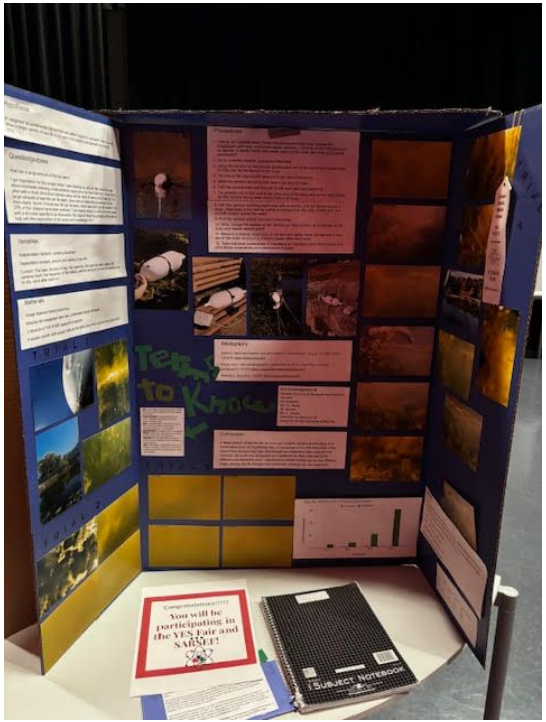
What's Underneath the Surface?



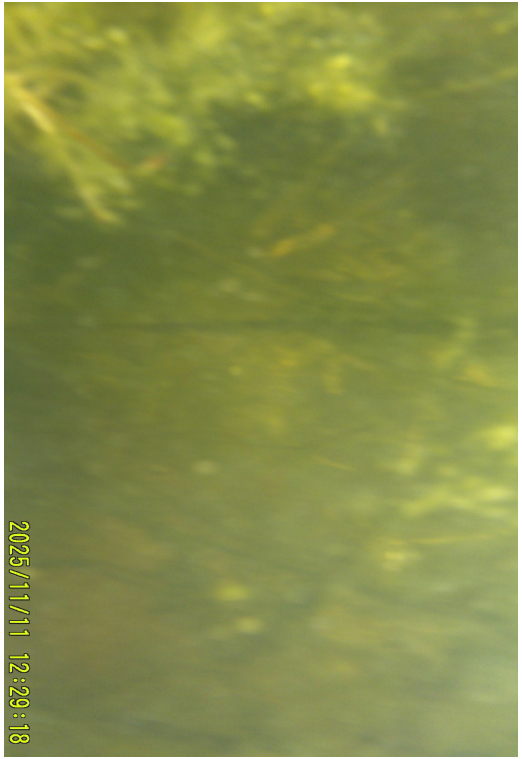
Grade: Seventh Grade

Category: Applied Technology

Question and Purpose

Can I design and engineer a floating viewing device that would allow observations of a greater amount and variety of aquatic organisms compared to a conventional ROV (remotely operate vehicle)?

I got inspiration for this project when I was reading an article for class that was about scientists videoing a rare antarctic squid alive for the first time. I think that a pillar with a multi directional camera setup will be able to see a lot of lake life. If a larger amount of lake life can be seen, more rare or interesting species will be more easily found. If more lake life can be seen, more lake life can be studied. Only 20% of the oceans have been explored. That means there is still a lot more ocean with a lot more sea life to be discovered. My hope is that my project will be able to help with new ideas for the exploration of the ocean and knowledge of it.



Engineering design 1
Trial 1 photo of plants

Independent/Dependent Variable/Control

Independent Variable

- Camera placement

Dependent Variable

- Amount and variety of living organisms

Control

- The lake
- Time of day
- Materials
- Type of video taken,
- Camera
- Resolution of the videos,
- Amount of time the camera was on dry land after each run

Engineering design 1
Trial 1 failed photo

Research

The oceans have been purely robotically studied without outside control since 1953 when Dimitri Rebikoff built the POODLE, the first ever ROV. The ocean has been explored only about 5%, a piece about the size of Rhode Island. There are many tools for studying different aspects of the ocean, three different tools just for measuring depth. There are 5 different commonly used tools for measuring salt level, most have to be used in combination to give better results than any individual one could. There are two tools for measuring oxygen, they are best used individually, unlike the ones for salt. There are two ways to measure PH and both are decently reliable, chemical test kits are for all except depth. ROVs can only video in one direction and cameras are expensive, very. Underwater cameras are very sensitive to the environment and lighting.

Hypothesis

If four varied designs of floating underwater devices were engineered to better support camera positioning, then a greater variety of aquatic life would be observed and documented.

Materials

Small Walmart brand boat buoy

Minolta 48 megapixel, dark teal, underwater digital camera

2 strands of 100 ft 550 paracord on spools

4 bungee cords

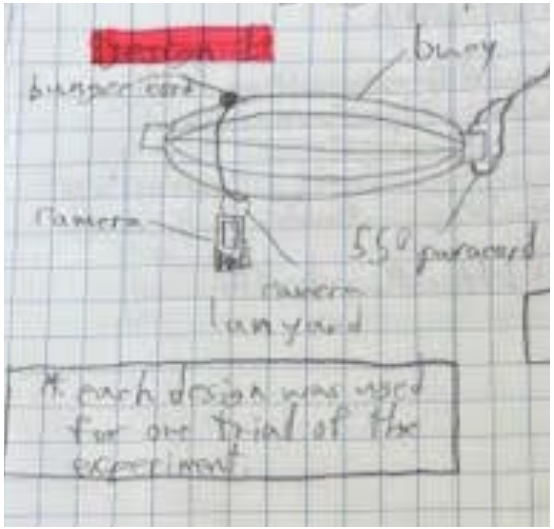
Very faint and blurry image of a fish

Procedures

1. Gather all materials listed: Small Walmart brand boat buoy, Minolta 48 megapixel, dark teal, underwater digital camera, 2 strands of 100 ft 550 paracord on spools, and 4 bungee cords.

Experimental design 1/Trial 1

2. Go to a shallow, vegetation/aquatic life filled lake
3. Using the lanyard on the Minolta camera and two of the bungee cords, wrap the bungee cords around the buoy and tie the lanyard to the buoy.
4. Tie one of the lines of 550 paracord to the end of the buoy using a box knot and then a sailor's knot.
5. Start the camera recording using the flash button on top and push it out into the lake, holding the paracord in one hand, the camera will float.
6. Pull the camera back with the coil of 550 cord and stop recording by double pressing the flash.



Engineering Design 1

Procedures

Experimental design 2/Trial 2

7. Tie another coil of 550 cord to the other end of the buoy with the same two knots as before and, using more bungee cords wrapped around the buoy, tie the camera facing down on the bottom of buoy, wrapping the bungee cords around the camera body.

8.Get the camera recording again with the flash button and, with a partner on the other side of the lake, pull the device across a large, deep area of the lake by pulling or letting loose the coils of 550 cord, in a smooth motion across the water, making sure that the device starts above land by tensioning the cords to bring it a few feet off the ground, to prevent camera damage.

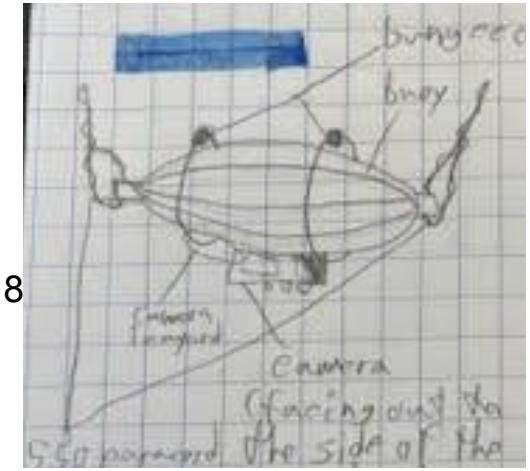
9. Pull the camera ashore and stop it recording, keeping it elevated with tensioned paracords.

Engineering Design 2

Procedures

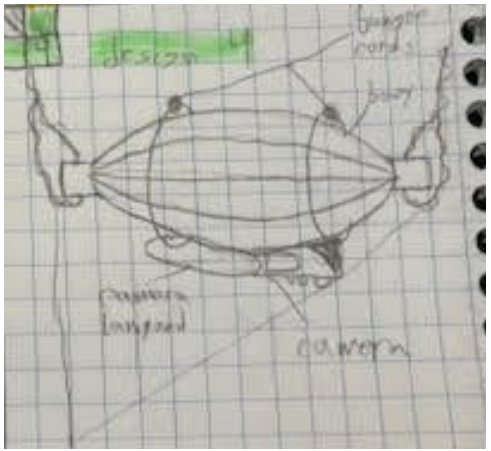
Experimental design 3/Trial 3

10. Now, change the position of the camera so that it points out to the left side of the buoy and repeat steps 8 and 9, ensuring that the cord remains tensioned when above land.



Engineering Design 3 (above)

Engineering Design 4 (below)



Experimental design 4/Trial 4.

11. Move to a shallow, and smaller area of the lake and lightly move the same camera setup from last trial in and out of the water moving it to different places after each dunk, using the same tensioning method as before.

12. Take individual screenshots of interesting or important parts of the videos and print those screenshots on small pieces of paper.

Data Table

	Fish Seen	Plants Seen	Coils of cord	Camera body tied down
Engineering design 1, Trial 1	0	7	1	no
Engineering design 2, Trial 2	1	12	2	yes
Engineering design 3, Trial 3	1	9	2	yes
Engineering design 4, Trial 4	0	161	2	yes

Data Analysis/Results

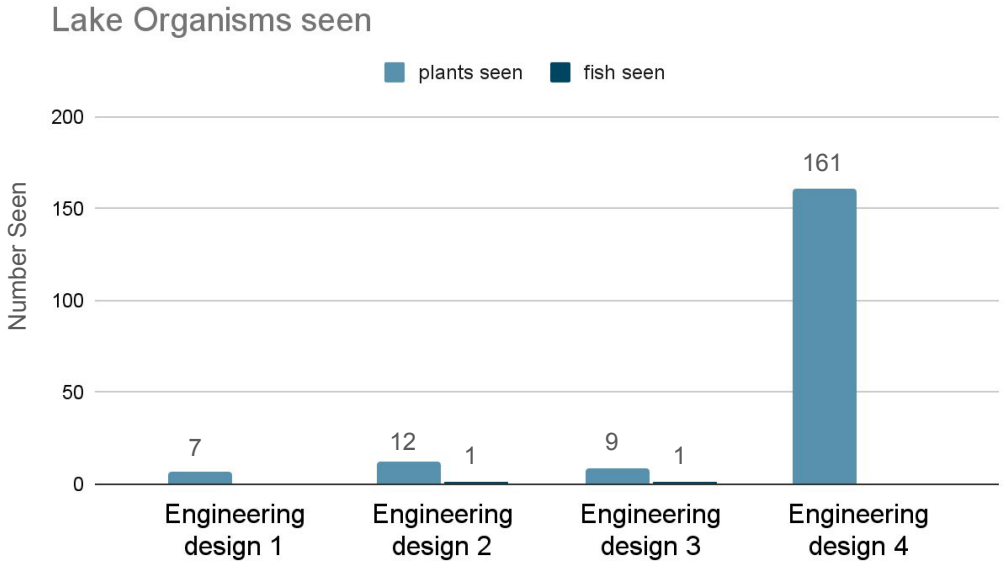
The experiment was run by sending a device with a camera attached out into the pond with variations in the design of the device, the way it was sent into the lake, and the way that the camera was attached to the device.

Trial 1 saw 7 plants and zero fish.

Trial 2 saw 12 plants and 1 fish.

Trial 3 saw 9 plants and 1 fish.

Trial 4 saw 161 plants and zero fish.



Conclusion

A large amount of living organisms can be seen with the right engineered flotation device. My hypothesis was not supported with the first three engineered designs of the experiment because less than 20 individual organisms were seen per trial, however, the fourth engineering design did support my hypothesis as there were 161 different organisms seen. I learned that a single camera can be very effective when viewing living organisms in a lake under the water and that underwater cameras are very expensive. In the future I would like to improve my project by testing the device in shallow waters and wearing anti-slip gloves for the wet paracord.

From Engineering Design 4 (to the left) Camera was upside down for filming purposes, meaning all trial 3 and 4 photographs are flipped to match actual orientation.

Abstract

The purpose of this experiment was to engineer a floating viewing device that would allow observation of a greater amount and variety of aquatic organisms compared to a conventional ROV. This was accomplished by redesigning camera placement and measuring organism visibility. The hypothesis stated that if four varied designs of floating underwater devices were engineered to better support camera positioning, then a greater variety of aquatic life would be observed and documented.

The experimental procedure involved building, submerging, evaluating, and varying a floating camera device through three types each for four trials. The manipulated variable was the redesigned placement of the camera on the floating device, while the responding variable was the amount and variety of aquatic organisms captured. To measure the responding variable, a digital clicker counter was used to record each observed organism during review.

Abstract continued

Results showed that trial one recorded seven different organisms, trial two recorded twelve, trial three recorded nine, and trial four recorded one-hundred and sixty-one. Sources of error included paracord slippage due to the lack of textured gloves and limited light availability because all trials were conducted in a deeper area of the lake. The hypothesis was not supported in the first three trials; however, trial four produced the most effective design for observing aquatic organisms.

These findings may be useful for biologists and environmental researchers studying aquatic ecosystems. Future improvements could include anti-slip gloves for the wet paracord and moving the experiment to shallow waters for lighting.

Acknowledgements

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Bibliography

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