NGA NGUYEN LOGBOOK- THE EFFECT OF MACROPHYTES ON CONTROLLED CENTENNIAL PARK NUTRIENTS

Entry 1- 24/03/2015

Today I have started to brainstorm ideas for my SRP. I plan to do something related to environmental issues, as I believe it is an important aspect of science. Currently I have no ideas but hopefully they will come to me.

Entry 2- 25/03/2015

I have decided to focus on water pollution. This idea came to me after I was cycling in Centennial park. I noticed that the ponds all came from different sources and I was interested to see whether stormwater or natural springs were affected by water pollution. Upon research when I got home, I discovered that Lily Pond, a natural pond in Centennial park, has had a long history with eutrophication, which is a type of water pollution brought on by the increase in nitrates or phosphates. My research discovered that eutrophication had been a major problem for the Moore Park Trust. I then proceeded to see any methods of filtering eutrophic water, and noticed that the schemes were quite costly and had side effectives as they utilised chemicals. However, there was an article by the NC. Museum of Natural Sciences that stated that duckweed, a type of plant, could be used to combat eutrophication based on its removal rates of nitrates and phosphates.

My plan now is quite rough but I plan to research the affect of duckweed on Centennial Park water, in terms of controlling nutrient qualities.

Entry 3- 26/03/2015

I have devised exactly my plan for this SRP. Over two weeks, I shall place 9 equal samples Lily pond water in a controlled environment. In the water, I will place varying densities of duckweed, and every two days I will measure 8 different nutrient levels. I will then determine whether duckweed is suitable for eutrophication prevention or control, and what the best duckweed density application is for optimum filtration that does not strip nutrients but rather keep them at a suitable level.

The different densities would be:

- 20%
- 25%
- 33%
- 50%

The different nutrients I will measure are:

- Apparent water colour
- Nitrate
- Nitrite
- pH
- Alkalinity
- Hardness
- Iron

Entry 4- 01/04/2015
Today I have collected all the materials and test kits required for my experiment.

The test kits I received courtesy of a contact in UTS Science. These test kits/equipment included:

1. Hanna instrument's colorimeter
2. Hanna instrument's hardness test kit- containing hardness buffer, calmagite indicator, EDTA solution
3. Hanna instrument's iron test kit- containing iron reagent
4. Hanna instrument's nitrate portable photometer
5. Hanna instrument's alkalinity test kit- containing phenolphthalein indicator, bromophenol blue indicator
6. Hanna instrument's pHep tester
7. Hanna instrument's nitrite test kit- nitrite regent

I also collected:

- Test tubes
- Glass cuvettes
- Calibrated syringes
- 25 L water storage container
- 9 open storage boxes
- De-ionised water

I would have liked to use more precise machines, but since I am a high school student, it is not possible for my access to these machines due to cost reasons and availability reasons.

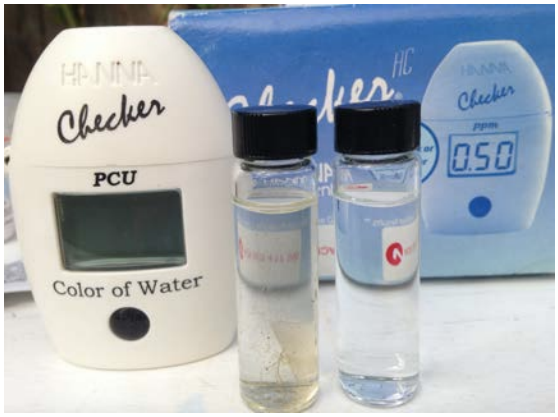
Entry 2- 03/04/2015
Today I went to my location at Centennial Park to collect the required amount of water. When collecting water, it is important to collect as pure water as possible, to ensure to not collect debris that will affect the results.

I also received duckweed from a controlled lab environment from the Macquarie University. The duckweed was isolated in a pond there and it's initial date of growth was the 11th of February.

Entry 3- 04/04/2015
Today I placed 1.5 L of Lily Pond water into 9 2 L tubs, using a permanent marker to mark out the starting water levels. Using string and rulers, I measured out the percentage area for the 20%, 25%, 33% and 50% densities. I placed the duckweed into the tubs, with 2 tubs for each density and 1 tub of no duckweed, to act as the initial nutrient results.

Entry 4- 06/04/2015
Today was the first day of result measurements for the 7 different nutrient qualities.

The first quality that I measured was apparent water colour. This was measured using a colorimeter. After each measurement, it was important to clean the test tube inside the colorimeter using de-ionised water, to ensure that a past samples' suspended solids did not affect a current result taking. This would have ensured a fair result. *Below: Colorimeter*



The hardness of water was measured using a test kit, that utilised EDTA titration to find out the hardness in mg/L. This test kit contained chemicals that could be harmful to humans if ingested or handled, so there were several precautions in

place. These were rubber safety gloves and goggles. If any clothing was contaminated, it was vital to wash and change out of the clothing.

Below: Hardness test kit

Iron was measured using by placing iron reagent into the sample and then to compare it with an iron colour chart to see the iron levels.

Below: De-ionised water and the iron test kit

Nitrate was measured using a nitrate photometer, that utilised a cadium reaction method. The photometer required a sample of water to be inserted in the photometer's cuvette.

Below: Nitrate photometer

Nitrite was measured in a much similar method to iron, where I utilised nitrite reagent against a colour chart to determine the nitrite levels

Alkalinity results relied on an acid titration method to determine the levels.
Below: Alkalinity test kits and the acid reaction

pH was measured using a pHep tester, that was inserted into the water until a stable result was reached.
Below: pHep tester

After the result taking, I replaced the amount of water I took from each tub, ensuring that the levels matched up to the permanent marker lines I made on the first day of the experiment.

Entry 5- 08/04/2015

Today I have measured nutrient results for the 6th day of the experiment. I also removed some excess duckweed in the different density tubs, to ensure accurate results per ratio.

Entry 6- 16/04/2015

Today is the last day of the 2 weeks and I have collected all the results. Below are my tables with my results.

APPARENT WATER COLOUR (PCU)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	15	20	15	25	20	25	15	25
	25%		35	20	20	20	30	20	40
	33%		30	20	25	25	30	20	40
	50%		45	30	30	30	40	25	45

HARDNESS (MG/L)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	60	40	60	63	70	68	62	58
	25%		52	58	63	64	71	54	52
	33%		44	60	58	68	68	59	52
	50%		56	43	50	60	58	53	51

IRON (MG/L)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	0.3	0.5	0.25	0.5	0.5	0.2	0.25	0.2
	25%		0.5	0.23	0.4	0.45	0.23	0.2	0.2
	33%		0.42	0.26	0.4	0.5	0.3	0.15	0.15
	50%		0.2	0.1	0.2	0.3	0.1	0.05	0.1

NITRATE (MG/L)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	2.25	0.45	0.29	0.31	0.23	0.2	0.2	0.18
	25%		0.47	0.29	0.31	0.24	0.23	0.18	0.18
	33%		0.45	0.38	0.29	0.24	0.2	0.2	0.18
	50%		0.54	0.43	0.24	0.2	0.23	0.24	0.2

NITRATE EFFICIENCY (PERCENT)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	N/A	80	87	86	90	91	91	92
	25%		79	87	86	89	90	92	92
	33%		80	83	87	89	91	91	92
	50%		76	81	89	91	90	89	91

TOTAL ALKALINITY (MG/L)

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	54	49	49	48	48	46	38	42
	25%		50	48	49	44	47	37	40
	33%		49	46	45	44	39	32	36
	50%		43	44	42	36	37	35	36

pH

	Density								
Day		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***
	20%	7.2	7.1	7.1	7.1	7.1	7.2	7.4	7.5
	25%		7.15	7.3	7.3	7.3	7.3	7.5	7.5
	33%		7.2	7.4	7.5	7.3	7.5	7.3	7.2
	50%		7.2	7.3	7.4	7.5	7.4	7.2	7.2

Entry 7- 20/07/2015

Today I have finished my science project and report. The findings were very interesting and can be extremely useful for governments and councils nationally and internationally.

This is due to duckweed having a far better than expected removal of the high and harmful starting nitrate levels, that influenced Lily Pond's history with eutrophication. Duckweed had up to a 92% removal rate of nitrate, in the short span provided. Therefore duckweed is extremely suitable as a filtering scheme in terms of nitrate.

All the other areas did present some notable results, but the pH and alkalinity is quite significant, as it measures whether duckweed would have any negative affects on the pond ecosystem.

The pH needed to remain stable over the course of the experiment, as it determines the water acidity and a secure and suitable pH is essential for healthy plant and animal life. Over the span of the project, the pH only varied slightly from 7.2 pH to at most 7.7pH. Therefore, duckweed does not negatively harm the pH and would be suitable to maintain the current life in Lily Pond. These results also demonstrate that in other pond environments, duckweed would not impact aquatic life.

The alkalinity, which is the water's ability to buffer against harmful pH changes, also remained stable and fairly high after the use of duckweed. Hence, duckweed is established to ensure the water's strong buffering capability.

Overall, I am extremely pleased with the results, as they present new findings that show great potential for duckweed as a cost effective and efficient solution to the recurring and severe issue of eutrophication throughout the world.