Spacing, Movements, and Orientation

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Distribution, Dispersion, and Dispersal

- A little review...
- Distribution: the area occupied by the population or species (line drawn around dispersion)
- Dispersion: the spatial pattern exhibited by the animas of a population
- Dispersal: the movement an individual makes from its place of birth to the place where it reproduces

What factors can contribute to movements?

- Intrinsic
  - Age
  - Life history stage
  - Size
  - Sex
  - Reproductive status
- Extrinsic
  - Environmental quality
  - Season
  - Temperature
  - Humidity
Local Dispersion of Individuals

• Dispersion of individuals occurs at a number of levels
• Species tend to be associated with specific microhabitat patches
• What is a microhabitat?

• Salamanders
  – Eastern Newts
• Frogs
  – Tree frogs vs. Pond frogs
• Snakes
  – Rat Snakes
  – Rattlesnakes
• Lizards
  – Anole vs. ground skink
• Turtles
  – Bog Turtle
  – Spotted turtle

Local Dispersion of Individuals

• Home ranges
  – What is a home range?
  – What is included in a home range?
• Territories
  – Why are territories important?
• Other patterns of space use
  – What are some other important uses of space?

Other patterns of space use

• Brooding/Nest Guarding
• Aggregations
  – Breeding
  – Schooling
  – Environmental factors
    • Drought
    • Overwintering
  – Homing
Movements, Homing, and Migrations

• Most movements occur within the home range
• What are some of the costs and benefits to moving?
• How can managers take advantage of movement data?

Mass Movements

• Migration
  – Amphibians
  – Turtles
  – Garter snakes
Dispersal

• What is dispersal again??
• Undirected movement to locations unknown by the moving animal and commonly refers to juveniles leaving the home ranges of their parents to find a home of their own.
• Why is this important?

Homing and Orientation

• Ability of a displaced individual to find its way home
• Migration
• What about translocation in conservation?

Movements and Amphibian Decline

• Climate Change
• Invasive Species
• Pollution
• Pet Trade
• Disease
• Habitat Loss
Management Issues

- Habitat Use/Quality
- Movement/Buffer Zones
- Population genetics
- Relocation, Repatriation, Translocation

Eastern Tiger Salamander

- *Ambystoma tigrinum*
- NYS Endangered
- Decreasing throughout their range
- Many areas on Long Island are in danger of development

Current Range
Historic Range in N.Y.

Current Range in N.Y.

Legal Protection

- New York State Freshwater Wetland Act: 30 m buffer surrounding wetlands
- NYS DEC Recommendations: 164 m, no more than 50% upland habitat within 305 m of breeding pond be converted to unusable habitat (based on Semlitsch 1998)
Brookhaven National Laboratory, Long Island, N.Y.
Over 5000 acres
22+ confirmed salamander ponds on site
3 Focal Ponds: L1, L3, L7
Tiger Salamander management and monitoring protocols already in place

Movements

Legend
- Developed
- Planted White Pine
- Pitch Pine Oak
- Field
- Water
- Male
- Female
- Juvenile
Methods

- Collected males and females upon emigration from breeding ponds
- Collected juveniles upon emigration or just before final metamorphosis

Results

- Tracked 33 males, 26 females, 47 metamorphs
- Predation: Bullfrog, Eastern Hognose Snake, Raccoon, Northern Short-Tailed Shrew, Eastern Ribbon Snake
Results

- Movements at night during rain event
- Some short movements after implant replacement
- Avoided open fields, development, planted white pine stands

![Adult A. tigrinum outside burrow](image)
Conclusions

- Circular buffer zones may be inadequate for this species.
- Fails to protect 20% of individuals in this study, however, incorporating a 50 m edge effect, only protects 62%.
- May encompass unsuitable habitat and reduce availability of good habitat.

Pre-metamorphic A. tigrinum.
Connectivity

- Fragmented landscapes resulting from anthropogenic habitat modification can have a significant impact on dispersal, gene flow, and persistence of wildlife populations
- Reduced genetic variation can severely compromise the ability of a population to respond to subsequent environmental change

Goals

- Assess population genetic diversity of remaining tiger salamander populations
- Quantify genetic and landscape connectivity among ponds and populations to identify potential corridors and barriers to migration

Methods

- Collected samples from 17 breeding sites across Long Island and 9 sites in New Jersey
- Collected as many samples as possible (N=2-93) from each site
- Genotyped 439 individuals across 12 microsatellite loci
- Samples included toe and tail clips and individual eggs from egg masses
Low allelic diversity
Markers not highly polymorphic (1-13 alleles)
Mean numbers of alleles ranged from 1.1 to 3.3 in New York and 1.7 to 2.4 in New Jersey

High levels of population differentiation between NY and NJ (average $F_{st}=0.217$) (FSTAT Goudet 1995; Weir and Cockerham 1984).

Few individuals were assigned to the pond at which they were sampled with either 80% or 95% confidence, and many of these individuals were assigned to other ponds with high confidence (GENECLASS2; Piry et al. 2004).
Results - Landscape Barriers to Migration

- Defined land cover resistance values from Compton et al. (2007) and Greenwald et al. (2009)
- Calculated euclidean distance and surface resistance (using CIRCUITSCAPE version 3.3; McRae and Shah 2009);
- Correlated these values with Fst using a Mantel test (Rosenburg and Anderson 2011)

Results - Landscape Barriers to Migration

- No relationship between connectivity indices and Fst in either New York (euclidean distance: $r = 0.044$, $p = 0.827$; surface resistance: $r = -0.056$, $p = 0.786$) or New Jersey (euclidean distance: $r = 0.120$, $p = 0.388$; surface resistance: $r = 0.226$, $p = 0.246$)

Management

- Calculate protection (buffer zones) on a case-by-case basis
- Estimate probable dispersal habitat and determine available corridors
- Individual breeding ponds can be susceptible to perturbations that may limit migration and dispersal
So What?

- Global amphibian declines
- Desire to know how to properly conserve and manage this and other amphibian species
- Disease outbreaks; already confirmed *Bd* and *Ranavirus* on site
- Can we actively manage this species (e.g. relocation, assisted migration)?