

Project Name: Actions to protect the Life Below Water

Big Idea: Prevent garbage from entering the ocean from rivers

Essential Question: How can we prevent the garbage from entering the ocean?

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School/Organization Name: The Affiliated Senior High School of National  
Kaohsiung Normal University

Location (City, State/Province, and Country): Kaohsiung City, Taiwan

# Engage:

Our team's project addresses the issue of marine debris, focusing on "**Life Below Water**" among the 17 SDGs. With the issue of marine debris worsening in recent years, our team believes that actions should be taken to improve the current situation.



# Engage:

Our team selected this topic after we witnessed the terrible conditions of the ocean ourselves when we visited a beach in Qijin district. We attempted to remove the garbage through beach cleaning, but discovered that this method is simply not efficient enough to tackle the serious issue.



There were lots of trash on the beach.



All sorts of garbage could be found.

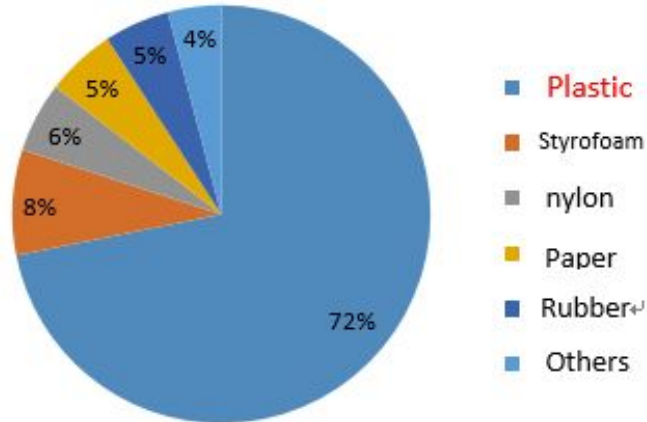


Manual removal is not good enough.

# Investigation:

According to statistics, 8 million tons of plastic ocean waste is released into the ocean every single year. Asia alone is responsible for about 80% of it. Severely impacting the ocean's ecosystem and causing the deaths of countless innocent sea creatures.

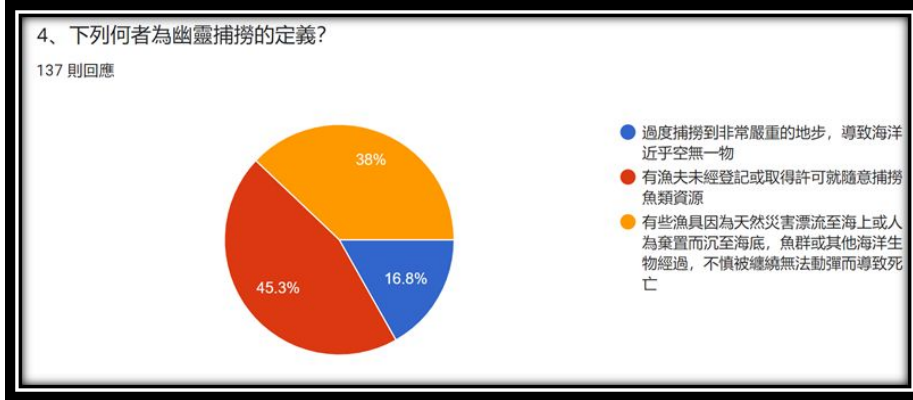
Ratio of the components ocean waste



Of all the wastes that are released into the ocean, plastic wastes take up 71.84%. Styrofoam takes up 8.17%, nylon takes up 5.44%, paper take up 5.37%, rubber take up 5.06%.

# Investigation:

After we looked into the seriousness of the issue of marine debris, we were eager to know how much high schoolers know about the this. We made a questionnaire and pass them out to the students in our school, we received 137 viable feedbacks.



## Full Questionnaire Results:

[https://drive.google.com/file/d/1IZwsJik9ykY6xsyQvs4xPN3I5Jt-ml8N/view?usp=share\\_link](https://drive.google.com/file/d/1IZwsJik9ykY6xsyQvs4xPN3I5Jt-ml8N/view?usp=share_link)

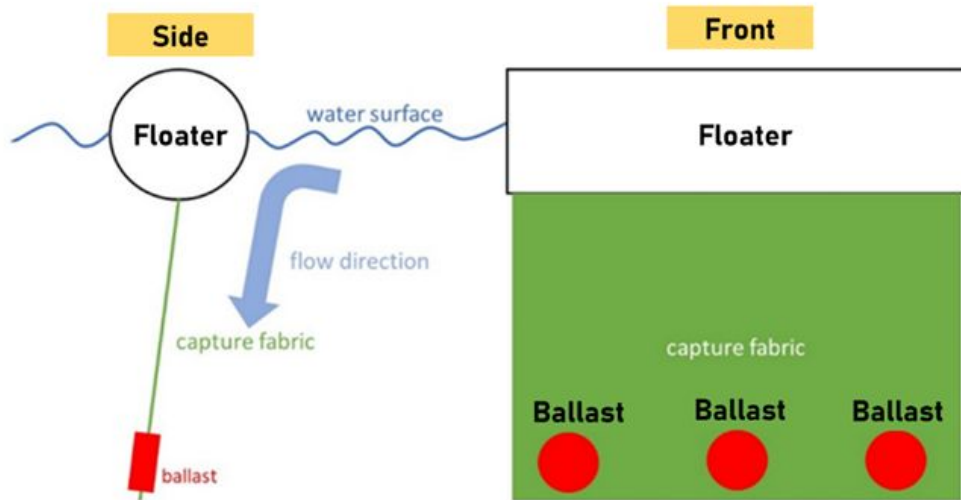
# Action (Overview):

In order to tackle the issue of marine debris, our team started a three year plan with a contraption we designed, the “**Capture Zone System.**” The model has gone through several changes in its design and continued to evolve from the feedbacks we received from teachers and our experiments.

During the three year plan, we have introduced the concept to different groups of people, such as the **AIT-K in Ocean Challenge 2021** and the **Japanese students in the online international exchange program with Osaka Kyoiku University.**

# Action (Capture Zone System Design):

Our idea behind the “Capture Zone System” is to **intercept the garbage before they enter the ocean**. We proposed the concept to the AIT-K in the Ocean Challenge 2021 with our first Alpha prototype version of the model.



Here is the complete design diagram and in depth introduction to our capture zone device.

**Capture Zone System Introduction:**  
<https://docs.google.com/document/d/1AkWlt-1sjnrgAGJgY3vfZoQ9v8oHz-it6jEF4qnSDQ/edit>

**Capture Zone System Explained(Video):**  
<https://youtu.be/pKYtU7Ruz4c>

# Action (Ocean Challenge 2021):

In the first year of our plan, our team attend the **Ocean Challenge 2021**. At first, we proposed the idea of the Capture Zone System and many other ideas to them. However, they reminded us that it is important to stick to one main idea in a project. So our team started to focus more on the Capture Zone device as well as an experiment to use wax worms to break plastic up.

**Our First proposal to the Ocean Challenge:**

[https://drive.google.com/file/d/162bwsBbynDi1RwBtEIVPhv4VgYetyPm-/view?usp=share\\_link](https://drive.google.com/file/d/162bwsBbynDi1RwBtEIVPhv4VgYetyPm-/view?usp=share_link)

**Our Second Proposal to the Ocean Challenge:**

[https://drive.google.com/file/d/1IICMGWRKL\\_Rmpki5pOVfZvXP\\_Gh3rl7k/view?usp=share\\_link](https://drive.google.com/file/d/1IICMGWRKL_Rmpki5pOVfZvXP_Gh3rl7k/view?usp=share_link)



# Action (Japan Exchange Program):

During the second year of our plan, our team attended an **online exchange program with the Japanese students from Osaka Kyoiku University**. This time, our team decided to take a step further and improve our Capture Zone System model, making it closer to its original design, as well as conduct a more scientific experiment in order to test the effectiveness of our system.



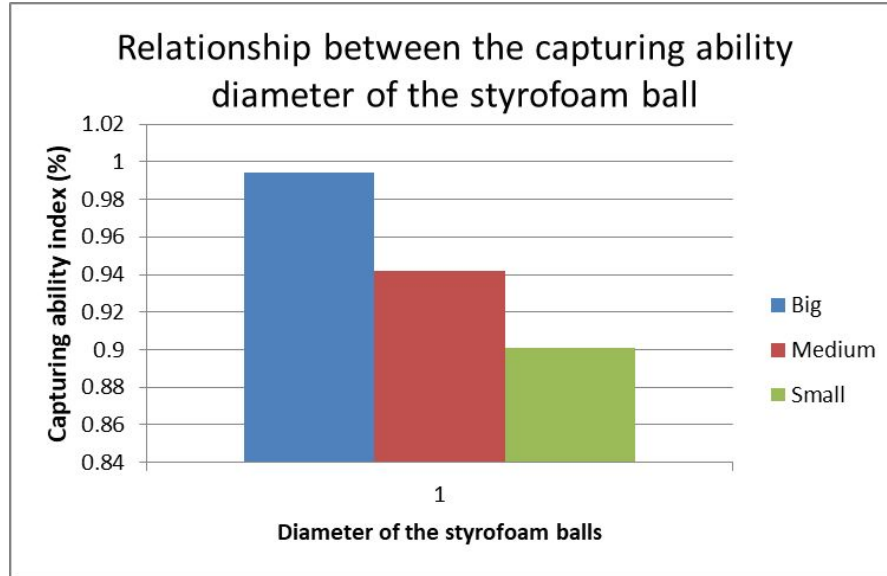
Here is a detailed gallery of the beta version of our model.

**Beta Version of the Capture Zone System:**

[https://docs.google.com/document/d/16YajG5eth22aADlh\\_1a8limgsoMgGpd\\_mWeq3jRE4To/edit](https://docs.google.com/document/d/16YajG5eth22aADlh_1a8limgsoMgGpd_mWeq3jRE4To/edit)

# Action (Experiment):

In our exchange program with the Japanese students, we conducted an experiment, which discussed about the effectiveness of the system by testing it against **different sizes of styrofoam balls** and **different types of garbage**.

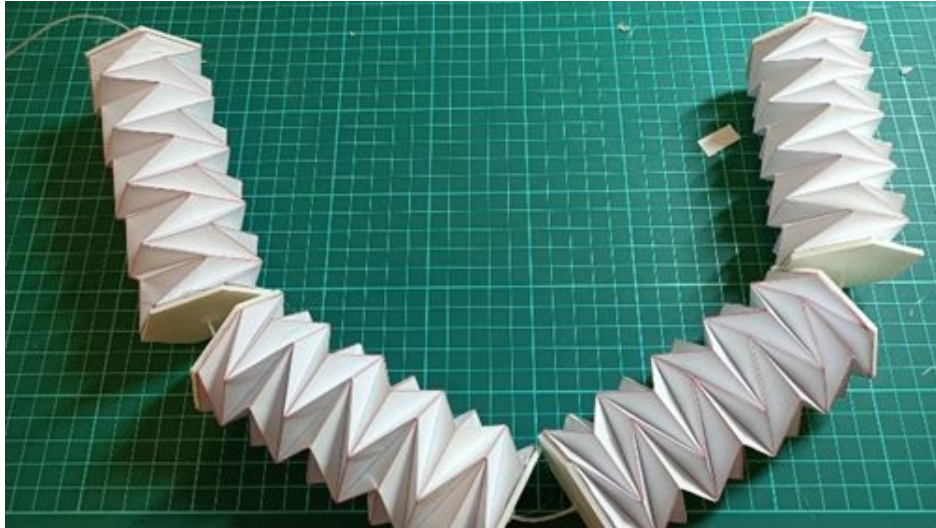


We've included a link to the complete experiment records.

**Complete Experiment Records:**  
<https://docs.google.com/document/d/1t0AEwSsuBvJwL37My3VSFb2Gbjq3DAnToGUFIVkPXE/edit>

# Action (Reflection Video):

We made a reflection video featuring the overview of the entire three year project. We've also talked about how we used technologies in creative ways, such as using a **CNC laser cutter** to make our floaters, using **3D printers**, and more. The video mentions our motivations, related SDGs, and the next step of our plan.



**Reflection Video:**

<https://youtu.be/qpMD9eMLZ1o>

# Action (Future Plans - System Upgrade):

Due to the fact that the natural terrains of the sides of a river is often uneven and ragged, as well as the phenomenon of the simulated trash escaping from the two sides of the model in our experiment, our team plans to **design a device that can change its shape to adapt to different terrains so that we can mount our Capture Zone System on it.** That way, we can minimize the damage we might cause during the process of installing the device as well as maximizing the amount of garbage we can catch with our system.



# Action (Future Plans - System Testing):

Since simulations have their limits, we still have to **test our system in the nature** in order to see its actual effectiveness. Therefore, we would like to contact the Environmental Protection Bureau Kaohsiung City Government, which we has previously contacted before, to **install our system on Houjin Creek**. We would use the width of the Houjin Creek as a reference, to manufacture floater that are capable of successfully capturing the garbage in the waterflow.

The width of the Houjin Creek is about **30 meters**. Our team estimated that the materials used to make a meter of the full sized Capture Zone would cost **\$60**. Therefore, we need **\$1800** on the materials alone, if we put the manufacturing of it into consideration (**\$400**), we would need **\$2200** to replicate the full sized Capture Zone System for the Houjin Creek.

# Action (Future Plans - Capture Zone Website):

The final step of our plan is to **set a website and record of the trash we have captured from the Houjin Creek**. We will then **analyse these data to find out where do these garbage came from in the first place**. At the same time, we would call for people to view the issue of marine debris more seriously. Our team has a firm belief that the way to eliminate marine debris is to solve the issue from its roots. What is the roots of the issue of marine debris? It's ourselves!

Our team plans on using the rest of the fundings (**\$300**) on the website and our actions to spread awareness.

# Action (Future Plans):

Taiwan is a island nation with sufficient rain. However, because of the mountainous terrain, much of the rain returns into the ocean before they can be collected and used, which is why the rivers in Taiwan flows fast and hard. On top of that, Taiwan is a developed country, from trash created through daily needs of people to wastes formed by heavy industrial factories, all sorts of wastes enters the ocean at a high speed. Once these wastes enter the ocean, it would be extremely difficult to remove them from the it. Due to the mentioned reasons, as well as the fact that education and policy changes needs a relatively longer time to take effect, our team strongly believes that the best way to solve the issue at hand is the intersect the garbage before they enter into the ocean.

Our team hopes that the Ciena Challenge may give us high schoolers a chance to fulfill our ambitions to change our environment, saving our beautiful ocean!