

Risk Assessment of Reptiles

Scott Steer

Risk Assessment Symposium

June 2, 2011



steer environmental
associates ltd.

Overview

- Status of Reptiles in BC
- Risk Assessment of Reptiles
- Status of Reptile Toxicity Research
- Literature Review: Relevant data for ERA
- Conclusions
- Data/Information Needs for ERA



Status of Reptiles in BC

- 18 Species¹
 - Snakes - 9
 - Lizards – 4
 - Turtles – 5
- Snakes: 8 of 13 BGCZ's
- Lizards: 6 of 13 BCGZ's
- Turtles: 8 of 13 BCGZ's²



Status of Reptiles in BC

- Provincially/federally listed species²
 - 6 of 9 snake species
 - 2 of 4 lizard species
 - 3 of 5 turtle species
- Mirrors global decline of reptile populations



Status of Reptiles in BC

- Multiple potential stressors³
 - Habitat loss and degradation (e.g., deforestation, draining of wetlands)
 - **Pollution**
 - Disease and parasitism
 - Introduced invasive species (e.g., plants and animals)
 - Human use (i.e., food, pets)
 - Climate change (e.g., reduced wetland habitat)



Risk Assessment of Reptiles

- Important
 - Many threatened and endangered species
 - May be sensitive to contaminant exposure (long living, small home range, some amphibious)⁴
 - Populations may be more sensitive to stress due to longevity, delayed sexual maturity and small home ranges⁵
 - May be sensitive to adverse effects



Risk Assessment of Reptiles

- Inclusion required by MOE protocols and guidance for all land uses
 - Protocol 1, Protocol 13, DERA
- Typically excluded due to lack of toxicity data
- Some apply uncertainty factors to bird TRVs



Reptile Toxicology Research: Status

- Least studied group of vertebrates
- 11271 citations dated 1972 – 1998: reptiles - 1.4%⁴
- 933 studies published by *ET&C* between 1990 and 1999: reptiles – 12 articles (~1%)⁵
- 17375 citations dated 1996 – 2008⁴
 - Reptiles – 0.8%
 - Increasing trend in citations
 - More studies since 2000 than previous 30 years



Reptile Toxicity Research: Status

- Most studied chemical classes⁴
 - metals>organochlorine pesticides>non-chlorinated pesticides>simazines, UV, acidification, nitrogen
- Most studied species⁴
 - American alligator>freshwater turtles>sea turtles>lizards
 - Studies on snakes uncommon
- Pre-2000: most studies dealt with chemical residues with no link to effects⁴
- 64% of post-2000 studies focussed on effects⁴



Reptile Toxicology Research: Status

- Reptiles comprise 28% of known vertebrate species⁴
- Why so under-represented in the literature?
 - Long generation times and slow growth rates⁵
 - Typically don't produce large numbers of offspring⁵
 - Considered difficult to maintain in captivity⁵



Literature Review

- Objectives
 - What is the state of the literature regarding relevant toxicity data for ERA of reptiles?
 - e.g., effects data from oral dosing studies
 - Are we further ahead than we were in 2000?
 - What are the primary data needs?



Literature Review - Methodology

- Search of oral dosing studies linking exposure with effects on mortality/growth/rep.
- <2000: RATL Database⁶
- 2000 – Present
 - Queried UVIC scientific databases for “Reptile” AND “Toxicology”
 - Filters: full text online/journal articles
 - Also included citations listed by Sparling et al 2010



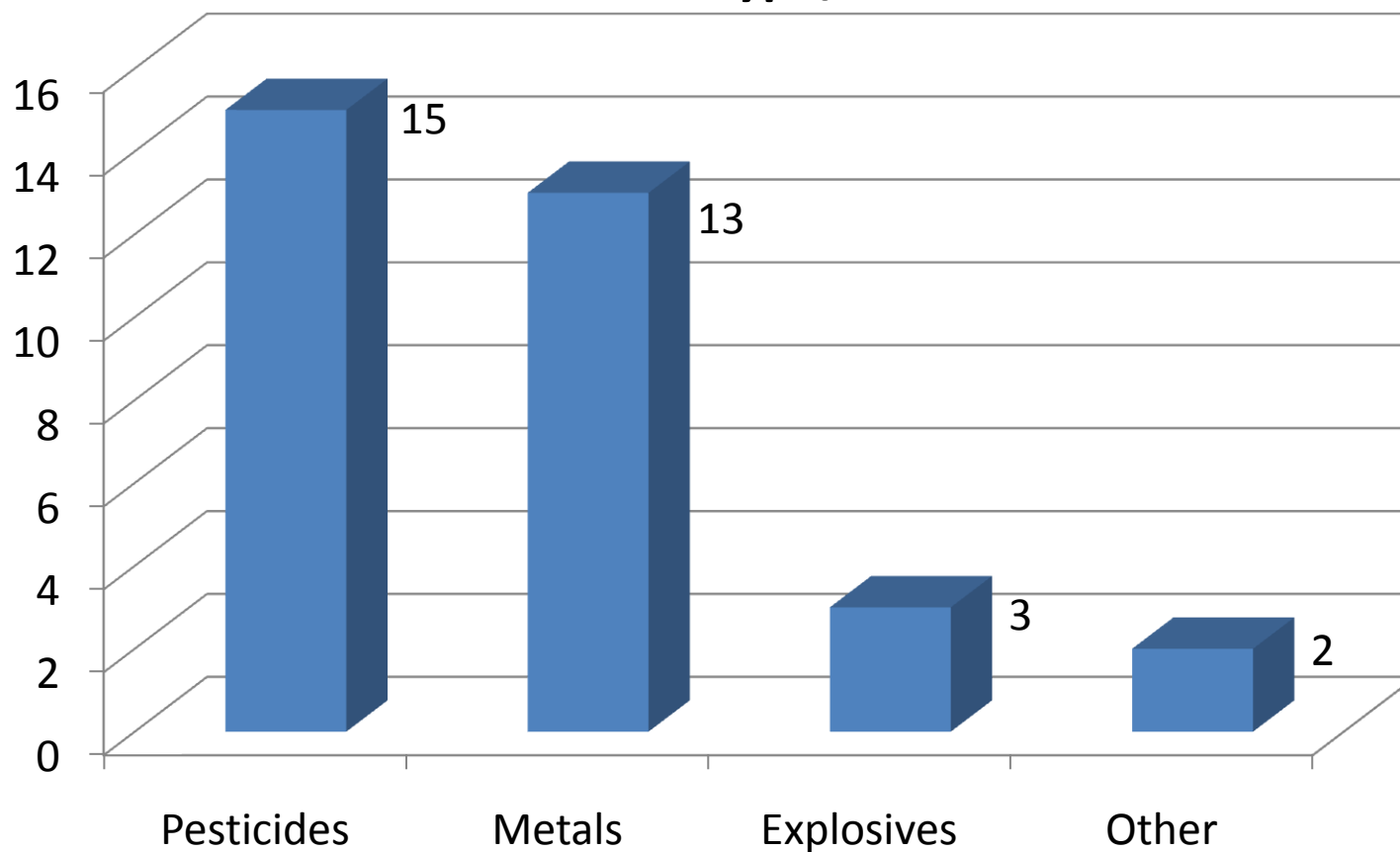
Literature Review – Results Overview

Number of Studies	33
Study Dates	1965-2009
Number of Orders	3/4
Number of Species	19
Number of Chemical Types	4
Number of Chemicals	26



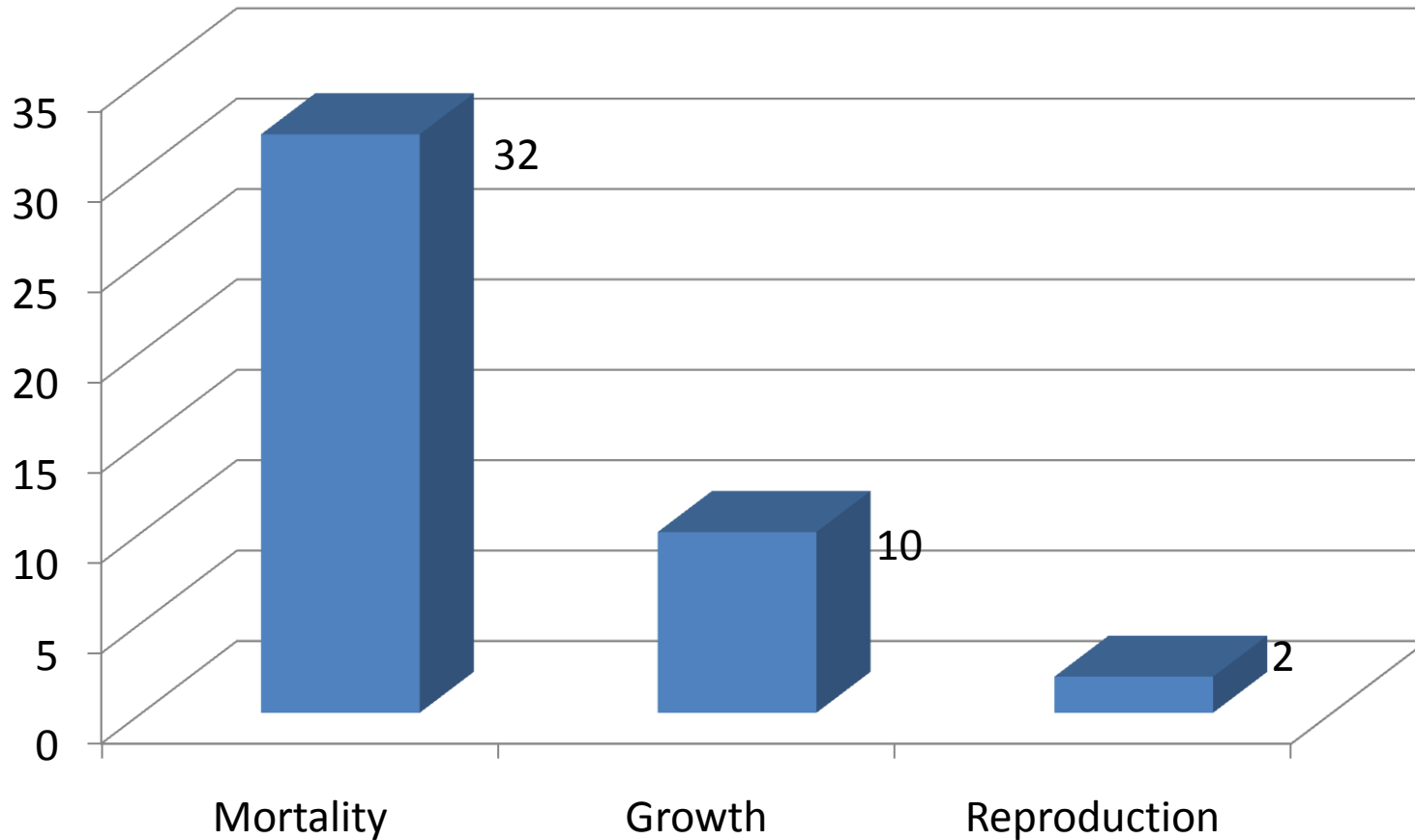
Literature Review

Chemical Type/Use



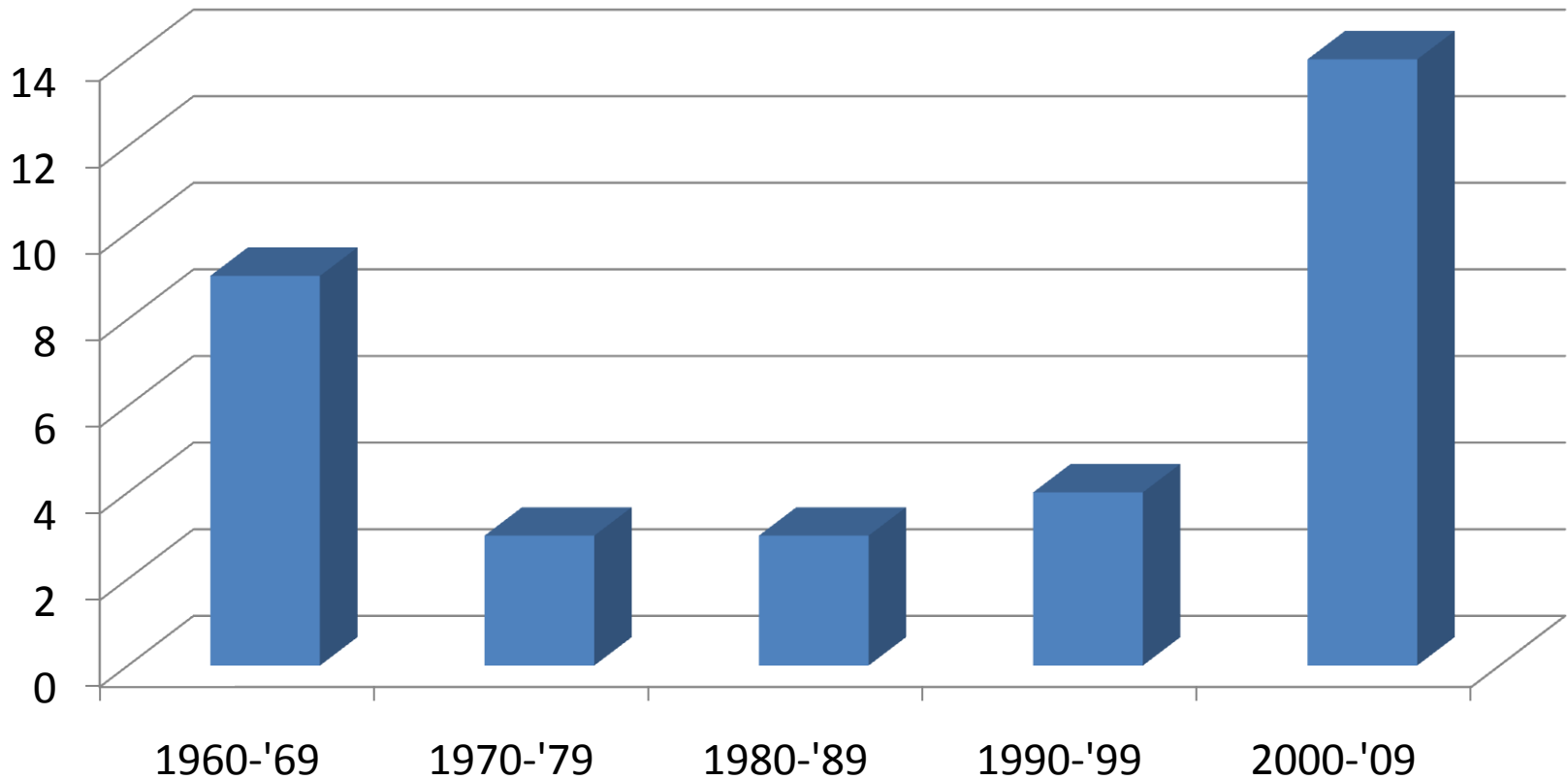
Literature Review

Study Endpoint



Literature Review

Decade of Study



Conclusions

- Reptiles are vulnerable to adverse effects and warrant inclusion in RA
- Good News: More work was done in last decade than ever before.
- Bad News: Very little relevant toxicity data for reptile RA
 - Few chemicals
 - Few species
 - Little data on reproduction and growth effects



Information Needs for Risk Assessment

- Effects of contaminants on reptile survival, growth and reproduction
 - Across orders and species
 - Dietary and other modes of exposure
- Links between exposure, body burden and effects on survival, growth and reproduction
- Biomarkers linked to exposure and effects on survival, growth and reproduction



Information Needs for Risk Assessment

- Links between effects on individuals and populations
- Better understanding of basic biology of reptiles (e.g., life history, physiology)
- Reptile-specific guidance for other RA tools (e.g., field surveys)
- What is expected from MOE and CSAP?



References

1. Reptiles of BC Website: <http://www.bcreptiles.ca/default.htm>
2. BC Species and Ecosystem Explorer Database: <http://a100.gov.bc.ca/pub/eswp/>
3. Gibbons et al. 2000. The global decline of reptiles, deja vu amphibians. *BioScience*. 50:653-666.
4. Ecotoxicology of Reptiles and Amphibians. Second Edition. 2010. Edited by: D.W. Sparling, G. Linder, C.A. Bishop, S.K. Krest. CRC Press.
5. Letter to the Editor, Reptile Toxicology: Challenges and Opportunities on the Last Frontier of Vertebrate Ecotoxicology. *Environmental Toxicology and Chemistry*. Vol.19. No. 10. pp.2391 - 2393. 2000.
6. Pauli, B.D., J.A. Perrault and S.L. Money. 2000. RATL: A Database of Reptile and Amphibian Toxicology Literature. Technical Report Series No. 357. Canadian Wildlife Service, Headquarters, Hull, Québec, Canada.

