Organism abundance in subtropical verses tropical intertidal zones

Study done by :
Christian Tettelbach,
Steven Dorris, and
Shannon Slowey

Introduction

- "There are usually more coins in your piggy bank than in your pocket. But you're always spending the coins in your pocket, and receiving new coins in the form of change. The coins in your piggy bank turn over less often, but over time they add up" (Bortero 2013).
- Question: Is there an increase in abundance of organisms with increased water cover and/or distance from shore?
- Question: Is there a difference between the abundance of organisms on tropical verses subtropical intertidal zones?
  - North Stradbroke Island=subtropical intertidal
  - North Keppel Island=tropical intertidal
  - Compare to first study on North Stradbroke

Hypotheses

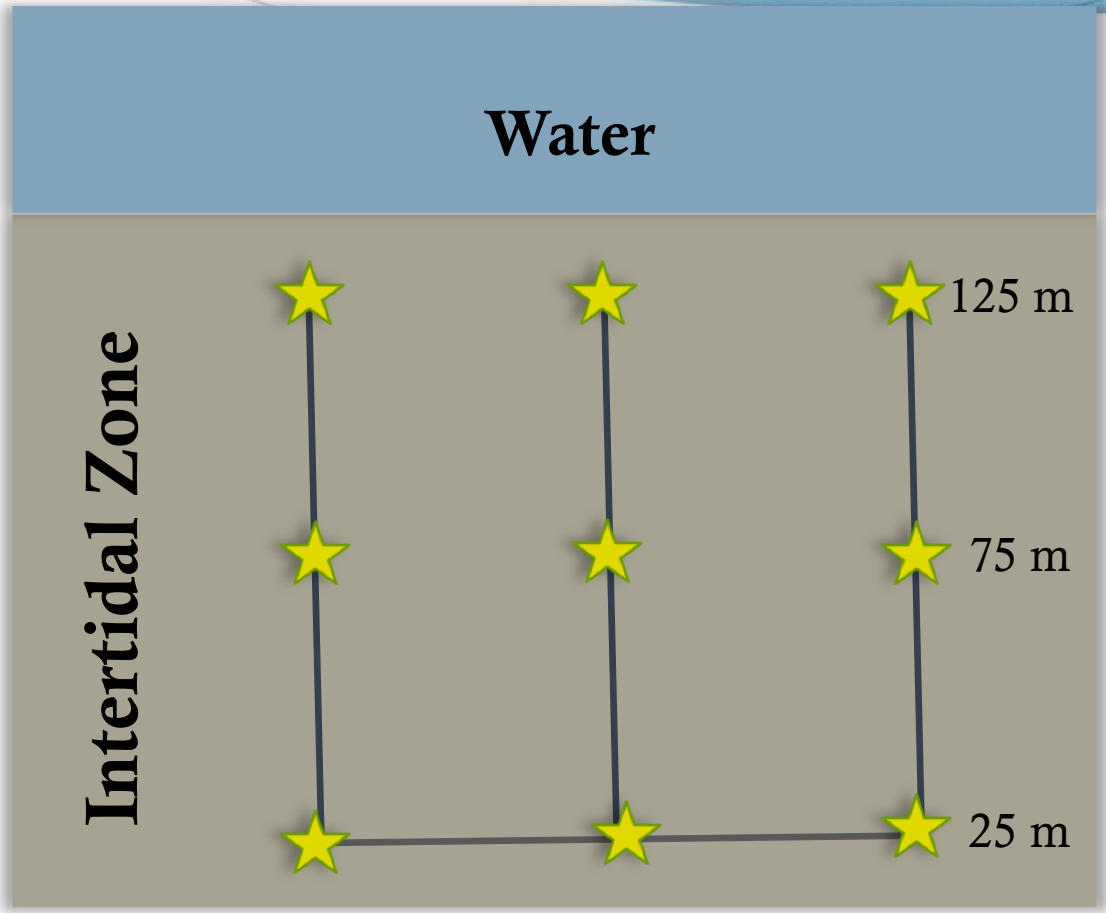
North Keppel

- Abundance of organisms will increase with increased water cover.
- Null: Abundance of organisms will not be effected by water cover.
- Abundance of organisms will increase further from shore.
- Null: Abundance of organisms will not be effected by distance from shore.

North Stradbroke & North Keppel

- Higher abundance of organisms in tropical intertidal zone of North Keppel Island compared to the subtropical intertidal zone of North Stradbroke Island.
- Null: No change in abundance of organisms in the tropical intertidal zone of North Keppel Island compared to the subtropical intertidal zone of North Stradbroke Island.

Materials & Methods



- Mazie Bay on North Keppel Island at low tide
- ¼ meter quadrants used to make 1 meter transects
- Each ★ represents a horizontal line of five transects, each separated by 1 meter squared
- Used 50 meter transect tape between each ★

Materials & Methods

- Tukey HSD Test
- ANOVA Test
- Simpson biodiversity index
  - North Stradbroke (.2205) vs. North Keppel (.2627)
- Generated through www.alyoung.com

Results: Distance from shore vs. organism abundance

Data Summary

	Samples					
	1	2	3	4	5	Total
N	15	15	15			45
ΣX	5	22	87			114
Mean	0.333333	1.466667	5.8			2.533333
ΣX^2	9	58	653			720
Variance	0.52381	1.838095	10.6			9.8
Std.Dev.	0.723747	1.355764	3.255764			3.130495
Std.Err.	0.186871	0.350057	0.840635			0.466667

Tukey HSD Test

HSD[.05]=1.85; HSD[.01]=2.34
M1 vs M2 nonsignificant
M1 vs M3 P<.01
M2 vs M3 P<.01

M1 = mean of Sample 1
M2 = mean of Sample 2
and so forth.

HSD = the absolute [unsigned] difference between any two sample means required for significance at the designated level. HSD[.05] for the .05 level; HSD[.01] for the .01 level.

Statistically Significant!

standard weighted-means analysis

ANOVA Summary Independent Samples k=3

Source	SS	df	MS	F	P
Treatment [between groups]	249.733333	2	124.866667	28.9	<.0001
Error	181.466667	42	4.320635		
Ss/Bl					
Total	431.2	44			

Graph Maker

Results: Distance from shore vs. water cover

Data Summary

	Samples					
	1	2	3	4	5	Total
N	15	15	15			45
ΣX	55	395	830			1280
Mean	3.6667	26.3333	55.3333			28.4444
ΣX^2	375	16575	63400			80350
Variance	12.381	440.9524	1248.0952			998.6616
Std.Dev.	3.5187	20.9989	35.3284			31.6016
Std.Err.	0.9085	5.4219	9.1218			4.7109

Tukey HSD Test

HSD[.05]=21.14;
HSD[.01]=26.79
M1 vs M2 P<.05
M1 vs M3 P<.01
M2 vs M3 P<.01

M1 = mean of Sample 1
M2 = mean of Sample 2
and so forth.

HSD = the absolute [unsigned] difference between any two sample means required for significance at the designated level. HSD[.05] for the .05 level; HSD[.01] for the .01 level.

Statistically Significant!

standard weighted-means analysis

ANOVA Summary Independent Samples k=3

Source	SS	df	MS	F	P
Treatment [between groups]	20121.1111	2	10060.5556	17.74	<.0001
Error	23820	42	567.1429		
Ss/Bl					
Total	43941.1111	44			

Graph Maker

Results: Distance from shore vs. organism abundance of North Keppel and North Stradbroke

Critical Values for the Tukey HSD Test

		HSD[.05]	HSD[.01]
Rows	2	0.92	1.23
Columns	3	1.36	1.71
Cells	6	2.35	2.8

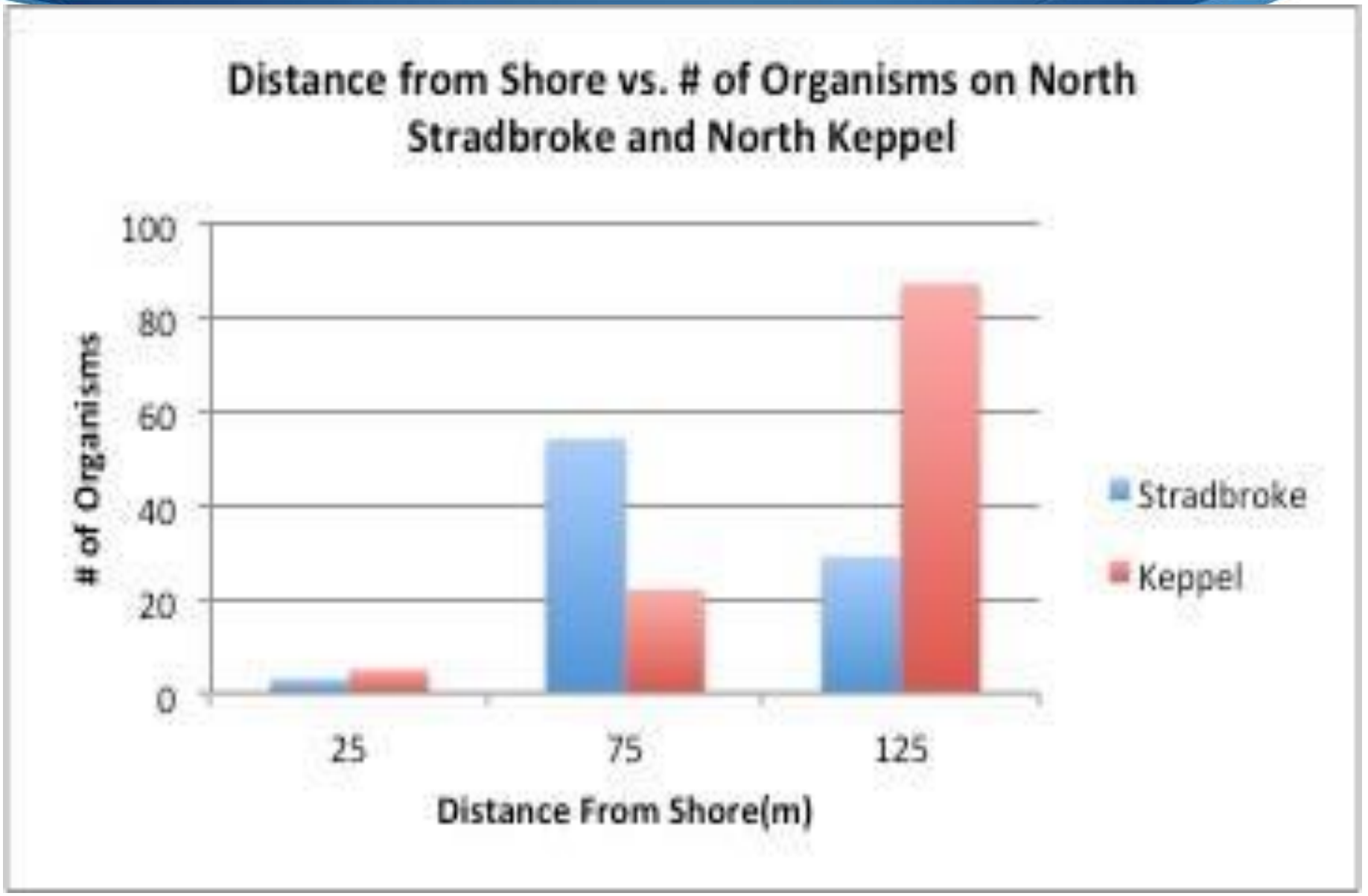
HSD=the absolute [unsigned] difference between any two means (row means, column means, or cell means) required for significance at the designated level: HSD[.05] for the .05 level; HSD[.01] for the .01 level. The HSD test between row means can be meaningfully performed only if the row effect is significant; between column means, only if the column effect is significant; and between cell means, only if the interaction effect is significant.

standard weighted-means analysis

ANOVA Summary 2rows x 3columns

Source	SS	df	MS	F	P
Rows	8.71	1	8.71	1.79	0.1845
Columns	198.76	2	99.38	20.44	<.0001
r x c	137.69	2	68.85	14.16	<.0001
Error	408.4	84	4.86		
Total	753.56	89			

Not Statistically Significant


Distance from Shore vs. # of Organisms on North Stradbroke and North Keppel
100
80
60
40
20
0
# of Organisms
25
75
125
Distance From Shore(m)
Stradbroke
Keppel

Discussion

- More water cover yields more organism abundance
- Distance from shore vs. organism abundance
  - p-value <0.0001
- Distance from shore vs. water cover
  - p-value <0.0001
- Distance from shore vs. organism abundance of North Keppel and North Stradbroke
  - p-value=0.1845

Discussion

North Keppel

- Reject null hypothesis that abundance of organisms will not be effected by water cover.
- Reject null hypothesis that abundance of organisms will not be effected by distance from shore.

North Stradbroke vs. North Keppel

- Did not reject the null hypothesis that there is no change in abundance of organisms in the tropical intertidal zone of North Keppel Island compared to the subtropical intertidal zone of North Stradbroke Island.

Literature Cited

- Botero C (2013) Environmental harshness is positively correlated with intraspecific divergence in mammals and birds. *Molecular Ecology*. 23: 259-268

- Cardillo M, Orme CDL, Owens IPF (2005) Testing for latitudinal bias in diversification rates: an example using New World birds. *Ecology*, 86:2278–2287.

- National Evolutionary Synthesis Center (2013). Biodiversity higher in the tropics, but species more likely to arise at higher latitudes. ScienceDaily. *In:* from www.sciencedaily.com/releases/2013/11/131122132451.htm