**Project 1: Ordination**

This goal of this project is to assess your ability to perform two of the ordination analyses we have covered in class.

1. **Principal Components Analysis (PCA) of the *Darlingtonia* data set using the R function *princomp*.**

Please answer the following questions based on PCA of the *Darlingtonia* data set. Standardize the data set using z-scores.

1. Based on a scree plot, how many PCA axes should you retain?

Two or three – beyond three, there isn’t much more variance to capture.

1. Based on the Latent Root Criterion, how many PCA axes should you retain?

Three (only the first three factors have eigenvalues > 1).

1. What percentage of the total variation in pitcher morphology is accounted for by the first two PCA axes?

Axis 1 – 48%

Axis 2 – 21%

Cumulatively - 70%

1. What 3 variables have the largest loading on PCA 1?

Wing area (.409), hood area (.39), and wing1 length (0.379)

1. What 3 variables have the largest loading on PCA 2?

Tube diameter (.496), tube area (.48), and height (.40) – but keel diameter is very close (.394).

1. Make a biplot of the first two PCA axes (attach to your submission)
2. In one sentence, how would you describe the morphology of pitcher sample 63?

63 is small – it has small wings, mouth and hood (low scores for PCA 1), and a narrow, short keel/tube (low scores for PCA 2).

1. In one sentence, how would you describe the morphology of pitcher sample 75?

75 is large – it has a large wing and hood (PCA 1) and a long, wide keel and tube (PCA 2)

1. If you could rename each axis in your biplot to describe the variation they explain, what would you name them? (Don’t just pick the name of the variable that has the highest factor loading)?

PC 1 seems to capture the wing, hood, and mouth parts, so I’d call it “Wing and hood size”. PC2 seems to describe the keel and tube measurements, so I’d call it “Keel and tube size”.

1. Now that you have a handle on variation in pitcher morphology for Darlington, describe a research question you could ask using the PCA axes?

Is there a relationship between the two axes, positive or negative? That is, do individuals with large wings/hoods also generally have large keels and tubes, or is there a negative relationship, or no relationship? This could relate to the groups/sizes of prey accessible to different individuals.

1. **Non-metric multi-dimensional (NMDS) analysis of Atlantic and Caribbean island bird communities using the *metaMDS* function in *R.***

Please answer the following questions based on NMDS of the *Atlantic\_Caribbean* data set. Use the Jaccard index as a distance measure.

1. What is the stress value for the NMDS of the island bird communities?

0.098

1. Based on this stress value, how well does the ordination represent the original distances?

0.09 is “good” (according to lecture); the high R2s (.99 and .96 for non-metric & linear fits, respectively) are also a good sign.

1. Plot the NMDS using 2 axes and color the islands based on their ocean. Attach the plot to your submission.
2. What do the results of your NMDS suggest?

The species of birds found on the islands clusters strongly according to which ocean they are in – the Atlantic and Caribbean islands form two distinct groups on the NMDS.

1. Plot the NMDS using 2 axes and color the islands based on their archipelago. Attach the plot to your submission.