The effect of herbivory and nutrient addition on the dynamics of the macroalgae, Dictyota spp. on Caribbean coral reefs in St. Thomas, U.S. Virgin Islands

by
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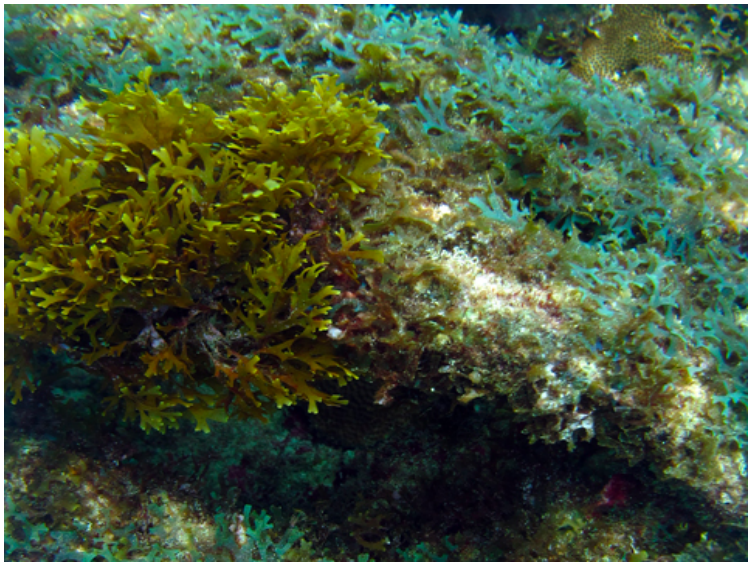

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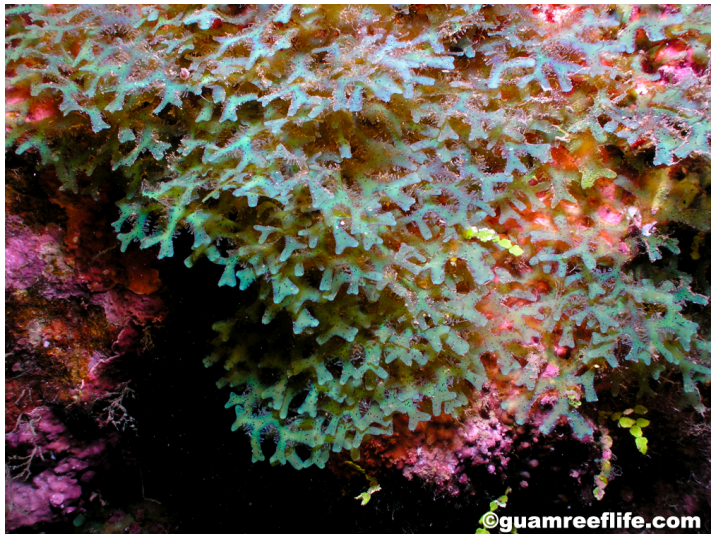
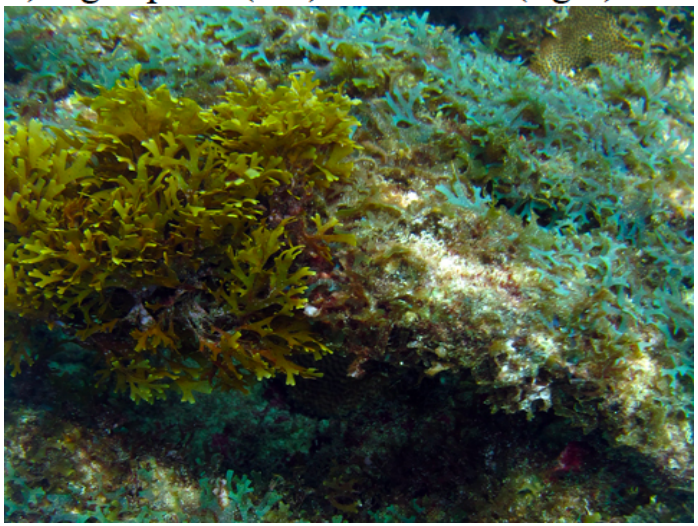
Macroalgae, *Dictyota* spp.

Figure 1 The brown alga, *Dictyota* spp. (Order Dictyotales) algae press (left) and *in situ* (right).





Herbivores

Sparisoma

Scarus

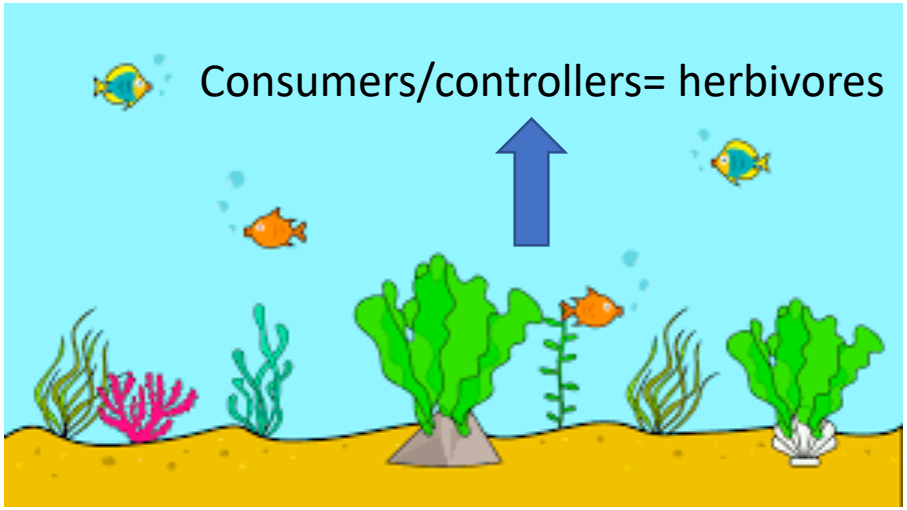
Acanthurus

Stegastes

Objective

To test whether nutrient addition and/or herbivore reduction facilitated *Dictyota* thallus growth measured as height.

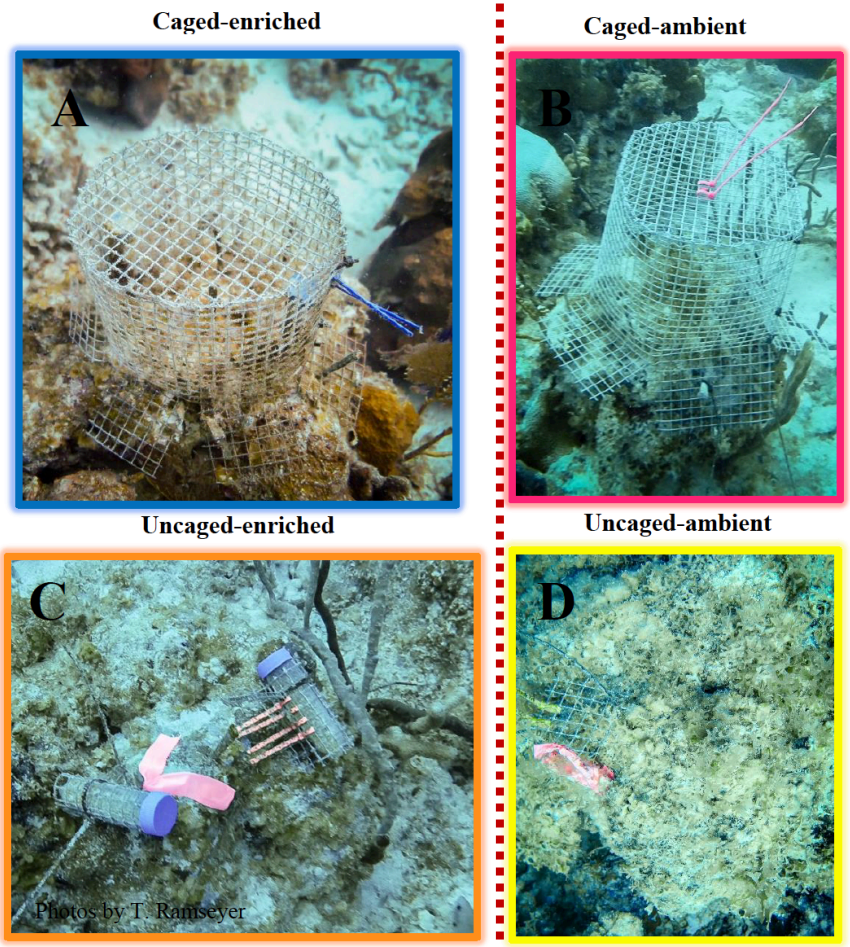
Sewage= nutrients



Nutrients = algae growth

Coral Reef System Balance?

Experimental treatments



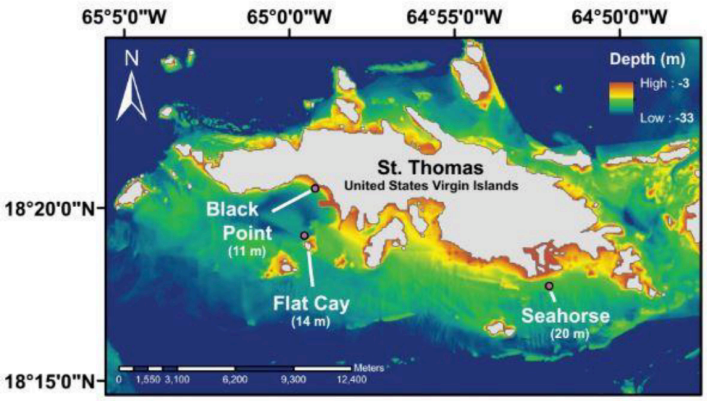


Figure 3 Study sites in St. Thomas, United States Virgin Islands. Black Point (18°20'40.20"N, -64°59'9.42"W), Flat Cay (18°19'5.59"N, 64°59'27.74"W), and Seahorse Cottage Shoal (18°17'40.81"N, 64°52'30"W).

Herbivore Reduction	Nutrient Addition	
Caged	Enriched	n = 10
Caged	Ambient	n = 10
Uncaged	Enriched	n = 10
Uncaged	Ambient	n = 10

(n = 40 per site)

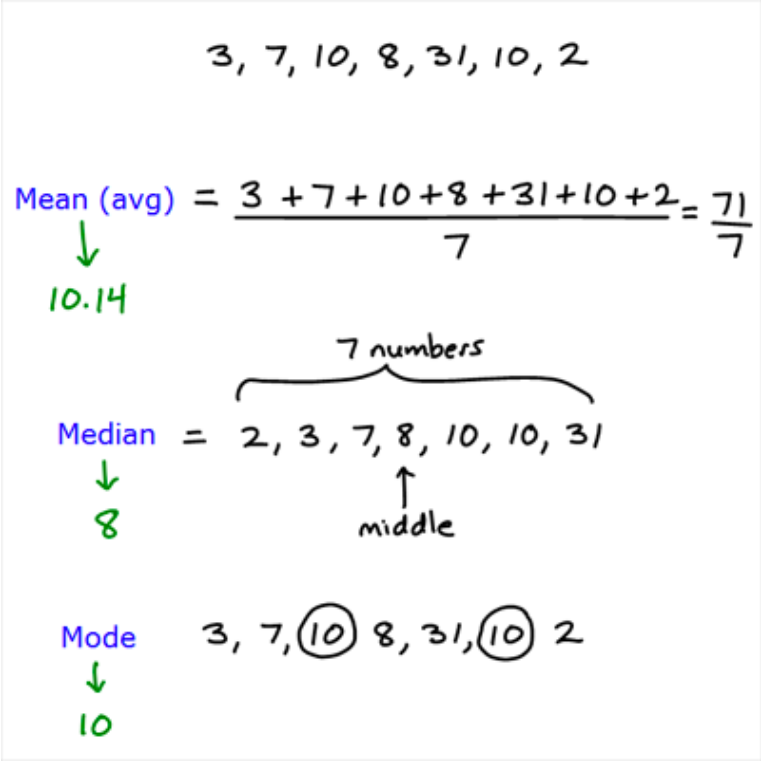
40 g of OsmocoteTM Plus Smart-Release® plant fertilizer contained in two 50 ml centrifuge tubes with ~35 small diffusion holes drilled at about 1 cm intervals.

Summarizing Data

The Average

An average is a way of representing the middle of a set of numbers, statisticians talk about the central tendency of a sample.

The three more common averages are the arithmetic mean, the Median and the Mode



Summarizing Data

Which average to use?

The best average to use is the one that best describes the data. The mean and median are more useful than the mode.

The MEAN is used when the data are fairly symmetrical, with more or less equal values above and below the mean values.

The MEDIAN is more useful when there is a preponderance of low values. Always used in Box-plots.

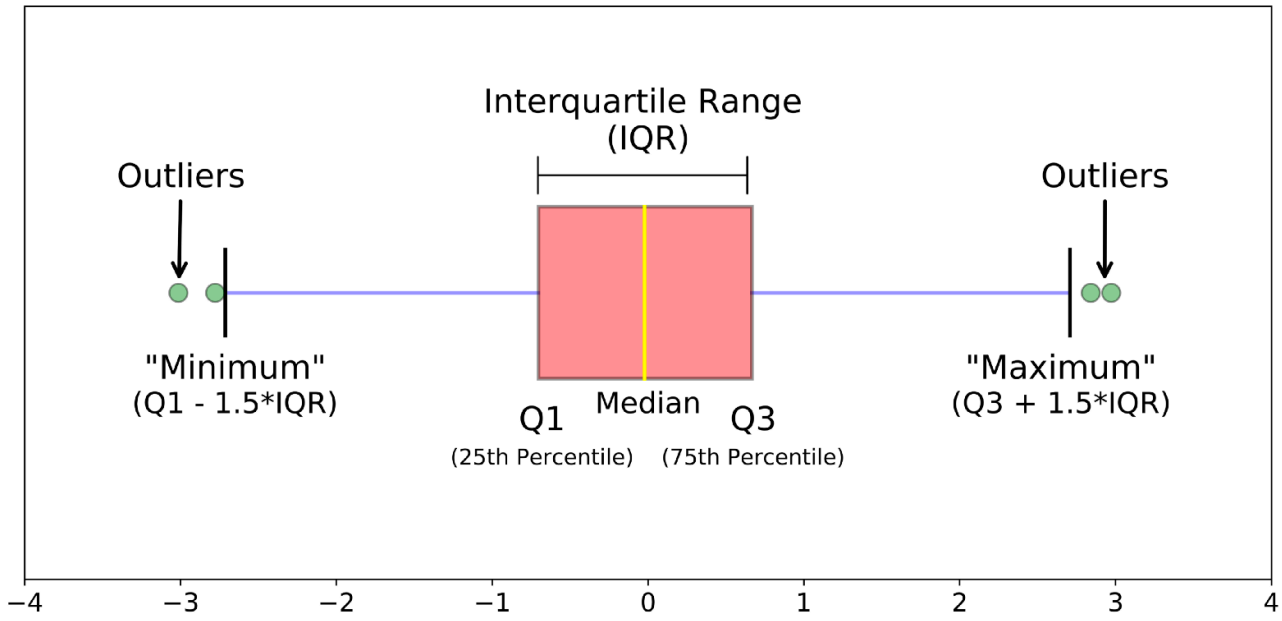
In general, the MODE is the least useful , and tends to be useful when the dataset contains a large quantity of numbers (n> 1000).

Summarizing Data

Besides observing the distribution graphically we also use numbers to describe the distribution of your data

Range: Smallest and largest values

Quartiles: Divide the data into further halves beside the median



Box –plot or box-whisker plot

Summarizing Data

Other measures of the distribution of the data include the Standard Deviation and the Standard Error

		y	y-mean (3)	(y-mean)^2 (4)	
		4	-1.5	2.25	
		3	-2.5	6.25	
		5	-0.5	0.25	
		6	0.5	0.25	
		8	2.5	6.25	
		6	0.5	0.25	
		5	-0.5	0.25	
		7	1.5	2.25	
	Sum	44	0	18	5
1	n	8			
2	Mean	5.5			
	Variance S^2	2.57			
	Standard deviation S	1.6			
	Standard Error Se	0.57			

1. n= number of items in the sample

2. Calculate the mean of the sample

3. Subtract the mean from each item in the sample

4. Square the differences to get rid of negative signs

5. Sum the square differences (sum of squares)

6. Divide the sum of squares by n-1 (this is the variance s^2)

7. Take the square root of the variance (this is the standard deviation **s**)

8. Divide the standard deviation by the square root of the number of items S_y)

6

$$s^2 = \sum_{i=1}^{n} \frac{(y_i - \bar{y})^2}{n-1}$$

Variance

7

$$s = \sqrt{\sum_{i=1}^{n} \frac{(y_i - \bar{y})^2}{n-1}}$$

Standard deviation

8

$$s_{\bar{y}} = \frac{s}{\sqrt{n}}$$

Standard error

Use programming in Python for Statistics

4. Algae growth, statistics, box plots

Data Analysis

4.1. Import Data

4.2. Check and Organize Data

4.3. Group data per condition/treatment

4.4. Compute Statistics

4.4. Plot statistics (bar plots and box plots)

4.5. Describe your plots (results) → Critical thinking

Programming

Python Data Analysis Library

Pandas