POPULATION SIZE AND DIVERSITY OF CENTRARCHID FISHES IN URBAN AND NON-URBAN PONDS

Group 2

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Urbanization Effects

- A growing human population has increased urbanization & created many environmental challenges.
- Effects of high urbanization:
  - Increase in impervious surfaces
  - Precipitation runoff volume/rate increase
  - Erosion
  - Removal of microhabitats
  - Increased pollutants (nutrients, sediments, and chemicals)
  - Riparian forest removal increases water temperature
- All of which can have a negative impact on aquatic assemblages

Urban Stream Syndrome in Lakes?

- The consistent ecological degradation of stream ecosystems due to the increasing urban landscape has been coined "urban stream syndrome".
  - Flashier hydrographs
  - Elevated concentrations of nutrients and contaminants
  - Altered channel morphology and stability
  - Reduced biotic richness
  - Increased dominance of tolerant species
- However, no studies have been done on the effects of urbanization on lakes or the fish communities within them

Study Goals

- Assess Species diversity, abundance, and population sizes between two urban and two non-urban ponds to determine the effects of urbanization on aquatic fish assemblages.
- Non-urban ponds – Airy & Ashe Lake
- Urban ponds – Lake Byron & South Pond

Study Family: *Centrarchidae*

- Sunfishes -- a group of ray-finned fishes primarily found in freshwater systems throughout North America.
- Within the state of Mississippi there are 18 species in six genera:
  - *Micropterus* (the freshwater black basses)
  - *Lepomis* (bream)
  - *Pomoxis* (crappies)
  - *Ambloplites* (shadow and rock bass)
  - *Centrarchus* (flier)
  - *Enneacanthus* (blue-spotted sunfish)
- 88% of licensed anglers prefer to fish for bass, crappies, and bream over all other game fish.

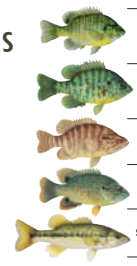
Methods – Day 1

- 3 ten-meter long stretches were sampled using a six-meter-long by two-meter-tall seine.
- If aquatic vegetation was present, a third person disturbed the vegetation to drive fish from the refuge.
- Forty captured fish per seine pull were identified to genus (*Lepomis* or *Micropterus*) and anesthetized with MS-222.
- Standard length (cm) was measured from the snout to caudal peduncle, the dorsal spines were clipped as a mark.

Methods – Day 2

- On day two the same ten-meter stretches were again seined
- All captured fish were fixed in 10% formalin and preserved in 70% ethanol.
- Centrarchids were identified to species, checked for dorsal spine clips, and standard length was measured for a maximum of 120 individuals per seine pull.
- Marked fish were recaptured at each pond.

Results



$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Species	Airey Lake	Ashe Lake	South Pond	Lake Byron
Bluegill	195 (99%)	7 (41.2%)	135 (100%)	3540 (99.9%)
Red-ear	0	7 (41.2%)	0	0
Warmouth	0	3 (17.6%)	0	0
Green	0	0	0	2 (0.06%)
Spotted Bass	2 (1%)	0	0	2 (0.06%)
Shannon Diversity Index	0.057	1.04	0	0.01
Lepomis Pop Estimates	10,700	374	1,620	35,440

Results

Lincoln – Peterson mark-recapture

$$N = \frac{n_1 \times n_2}{m}$$

N_1 = # marked on first day
N_2 = total # captured on second day
m = # of recaptured

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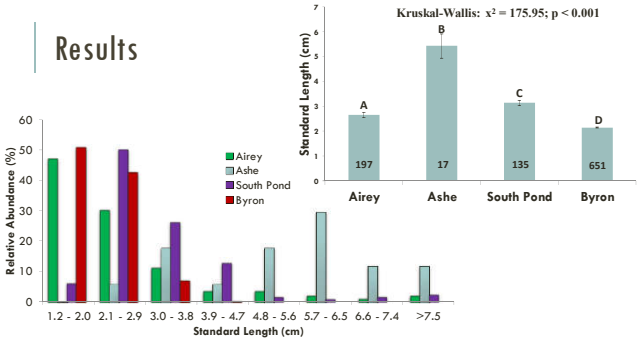

Discussion

- Centrarchid diversity higher in rural ponds
  - Potential urbanization effect on habitat quality
- Ashe Lake had two unique species
  - Warmouth and red-ear (more sensitive)
- Increase in abundances of tolerant species
- Lowest population estimate in rural Ashe Lake (largest lake)
  - Small 2nd day sample size at Ashe lowered population estimates
- Largest population estimate in urban Lake Byron (>35,000 fish)

Stunting and Lake Byron

- Stunting = reduction in growth, allows for energy allocation to reproduction
- Populations with abundant resources and in extremely high densities
- Populations of stunted individuals tend to reproduce later in the year.
  - Late reproduction may have heavily skewed population estimates, as 50% of the fish captured were less than 2 cm.

Aday *et al* 2002

Further Research?

- Quantifying habitat variables across an urban gradient
  - Canopy cover
  - Area of impervious surfaces
  - Water chemistry
  - Substrates
  - Pollutants
- More replicate rural and urban sites to provide further evidence to explain the effects of urbanization on pond communities.
- Stop neglecting natural and artificial ponds in the Urban Stream Syndrome theory
  - Ponds can increase biodiversity in urban areas (Hill *et al* 2016)