Ms. Fairchild's Class
4th grade
Kailua, Hawaii

Kaelepulu Canal Water Quality Testing: A GLOBE-Inspired Scientific Inquiry

Summary

When we learned that we were going to complete a scientific inquiry, we wanted to choose something that really matters to us. We immediately thought of Kailua Beach Park, a beach area that is just a block from our school campus. At the far end of the park, there is a canal with still water. Lots of kids and tourists like to play in the water but many parents say that it is not healthy. We decided that we would like to conduct water quality testing of this area to learn, once and for all, about whether or not it was a good place to splash around. We developed questions research questions that focused on the health of the body of water, based on GLOBE protocol, and whether the results were changed when the sand berm as opened and water could flow into the ocean. We established a study site and collected water samples, for seven tests, over four dates. We analyzed our results. We decided that, based on GLOBE protocol, the water was healthy and the results did not change drastically when the berm was opened but we now have additional questions and would like to conduct further tests.

Research Questions

While we knew immediately what the topic of our inquiry was we wanted to get more information, by doing research, before we just jumped in. We did searches on the internet and learned a lot of information about the area and how it has changed overtime. As we live in Hawaii, we were curious about the history of the canal (and the stream that leads up to it). We were able to connect with an environmental scientist, Uncle Bob, that gave us a lot of information about the canal. One thing we learned from talking with him is that the city and county of Honolulu are supposed to help organize berm openings on a regular basis. This really intrigued us! We had seen the big bulldozers out at the canal before and saw them digging the sand out, to make a path for the water to exchange from the canal/pond and the ocean. Uncle Bob said that this is really good for the pond and helps clear out a lot of the murky stuff. It also lets the large fish go out to sea and lets small fish eggs float in from the sea into the pond. We developed several research questions: *Is the Kaelepulu Canal healthy for public human use? How does the water quality of the canal water differ before and after the berm is opened?*

The way we decided to test our questions was through a thorough water quality investigation at the canal. Our first step was establishing a site, following the GLOBE protocol. We determined what tests we were going to conduct and split up into groups, where several students were in charge of a specific test. The students were trained for their tests. Each group would focus on looking at their test and whether or not their test results would change after the berm was opened or not. We determined that after collecting weeks of data we would analyze the results in groups, than put them together and analyze as a whole class and then put together answers to our two driving questions.

Research Methods

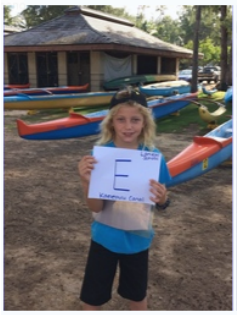
The first step was visiting the canal and selecting our specific site. We found a sandy bank, right at the mouth of the canal. The area is shallow and calm, with little water movement. On one end is the pond that leads to the canal and at the far end is the large berm of sand that the city workers will come and bulldoze, opening up the free-flow of pond and ocean water. The left side of our study site has a bridge that goes over the canal water. The climate is warm and there is little fluctuation in the weather year-round, as Hawaii does not experience traditional seasons.

The name of the pond that ends at the canal is Kaelepulu Pond, so we named our site Kaelepulu Canal (Eastern Bank), as we collected water samples on the Eastern bank. We measured out our site and then laid out cones. All students mapped out the site. We've selected one student's map of the site and included it below.

Site Information

Site ID	45920
Name	Kaelepulu Canal (Eastern Bank)
Latitude	21.39636°
Longitude	-157.72641°
Elevation	4.8m
Location Source	gps

Water Body Name	Kaelepulu Canal
Water Body Type	brackish
Water Body Source	pond
Area	0.574654 sq/km
Depth	1.5 m
Water Sample Location	bank
Can See Bottom	Yes
Bank Material	Unknown
Bedrock Type	Mixed Sediments
Salt Habitat	has Sandy Shore

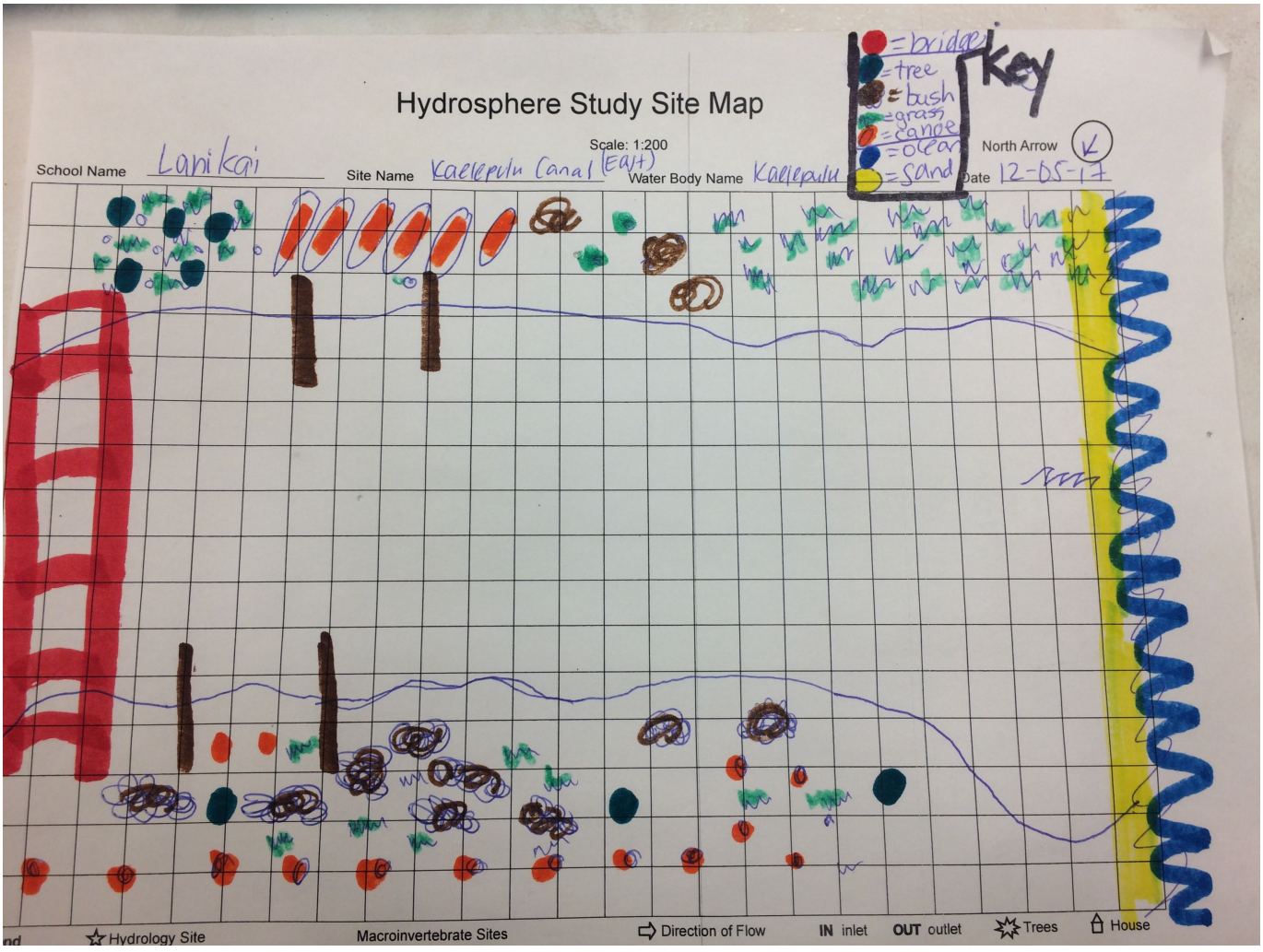


East

South

North

West



We conducted a total of seven different water quality tests, as part of our comprehensive water quality inquiry. We established our study site on 12-05-2017. We collected water samples four different times; three times before the berm opened (12-15-2017, 01-12-2017 and 01-19-2017) and once after it was opened (01-26-2017). Here are the details of the GLOBE hydrology tests we used:

Water Temperature
We tested for water temperature using alcohol-filled thermometers. We tested this immediately on-site and repeated the test three times each sample session.

pH
We tested for pH using pH test strips. We collected three samples of water, brought them back to the lab and tested for pH there, within the hour.

Nitrates
We collected water samples to use to test for Nitrates at the study site. We brought them back to the lab and completed the Nitrates test there, using a chemical kit, manufactured by Hanna.

Water Transparency
We conducted water transparency tests at the study site each time we visited. We brought both the secchi disk and the transparency tube with us. Due to the level of water (it was shallow) we recorded the data from the transparency tube.

Salinity
We tested for salinity using a hydrometer. We collected three samples of water, brought them back to the lab and tested for salinity there, within the hour.

Dissolved Oxygen
We collected water samples to use to test for Dissolved Oxygen at the study site. We had to be very careful not to get any air bubbles in the water sample at all. We brought them back to the lab and completed the Nitrates test there, using a chemical kit, manufactured by Hanna.

Electrical Conductivity
We used an electrical probe to test for electrical conductivity. We did the test immediately after collecting the sample at the study site.

Below is the **data** we collected for our four collection dates, as entered into the GLOBE database:

Alkalinity

Lanikai School : Kaelepulu Canal (Eastern Bank) Data Table

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Alkalinity Via Direct Mgl
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	30
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	30
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	30
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	30

Electrical Conductivity

Lanikai School : Kaelepulu Canal (Eastern Bank) Data Table

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Conductivity Micro Siemens Per Cm
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	2000
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	2000
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	2000

Dissolved Oxygen

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Dissolved Oxygen Via Kit Mgl
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	6.8
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	7.4
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	7.2
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	7.2

Nitrates

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Nitrate And Nitrite Mgl
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	0
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	0
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	0
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	0

pH

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Ph	Ph Method
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	7	paper
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	7	paper
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	8	paper
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	7	paper

Temperature

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Water Temp C	Temperature Method
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	24.4	alcohol-filled thermometer
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	25	alcohol-filled thermometer
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	25.2	alcohol-filled thermometer
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	25.5	alcohol-filled thermometer

Transparency

School Name	Site Name	Userid	Latitude	Longitude	Elevation	Measured At	Water Body State	Transparency Disk Image Disappearance M
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-19 10:20:00	normal	1.28
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-12 20:20:00	normal	1.25
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2017-01-26 20:22:00	normal	1.48
Lanikai School	Kaelepulu Canal (Eastern Bank)	22066622	21.39636	-157.72641	4.8	2016-12-15 20:25:00	normal	

Conclusion

After thoroughly analyzing our data we came together to revisit our two research questions. The first thing we all agreed on is that there was not a significant change to the water quality when the berm opened. We had hypothesized that the change would be greater in the level of dissolved oxygen. We had specific time constraints for this project; however, if we had more time, we would have liked to go back and collect several more samples after the berm had opened. The berm was opened on 01-24-2017, just two days prior to our last collection date. It would have been better to allow more time for the water to exchange. One thing we did notice though is all of the green algae flowing out of the pond and into the

ocean. We could see that happen. We know that this is definitely going to make a difference on the amount of algae in the water, which will affect other levels.

To address our other question, all of the tests we conducted came back in the normal range. There was nothing that stood out as being “bad.” We are still not sure though that we would say that the canal water is healthy and good to swim in. We know this because we have seen signs there before that say not to go in the water. We are now wondering: Who put the signs there? What is the reason? Who decides when to put them up and take them down? We also think that we may need to test the water for other things, such as different types of bacteria. Another point that got brought up by one student is whether the quality of the pond changes over the year; if the levels in the winter are very different from the levels in the summer.

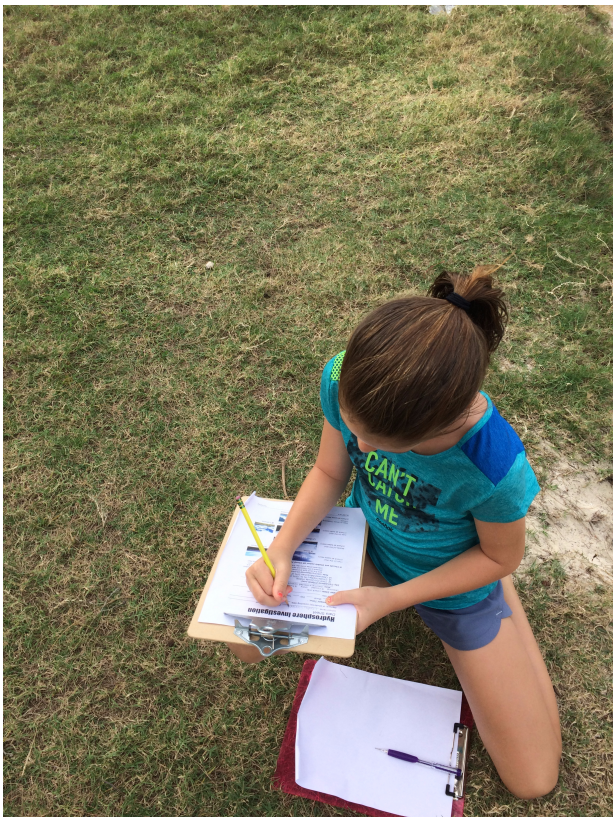
Overall, this was a great scientific inquiry! We were able to use GLOBE protocols to help us learn about an area in our neighborhood that is very important to us. While we answered our research questions, we now have even more questions and look forward to coming back to this special place and learning more!

Community Impact Badge

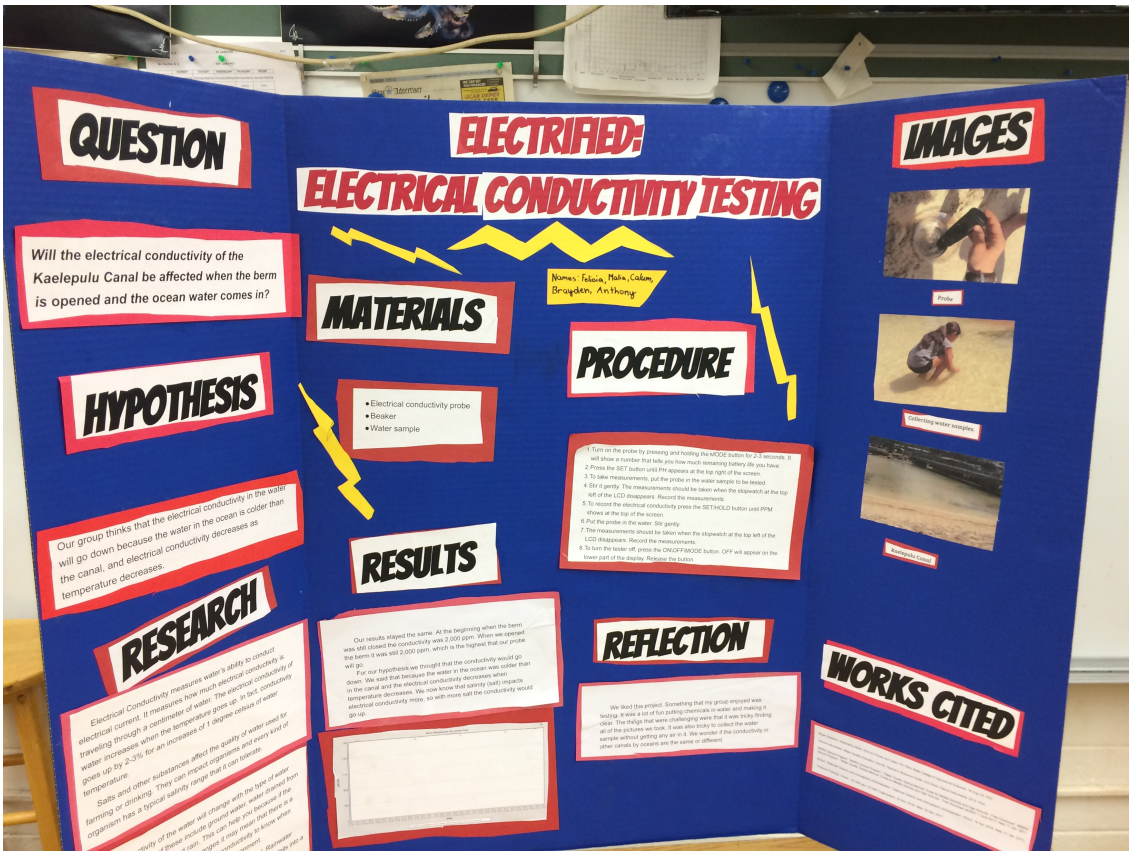
Our project is something that our school and neighboring community all think about. We took a topic of concern and were able to look at it closely, through Science. We have alleviated some concerns of the water health and are inspired to take the testing a step further by testing for bacteria. We also plan on talking to the healthy department to learn more about the signs that are put up in the area, what they mean and if there is anything that can be done to help the health of the water.

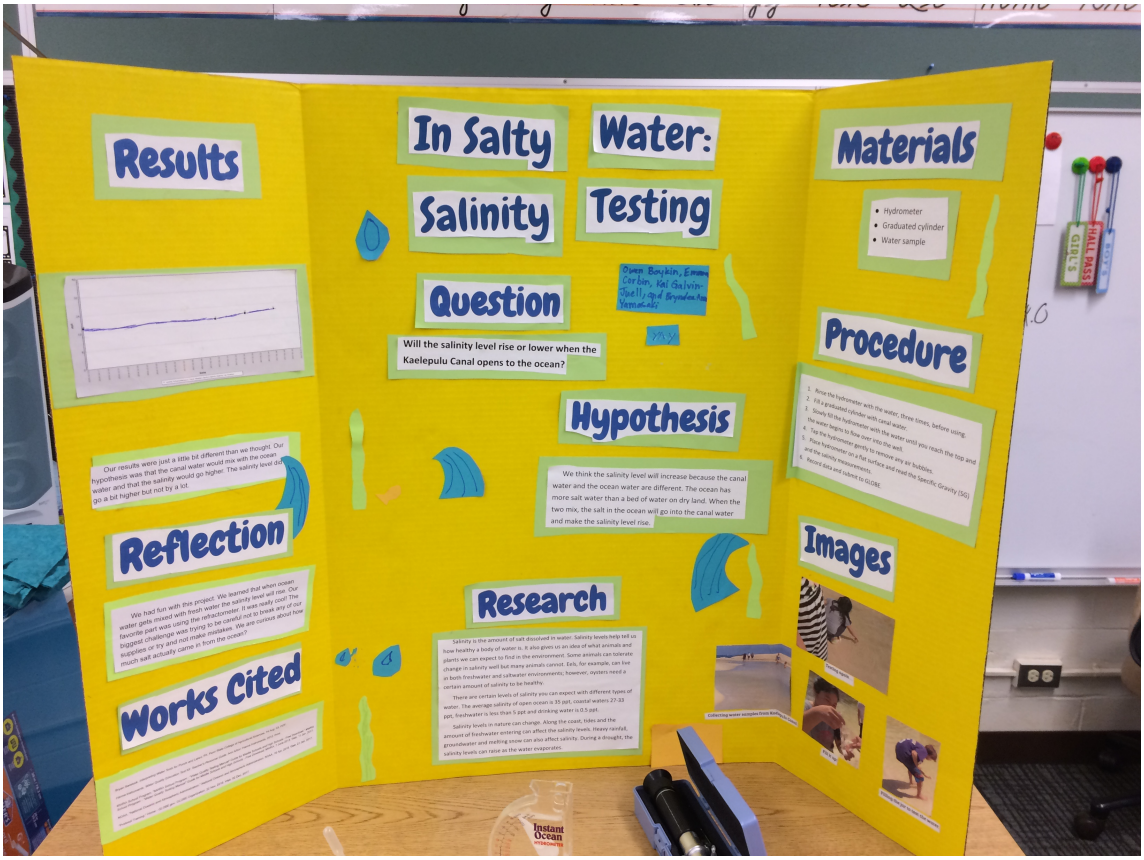
Connecting to a STEM Professional

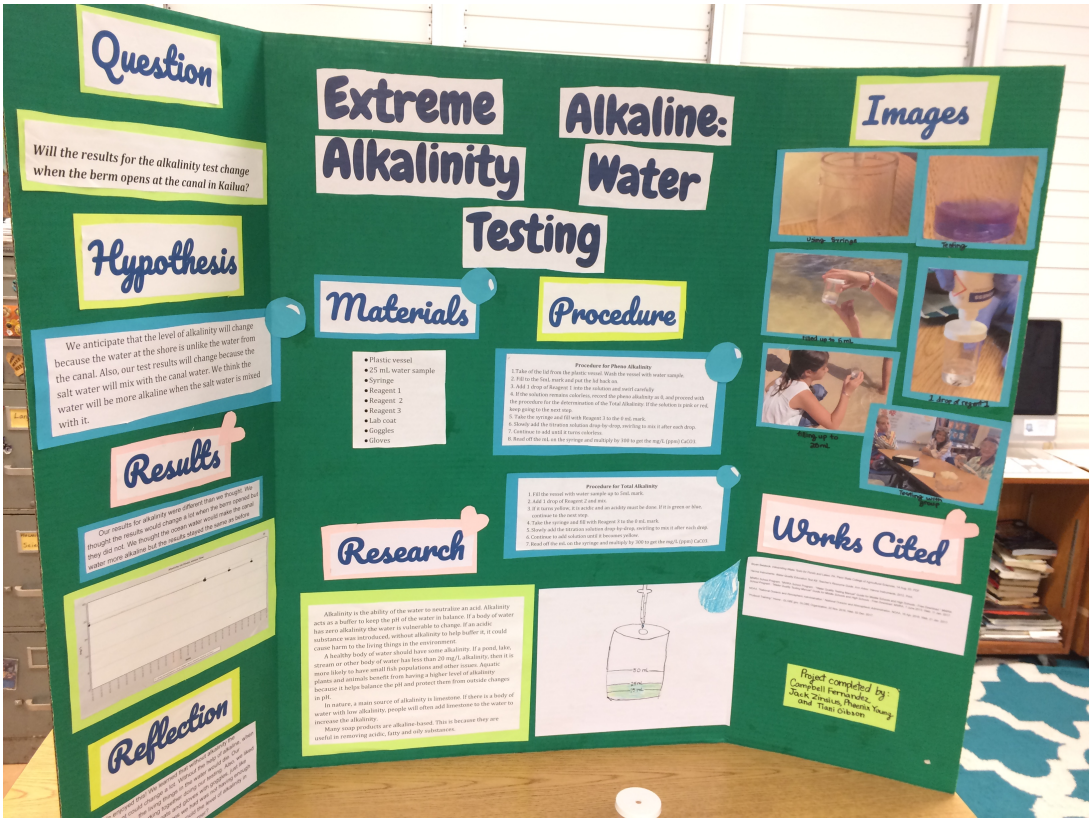
We were able to connect with Uncle Bob, an environmental scientist that lives in a neighborhood that borders the pond. He is really invested in the health of the water and is on a board that helps make decisions about the pond and works to clean-up the area. He helped give us information on the history of the area, the full details of the water and surrounding area (depth, tide times, etc) and is the one who connected with the city and found out when exactly they were going to bulldoze the area. This helped us plan our water sample dates. Uncle Bob was a huge help!

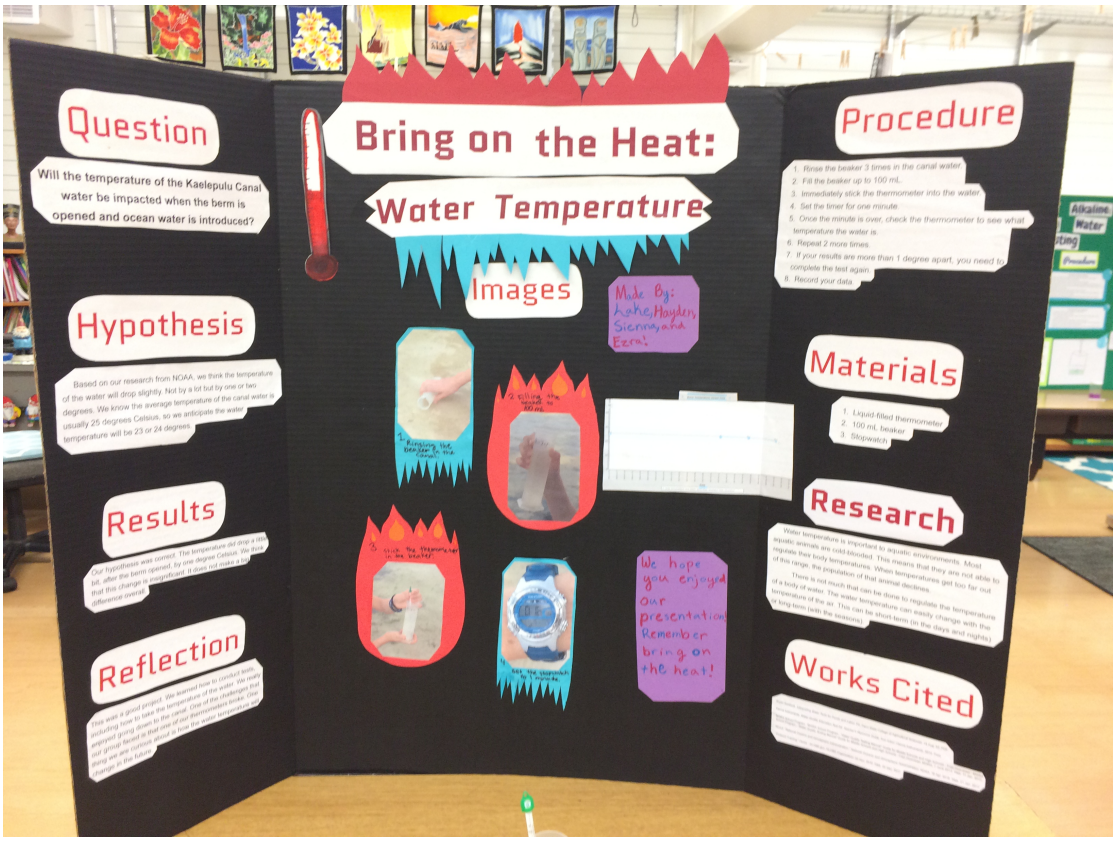

CAN'T
ME

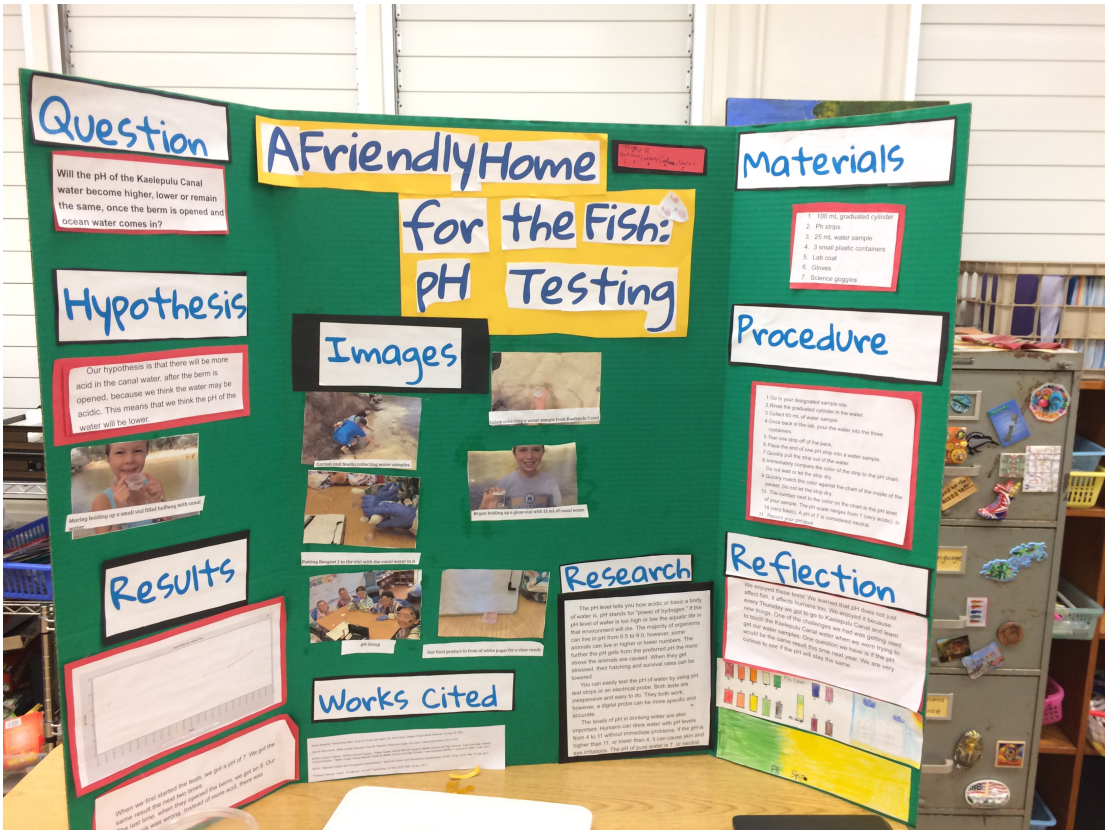

KAILUA

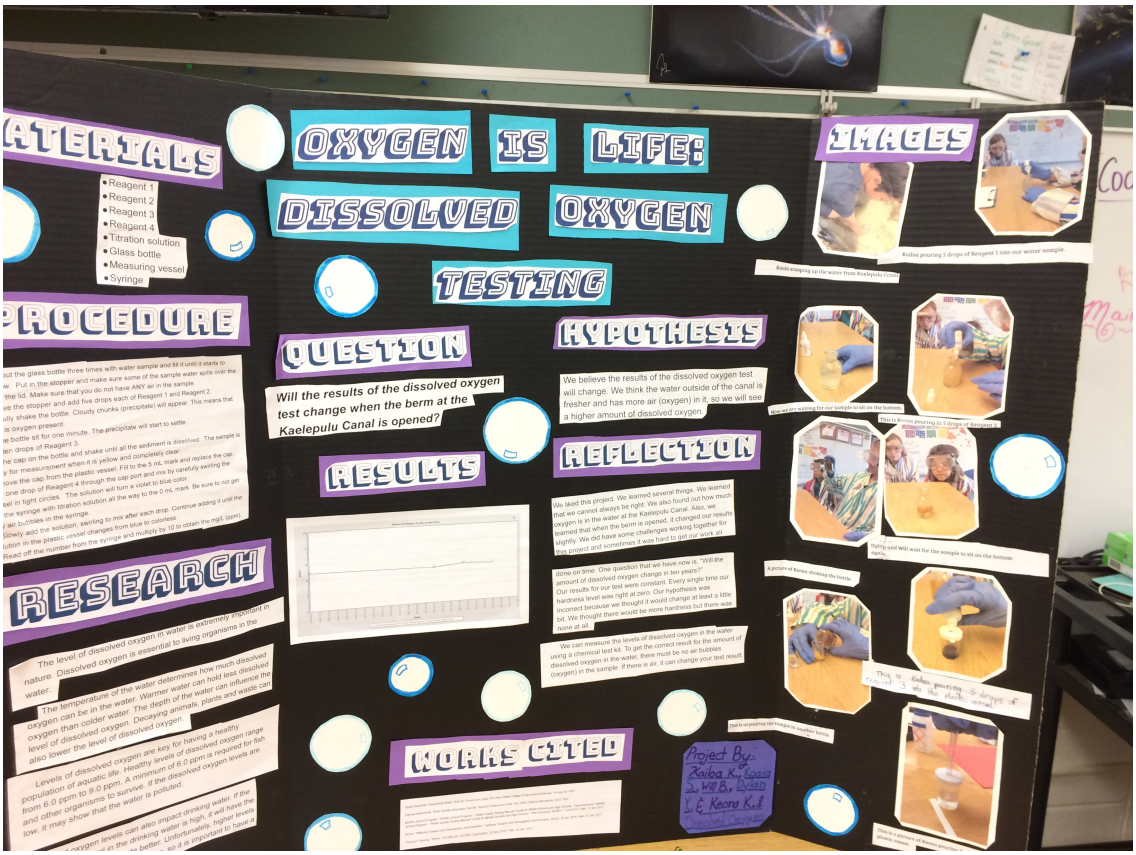

QUESTION
ELECTRIFIED:
ELECTRICAL CONDUCTIVITY TESTING
IMAGES
Will the electrical conductivity of the Kaelepulu Canal be affected when the berm is opened and the ocean water comes in?
Names: Felicia, Malia, Calum, Brayden, Anthony
MATERIALS
PROCEDURE
HYPOTHESIS
• Electrical conductivity probe
• Beaker
• Water sample
Our group thinks that the electrical conductivity in the water will go down because the water in the ocean is colder than the canal, and electrical conductivity decreases as temperature decreases.
RESULTS
RESEARCH
REFLECTION
WORKS CITED


Results
In Salty
Water:
Salinity
Testing
Materials
• Hydrometer
• Graduated cylinder
• Water sample
Question
Will the salinity level rise or lower when the Kaelepulu Canal opens to the ocean?
Procedure
Hypothesis
We think the salinity level will increase because the canal water and the ocean water are different. The ocean has more salt water than a bed of water on dry land. When the two mix, the salt in the ocean will go into the canal water and make the salinity level rise.
Reflection
Images
Research
Works Cited
Instant Ocean


Question
Will the results for the alkalinity test change when the berm opens at the canal in Kailua?
Hypothesis
We anticipate that the level of alkalinity will change because the water at the shore is unlike the water from the canal. Also, our test results will change because the salt water will mix with the canal water. We think the water will be more alkaline when the salt water is mixed with it.
Results
Our results for alkalinity were different than we thought. We thought the results would change a lot when the berm opened but they did not. We thought the ocean water would make the canal water more alkaline but the results stayed the same as before
Reflection
Extreme Alkalinity
Alkaline: Water Testing
Materials
• Plastic vessel
• 25 mL water sample
• Syringe
• Reagent 1
• Reagent 2
• Reagent 3
• Lab coat
• Goggles
• Gloves
Procedure
Procedure for Phenn Alkalinity
1.Take of the lid from the plastic vessel. Wash the vessel with water sample.
2. Fill to the 5mL mark and put the lid back on.
3. Add 1 drop of Reagent 1 into the solution and swirl carefully
4. If the solution remains colorless, record the phenn alkalinity as 0, and proceed with the procedure for the determination of the Total Alkalinity. If the solution is pink or red, keep going to the next step.
5. Take the syringe and fill with Reagent 3 to the 0 mL mark.
6. Slowly add the titration solution drop-by-drop, swirling to mix it after each drop.
7. Continue to add until it turns colorless.
8. Read off the mL on the syringe and multiply by 100 to get the mg/L (ppm) CaCO3.
Procedure for Total Alkalinity
1. Fill the vessel with water sample up to 5mL mark.
2. Add 1 drop of Reagent 2 and mix.
3. If it turns yellow, it is acidic and an acidity test must be done. If it is green or blue, continue to the next step.
4. Take the syringe and fill with Reagent 3 to the 0 mL mark.
5. Slowly add the titration solution drop-by-drop, swirling to mix it after each drop.
6. Continue to add solution until it becomes yellow.
7. Read off the mL on the syringe and multiply by 300 to get the mg/L (ppm) CaCO3
Research
Alkalinity is the ability of the water to neutralize an acid. Alkalinity acts as a buffer to keep the pH of the water in balance. If a body of water has zero alkalinity the water is vulnerable to change. If an acidic substance was introduced, without alkalinity to help buffer it, it could cause harm to the living things in the environment.
A healthy body of water should have some alkalinity. If a pond, lake, stream or other body of water has less than 20 mg/L alkalinity, then it is more likely to have small fish populations and other issues. Aquatic plants and animals benefit from having a higher level of alkalinity because it helps balance the pH and protect them from outside changes in pH.
In nature, a main source of alkalinity is limestone. If there is a body of water with low alkalinity, people will often add limestone to the water to increase the alkalinity.
Many soap products are alkaline-based. This is because they are useful in removing acidic, fatty and oily substances.
Images
Works Cited
Project completed by:
Campbell Fernandez,
Jack Zirnius, Phoenix Young
and Tiani Gibson


Question
Will the temperature of the Kaelepulu Canal water be impacted when the berm is opened and ocean water is introduced?
Hypothesis
Based on our research from NOAA, we think the temperature of the water will drop slightly. Not by a lot but by one or two degrees. We know the average temperature of the canal water is usually 25 degrees Celsius, so we anticipate the water temperature will be 23 or 24 degrees.
Results
Our hypothesis was correct. The temperature did drop a little bit, after the berm opened, by one degree Celsius. We think that this change is insignificant. It does not make a big difference overall.
Reflection
This was a good project. We learned how to conduct tests, including how to take the temperature of the water. We really enjoyed going down to the canal. One of the challenges that our group faced is that one of our thermometers broke. One thing we are nervous about is how the ocean temperature will change in the future.
Bring on the Heat:
Water Temperature
Images
Made By: Ashe, Hayden, Sienna and Ezra
We hope you enjoyed our presentation! Remember bring on the heat!
Procedure
1. Rinse the beaker 3 times in the canal water.
2. Fill the beaker up to 100 mL.
3. Immediately stick the thermometer into the water.
4. Set the timer for one minute.
5. Once the minute is over, check the thermometer to see what temperature the water is.
6. Repeat 2 more times.
7. If your results are more than 1 degree apart, you need to complete the test again.
8. Record your data.
Materials
1. Liquid-filled thermometer
2. 100 mL beaker
3. Stopwatch
Research
Water temperature is important to aquatic environments. Most aquatic animals are cold-blooded. This means that they are not able to regulate their body temperatures. When temperatures get too far out of this range, the population of that animal declines.
There is not much that can be done to regulate the temperature of a body of water. The water temperature can easily change with the temperature of the air. This can be short-term (in the days and nights) or long-term (with the seasons).
Works Cited


Question
Will the pH of the Kaelepulu Canal water become higher, lower or remain the same, once the berm is opened and ocean water comes in?
A Friendly Home for the Fish: pH Testing
Materials
1. 100 mL graduated cylinder
2. Ph strips
3. 25 mL water sample
4. 3 small plastic containers
5. Lab coat
6. Gloves
7. Science goggles
Hypothesis
Our hypothesis is that there will be more acid in the canal water, after the berm is opened, because we think the water may be acidic. This means that we think the pH of the water will be lower.
Images
Procedure
Results
Research
Reflection
Works Cited


OXYGEN IS LIFE:
DISSOLVED OXYGEN TESTING
MATERIALS
• Reagent 1
• Reagent 2
• Reagent 3
• Reagent 4
• Titration solution
• Glass bottle
• Measuring vessel
• Syringe
IMAGES
PROCEDURE
QUESTION
Will the results of the dissolved oxygen test change when the berm at the Kaelepulu Canal is opened?
HYPOTHESIS
We believe the results of the dissolved oxygen test will change. We think the water outside of the canal is fresher and has more air (oxygen) in it, so we will see a higher amount of dissolved oxygen.
RESULTS
REFLECTION
RESEARCH
WORKS CITED
Project By: