Investigation 2 Report

Quarantine & Environmental Management

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Contents

1. Introduction

Mutation, Evolution and Natural Selection made up the basis of this investigation. Mutations are the raw materials of evolution. It is a result from errors during DNA replication or other damage to DNA. Mutation may also result from insertion or deletion of segments of DNA. Effect of mutation isn't always physically visible (phenotype) on a species as it might happen on a DNA with no function. Mutations play a part in both normal and abnormal biological processes such as cancer, evolution, and the development of the immune system. Mutation in genes can either have no effect, change the production of the gene, or even prevent the gene from functioning properly or completely. Mutation also helps a species to adapt to its environment to be able to survive. The trait would then be passed down to the species' offspring. As more and more organism of a certain species inherits the trait, the mutation becomes a typical part of the species.

Fig 1.1: Graph of Change in Nitrogenous Base

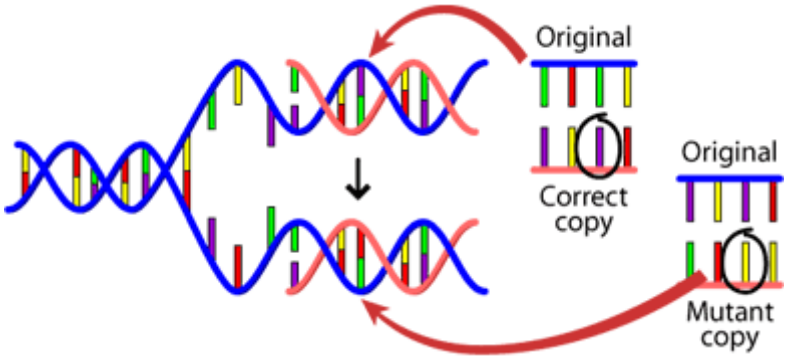


Fig 1.1: The diagram below shows what happened to the ATCG combination when mutation is taking place. It shows in the picture that one pair of the ATCG pair undergoes a little bit of change.

Evolution is the change in the characteristic of biological population over successive generations. There are 2 theory of evolution; Descent with Modification and Common Descent. Descent with modification is passing traits of the parents into the offspring. However, the offspring won't get the exact same gene as one of the parents. Genes are like a blueprint of how a person will be. Both of the parents gene will then combine and small mutation might happen along the way. The reason why siblings looks different than the other is because they have a different DNA variation from the other. There are 4 different possible DNA combinations, what matters is that which of the variation gets fertilised. Each variation carries unique combined traits from both parents that will be passed on to the offspring. Common Descent is a theory that all living being on Earth comes from the same ancestor.

Natural Selection is simply put the fittest, healthier and the strongest survives. That's the reason why animals always look for the fittest partner when they reproduce, so the offspring would have better chance to survive. Though nature does not have intelligent mind, they are able to choose which of the variation is suitable to live and

reproduce. Over time, the offspring would be stronger and healthier as the impact of "selective breeding" by nature itself.

The introduction of Quarantine Management System (QMS) by Chevron to Barrow Island is to keep the flora and fauna as the way it is despite of having an LNG facility built on the site. Barrow Island itself is a "Class A Reserve" and an Evolutionary Ark due to the uniqueness of the flora and fauna that can only be found in Barrow Island. Barrow Island got separated from the Mainland Australia due to the rising of the sea level caused by global warming around 8 000 to 10 000 years ago. Causing the animals to undergo genetic mutation over the past 8 to 10 million years ago to be able to suit to its environment and survive. Chevron's QMS is to keep indigenous species protected from the non-indigenous species, as they can be a rival for the indigenous species and may cause extinction in the indigenous species.

In this investigation, we will be investigating the rate of pollution in 3 different spot of Swan River's shore (Burswood Park, South Perth Foreshore and Matilda Bay). We will be taking soil and water samples from each of the location, measure its temperature, pH, salinity and identify the type of soil the shores have and what effect has it caused to its surrounding and the salinity of the water. Of course, none of the soil that we took would be present at Barrow Island. However, if one of the soils somehow get into Barrow Island, it will most likely to cause changes and disturb the indigenous flora and fauna which is really important for Chevron to build a Quarantine System to keep the species preserved.

Fig 1.2: Diagram of Sampling Location

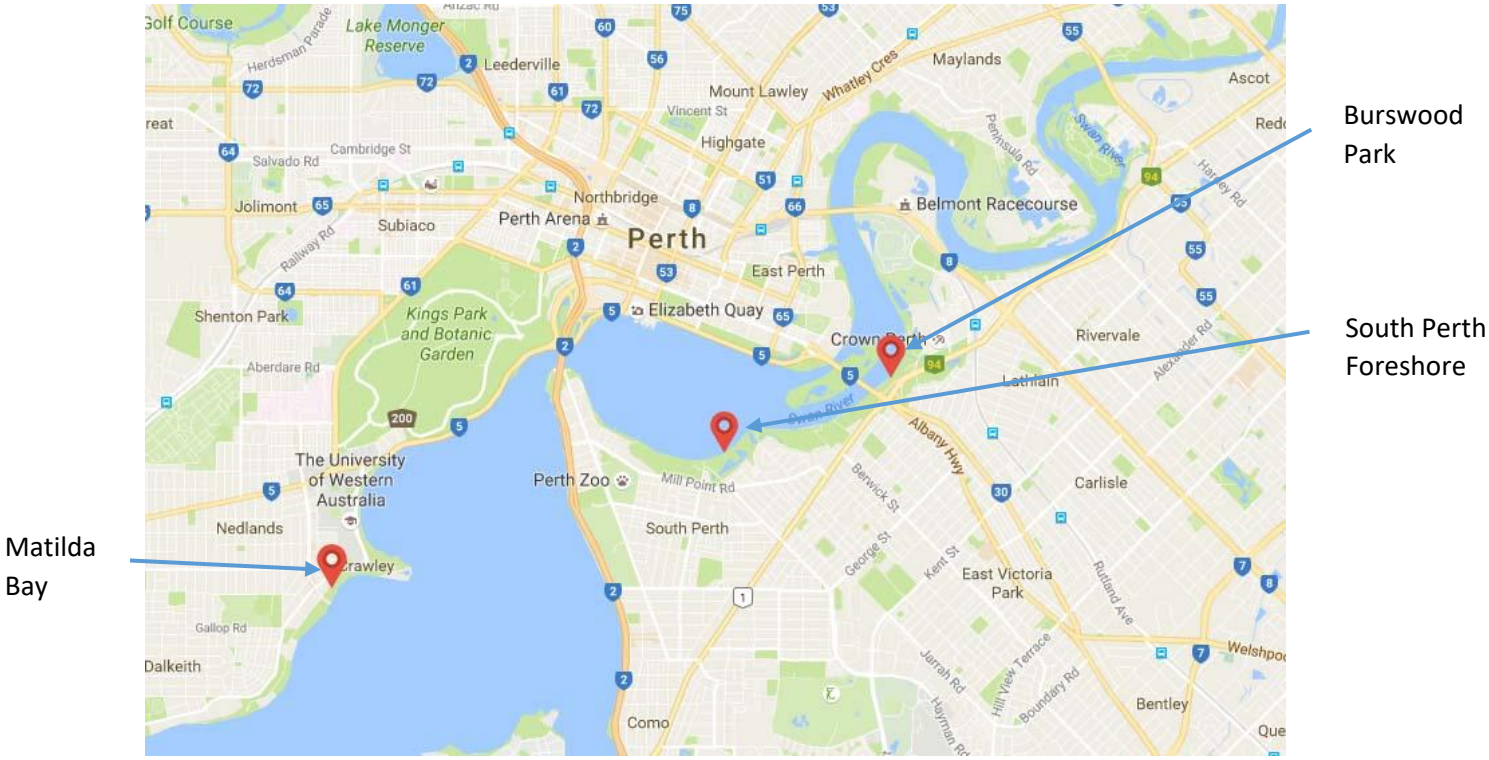


Fig 1.2: The diagram above with red pin shows our sampling locations. The sampling spots are located from north east to north west in intention to find different effect on the locations as the river flows to the sea.

1.2 Purpose

To understand how human activity can affect the quality of water and how it relates to the situation at Barrow Island.

1.3 Aim

To find out which part of the river is more polluted than the others.

2 Plan and Design

2.1 Investigation Set-up

Fig 2.1: Diagram of Investigation Set-up

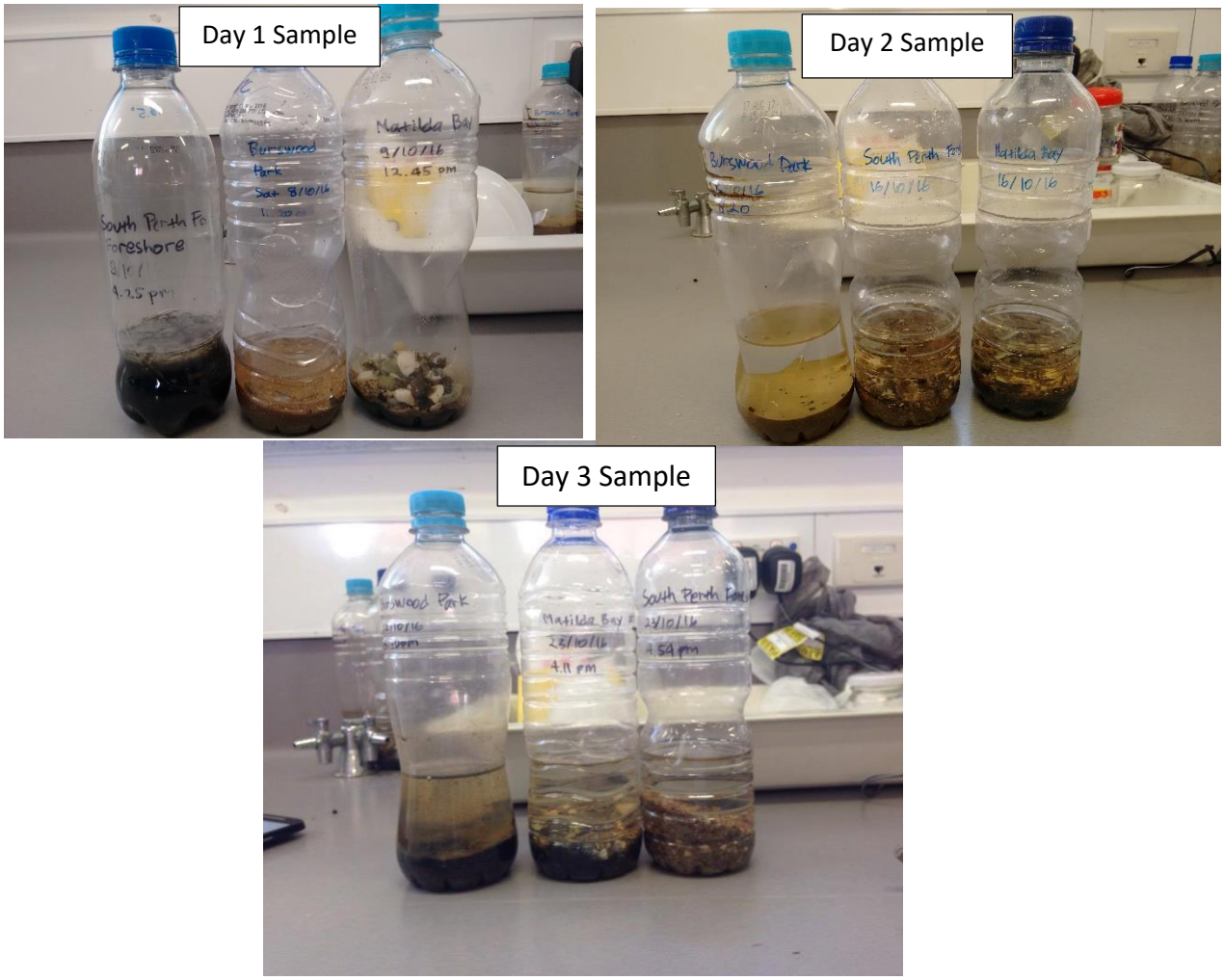


Fig 2.1: The diagram above shows the soil and water sample that we've gathered in 3-week time. We've gathered the data from 3 different areas, Burswood Park, South Perth Foreshore and Matilda Bay. From the picture, all the three locations have different type of soil and different water colour (either murky or clear)

2.2 Table of Variables

Constant (The Same)	• The day of the sampling (Saturday for Burswood and South Perth Foreshore and Sunday for Matilda Bay) • The amount of water from each sample while measuring the salinity
Independent (Changed)	• The location of sampling (Burswood Park, South Perth Foreshore and Matilda Bay) • The type of soil (depending on the location)

	• The weather during the week • The time of sampling
Dependent (Measured)	• The pH of each sample • The temperature of each sample • The salinity

Fig 2.2: The table above shows the variables for the investigation. The day of sampling, the amount of water from the sample to be tested for its salinity was kept the same and the three different spot of where the soil and water sample were taken was kept the same. Location of sampling (from north east to north west shores) were changed, the type of soil and the weather would also be changed depending on the situation. The pH, temperature and the salinity of the sample are the variables measured.

2.3 Materials and Equipment

- 9x plastic bottle (glass jars would be better)
- A spoon
- A phone to take notes of observation and take pictures
- 3x funnels
- pH probe
- Thermometer
- 9x filter paper
- 3x chronical flask
- Bunsen burner
- Gauze mat
- Safety mat
- Match
- A Tripod

2.4 Methods and Procedure

Soil Sampling

1. Choose three different locations that you want to do the sampling on. Remember to always take the sample from the same place to keep this investigation fair.

2. If you have pH and temperature probe/measuring device that you can bring to the site, it is good to bring it with you so you can make the measurement at the site which would be more accurate, if you don't, you can try to research the water temperature of the particular area that you did the sampling on.

3. Before you take the soil and water sample, wash the bottle with the river water itself so it wouldn't change your data.
4. Just take approximately 3 to 4 spoonful of soil in the part where the soil has been submerged with water. Be careful of your surroundings. Sometimes the tide can be high and make it difficult for you to do sampling.
5. Once you think you have got enough soil, you can start to put the water into the bottle.
6. After you finish, don't forget to record the date, place, and the time.
7. After that, start to observe your surroundings. Notice if the water smells weird, the water is murky, if the tide is in/out, if there are animals in the water and what they do.
8. Once you have enough observation and made sure you didn't miss anything, you can pack up and leave the site.
9. Do the steps above for every time you do your sampling.

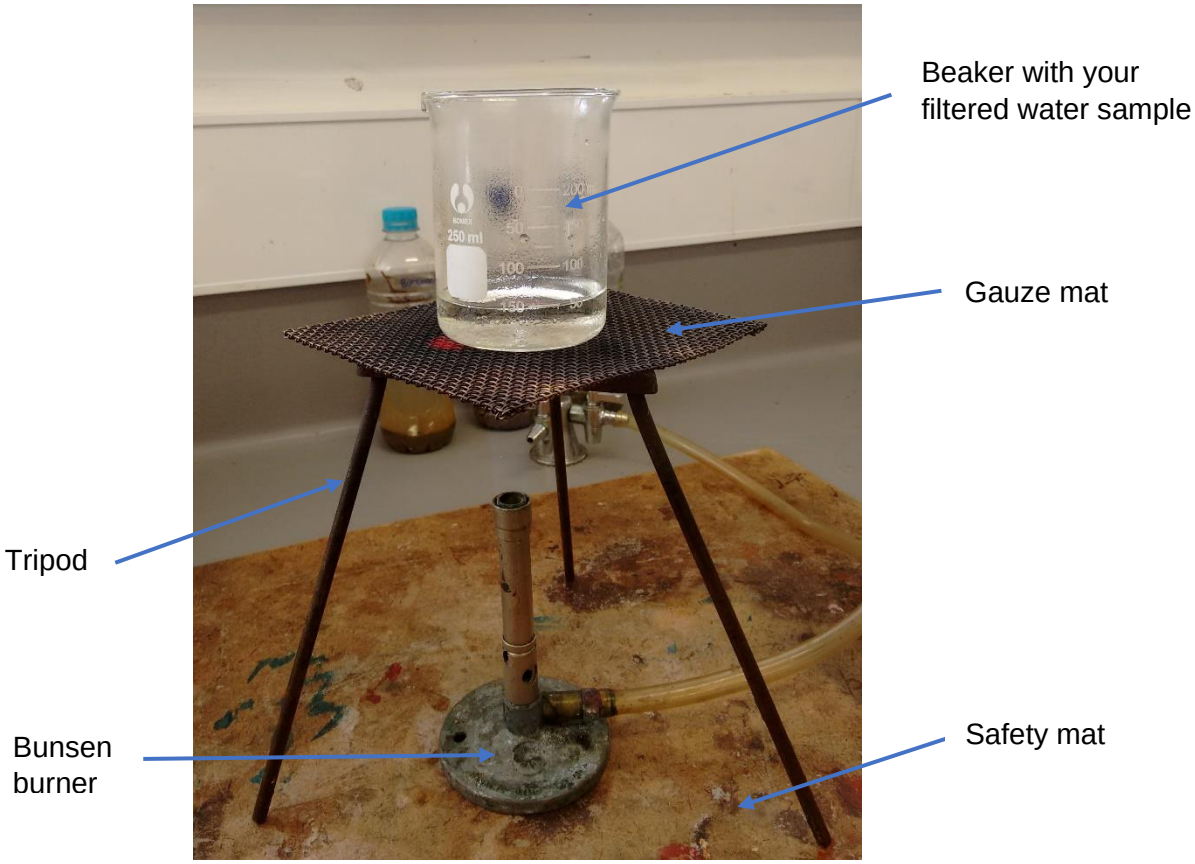
pH Measuring

In this investigation we used pH measuring probe. To use this pH measurement, you are required to install the software to collect the data from the probe.

1. Open up the app on your device.
2. Prepare the pH probe for testing.
3. Prepare the water sample for testing as well.
4. Once everything is set, put in the pH probe in the water sample just enough for the probe to be able to read the pH.
5. After you can see the result, record the data and take out the probe out from the sample.
6. Before using the probe for other sample, clean the probe with distilled water so the result from the previous sample won't affect your future result.
7. Repeat the steps above until you measure the pH of all of your sample.

Salt Measuring

1. Before you start anything, don't forget to weigh the initial beaker weight so it'll be easier for you to do the measurement of the salt.
2. Filter about 50ml of your soil sample to make sure there is nothing in the water so it wouldn't affect your result.
3. Set up the equipment similar to diagram below:



4. Carefully turn on the gas flap then turn on the Bunsen burner.
5. Wait until the water evaporates.
6. After all of the water evaporated, turn off the Bunsen burner and wait until the beaker's temperature cooled. Be careful! The beaker will be extremely hot.
7. After it's safe for you to hold the beaker, carefully weigh the beaker on a scale.
8. Repeat the stages above until you measured the salinity of all samples.

2.5 Hypothesis

The south west part of the river would have lower pH and higher level of salt compared to the other 2 locations.

3 Conducting

3.1 Table of Observation and Measurement

1. Burswood Park

Date of Observation	Temp (°C)	pH	Observation
Saturday, 8 October 2016, 11.20am Day 1	17.8	6.6	It was windy, the tides weren't that high but it was difficult to see to underwater due to cloudy day. Not much ducks/birds were swimming, there were seafoam on the shore. Not much interesting things happened. The soil sample we've collected from this area was a typical sand beach, similar what we found at South Perth Foreshore.  Fig 3.1.1: The diagram above shows the condition of the sampling area that we did observation on. It is also shown there were seafoam forming on the shore
Saturday, 15 October 2016, 8.20am Day 2	18.9 (https://goo.gl/dzsbPT)	6.7	It was windy, raining, the tide was in, there are more of seafoam (Fig 3.1.2), a lot of things got washed up the shore such as seaweeds and what seems to be debris of something (maybe due to the heavy rain on Friday night), the water wasn't murky but there was mud on top of the soil sample that were taken.

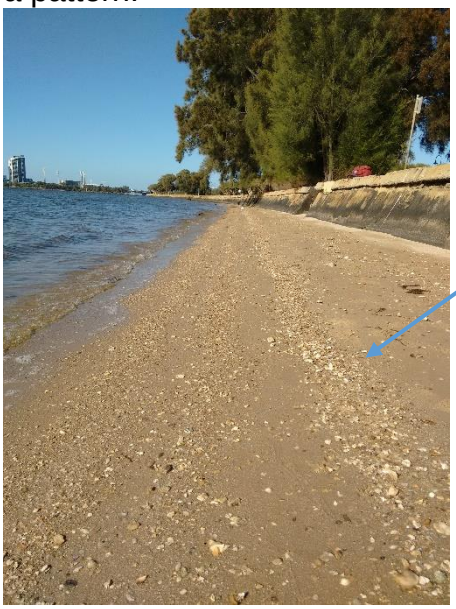
			 Fig 3.1.2: Diagram above shows the shore's condition when the group took the sample. It looks a bit messy and the blue ball that is floating around seems to be something that got washed up to the shore after the heavy rain on Friday night.
Saturday, 22 October 2016, 5.30pm Day 3	17.8 (https://goo.gl/ZmXTP3)	7.1	First time it wasn't raining when the group did the sampling. The tide was out and it was a beautiful day. The water was really murky and the soil was more like goo (maybe because we took the soil that was further in the water and has been submerged in the water more often than the soil sample that we took the previous 2 weeks). There were also a lot of seaweed got washed over to the shore.

			 Fig 3.1.2: The picture above shows how low the water level was the group were on the site, which was much lower than the previous weeks.  Fig 3.1.3: The picture above shows how the soil looked on the last day of observation. It looks like mud and it's clumped together, it was difficult to put the soil into the bottle plastic.

Fig 3.1: This table shows the measurement and observation made at Burswood Park that were made during 3 Saturdays in a row with a week of interval when taking each data. It shows that with the different time of observation, the condition of the sampling site can be so different in the morning and the afternoon in this case. It shows that in the morning, the water level is high while in the afternoon, the water level is so low until you can see the soil difference in the sample that we took. It is also shown that the lowest pH (acidic) is in the morning water. As the day goes on, the pH of the water slowly rises.

2. South Perth Foreshore

Date of Observation	Temp (°C)	pH	Observation
Sunday, 9 October 2016, 4.25pm Day 1	18.5	6.8	It was a sunny day, quite windy as well. The sun was bright, a lot of seaweed near the area where the group took the sample. The soil sample that we've gathered was just a typical beach would have, sand with quite a large amount of seashell. From the data we've gathered, the sea shells on the

			sampling site has been imported, it's originally not there.  Fig 3.2.1: The diagram above shows what the seaweed looks like under the water during sampling. The water was quite murky as the reason why the seaweed is not clear.
Sunday, 16 October 2016, 4.06pm Day 2	17.8 (https://goo.gl/h4ic70)	6.9	It was a sunny, windy day, not as windy as the week before. Some people were doing water activity, a few ducks swimming around and what it seemed they were looking for food. There were also a lot of seaweed that looked like it got washed up to the shore and made a pattern.  Fig 3.2.2: The diagram above shows the pattern that the seashell formed by the tide. It looked like the tide and the water level goes as the day goes on.

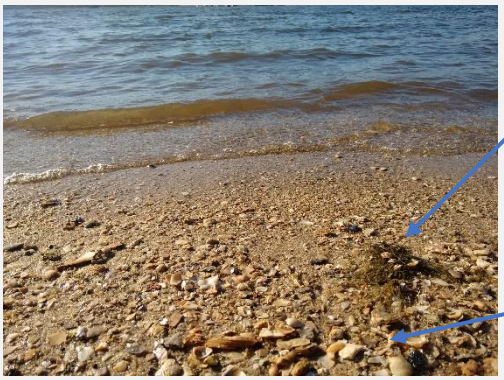
Sunday, 23 October 2016, 4.42pm Day 3	18.3	7.2	Medium tide, sunny day. Fresh seaweed got washed over the shore, the seashell line was still visible.  Fig 3.2.3: The diagram above shows the condition of the sampling site on the last day of testing trial. The tide wasn't that high and a few green seaweeds got washed up to the shore.

Fig 3.2: This table shows the measurement and observation made at South Perth Foreshore (the one near Wesley College Boat Shed) on 3 Sundays in a row with a week of interval of taking the data. The result of the observation shows that the pH is slowly rising throughout the week, when the last sample was taken, there were no rain during the weekday.

3. Matilda Bay

Date of Observation	Temp (°C)	pH	Observation
Sunday, 9 October 2016, 12.45pm Day 1	18.5	6.9	It was a windy and sunny day, a lot of people went for kayaking and other activities in the water. The tide wasn't that high though it was very windy. There were a lot of green seaweed (see Fig 3.3.1) on the shore. There are also some kind of sewer system near the site (see Fig 3.3.2). The top part of the soil from the site is mainly from seashells, then after 2 cm, the sand starts appearing. The colour of the sand was brown-ish, like typical beach sand. However, after digging a bit more, we found out that the colour of the sand changed after approximately 2 cm from brown to black.

			 Fig 3.3.1: Diagram above shows the appearance of green seaweed on the sampling site. The water was clear enough to see the seaweed clearly.  Fig 3.3.2: Diagram above shows what it looks like a sewer system approximately 20m from our sampling site. There were a few ducks swimming around the bay as well.
Sunday, 16 October 2016, 1.07pm Day 2	17.8	6.8	Smells a bit weird – like sewer water. It was sunny, not as windy as the previous week. A lot of weed got washed up the shore (see Fig 3.3.3). The tide was really low until the group was able to make a hole in the water where we took the soil sample and measured it.  Fig 3.3.4: The diagram above shows the condition of the sampling site on the

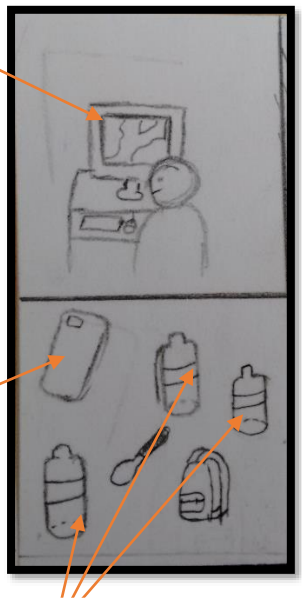
			second day of trial. A lot of green seaweed got washed up the shore, maybe due to the storm on Friday.
Sunday, 23 October 2016, 4.00pm Day 3	18.3	7.4	Not that windy, the tide was low and the water level was low. The seaweed that for washed over the shore were mostly from last week's big storm, only one or two birds swam around the area due to human activities in the water  Fig 3.3.5: Diagram above shows the condition of the sampling location on the last day of trial. It is shown that there are a lot of dried seaweeds on the shore, more than what was there on last week.

Fig 3.3: This table shows the measurement and observation that were made at Matilda Bay (the one near the playground) on 3 Sundays in a row with a week of interval when taking the data. It is shown in the data that as the day goes on, the pH of the water seems to slowly rising (becoming more basic from slightly acidic)

3.2 A Flowchart

Computer, to do research

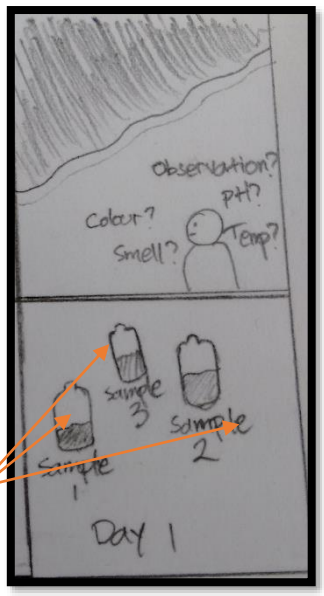
Phone, to take pictures and write down observations



Bottle plastic, to be the container of the soil and water sample

Do some research to decide which area you're going to do your samplings on and the time of your sampling (e.g once a week), then prepare the equipment needed.

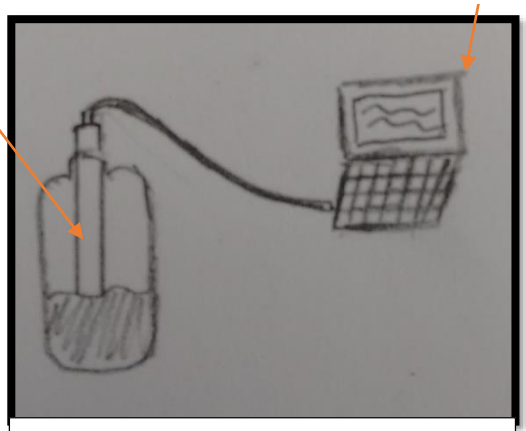
Bottles with soil and water samples



When arrived at the site, do observation and measurement of temperature, using any form of device to take notes. Then take some soil and water sample. Do this step until you reach your last day of trial.

Device, with pre-installed software to measure the pH

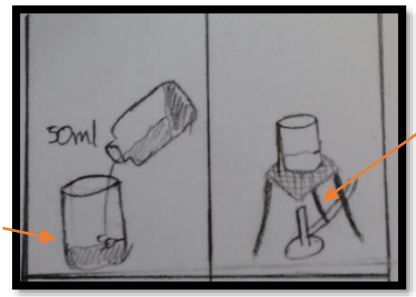
pH probe, to measure the pH of the river water



Take the sample to school/lab and measure the pH of each sample with pH probe or Universal Indicator if the school doesn't provide you with pH measuring device. Do this after all of the pH of the samples measured.

Bunsen burner, to evaporate the water until the salt precipitate

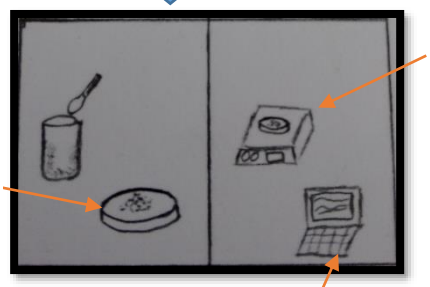
50ml of River water, to measure the salinity of the river



After you measured the pH, pour about 50ml of the river water into a beaker (if the water is murky, filter the water first to make your result more accurate), prepare a Bunsen burner and put the beaker on top of it. Do this to all of the samples.

Weigh scale, to measure the weight to the salt

Salt on petri dish, a container for the salt before it gets weighed



Device, to record the result and observations

After the water evaporated, let the beaker settle down for a bit as it would be really hot, then after it gets cold, start scraping the salt to be weighed. After that, weigh the salt on the scale. Don't forget to measure the weight of the petri dish to make your life easier, then record the results

4 Processing

4.1 Measuring the Salinity

1. Burswood Park

Day	Weight of Salt	Observation
Wednesday, 19 October 2016	0.5	After we filtered it and left it for a few days, the water doesn't smell The salt's grain is big; the surface is rough when touched. 
Thursday, 20 October 2016	0.2	The grain is finer; the colour of the salt is still the same with last week's result (yellow-ish) 
Tuesday, 1 November 2016	0.4	The grain is finer; the colour is brighter than the last two weeks result, the grain is also finer compared to the first week result. Maybe due to the sunny weekend, as when the group collected the data for the past 2 weeks, it was always raining on the Friday night, causing the mud to get washed up the shore.

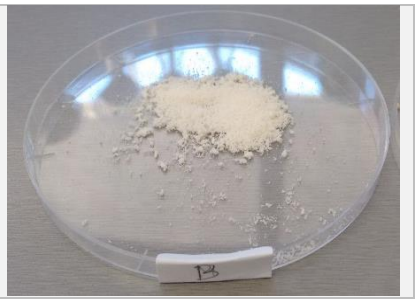
		

Fig 4.1: The table above shows the salinity of the river water in 50ml of water sample taken from Burswood Park. It shows that the salinity has changed over time, the saltiest water sample is happened to be the sample that the group took after rainy weekday.

2. South Perth Foreshore

Day	Weight of Salt (g)	Observation
Wednesday, 19 October 2016	0.3	The water has become murkier, maybe due to the brown seaweed in the sample, smells like sewer water. Due to the mould in the water, we needed to re-filter the water. The salt's grain is finer and the texture is smoother compared to the other samples. The colour of the salt is similar from what the group have gathered from Burswood Park for the first 2 weeks. 
Thursday, 20 October 2016	0.4	The salt's grain is course, more the salt is more like clumped together, and the colour of the salt is a bit brighter compared to the previous week result.

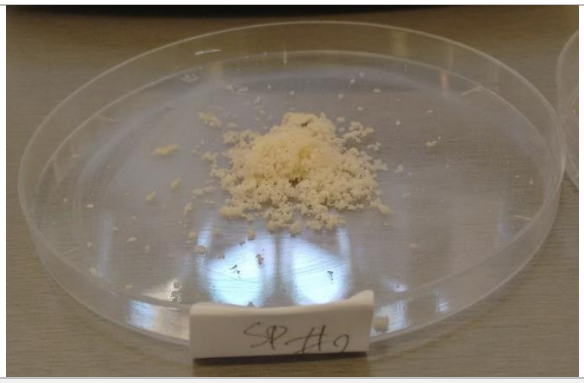
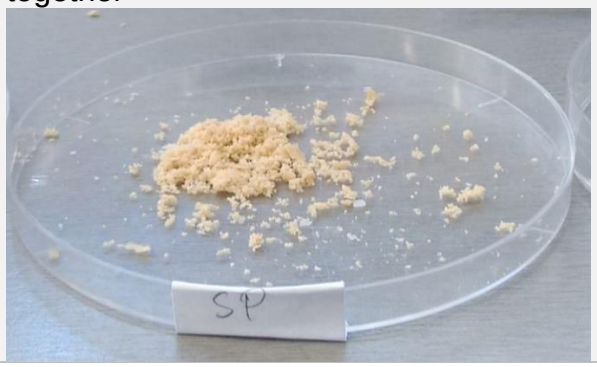
		
Tuesday 1 November 2016	0.3	The water was really clear, the salt was yellow-ish and more like clumped together 

Fig 4.2: The diagram above shows the development of the salinity of the water sample taken from South Perth Foreshore on a 3-week trial. The only sample that has different result from the rest was the second week data. The group found out that the colour of the salt depended on the colour of the river water that got evaporated. The clearer the water is the brighter colour the salt would be.

3. Matilda Bay

Day	Weight of Salt (g)	Observation
Thursday, 20 October 2016	0.7	The condition of the water didn't change, still the same. It smells quite a bit. The salt is whiter than the other samples, it's more clumped together. The colour of the salt is brighter compared to the other samples. The salt level is higher compared to the other results.

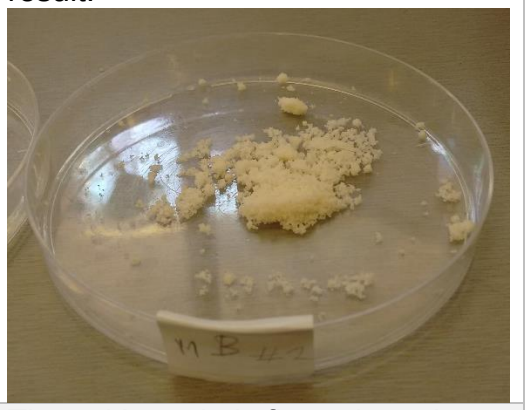
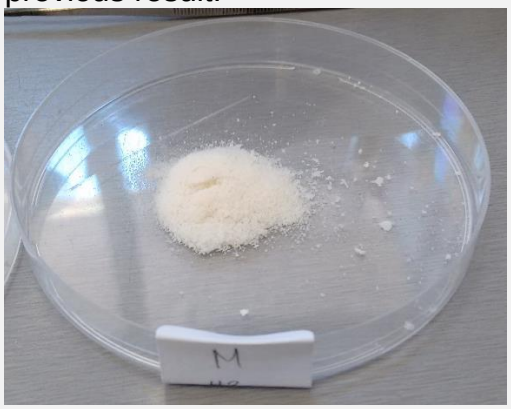
		
Thursday, 20 October 2016	0.8	We did the same process with the water filtration. The salt level has increased by 0.1 from the previous result. The salt is more like clumped together, the colour of the salt is darker than the previous result. The texture of the salt remains the same from the last result. 
Tuesday, 1 November 2016	0.8	The salt's grain is finer, the colour has become lighter than the previous results, the weight of the salt hasn't changed from the previous result. 

Fig 4.3: The table above provides the information about the salinity of the river water tested from the samples taken from Matilda Bay. On the table above, the salinity of the water has always been the highest out of all samples that the group took. The group also noticed the

colour of the salt is depending on the colour of the water sample, the murkier the water is the yellower the salt would be.

4.2 Table of Averages

Table of Salinity Averages of the Water Samples

Burswood Park	
Date Tested	Clean Weight (g)
Day 1 (8/10/16)	0.5
Day 2 (20/10/16)	0.2
Day 3 (1/11/16)	0.4
Avg	0.37

Fig 4.2: Diagram above shows the weight of salt on 50ml of river water taken from Burswood Park, it is shown that the data that was taken on the second week produced less amount of salt compared to the other results.

South Perth Foreshore	
Date Tested	Clean Weight (g)
Day 1 (9/10/16)	0.3
Day 2 (20/10/16)	0.4
Day 3 (1/11/16)	0.3
Avg	0.33

Fig 4.3: Diagram above shows the weight of the water samples taken from South Perth Foreshore, it is shown that the result gathered from day 2 produces the highest level of salt compared to the other results.

Matilda Bay	
Date Tested	Clean Weight
Day 1 (9/10/16)	0.7
Day 2 (20/10/16)	0.8
Day 3 (1/11/10)	0.8
Avg	0.77

Fig 4.4: On the diagram above, it shows that the less amount of salt produced from water sample taken from Matilda Bay is on the sample that was taken on the second week. So far, the hypothesis was correct, providing that Matilda Bay has the highest average of salinity out of all.

Table of pH Averages of the Water Samples

Burswood Park	
Day	pH
Day 1 (8/10/16)	6.6
Day 2 (15/10/16)	6.7
Day 3 (22/10/16)	7.1
Avg	6.80

Fig 4.5: Diagram above shows the pH average of the water sample taken from Burswood Park, it is shown that the lowest pH out of all the 3 data was on Day 1 (slightly acidic) and the highest pH being the sample from Day 3 (neutral).

South Perth Foreshore	
Day	pH
Day 1 (9/10/16)	6.8
Day 2 (16/10/16)	6.9
Day 3 (23/10/16)	7.2
Avg	6.97

Fig 4.6: Diagram above shows the pH average of the water sample taken from South Perth Foreshore. Similar to the result gathered from Burswood Park, the lowest pH (slightly acidic) and the highest pH (neutral) being the sample from the third day.

Matilda Bay	
Day	pH
Day 1 (9/10/16)	6.9
Day 2 (16/10/16)	6.8
Day 3 (23/10/16)	7.4
Avg	7.03

Fig 4.7: Diagram above shows the pH development and average of the water sample taken from Matilda Bay. A little bit different from the other 2 sets of result, with the lowest pH (slightly acidic) being the sample from Day 2, and the highest (neutral) being the sample from Day 3.

Table of Temperature Averages of the Water Samples

Burswood Park	
	Temp (°C)
Day 1 (8/10/16)	17.5
Day 2 (15/10/16)	18.9
Day 3 (22/10/16)	17.8
Avg	18.07

Fig 4.8: Diagram above provides the information of the temperature change over the weekend during the day of samplings. Though the weather of each sampling day are different, the temperature does not vary very much from each day. Day 1 being the day with lowest temperature and Day 2 being the day with highest temperature in the set.

South Perth Foreshore	
	Temp (°C)
Day 1 (9/10/16)	18.5
Day 2 (16/10/16)	17.8
Day 3 (23/10/16)	18.3
Avg	18.2

Fig 4.9: Diagram above provides the information of the temperature changes over the weekend during the day of sampling. Similar to the result gathered from Burswood Park, there

isn't much variation in the temperatures, Day 2 being the day with lowest temperature and day 1 being with the highest temperature in the set.

Matilda Bay	
	Temp (°C)
Day 1 (9/10/16)	18.5
Day 2 (16/10/16)	17.8
Day 3 (23/10/16)	18.5
Avg	18.27

Fig 4.10: The diagram above provides the information about the temperature change during the day of sampling. Similar to the previous sets, there isn't much variations in the data gathered. Day 1 being the day with the lowest temperature and Day 1 and 3 with the same temperature.

4.3 Graphs

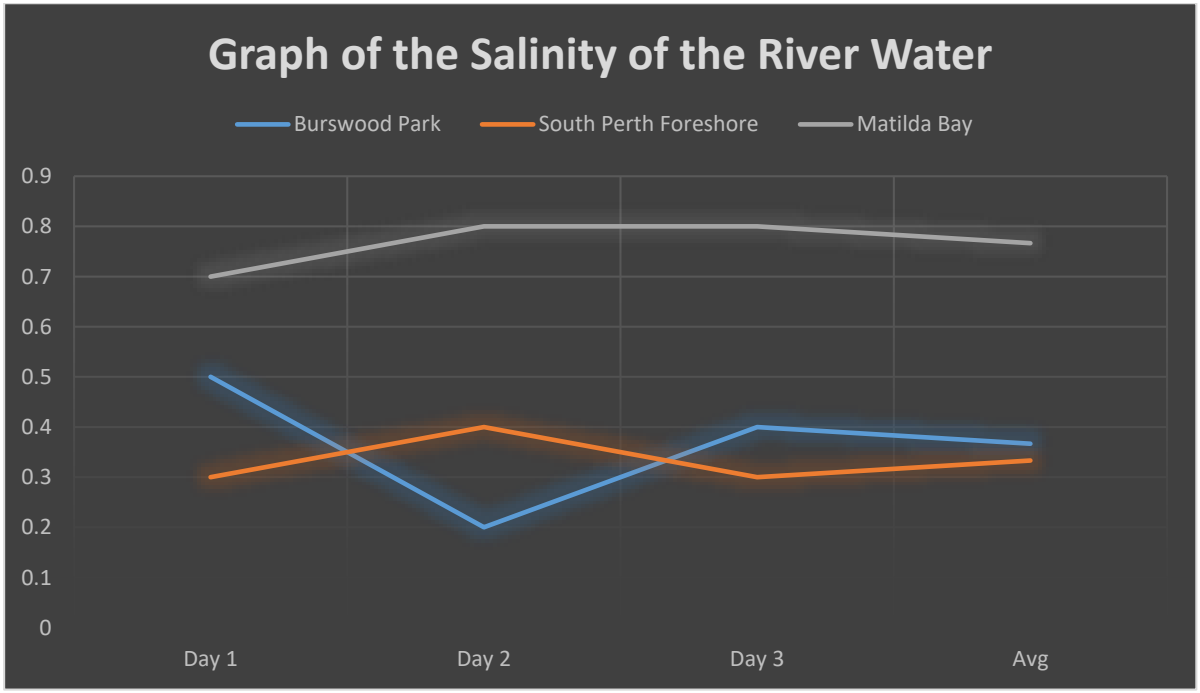


Fig 4.3: The graph above provides the difference of the amount of salt in each set. It is shown that Matilda Bay sets has is the highest salt producer, while South Perth Foreshore being the least salt producer overall. On the second day, the amount of salt the sample taken from Burswood Park reduced dramatically when South Perth and Matilda Bay salinity increased. This may due to the huge rain that happened on Friday before the group did their Day 2 sampling, and as Burswood Park being tested every Saturday morning, with showers during sampling time, and due to the fact that rain water is freshwater, it might be the reason why the salinity level of Burswood Park has dropped during that day.

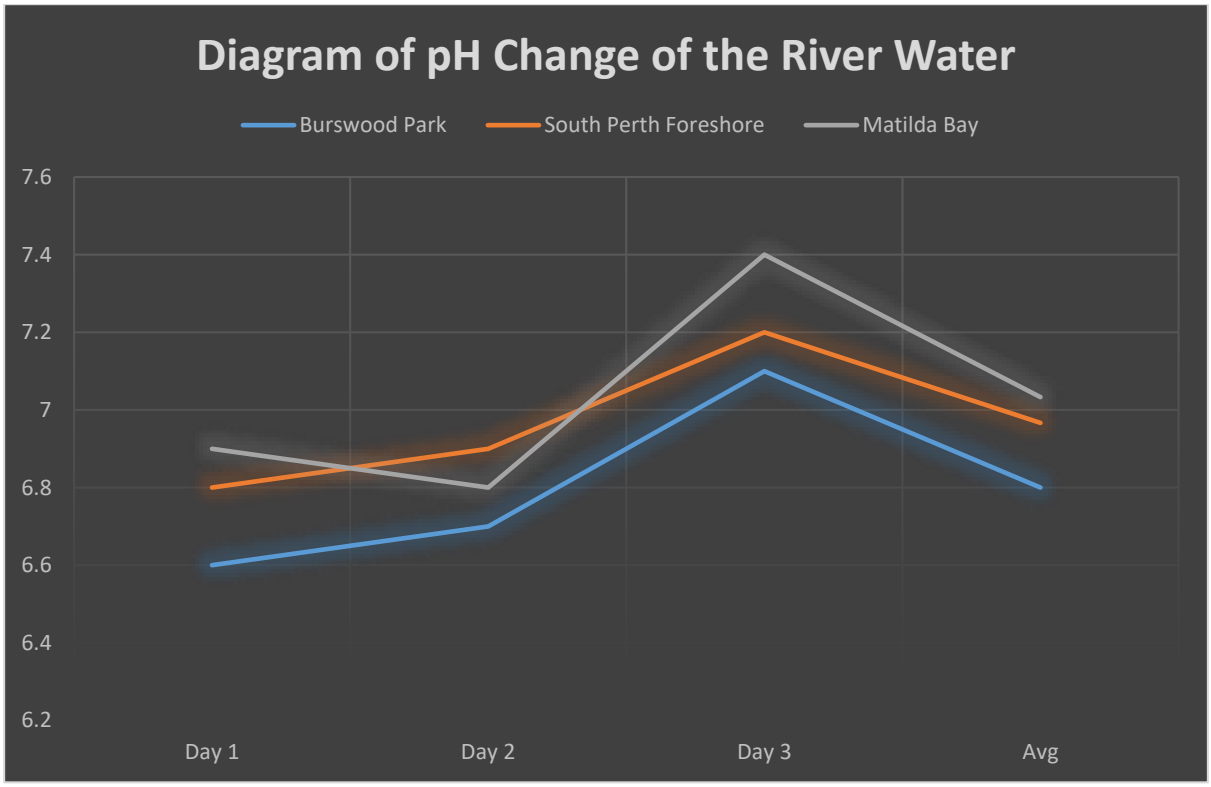


Fig 4.4: The graph above provides the information about the pH development over the course of 3 weeks on each sampling site. Burswood Park being the site with the lowest pH out of all 3 sets, and Matilda Bay with the highest pH average. This might happen due to the different type of soil that each sampling site has. Which means, Burswood Park's soil is rich in mineral which could make the pH of the water lower, while Matilda Bay soil's has less mineral since it has a higher pH (basic).

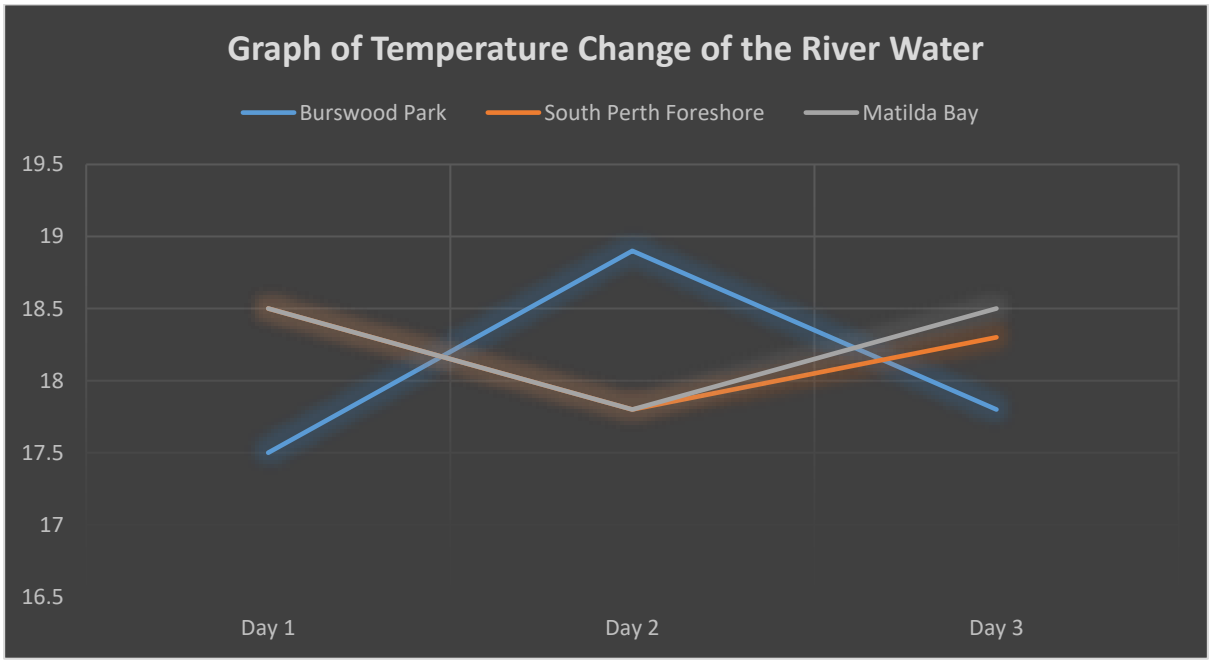
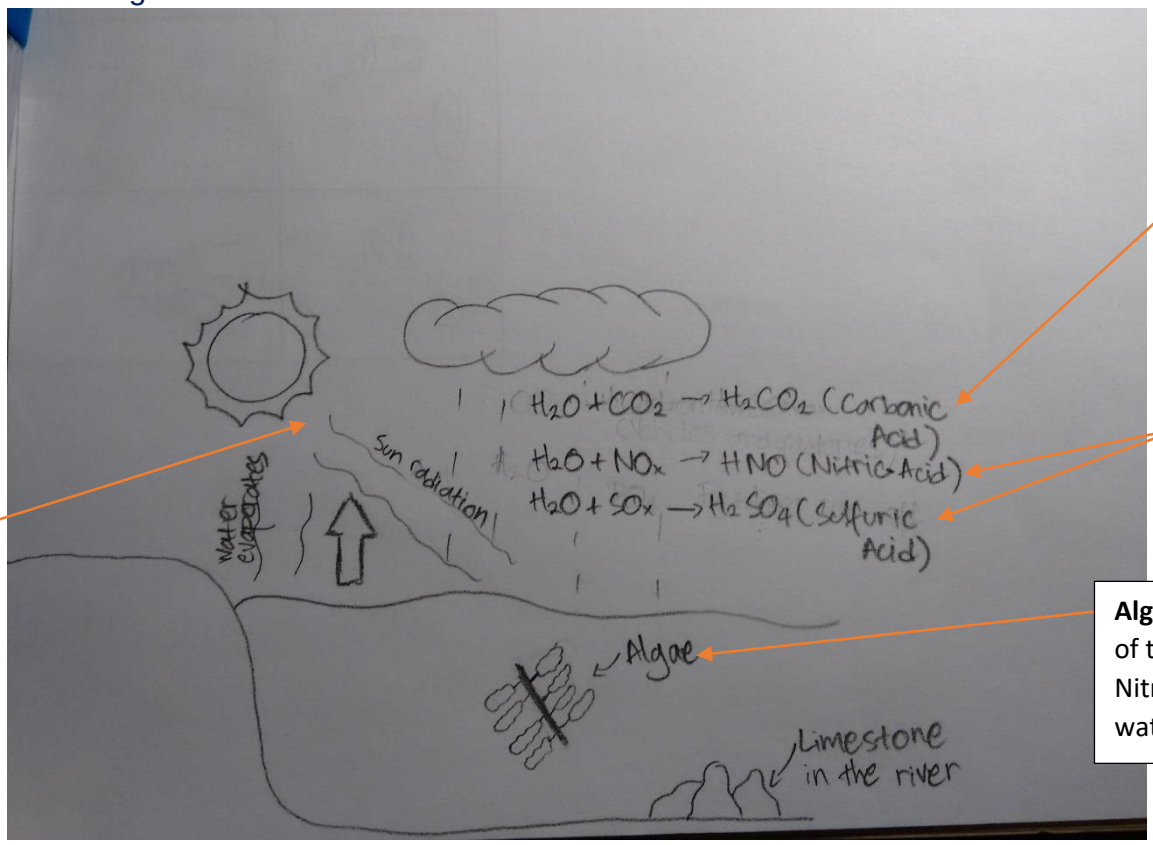


Fig 4.5: Diagram above provides the information of temperature changes during the sampling day. As Burswood Park's sampling day was on Saturdays, the temperature of

Burswood is much different while the temperature of South Perth and Matilda is similar as their sampling day was on Sundays with a couple of hours difference.

4.4 Diagrams



Sun radiation, evaporates the water into the atmosphere, making the water more concentrated /acidic as less water is in the river

Carbon emission, from factories and vehicles

Pesticide run-off, from farms

Algae, first sign of too much Nitrogen in the water

Fig 4.4: The diagram above shows the factors of ocean acidification. Factorised by human activities and natural cycle such as carbon cycle. The rain strips the CO2 from the atmosphere, causing it to mix with water then turn into Carbonic Acid, then the other gases and fertiliser run-off such as Nitric Acid and Sulfuric Acid also got washed into the river, causing the pH of the river decreasing (becoming more acidic) and possibly corrodes the limestone in the river. Then the sun radiation evaporates the water from the river, causing the river to be more concentrated/acidic as less water is in the river. Besides that, a high level of Nitrogen in the water can support the growth of algae in the river, which is known as Eutrophication, which then affects the Nitrogen cycle.

4.5 Discussion of Result

After the group collected, measured and observed the data, it turns out that it doesn't matter where the sample has been collected, whether it's from the north eastern part of the river or the south western part of the river, the pH and the salinity of the water sample are affected by the type of soil the shore has, whether the soil holds minerals (which can lower the pH of the water) or clay (does not hold any minerals). The acidity of a stream or a river could be increased by carbonate-rich soils such as limestone.

The pH of the water is also affected by the weather of sampling time. If it was raining during the sampling day, it is likely for the pH of the water to be higher (neutral or basic) due to the rain water which is usually neutral (the more air pollution the city has, the more acidic the rain water become). As when it is raining, the rain water would dissolve the salt making the pH of the river higher (the water would be less salt concentrated) than when it is a sunny day. When there is no rain and the sun is bright, the water evaporates, reducing the volume of water in the river, which makes the river more salt concentrated as the salt precipitates.

Another effect that could increase the salinity of the river water is anthropogenic effects such as; the use of pesticide in farms and the factories and vehicles emission, especially in metropolitans and big city. The increase of CO_2 in the air can also support the warming of the climate, as when the rain is pouring down, it strips CO_2 from the air, and dissolving it in the ocean/any water body such as rivers. When CO_2 combines with H_2O, making it Carbonic Acid (H_2CO_3). The more carbon emission in the air, the more CO_2 would be deposited in the water. Besides carbon, there are also other substances that got dumped in the water such as fertilisers made up of dangerous substances for our environment; commonly they are made of substances such as nitric acid and sulfuric acid, which when they got released into the rivers, those substances would add up unnecessary nutrients into the system which supports the growth of algae.

The warming of the climate could also support ocean acidification. As the warmer climate would increase the rate of evaporation of the water from the river, leaving the salt and other gases precipitated at the bottom of the river and could harm the ecosystem and corrodes limestones underneath the river, releasing Calcium Carbonate into the water and increases the water's pH. Which can be very harmful to the living organisms.

In conclusion, the pH and the salinity of the river is affected by various factors, which is more complex than it looked but a small change in the environment can have a chain effect and bigger effect into the environment. It is also concluded that no matter where the sample is taken, either from north east or south west of the river, the pH and the salinity of the water is also affected by the environment of the river in that particular area, either it has sandy soil or clay as the soil in the site.

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