FIELD EVALUATION OF AN AVIAN RISK ASSESSMENT MODEL

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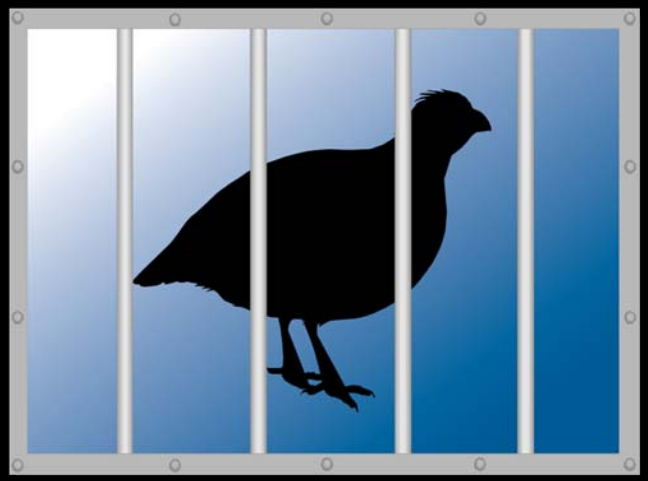

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Introduction

Laboratory Testing → Risk Assessment → Field Effects

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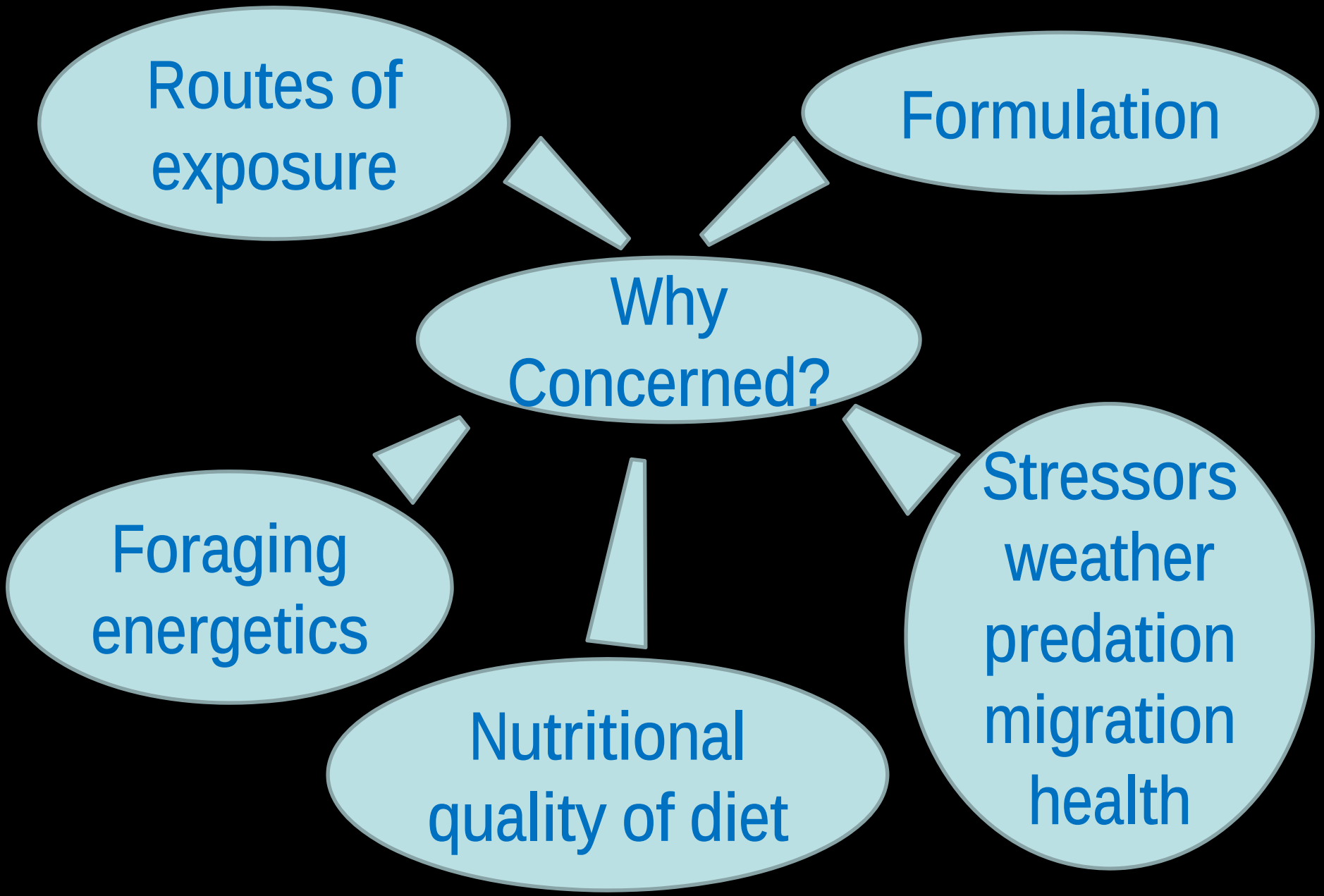
Routes of exposure
Formulation
Why Concerned?
Foraging energetics
Nutritional quality of diet
Stressors weather predation migration health

Methods

1. Procedure similar to the standardized avian dietary toxicity test

2. Canada goose goslings
   Lawn
   Diazinon

3. Laboratory Dietary Toxicity Test - t.g. diazinon (87.4% a.i.)
   Laboratory Toxicity Test - DZN 50W
   Outdoor Dietary Toxicity Test- DZN 50W
      Bantam chickens
      Five outdoor test pens (approx. 0.4A)
      Study site

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Measurements

- Mortality Dose-Response Relationship
- Brain Cholinesterase Activity
- Pesticide Residues
  - Food items
  - GI contents
  - Skin/Feathers
  - Feet

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Results

Laboratory Toxicity of Diazinon t.g.

Treatment (a.i., ppm)	n	% mortality
Control	15	0
190	10	10
400	10	30
700	10	60
1100	10	70

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Results

Laboratory Toxicity of DZN 50W

Treatment (a.i., ppm)	n	% mortality
Control	10	0
84	10	0
240	10	10
390	9	50
1100	10	55
1800	10	90

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Results

Outdoor Toxicity of DZN 50W

Appl. Rate (lbs a.i./A)	Mean measured residues d0 (ppm, a.i.)	n	% mortality
0	0.2	11	9
0.25	2.8	8	25
0.50	8.1	10	100
1.0	7.4	8	100
2.0	16.0	8	100

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Results

Laboratory tests vs. Outdoor test

Test	LC50 ppm a.i. [95% CL]	Slope [95% CL]
Laboratory technical grade diazinon test	623 [397-1210]	2.5 [0.8 – 4.1]
Laboratory diazinon D·Z·N® 50W formulation test	634 [404-1064]	2.4 [1.2 – 3.5]
Outdoor diazinon D·Z·N® 50W formulation test	3.6 [0 – 7.4]	NA

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Results

Gosling Brain Cholinesterase Activity

Tests	ChE Inhibition as % of Control (Range)	
	Died	Survived
Laboratory t.g. diazinon 190-1100 ppm a.i.	78 - 93	36 - 54
Laboratory D•Z•N® 50W 84 – 1800 ppm a.i	82 – 92	19 - 40
Outdoor D•Z•N® 50W 0.2-16.0 ppm a.i.	22 – 76	11

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Results

Diazinon residues

Tests	Range (ppm) (*n* samples > dl/ *n* samples analyzed)		
	Feet	GI contents	Skin + Feathers
Laboratory t.g. diazinon 190-1100 ppm a.i.	0.01 -1.3 13/37	2.2 -118 13/13	0.01-0.7 15/38
Laboratory D•Z•N® 50W 84 – 1800 ppm a.i	0.05 - 1.0 20/49	2.1 – 156 16/19	0.01 - 0.33 17/47
Outdoor D•Z•N® 50W 0.2-16.0 ppm a.i.	0.20 - 92.0 26/34	0.02 - 6.60 21/33	0.03 - 16.0 33/33

dl = 0.01 ppm

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Risk Characterization

Risk quotient

≥ 0.5	Presumption of high risk
0.2 - 0.5	Presumption of acute restricted use risk
<0.2	Risk not presumed for non-listed species

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Results

Laboratory test vs. Outdoor test

Application rate (lbs a.i./A)	Mean measured residues d0 (ppm, a.i.)	Percent mortality observed in outdoor test	Risk quotient	
			Laboratory test	Outdoor test
0.0	0.2	9	NA	NA
0.25	2.8	25	<0.01	0.78
0.50	8.1	100	0.01	2.25
1.0	7.4	100	0.01	2.06
2.0	16.0	100	0.02	4.44

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Results

Species	Risk quotient (EPA nomogram)	Risk quotient (outdoor test)
Outdoor goslings test	16.7	0.78
Mallard	1.9	0.09
Brown-headed cowbird	1.6	0.07
Japanese quail	1.3	0.06
Mallard	1.0	0.05
Japanese quail	0.4	0.02
Mallard	0.3	0.01
Ring-necked pheasant	0.2	0.01
Northern bobwhite	0.2	0.01
Laboratory tech grade goslings test	0.1	<0.01
Canada goose	0.02	<0.01

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Conclusions

- Diazinon was significantly more toxic to goslings in the outdoor test than in the laboratory tests.
- Residues on the skin plus feathers and the feet were greater in goslings from the outdoor test than in goslings from the laboratory tests, whereas the converse was true for the gastrointestinal content residues.

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Conclusions

- Residues in the environment need not be as high as the values used in the U.S. Environmental Protection Agency's risk assessment model to cause adverse effects to birds in the field.
- The deterministic risk assessment method identified potential risk to birds but it resulted in the underestimation of risk to the goslings.
- Laboratory-based risk quotients should be interpreted with caution.

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Interns and Volunteers

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