

Title: Analysing the biotic and abiotic features of a rock platform ecosystem by determining the distribution and abundance of two biotic species (Neptune’s Necklace and Black Periwinkle) by collecting data using quadrats along a transect line and measuring the abiotic features by collecting data using specific instruments/equipment.

Introduction:

The results included for this experiment was collected from a rock platform ecosystem at Cronulla beach. A *rock platform* is an eroded rocky region along the coastline, usually containing small pockets of water in which a variety of plants and animals inhabit (called rock pools). This expanse of rocky region contains a range of biotic and abiotic features. Anything that is *biotic*, is associated with life or living organisms. This includes the diverse plants and animals that dwell in rock platforms. Neptune’s Necklace is an example of a *native plant* found in the rock platform ecosystem that will be analysed in further depth in this report. Neptune’s Necklace is an olive-brown coloured marine algae made up of many hollow, water-filled, oval beads joined together to form a chain that looks much like a necklace. Black Periwinkle is an example of a *native animal* found in the rock platform ecosystem that will also be analysed in this report. Black Periwinkles can be identified by their thick, small, black shells and white underside. Both of these species are biotic features of the rock platform ecosystem. As opposed to the biotic features, anything that is *abiotic*, is non-living and not derived from living organisms. An example of a *biotic feature* that can be measured in the rock platform ecosystem is water temperature. Water temperature can greatly affect the quality of the water, and in turn the aquatic plants and animals. The diverse mix of biotic and abiotic factors in the rock platform are closely interlinked and this makes it a very unique ecosystem.

Aim: To analyse the biotic and abiotic features of a rock platform ecosystem by determining the distribution and abundance of two biotic species (Neptune’s Necklace and Black Periwinkle) by collecting data using quadrats along a transect line and measuring the abiotic features by collecting data using specific instruments/equipment.

Materials:

- Transect line (at least 35m)
- 1m x 1m Quadrat
- 3 x Thermometer
- 3 x Silver nitrate
- 3 x Anemometer
- 3 x Light meter
- 3 x Universal indicator
- 3 x Sample bottle
- Pen
- Paper

Method:

Biotic features

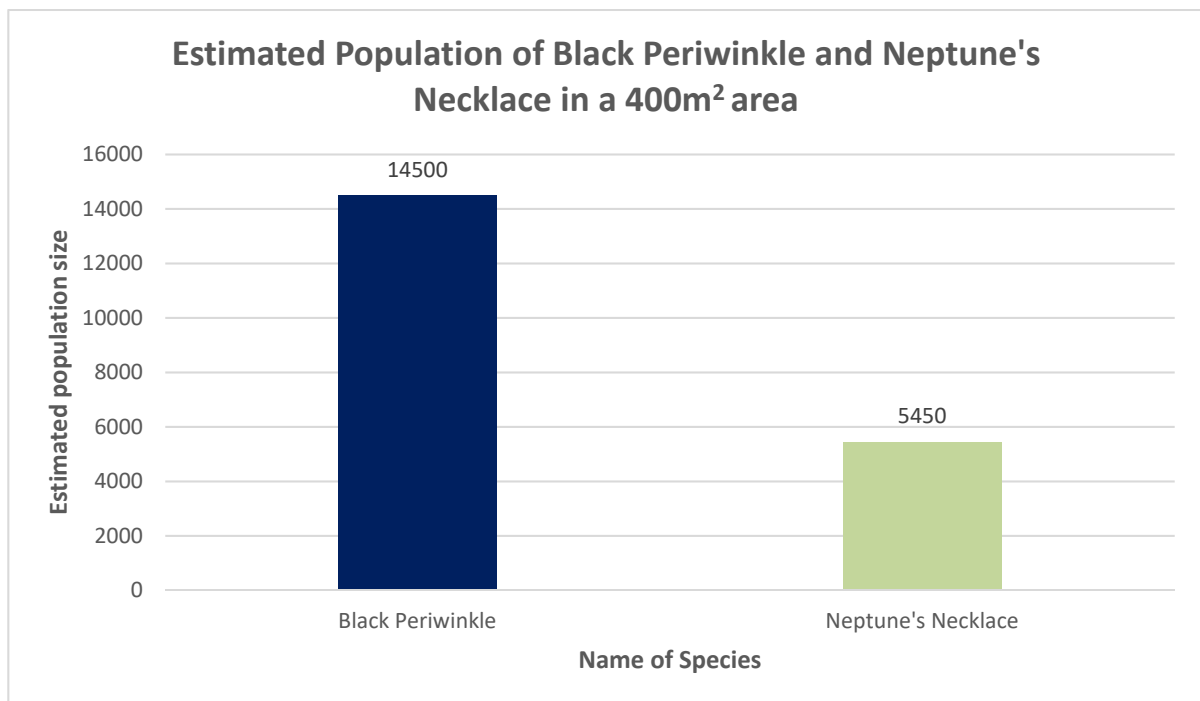
- **Step 1:** Set up the transect line starting from the base of the sea water, up the rock platform and into the sand until 35m is reached.
- **Step 2:** Place the quadrat at the start of the transect line at the base of the water which is 0m and count the number of Neptune's Necklace and Black Periwinkle that are within the quadrat. Record this on paper.
- **Step 3:** Repeat step 2 once at 5m, 10m, 15m, 20m, 25m, 30m and 35m on the transect line.

Abiotic features

- **Step 1:** Split the group into three. Each group should separately do Steps 2-9.
- **Step 2:** Measure the air temperature of the exposed rock surface and rock surface under a boulder by using a thermometer. Record results.
- **Step 3:** Measure the water temperature in of the ocean and rock pool using a thermometer. Record results.
- **Step 4:** Measure the salinity by collecting a sample of ocean water by dipping the sample bottle in the ocean and filling it up. Add a few drops of silver nitrate and look for colour change. Record results.
- **Step 5:** Repeat step 4 for the rock pool water.
- **Step 6:** Measure the wind velocity of the exposed rock surface and the rock surface under a boulder by using an anemometer. Make sure to hold the anemometer away from the body when measuring to ensure that wind flow is not interrupted. Record results.
- **Step 7:** Measure the light intensity of the exposed rock surface and rock surface under a boulder by using a light meter. Record results.
- **Step 8:** Measure the pH of the ocean by collecting a sample of ocean water with the sample bottle. Add a few drops of the universal indicator in the sample and compare the colour the sample turns to a pH chart to determine the pH. Record results.
- **Step 9:** Repeat step 8 for the rock pool water.

Results:Biotic features

Number of Black Periwinkles and Neptune's Necklaces in each quadrat measured of a total site of 400m²		
	Black Periwinkle	Neptune's Necklace
Quadrat 1 (0m)	25	36
Quadrat 2 (5m)	74	21
Quadrat 3 (10m)	47	35
Quadrat 4 (15m)	39	12
Quadrat 5 (20m)	28	0
Quadrat 6 (25m)	17	0
Quadrat 7 (30m)	27	5
Quadrat 8 (35m)	33	0
Total area measured by the quadrats	$8 \times 1\text{m}^2 \text{ quadrat} = 8\text{m}^2$	8m^2
Average number of species/m ²	$(25 + 74 + 47 + 39 + 28 + 17 + 27 + 33) \div 8\text{m}^2 = 36.25 \text{ species/m}^2$	13.625 species/m ²
Estimate for the total population size in 400m ² area	$36.25 \text{ species/m}^2 \times 400 \text{ m}^2 = 14\,500 \text{ species}$	5450 species



Abiotic features

Abiotic Factor	Measurements			Average*	Instrument used
	Group 1	Group 2	Group 3		
Air temperature (°C) - Exposed rock surface - Rock surface under boulder	30 27	27 25	28 26	$(30+27+28) \div 3 =$ 28.33 26	Thermometer
Water temperature (°C) - Ocean - Rock Pool	24 25	23 26	23 25	$(24+23+23) \div 3 =$ 23.33 25.33	Thermometer
Salinity (ppt) - Ocean - Rock Pool	40 45	39 43	39 44	$(40+39+39) \div 3 =$ 39.33 44	Silver nitrate
Wind Velocity (kph) - Exposed rock surface - Rock surface under boulder	2.5 1.4	2.7 1.7	2.9 1.5	$(2.5+2.7+2.9) \div 3 =$ 2.7 1.53	Anemometer
Light intensity (Lux) - Exposed rock surface - Rock surface under boulder	690 7	700 25	670 15	$(690+700+670) \div 3 =$ 686.67 15.67	Light meter
pH - Ocean - Rock Pool	7 7	7 6.5	6.5 7	$(7+7+6.5) \div 3 =$ 6.83 6.83	Universal indicator

*rounded off to 2 decimal places

Discussion:

The biotic results clearly show that the abundance of Black Periwinkle is significantly higher than that of Neptune's Necklace in the rock platform ecosystem with the population of Black Periwinkle in a 400m² area estimated to be 14 000 and Neptune's Necklace 5 450. This may be due to the fact that Black Periwinkles are more widely distributed in the rock platform ecosystem than that of Neptune's Necklace, which are only limited to inhabit areas closer to the shore typically at mid-tide level. This is shown in the results as the distribution of the black periwinkle is rather even except for a clustering at 5m and the Neptune's Necklace is distributed higher near the shore (0-15m).

In the abiotic results, air temperature of the rock surface under a boulder is slightly cooler than that of the exposed rock surface. This may be because the rock surface is constantly exposed to the sunlight, making it heat up more compared to the rock surface under the boulder which is shaded.

The water temperature of in rock pools are generally warmer than in the ocean. This may be due to the waters in rock pools being shallower, making it easier to heat up than the water in the ocean.

The results also depict that salinity levels are higher in the rock pools than in the ocean. This is because the water in rock pools may not be regularly refreshed with ocean water, causing the water in shallow rock pools to be continually evaporate, leaving dissolved minerals, mostly salt, in the remaining water. Therefore, the concentration of salt in rock pool water reaches levels higher than that of ocean water. Very few plants and animals can live in areas of high salinity levels.

Wind velocity is higher on exposed rock surfaces than rock surfaces under boulders. This is because air flow is not restricted or interrupted on exposed rock surfaces as they have larger contact with the open air as opposed to the rock surface under a boulder. Wind flow is much more restrictive as under a boulder as obstacles such as other rocks can block air flow.

The light intensity on an exposed rock surface is considerably greater than the rock surface under a boulder for obvious reasons. The exposed rock surface has larger contact with the sun, therefore it receives a much higher light intensity than the rock surface under a boulder with has little light from the shade of the boulder.

The results record that the pH levels in the ocean and in the rock pools are the same. This may be because the water in rock pools typically originate from the ocean, resulting in both waters retaining the same pH level.

Conclusion:

In conclusion, the experiment was successfully completed as the aim which was to analyse the biotic and abiotic features of a rock platform ecosystem was fulfilled. The distribution and abundance of Neptune's Necklace and Black Periwinkle was determined. The abundance of the Black Periwinkle is significantly higher than Neptune's Necklace and more widely distributed while Neptune's Necklace has a lower abundance and distributed closer to the shore. The abiotic features were also measured and analysed. The air temperature, wind velocity and light intensity are higher on exposed rock surfaces than under a boulder and water temperature and salinity are higher in rock pools than

in the ocean. The pH levels are however, the same in both the rock pool and the ocean. The biotic and abiotic features contribute to make a unique rock platform ecosystem.