A Study of the Whole Body Density in Strongylocentrotus Purpuatus

Purple Sea Urchins

Introduction: Sea Urchins are very complex, simple creatures. The surface of the Sea Urchin is a little miroenvironment for samll organisms who live perminantly and safely among the spines and the predicellan's poisonous jaws[1].

The purple sea urchin seems to be sensitive to low pressure of an ensuing storm. They move into crevasses and hunker down before a storm hits[2] and are commonly found in the low intertidal waters on the edge of infralittoral zones. They are also found in the tide pols of the lower to mid intertidal zone. These animals adapt and adjust to extreme environments by dramatically changing their test[3] (see picture of deep sea sea urchins).

Question: Do the purple sea urchins that enure the crashing waves in the lower intertidal zones have a stronger test as measured by their density (mass/volume) than mid intertidal tide pool purple sea urchins? The mid intertidal tide pool sea urchins I am studying are protected from the surf by a four foot tall rock ledge barrier.

Are the density of purple sea urchins in Sunset Bay a constant?

Method: Collect Sea urchins at low tide keeping track of their position relative to the surf.

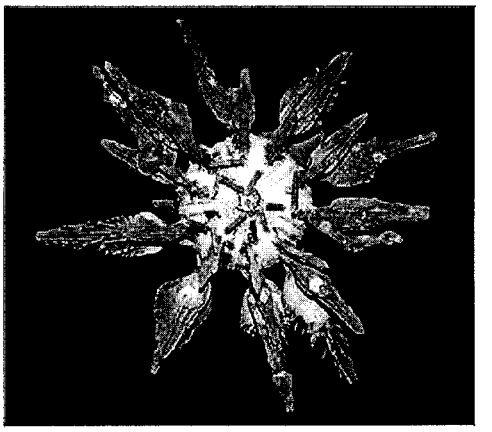
Weighing: A triple beam scale was set up on a flat dry rock and carefully set to zero. The urchins were then collected at low tide and kept in water until weighted to keep the moisture level constant while keeping track of their positions relative to the surf.

Volume: Sea urchins that fit in a graduated cylinder were measured directly. The urchins too large to fit in the graduated cylinder were measured by displacement Archimedes principal. The sea urchins were placed carefully in a container filled to the very top with water. The displaced overflow water collected in a tub was measured in the graduated cylinder to make the volume in millimeters.

Ron Fonte
Exploratory Paper
Data Colleted 07/30/07
Morning Tide of -1.07 ft.

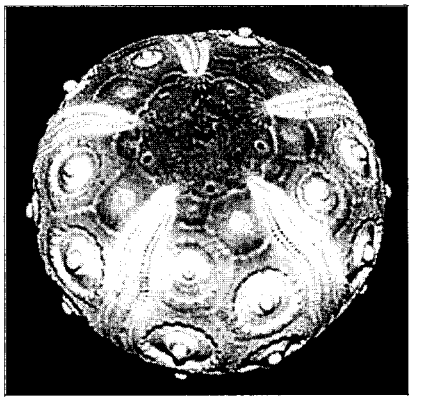
List of sea urchin density group according to zone relative to the surf taken low tide of -1.4 ft

density	standered deviation	
1.41	0.29198	
1.5		
0.91		
0.91		Edge of the high surf zone.
1.18		
1.06		
0.75		
1.5		
1.17	0.11825	
1.25		
0.95		
1.13		Up from the high surf zone ~8 ft.
1.11		
1.11		
0.89		
1.02		
1.18	0.06896	
1.13		
1.05		
1.08		High up from the high surf zone~10 ft
1.17		behind a 8 ft rock wall in an isolated tide pool.
1.08		
1.13		
0.97		

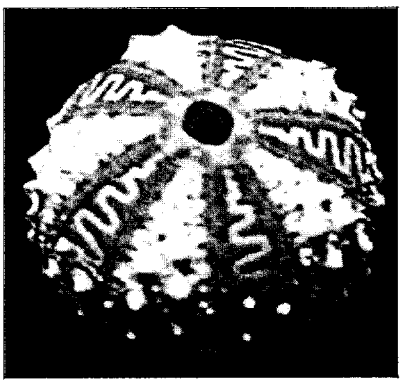


The real puzzle, however, is why the tests themselves, hidden completely from view, are so colorful. I will present a few examples here for you to wonder about.

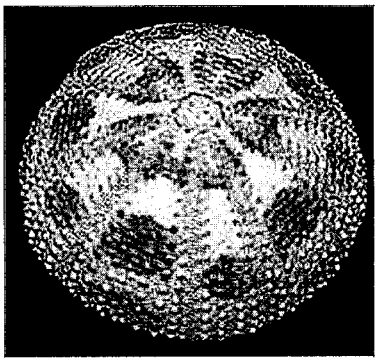
A cidaroid urchin of the genus *Stereocidaris grandis*



A small deep sea genus with a striking pattern: *Coelopleurus interruptus**. This was dredged off the coast of New Caledonia from a depth of 1000 feet. (*Editor's note: Now *C. exquisitus*, with thanks to W. Clarenbach for pointing this out.)



A "mushroom" urchin, *Toxopneustes pileolus*, with delicate coloration and lovely patterns:



#3 Motte

Conclusion:

Although the numbers seem to say yes , the density of the purple sea urchin in sun set bay is constant. The standard deviation of the density is low as well, suggesting the density is constant.

I know it isn't! May be the density within a zone taken at the same relative level might be consistent.1

Temperature must play in here, as an influence. Chemical reactions are driven and stirred by temperature:, growth, development, adaptation and reproduction are all primary chemical reactions, not only for the sea urchins but all living things.(non living things are affected by temp. too).

Qualitatively speaking: I inspected the roe (yoke) of each group by cutting open 3 or 4 individual urchins (egg). The tide pool urchins were more advanced ~25% roe content of body weight. While the surf zone urchins were only ~5% roe. Note: no roe was wasted in this qualitative study; I ate all the roe and presently, I am using this roe energy to write this, so they did not die in vain, not to worry.

I swam in both the surf zone and in the closed sheltered tide pool and noticed a big difference in temperature. I didn't have a thermometer, didn't know it to be significant, Of course a follow up return to the sampling site would shed more light on the subject of temperature and its influence.

What I think is really happening here; even though the surf zone Urchins are being bathed with the high dissolved oxygen of the frothy surf, the temperature wins out as being more influential then the O2 concentration in terms of roe development.

The roe readily sinks in sea water and would contribute to the density when calculated as Mass/volume, giving the numerator more heft, thus the density larger. Its my contention, that the roe and the shell thickness swap off. LOW intertidal sea Urchins have thicker shells but less roe while the tide pool urchins have thinner shell but a lot more roe.

References

1. Carefort, Thomas, Pacific Sea Shore, Department of Zoology, University of British Columbia.

2. Fisheries & Oceans, Canada, Stock Assessment Division, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, B.C. V9R 5K6.

3. Motte, M.G., 1976, Fishing Biology of Sea Urchins in the Family Strongy Locentrotidae.