Marine and coastal ecosystems degradation assignment

On the 23rd of August, the three biology classes or grade 11 at Redlands College visited the rocky shore ecosystems at Point Cartwright in Queensland. Two different types of rocky shore ecosystem were examined, the rock pool area, and the Boulder area. We first examined areas within the rock pool area. The rock pool area has several specific features which set it apart from other rocky shore ecosystems, including its geological makeup and position.

It is made up of a flat platform of rock pockmarked with numerous rock pools; indents in the rocks which are filled with water and contain numerous forms of marine life. These pools can vary in size, from small cracks in the rock which have a changing water level or huge crevices which almost always have a level of water in them. Each rock pool has different species of marine life, in varying numbers. The platform lies at the base of a cliff, and is usually sheltered from the constant barrage of waves, except occasionally at high tide when the occasional wave will replenish the water in each rock pool.

However, the platform can become quite windy, as there is no shelter from an onshore wind. The classes from Redlands College were constantly buffeted by the onshore wind while they were there, giving them an idea of the sought of conditions the pools are subject to every day. These abiotic factors define the type of organisms present in the rock pool area as the organisms need to withstand the effects of the abiotic factors and still be able to carry out the processes required for them to survive. The effect of each abiotic factor and resulting population in each area will be examined in more detail later in the report.

The second ecosystem examined was the boulder area. The boulder area consisted of a number of boulders clumped together on the sandy shore at Point Cartwright beach in the inter-tidal zone. The boulders themselves were all clumped together, forming small pools of water whose water level changed with the flowing tide. As they were on the shore, they were constantly buffeted by waves; however, the boulders provided some degree of shelter from the waves. The boulders closer to the shore were dryer, except as the tide flowed out, small pools would form which could contain marine life.

These pools would be unaffected by the tide, but were less sheltered, and could be venerable to evaporation. Each area, and the organisms present were affected by both biotic and abiotic factors, which set the areas apart and helped to define each one. Data: From the data collected from both the Boulder area, and rock pool areas numerous and varying trends and relationships within the data can be identified. The most prominent of these is the difference in the species of the organisms present in the rock pool and boulder areas. Whilst some organisms lived in both areas, there were others that only lived in their specific area.

Organisms like anemones, sea urchins and zoanthids are all organisms that were present in the rock pools, but not in the Boulder area. This can be contributed to the abiotic factors and differences in these factors in each area. The rocky pool area is relatively sheltered from wave action which allows more soft-bodied organisms which cannot constantly be buffeted by waves such as zoanthids and sea anemones to live without being carried off

their rocks by a current. Another difference in the abiotic factors of each area is water.

In the rock pools, there is constant water as most of the pools do not have a draining passage, and are filled up by the occasional wave that breaches the platform. Organisms like zoanthids, sea urchins, and anemones require constant water to survive, which is why they thrive in areas such as rock pools. Some zoanthids that were on the edge of the rock pool had emerged from the waterline as it dropped slightly, these zoanthids were slightly paler than the rest of the colony, and had closed up to try and conserve water. Sea anemones feed from the surrounding water by catching small micro-organisms in their tentacles.

For this reason, anemones need constant water to survive which is why none were observed in the Boulder area as an area with constant water cannot be guaranteed. Sand is another factor which is present in the Boulder area, but not in the rock pools. Sea cucumbers were thriving closer to the low tide mark in the Boulder area, yet none were observed in the rock pool area. Sea cucumbers are almost always found laying spread out across the sand, with their feeding tubes out, browsing along the sand bed. This is the feeding habit of the sea cucumber and it would not be able to carry out this habit without the presence of sand.

It is shown time and time again by the presence and habits of specific organisms in each area that the abiotic factors of each area affect the ability for an organism to survive in that system. See next page for transect table taken at Point Cartwright boulder area. (TRANSECT TABLE INSERT HERE!)

Figure 1: Green Algae Percentage of Algae Cover (%) Metres from shore (M)

Figure 2: Limpets Number of Limpets in Sector Metres from Shore (M) As seen in figure one, percentage of cover of green algae in each transect sector decreased the further from shore we travelled, and closer to the low tide mark.

This is a clear example of an organism’s ability to thrive depending on its position in the Boulder area. This could be due to a number of factors, the first of these being first-order consumers. Limits’ primary food source is algae; they graze along the boulders feeding upon it as they go. The gradual decrease in algae may correlate directly to the gradual increase in limits as the transect line progresses. As there are more limits to eat the algae in that vicinity, the algae coverage may decrease. Another possible cause for the decrease in algae coverage is the abiotic factor of wave action.

Algae is not like normal plants, for it does not have a supporting structure like plants do in their fluid-filled supporting cells. As a result, Algae is fragile and cannot withstand a constant pounding of waves without breaking up. Strong wave action is seen near the low tide mark when the tide goes out, and come back in, which may result in a decrease in algae coverage. Analysis: Before the grade 11 biology classes visited the rocky shore eco-systems, they made a number of predictions on the organisms previously studied in class. These predictions included population density, distribution, presence of food, and predators.

Since traveling to Point Cartwright, I have found a large amount of my predictions to be extremely inaccurate. Whilst some to be accurate.

Particularly my predictions on population density were far from reality. I predicted that algae coverage in the Boulder area would average around 20 % increasing as we got closer to the low tide mark, and further from the shore. This was completely opposite to our findings at the Boulder area. There wasn’t an average algae cover percentage at all, as it varied significantly from quadrat to quadrat as we progressed.

Not only that, but it decreased as we ventured further out from the shore, completely disproving my earlier predictions. I predicted that the mulberry population would be quite high in the areas we visited (around 3-5 per square metre in certain areas including crevices and moist rock pools). Yet my predictions were contradicted once again by my findings. We came across no mulberry shells in the rock pool we examined, nor did we find any along our transect line. This could be because they are quite rare in the areas we explored, or that they were well hidden.

We searched in the cracks in the rocks but could find no mulberry shells. My predictions on the zoanthid population were reasonably accurate. My prediction was that they would only exist in areas of constant water and cover 0 – 2% in the areas they could possibly inhabit. This prediction was accurate in that we only found zoanthids at the rock pool area which is the only place that can guarantee constant water. Also, they covered roughly 5% of the pool we drew diagrams of. The accuracy of my predictions about distribution also varied.

My predictions on algae and mulberry shells were wring again, as the mulberry shells were not spread out across the shore, and the amount of

algae did not increase as we travelled further from the shore. My predictions on zoanthids were in fact accurate again. We found no zoanthid colonies living above water was they need constant immersion. My predictions on food presence were accurate as zoanthids and algae photosynthesise, as the sun was present, the plants photosynthesised. Mulberry shells eat barnacles and other shells attached to the rocks.

There were organisms like these everywhere we observed, leaving no lack of food for a mulberry shell. My predictions on predator presence were also accurate. There were algae eaters both above and below the water line such as limits and algae eating fish. Birds were everywhere on the surrounding cliffs and in the sky during low tide, meaning any exposed mulberry shell could be eaten. My predictions on zoanthids were somewhat inconclusive. I did not observe any organisms eating the zoanthids in the rock pool, but I did not get to see any below the low tide mark as I didn’t have the means to go there.

However, if there were zoanthids below the low tide mark in the Boulder area, predators would be present as some marine fish feed on zoanthid polyps. The huge differences between the two different ecosystems we examined where most prominent in the types of organisms found. However, the only reason that these organisms differed in their species so much is because of the physical environment. The different abiotic factors in each area allowed some organisms to survive, while disallowing others, effectively controlling the organisms in each area.

The abiotic factors that differ most include wave action, wind, water and sand. The wave action towards the low tide mark in the Boulder area is much stronger than that of the rock platform. The platform is largely protected against wave action allowing more soft-bodied organisms to live in the rock pools. The rock platform has no jutting rocks which would provide shelter. The Boulder area is made up of boulders, sheltering organisms from wind. This is why most of the organisms living on the rock platform have a mechanism to hold onto the rock and stop the organism from being blown away.

You would think for all ecosystems on the ocean, water would be the same for each system. However, this is wrong, as the presence of water can still be a defining factor between the boulder and rock pool areas. In the rock pools there is always water as when high tide comes around, the pool is replenished. It is not the same for the Boulder area as the small pools left behind when the tide goes out can dry up because they are shallow. The rock pools provide a safe area for organisms to live that need constant water to survive, such as zoanthids.

Sand is the bed of the Boulder area, but is rare in the rock pools on the platform. Sand is used as a protection method for some organisms like crabs who bury themselves in it and as a food zone for grazers like sea cucumbers. This is why fewer crabs were found on the platform than at the Boulder area, and more sea cucumbers were found in the Boulder area. Evaluation of investigative process: While year 11 did the best that they could to gather accurate data, and draw correlating conclusions from that data, they were limited in how accurate that initial data could be.

There were a number of factors which limited accurate data collection such as rain, time, and inexperience. The rain we experienced forced us to cut short our collecting of data along the transect line. We were inevitably rushing as we were told we had to finish up quickly because we were trying to gather as much data as possible to complete our assignments in the short amount of time we had left; because of this, we may have miscounted the number of organisms, inaccurately predicted a percentage of coverage, or missed an organism altogether.

Our inexperience as marine biologists may have to lead us to miss-interpret signs such as the lack of an organism in a particular area or the effect that an abiotic factor has on life in that area. There are ways, however, through which we could have obtained better and more accurate data. Repetition is a necessity when conducting a scientific experiment and it is the same when gathering data. Given more time we may have been able to double check and triple check data on the field, but there was very little time to begin with, let alone the time we lost because of the weather.

Through repetition we could have returned to the beaches to gather data at different time periods and during different weather conditions. The population of an area changes according to the time of day, so the organisms that could be observed would be different at night time, and early in the morning. This is why in most biological definitions to do with an ecosystem, a specific time is mentioned. The same goes for weather conditions, the number and types of organisms would change according to weather patterns.

If the day was sunny for example, we may have seen some new organisms soaking up the sun instead of hiding under boulders, sheltered from the rain and wind. Evaluation of biological issues: Oil Spills There is no doubt that an oil spill onto a sandy beach ecosystem would be devastating to the environment and its inhabitants, as there are both destructive effects in both the short and long term. We see oil spills on the news every year, as they are far from rare, and the television is flooded with pictures of baby seals, and birds blackened and slicked by the oil.

This is indeed one of the negative impacts on the organisms present on the sandy shore as oil can very easily stick to birds, mammals, and small marine life. The feathers on a bird are designed to repel water, so if they become covered in oil, the feathers can no longer carry out their functions, including aiding in flight. The feathers become caked in oil, effectively grounding, and weighing down the bird. A grounded bird is a death sentence, as it would then be venerable to predators. The oil impacts mammals and small marine life on the shore in a similar way.

Oil cakes the fur of mammals, neutralising the furs ability to insulate heat, leaving the mammal venerable to the elements. Small shoreline marine life would be covered in oil, in every open pore of their shells and bodies, in most cases, completely suffocating them. In all cases of life on the shore, habitats and homes are damaged or destroyed. The loss of shelter and safety for these organisms would result in a massive population decrease as large numbers of each population would die as a result of predators, or the elements.

In the long term, an oil spill can completely decimate any shoreline ecosystem, and its organisms. When animals try to clean oil of their bodies, some oil can accidentally be ingested. If the animal does not die within a few days from poisoning, the oil can make the animal sick, which in turn can affect reproduction. In the most recent oil spill in the Gulf of Mexico, scientists are worried that the spill could cause the extinction of whole species, as it is both the initial blow to the animal species combined with long-term inability to reproduce that can decimate a population.

An oil spill that doesn’t have a relief effort set up for it immediately can cause long-term damage to the coastline and animal habitat. Oil covers everything it touches in a fine layer called oil sheen so every grain of sand, ever boulder, and every nook and cranny is covered in oil slick during a spill. If there is no one to clean the oil, it will stay there for years until weather eventually breaks it down and it washes away, but until then, a contaminated shoreline is a barren wasteland which is extremely dangerous to any form of marine life.

There is no doubt that an oil spill is devastating to any type of environment that it touches, but to a rocky shore system like at Point Cartwright, it would be particularly destructive. Like any rocky shore ecosystem, Point Cartwright’s rocky shores are full of marine life and vegetation, and if an oil spill were to wash through, the entire community on the shores would be in jeopardy. Almost every animal present in the rocky chore eco-system at point Cartwright would be affected by an oil spill because the oil sheen would cover every area of the eco-system.

Small shelled animals like periwinkles, and limits would almost certainly die because they are grazers and feed of algae beds. The algae itself would be covered in oil, so the grazers of the ecosystems could ingest some oil, poisoning them and probably killing them. This, in turn, affects the food source of some of the animals that may not have been directly covered in oil like birds. If birds cannot find food in the rocky shore system, they will move on to a different area, which in turn affects the rest of the animals that the birds preyed on, or that preyed on the birds themselves.

Filter feeders will also be subject to oil ingestion from the waves that roll into the shore. Filter feeders generally live closer to the low tide mark, as they need the rolling waves to capture small food particles from the moving waves. Because of this feeding pattern, filter feeders such as cunjevoi, sea cucumbers, and sea anemones will be guaranteed to ingest an amount of oil during feeding. Again, this would result in poisoning and probable death. The short-term of the oil spill in the rocky shore ecosystem, would be the initial population decrease as organisms perished due to poisoning.

However, the long-term effects can be much more serious. Entire food sources for organisms that have not been directly affected by the oil spill can be wiped out, leaving the area bereft of food supply. This would force whole populations to move to another area. If the population that migrated was another predator’s food source, the chain continues until the area is completely lifeless. If this does not happen because there is more than one food source, then there is the reproduction problem.

When organisms like the sea gulls that were seen at the rocky shore system at Point Cartwright try to clean their feathers of an oil slick, oil can accidentally be ingested, again resulting in poisoning and almost certain death. The 1% of birds that survive can encounter reproduction problems due the oil poisoning, which in turn would cause long-term issues for the seagull population in that area. On March 11 2009, nearly 300 tonnes of oil was lost from the cargo ship Pacific Adventurer. In the aftermath of the initial spill volunteers and workers tried to contain, and then clean up the oil spill in a number of ways. The slick reached the beaches of Moreton Island very quickly, so there was an amount of oil on the beach before the workers erected booms around most of the beaches which would be most affected. Booms can vary in size and shape, but are typically floating buoy lines which would separate the oil sheen which is only millimeters thick. The boom sits on top of the water and so the oil cannot get past it. The oil that is trapped in boom lines can be scooped up and disposed of by various methods. This is called skimming.

Regardless of these containment methods, oil still made it to the beaches, and soiled numerous beaches. After this happened, the workers and volunteers on Moreton island underwent a long, and arduous process which involved manually digging all of the oil-soaked sand into containers, and then carting them away. While a time-consuming process, it is the most effective as all traces of the oil are then removed from the beach. While effective on most sandy shore ecosystems, slight variations to this method would need to be put in effect if an oil spill were to occur on the rocky shore ecosystems of Point Cartwright.

While sand makes up a large part of the rocky shore ecosystems, particularly in the Boulder area, it is not the only major habitat and source of shelter for the marine life present in the rocky shores. The boulders and the rock platforms in both the Boulder area and rock pool area would need to be thoroughly cleaned and scrubbed to remove traces of all oil whilst maintaining the integrity of the boulders/rocks original position. Also, when cleaning up the sand which has absorbed oil, the workers would need to be careful when cleaning sand around the rock platforms and boulders.

A safe way would be to scrape off as little as possible whilst still cleaning all the oil, and not leaving great pockmarks and pits around the boulders particularly. This could change the positioning of the boulders which in turn could affect the natural habitats of the marine life. One decision they made when cleaning up Moreton Island was to not use any chemical dispersants. Dispersants decrease the surface tension of the oil which encourages it to form tiny droplets instead of a solid sheen. This in turn would allow the oil to disperse easier, neutralising its harmful effects of covering everything it touches.

This is also a good idea if oil spilled on the rocky shore ecosystem at Point Cartwright. The chemicals used can also spread on the boulders, algae, and rocky platforms just as the oil would have done, in some cases this can be worse than the oil itself. When gathering information on a man-made environmental disaster such as an oil spill, one must be careful, as there are always groups which put forward incredibly bias information as well as ‘ green’ propaganda which slanders government policies and companies alike.

As previously mentioned, as soon as someone mentions an oil spill these green groups put forward pictures of dead and dying animals covered with oil and use them to aid in their own causes. While some of this information is accurate, I had to be careful which information that I used. I intentionally avoided sites which slandered the B. P oil company and slammed the viewer with pictures, as very little information was presented, and the little information they did put forward was un-referenced, and hence unreliable.

The sources I have used have been very reliable, as I have either used sourced organizational sites or carefully referenced Wikipedia sites. For the information that was presented on Wikipedia, I checked the source that is was linked to in order to confirm its validity. As a result of my recourse picking, all information that I have gathered is objective and accurate, intent on providing pure facts on areas such as cleanup methods, the effects of an oil spill on the environment, and containment methods. This is instead of political and green views and blame placing.

Sites which held that sought of intention would contain bias information and were strictly avoided. Conclusion: After gathering and reviewing all of the data collected at the rocky shore eco-systems, a number of trends and patterns were identified, including the relation between the algae decrease and limit increase. Also the differences in the species of organisms between the rock pool and boulder areas.