Stormwater wetlands: Valuable habitats for urban conservation or ecological traps?

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Rob Hale
Steve Swearer
Kirsten Parris
“The rates, scales, kinds, and combinations of changes occurring now are fundamentally different from those at any other time in history; we are changing Earth more rapidly than we are understanding it.”

Vitousek et al. 1997 Science
Responding to human-induced rapid environmental change (HIREC)

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Ecological traps

• Preferred (severe trap) or equally-preferred (equal-preference trap) habitat within which, fitness is lower
• Indirect cues used to infer habitat quality
• HIREC alters cues, habitat quality or both
• An emerging conservation concern

Chaine and Clobert (2012)
Altered wetlands as habitat

Altered wetlands as habitat

- Communities and populations comparable
- Individual fitness lower

Stormwater wetlands
Stormwater wetlands

- Directly impact fitness

Brand et al. 2010. *Arch Environ Contam Toxicol.*
Stormwater wetlands

• Indirectly impact fitness

Initial cue preference

Cue preference in pesticide

77 ± 4%

44 ± 5%

22 ± 4%

1μg/L

100μg/L


Hayden et al. 2015. *Ecosphere*
Ecological traps?

• Does fitness differ?

• Are frogs (equally) preferring conditions which reduce offspring fitness?
Simulate wetland pairs that differ in levels of contamination

Spotted Marsh Frog – *Limnodynastes tasmaniensis*
Does fitness differ between wetlands?
Does fitness differ between wetlands?

Wetland quality
Does fitness differ between wetlands?

Control

Visual

Olfactory

Vis + Olf

Percentage of time away from predator

Cont Vis Olf

Wetland quality

Cont

Experimental tank

Vis

Control

Visual

Olfactory

Vis + Olf

Percentage of time away from predator

High

Low

Wetland quality
Ecological traps?

• Does fitness differ? **YES**

• Are frogs (equally) preferring conditions which reduce offspring fitness?
Are oviposition habitat selection decisions adaptive?
Are oviposition habitat selection decisions adaptive?

Number of egg masses laid into HQ wetland and LQ wetland.

Pond quality

n_{TOTAL} = 46
Ecological traps?

• Does fitness differ? **YES**

• Are frogs (equally) preferring conditions which reduce offspring fitness? **YES**
Ecological traps?

- Does fitness differ? **YES**

- Are frogs (equally) preferring conditions which reduce offspring fitness? **YES**

*Equal-preference ecological trap!*
Conservation/Management

(1) conserving and maintaining high-quality wetlands.

(2) restricting access by wildlife to low-quality wetlands.

(3) determining the cues used by animals when selecting wetlands and removing these cues from low-quality sites, or adding them to high-quality sites.

(4) finding alternative stormwater treatment solutions in sensitive areas (e.g. bio-filtration systems or rainwater tanks).

(5) providing high-quality, off-line wetlands that do not receive large volumes of stormwater nearby.

Sievers et al. in review. Urban stormwater wetlands function as an ecological trap for frogs. JAPPLE
Conservation/Management

Conserving and maintaining high-quality wetlands.

JF Brennan

Friends of Darebin Creek
Conservation/Management

Restricting access by wildlife to low-quality wetlands.
Conservation/Management

Determining the cues used by animals when selecting wetlands and removing these cues from low-quality sites, or adding them to high-quality sites.
Conservation/Management

Finding alternative stormwater treatment solutions in sensitive areas

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Spromberg et al 2016. JAE
Providing high-quality, off-line wetlands that do not receive large volumes of stormwater nearby.
Final thoughts

- Emerging ecological and conservation issue
- How do other animals respond?
- Focus on individual-level metrics
- Fitness-reducing elements?
- Minimise the ecological costs of stormwater wetlands
Supervisors

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Rob Hale
Kirsten Parris

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