Effects of Substrate Rugosity on Abundance and Gonad Condition of Purple Urchins (*Strongylocentrotus purpuratus*) in the Intertidal Zone

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INTRODUCTION

Study Questions
- Does rugosity affect abundance of urchins?
- Does rugosity affect maturity of urchins?

Variables Measured
- Rugosity (roughness of substrate)
- Abundance & Gonad condition of urchins

Study Site Description
- Rocky intertidal shore w/ boulders
- 3 subsites within Baker Beach in Trinidad Bay (Map1)

METHODS

Transects and Collection
- 3 transects (30m) along shoreline
- 0.5 m^2 quadrats to measure rugosity and abundance at each meter
- Up to 2 urchins collected at each meter and sorted into rugosity levels

Gonad Condition
- Total wet weight (g) and gonad weight (g)
- Gonad ratio = gonad weight/total weight

Data Analysis
- Linear regression: relationship between rugosity and abundance
- ANCOVA test: if rugosity affects relationship between total weight and gonad weight

RESULTS

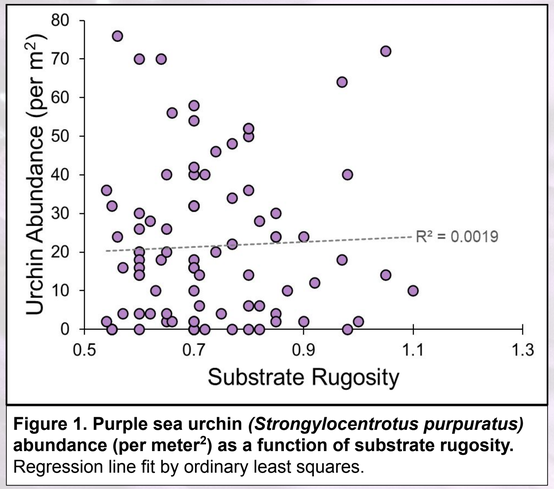

Figure 1. Purple sea urchin *(Strongylocentrotus purpuratus)* abundance (per meter^2) as a function of substrate rugosity. Regression line fit by ordinary least squares.

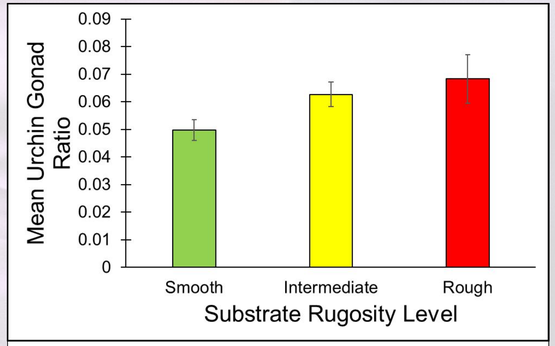

Figure 2. Mean purple sea urchin (Strongylocentrotus purpuratus) gonad ratio at three substrate rugosity levels. Gonad ratio is gonad wet weight (g) divided by total wet weight (g). Sample sizes for smooth, intermedaite and rough rugsoity levels are 79, 87, and 19 urchins, respectively. Error bars are ± standard error of the mean. $F = 3.27$, $df = 2$, $P = 0.040$.

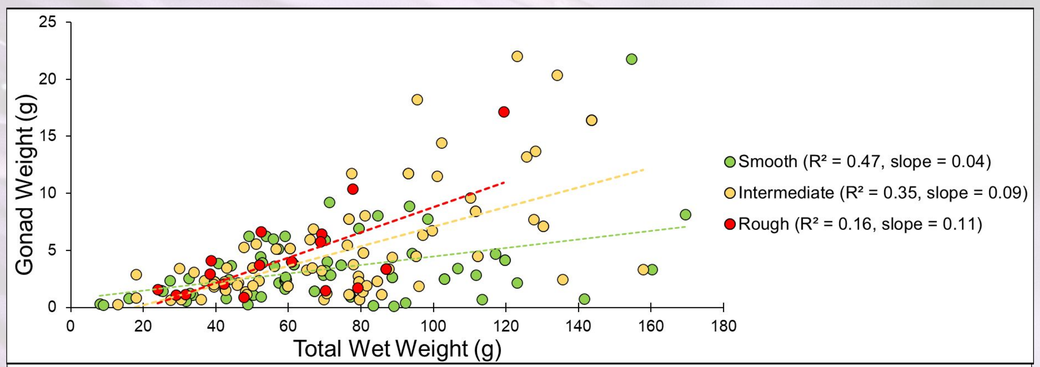

Figure 3. The relationship between purple sea urchin (*Strongylocentrotus purpuratus)* total wet weight (g) and gonad wet weight (g) at three substrate rugosity levels. Sample sizes for smooth, intermediate, and rough rugosity levels are 79, 87, and 19 urchins, respectively. Regression line fit by ordinary least squares. $F = 3.95$, $df = 2$, $P = 0.021$.

DISCUSSION

Abundance:
- Rugosity does not impact where urchins reside within the intertidal zone

Gonad Condition:
- Rugosity affects the relationship between urchin size and gonad weight
- As rugosity increases rate of gonad growth increases
- Able to hold onto substrate better?
- More food available?

Future Studies
- Does this aid in intertidal invasion?
- Why does rugosity affect gonad condition?
- Directly or indirectly?

RESOURCES

Ebert, T. A., Hernandez J. C., & Russell, M. P. (2011). Problems of the gona index and what can be done: analysis of the purple sea urchin Strongylocentrotus purpuratus. Marine Biology, 158, 47-58. https://doi.org/10.1007/s00227-010-1541-2

Spyksma, A. J. P., Taylor, R. B., & Shears, N. T. (2017). Predation cues rather than resource availability promote cryptic behaviour in a habitat-forming sea urchin. Oecologia, 183, 821-829. https://doi.org/10.1007/s00442-017-3809-4