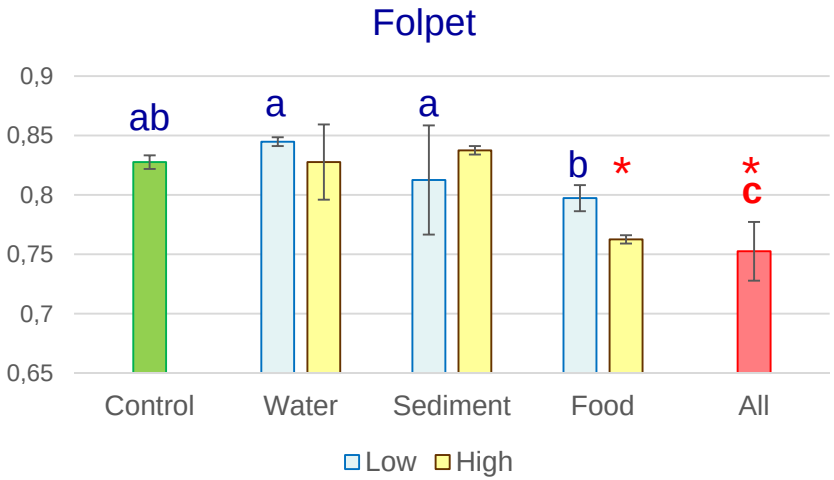


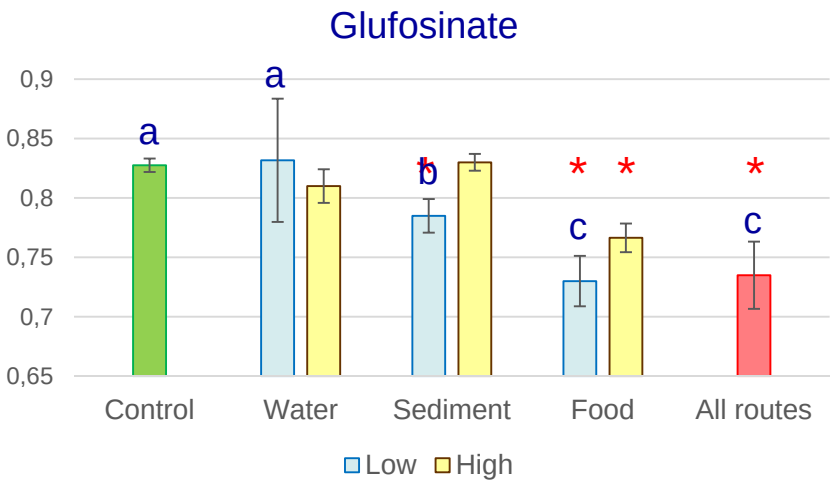
- Development was delayed by all treatments from all pesticides
- At the low dose, food exposure tended to cause the highest effect
- Combination of routes had no additional effects

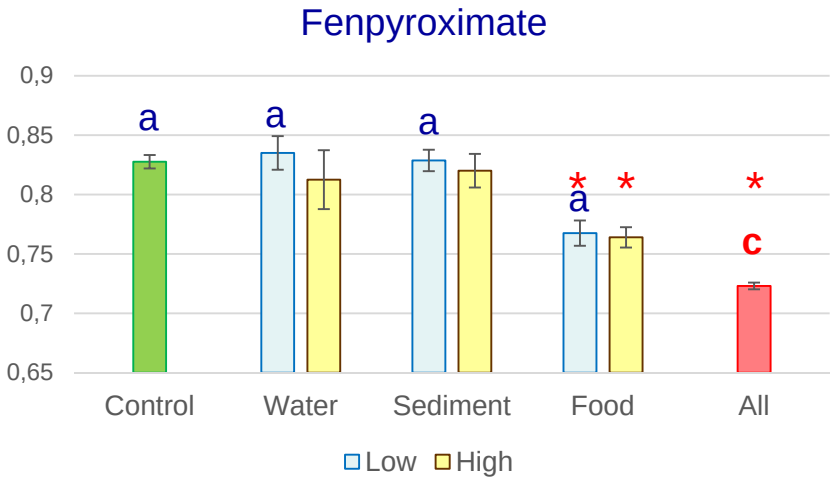
* Different from control

Data in Gosner stage (mean±SD)

Results – Mass





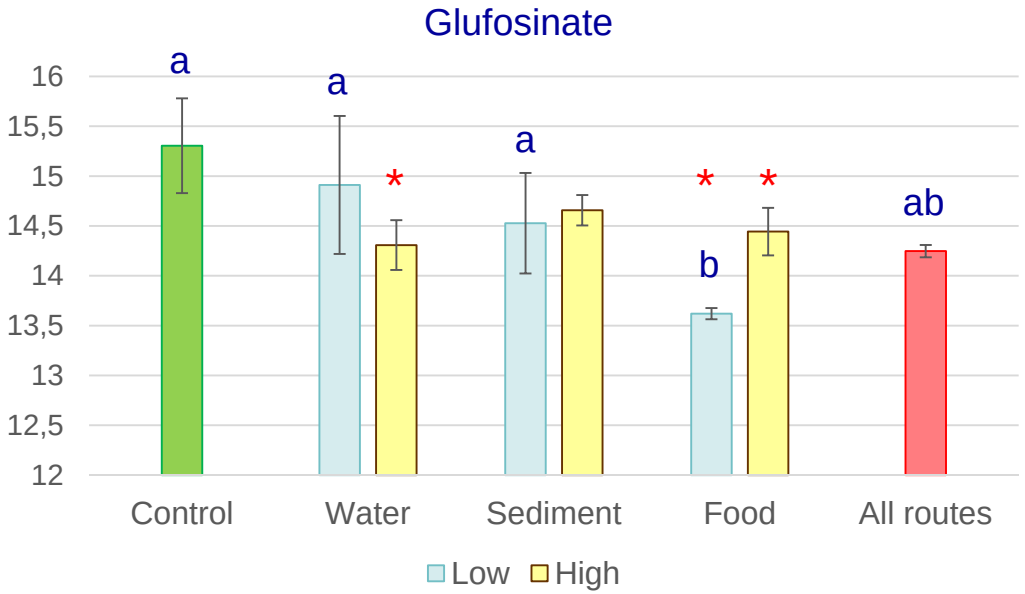


- Mass was always reduced by exposure through food
- Combination of routes had additional effects when exposing to folpet and fenpyroximate

* Different from control

Data in g (mean±SD)

Results – SVL

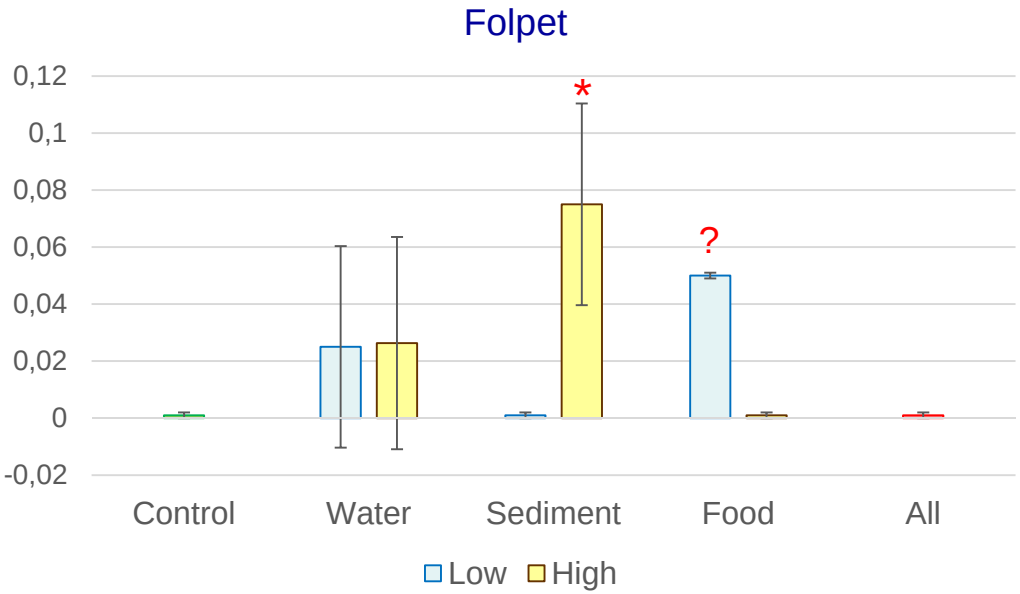


- SVL was only affected by exposure to glufosinate ammonium through food and high water concentration
- Combination of routes had no additional effects

* Different from control

Data in mm (mean±SD)

Results – Abnormalities



* Different from control

- Only folpet (exposure to high dose via sediment) increased abnormality occurrence
- Effects of exposure to low dose in the food are not supported

Data in abnormality rate (mean±SD)

Conclusion

- Pesticide concentrations implicitly considered as environmentally safe by the EU legislation cause consistent developmental delays and growth retardation in common frog tadpoles, as well as punctual increases in abnormality occurrence.
- Exposure through food and sediments was revealed at least as important as exposure through water.
- Likely because of chemical partitioning of chemicals, additive effects of route combination was occasional.
- Observed effects were very consistent among all pesticides, in spite of the expected differences in mode of action and environmental behaviour → Support relevance of endpoints

Are all relevant routes taken into account when exposing amphibian tadpoles to pesticides? → NO

Thank you!

Collaborators:

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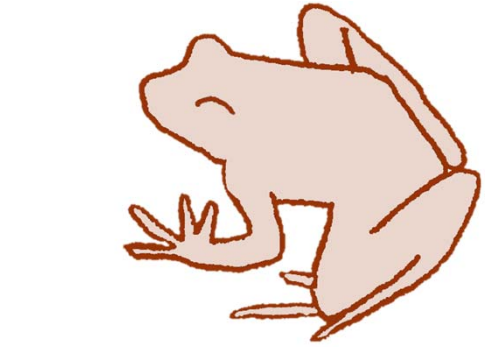

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