

Amphibians and Herbicides A Literature Review

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The Review

- Approximately 5 databases
- Covers 30 years
- Websites
- Over 30 references pulled
- 17 studies most relevant

Salamanders in Northern California

Mole Salamanders

- Long-toed salamander
- Northwestern salamander



Giant and Olympic Salamanders

- Cope's giant salamander
- Olympic salamander
- Pacific giant salamander
- Rocky Mountain giant salamander
- Southern torrent salamander

Lungless Salamanders

- Arboreal salamander
- Black salamander
- California slender salamander
- Clouded salamander
- Del Norte salamander
- Dunn's salamander
- Ensatina



Lungless Salamanders (cont.)

- Larch Mountain salamander
- Oregon slender salamander
- Plethodontid salamanders
- Redback salamander
- Siskiyou Mountains salamander
- Van Dyke's salamander
- Western redback salamander

Newts, Frogs and Toads in Northern California

- Roughskin newt
- Cascades frog
- Foothill yellow-legged frog
- Pacific treefrog
- Red-legged frog
- Tailed frog
- Western toad



Study Methods

- Lab Experiments
 - Food chain experiment
 - Various life stages
 - Short-term exposure
- Man-made Ponds
- Test Concentrations of
0.8 ppb to 150,000 ppb
- Population Studies
 - Uncut, logged & burned, and logged, burned and sprayed

Possible Effects of Herbicides

- Behavior (in general)
- Feeding Activity
- Swimming Behavior
- Growth / Body Size
- Muscular Response
- Morphological Abnormalities
- Pathological Changes
- Mortality

Chemicals Tested - Found to Have Effects

- 2,4-D
 - pathological changes and mortality
 - 50,000 ppb; LT50 at 75,000 ppb is 72h for males and 132h in females (Pacces Zaffaroni et al. 1986)
 - no effect at 50,000 ppb (Cooke 1977)
- Atrazine
 - pathological changes
 - 2800 ppb resulted in abdominal edema; LC₅₀ 2,800 to 23,000 ppb (24h); LC₅₀ 10,700,000 to 47,600,000 ppb (96 h) (Howe et al. 1998)
- Alachlor
 - LC₅₀ 3,300 to 11,500 ppb (96h) (Howe et al. 1998)

- DDT (Insecticide)
 - behavior, growth/body size, and morphological abnormalities
 - 20 ppb in frog tadpoles; 5 ppb in toad tadpoles (Cooke 1972)
- Dieldrin (Insecticide)
 - behavior, growth/body size, and morphological abnormalities
 - 500 ppb (Cooke 1977)
- Paraquat
 - swimming behavior, growth/body size, muscular response, morphological abnormalities, and mortality
 - food chain study, 1,011,000 ppb *Myriophyllum* (Bauer-Dial and Dial 1995)
 - 500 ppb (Dial and Bauer 1984)

Chemicals Tested - No Effects Found

- Triclopyr
- Dichlobenil
- Diquat
- Glyphosate
- Hexazinone

Comparison of Concentration

From Klamath Study

- Triclopyr
 - 0.174 to 1.06 ppb
- 2,4-D
 - 0.103 to 0.584 ppb
- Atrazine and glyphosate
 - No Detects

From Literature

- Lowest concentrations tested was 0.8 ppb (2,4-D); no effects
- Effects were found at 50,000 ppb for 2,4-D in one study



Useful Internet Sites

- biology.usgs.gov/frog.html
- www.teraplanning.com
- www.mp1-pwrc.usgs.gov/amphib/frogsum.html
- ice.ucdavis.edu/toads/enos.html