Insecticides

Cause of Global Amphibian Declines?

Insecticides/Pesticides

- Generally a chemical or biological agent that incapacitates or kills insects/pests.
- The chemical agent is inherently created to kill, this effectively makes it an ecological/ biological weapon.

Commonly Used Pesticides

- Organophosphate- diazinon, acephate
- Carbamate- aldicarb
- Organochlorine- DDT, Heptachlor
- Pyrethroid- Raid
- Biopesticides- fungi, nematodes

What makes insecticides so deadly to amphibians?

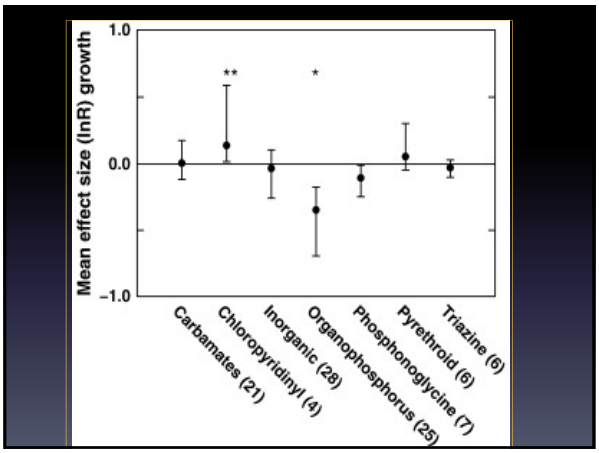
- Adult amphibians that are insectivorous eat prey that is contaminated by insecticides, then eaten by larger predators (Biomagnification)
- Exposure to pesticides might weaken their immune systems increasing their susceptibility to disease.
- Skin is highly permeable to allow various exchanges with the environment. Absorption of chemicals through the skin is faster than in mammals, suggesting that for terrestrial amphibian life stages present in agricultural fields, pesticides can be deadly.

Cont…

- Amphibians with high occurrence of meta-populations may be more heavily impacted. One segment of the population may die off.
- Synergistic Effects- effect of two variables that, when combined, have an overall effect greater than the sum of the individual variable

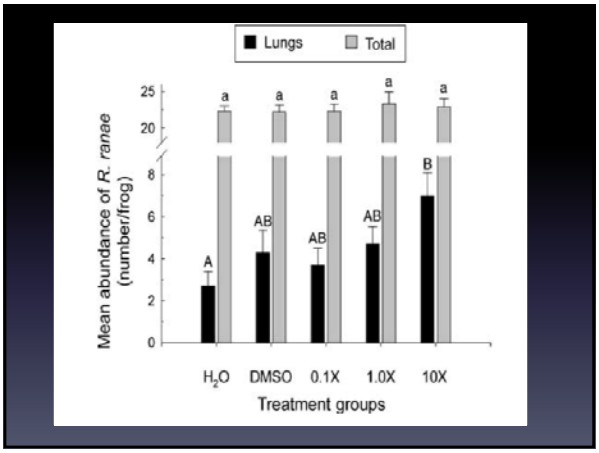
A **meta-analysis** of the effects of pesticides and fertilizers on survival and growth of amphibians

- Pesticides have a negative effect on survival (-0.9027) and growth (-0.0737) across all reported amphibian species
- Pesticides and fertilizers are an important stressor in Ag dominated areas. Certain pesticides are more likely to harm amphibians. (Organophosphates)



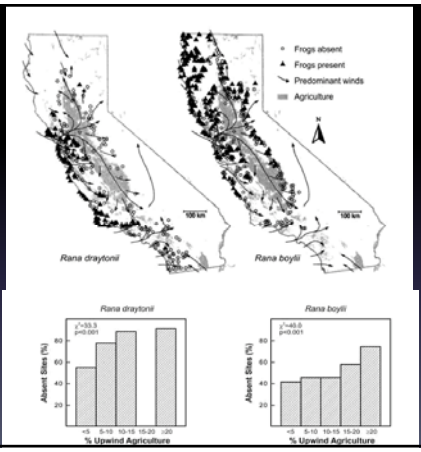
Exposure of leopard frogs to a pesticide mixture affects life history characteristics of the lungworm *Rhabdias ranae*

- Found that the migration of lungworms (*Rhabdias ranae)* was significantly accelerated in leopard frogs exposed to the highest concentrations of pesticides, leading to the establishment of twice as many adult worms in the lungs of frogs 21 days post-infection.
- Pesticide treatment did not influence the growth of lungworms but thier results indicate that they matured and reproduced earlier in pesticide-exposed frogs compared to control animals.



Affect on populations

- Windblown pesticides have contributed to declines of several species in Sierra Nevada and Yosemite National Park (Fellers and Drost 1996)
- Geographic pattern of population declines in several species of ranid frogs is strongly correlated with the amount of upwind agricultural land (Davidson 2002)



Why are insecticides the most important factor?

- Weakens immune response
- Absorption of chemicals through skin
- Biomagnification
- Effect on meta-populations
- Synergistic Effects

References

- "A meta-analysis of the effects of pesticides and fertilizers on survival and growth of amphibians." Baker, Bancroft, Garcia. 2013.
- "Exposure of leopard frogs to a pesticide mixture affects life history characteristics of the lungworm *Rhabdias ranae.*" Gendron, Marcogliese, Barbeau, Christin, Brousseau, Ruby, Cyr, Fournier. 2002.
- "The Ecology and Behavior of Amphibians." Wells. 2007.

Questions?