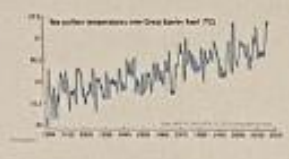
A Novel Way to Solve Coral Bleaching

Problem being Addressed

Coral bleaching occurs when a coral loses its vibrant color and turns into a bleached white. Although many know that the bleaching is being caused by ocean temperatures rising, many are unaware of the overall bleaching process which occurs. This therefore causes the coral to lose its color and become bleached, however the color isn't the only thing being affected, but the livelihood of the coral itself.



Current solutions that are being used in the oceans right now are coral nurseries and cool water dumping. Both methods are ineffective to the fact that coral bleaching still occurs and nothing is being done to solve the problem. Additionally, both methods have number disadvantages.

Goals:
Making a prototype that is:
- Affordable
- Effective
- Long term
- Low carbon emissions
- Does not change the composition of the water

Coral Nurseries

- It does not solve the issue of rising ocean temperatures
- Temporary fixes are not efficient because the corals are going to be bleached in the near future if ocean temperatures do not go down
- Corals are grown in nurseries just to be put back into the ocean where they are then again in warmer water which causes bleaching and starts this process over again

Cool Water Dumping

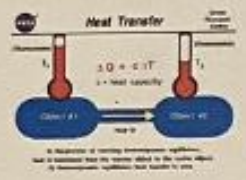
- Not cost effective (costs around $3.9 million just for 1 summer)
- Bringing the cold water can create more CO_2 in the environment
- Only lowers temperatures by a third of a degree
- Can possibly change the composition of the water
- Would further contribute to the warming of the ocean

Hypothesis

Our hypothesis for this project was, if we were to use a thermoelectric chip combined with an CPU fan with a heatsink and hooked it all up to a 12 volt power bank that we could create a water coolant technique that would run off of hydro energy, which in turn would cool down the reefs in the future if we were to large scale this idea.

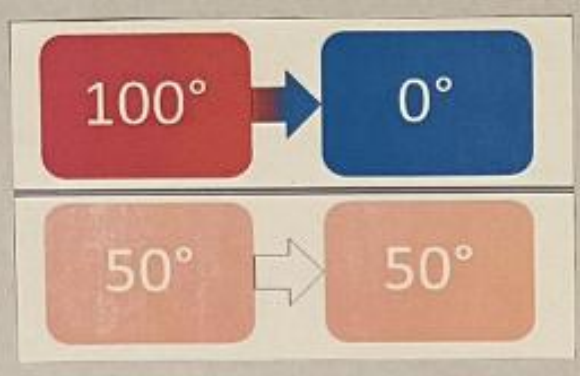
Thermal Equilibrium

Thermal equilibrium means that when two substances come into contact together, the hotter surface will transfer its heat to the colder substance by conduction. For example if there is a surface that is 100°F and another that is 0°F then when the two are brought together the temperature of both will be 50°F because the hotter surface transfers its heat onto the colder surface therefore being in balance.



Materials Used to Create Prototype

Thermoelectric Chip:
Is a mechanism that employs the Peltier effect for thermal transfer. Heat is created on one side of the junction and absorbed on the other as current travels through the junction between two ceramic substrates. It acts as the barrier between the heat transfer and is the barrier in thermal equilibrium.



Power Bank:
The power bank used for our project is in substitute of hydro electricity that powers up our prototype. It supplies power to our cooling system and makes it work. In the ocean we would take hydro electricity to power our mechanism but in our prototype we are using this power bank because we do not have the ability to. It is a 12 volt/5 amp power bank so there is no risk involved but it powers up our project. The prototype gets plugged into the power bank.

APC Fan with Heatsink an active cooling solution used to cool down integrated circuits in computer systems, commonly the central processing unit (CPU). This is the part of the prototype that cools down the surfaces and carries out the peltier effect.

Heat sink compound is used to fill gaps between the CPU (central processing unit) or other heat generating components and the mechanical heat sink. The mechanical heat sink, a passive component made of a conductive metal, is placed over the CPU. We used this to glue the APC fan to the thermoelectric chip.

Procedure

Materials Used:

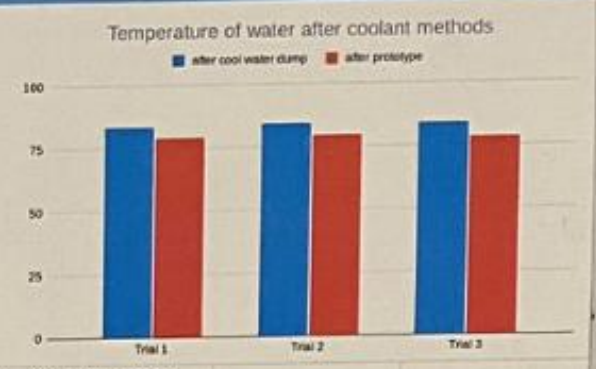
- Metal Sheet
- Tank
- Thermoelectric Chip
- Heat Compound
- APC Fan with Heatsink
- Plastic Box
- Power Bank 12 amp

How to Conduct Experiment:

1. We heated up some water using a water heater and made sure that the temperature was 85°F
2. After waiting a few minutes and insuring the temperature was 85°F we tested out both of the cooling methods
3. We then set a timer and waited for the temperature drop as fast and far as possible
4. After the water was cooled to its fullest potential, we checked the temperature to see how far it had cooled
5. We stopped the timer and recorded the temperature, time, and effectiveness
6. We repeated the process multiple times in order to insure our experiment was accurate

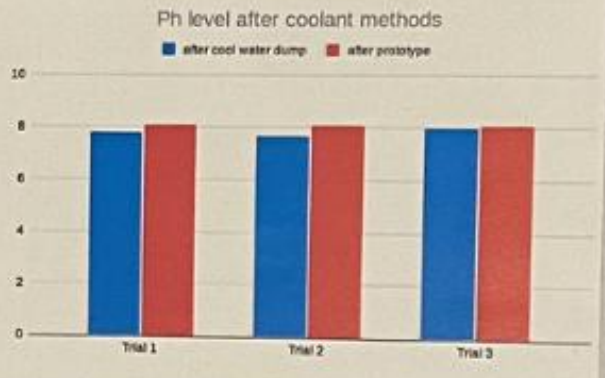
Results

Clearly our prototype decreased the water temperature much more than cool water dumping proving that it is a much more effective method to use for this problem than the method being used right now. Cold water dumping did not decrease the temperature enough to make the water temperature liveable for the corals to survive which is in between 76°F and 80°F.



	Before Cool Water Dumping	After Cool Water Dumping	Before Prototype	After Prototype
Trial 1	85	83.5	85	79
Trial 2	85	84.5	85	79.5
Trial 3	85	83.9	85	78.4

A large concern throughout our project was changing the composition of the water due to the fact we didn't want to cause more damage to the marine ecosystem and fix one part while hurting the others. That being said not changing the composition was a main concern of ours and exactly what cool water dumping causes the water to do. Even if a small amount of water that isn't saltwater is distributed into the ocean it can major effects on the ph level.



	Before Cool Water Dumping	After Cool Water Dumping	Before Prototype	After Prototype
Trial 1	8.1	7.8	8.1	8.1
Trial 2	8.1	7.7	8.1	8.1
Trial 3	8.1	8	8.1	8.1

Ways to Refine Prototype

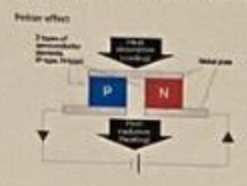
There can be so many ways to improve a product or a prototype. If we had more time we would have refined our prototype much more, and improved the overall quality. The first thing that we would reconsider is the investment of better quality materials to enhance the performance of the prototype. Most of our materials used were second hand and bought from a computer repair shop in Stamford, CT, that being said the materials were already used with could have lead our prototype to not being as efficient. In addition we also think we could've improved upon the overall build and structure of our prototype due to the fact that it was not very stable. Also the effectiveness and efficiency of the prototype could be improved upon as it is not extremely fast but is slower paced. Furthermore we would like to improve the look of the prototype and make it so that if large scaled to the ocean, it would not be an eye sore or anything that disrupts the viewing and look of the ocean. That being said everything can be improved upon and further development. There is always room for improvement.

How We Would Large Scale Our Prototype

In our small scale project prototype, we used a small container to hold the water and an APC fan with a heatsink. In the ocean we would large scale it to a big cage type container (ex. Shark cage) and large scale the heatsink and APC fan to fit with it. Also in our prototype we used a power bank that powers up our prototype but in the ocean we would use tidal energy, harness it, and use it to power our project instead of using a power bank. Also the water container that is being used for our prototype is plastic. In the ocean, something more durable like glass, platinum silicone, or stainless steel. We also don't want to put plastic into the ocean because it can emit harmful chemicals that degrade the ocean's water quality even further and when plastic decomposes in the ocean such as bisphenol A and substances known as polystyrene-based (PS) oligomers, which are not found naturally. Also when it is released into the ocean it can harm human and animal health which includes the corals.

The Peltier Effect

The Peltier effect is the cooling of one junction and the heating of the other when an electric current is maintained in a circuit of material consisting of two dissimilar conductors; the effect is even stronger in circuits containing dissimilar semiconductors. A temperature drop occurs at the junction where the current passes from bismuth to copper. Peltier modules can be an optimum solution when there is a need to cool an object to below the ambient temperature or to maintain an object at a specific temperature. The heat exchanger is typically either the electronic package itself or an extruded or stamped heat sink attached to the package. The Peltier effect is the reverse phenomenon of the Seebeck effect; the electrical current flowing through the junction connecting two materials will emit or absorb heat per unit time at the junction to balance the difference in the chemical potential of the two materials.



What is Tidal Energy

Tidal energy is produced by the surge of ocean waters during the rise and fall of tides. Tidal energy is a renewable source of energy. During the 20th century, engineers developed ways to use tidal movement to generate electricity in areas where there is a significant tidal range—the difference in area between high tide and low tide. All methods use special generators to convert tidal energy into electricity that being said there are very few commercial-sized tidal power plants operating in the world. The first ever in the world was located in La Rance, France and we hope to see more coming into play throughout the years. That being said tidal power and hydro energy have been known as low energy sources but if we position them in the right areas in the near future we can expect to use it as a reliable source of energy.

Creating Prototype

Step #1: We first cut out a plastic tupperware container according to the size of the thermoelectric chip

Step #2: Then we put our simple heat sink into the inside of the container and used our heat compound to ensure that it wouldn't fall apart

Step #3: We stuck the thermoelectric chip onto the back of our heatsink and from there added more heat compound and attached the CPU fan with heat sink to the chip

Step #4: Finally we connected all of the wires together and connected them to our power supply.

Step 1:

Step 2:

Step 3:

Step 4:

Product

Benefits:

- Affordable
- Effective
- Long term
- Low carbon emissions
- Does not change the composition of the water

Price

Thermoelectric Chip: $5.49

Plastic Tupperware Container : FREE

Power Bank 12 amp: $25.67

Heat Compound: $10.00

APC Fan with Heatsink: FREE

Heatsink: $3.78

TOTAL: $44.94