Assessing population and species level effects of environmental contaminants

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Organismal responses to contemporary environmental change

The influence of land use & water management on fishes

The influence of climate stressors on coastal marshes
Do environmental contaminants elevate population or species vulnerability?

Physical drivers like sedimentation

Chemical drivers like EDCs & heavy metals
How do individual-level responses emerge at the population and species level?

Do populations vary in response?

If so, is variation attributable to genetic or environmental factors?
How do individual-level responses emerge at the population and species level?

Reduced ovarian size in white suckers following exposure to Bleached Kraft Mill Effluent

Organismal level effects of exposure:
Induced gene expression (vitellogenin)
Sex modification (intersex individuals)
Behavioral modification
How do individual-level responses emerge at the population and species level?

Estimating the effects of lead exposure on fitness at three stages of reproduction

Prezygotic

Post-mating prezygotic

Postzygotic
How do individual-level responses emerge at the population and species level?

2 & 8 week exposures to lead concentration gradient

Biomarker & histological assays during development
How do individual-level responses emerge at the population and species level?

Exposure may impact levels of aggression during spawning.
Sorting and establishment of spawning hierarchy

Antagonism
Male-male territorial defense

Courtship
Both sexes solicit (displays, contact)

Spawning
Repeated spawning
Solo milting runs

Approach territory

"Slow" Approach

Exit territory

Territorial aggression

Courtship, spawning

β♂

α♂

♀
How do individual-level responses emerge at the population and species level?

Exposure may impact courtship & selection during spawning
How do individual-level responses emerge at the population and species level?

Estimating the effects of lead exposure on fitness from egg development to larval maturation
Do populations vary in response?

If so, is variation attributable to genetic or environmental factors?

Population A  Population B  Population C

Effects on aggression and courtship may vary across populations due to differences in susceptibility
Do populations vary in response?

If so, is variation attributable to genetic or environmental factors?

Population A
Population A
Population B
Population B
Population C
Population C

Replicate experiments involving multiple populations of two species
Common garden conditions to control environmental variation
Elevated vulnerability of populations & species may vary geographically

Physical drivers and chemical drivers can vary spatially and temporally
Environmental drivers of genetic change can induce ecosystem change.

Bottom-up, system-wide effects of exposure on ecosystems?