Marine Education

ANALYSING POPULATION DATA

Name:

Date:

 QCAA Marine Science 2019 v1.2 General Senior Syllabus. Unit 2. Topic 1. Subject Matter: Biotic components of marine ecosystems

It's all about answering the Research Question!

When comparing two datasets, at what point is the difference between them considered to be *significant*? To find out, we need to do some more calculations (begin by entering 2012 data into cells B2-B5 in Excel).

Measures of Central Tendency (i.e. medium, mean, mode).

A common measure of central tendency used in population dynamics is the mean, or average.
The mean of a *population* goes by the symbol μ
The mean of a *sample* (usually representative of the population) goes by the symbol $\bar{x}$
Always quote the mean to **one decimal place more than the raw data**. To calculate the mean:

- In Excel, type in an empty space/cell at end of data (i.e. B6): **=AVERAGE(B2:B5)** (then press Enter)
- Or, manually, add them all up (Σ x) and divide that total, by the number of observations ($\bar{x} = \Sigma x / n$)

Measures of Dispersion (i.e. range, deviation & standard deviation).

The **range** is the distance between the lowest data point and the highest data point. Range is a very crude measure of dispersion because we still don't know how close or far away each data point is from the mean (known as deviation). Hence, **Standard deviation** is a much better measure of dispersion.
The standard deviation of a *population* goes by the symbol **σ** (sigma)
The standard deviation of a *sample* (usually representative of the population) goes by the symbol **s**
Always quote the standard deviation **one decimal place more than the mean.** To calculate s:

- In Excel, type in the next empty space/cell at end of data (i.e. B7): **=STDEV(B2:B5)**
- Or, manually, square root the sum of the deviation squared, divided by the number of observations -1

Standard Error (SE) of the mean measures how well $\bar{x}$ represents μ. Were we close?

The smaller the value, the more accurate the sample mean represents the population mean.
The standard error equals the standard deviation divided by the *square root* of the sample size (SE=s/√n).

- In Excel, first type in the next empty space/cell at end of data (i.e.B8) **=COUNT(B2:B5)** to calculate 'n'.
  Then, type in the next empty space/cell at end of data (i.e. B9) **=(B7)/SQRT(B8)**

A Confidence Interval is a range of values that we are 95% confident contains the pop. mean.

It's a bit like saying, *I am 95% confident the population mean will be somewhere within the range of this value and that value*. Whereby, the sample mean is at the centre of this range. To calculate the confidence interval (CI), you need the following values: α =0.05, the standard deviation (s), and the sample size (n).

- In Excel, type in an empty space/cell at end of data (i.e. B10): **=CONFIDENCE.T(0.05,B7,B8)**

Error Bars represent the uncertainty in estimates. It's a line that passes through a point (or bar) on a graph, representing s or SE or CI. If error bars do *not* overlap, the difference *could* be *significantly* different (answering your research question!). However, to be sure, a t-test is required (see next page).

	A	B	C
1	Replicate	Population 1	Population 2
2	1	1	50
3	2	0	60
4	3	2	55
5	4	3	70
6	Average (Mean)	1.5	58.8
7	Standard Deviation (s)	1.29	8.54
8	Sample Size (n)	4	4
9	Standard Error	0.6	4.3
10	Confidence Interval	2.1	13.6

Activity: Copy the data pictured left (down to row 5) onto an Excel spreadsheet. Add the formulas (provided above) to calculate the same answers pictured left (rows 6-10). Highlight both *Means* & **Insert Chart** (column graph). **Add error bars.**

Q. Do the error bars overlap? Ans. [Yes] [No] Circle correct answer