Height in Relation to Splash Zone of Snail Populations on Champagne Beach

Noelle Adams

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Texas A&M University

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Dominica, W.I.

Dr. Bob Wharton

ABSTRACT

The purpose of this study is to show the various heights and placements of five different groups of West Indian coastal seashells on littoral rocks. The small planaxid *Supplanaxis nucleus* preferred the calmer, less turbulent backside of the rock with greater exposure to the waves. The larger limpets, *Lottia antillarum* and *Lottia leucopleura*, were primarily found on the front side of the rock with greater exposure to the waves.

INTRODUCTION

The Animal Kingdom is divided into two major categories: vertebrates (Chordata or with backbone) and invertebrates (no backbone). The phylum Mollusca falls into this second category. Marine invertebrates evolved over 600 million years ago. They developed and diverged, creating complex shapes, sizes, and colors throughout the years. The fossil evidence has been invaluable in understanding how life has evolved (Sutty 1992). With no backbone, most mollusks form a calcareous shell around themselves for protection and support. All mollusks have a fleshy mantle, which produces this shell. Included in this phylum are clams, oysters, snails, scallops, slugs, as well as squids, octopuses, and chitons. Approximately 100,000 living forms are known throughout the world (Abbott & Tucker 1995).

The largest group of Mollusca is the Gastropods, or *Gastropoda*. These univalves have a single, often coiled shell, valve, head, often eyes, and a toothed radula to tear its food.

They can be either herbivorous or carnivorous. The species discussed in this paper are members of the class *Gastropoda* and the subclass Prosobranchia. The five groups of species used in this report include the Black Planaxis, *Supplanaxis nucleus,* two species of the Nerites, Four-tooth Nerite, *Nerita versicolor* and Tesselate Nerite, *Nerita tessellata*, three species of Periwinkles, Prickly Periwinkle *Nodlittorina tuberculata*, False Prickly-Winkle, *Echininus nodulosus*, and the Zebra Periwinkle, *Littorina ziczac,* and two species of Limpets, the Southern Limpet, *Lottia antillarum* and the Black-Ribbed Limpet, *Lottia leucopleura*.

The first group is the Planaxis, family Planaxidae. The Black Planaxis, *Supplanaxis nucleus* are small brownish/black snails approximately ¼ inch high. They have between 3 and 4 whorls and evenly spaced spiral grooves. The Nerites are part of the family Neritidae. The two species, the Four-tooth Nerite, *Nerita versicolor* and Tesselate Nerite, *Nerita tessellata* are small, usually brightly colored, with a roundish globular shape. They have toothed apertures, which are used for scraping rock for food. They measure approximately 1 inch in height. The Periwinkles, family Littorinidae, are a large family of snails with several different characteristics. The species studied include the two prickly species, *Nodlittorina tuberculata* and *Echininus nodulosus*, and the smooth *Littorina ziczac.* These snails were approximately ½ to1 inch tall with few whorls and spiral grooves. The family Acmaeidae, or the Limpets, are conical, oval, and open at the base. There is no spiral at any stage of growth (Abbot & Morris 1995). The genus Lottia is mainly found in the islands of the West Indies. All of the five groups are usually found in the intertidal waters or on coastal/shore rocks.

MATERIALS & METHODS

All data were observed and recorded at Champagne Beach on the southwest coast of Dominica, West Indies during four days during May 28th through June 2nd. The beach is predominantly comprised of small to large, well-rounded igneous rocks. I selected seven of the larger rocks within 150 feet of each other on the beach. All had similar positions relative to distance from the water line. Data were collected in the morning between 9 and 10:30 AM during low tide. Each rock was measured from the base up in increments of one foot and separate records were kept for the front and backside of each rock. Each of the five groups (Planaxis, Nerites, Prickly and Smooth Periwinkles, and Limpets) was counted in each zone and recorded each day data were collected. A percentage of each species present in each zone was calculated from the total number of species collected in each zone. The number of species per square foot was calculated for the Planaxids and the Limpets. Means for each group were calculated from the four daily totals. Materials were minimal and included only a shell field guide, tape measure, paper and pencil. The data collected could be easily replicated with minimal difficulty.

RESULTS

I found that the Planaxid, which is the smallest species of snail studied, tended to attach itself to the lower areas of rock in which waves of water were frequent but in which little splash occurred i.e. less turbulent water. This area tended to be either at the back base, as in rock 1, 3, 6, and 7, or at the front of the rock where the waves reached infrequently, as

in rock 4. Figures 1-5 show the percent abundance of Planaxis at lower heights. Figure 6 shows the average number of Planaxids per square foot for rocks 1,3,6, and 7.

The two limpet species tended to be at the higher splash zone where the waves were more frequent and they were more directly exposed to wave action than the Planaxids. Figures 7-9 show the relatively high percent abundance of limpets on the lower font side of rocks 1 and 5 and on the back of rock 5. Figure 10 shows the number of limpets per square foot for these rocks.

DISCUSSION

The data in table 1 suggests that there is a strong relationship between the amount of splash the rock receives and the type of species that usually reside there. As shown in figures 1-5, the smaller Planaxid was usually found at the bottom and towards the back of most rocks that were closer to the coastline. Rocks 1 and 5 were similarly sized and approximately equal distance from the water line. Rock 5 appeared to receive slightly more splash than rock 1. Rocks 2 and 3 were behind rock 1 and rocks 6 and 7 were behind rock 5 (see figures 11 and 12). These four rocks (2,3,6,and 7) experienced a reduced amount of direct wave action but water did regularly flow up the beach onto them so that many species of snails were able to congregate there. These “back” rocks also had a high percentage of Planaxids on them as figures 4 and 5 demonstrate. Figures 7-10 show the high amount of limpets, usually on the lower front, on rocks 1 and 5 that, as stated before, received the highest amount of direct wave action.

Figures 6 shows the high abundance of Planaxids within 1 foot of the base on rocks 1,3,4,6, and 7. These areas did not receive a high amount of turbulent wave action but were subjected to a substantial level of water flow.

In future studies, one might be able replicate this observational experiment and in addition, develop and test hypotheses as to why these species prefer different amounts of splash. One possible explanation might be the size of the snail and its ability to adhere to the rock surface.

REFERENCES

Abbott, R. Tucker, Percy A. Morris. 1995. A Field Guide to Shells; Atlantic and Gulf Coasts and the West Indies. Houghton Mifflin Company, Boston.

Abbott, R. Tucker, Robert E. Lipe. 1991. Living Shells of the Caribbean and Florida Keys. American Malacologists, Inc., Florida.

Sutty, Lesley. 1990. Seashells of the Caribbean. The Macmillan Press Ltd., London.

Table 1. Means for each group of species: Planaxids, Nerite, Prickly Periwinkles, Smooth Periwinkles, and Limpets

AVERAGES OF SPECIES

Rock 1

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	84.68%	7.31%			8.01%
Front 1 ft.					
Back 2 ft.	14.43%	16.17%	59.18%	7.17%	3.06%
Front 2 ft.					100.00%
Back 3 ft.	18.24%	0.90%	52.93%	27.47%	0.45%
Front 3 ft.	41.89%	8.70%	3.26%	1.63%	44.52%
Back 4 ft.	0.71%	1.43%	39.22%	33.63%	
Front 4 ft.	60.33%	6.79%	29.99%	2.89%	
Back 5 ft.			36.25%	63.75%	
Front 5 ft.	7.69%		77.68%	14.62%	

Rock 2

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	25.00%	25.00%			
Front 1 ft.	55.32%	14.85%	10.16%	3.13%	16.55%
Back 2 ft.		25.00%	25.00%		
Front 2 ft.	2.50%	4.03%	57.62%	35.85%	
Back 3 ft.		3.57%	41.07%	19.64%	10.71%
Front 3 ft.		16.67%	35.28%	48.06%	

Rock 3

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	94.86%	1.58%			3.55%
Front 1 ft.	48.61%				1.39%
Back 2 ft.	47.83%	51.09%			1.09%
Front 2 ft.	97.79%	1.92%			0.29%

Rock 4

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	50.00%				
Front 1 ft.	93.43%	0.32%			6.25%
Back 2 ft.			16.67%	33.33%	
Front 2 ft.	65.67%		2.27%	32.06%	
Back 3 ft.			25.00%		
Front 3 ft.				25.00%	

Rock 5

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.					50.00%
Front 1 ft.					50.00%
Back 2 ft.			1.92%		98.08%
Front 2 ft.					25.00%
Back 3 ft.			21.08%	15.59%	38.33%
Front 3 ft.			20.42%	29.58%	
Back 4 ft.		0.76%	53.15%	46.10%	
Front 4 ft.				72.92%	2.08%

Rock 6

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	96.00%	3.51%			0.49%
Front 1 ft.	25.00%	25.00%			
Back 2 ft.	2.50%		58.33%	39.17%	
Front 2 ft.	5.00%	45.00%		25.00%	

Rock 7

	Planaxids	Nerites	Prickly Periwinkles	Smooth Periwinkles	Limpets
Back 1ft.	94.30%	5.70%			
Front 1 ft.	25.00%		6.25%	18.75%	
Back 2 ft.	15.63%	2.78%	21.88%	34.72%	
Front 2 ft.	20.00%		5.00%		

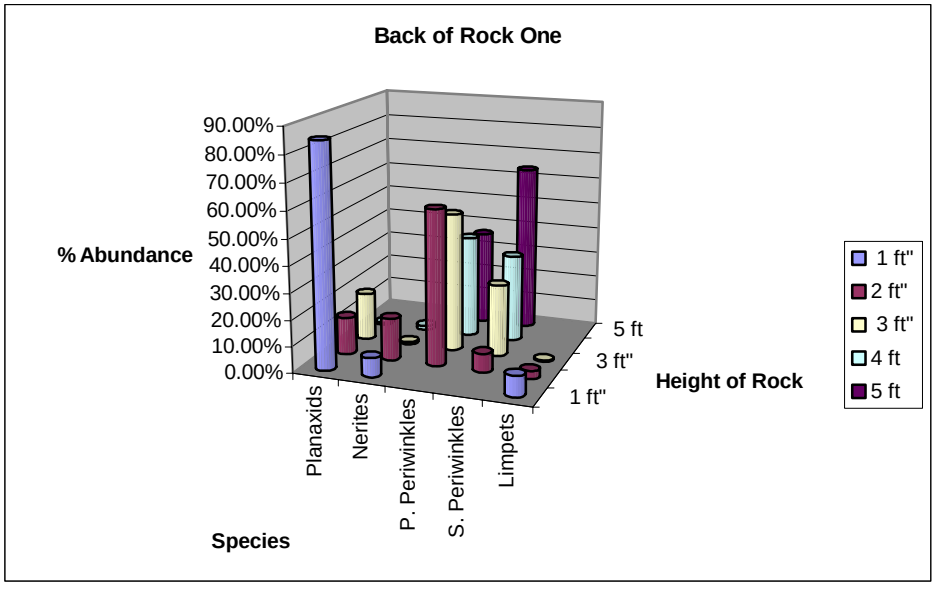

Figure 1: Abundance of 5 groups of gastropods at the back of rock one.

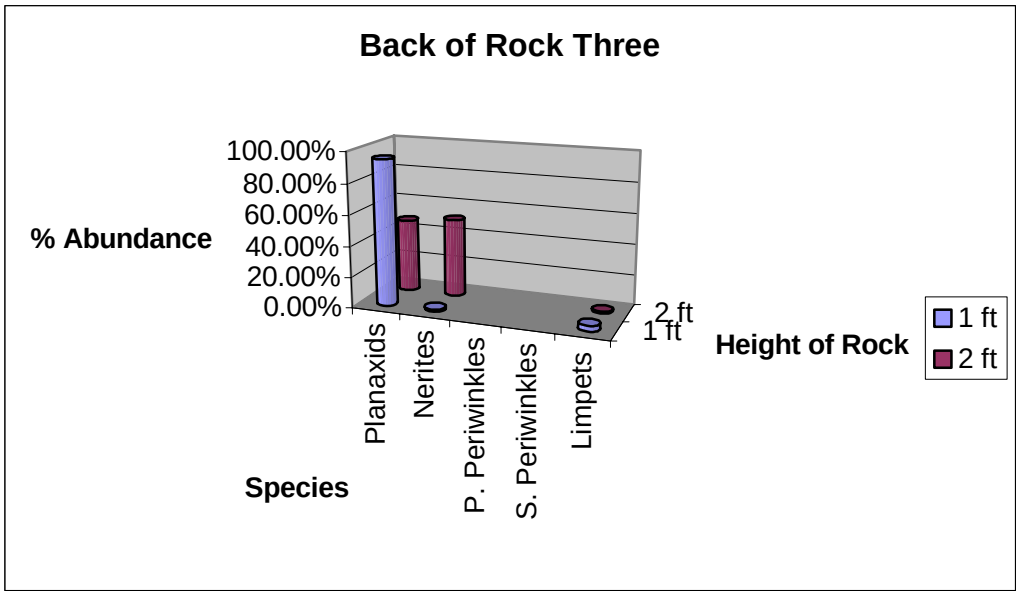

Figure 2: Abundance of 5 groups of gastropods at the back of rock three.

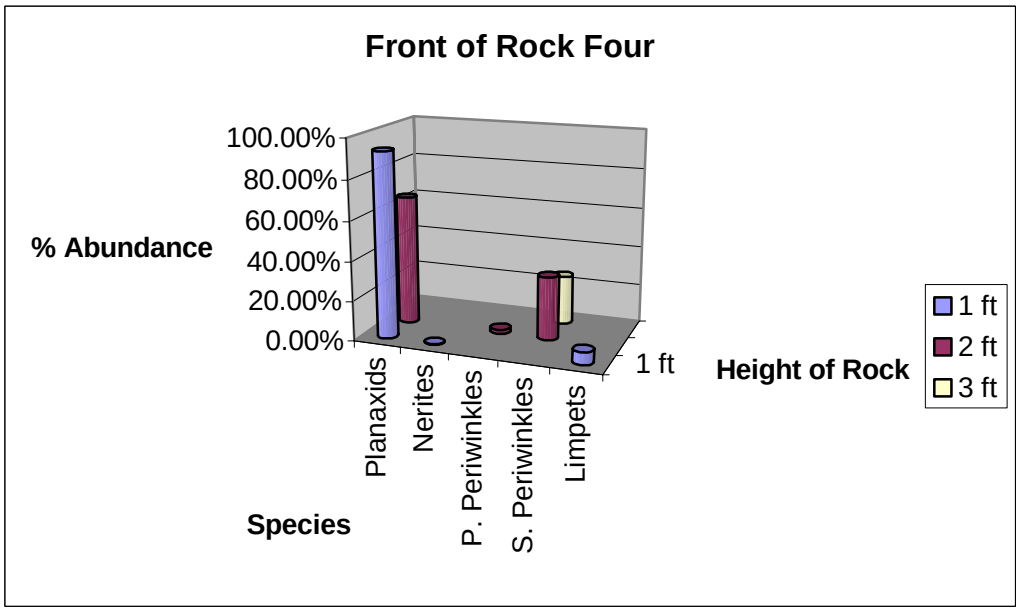

Figure 3: Abundance of 5 groups of gastropods at the front of rock four.

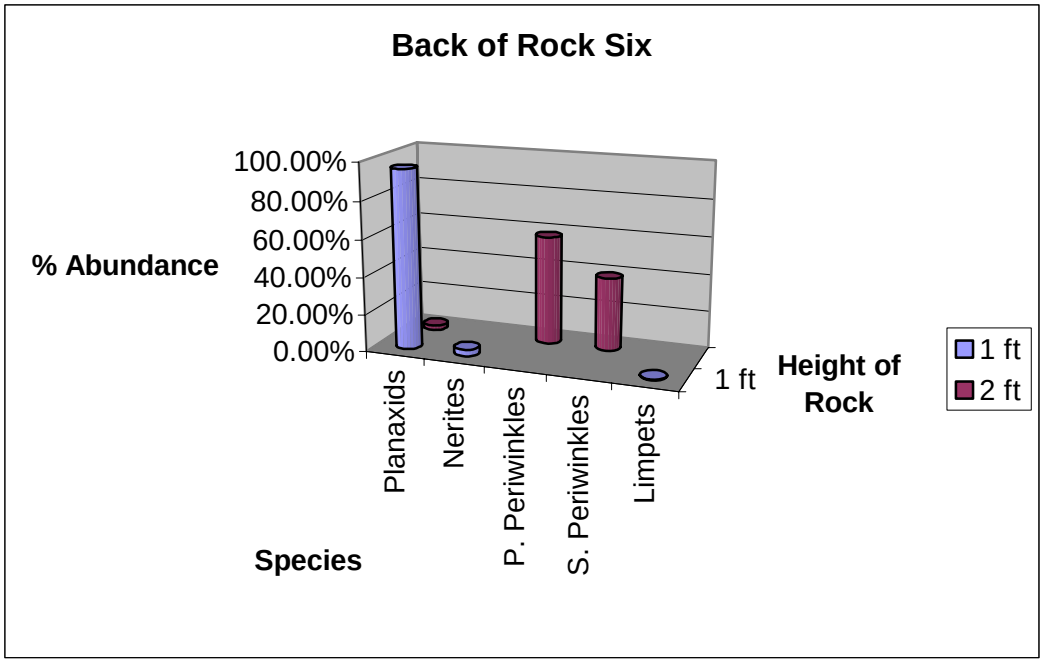

Figure 4: Abundance of 5 groups of gastropods at the front of rock six.

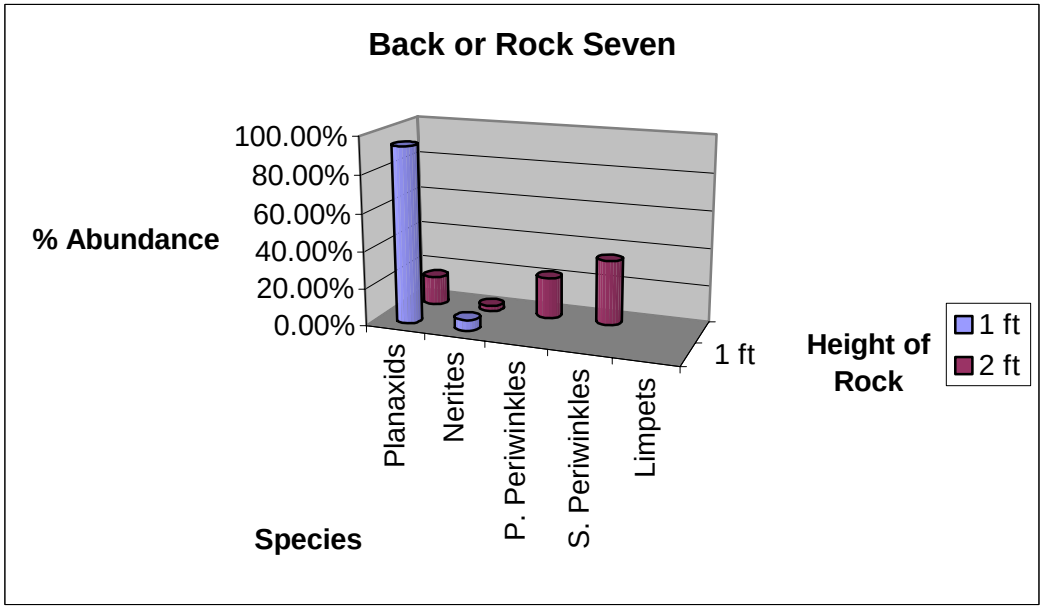

Figure 5. Abundance of 5 groups of gastropods at the back of rock seven.

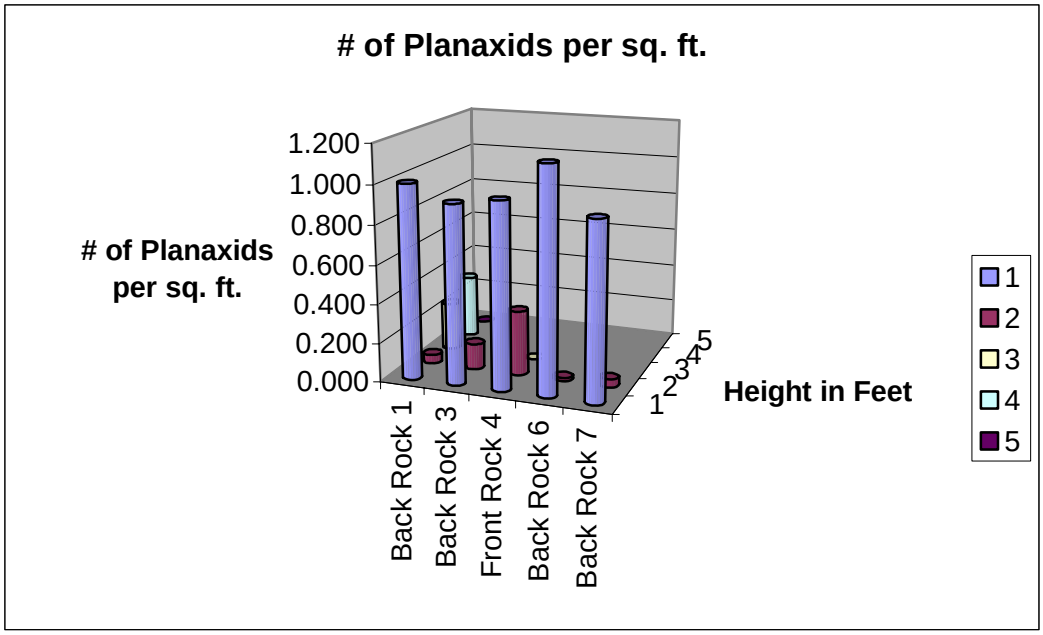

Figure 6. The number of Planaxids per square foot for the front of rock 4 and the back of rocks 1,3,6 and 7

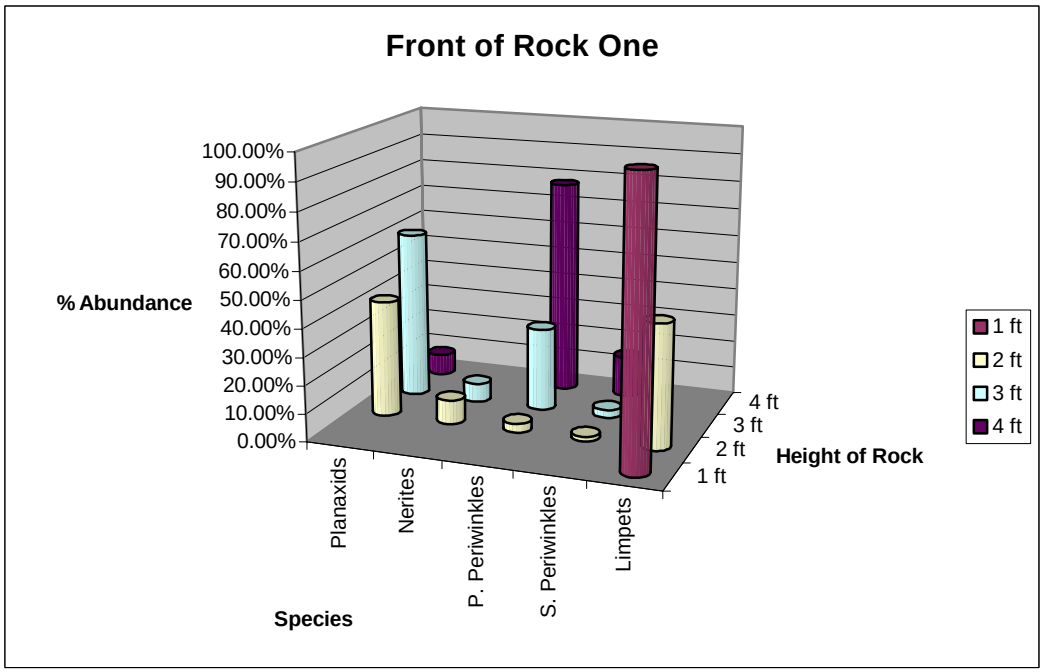

Figure 7. Abundance of 5 groups of gastropods at the front of rock one.

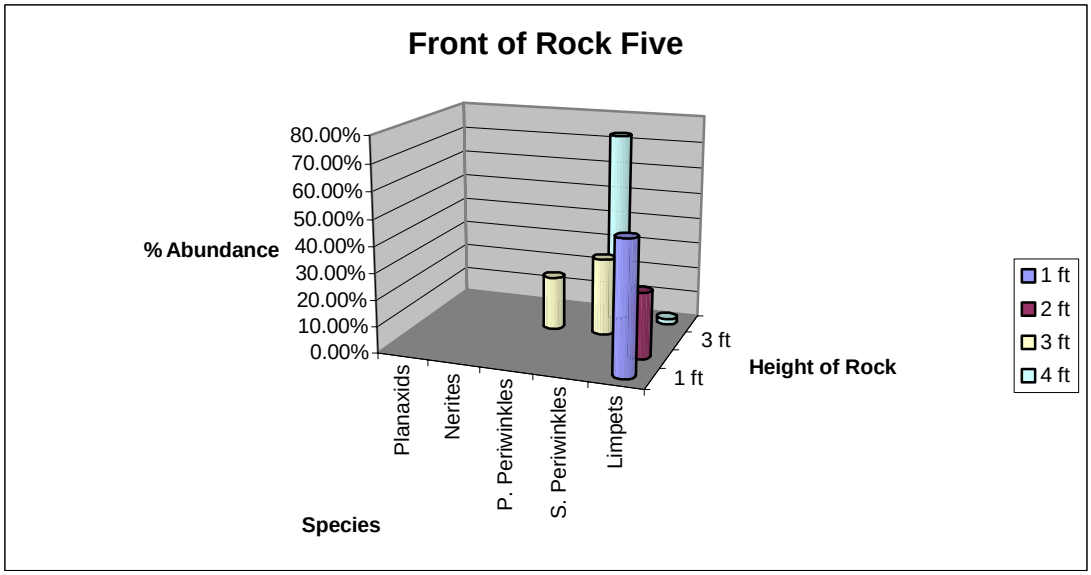

Figure 8. Abundance of 5 groups of gastropods at the front of rock five.

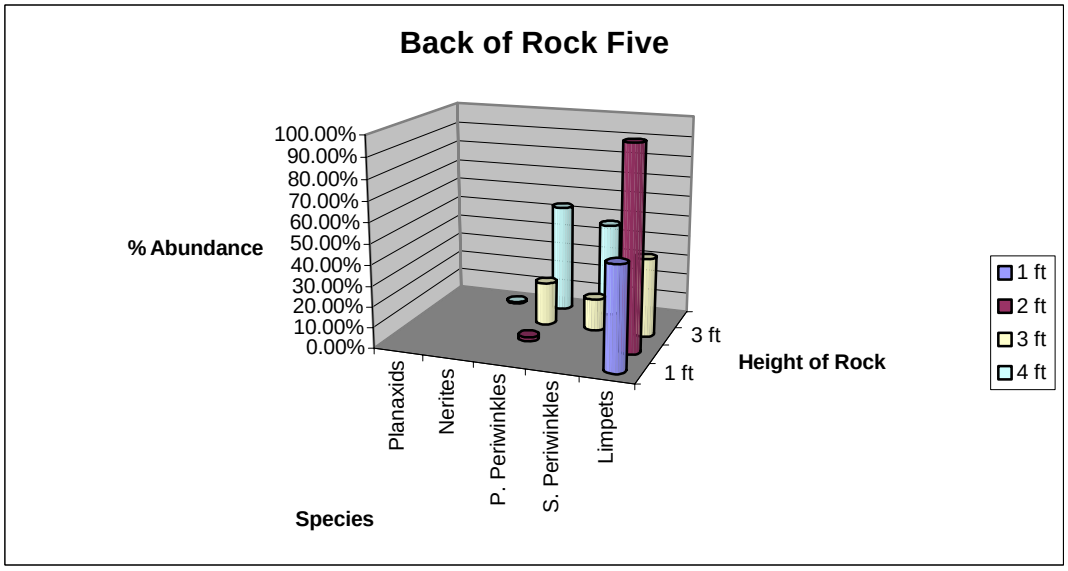

Figure 9. Abundance of 5 groups of gastropods at the back of rock five.

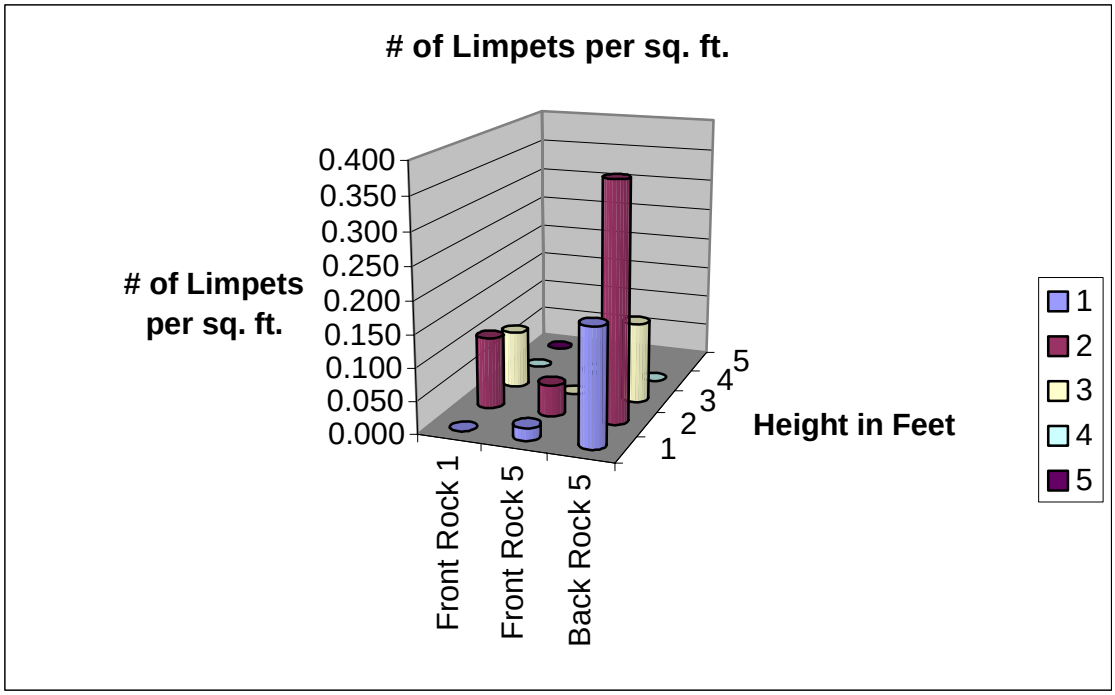

Figure 10. The number of Limpets per square foot for the back of rock 5 and the front of rocks 1 and 5

Figure 11. Rock 1 in back, 2 front left, 3 front right

Figure 12. Rock 5 in back, 6 front left, 7 front right