

EFFECTS OF AGRICULTURAL POND WATER ON THE SURVIVAL OF ANURANS IN THE UPPER MIDWEST



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Abstract

Globally declining amphibian populations are due, in part, to habitat loss. Consequently, constructed habitats, such as farm ponds, may be important for maintaining regional populations of amphibians. The objective of our study was to assess the potential toxicity of agricultural pond water to anurans through a series of field and laboratory studies. In the field, we placed mesocosms in twelve ponds (7 farm ponds and 5 natural wetlands). Mesocosms were stocked with embryos of the northern leopard frog (*Rana pipiens*), which were allowed to develop through metamorphosis. Differences in mortality of leopard frogs between agricultural ponds and natural wetlands were assessed. Concurrently, we assessed the toxicity of water from 19 ponds (9 farm ponds and 10 natural wetlands) with the Frog Embryo Teratogenesis Assay *Xenopus* (FETAX). The results of FETAX assays were compared with the survival of *R. pipiens* held in mesocosms. There was no significant difference in the survival of amphibians between agricultural ponds or natural wetlands. Concentrations of ammonia, total nitrogen and total phosphorus in water from the ponds did not effect amphibian survival in mesocosms or in FETAX assays. The results of this study were used in conjunction with field surveys and water quality measurements conducted by the USGS to assess the suitability of farm ponds as amphibian habitat.

Study Objectives

- Determine if differences exist in malformation or survival of developing leopard frogs (*Rana pipiens*) between mesocosms placed within agricultural ponds and natural wetlands.
- Use FETAX to assess potential toxicity of pond water to developing anurans.
- Determine relationship between concentrations of ammonia, total nitrogen and total phosphorus and amphibian survival.



Methods

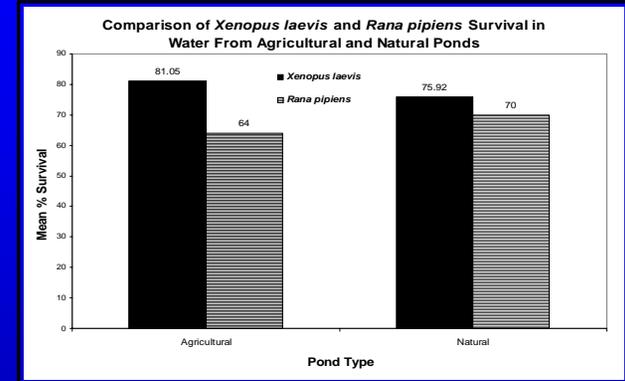
- Mesocosms** - Mesocosms constructed in 6 agricultural ponds and in 4 natural wetlands in southeastern Minnesota during spring 2001. Topography typical of driftless area (unglaciated area of Minnesota and Wisconsin).
- Ponds were selected based on the breeding activity of *Rana pipiens* and relative ease of mesocosm construction.
- Mesocosms were 3.65 m long X 0.92 m wide X 1.21 m high and consisted of an aluminum frame covered with a 63-mm plastic fence and window screen. Tops were anti-predator mist nets used in aquaculture.
- 100 *Rana pipiens* embryos were placed into each mesocosm.
- Tadpoles were allowed to develop through metamorphosis (Gosner stages 42-46) and rates of mortality and malformation were determined.



- FETAX**- Frog Embryo Teratogenesis Assay *Xenopus* (FETAX) conducted concurrently with the field study.
- Embryos of *Xenopus laevis* cultured in water from 9 agricultural ponds and 10 natural wetlands.
- Survival of *Xenopus laevis* was compared with survival of *Rana pipiens* in mesocosms and with water quality data from ponds.
- Water Quality Data**- Levels of ammonia, total nitrogen, and total phosphorus were measured twice monthly in ponds.

Results

- No differences in survival of *Rana pipiens* from agricultural and natural wetlands.
- No differences in survival of *Xenopus laevis* cultured in water from agricultural ponds and natural wetlands.
- Ammonia, total nitrogen, and total phosphorus had no significant effect on amphibian survival in agricultural and natural wetlands.
- Only one malformed *Rana pipiens* was collected from a single mesocosm within an agricultural pond (n=1,000).



Conclusions

- Because the driftless area is typically void of sites with severe amphibian mortality or malformation, our results are not unexpected.
- Agricultural ponds within the driftless area make suitable habitats for amphibian breeding and development.

Acknowledgements

- Funding for this project was provided by:
 - Minnesota Environmental and Natural Resources Trust Fund as recommended by the Legislative Commission on Minnesota Resources
 - USGS Upper Midwest Environmental Sciences Center, La Crosse, WI
 - University of Wisconsin-La Crosse River Studies Center
- We thank Shawn Weick at the USGS Upper Midwest Environmental Sciences Center, and Ben Campbell, Sam Bourassa, Joel Jahimiak and Shane N. Jones of UW-LaCrosse for their help throughout the project.
- We also thank Dr. David Reineke of U.W.-LaCrosse for help with statistical analyses.