



Ecological Factors Influencing Nesting and Hybridization Among Sympatric Sunfish Species in an Isolated Lake



Evan Miller and Patricia Bohls, Dr. Evon Hekkala, Rachel Coffey
 Louis Calder Center ~ Biological Field Station, Armonk, NY, 10504



Lepomis auritus
 (Coffey, 2011)



Lepomis gibbosus
 (Coffey, 2011)



(Bohls, 2013)

CONTACT

Evan Miller, Morehouse College '15
 CSUR REU Program 2013
 evan.miller232@gmail.com
 Cell: (845) 826-1374
 830 Westview Drive S.W., Atlanta, GA 30314

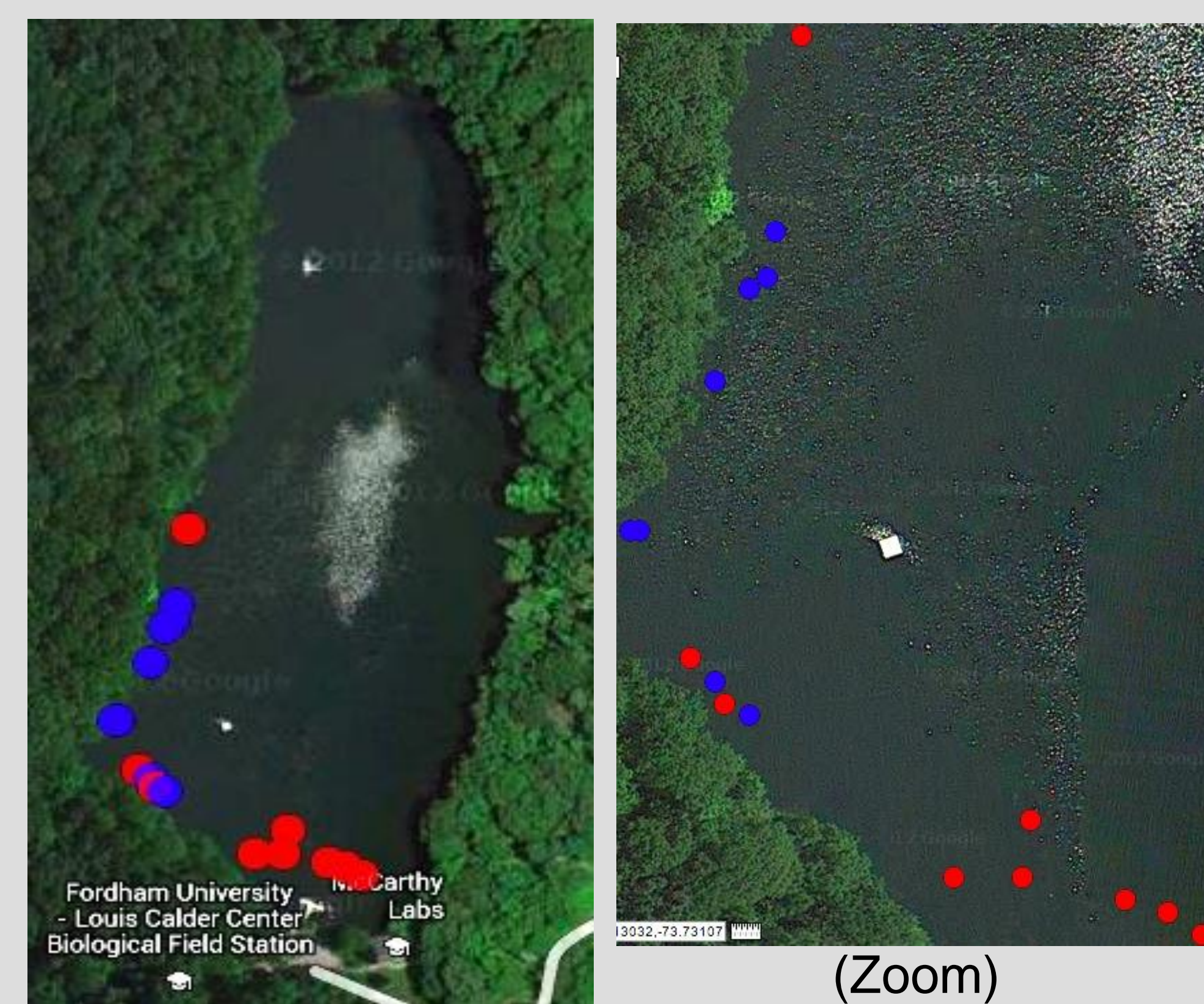
INTRODUCTION

The purpose of this research is to investigate the temporal, spatial, and ecological factors influencing hybridization among sympatric species of sunfish in an isolated lake. Previous experiments suggest that sunfish of the genus *Lepomis* show a propensity to hybridize with one another (Avisé, 1984; Thorp, 1988). This project targets *Lepomis auritus* and *Lepomis gibbosus*, two species that occupy Calder Lake simultaneously during their overlapping mating seasons. The overall project was comprised of field sampling to collect DNA and genetic analysis that evaluated the microsatellites of each specimen at 6 loci.

Hypotheses:

- *Lepomis auritus* and *Lepomis gibbosus* are hybridizing in Calder Lake
- Fish in close proximity to one another are more likely to be related
- Nests in close proximity to the opposite species are more likely to contain hybrids

STUDY SITE



Nest Distribution 2013

Calder Lake, Louis Calder Center
 Armonk, NY

- = *Lepomis auritus* (Redbreast)
- = *Lepomis gibbosus* (Pumpkinseed)

METHODS

In the field:

- Lake surveyed and individual nests marked with labeled fishing bobbers
- GPS coordinates, depth, dissolved oxygen content, spatial location, temperature, and level of debris (1-5) recorded for each nest
- DNA Collection
 - Guard Males caught with fishing pole
 - Swabbed with Q-tip and anal fin clipped
 - Fry (hatchlings) gathered with and sifted out of nest bed sample
 - Approximately 20 individuals per nest
 - All samples frozen

In the laboratory:

- Microsatellite Analysis
 - DNA extracted from each sample using Qiagen DNeasy Kit
 - PCR amplification of extracted DNA using 6 known primers (across a broad range of temperatures)
 - PCR products separated into panels (for efficiency) by dye color, and size and run on ABI 3100 DNA Analyzer

	Locus (Primer)	Length (bp)	Dye
Panel A	Lma104	98-100	Hex
	Lma117short	152-176	Hex
Panel B	Lma21	158-182	Fam
	Lma122	73-132	Hex



Figure 1. Redbreast Nest (Bohls, 2013)



Figure 2. Pumpkinseed on Nest (Bohls, 2013)

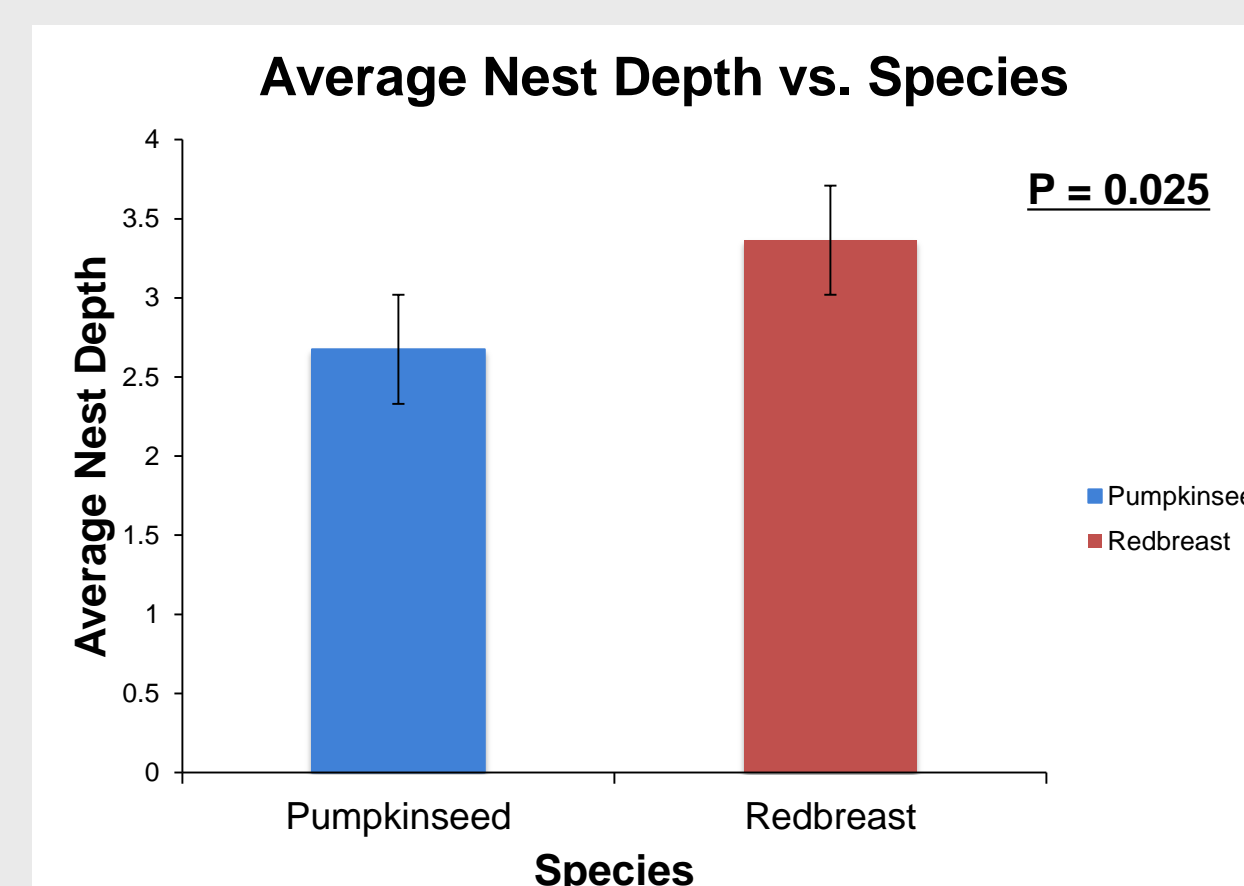


Chart 1. Average Nest Depth vs. Species

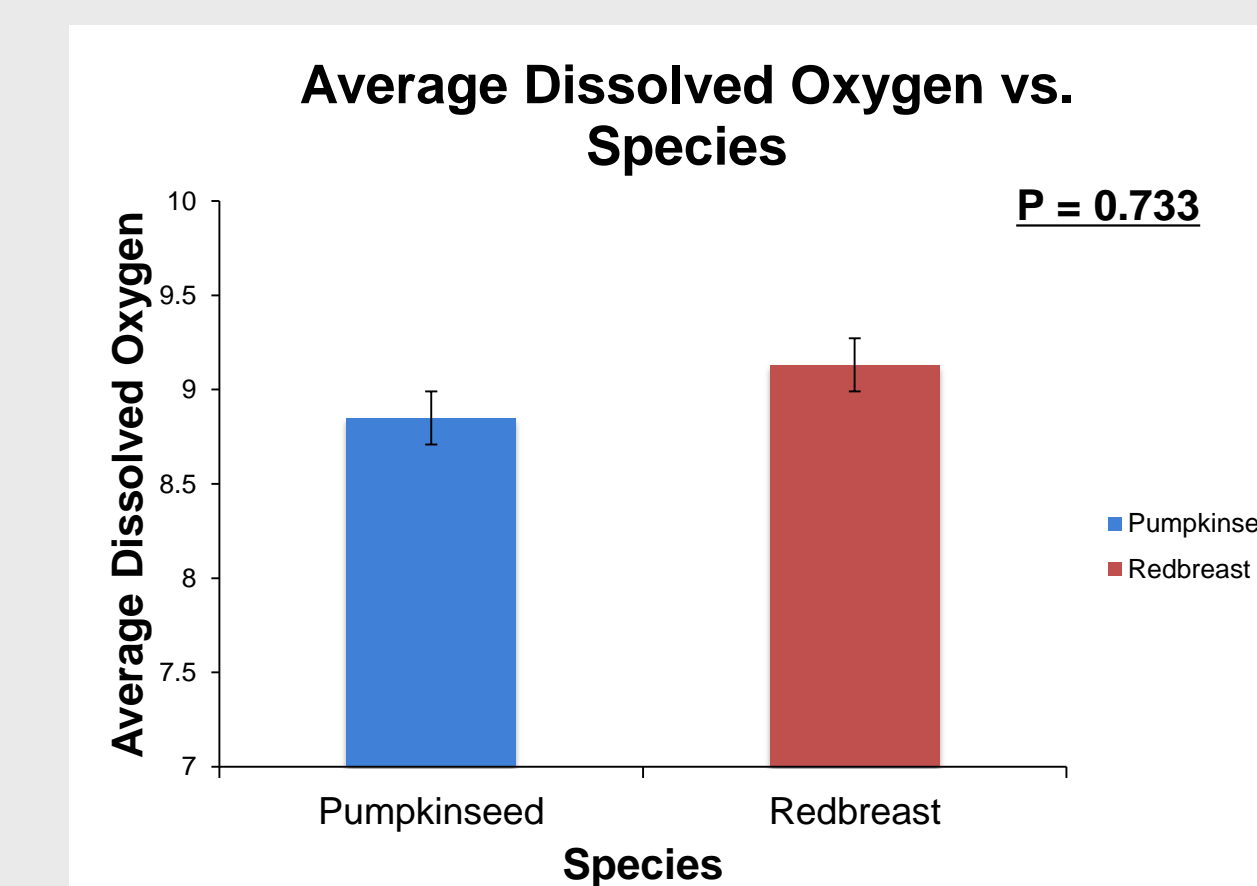


Chart 2. Average Dissolved Oxygen vs. Species

RESULTS

- Microsatellite (allele based) comparison shows that hybridization is relatively rare
- Hybrids are adult males or show random distribution across sample area
 - No evidence of first generation hybridization
 - Approximately 4.79% show evidence of backcrossing/introgression

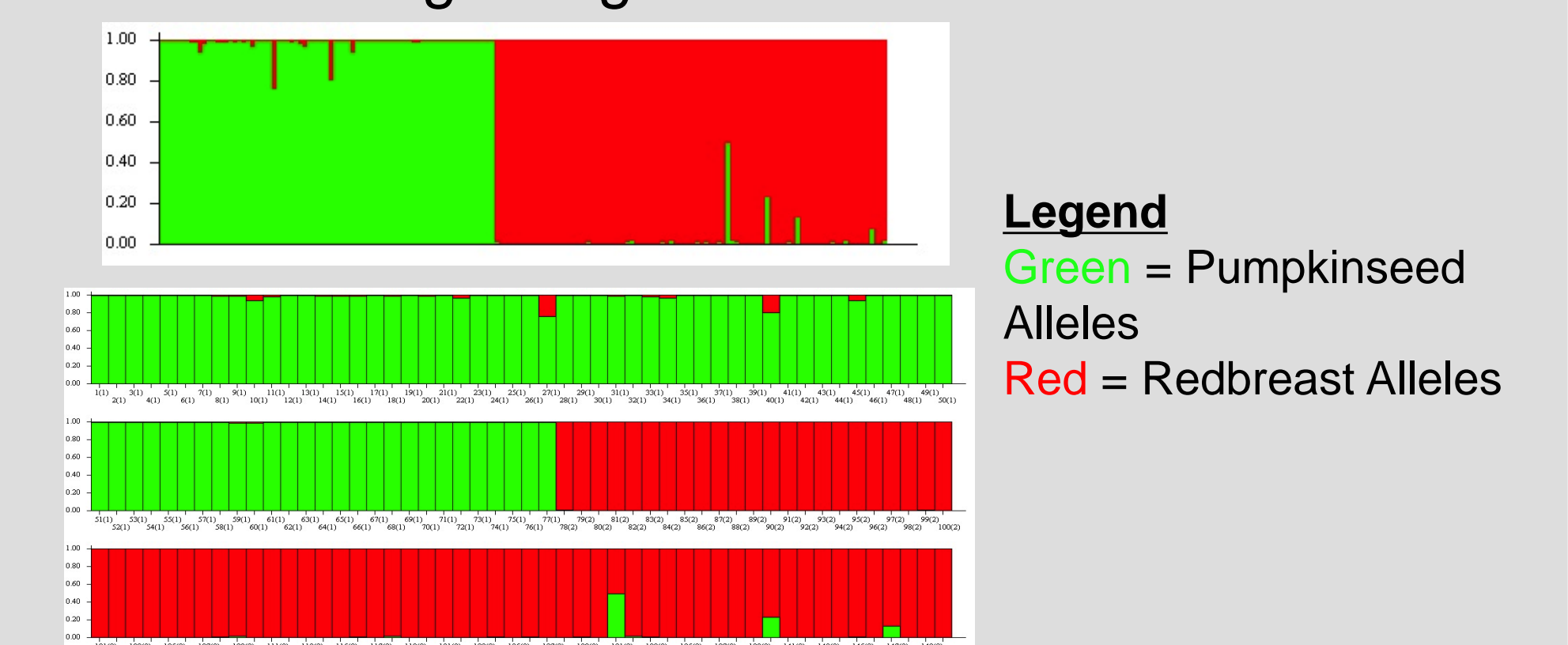


Figure 3. Bar plot of allele distribution across species (Top) and per individual (Bottom); K=2

- Species only demonstrate significant preference for nest debris scale

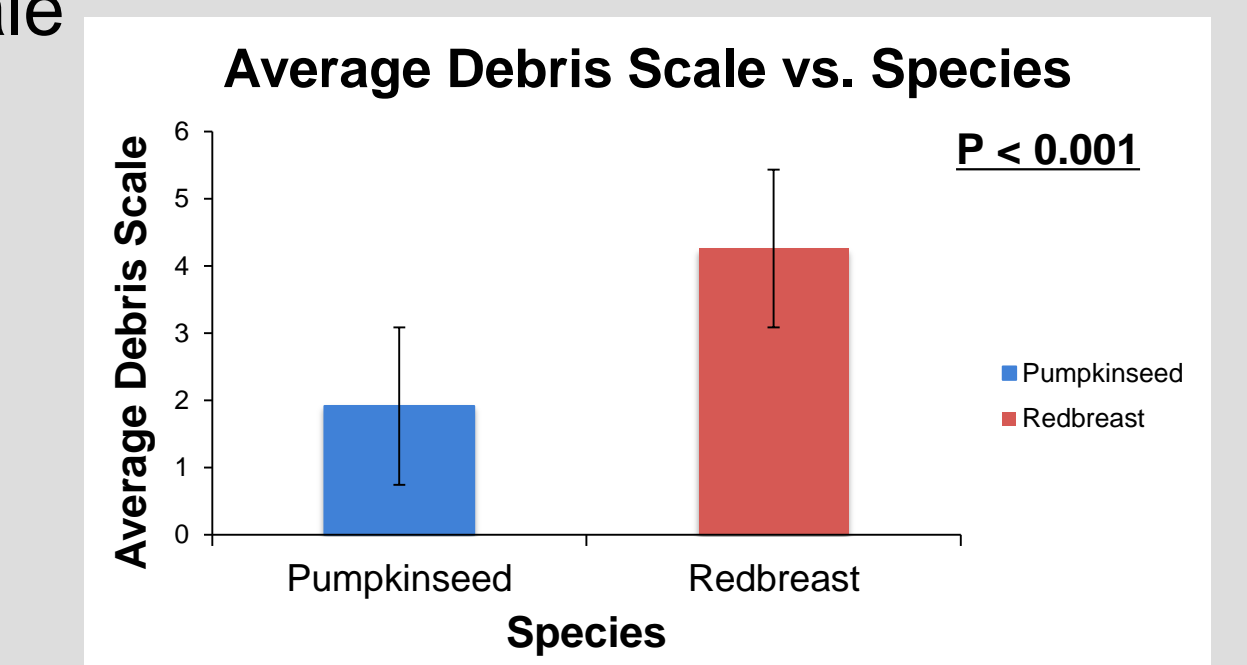


Chart 3. Average Debris Scale vs. Species

CONCLUSIONS

- Hybridization is occurring on Calder Lake, but on a small scale
- No first generation hybrids
 - Hybrids found are likely a result of backcrossing/introgression
- Clear partitioning of resources between species suggests ecological mechanism preventing hybridization
- No significant contrast in preference for dissolved oxygen or temperature between species

Future Directions

- Examine ecological mechanisms preventing hybridization in Calder Lake
- Does competition for nesting locations influence separation of species?
- Consider any prezygotic barriers taking effect within lake environment

ACKNOWLEDGEMENTS

Dr. Evon Hekkala (Mentor), Kaitlin Abrams (Co-mentor), Seth Cunningham, Mike Lambros, Alissa Perrone, Petra Del Valle, Dr. John Wehr, Dr. James Lewis, Kam Truhn, Seth Ganzhorn, my fellow CSUR students, NYS DEC

Thank you to the NSF and Fordham University for providing us with this opportunity!