

# Results

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# Results

## Univariate analysis: trait ~ group + year

### Model 1: Mainland/Island

#### Mericarp

We found that mericarps in island populations are larger but less spiny than mericarps in mainland populations. Mericarps on islands are 7% longer, 5% wider, 12% deeper than mainland populations ( $X^2 = 14.10$ ,  $p = <0.001$ ;  $X^2 = 12.43$ ,  $p = <0.001$ ;  $X^2 = 52.33$ ,  $p = <0.001$ ). Their upper spines are 6% more separated between them on island populations than on mainland ( $X^2 = 5.85$ ,  $p = 0.015$ ). However, lower spines are more common on mainland populations than on island populations ( $X^2 = 76.74$ ,  $p = 0.001$ ). The effect of year was significant on all traits ( $X^2 = 8.61$ ,  $p = <0.001$ ;  $X^2 = 8.16$ ,  $p = <0.001$ ;  $X^2 = 19.54$ ,  $p = <0.001$ ;  $X^2 = 0.091$ ,  $p = <0.001$ ).

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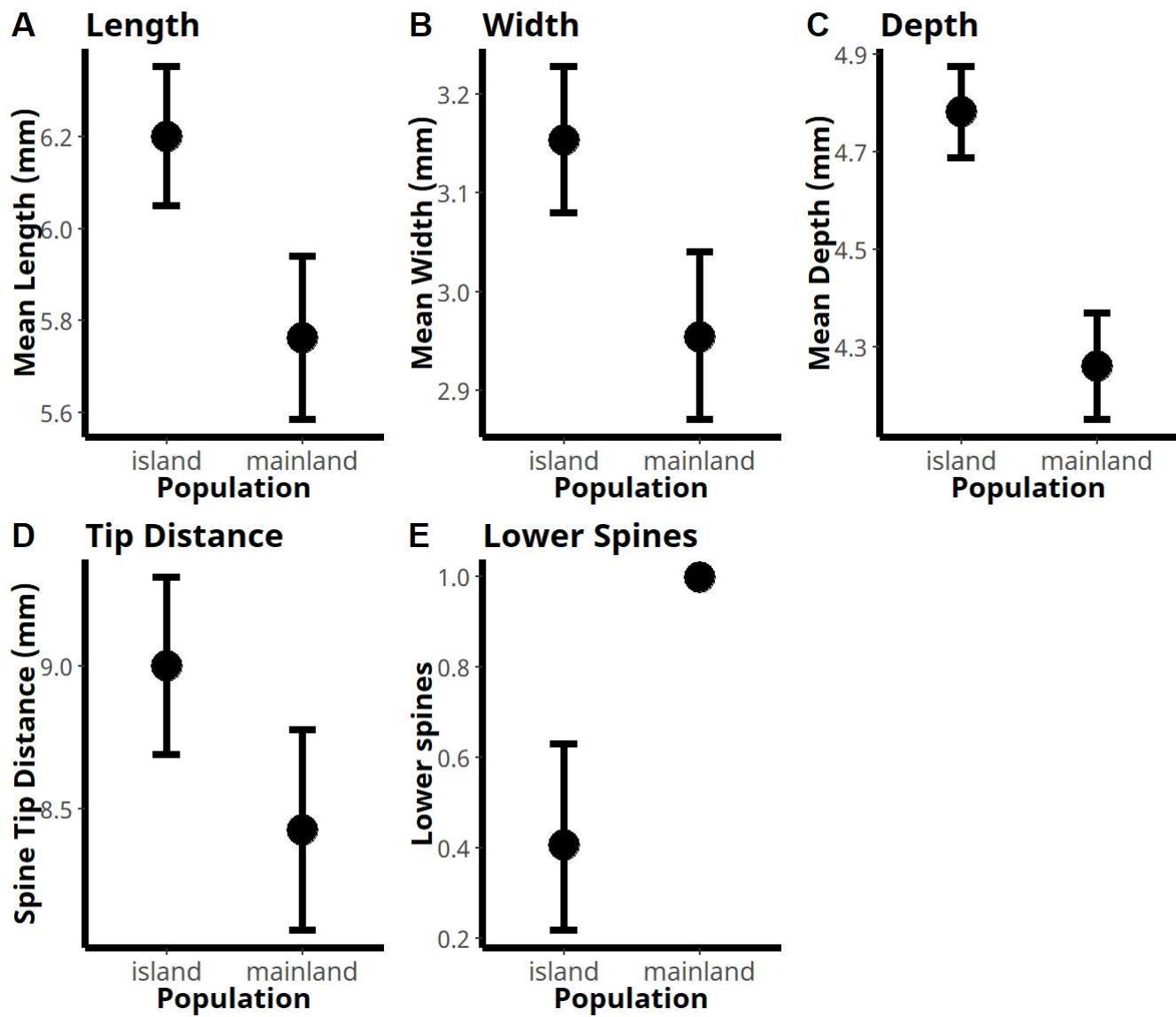
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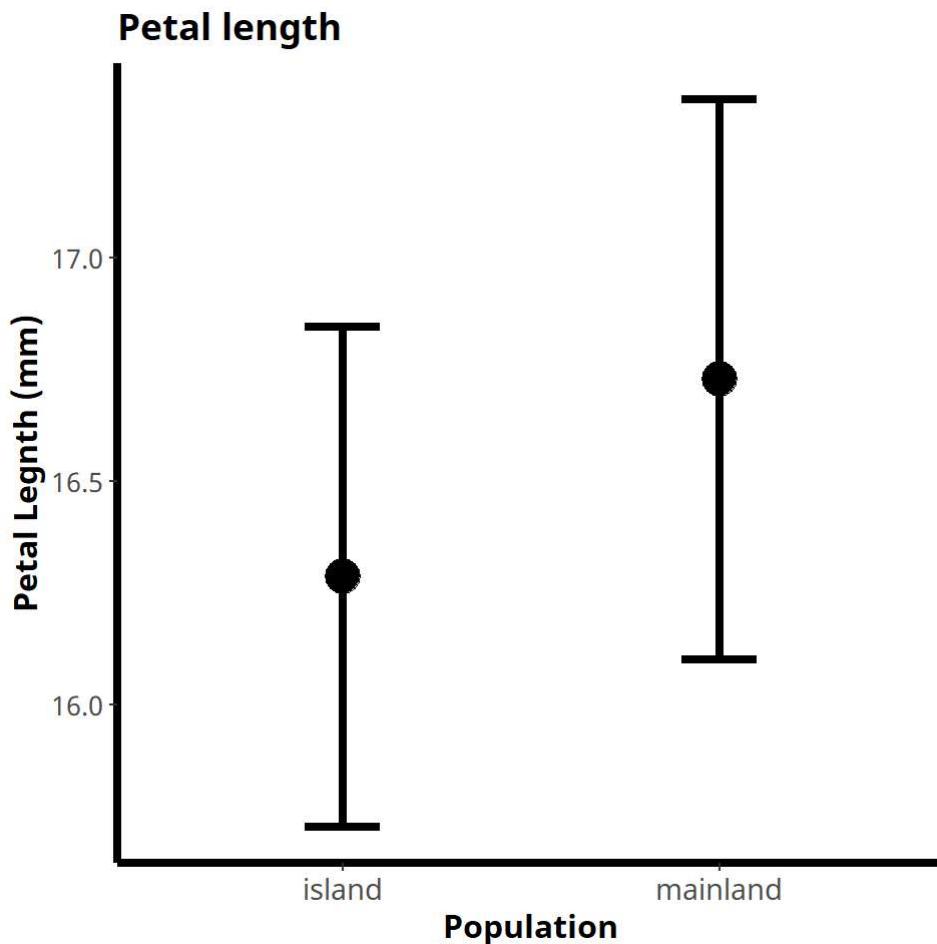
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Estimated means of mericarp traits between island and mainland populations.

## Flower

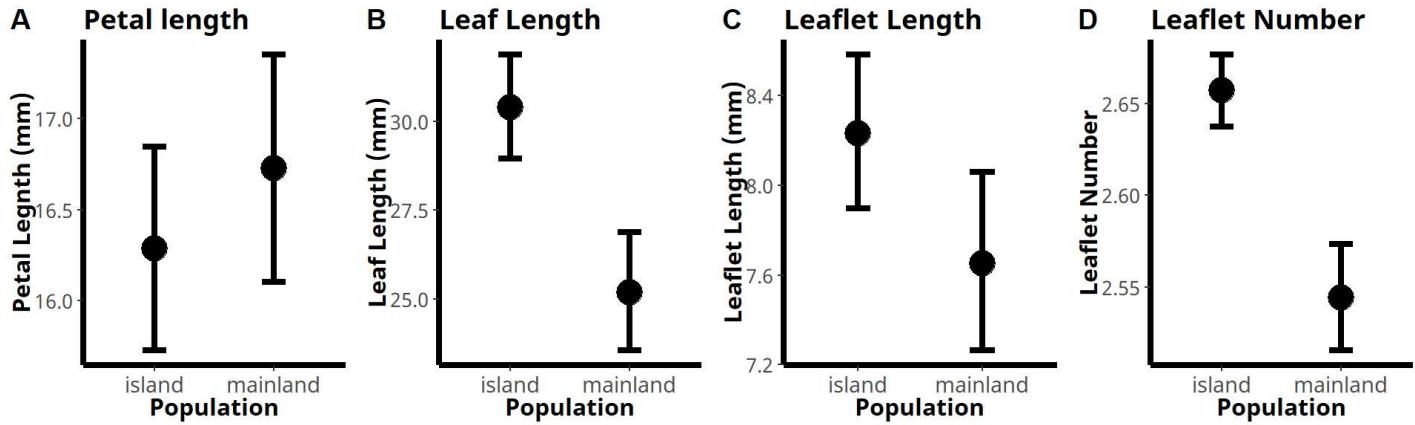
We found no significant differences between mainland and island populations on petal length ( $p = 0.299$ ). However, there was a significant result for year ( $X^2 = 15.89$ ,  $p = <0.001$ ) between mainland and island populations.



Estimated means of petal length between island and mainland populations.

## Leaf

We found that leaves in island populations are longer, and have more leaflets than leaves in mainland populations. Leaves on islands are 20% longer, their leaflets are 7.5% larger and they have approximately 11% more leaflets than mainland populations ( $X^2 = 21.86, p = <0.001$ ;  $X^2 = 4.86, p = 0.027$ ;  $X^2 = 39.61, p = <0.001$ ). The effects of year were also significant for all three traits. ( $X^2 = 6.50 p = <0.001$ ;  $X^2 = 4.86, p = <0.001$ ).

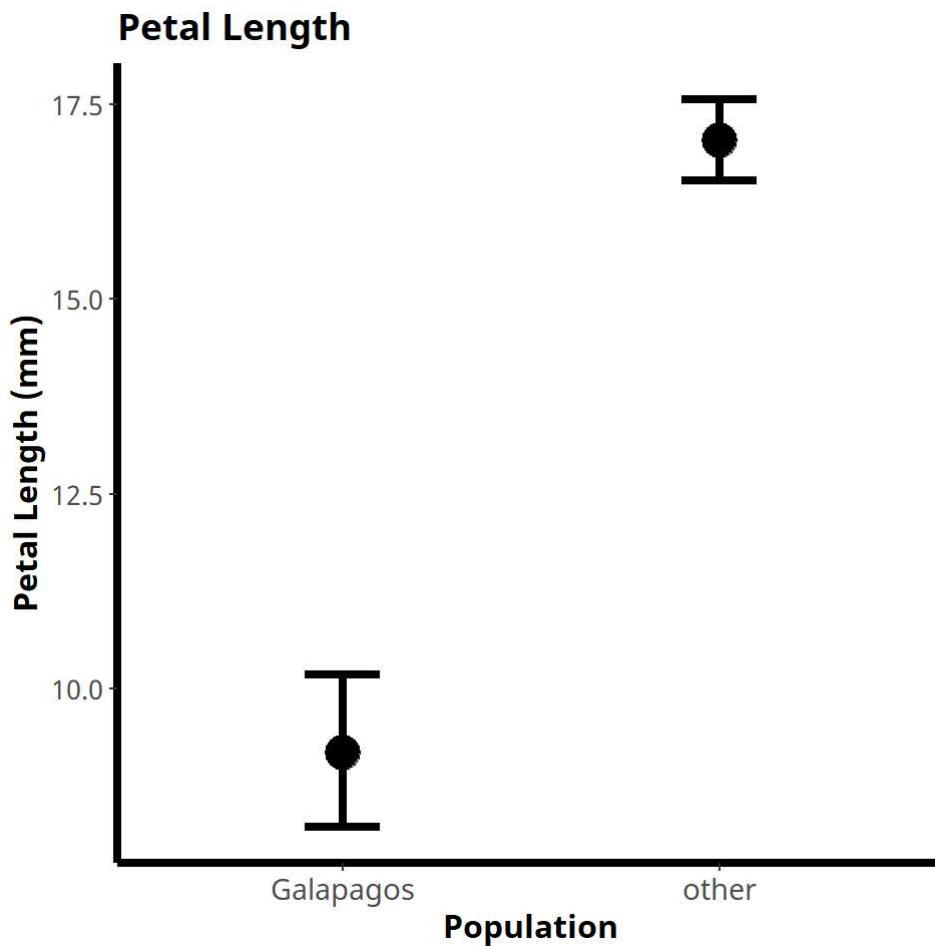


Estimated means of leaf traits between island and mainland populations.

# Model 2: Galapagos/Other Islands

## Flower

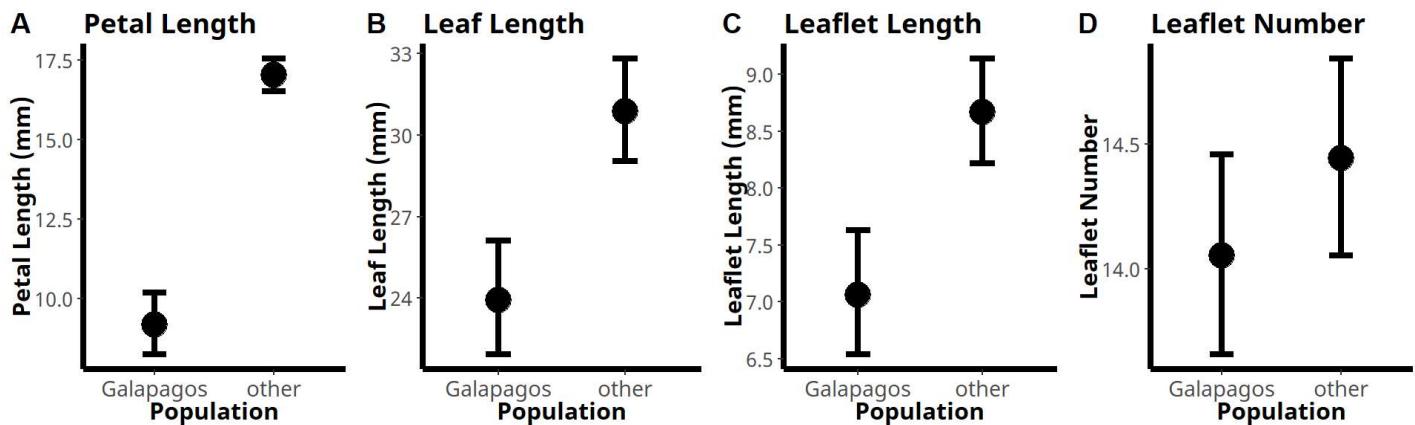
We found that *Tribulus* flowers in the Galapagos are smaller than flowers of populations from other islands. Petal length of *Tribulus* on the Galapagos is 46% shorter than petals from other islands ( $X^2 = 156.39$ ,  $p = <0.001$ ). The effect of year has also significant between the two groups ( $X^2 = 10.13$ ,  $p = 0.0014$ )



Estimated means of petal length between the Galapagos and other islands populations.

## Leaf

We found that leaf length of population from the Galapagos are smaller than populations from other islands. Leaves are 22% shorter and leaflets are 18.5% shorter compared to other island populations ( $X^2 = 20.39$ ,  $p = <0.001$ ;  $X^2 = 17.20$ ,  $p = <0.001$ ). However there were not significant differences for the number of leaflets between Galapagos and other island populations ( $p = 0.17$ ). The effect of year was not significant for both leaf and leaflet length ( $p = 0.44$ ,  $p = 0.347$ ).

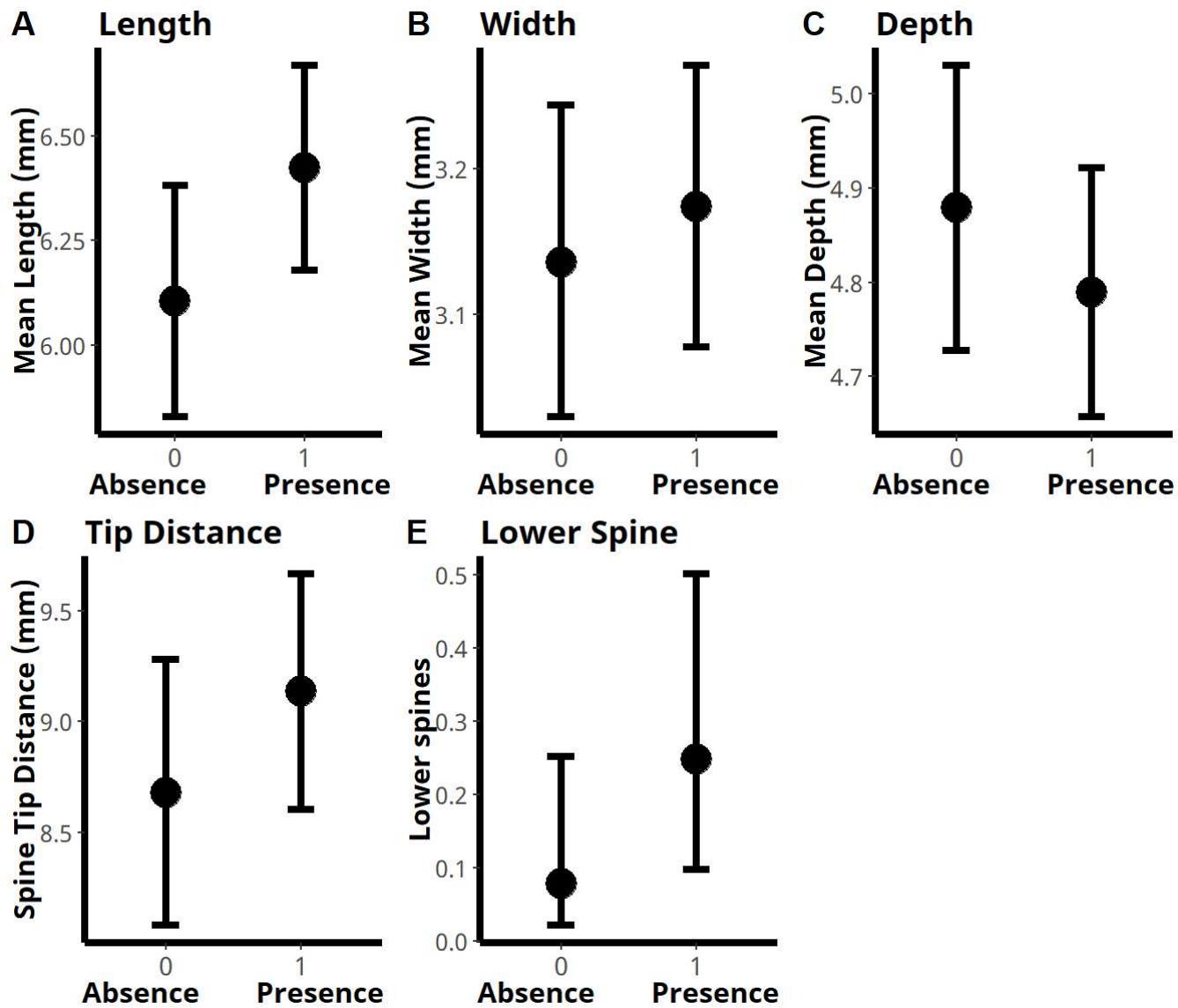


Estimated means of leaf traits between the Galapagos and other island populations.

# Model 3: Finch Beak

## Mericarp

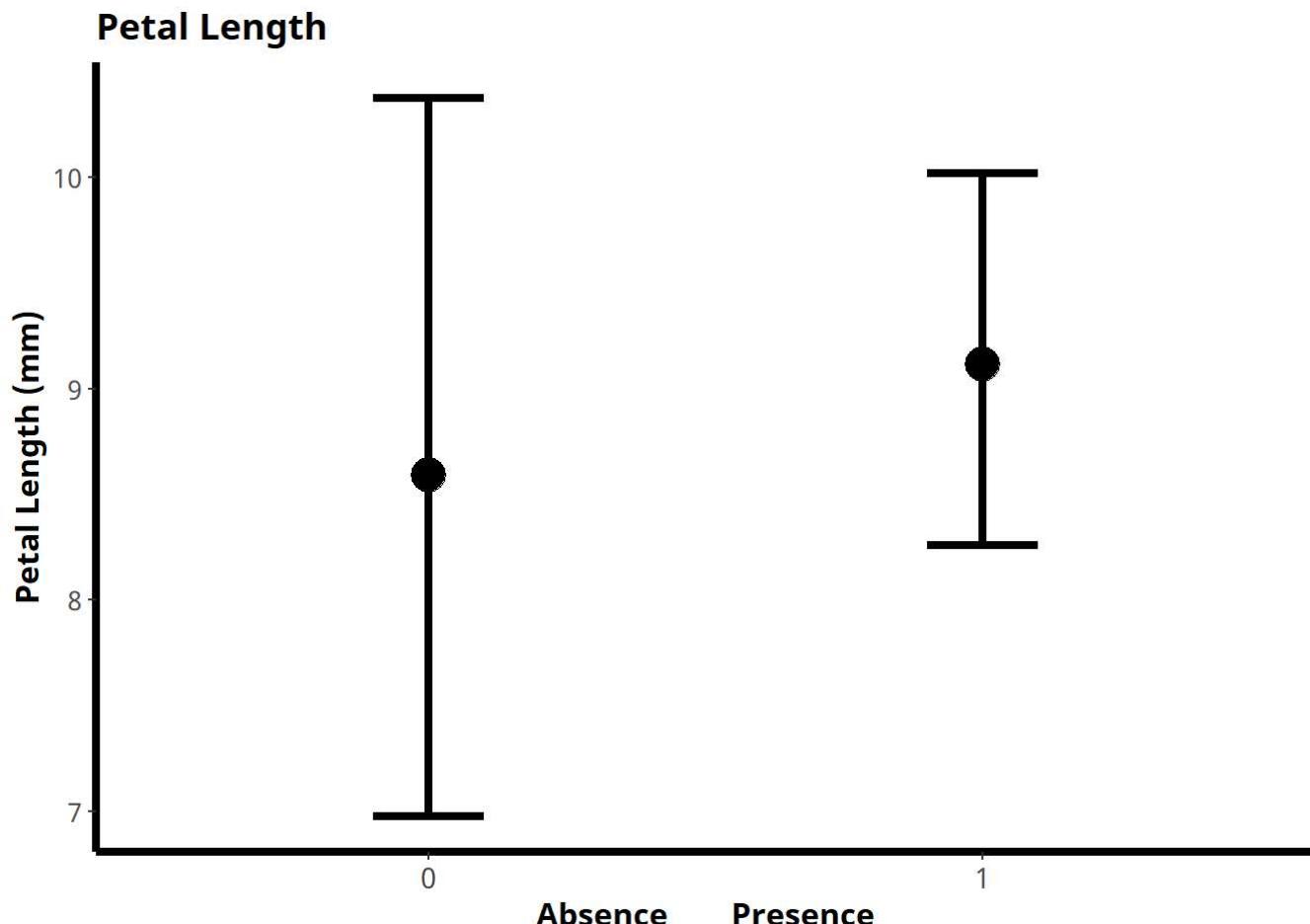
The presence of large beak finch species, *Geospiza magnirostris* and *Geospiza cornirostris* was significantly associated with the presence of lower spines ( $X^2 = 125.47$ ,  $p = <0.001$ ). However, mericarp length, width, depth and spine tip distance were not significant ( $p = 0.08$ ,  $p = 0.58$ ,  $p = 0.37$ ,  $p = 0.25$ ). The effect of year was significant for lower spines ( $X^2 = 17.414$ ,  $p = <0.001$ ) but not significant for the other traits ( $p = 0.69$ ;  $p = 0.32$ ;  $p = 0.11$ ;  $p = 0.94$ ).



Estimated means of mericarp traits between finch beak communities. 1 = Presence of large finch species, *Geospiza magnirostris* and *Geospiza cornirostris*. 0 = Absence of large finch species.

## Flower

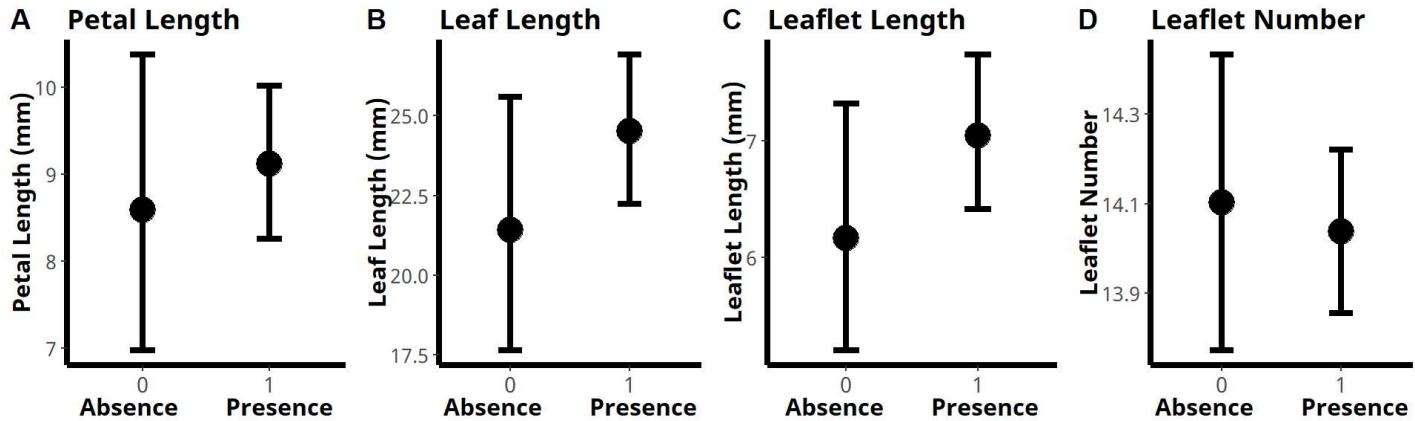
There was no statistically significant difference for petal length and year between islands with large beak finches present and absent ( $p = 0.55$ ;  $p = 0.009$ )



Estimated means of petal length between finch beak communities. 1 = Presence of large finch species, *Geospiza magnirostris* and *Geospiza cornirostris*. 0 = Absence of large finch species.

## Leaf

There is not statistically significant difference between islands with large finch beak species present and absent for all three leaf traits, leaf length, leaflet length and leaf number ( $p = 0.17$ ;  $p = 0.15$ ;  $p = 0.73$ ). However there was a significant effect of year for leaf length and leaflet number ( $X^2 = 12.85$ ,  $p = <0.001$ ;  $X^2 = 11.98$ ,  $p = <0.001$ ). The effect of year for leaflet length was barely significant ( $X^2 = 3.7091$ ,  $p = <0.0542$ ).



Estimated means of leaf traits between finch beak communities. 1 = Presence of large finch species, *Geospiza magnirostris* and *Geospiza cornirostris*. 0 = Absence of large finch species.

# Univariate ANOVA table summary

Model	Dataset	Trait	Chisq	P
Model 1: Mainland/Island	Mericarp	Length	14.101	0.000
		Year Length	8.619	0.003
		Width	12.438	0.000
		Year Width	8.160	0.004
		Depth	52.334	0.000
		Year Depth	19.542	0.000
		Tip Distance	6.090	0.014
		Year Tip Distance	0.028	0.868
		Lower Spines	76.744	0.000
		Petal Length	1.077	0.299
Model 1: Mainland/Island	Flower	Year Petal Length	15.899	0.000
		Leaf Length	21.862	0.000
		Year Leaf Length	6.502	0.011
		Leaflet Length	4.865	0.027
		Year Leaflet Length	8.693	0.003
Model 2: Galapagos/Other Islands	Leaf	Leaf Number	39.619	0.000
		Petal Length	156.398	0.000
		Year Petal Length	10.133	0.001
		Leaf Length	20.397	0.000
		Year Leaf Length	0.573	0.449
Model 2: Galapagos/Other Islands	Flower	Leaflet Length	17.206	0.000
		Year Leaflet Length	0.882	0.348
		Leaf Number	1.864	0.172
		Length	3.018	0.082
		Year Length	0.157	0.692
Model 3: Finch Beak Presence/Absence	Mericarp			

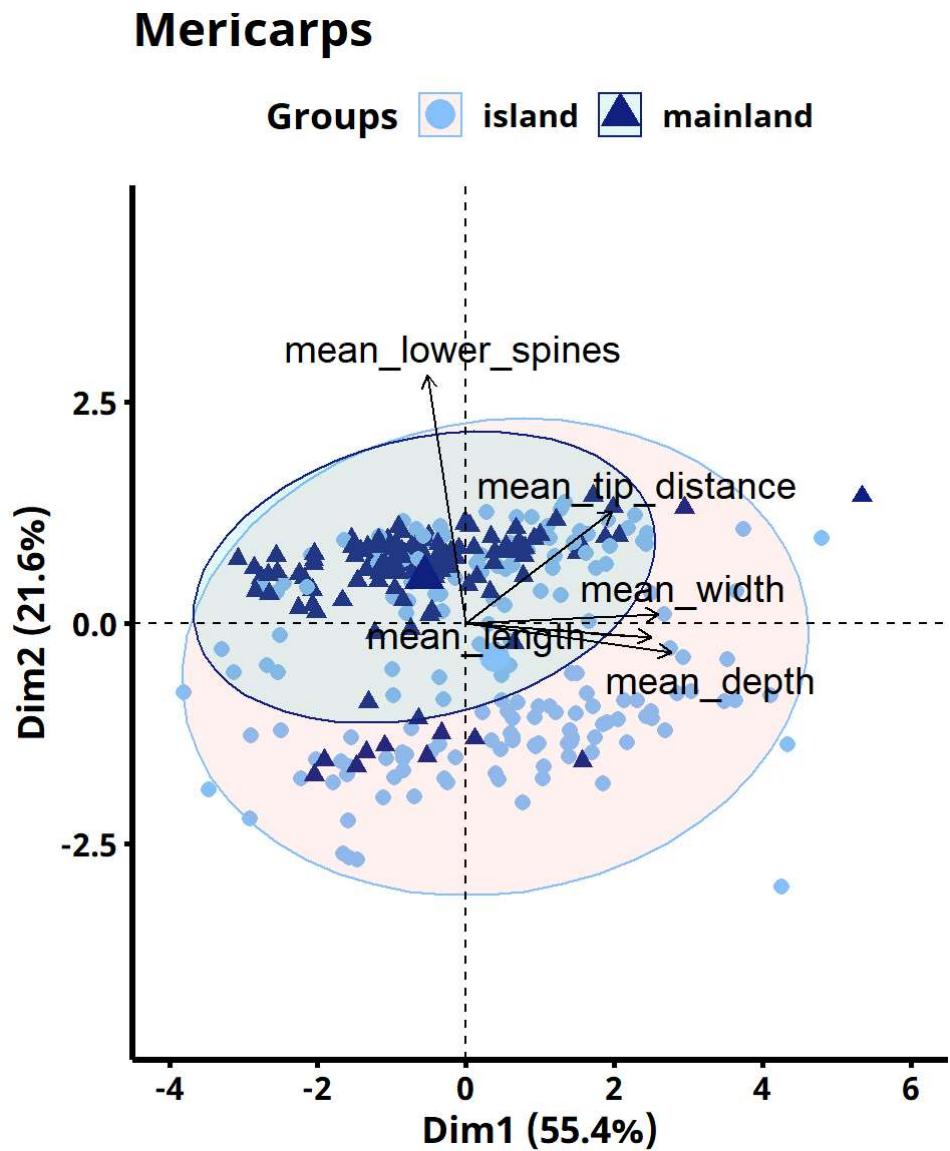
Model	Dataset	Trait	Chisq	P
		Width	0.277	0.599
		Year Width	0.963	0.326
		Depth	0.795	0.373
		Year Depth	2.468	0.116
		Tip Distance	1.313	0.252
		Year Tip Distance	0.005	0.944
		Lower Spines	2.487	0.115
Model 3: Finch Beak Presence/Absence	Flower	Petal Length	0.346	0.556
		Year Petal Length	6.720	0.010
Model 3: Finch Beak: Presence/Absence	Leaf	Leaf Length	1.879	0.170
		Year Leaf Length	12.856	0.000
		Leaflet Length	2.028	0.154
		Year Leaflet Length	3.709	0.054
		Leaf Number	0.113	0.737
		Year Leaf Number	11.986	0.001

# Multivariate analysis: trait ~ group + condition(year)

## Model 1: Mainland/Island

### Mericarp

We observed that mericarps from islands and mainlands populations differed in size and number of spines. Mericarps on islands are larger than mericarps on the mainland with depth being the variable that contributes more to the variation of mericarp size. For spines, the presence of lower spines was more related to mainland populations than to island populations and was the variable that contribute to most of the variation between the two groups.



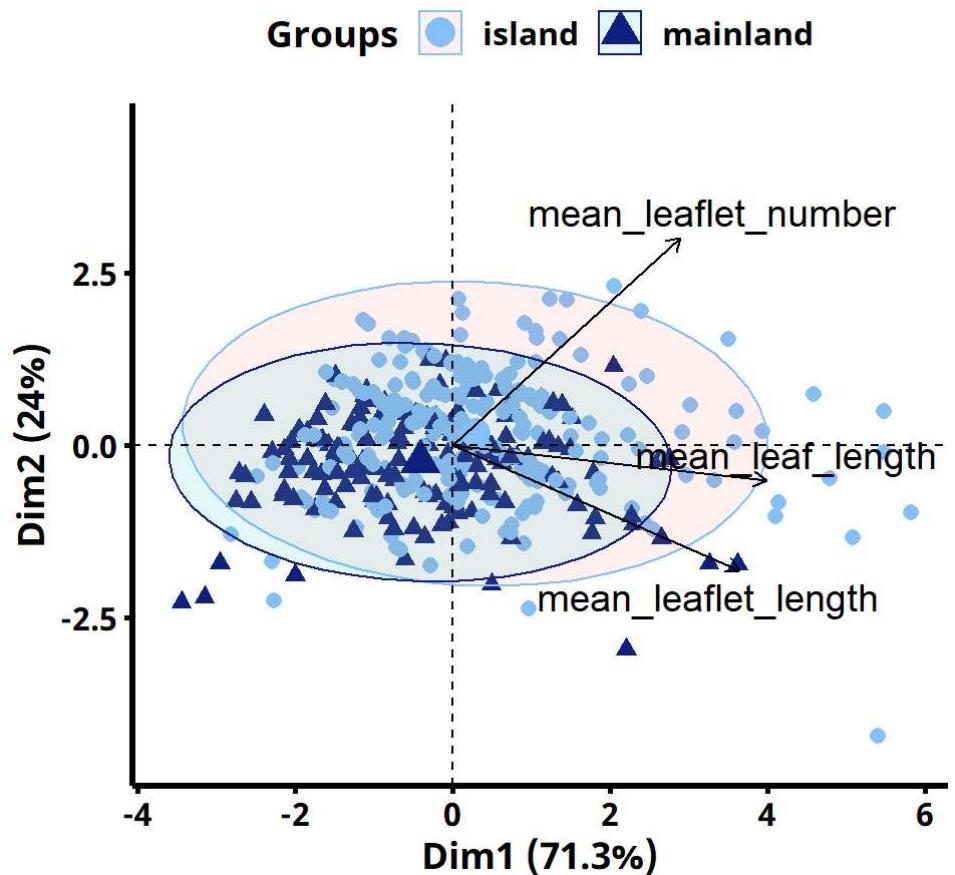
	Df	Variance	F	Pr(>F)
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mainland_island	1	0.2606884	255.7926	0.001
Residual	4626	4.7145399	NA	NA

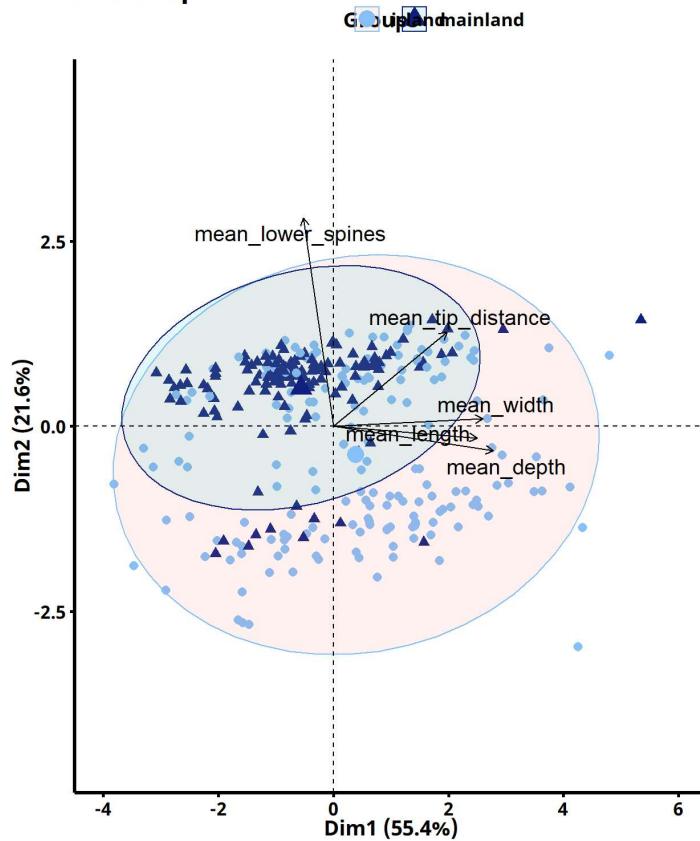
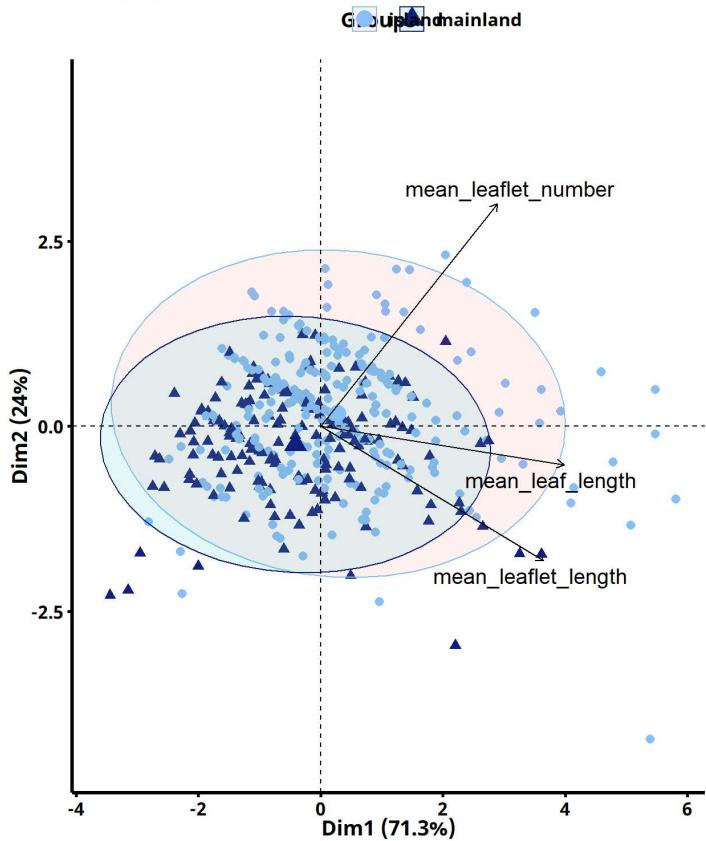
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## Leaf

Leaves are larger on islands than in the mainland. This size difference also contributes to the number of leaflets present, with island populations having more. This trait is the main difference between the two groups.

### Leaves

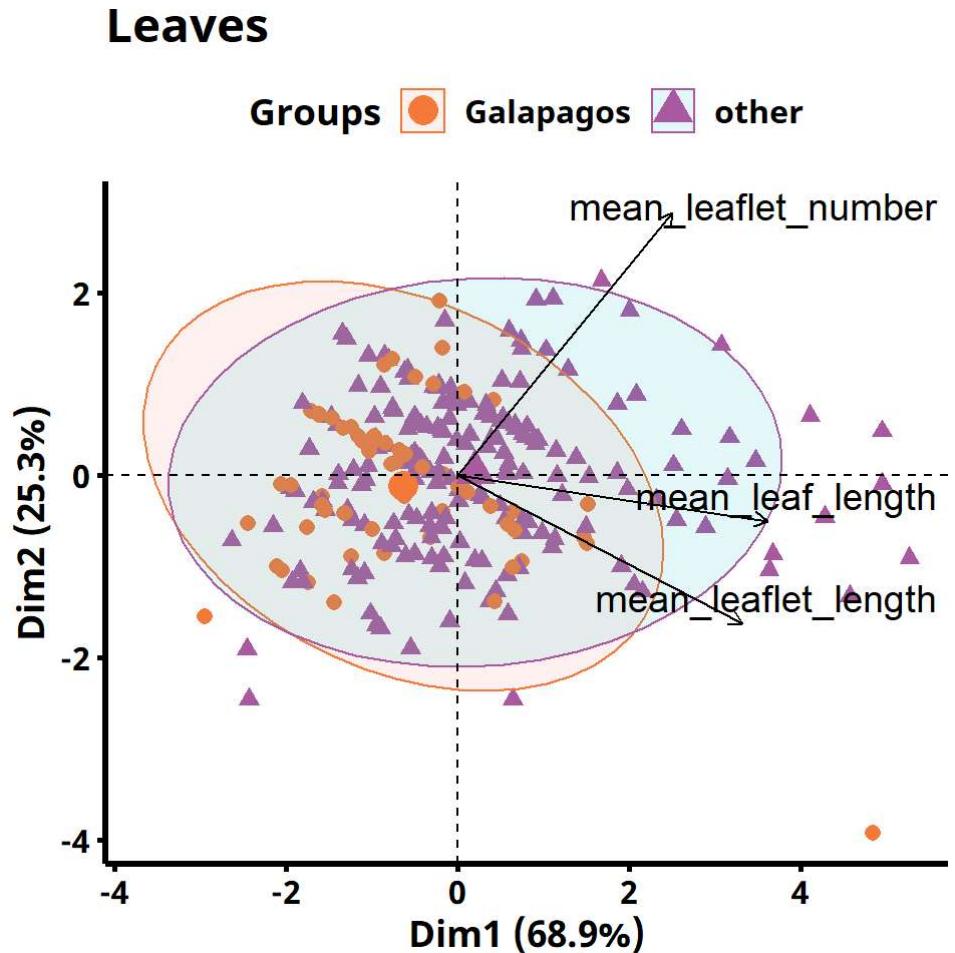


**A Mericarps****B Leaves**

# Model 2: Galapagos/Other

## Leaf

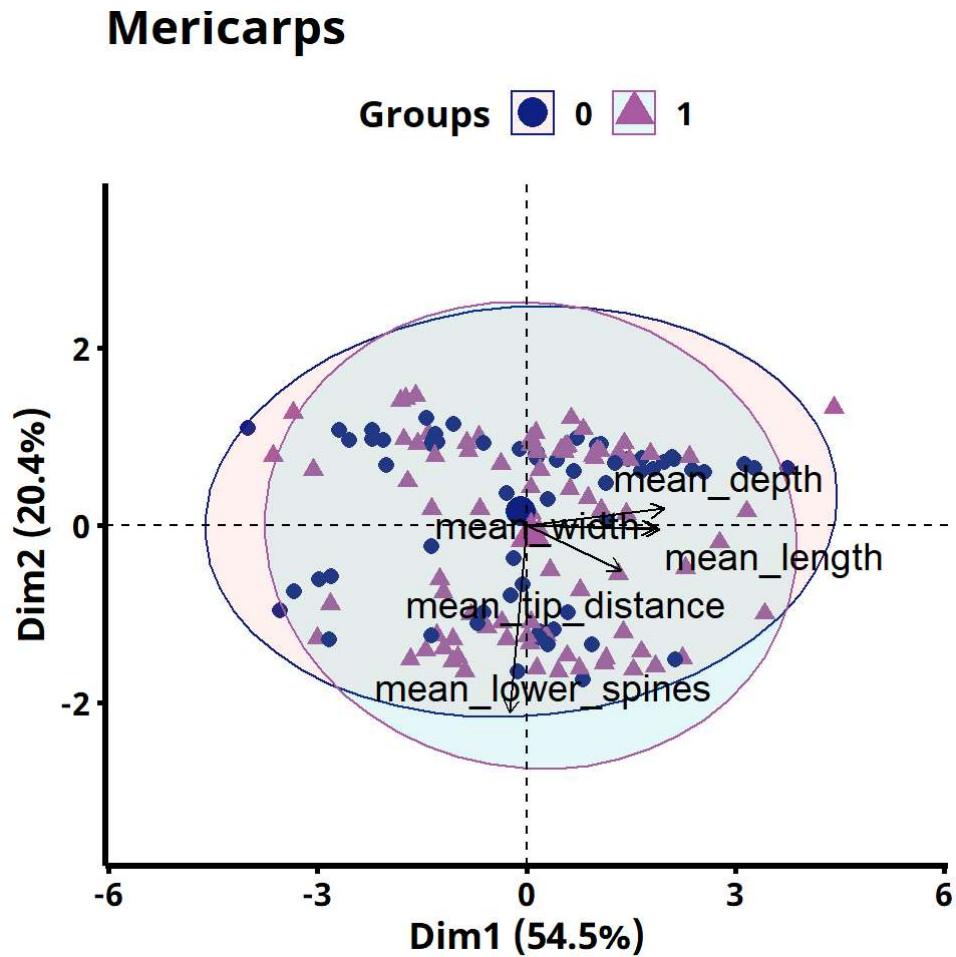
Leaves from the Galapagos Islands are smaller than other island populations. *Tribulus* leaves in the Galapagos are smaller and have less leaflets than other Islands.



# Model 3: Finch Beak

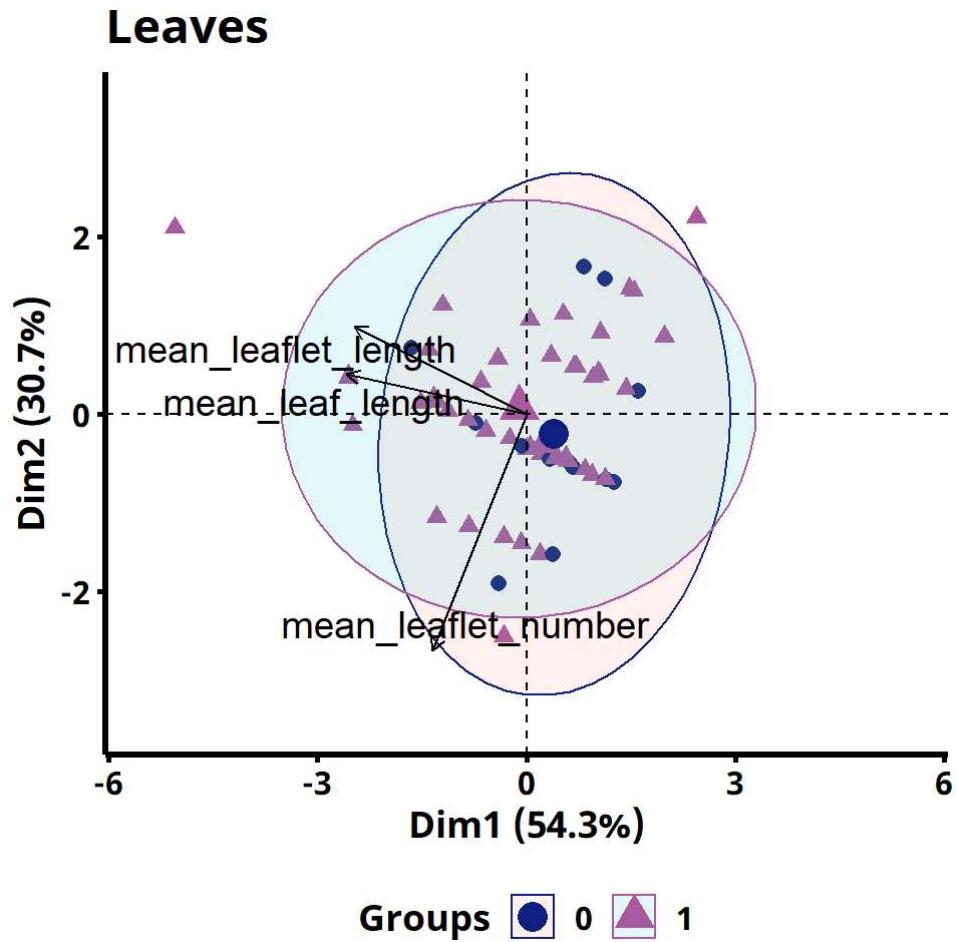
## Mericarp

The presence of lower spines is by far the trait that contributes most to the differences between groups. This means that the presence of lower spines are associated with large beak finches. Mericarp size contributes 54% of the variation but is not particularly associated with any group.



## Leaf

Leaf size and leaflet number is not particularly associated with any group of finches.



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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x75
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x70
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x73
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## metrics unknown for character 0x4d
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30
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```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31

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## width unknown for character 0x31

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31
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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x30

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
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## width unknown for character 0x30
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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31

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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31
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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x47
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```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x72
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```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x6f
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```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x75
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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x70
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```
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## width unknown for character 0x73
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## metrics unknown for character 0x4d
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## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x47
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## width unknown for character 0x72
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## width unknown for character 0x6f
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```

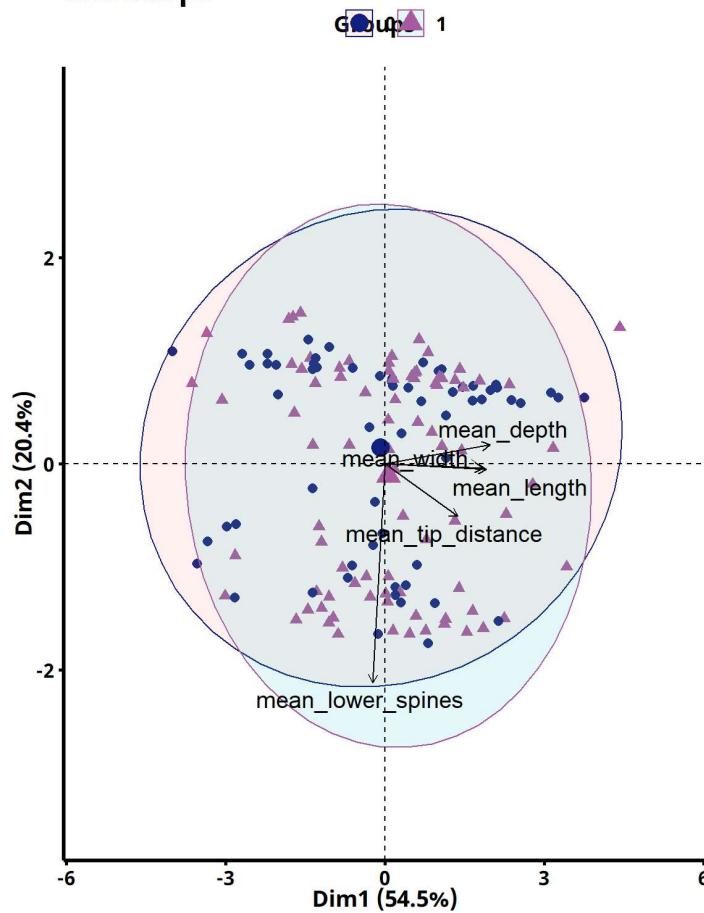
```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
## width unknown for character 0x31

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
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## width unknown for character 0x31
```

**A Mericarps****B Leaves**