

**Research Question** After an outbreak of COTS was *observed* on Swains Reef in 2017.....

**Q. Is there a difference in** Population SIZE (or density) of Crown of Thorns starfish **between** 2012 on Swains Reef **&** 2017 on Swains Reef **?**

\*Hodgeson et al., (2006). Reef Check Instruction Manual: A Guide to Reef Check Coral Reef Monitoring. Reef Check Foundation, Pacific Palisades, California, USA (published on biosphere-expeditions.org/)

**Method: Belt Transect**

An 80m transect line (graduated tape measure) was randomly laid down (at a constant depth) at four potential COTS habitats around Swains Reef (identified using a Manta Tow). Divers spent 30-40 minutes surveying each 80m transect using an s-shaped search pattern extending 2.5m either side of the line, to look for and count COTS inside cracks and crevices on the reef (methods modified from Reef Check\*). The total survey area is  $4(80m \times 5m) = 1600m^2$ . The total area of Swains Reef is  $580,000m^2$ .



**Results**

Note: the COTS outbreak was real, but the data for this worksheet has been made up.

**Activity: Complete the table below. Formulas for Population Size & Density are provided below.**

Group (population)	Transect (quadrat)				Mean (average) $\bar{X}$	Total Area of Population $m^2$	Area of one transect (quadrat) $m^2$	Population Size "N"	Population Density per $m^2$
	1	2	3	4					
2012	1	0	2	3	1.5	580,000	400	2175	0.00375
2017	50	60	55	70		580,000	400		

**Estimating Population Size (Quadrat Method)**

Note: the 'belt' is the same as one long rectangular quadrat (length x width)

**Population Size =** 
$$\frac{\bar{X} \times \text{Total Area of Population}}{\text{Area of one quadrat}}$$
 "N"

**Population Density =** 
$$\frac{\text{Population Size}}{\text{Total Area}}$$

**Data Analysis**

To *statistically* answer the research question, we must first calculate s, SE & CI to obtain **error bars** and a **P value**. If the error bars do *not* overlap, and the P value is *equal to or <0.05*, the difference is significant.

**Activity: Complete the table below. Read the following two pages for instructions!!!**

Group (population)	Transect (quadrat)				Mean	N	Density per $m^2$	n	s	SE	CI	df	P
	1	2	3	4									
2012	1	0	2	3	1.5	2175	0.00375	4	1.29	0.6	2.1	6	0.0001
2017	50	60	55	70									

n=sample size s=standard deviation SE=Standard Error CI=Confidence Interval df =degrees of freedom  $(n_1 - 1) + (n_2 - 1)$  Note: subscripts indicate group number. P value: results from t-test

**Q. Is there a significant difference between Group 1 (2012) & Group 2 (2017)? Ans.** **[Yes] [No]**  
Circle correct answer