

OSCAR Proposal

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To whom it may concern,

My name is Riley Payung and I am a Computational & Data Sciences undergraduate student at George Mason University. I am currently researching the effects of Bisphenol A in ocean water. It has become clear to me that the next step in my research on Underwater Life is to secure funding necessary to complete my task of understanding the true effects that Bisphenol A (BPA), a plastic hardening agent, has on underwater life. I have been working on providing the correlation of ocean-bound plastics and the health effects of Bisphenol A to raise awareness of the harm that plastic pollution causes to both our world and our own health, as we occasionally consume seafood. Funding for this project will allow me to fully set up a working environment for sea life; more specifically, to find out whether BPA has lasting effects on different species of consumed fish, and whether there are species that are mostly unaffected by BPA.

This project hits home to me because I am a SCUBA diver; I travel and dive in various locations around the world, and I would like to see the oceans clean one day. There have been countless dives where I have found garbage on the seafloor and it sickens me. As an avid eater of seafood, I also understand that there are implications in the types of seafood that I am eating, and that I am aware that I will ingest some ocean-bound microplastics (MP). Seafood is also a major part of coastal line diets, and even makes up a large portion of most island countries. Taking the time to read my paper titled “The Life of Plastic,” one will realize that some countries are disproportionately affected by BPA and ocean litter. Most of this disproportion is also caused by countries that are not as affected by ocean-bound trash.

Thank you and look forward to working with you,

Riley Payung

## Outcomes from Previous Funding

None. This project is in its initial funding phase.

## Introduction

Plastic has been engrained in our society for most of the past sixty years, and since its invention in the 1950's, nearly 8.3 billion tons of the material have been produced (Cox et al.). Of the plastics that we have ever created, most have already been discarded by either being thrown away, incinerated, or recycled with a large portion of the material ending up in oceans and waterways. For the better half of this millennia, the population has increased dramatically, and so has consumption of resources. The increase in population is also matched with most of the countries involved in major pollution of the oceans having little-to-no waste management policies. It is quite clear that there needs to be better advocacy in said countries in order to curtail the mismanagement of waste.

The mismanagement of waste not only causes issues in their own countries, but also in surrounding countries and island nations like Japan (Cox et al.). Japanese citizens consume on average about 154 microplastics per day since the average MP is approx. 1.48 MP per gram of fish. Japan diets heavily rely on seafood as a major calorie source, and as such are at higher risks of health issues from foodborne microplastics. Despite their shortcomings however, "Japan led the way in concluding the Vision, through which G20 countries aim to reduce additional marine plastic pollution to zero by 2050." (Kojima and Iwasaki et al. 2019). On a global scale, Japan has looked to solve this issue.

Only until recently, BPA was considered safe for use in the United States on all plastics. "In 2008, the possible health risks of Bisphenol A (BPA) -- a common chemical in plastic --

made headlines. Parents were alarmed, pediatricians flooded with questions, and stores quickly sold-out of BPA-free bottles and sippy cups.” (Brennan et al. 2019). The use of BPA in plastics made general consumers slightly worried for their children, since it seems to have more of a pronounced effect on children. It is worth noting that most of the studies completed on BPA have been conducted on animals, so more studies have still yet to yield proper results on humans.

BPA and its affects can be seen in marine life, specifically in vertebrate organisms. “More recent advances were obtained in zebrafish, where it was demonstrated that the orphan nuclear estrogen-related receptor  $\gamma$  (ERR $\gamma$ ) is the mediator of BPA-induced malformation of the otoliths” (Canesi, Fabri et al. 2015). It has been determined that BPAs have caused malformation in males, leading them to have a higher output of estrogen hormones. Experiments were done on these zebrafish with varying amounts of BPA traces up to 100 micrograms per liter of water for a total of four days. “E<sub>2</sub> concentrations were significantly decreased in plasma of females, while circulating testosterone levels were significantly reduced in males, consistently with a negative feedback response to an increasing estrogenic signal.” With the varying levels of BPA introduced into the water, one can imagine just how much this has an effect on actual sea life. I intend to find out this information, to see just how potent varying levels of BPA can be.

## Process (4000)

I am looking to fund this research for the \$1500 award during the Fall 2020 or Spring 2021 semester for part time research work being done. Due to the nature of this project, data can be collected in a very specific way, at very specific time increments, and does not require constant surveillance. I plan to build two large enough tanks to hold approx. 6 cubic meters of ocean-matched salt water each (approx. 5 feet deep). It is worth noting that the salinity level of certain areas is different. So, for the first two months of research, the salinity level of the water will be matched of that in the Gulf of Mexico off the West coast of Florida. The tanks will also be outfitted with multiple coral reef structures, and to match conditions, will be kept to a certain temperature, and given a specific amount of light akin to the same area that salinity was matched from. Different species of fish will then be added to the tank from the same location, both of male and female genders. The tanks will be agitated using some mechanical process to simulate ocean waves and current. One tank's water may be changed by adding plastics that have been made with Bisphenol A. There may be a need for ultraviolet light as well.

The health of each species will be monitored for the duration of the research by observation. Each observation will occur at noon for all individual species for the duration of each attempt, with any other observations that are significant being recorded at the time of occurrence. The health of the coral will also be recorded to see if BPA has an effect on the formation of new or existing coral. Eventually at the end of the first attempt, the original fish will be released in the wild and any offspring will be used during subsequent attempts. Monetary awards will be used for the building and upkeep of these "zoos." I will hopefully set up a sensor in the ocean near the source of the water for these tanks in order to check for any changes in the salinity or temperature changes in the water. The tanks will be matched accordingly.

I would like to perform the experiment on varying amounts of BPA to try and show a correlation: if the amount of trace BPA is increased, does it have a more pronounced or lasting effect on the population of fish? More specifically, individual species. Each week, the amount of BPA will be increased in the water and the health of each species will be recorded as well as genders and quantity of offspring. Along with the genders and quantity of offspring, scale color will be recorded, fins and tail lengths or widths, as well as the size of the fish itself. If there is any effect on the fish from BPA, it may be externally produced.

### Timeline (15 Weeks or 1 Semester)

- Week 1
  - Beginning to build the two tanks. Travel to Florida for local seawater. Order parts for tanks for aeration, heat, etc.
- Week 2
  - Building continues. Installation of parts. Introduction of water into the tanks. Placing coral in the tanks and coral-like structures.
- Week 3
  - Introduction of fish and crustaceans into the water. Second half of week: Introduction of about 10 pounds of plastics hardened with BPA to simulate waste into one of the tanks.
- Week 4
  - Introduction of additional 10 pounds of plastics hardened with BPA for a total of 20 pounds.
  - Data collection as described in the process section.
- Week 5
  - Introduction of additional 10 pounds of plastics hardened with BPA for total of 30 pounds.
  - Data collection as described in the process section.
- Week 6
  - Repeat of week 5. Total 40 pounds of waste.
- Week 7
  - Repeat of week 6. Total of 50 pounds of waste.
- Week 8
  - Waste has reached the total amount that may be added in this case.
  - Data collection as described in the process section.
- Week 9
  - Data collection as described in the process section. Focusing on the offspring.
- Week 10
  - Repeat of Week 9.

- Collection of data on corals. Any staining or death of coral will be recorded.
- Week 11
  - Repeat of Week 10.
- Week 12
  - Removal of all waste.
  - Data collection later in the week, focusing on offspring.
- Week 13
  - Data collection on corals and all fish.
- Week 14
  - Return of fish to wild. Corals will also be planted in the original ocean area.  
Depending on what happened to the corals in the waste group, they may or may not be returned.
- Week 15
  - Summarization of the data and cleanout of the tanks
  - Conclusion of results.



### Expected Outcomes

I expect that this project will produce some results in showing the effects of BPA on fish populations and subsequently deduce some information about how it may affect human populations, although considering I do not have a background in medicine or biology, this may come as a hardship for me. Perhaps it may prove useful to get someone with such a background to help.

## References (APA)

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