Hypothesis Exercise - Calibration (Emma McEnhill & Sophie Schaedel)

<u>1) What is your question?</u>

From assignments: "Calibration (how good are our measurements? what do we need to correct? how do the drone measurements compare to the actual weights?)"

How good are drone ML estimated measurements (length) compared to procedure animals- are they biased in a specific direction? How do drone-based mass estimates compare to actual-weight seal measurements?

Extra: If drone image estimates are suggested to be fairly accurate- Do the mass measurements from drone seals follow the same oceanographic pattern correlations that known weight seals do? (see the paper from 3 years ago)

<u>2) What is the null hypothesis? What is your hypothesis?</u>

The null hypothesis is that there is no difference between the drone estimates and actual measurements of procedure seals. Our hypothesis (currently) is that there will be inaccuracy, but we are not sure right now if it would skew high or low, or even completely randomly

<u>3) What data do you need to answer your question?</u>

Length and Mass measurements of procedure (actual measurement) seals
Length and Mass measurements (estimate data) from drone photos
Ideally: there would be overlap- where seals of known weight that are also measured via drone estimates

Help! What do if there is no overlap found? Would we run straight to seeing how patterns match between actual and drone estimates as a proxy?

Basically, yes, since if the drone estimate data exhibits completely different patterns to the patterns that correlate with known mass/lengths, something's up!

4) How would you graph that data? What would the x and y axes be?

Comparison Scatter Plot:
(Star representing drone plot & Circle representing known elephant seal weight plot)
X Axis - Year
Y Axis - Mass (kg)

5) What would you expect your results to look like if the null hypothesis was true?

If the null hypothesis is true, I would expect the drone estimates to closely match the actual seal measurements, with no significant difference between them. The data should show similar averages, and statistical tests would result in a high p-value, indicating that any differences are due to random chance rather than a true discrepancy.

6) What would you expect your results to look like if your hypothesis was correct?

If the hypothesis is correct, I would expect to see a significant difference between the drone estimates and the actual seal measurements. The results would show a consistent pattern where the drone data either overestimates or underestimates the true values, and statistical tests would yield a low p-value, indicating that the difference is unlikely to be due to chance.

7) What kind of data visualization would best illustrate your findings?

The use of a scatter plot would be a super useful tool for making specific comparisons between weight predictions from the drone and the actual weights of known individuals. Other options might be a box plot or histogram.
Visualising the uncertainty in the drone data with something like half eyes or confidence bands could also be useful?

Bonus question (after you watch Roxanne's R Tutorial):

8) Give a written, step-by-step description of how you would go about creating your figure in R. ("First, load the data and extract column x and column y.")

1. Load the packages:
    a. We want ggplot2 for plotting and possibly readr or readxl depending on the data format (library(ggplot2))
    b. Tidyverse will also be useful since it's likely we will need to clean or otherwise mutate data

2. Import dataset
    a. Load the data into R. Let’s assume we are using a CSV file called "seal_weights.csv", and save it as its own data frame, and maybe a second csv called “drone_polygons.csv”

3. Check our data structures
    a. Look at the first few rows of each to make sure the data loaded correctly
    b. Check the structure of the variables- do things need to be changed?

4. Tidy our data to have what we want- ex- is it in wide or long formatting?
    a. It’s really likely that we will have a lot more information than we need, and will be missing some calculated sections
    b. For this example, let’s say we have the following columns in drone_polygons.csv:
        i. Polygon.ID
        ii. Polygon.Width
        iii. Polygon.Length
        iv. Year (the year of Drone Survey)
        v. Sex
    c. And these in seal_weights.csv:
        i. Seal.ID (seal tag)
        ii. Sex
        iii. Age.Class
        iv. Girth (probably multiple)
        v. Standard.Length
        vi. Mass
        vii. etc.
    d. And we want to add to a new, third frame with :
        i. Seal/Polygon ID (or, merge these to only be seal ID if we have measures in both styles of the same seal)
        ii. Length
        iii. Mass (the seal’s mass in kilograms from drone_polygons.csv OR real weight from
        iv. Port in known weight from another data frame
        v. Source: indicates whether the measurement came from a drone or a known measurement (e.g., "Drone" or "Actual")
    e. (this would make it easier to use ggplot id its in long form!)

5. Create a potential scatter plot
    a. Use our cleaned frame, with seal ID as X (if we have matches?) and mass (kg) as y
    b. Group by source so that each appears as its own color?
    c. Could also be interesting to facet scatter plots by source and then fit a confidence line (maybe with a ribbon) to it
    d. Optional (required): create a custom palette and load it in during the ggplot command color for better visual distinction
6. Review our plot, and use ggsave to save as a PDF

Notes from Allison: (more fitting for proposal)
Look into other drone imagery studies and calibrations they used
Ex: harbor seal colony studies
Pictera is the software
Email molly about what she knows and what is available