Ayo's Logbook

Good Copy:
https://docs.google.com/document/d/1sy5hlHAqtaDCGWY7jTm302PxTcQDBp_4N0WS4f6D32w/edit?usp=sharing

Legend:
Research
Entry
Links
Important

January 22
- Looked for a topic
- Asked parents for advice and ideas

January 23
- Found a topic (Can we slow down freshwater acidification?)
- Brainstormed questions:
    - What is acidification?
    - How does it affect humans and the environment?
    - Is there an environmentally friendly and easy way to slow or stop this?
- Told my friends about it and asked for more questions and advice.
- Told parents my idea. They asked me questions about it and how we would experiment.
- Planned out the experiment a little more
- Dad helped me with my variables and which one was my manipulated variable.
- Dad assisted me with the planning of the experiment.
- Looked online for the supplies I needed

January 24
- Tried to find a way to increase the difficulty of my experiment and project.
- Looked online more for supplies:
    - **Grow lights**
        - https://www.amazon.ca/Plants-Adjustable-Gooseneck-Dual-lamp-Outdoor
        - https://www.amazon.ca/dp/B07VR5JDPK/ref=sbl_dpx_B08P316JR4_0
    - **Aquarium plants (Moneywort/Amazon Sword)**
        - https://www.petsmart.ca/search/live-plants/fish/?q=plants&pmin=0.00&srule=relevance
    - **pH testing stick**
        - https://www.amazon.com/dp/B01M5IASHD/ref=emc_b_5_t
- Looked over my question with my dad and brainstormed more on my project

January 25
- Ordered some of my variables.

- Talked to my teacher about my experiment and asked for a little bit of help.
- Talked to my dad more about my experiment
- Planned what I wanted in my background research.
- Rewrote question;
    - **Question: Are aquatic plants an easy and environmentally friendly way to slow down freshwater acidification?**

January 26

- Wrote hypothesis
    - **Based on the information I have jotted down, I think that aquatic plants are an easy and environmentally friendly way to slow down freshwater acidification by using the process of photosynthesis.**
    - **In photosynthesis, plants use carbon dioxide to make their food and by doing that, they release the gas we need which is oxygen. They don't only use the carbon dioxide for food but to strengthen up and grow faster.**
    - **After growing, they could pollinate by releasing reproductive cells into the water and will spread around the river.**
    - **We could plant even more plants in different rivers and lakes making them spread even more.**
    - **For this to work, we will need to lower the amount of plastic we use and the things we waste.**
- Ordered more things.

January 27

- Finished ordering the things I had to get online.
- Background Information
    - **What is pH?**
        - What is pH?
            - pH is a unit of measurement used to measure how acidic or basic a substance is.
            - Its scale begins with 0 and ends with 14.
            - 0-6.5 is acidic
            - 7 is neutral (Water should be this)
            - 7.5-14 is basic or alkaline.
                - https://www.usgs.gov/special-topic/water-science-school/science/ph-and-water?qt-science_center_objects=0#qt-science_center_objects
                - https://www.britannica.com/science/pH

January 30

- Talked to my dad about the costs of the project and how much space we had.
- **We decided to change it to a research project with a demonstration.**
- I looked over the criteria for a research project and the judging criteria.

- Continued my research.
    - **Freshwater Acidification**
        - Just like our oceans, our freshwater bodies are also acidifying.
        - Researchers from the Ruhr-University Bochum in Germany found that some freshwater ecosystems that they studied had become more acidic as atmospheric CO2 levels rose.
        - Acidity in freshwater bodies had increased too and the pH by 0.3 units in the 35 years.
        - In about 100 years, the pH of our rivers and lakes could lower by 1.5 if we don't take action now.
        - https://www.downtoearth.org.in/news/climate-change/not-just-oceans-freshwater-bodies-are-turning-acidic-as-well-59494
        - https://www.scientificamerican.com/article/like-oceans-freshwater-is-also-acidifying/

February 6

- Went to PetSmart to buy the remaining materials. Only the fish tanks were there. We are coming back on Tuesday to get the plants and will start the demonstration on Sunday/Monday.

February 9

- Today we went to Pet Land instead where we found some plants. I couldn't find the ones I wanted to use so I brought 2 different types of plants. I took some pictures and kept the plants in their tanks so they don't die when I start the experiment/demonstration.
- My teacher helped me plant some of the topics I will talk about during my project.
- Talked to my dad about the demonstration

February 10

- My teacher gave me more ideas for the research part of my project

February 11

- I watched more CYSF videos on how we are going to do our projects this year.
- Looked into what "Background Research" meant.
- I wasn't able to find as much information as I thought I would find on this topic.
  Therefore, I will now focus on the ocean instead.
    - **Rewrote question and hypothesis**
    - **Question:**
        - **Are planting seagrass beds in our nearby oceans a convenient and sustainable way to slow down acidification in them?**
    - **Hypothesis**
        - **Based on the information I already know, I assume that we could use seagrass beds to slow down acidification in our local oceans (Oceans that surround Canada) by using the process of photosynthesis.**

        - **In photosynthesis, plants like seagrass, use carbon dioxide (CO_2) to make their food and by doing that, they convert the gas to oxygen. They don't only use carbon dioxide for food but to vigor and grow faster. After they become adult plants they could spread around the oceans in their own ways.**
        - **Seagrass, for example, is a flowering plant and it reproduces sexually or asexually;**
            - **In sexual reproduction, pollen is carried through the water to fertilize female plants**
            - **In asexual reproduction (clonal growth), they shoot out rhizomes that sprout new growth which means one plant can produce a tuft of seagrasses.**
        - **For this to work, we will need to lower the amount of carbon dioxide we are putting in the atmosphere by switching to renewable resources and going green.**
- So, I'm thinking about starting my research all over again to be able to organize myself a little better.
- Emailed professors
- Ocean Acidification
    - What is it?
        - Acidification is the process in which a substance gradually becomes more and more acidic over time (decrease in pH). Therefore, ocean acidification is when our oceans lower in pH (become more acidic).
        - The number of acids surpasses the bases in the water changing its pH
        - To put it simply, ocean acidification is an error happening in the carbon cycle.The amount of carbon dioxide in our atmosphere is too much to be converted to oxygen by plants. The carbon cycle is a biogeochemical cycle where carbon is put into the air and is turned into oxygen or dissolves in water
        - http://www.air-quality.org.uk/13.php
        - https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification
        - https://www.marineinsight.com/environment/effects-of-ocean-acidification-on-marine-and-human-life/
        - https://www.whoi.edu/know-your-ocean/ocean-topics/ocean-chemistry/ocean-acidification/
    - Causes
        - Natural Causes
            - Acid rain
            - Podzolization/ Podsolisation (Minerals from the upper layer of soil become acidic then leach into the lower layer of soil.
            - Atmospheric carbon dioxide levels increase and dissolve into the water. (Humans increase the levels, co2 dissolves on its own)

- Land Use Causes
    - Using nitrogen fertilizers. (Runoff water from fields with high levels of dissolved nitrogen and phosphorus may enter the water)
    - Dry deposition of air pollutants. (Atmospheric gasses freely fall into our oceans from the atmosphere.)
    - Wet deposition of air pollutants. (Atmospheric gasses mix with water in the atmosphere, then are washed out with precipitation and land in the ocean)
        - Sulphuric and nitric acids
        - https://public.wmo.int/en/our-mandate/focus-areas/environment/atmospheric-deposition#:~:text=Dry%20deposition%20is%20the%20free,through%20rain%2C%20snow%20or%20fog.
- Man-made Causes
    - Burning of fossil fuels and Fossil fuel emissions
    - "Fossil fuel emissions are the gases that are spewed out of most cars, aeroplanes, power plants, and factories that are burning fossil fuels (coal, oil or gas). Since the industrial revolution, fossil fuel consumption has risen exponentially to create many climate change-related issues, including ocean acidification." - Debbi Stone and Kevin Van Dien
    - -https://climateinterpreter.org/content/how-are-humans-causing-ocean-acidification#:~:text=These%20activities%20include%20the%20burning,leading%20to%20a%20CO2%20imbalance.
    - Deforestation
    - Vehicle Emissions
    - We are putting more carbon dioxide in our atmosphere than can be absorbed by Earths natural process

February 12

- Ocean acidification.
    - Effects
        - Aquatic Ecosystems
            - Reduces the amount of carbonate (salt of carbonic acid) which is very needed for marine life.
            - Makes it difficult for marine organisms (coral and some plankton ex.) to create their shells and skeletons.
            - Existing shells may dissolve.
            - Calcifying organisms might not be able to adapt to the rapid change of ph
            - A more acidic environment will harm other marine species such as molluscs, corals and some kinds of plankton.
            - The shells and skeletons of these organisms may become less dense or strong.

- Coral reefs will be more vulnerable to storm damage and slow the recovery rate.
- Marine organisms could also experience changes in growth, development and survival.
- Most species seem to be more vulnerable in their early life stages. (Juvenile fish may have trouble locating suitable habitat to live.)
- https://coastadapt.com.au/ocean-acidification-and-its-effects
- Clams and Mussels
    - Makes it harder for clams and mussels to find the material they need to build and maintain their calcium carbonate shells.
    - https://www.iaea.org/newscenter/news/jeopardy-at-sea-what-atoms-in-clams-tell-us-about-ocean-acidification
- Oysters, Corals
    - Cannot grow their shells in the acidic water.
    - https://ocean.si.edu/ocean-life/invertebrates/farming-oysters-despite-acidic-seas#:~:text=Ocean%20acidification%20is%20a%20consequence,shells%20in%20the%20acidic%20water.
- Scallops
    - Can prevent larvae of scallops and other bivalves (a large class of molluscs) from forming the calcium carbonate shells required for their development to maturity.
    - https://news.virginia.edu/content/study-ocean-acidification-may-reduce-sea-scallop-fisheries#:~:text=Increasing%20acidity%20in%20sea%20water,for%20their%20development%20to%20maturity.
- Starfish
    - Brittle stars and other invertebrates may have more difficulty produce calcite, affecting their skeletal formation and their ability to survive
    - https://www.anl.gov/article/dissolving-brittle-stars-hint-at-implications-of-ocean-acidification#:~:text=The%20rate%20the%20starfish%20decay%20offers%20clues%20to%20ocean%20acidification.&text=With%20increasing%20levels%20of%20carbon,and%20their%20ability%20to%20survive. .
- Sea urchins and sea butterflies (pteropods)
    - Acidic water not only destroys their shells, but it also makes it harder for them to build new ones

- https://www.sciencemag.org/news/2019/07/ocean-acidification-could-boost-shell-growth-marine-life-snails-and-sea-urchins#:~:text=That's%20bad%20news%20for%20tiny,them%20to%20build%20new%20ones.&text=Often%20called%20climate%20change%20%E2%80%9Cevil,ocean%20absorbs%20atmospheric%20CO2.

February 14

- Ocean Acidification
  - Effects on Humans
    - It will affect the food we eat since most of our shellfish require calcium carbonate to form or to fortify their shells.
    - The presence of healthy coral reefs is imperative to our survival because we rely on them for food, coastal protection and medicine (New medicines are being developed for cancer, arthritis, human bacterial infections, Alzheimer's disease, heart disease, viruses, and other diseases)
    - https://climateinterpreter.org/content/ocean-acidification-effects-humans
  - Economy
    - Potential job losses through declining harvest and fishery revenues from shellfish.
    - New Brunswick and Nova Scotia could see declines in resource accessibility but are not really affected by these changes.Unlike NB and NS, Prince Edward Island, along with Newfoundland and Labrador are more vulnerable to losses in fisheries.
    - https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0226544
  - Moved the demonstration date to tomorrow.

February 15

- Planned my demonstration today.
  - Materials
    - Plants used
      - Microsorum pteropus (Java Fern)
      - Hygrophila costata (Gulf Swampweed)
    - Three 0.8-Gallon Tanks
      - 2 with plants
      - 1 control
    - Carbonated water
    - Water
    - pH meter

        - Grow lights
        - Sea gravel (optional)
    - Procedure
        - Wash each tank
        - Fill each tank with 1L of lukewarm water.
        - Pour in 1L of carbonated water (carbonic acid) and mix.
        - Put sea gravel at the bottom of the tank (sea gravel is not needed for this experiment. It only keeps the plant in place)
        - Put a plant in one of the tanks and put the second one in a different one.
        - Leave one tank with no plant (Control)
        - Record the pH of the water for each tank
        - Put each tank under a grow light and leave overnight for a week after that night
        - Every night at 8;30, record the pH of each tank
        - Put the information gathered into a graph or table
    - Variables
        - Controlled:
            - Temp of water and carbonic acid
            - Amount of water and carbonic acid
            - Size of tubs
            - Time the tubs are left out
            - Amount of light each tub gets
        - Manipulative:
            - 2 tanks have a plant, the other does not
        - Responding:
            - pH of the water.
- Had to postpone my experiment again due to lack of time.
- Prof. Kim Juniper replied to my question and said
    - *Hi Ayo,*
      Interesting question. All plants can help reduce global atmospheric CO2 by fixing it into biomass, and this will eventually help reduce acidification caused by atmospheric CO2 dissolving in the oceans. However, this global effect does not scale down very well. Planting seagrass beds in one of our local oceans is unlikely to have much of a local effect on acidification because CO2 usually enters oceans from the atmosphere faster than it can be removed by the seagrass.

February 16

- Took pictures of my demonstration.
- Took the pH of each tank
    - Tank 1 (Java Fern)
        - pH of 5.19
    - Tank 2 (Gulf Swampweed)
        - pH of 5.11

    - Tank 3 (Control)
        - pH of 5.14
- One of the professors I emailed replied (Nancy Williams)
    - *Hello Ayo,*

      Thanks for your email. I do think that this strategy of using seagrass to create local OA refugia locally can be a short-term solution, but I do not see it as a long-term solution to OA. These plants eventually die and break down and their carbon is released back into the water, so the storage of carbon is not forever, and we still need to work to reduce anthropogenic CO2 emissions...

February 17

- I received an email from my teacher sharing the link for the CYSF platform.
- Took the pH of each tank
    - Tank 1
        - pH of 5.89
    - Tank 2
        - pH of 5.9
    - Tank 3 (Control)
        - pH of 5.51
- **What is pH?**
    - What is pH?
        - pH is a unit of measurement used to measure how acidic or basic a substance is.
        - Its scale begins with 0 and ends with 14.
        - 0-6.5 is acidic
        - 7 is neutral (Water should be this)
        - 7.5-14 is basic or alkaline.
        - https://www.usgs.gov/special-topic/water-science-school/science/ph-and-water?qt-science_center_objects=0#qt-science_center_objects
        - https://www.britannica.com/science/pH

February 18

- Took the pH of each tank
    - Tank 1
        - pH of 6.62
    - Tank 2
        - pH of 6.64
    - Tank 3 (Control)
        - pH of 6.36

February 19

- Took the pH of each tank
    - Tank 1
        - pH of 6.98
    - Tank 2
        - pH of 7.02
    - Tank 3 (Control)
        - pH of 6.88
- Transferred my question and hypothesis to the platform.

February 20

- Took the pH of each tank
    - Tank 1
        - pH of 7.48
    - Tank 2
        - pH of 7.45
    - Tank 3 (Control)
        - pH of 7.34
- Started researching on the topic, Plants

February 21

- Took the pH of each tanks
    - Tank 1
        - pH of 7.6
    - Tank 2
        - pH of 7.39
    - Tank 3 (Control)
        - pH of 7.21

February 22

- Took the pH of each plant
    - Tank 1
        - pH of 7.78
    - Tank 2
        - pH of 7.48
    - Tank 3 (Control)
        - pH of 7.29

February 23

- Took the pH of each plant
    - Tank 1
        - pH of 7. 71
    - Tank 2
        - pH of 7.65
    - Tank 3 (Control)

        - pH of 7.32
- This was the last day.

February 25

- Started researching plants.
    - Photosynthesis and seagrass
        - Like most plants, seagrass needs sunlight to grow and photosynthesize.
        - Even in the ocean, sunlight still penetrates it for about 600ft. (sunlight zone)
        - Special cells within the seagrass, called chloroplasts, use energy from the sun to convert carbon dioxide and water into carbohydrates which are also known as sugar and oxygen through photosynthesis. Seagrass roots and rhizomes absorb and store these nutrients and help to keep the seagrass plants in place.
        - https://kids.frontiersin.org/article/10.3389/frym.2018.00002
        - Chloroplasts in their tissues use the sun's energy to convert carbon dioxide and water into sugar and oxygen for growth through the process of photosynthesis. Veins transport nutrients and water throughout the plant, and have little air pockets called lacunae that help keep the leaves buoyant and exchange oxygen and carbon dioxide throughout the plant. Like other flowering plants, their roots can absorb nutrients.
        - https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds#:~:text=Like%20their%20relatives%2C%20seagrasses%20have,through%20the%20process%20of%20photosynthesis.&text=Like%20other%20flowering%20plants%2C%20their%20roots%20can%20absorb%20nutrients

February 27

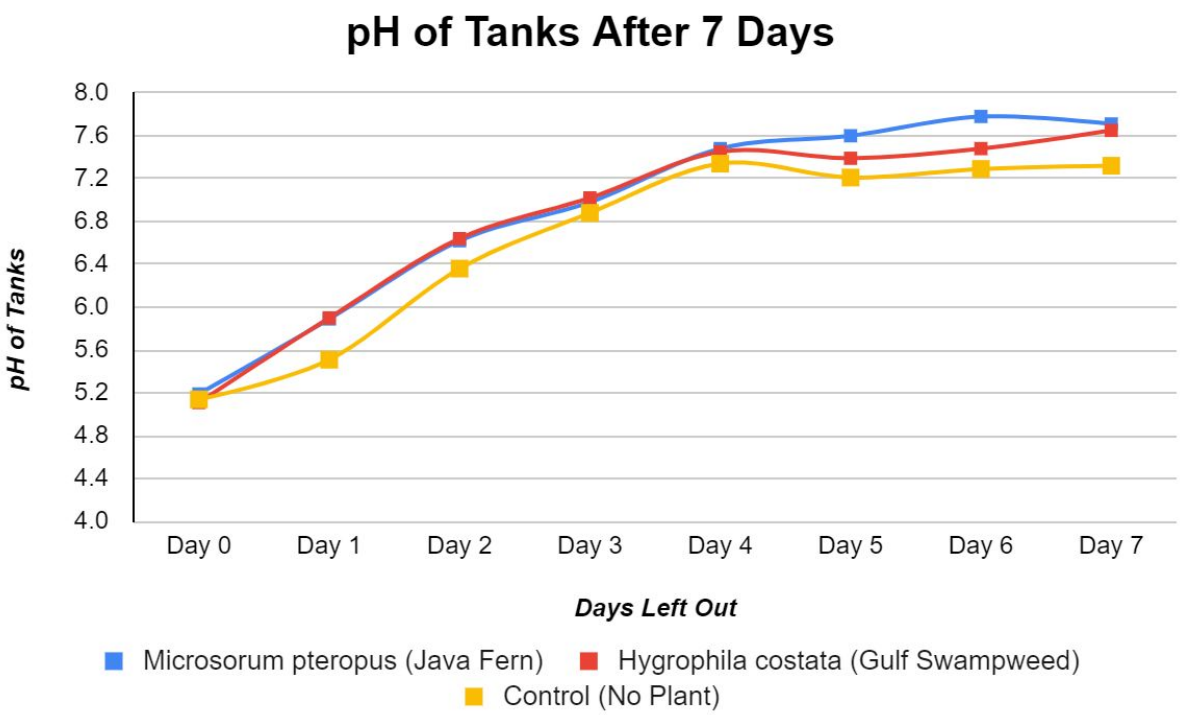
- What is seagrass
    - Not a seaweed
    - Group called monocotyledons
    - Have veins, roots, produce flowers seeds. Rhizomes too
    - Mostly found in salty and brackish
    - Deepest it can grow is 190ft
- Parts of seagrass
    - Leaves: Little air pockets called lacunae help keep the leaves buoyant and exchange oxygen and carbon dioxide throughout the plant. Act as a habitat for many fish and invertebrates,
    - Flowers: Carry pollen and seeds
    - Rhizomes: Keeps the plants in place and sprouts new plants.
    - Roots: Produces new plants and store nutrients. Also anchors the plant in place.
    - https://www.seagrasswatch.org/seagrass/

March 1

- How does seagrass affect OA
    - A single square meter of seagrass can produce ten litres of oxygen per day
    - Photosynthetically productive; seagrass can absorb huge amounts of carbon from the atmosphere.
    - Each square metre of seagrass can absorb 83 grams of carbon per year
    - seagrass meadows hold around 15% of the carbon stored in the ocean.
    - make up only 0.1% of the ocean floor.
    - The carbon is stored in the plant, and as the plant dies, the leaves sink to the seabed and decay. The carbon trapped inside the leaves and rhizomes of the seagrass will become buried by sediment, and trapped indefinitely — that is unless the seagrass meadow is interfered with.
    - https://www.gvicanada.ca/blog/the-importance-of-seagrass-why-we-should-conserve-this-marine-habitat/#:~:text=Because%20they%20are%20so%20photosynthetically,carbon%20stored%20in%20the%20ocean.

March 3

- Converted information from experiments to line graphs



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March 10

- Asked teacher for advice and she gave me more ideas for my project

    - Pros and cons of this idea
    - Challenges of this idea
    - For my whats next, I should do this on a bigger scale
    - Is it realistic?
- Adaptations for seagrass
    - Seagrasses have evolved to withstand various degrees of salinity.
    - They can tolerate temperatures ranging from minus 6 to 40 degrees C.(Coldest part of the ocean is -1.94C) If higher/lower temperatures, it can change the pattern of sexual reproduction)
    - Their stems, called rhizomes, anchor the plant.
    - Roots grow down from the rhizome to anchor the plant to the seabed, while flexible blades grow straight up and can bend to the current.
    - Fast-growing grasses form a mat that traps sediment (solid material that settles at the bottom of a liquid) and stabilizes the seabed, allowing taller, slower-growing varieties to establish roots.
    - Seagrass responds to rising sea levels by spreading shore-wards into shallower water. The sediment it collects helps prevent erosion and slow the rate at which land area is lost to the sea
    - https://sciencing.com/adaptations-survival-seagrass-8547892.html
    - http://www.ouchvolunteers.com/seagrass.php#:~:text=The%20water%20needs%20to%20be,cold%20for%20it%20to%20survive.
- Apparently seagrass is endangered so I decided to research more on that.
    - Natural Threats
        - Climate change due to global warming threatens both marine and terrestrial ecosystems. Storms, earthquakes and tsunamis can rip up seagrass fields and fill the water with mud and debris.
        - High levels of plant nutrients. High nutrient levels, often due to agricultural and urban runoff, cause algae blooms that shade the seagrass. Reduction in light decreases seagrass growth and can kill whole populations.
    - Man Made Threats
        - Global warming
        - Sewage, oil spills and agricultural and industrial waste pollute the water and make it murky.
        - Seagrass needs clear, sunlit water for photosynthesis. Without it, the plants die and rot, resulting in more greenhouse gases, as well as loss of habitat for the other plants and animals that depend on the grass.
        - Coastal development; dredging harbors and building sea-walls and jetties can destroy seagrass meadows and disrupt currents.
        - Boat propellers can also tear up seagrass, leaving deep scars. https://www.aims.gov.au/docs/projectnet/seagrasses.html#:~:text=The%20greatest%20pollution%20threat%20to,Suspended%20sediments%20also%20reduce%20light