PERMANOVA
Permutational MANOVA

Resemblance worksheet
Name: cp23S_Sydney_clade_rm1_stand_sqrt_resem
Data type: Similarity
Selection: All
Standardise Samples by Total
Transform: Square root
Resemblance: S17 Bray Curtis similarity

Sums of squares type: Type III (partial)
Fixed effects sum to zero for mixed terms
Permutation method: Unrestricted permutation of raw data
Number of permutations: 999

Factors
Name Type Levels
Site Fixed 3
Habitat Fixed 5
Season Fixed 2

PAIR-WISE TESTS

Term 'SitexHabitatxSeason' for pairs of levels of factor 'Site'
Within level 'Hard coral' of factor 'Habitat'
Within level 'Pre-bleaching' of factor 'Season'

Denominators
Groups Denominator Den.df
Site 1, Site 2 1*Res 0
Site 1, Site 3 1*Res 0
Site 2, Site 3 1*Res 0

Average Similarity between/within groups

Site 1 Site 2 Site 3
Site 1 100
Site 2 100 100
Site 3 100 100 100
Within level 'Soft coral' of factor 'Habitat'
Within level 'Pre-bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>0</td>
<td>0.576</td>
<td>2</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>17.377</td>
<td>0.028</td>
<td>15</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>11.632</td>
<td>0.032</td>
<td>15</td>
</tr>
</tbody>
</table>

Denominators
Groups        Denominator Den.df
Site 1, Site 2 1*Res 6
Site 1, Site 3 1*Res 6
Site 2, Site 3 1*Res 6

Average Similarity between/within groups
<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>96.83</td>
<td>93.496</td>
<td>89.839</td>
</tr>
</tbody>
</table>

Within level 'Soft coral' of factor 'Habitat'
Within level 'Bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 2, Site 3</td>
<td>0</td>
<td>0.576</td>
<td>2</td>
</tr>
</tbody>
</table>

Denominators
Groups        Denominator Den.df
Site 2, Site 3 1*Res 6

Average Similarity between/within groups
<table>
<thead>
<tr>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
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</tbody>
</table>

Within level 'Water' of factor 'Habitat'
Within level 'Pre-bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1.1315</td>
<td>0.576</td>
<td>2</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>17.377</td>
<td>0.028</td>
<td>15</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>11.632</td>
<td>0.032</td>
<td>15</td>
</tr>
</tbody>
</table>

Denominators
Groups        Denominator Den.df
Site 1, Site 2 1*Res 6
Site 1, Site 3 1*Res 6
Site 2, Site 3 1*Res 6

Average Similarity between/within groups
<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>96.83</td>
<td>93.496</td>
<td>89.839</td>
</tr>
</tbody>
</table>

Within level 'Water' of factor 'Habitat'
Within level 'Bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>5.9156</td>
<td>0.025</td>
<td>8</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>4.1809</td>
<td>0.028</td>
<td>8</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>2.4651</td>
<td>0.082</td>
<td>35</td>
</tr>
</tbody>
</table>

Denominators
Groups        Denominator Den.df
Site 1, Site 2 1*Res 6
### Average Similarity between/within groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>100</td>
<td>81.068</td>
<td>91.85</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>34.886</td>
<td>57.319</td>
<td>60.903</td>
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</tbody>
</table>

Within level 'Sediment' of factor 'Habitat'
Within level 'Pre-bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Unique Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>2.2516</td>
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<td>35</td>
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<tr>
<td>Site 1, Site 3</td>
<td>2.9157</td>
<td>0.021</td>
<td>35</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>1.4521</td>
<td>0.168</td>
<td>35</td>
</tr>
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</table>

**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>Den.df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1*Res</td>
<td>5</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>1*Res</td>
<td>5</td>
</tr>
</tbody>
</table>

### Average Similarity between/within groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>65.164</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>51.258</td>
<td>78.749</td>
<td></td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>23.538</td>
<td>55.79</td>
<td>57.719</td>
</tr>
</tbody>
</table>

Within level 'Sediment' of factor 'Habitat'
Within level 'Bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Unique Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>0.96553</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>1.3441</td>
<td>0.326</td>
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<td>Site 2, Site 3</td>
<td>0.41793</td>
<td>0.779</td>
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**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>Den.df</th>
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</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>1*Res</td>
<td>6</td>
</tr>
</tbody>
</table>

### Average Similarity between/within groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>73.041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>43.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>53.819</td>
<td>44.6</td>
<td>51.773</td>
</tr>
</tbody>
</table>

Within level 'Macrophyte' of factor 'Habitat'
Within level 'Pre-bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Unique Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1.373</td>
<td>0.126</td>
<td>35</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>2.1764</td>
<td>0.043</td>
<td>35</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>0.93881</td>
<td>0.506</td>
<td>35</td>
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</table>

**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
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<th>Den.df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>1*Res</td>
<td>6</td>
</tr>
</tbody>
</table>

### Average Similarity between/within groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>34.681</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>28.523</td>
<td>38.925</td>
<td></td>
</tr>
</tbody>
</table>
Within level 'Macroalgae' of factor 'Habitat'
Within level 'Bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>0.7817</td>
<td>0.656</td>
<td>35</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>3.7773</td>
<td>0.064</td>
<td>15</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>2.2086</td>
<td>0.093</td>
<td>4</td>
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</tbody>
</table>

Denominators

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>Den.df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1, Site 2</td>
<td>1*Res</td>
<td>5</td>
</tr>
<tr>
<td>Site 1, Site 3</td>
<td>1*Res</td>
<td>5</td>
</tr>
<tr>
<td>Site 2, Site 3</td>
<td>1*Res</td>
<td>4</td>
</tr>
</tbody>
</table>

Average Similarity between/within groups

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>63.755</td>
<td>51.532</td>
<td>25.067</td>
</tr>
<tr>
<td>33.602</td>
<td>13.247</td>
<td>100</td>
</tr>
</tbody>
</table>
**PERMANOVA**

Permutational MANOVA

*Resemblance worksheet*

Name: cp23S_Sydney_clade_rm1_stand_sqrt_resem  
Data type: Similarity  
Selection: All  
Standardise Samples by Total  
Transform: Square root  
Resemblance: S17 Bray Curtis similarity

Sums of squares type: Type III (partial)  
Fixed effects sum to zero for mixed terms  
Permutation method: Unrestricted permutation of raw data  
Number of permutations: 999

**Factors**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Fixed</td>
<td>3</td>
</tr>
<tr>
<td>Habitat</td>
<td>Fixed</td>
<td>5</td>
</tr>
<tr>
<td>Season</td>
<td>Fixed</td>
<td>2</td>
</tr>
</tbody>
</table>

**PAIR-WISE TESTS**

Term 'SitexHabitatxSeason' for pairs of levels of factor 'Habitat'

Within level 'Site 1' of factor 'Site'  
Within level 'Pre-bleaching' of factor 'Season'

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral, soft coral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard coral, water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard coral, Sediment</td>
<td>2.3145</td>
<td>0.032</td>
<td>8</td>
</tr>
<tr>
<td>Hard coral, Macroalgae</td>
<td>2.1133</td>
<td>0.136</td>
<td>4</td>
</tr>
<tr>
<td>Soft coral, water</td>
<td>63.073</td>
<td>0.023</td>
<td>4</td>
</tr>
<tr>
<td>Soft coral, Sediment</td>
<td>6.6088</td>
<td>0.034</td>
<td>8</td>
</tr>
<tr>
<td>Soft coral, Macroalgae</td>
<td>3.1001</td>
<td>0.035</td>
<td>8</td>
</tr>
<tr>
<td>Water, Sediment</td>
<td>2.2979</td>
<td>0.031</td>
<td>15</td>
</tr>
<tr>
<td>Water, Macroalgae</td>
<td>2.0076</td>
<td>0.138</td>
<td>8</td>
</tr>
<tr>
<td>Sediment, Macroalgae</td>
<td>1.8121</td>
<td>0.119</td>
<td>35</td>
</tr>
</tbody>
</table>

**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>Den.df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral, Soft coral</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Hard coral, Water</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Hard coral, Sediment</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Hard coral, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Soft coral, Water</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Soft coral, Sediment</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Soft coral, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Water, Sediment</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Water, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Sediment, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
</tbody>
</table>

**Average Similarity between/within groups**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Hard coral</th>
<th>Soft coral</th>
<th>Water</th>
<th>Sediment</th>
<th>Macroalgae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Water</td>
<td>98.415</td>
<td>0</td>
<td>96.83</td>
<td>0</td>
<td>66.959</td>
</tr>
<tr>
<td>Sediment</td>
<td>67.189</td>
<td>0</td>
<td>66.959</td>
<td>86.516</td>
<td>56.164</td>
</tr>
<tr>
<td>Macroalgae</td>
<td>44.177</td>
<td>7.2563</td>
<td>45.596</td>
<td>33.175</td>
<td>34.681</td>
</tr>
</tbody>
</table>

Within level 'Site 1' of factor 'Site'  
Within level 'Bleaching' of factor 'Season'
<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral, Water</td>
<td>Denominator is 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard coral, Sediment</td>
<td>1.633</td>
<td>0.338</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Hard coral, Macroalgae</td>
<td>2.4052</td>
<td>0.027</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Water, Sediment</td>
<td>1.633</td>
<td>0.345</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Water, Macroalgae</td>
<td>2.4052</td>
<td>0.026</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Sediment, Macroalgae</td>
<td>1.2864</td>
<td>0.337</td>
<td>15</td>
<td></td>
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</tbody>
</table>

**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>Den.df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral, Water</td>
<td>1*Res</td>
<td>0</td>
</tr>
<tr>
<td>Hard coral, Sediment</td>
<td>1*Res</td>
<td>4</td>
</tr>
<tr>
<td>Hard coral, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Water, Sediment</td>
<td>1*Res</td>
<td>4</td>
</tr>
<tr>
<td>Water, Macroalgae</td>
<td>1*Res</td>
<td>6</td>
</tr>
<tr>
<td>Sediment, Macroalgae</td>
<td>1*Res</td>
<td>4</td>
</tr>
</tbody>
</table>

**Average Similarity between/within groups**

<table>
<thead>
<tr>
<th></th>
<th>Hard coral</th>
<th>Water</th>
<th>Sediment</th>
<th>Macroalgae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sediment</td>
<td>86.521</td>
<td>86.521</td>
<td>73.041</td>
<td></td>
</tr>
<tr>
<td>Macroalgae</td>
<td>66.084</td>
<td>66.084</td>
<td>64.251</td>
<td>63.755</td>
</tr>
</tbody>
</table>

**Within level 'Site 2' of factor 'Site'**

**Within level 'Pre-bleaching' of factor 'Season'**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Denominator</th>
<th>t</th>
<th>P(perm)</th>
<th>perms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard coral, Soft coral</td>
<td>Denominator is 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard coral, Water</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hard coral, Sediment</td>
<td>3.1798</td>
<td>0.028</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Hard coral, Macroalgae</td>
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<td>8</td>
<td></td>
</tr>
<tr>
<td>Soft coral, Water</td>
<td>18.654</td>
<td>0.032</td>
<td>4</td>
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**Denominators**

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**Average Similarity between/within groups**

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<tr>
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<th>Macroalgae</th>
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**Within level 'Site 2' of factor 'Site'**

**Within level 'Bleaching' of factor 'Season'**
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Within level 'Site 3' of factor 'Site'
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**Denominators**

<table>
<thead>
<tr>
<th>Groups</th>
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<tbody>
<tr>
<td>Hard coral, Soft coral</td>
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**Average Similarity between/within groups**

<table>
<thead>
<tr>
<th>Component</th>
<th>Hard coral</th>
<th>Soft coral</th>
<th>Water</th>
<th>Sediment</th>
<th>Macroalgae</th>
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<tbody>
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