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Occurrence of common frog and common toad in agricultural fields in Germany: potential for exposure to plant protection products

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Introduction

Amphibians are a highly endangered class of vertebrates and the environmental risk of chemicals to amphibians is a current topic of debate. Though the major causes for population declines are habitat loss and disease, exposure to chemicals, including plant protection products (PPPs), also needs to be assessed. For risk assessment of PPPs, considering exposure alongside toxicity is required.

We present the results of a project that studied the **occurrence and habitat use** of adult and metamorph common frogs (*Rana temporaria*) and common toads (*Bufo bufo*) **in an agricultural landscape**, and the **implications for potential exposure of amphibians** to PPPs.

Materials and Methods

Four study sites (ponds) with > 85% agricultural land (mainly cereal fields) surrounding the ponds were selected for the study (Fig 1) and considered suitable to study amphibian occurrence in agricultural land. Adults were monitored with radio tracking devices for 2 years and juveniles were caught in pitfall traps alongside drift fences (Fig 2).

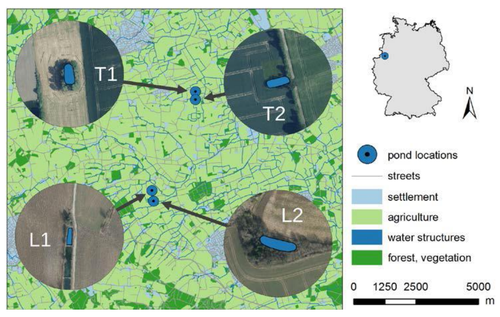

Fig 1: Study sites located in North-West Germany

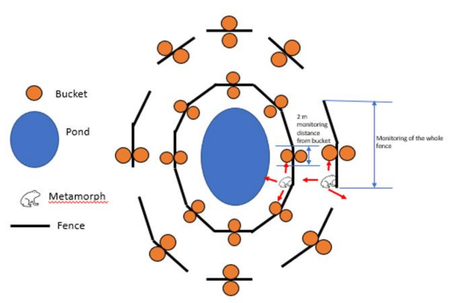

Fig 2: Example schematic of the capturing of metamorphs via fences (0 and 10 m) and buckets.

Results

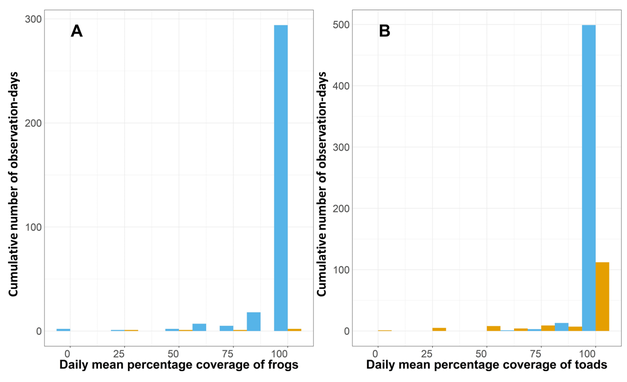

Fig 3: Observed coverage of adult frogs (A) and toads (B) in arable (orange bars) and non-arable (blue bars) habitats.

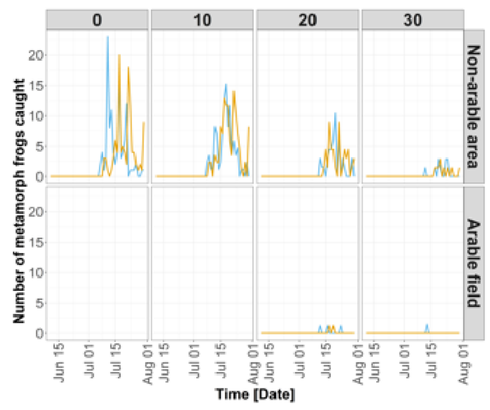

Fig 4: Common frog metamorph captures, by distance from pond and in arable /non-arable habitat.
---outgoing animals
---incoming animals

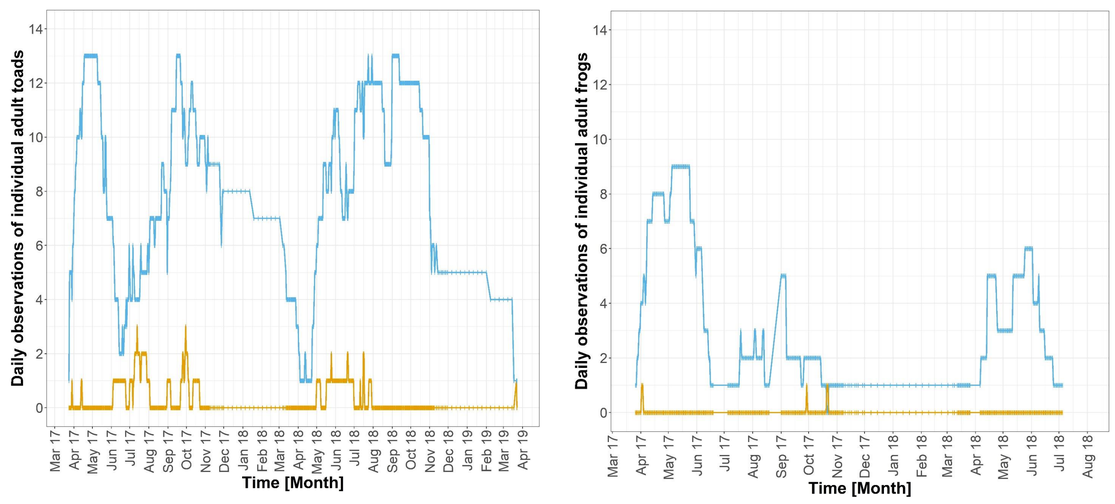

Fig 5: Observations of adult frogs and toads within (--) and outside of (--) arable habitats across all sites.

Discussion

Adults were rarely observed in arable fields at any of the sites (overall 0.5% and 4% of total observations for frogs and toads respectively). Metamorph captures in arable fields were 1.2 - 38.8% and 0.0 – 26.1% of total, for frogs and toads respectively. For both species, the highest numbers occurred at the site where the pond was completely surrounded by arable fields. Overall, the presence of amphibians in arable fields was low and primarily occurred later in summer, when crops were denser and spray interception higher. Also, diurnal hiding behaviour was observed, which further reduces the risk of dermal exposure. The use of buffer zones around water bodies in agricultural areas would be effective risk mitigation measures to protect terrestrial adults and metamorphs staying there and also would reduce spray drift entry into water bodies following PPP applications.

Conclusions

- New useful methods are available to study occurrence of anurans in agricultural landscapes
- Frog and toad juveniles rarely used arable fields, and when they did, preferred later growth stages with more cover. This should be considered in risk assessment for these organisms. Data for adults covered only few individuals in early spring and thus do not allow firm conclusions on habitat use during early spring migration..
- Protecting water body quantity and quality is paramount for amphibian protection in all habitats, including agricultural landscapes.
- Buffer zones around water bodies in agricultural areas would be effective risk mitigation measures to protect terrestrial anurans and would reduce spray drift entry into water bodies

---Internal Use---