



Identifying island-mainland bee populations with wings

Charles N. Thrift¹ & Katja C. Seltmann²



UC SANTA BARBARA
Undergraduate Research
& Creative Activities

Cheadle Center for Biodiversity
and Ecological Restoration
UC Santa Barbara

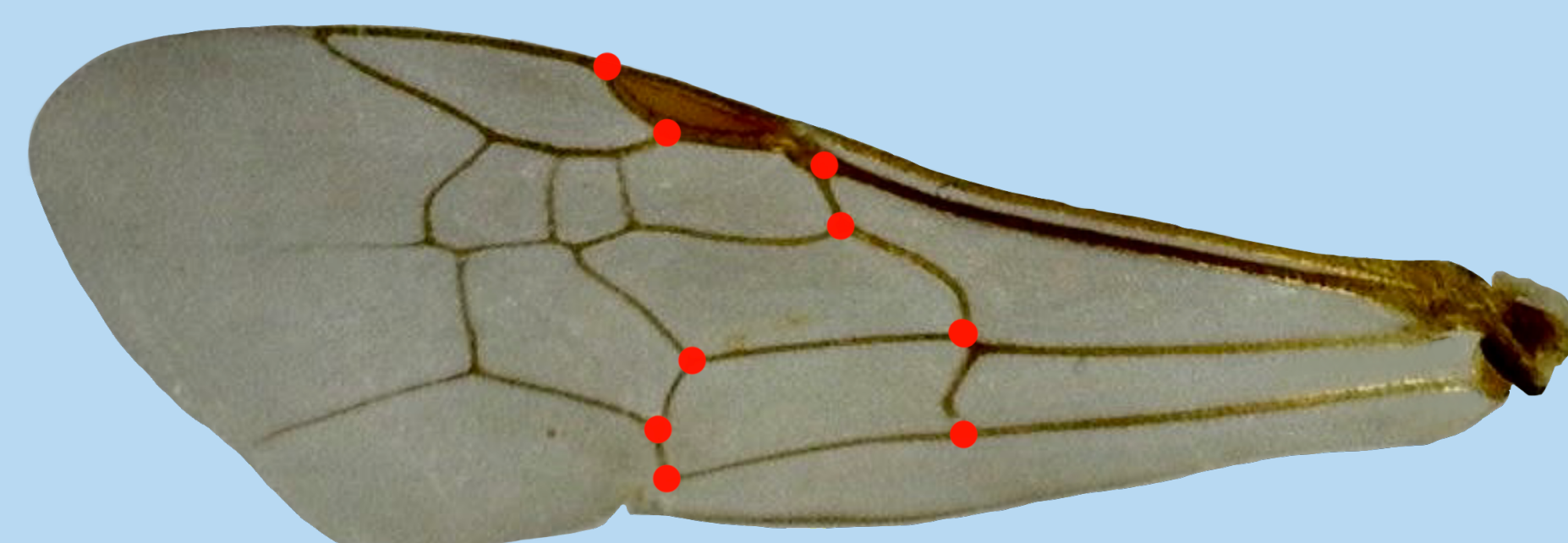
1. cnthrift@ucsb.edu
2. seltmann@ucsb.edu

1. Background

- *Halictus tripartitus* is a sweat bee living on both Santa Cruz Island and the Santa Barbara mainland
- These populations of the same species are divided by the ocean
- **Are these two populations phenotypically different?**



1 mm

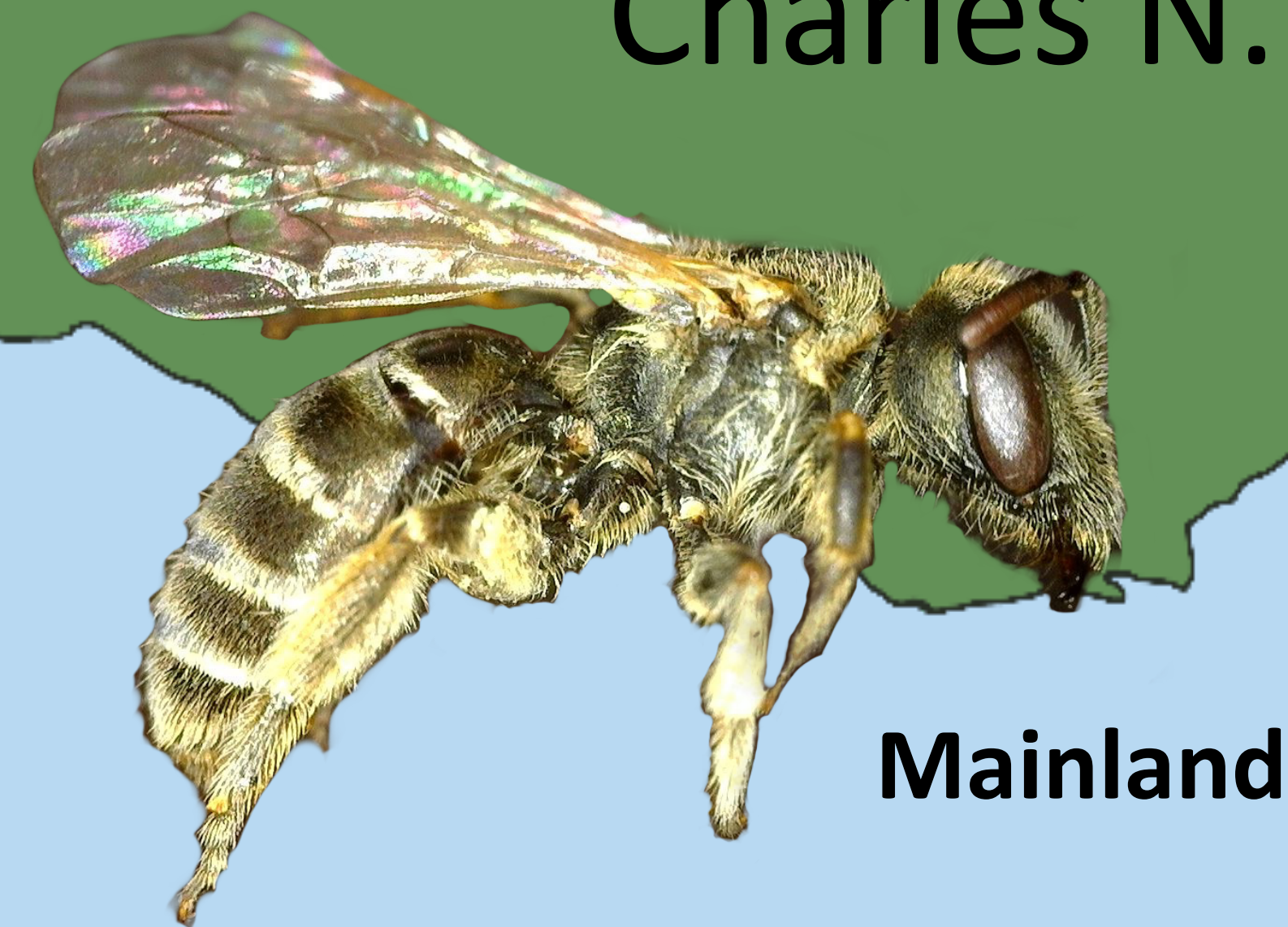


2. What we did

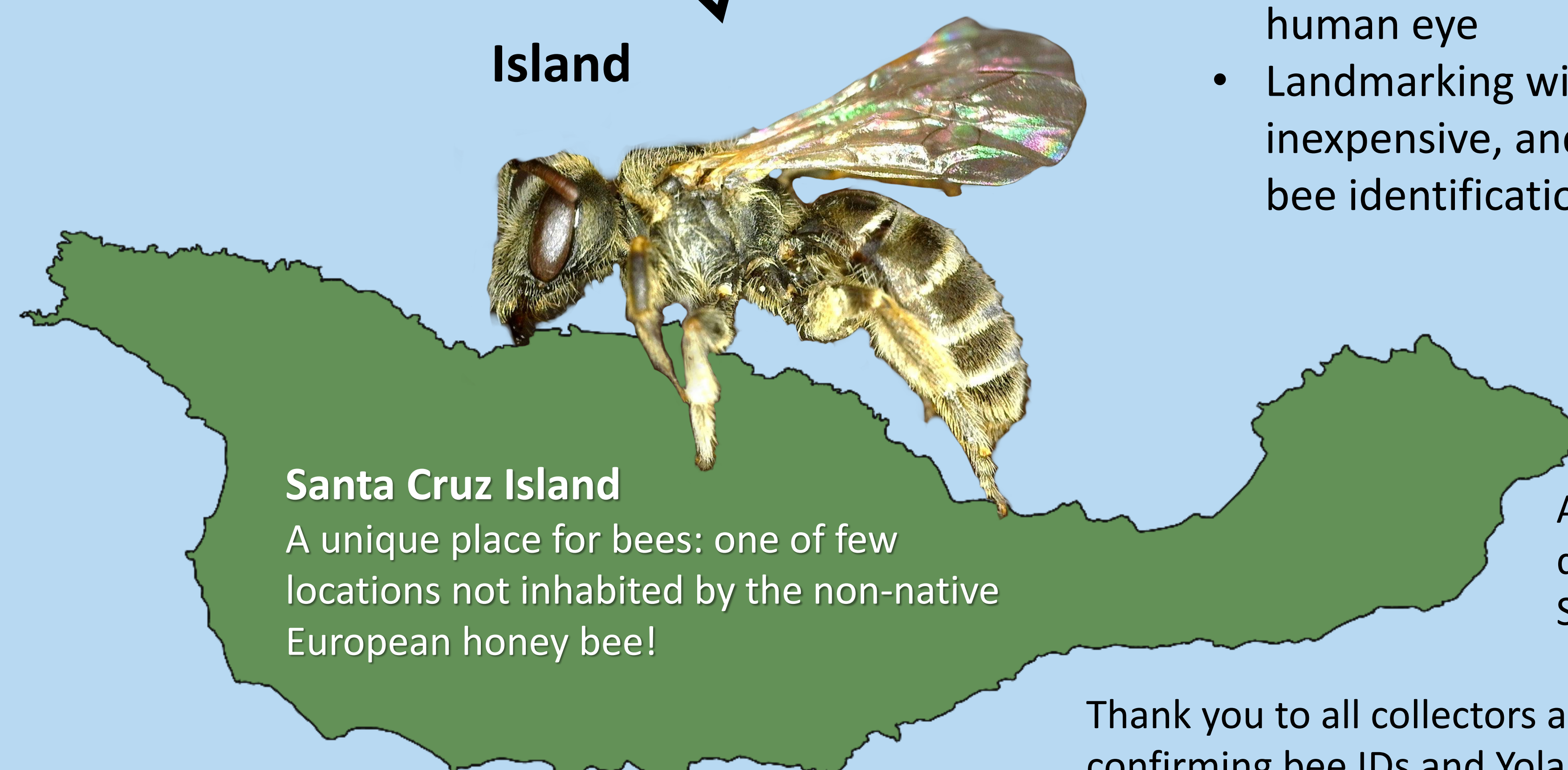
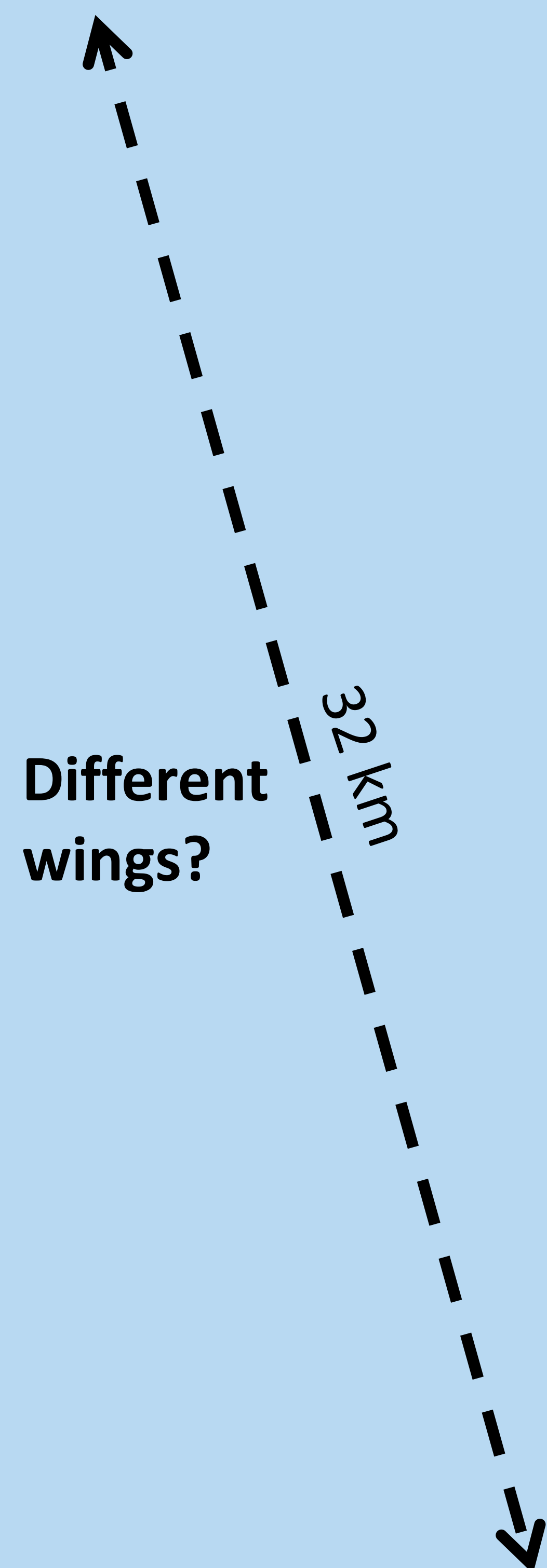
- Quantified differences between 260 specimens using wing venation alone
- Plotted 9 landmarks onto each wing with TPS software (see wing before and after above)
- Analyzed the 9 landmarks with geometric morphometrics in R version 4.1.0

2.1 Data Analysis

- Principal Component Analysis: compressed data, which was then visualized onto a biplot
- Cross validation test: assigned “unknown” specimens to mainland or island population
- ANOSIM test: measured the difference between the two groups



Mainland

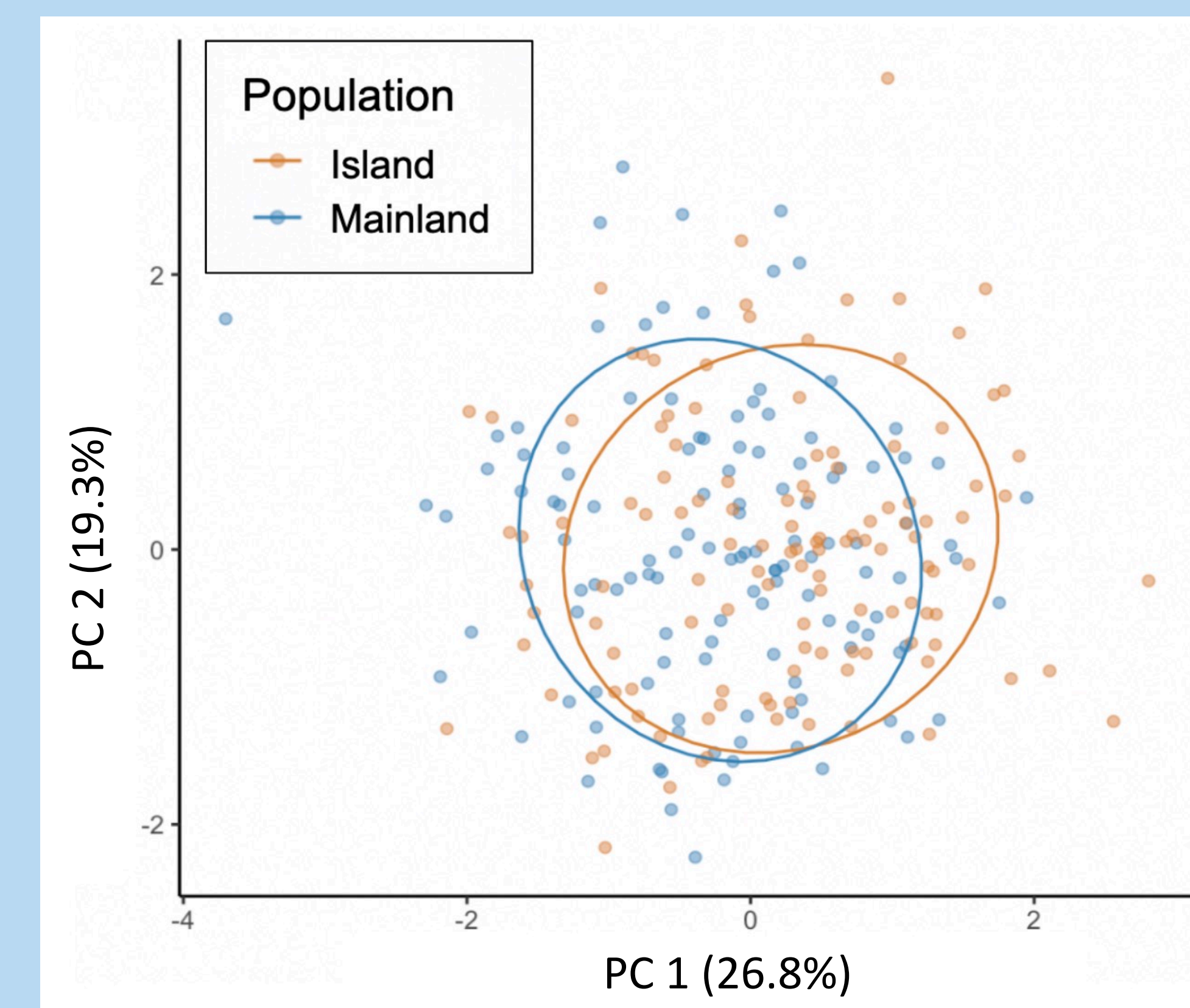


Island

Santa Cruz Island

A unique place for bees: one of few locations not inhabited by the non-native European honey bee!

3. What we found



Biplot of *Halictus tripartitus* specimens by location, with mainland wings in blue and island wings in tan. Some separation is visible: island bees trend towards right and mainland bees trend towards left. There is considerable overlap in the middle.

72.8%

Accuracy of cross validation test
Assigning an unknown bee to either mainland or island population

p < 0.001

R = 0.079

ANOSIM Test Results
Significant, but weak, difference between populations

4. Why it matters

- Analyzing wing venation in this way detects differences unseen by the human eye
- Landmarking wings can be an easy, inexpensive, and accurate form of bee identification
- Evidence of **founder effect** (a loss of genetic diversity when a population descends from a small number of ancestors) among bees on Santa Cruz Island
- Evidence that populations truly are separated

Thank you!

As the 2021 Tiffney Fellow, my CCS Summer Research Project was possible due to the generosity of donors to The Bruce H. and Robin G. Tiffney Summer Undergraduate Research Fund.

Thank you to all collectors and volunteers for the UCSBees Project, including Jaime Pawalek for confirming bee IDs and Yolanda Diao for landmarking wings. Thank you to Claudia Tyler, Michelle Lee, and Caroline Owens for mentorship. Thank you to the CCBER lab group for support. Additional thanks to the Coastal Fund, UCSB Undergraduate Research and Creative Activities grant, and CCS Travel Fund.