# URCHENT MISSION: HOW ENVIRONMENTAL FACTORS INFLUENCE SPINE LENGTH IN *STRONGYLOCENTROTUS PURPURATUS*

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## Introduction:

Urchins are well adapted to a variety of habitats due to the use of protective spines. Large variation between *Strongylocentrotusp purpuratus* spine length is found along the Oregon Coast. The Purple Sea Urchin is present in varying environments in both low and high tide pools with differing amounts of wave action. Spine length is influenced by environmental factors such as wave action and microhabitat. We selected 4 distinctly protected/unprotected environments to compare spine length and test height ratios.

## Methods and Materials:

A total of 45 *S. purpuratus* were collected in Middle and South Cove. A variety of wave action exposure was the basis of selection of three sites in Middle Cove and one in South Cove.

Site 1 provided 15 specimens. It had the most wave action; rocky terrain and all urchins were collected at random from cavities in the sandstone. It was the least protected of the four sites. Site 2, was in the lower intertidal. 10 urchins were collected in the boulder field. This area was densely populated and the majority of the organisms were collected outside of cavities under large rocks. Site 3 was slightly more protected from wave action than our second location. Five *S. Pupuratus* were collected from a boulder field which was moderately protected seaward by a row of large boulders. This area was particularly difficult to access at the tidal level of + 1.0. Our final location was South Cove where 15 urchins were collected. All were randomly selected from shallow tide pools were we dislodged them from their cavities. This served as our most protected location from wave action.

Measurement of the urchins were taken using calipers, 4 categories of data were assigned to each individual. Our measurements included height: oral to aboral. Spines; three of the longest spines found in the lateral region (indicated on diagram), and one from the aboral surface. This spine was selected on two parameters: proximity (with in 1 cm of the aboral) and for the greatest length. Length was measured from the base of the spine to the tip.

Results:

Urchins collected at site 1 ranged from 1.9cm to 3.5cm. The average aboral spine length was 0.77cm and the average lateral spine length was 0.97cm. Site two urchins ranged from 1.7 to 4.4cm with an average aboral spine length of 0.75cm and an average lateral spine length of 01.24cm. Site three had urchins ranging from 1.5cm to 3.7, with average aboral spine lengths of 0.58 and lateral spines averaging 1.00cm. Site four had urchins from 2.1cm to 3.6cm. Their average aboral spine length was 0.7cm and average lateral spine length was 0.87cm.

Discussion:

We did not find any significant differences between the samples. Locations two and three both showed a tendency to have longer lateral spines in proportion to test height (Fig 4) while locations one and four had a tendency to have longer aboral spines in proportion to test height (Fig 5). Uchins collected at site two seemed to be bigger than those collected at any other site (Fig 1) with lateral spine lengths much larger than the others (Fig 2), but with aboral spine lengths that nearly matched both sites one and four (Fig 3).

The similarities found between sites one and four and between sites two and three can be accounted for by looking at similarities between the habitats where they were found. The longer lateral spines found in sites two and three may be due to the fact that they are not restricted by living in a pit, while the shorter aboral spines may be due to living under boulders and rocks that may bounce around in the waves.

With the limited data that we worked with we believe it is safe to say that living circumstances, urchin beds versus boulder fields, influence the spine lengths of *S. purpuratus.*

In a study conducted using *Strongylocentrotus franciscanus* spine length was suggested to be primarily influenced by the environment, wave action. In this study short spined Urchins collected in the field were capable of growing long spines in the laboratory (Rogers-Bennett 1995). Growing *S. purpuratus* in the lab would most likely end with similar results, so it is likely that some environmental factor is responsible for the variability. In another study conducted in Sunset Bay, the author suggests that *S. purpuratus* living in exposed areas would have more spines broken or totally removed (Ebert 1968). This suggests that wave action may in fact be responsible for urchin spine length variability, but to prove it wave action would have to be measured. Our results seem to make sense, as urchins living in pits must carve the pit using their spines and in doing shorten them as seen in Fig 6, A and B. A displays a spine with a fine point and B has a spine obviously worn. In a study done by Ben Grupe (2006) at Middle and South Coves 90% of the largest urchins in found were found outside of pits. This suggests that pits are responsible for limiting urchin growth.

In conclusion we found evidence to support our hypothesis that environment influences spine length in urchins. We however were wrong in our assumptions on which environmental factors would most influence spine length. Microhabitat is the only factor that we were able to link to spine length.

WORK CITED

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Grupe, B. M.. 2006. Purple sea urchins (*Strongylocentrotus Purpuratus*) in and out of pits: The effects of microhabitat on population structure, morphology, growth and mortality. Thesis. University of Oregon, Eugene, Oregon, USA.

Rogers-Bennett, L. , Bennett, W. A., Fastenau, H. C., Dewees, C. M. 1995. Spatial Variation in Red Sea Urchin Reproduction and Morphology: Implications for Harvest Refugia. Ecological Applications. Vol. 5, No. 4, pp. 1171-1180

FIGURES:

Collection Sites

(1) Middle Cove of Cape Arago urchin beds.

(2) Middle Cove boulder field.

(3) Middle Cove boulder field with slight protection from wall of boulders.

(4) South Cove urchin beds.

Fig 1. Average urchin test height. Relatively similar across samples.

Fig 2. Average lateral spine lengths. Slightly longer found in boulder fields.

Fig 3. Average aboral spine lengths. Even with the exception of site three which were on average shorter.

Fig 4. Average of aboral spine lengths divided by test heights. Urchins found in beds had longer aboral spines in proportion to test height.

Fig 5. Average of lateral spine average divided by test heights. Urchins found in boulder fields had longer lateral spines in proportion to test height.

Fig 6. Diagram of urchin measurements taken and spine morphologies. (A) Drawing of normal spine. (B) Drawing of a worn spine. (C) Drawing of Urchin, measurements were taken at the lateral spine row, and one from within 1 cm of the anus. Height was measured as the distance from oral to aboral. (D) Drawing depicting the portion of the spine measured as spine length.

Fig 1

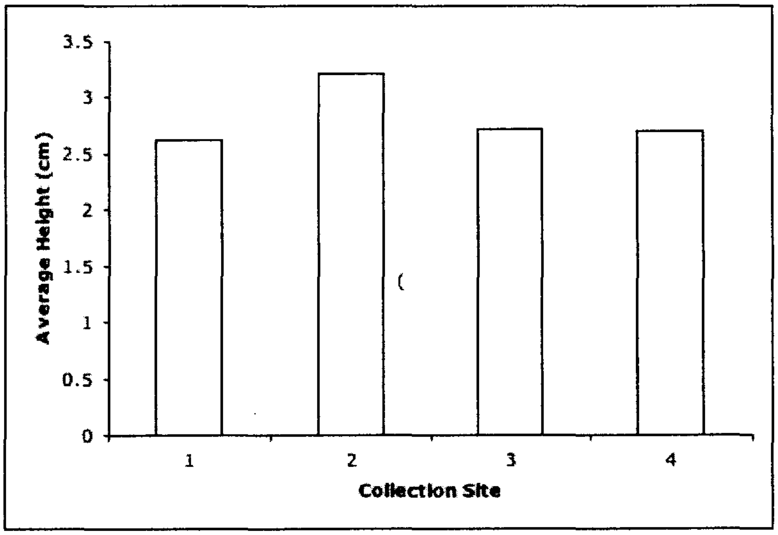



Fig 2

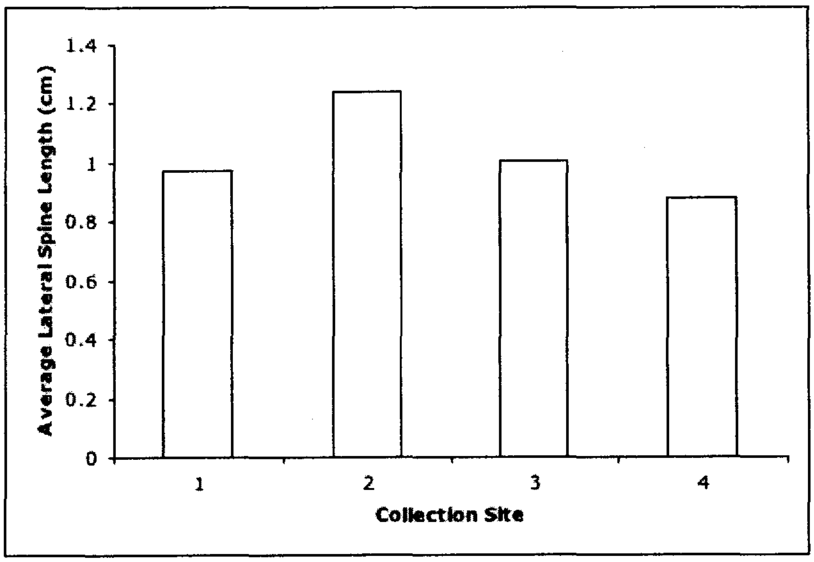



Fig 3

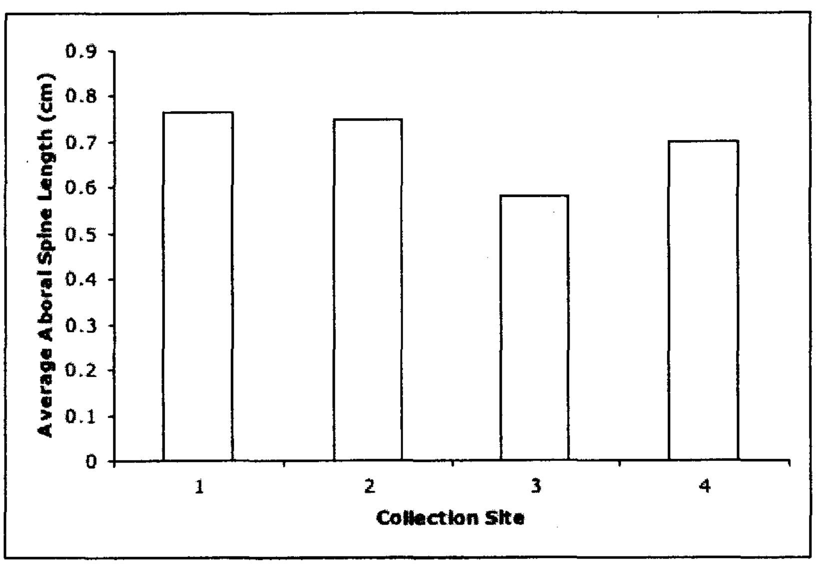


Fig 4

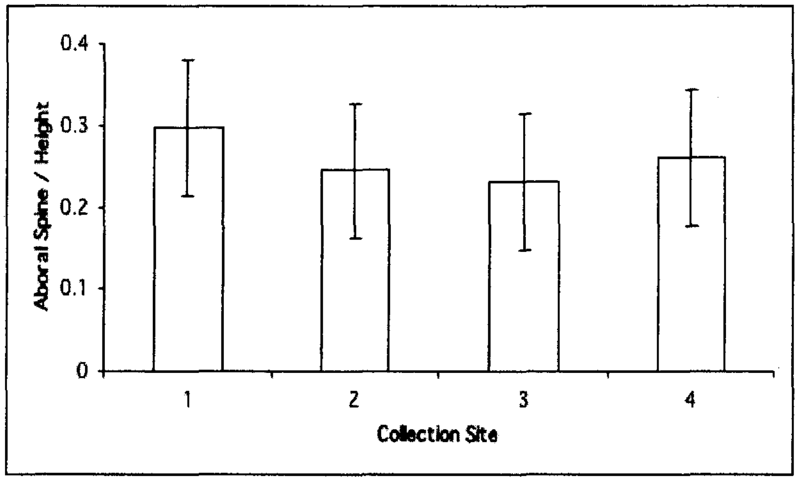

0.4
0.3
0.2
0.1
0
Aboral Spine / Height
1
2
3
4
Collection Site

Fig 5

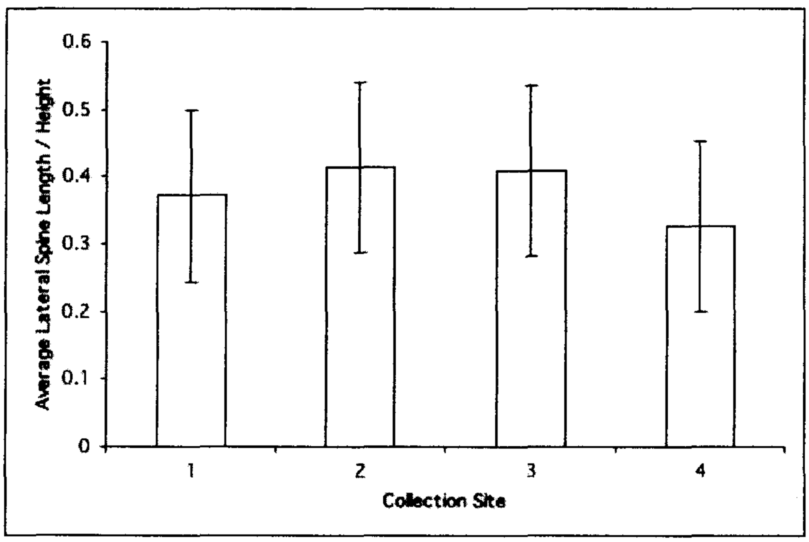
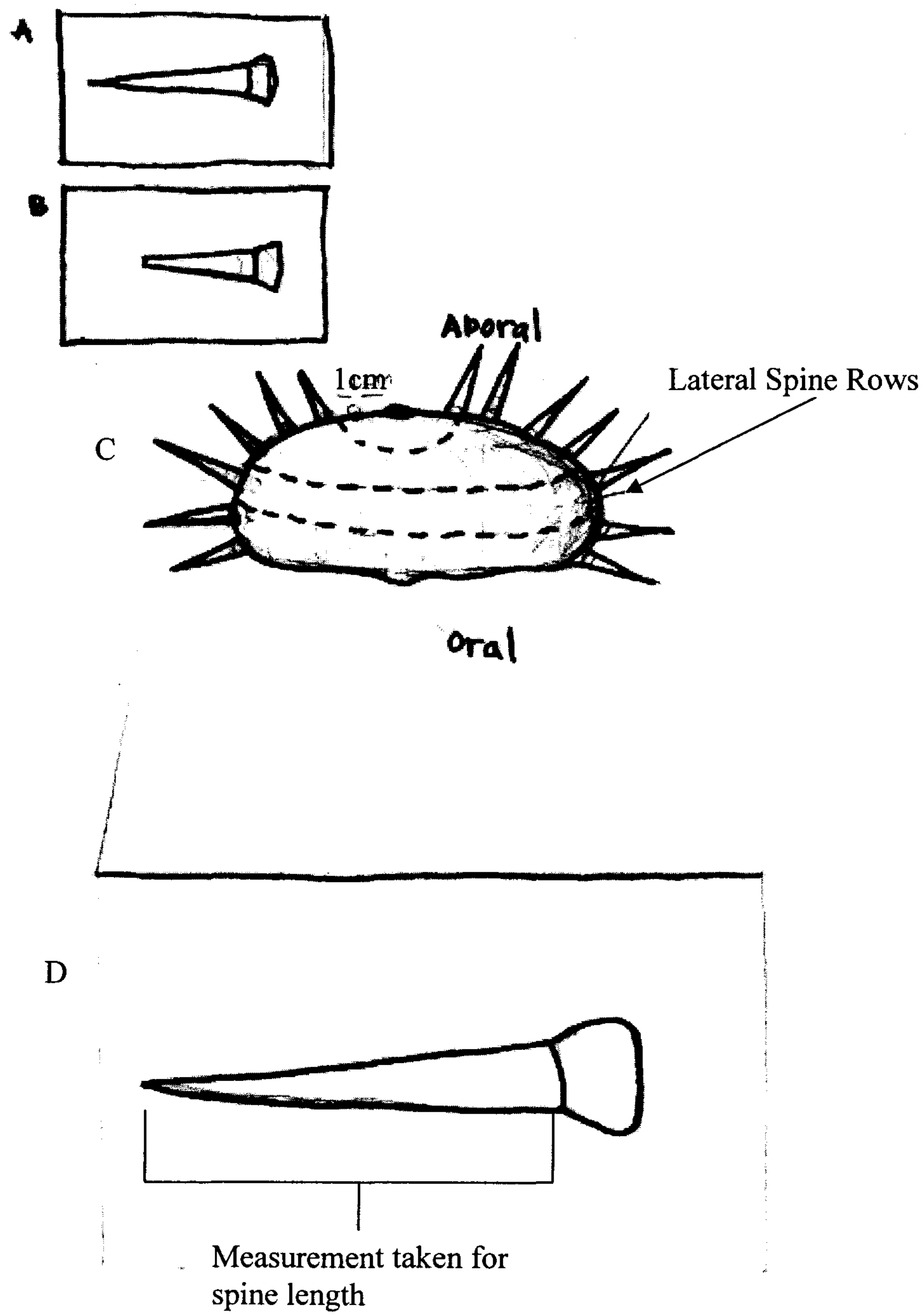

0.6
0.5
0.4
0.3
0.2
0.1
0
Average Lateral Spine Length / Height
1
2
3
4
Collection Site

Fig 6


A
B
Aboral
1cm
Lateral Spine Rows
C
Oral
D
Measurement taken for spine length