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The 4 F's: Frogs, Freshwater Ponds, Fragmentation, and Fish

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F #1 – Frogs

Amphibian Declines

- Amphibians = 3 Orders - Anura (the frogs and toads), Urodela (the salamanders), and Apoda (the caecilians)
- Of the almost 6,000 known amphibian species in the world, it is estimated that 32% are threatened with extinction (vs. 12% of birds and 23% of mammals; Stuart et al. 2004)
- Habitat loss and degradation are the greatest threats to amphibians (along with pollution, invasive species, and disease; Stuart et al. 2004)

Why are amphibians so vulnerable to habitat degradation and loss?

- semi-permeable skin (desiccation; contaminants)
 - require moist microsites
- dependent on both aquatic and terrestrial habitats
- low vagility (don't move very much - can't escape)
- high philopatry (faithful to sites)

Amphibian Species on Vancouver Island (and Gabe?)

Common Name	Species	Old	Sp-Code	Prov.	BC	COSEWIC
<i>Terrestrial-Breeding Salamanders</i>						
Western Redback Salamander	<i>Plethodon vehiculum</i>		PLVE	S4	Yellow	NAR
Ensatina	<i>Ensatina eschscholtzii</i>		ENES	S4	Yellow	NAR
Wandering Salamander	<i>Aneides vagrans</i>		ANVA	S3S4	Blue	SC
<i>Lentic-breeding Amphibians</i>						
Northwestern Salamander	<i>Ambystoma gracile</i>		AMGR	S4S5	Yellow	NAR
Long-toed Salamander	<i>Ambystoma macrodactylum</i>		AMMA	S4S5	Yellow	NAR
Roughskin Newt	<i>Taricha granulosa</i>		TAGR	S4S5	Yellow	
Pacific Treefrog	<i>Pseudacris regilla</i>	<i>Hyla regilla</i>	PSRE	S5	Yellow	
Western Toad	<i>Anaxyrus boreas</i>	<i>Bufo boreas</i>	ANBO	S3S4	Blue	SC
Red-legged Frog	<i>Rana aurora</i>		RAAU	S3S4	Blue	SC
American Bullfrog	<i>Lithobates catesbeianus</i>	<i>Rana catesbeiana</i>	RACA	SNA	exotic	
Green Frog	<i>Lithobates clamitans</i>	<i>Rana clamitans</i>	RACL	SNA	exotic	

What does Blue Listed mean?

- BC government definition: “Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.”
- For example, Western Toads are particularly vulnerable to roads, and to subsidized predators (e.g., crows/ravens, raccoons, etc.)

F #2 - Freshwater Ponds

Most of our native amphibian species breed in freshwater habitats

- Forestry is often cited as a major threat to amphibians
 - but, less of an issue for species in coastal areas of BC (cool, moist)
 - effects are species specific and often temporary
- In contrast, one of the biggest threats = urban and rural development
 - all species are affected, and effects are permanent
 - big issue for species occurring only on the south coast
 - e.g., wetland drainage / conversion (e.g., 75% wetland loss in the Lower Mainland and Greater Victoria area)

Multiple Assaults from Urban and Rural Development

- Habitat loss (wetland drainage, road building, housing developments)
- Habitat fragmentation (isolation, road mortality)
- Invasive species (fish, Bullfrogs)
- Subsidized predators (raccoons, ravens, cats)
- Pollution / contaminants

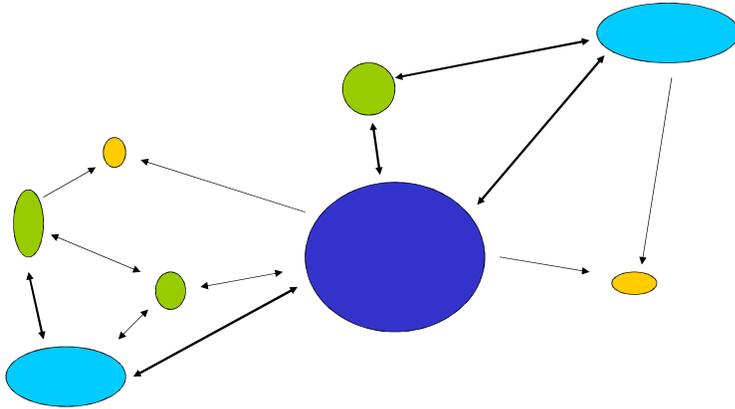
F #3 – Fragmentation

- Development leads to isolation of amphibian populations
 - wetland loss and isolation
 - roads; built environment
- We manage habitats in isolation
 - e.g., “donut” buffers; work project by project
- ***We need to take a landscape-level approach***

Amphibians Live in Metapopulations

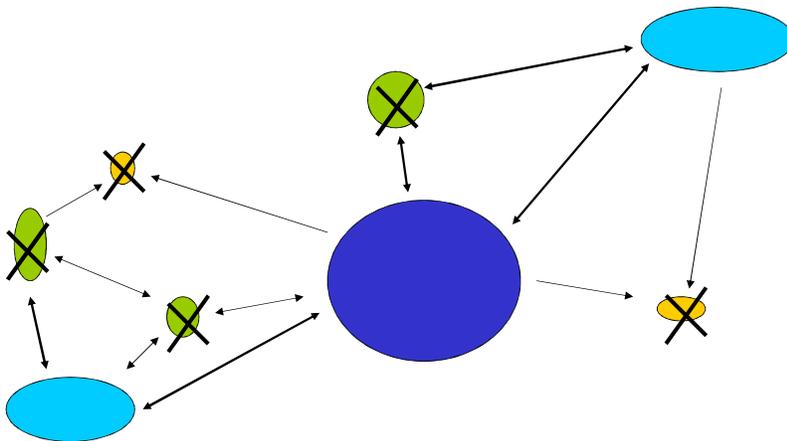
- Some ponds may provide a low, but predictable reproductive output (blue - source)
- While others may only have breeding success in wet years (green and orange - sinks)
- Together they meet a variety of life-history requirements

STEPPING STONES



- When we do not protect small ponds and wetlands, the result is:
 - Loss of important (breeding) habitat
 - Isolation / longer travelling distances (loss of stepping stones)
 - Forced to utilize permanent waters (with fish, Bullfrogs)

~~STEPPING STONES~~



Importance of Small, Seasonal Wetlands

(also called "vernal pools", temporary, semi-permanent, or ephemeral ponds)

- ✓ highly unpredictable, but
- ✓ contain a unique species assemblage
- ✓ have fewer predators (e.g., fishless, no Bullfrogs)
- ✓ are highly productive
 - algae; shallow and warm - speeds larval development

Bigger ≠ Better: Small Wetland Management Issues

- There is no correlation between wetland size and amphibian species diversity
- But, wetland legislation is largely based on wetland size:
 - FRPA (forestry regs) does not protect isolated wetlands < 0.5 ha on coast; most are \approx 0.25 ha on eastern VI
 - the RAR (municipal regs) only protects water bodies that contain or are connected to areas containing fish (bad for amphibians...)
 - Small wetlands / ponds are not identifiable from air photos (Wind 2003)

F #4 – Fish (Non-native and Invasive Aquatic Predators)

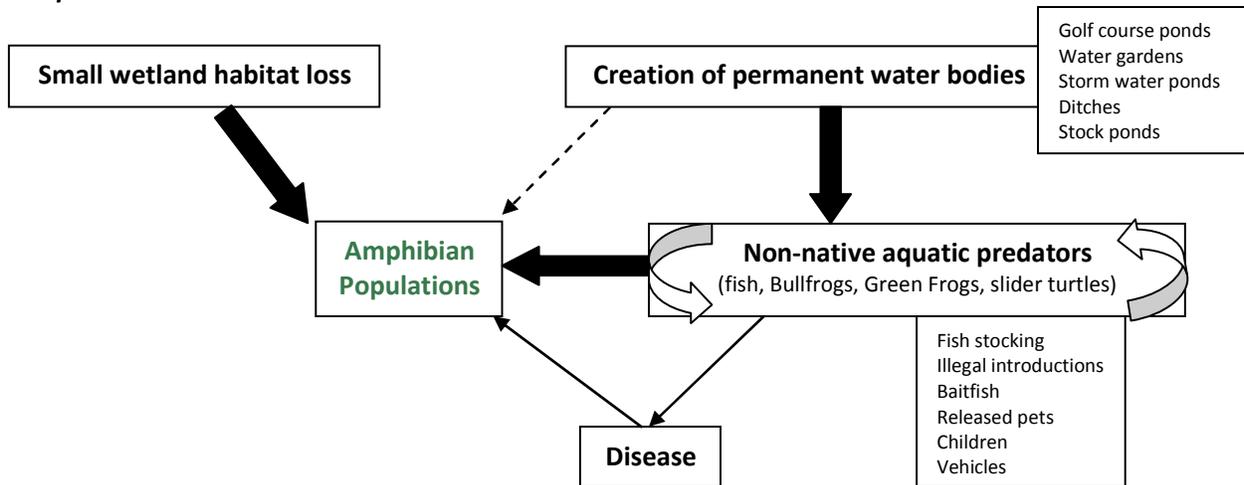
Research has shown that non-native fish can facilitate the survival of Bullfrogs, via preying on invertebrates that impact Bullfrog tadpole survival, such as dragonfly larva.



M. J. Adams, C.A. Pearl and R. B. Bury. 2003. Indirect facilitation of an anuran invasion by non-native fishes. Ecology Letters 6(4):343-351.

C.A. Pearl, M.J. Adams, N. Leuthold, R.B. Bury. 2005. Amphibian occurrence and aquatic invaders in a changing landscape: implications for wetland mitigation in the Willamette Valley, Oregon, USA. Wetlands 25(1):76-88.

Complex Interactions



Management of Wetlands in Urban Areas

Protect amphibian habitat

- identify, map, and protect small wetland habitats
- implement landscape-level planning
- maintain connectivity to and between forested areas (e.g., through partnerships)
- communicate with various agencies (e.g., BC Hydro, DFO) about vegetation control measures (e.g., use of herbicides) and fisheries management practices
- control subsidized predators (e.g., crows / ravens & raccoons; garbage, feeding)
- consider using amphibians and wetlands as indicators of environmental health (e.g., through monitoring programs)

Don't facilitate invasive, aquatic predators

- avoid the creation of permanent water bodies - allow / design water bodies to dry up on occasion (in fall)
- do not stock lakes or ponds with fish
- deter introductions by the public (limit access; bait use; tadpoles in schools / kids)
- responsible water garden and pet owner education needed
- conduct surveys for non-native amphibians and fish and implement control measures if necessary