

No difference in male Northern Cardinal plumage color between Rural and Urban Environments

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Question

- ▶ Does male Northern Cardinal (*Cardinalis cardinalis*) plumage color vary between rural and urban environments?

Introduction

➤ Previous studies analyzed:

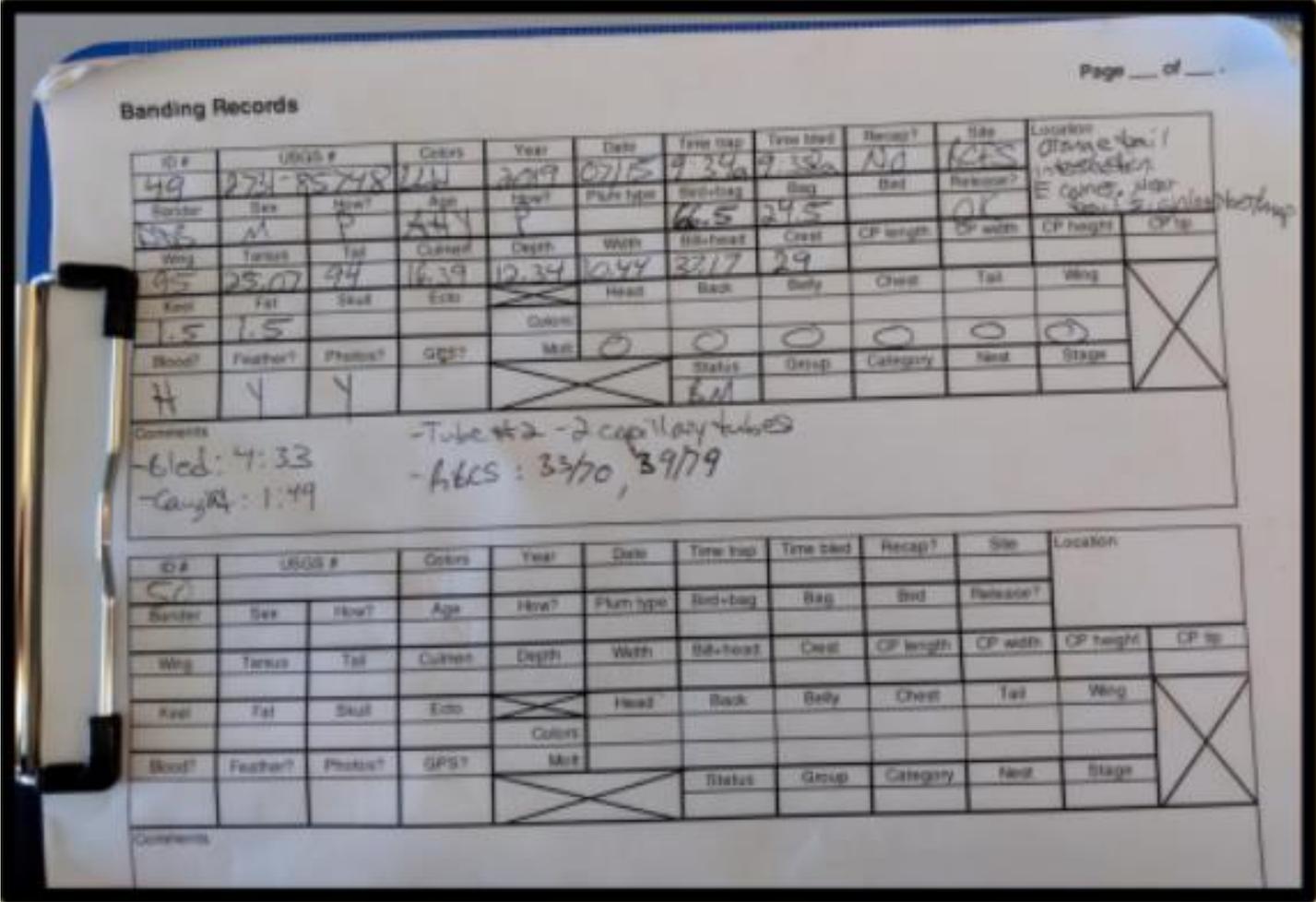
- Different food resources and foraging behaviors between rural and urban environments (Giraudeau et al. 2018)
- Red plumage color is a sexual signal composed of carotenoid pigments from food (Giraudeau et al. 2018)
- Sexual signaling is affected by relationship between body condition and plumage brightness in rural environments (Jones et al. 2010)

➤ Our goal:

- Compare plumage hue, chroma, and brightness between rural and urban environments, accounting for the unique UV-sensitive avian visual system

Methods: Fieldwork

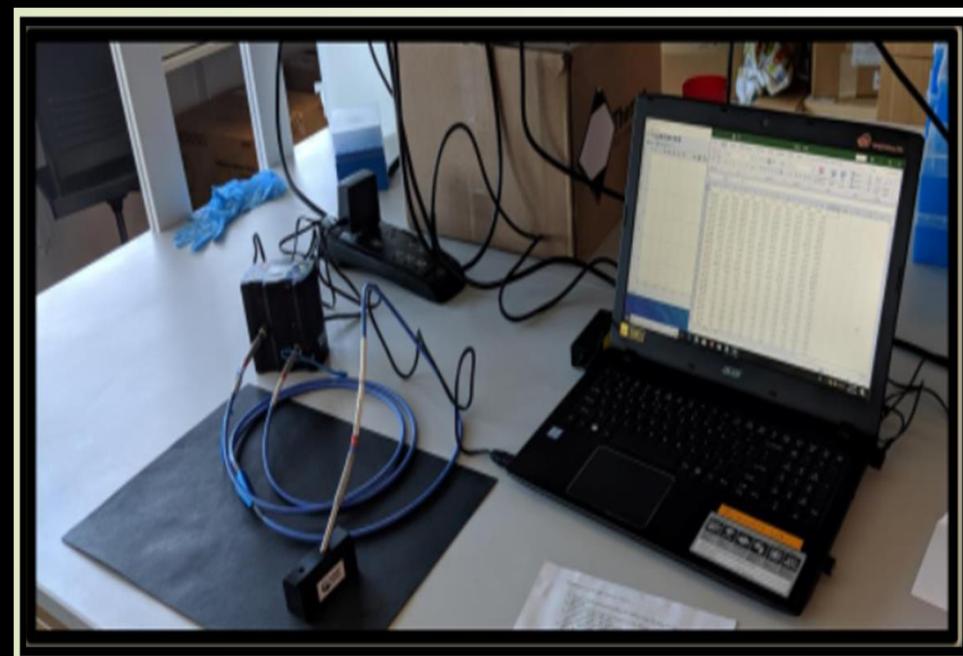
- ▶ Banded cardinals at Rice Creek Field Station (RCFS, rural) and Barry Park (BP, urban)
- ▶ Collected ten feathers from chest and back
- ▶ Recorded morphological data for each cardinal
- ▶ Sample sizes: RCFS = 24 , BP = 10 cardinals





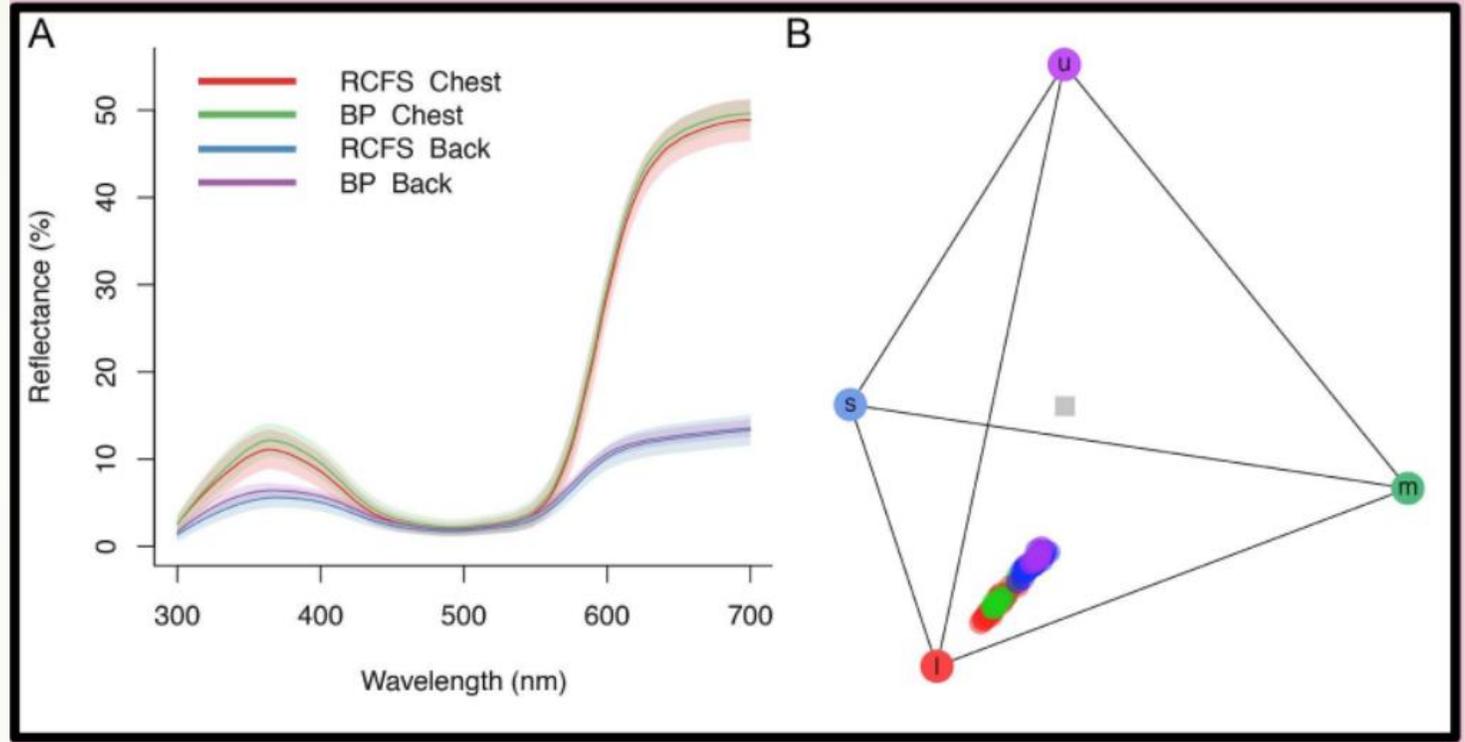
Methods: Lab Work

- Mounted feathers
- Reflectance spectrophotometer for measuring feather samples from 300-700 nm
- Analyzed reflectance curves using a mathematical model of the avian visual system:
 - **Hue:** position of color in the avian color space
 - **Chroma:** distance from the achromatic center to the color in the avian color space
 - **Brightness:** total reflectance as perceived by the bird



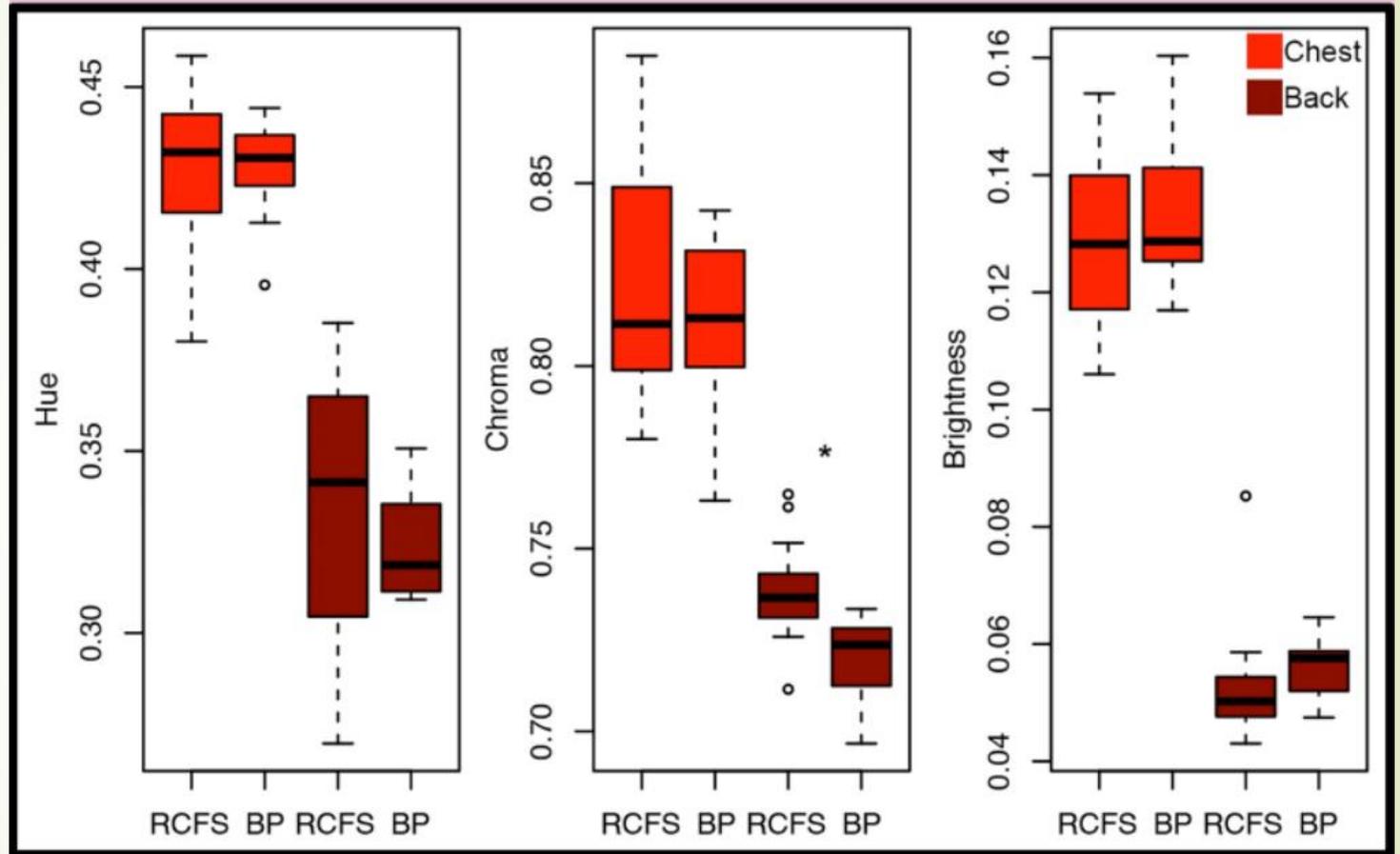
Results

- ➔ Chest or back feathers between RCFS and BP revealed overlap in reflectance curves and colors plotted in the avian color space



Results

- No significant difference found in chest hue, chroma, or brightness between RCFS and BP (t-test: all $p > 0.05$)
- No significant difference found in back hue or brightness between RCFS and BP (t-test: both $p > 0.05$).
- Slight, but significant difference in chroma (t-test: $p < 0.001$)



Conclusions

1

There was little to no variation in male plumage color between rural and urban populations.

2

Food availability and carotenoid intake may be similar at these sites.

3

There was a slight difference in back chroma, which warrants further investigation.



Future Work

Increase	Increase sample sizes
Measure	Directly measure food availability (vegetation census, behavioral observations)
Test	Test for relationships between age, body size/shape and plumage color
Conduct	Conduct photo analyses of other potential color signals, including females (<i>Figure 6</i>)

Future Work

- **Figure 6.** Female Northern Cardinal plumage color photo analysis





References

Giraudeau, M.,
Toomey, M. B., Hutton,
P., & Mcgraw, K. J.
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Jones, T. M.,
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333.