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## Posters

### Title

Variation between Santa Cruz Island and mainland bee specimens

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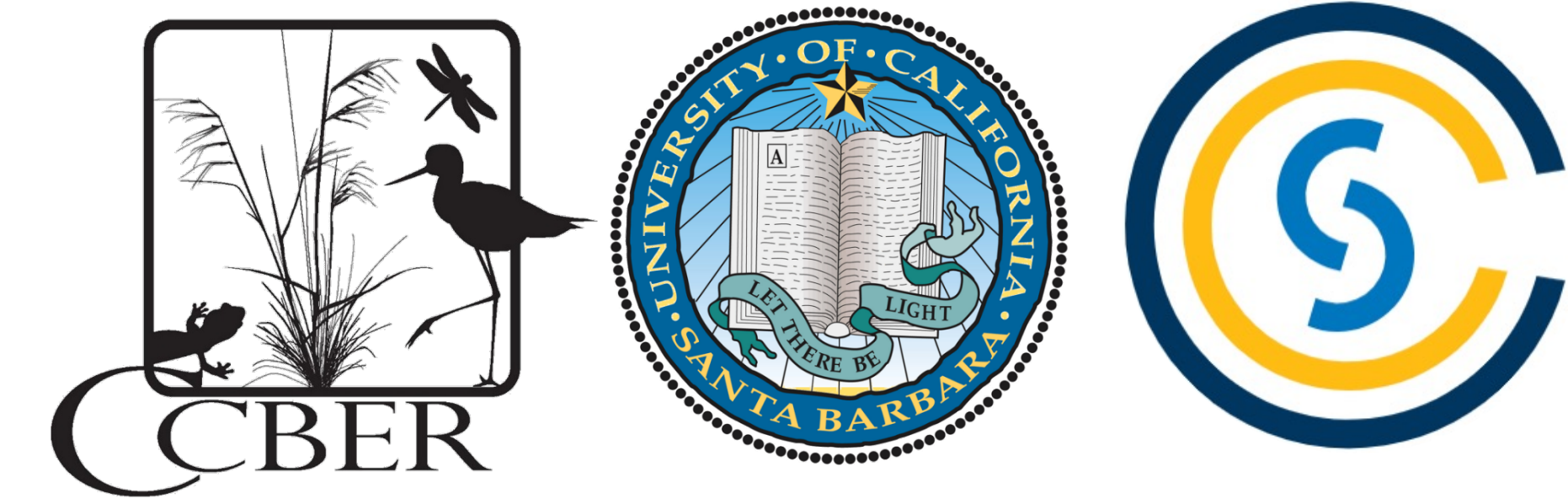
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# Variation between Santa Cruz Island and mainland bee specimens

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## Introduction

- The UCSBees<sup>1</sup> Project has been collecting bees monthly since December, 2018
- Collection sites span Santa Barbara and Ventura counties, including UC Santa Barbara and Santa Cruz Island
- Island/mainland populations of a single species can vary in phenotype

## Questions

- Does bee diversity vary by collecting location?
- Do wings vary in a single bee species (*Halictus tripartitus*) by island or mainland population?

## Methods

### Boxes 1 and 2

Bees are collected monthly via pan traps at all collection sites. Some bees avoid pan traps<sup>2</sup>, and thus supplemental bees are hand collected. Specimens are deposited as research vouchers in the UCSB Natural History Collections. Collected bees are then pinned, identified to lowest taxonomic level, and databased. Data is analyzed in R version 3.6.1.

### Box 3

Collected *Halictus tripartitus* (Halictidae) bee wings are removed, slide-mounted, and imaged with a microscope camera. Images are edited for clarity, then landmarked with the TPS software suite<sup>3</sup>.

With R package 'geomorph'<sup>4</sup>, landmark coordinates are aligned with a Generalized Procrustes Analysis. With R package 'vegan'<sup>5</sup>, an ANOSIM tests for difference between the island and mainland populations, and a biplot visualizes the output of a Principal Component Analysis.

## 1. Collecting Bees

### Pan Trapping

- Bowls of soapy water
- Place in morning, pick up in evening
- Bees fly into them during the day

### Hand Collecting

- Collect bees directly with a net



## 2. Collection Sites



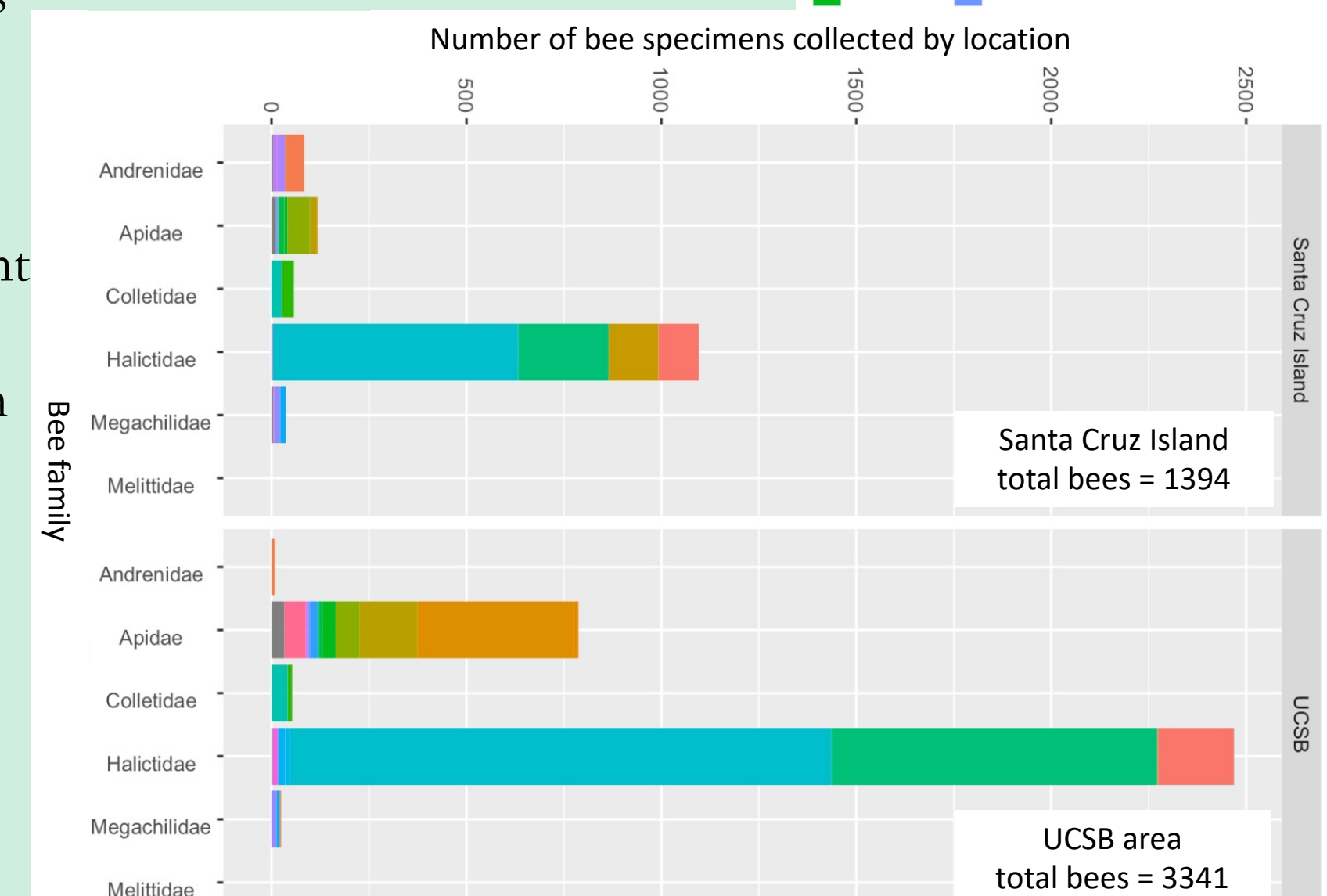
- North Campus Open Space
- Coal Oil Point Reserve
- UCSB Lagoon
- UCSB North Parcel
- CCBER Greenhouse
- Carpinteria Salt Marsh Reserve
- Santa Clara River
- Santa Cruz Island



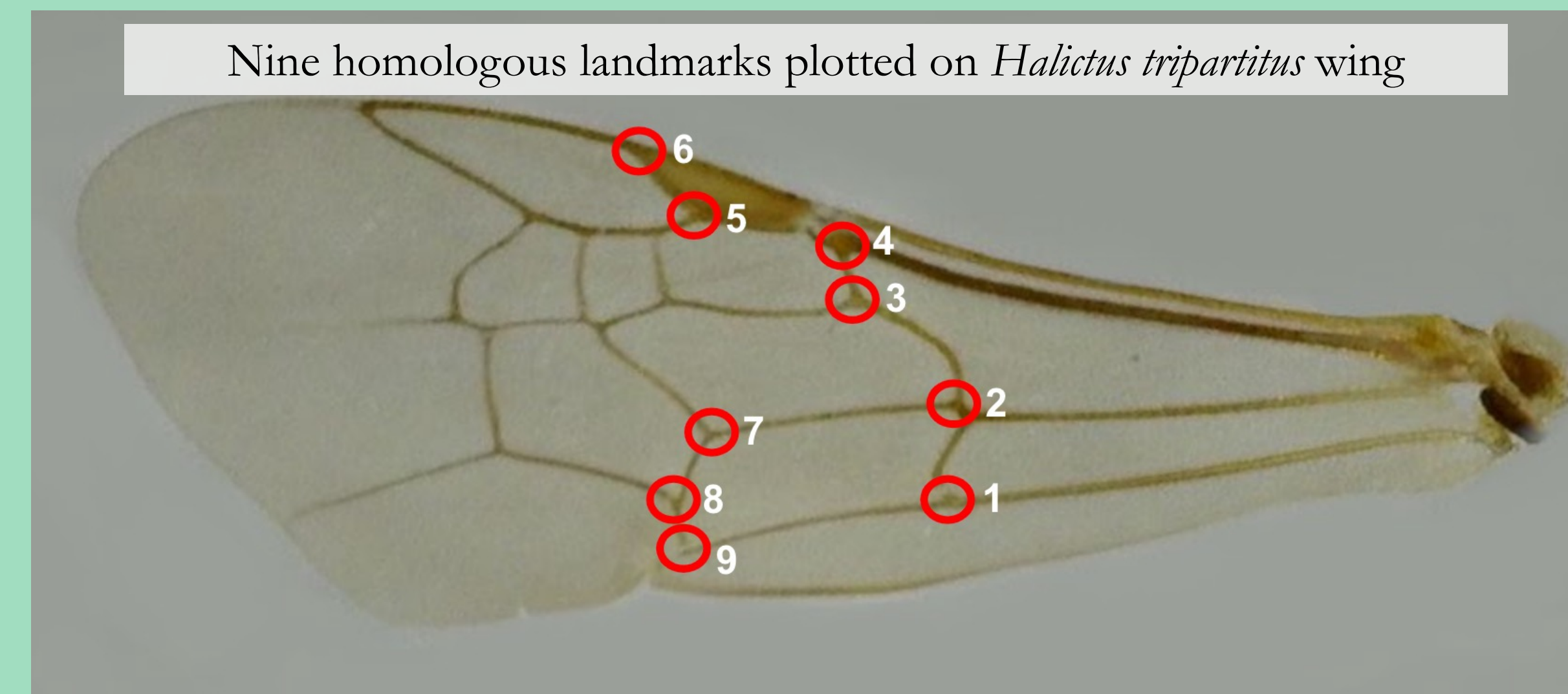
genus	genus	genus
Agrotopon	Eucera	Osmia
Ancistrus	Halictus	Paragrapta
Anthidium	Hesperapis	Panurgus
Anthophora	Hoplitis	Pipronapis
Apis	Hyaleus	Perrilla
Ashmeadella	Hyaleus (Protopis)	Protosmia
Augochlorini	Lasiglossum	Sphocodes
Bombus	Lasiglossum (Dialictus)	Stelis
Callisitta	Lasiglossum (Elysius)	Tetraloniella
Centris	Lasiglossum (Lasiglossum)	Trachusa
Ceratina	Megachile	Xeralictus
Chalostoma	Megachile	Xeromelecta
Coelioxys	Melicta	Xylocopa
Cilicera	Melissodes	NA
Dialictus	Nomada	

### Zooming in: UCSB area vs. Santa Cruz Island

- UCSB has more specimens due to greater collecting effort
- Halictidae, the sweat bee family, is the most abundant in both collections
- Santa Cruz Island has been free of the non-native European honey bee (*Apis mellifera*) since the early 2000s
- An updated bee species checklist of Santa Cruz Island is in progress



## 3. Quantifying Island vs. Mainland Population Variation

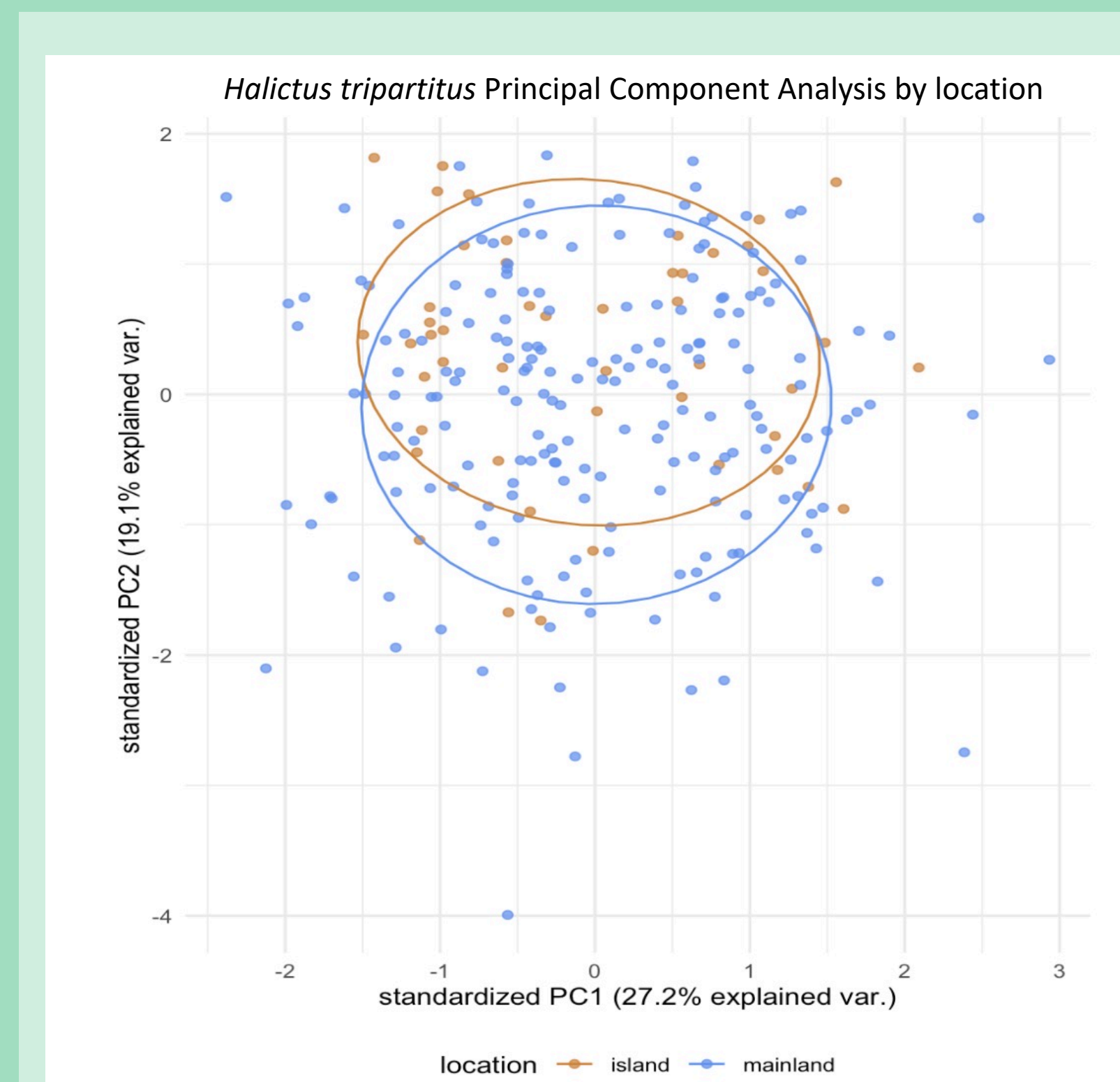


```
Call:
anosim(x = dataforanosim_tri_location
9999, distance = "bray")
Dissimilarity: bray

ANOSIM statistic R: 0.0774
Significance: 0.033

Permutation: free
Number of permutations: 9999
```

ANOSIM results show a significant difference between island and mainland populations ( $p < 0.05$ ), but with a low R statistic, showing a weak difference.



Biplot showing *Halictus tripartitus* specimens by location, with mainland wings in blue and island wings in tan. There is considerable overlap but some difference visible between the two populations.

## Results and Future Directions

UCSBees Project bee collection efforts have yielded over 4000 specimens. Many collection events have continued safely into the COVID-19 pandemic, including valuable hand collecting on Santa Cruz Island. To date, the UCSBees Project has collected 126 species from 32 genera across 6 families in mainland Santa Barbara, and 140 species from 35 genera across 5 families on Santa Cruz Island. An updated bee species checklist of Santa Cruz Island is in progress for eventual publication.

Additional specimens are being added to the wing landmarking project. Population level variation in wing venation between Santa Cruz Island and mainland specimens is supported by current data, but more bees and more tests (including K-means clustering and NMDS plots) are needed.

## Questions?



Scan this code or type this link:  
<https://bit.ly/3hVABHn>

## Acknowledgements

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## Literature

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