

V O L V O



# FISHTANK

GOOD IDEAS FOR THE OCEAN

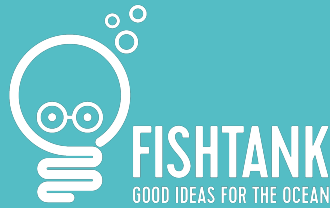
## 2024 Submissions

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# SENIOR



# Project RippleClean

**Amira Rahman**

**Hurlstone Agricultural High School**

*Year: 10*

[View video here.](#)



*In the vast expanse of our oceans lies a problem that demands our attention and concerted efforts – plastic pollution. Project RippleClean emerges as a beacon of hope, a comprehensive initiative aimed at tackling this grave issue, particularly in beach communities affected by tourism.*

*“Picture a world where our oceans thrive, their beauty unmarred by the insidious impact of plastic pollution. Now, envision being a catalyst for change in achieving this reality. Welcome to Project RippleClean.”*

*Our oceans, vital to the health of our planet, are under siege from the ever-growing menace of plastic pollution. Coastal areas frequented by tourists face a disproportionate amount of litter, threatening marine life, ecosystems, and the very essence of our marine environments.*

*Enter Project RippleClean, a visionary approach that blends technology, community engagement, and education to combat plastic pollution in beach communities. At the heart of our solution is a revolutionary mobile app designed to empower individuals, schools, and entire communities to actively participate in the restoration and preservation of our coastal ecosystems.*

*The app’s features are tailored to address the unique challenges faced by beach communities. Users can seamlessly organize and join beach clean-ups, report plastic hotspots, and, crucially, discover nearby disposal areas to prevent further littering. To enhance the effectiveness of our initiative, Project RippleClean establishes direct connections with local councils, implementing targeted management strategies in high-traffic and problem areas.*

*Project RippleClean extends beyond traditional cleanup efforts. By forging partnerships with local businesses, our initiative introduces eco-points as incentives, redeemable for discounts on sustainable products. This not only rewards eco-conscious actions but also stimulates a circular economy that actively reduces plastic waste.*

*Education is a key pillar of Project RippleClean. We collaborate with schools and communities to integrate plastic reduction into curriculums, fostering a culture of environmental responsibility from a young age. The benefits extend beyond immediate cleanup efforts, creating a lasting impact through the development of a socially conscious and environmentally aware generation.*

*The urgency of addressing plastic pollution cannot be overstated. Our oceans are not only vital for biodiversity but also play a crucial role in regulating the Earth’s climate. Project RippleClean is not just about cleaning up the mess; it’s about instigating a cultural shift. By actively involving communities, engaging businesses, and educating future generations, we envision a world where responsible environmental practices become second nature.*

*Project RippleClean is more than an idea; it’s a movement. To bring this vision to life, we plan to strategically develop and market our initiative. This involves continuous app development to ensure a user-friendly experience, encouraging widespread adoption. Marketing efforts will leverage social media and online campaigns to spread awareness, inspiring a global movement of ocean lovers dedicated to the cause.*

*Partnerships with NGOs, corporate sponsors, and environmental organizations will play a pivotal role in scaling our initiative. We recognize the importance of collaboration in achieving meaningful impact, and these partnerships will provide the resources and support needed to expand our reach.*

*In conclusion, Project RippleClean is a call to action, an invitation for individuals, communities, and businesses to join hands in the fight against plastic pollution. By turning ripples of individual actions into waves of collective change, we can reclaim the health and beauty of our oceans for generations to come. This isn’t just a vision; it’s a commitment to a sustainable and thriving future, where our oceans remain the lifeblood of our planet. Join us in making waves of change with Project RippleClean*



# **Give back to the Reef**

**Anjini Lokini Kaushik**

**Five Islands Secondary College**

*Age: 17*

*Year: 12*

[View video here.](#)



## Our Vision

*Our ocean works so hard to mitigate the damage created by the carbon emissions we emit. Humanity has taken so much from our ocean, and I think it's time we use our knowledge to give back to the ocean. Give back the reef aims to use stem cells and gene modification technologies to resurrect our oceans coral reefs. The research initiative is inspired by the ongoing research about stem cells around the woolly mammoth and the desperate need to find a solution for our oceans. Give back to the reef's goal is to use stem cells to revive the coral reefs around Australia, in order to minimise the oceans acidity and the effect of global warming. Once this is achieved to then reintroduce the coral species that have gone extinct using stem cells de-extinction technologies. Our oceans deserve a thank you for all that they have done. Let's give back the reef.*

## Problem

*The ocean absorbs 25% of the carbon emissions we produce, produces 50% of the oxygen we breathe, and absorbs 90% of the heat created by these carbon emissions. The ocean does so much work towards regulating our climate. But it comes with a cost. Our oceans are now 30% more acidic. As a result, we are losing our precious coral reefs. Coral reefs provide habitat to 25% of marine life and 90% of animals rely on the reefs in a multitude of ways. Without coral reefs these species would become endangered or even extinct, and the oceans would never be the same. We have already faced so much marine biodiversity loss in the current years. With less than 50% of our reefs remaining.*

## Solution

*What if we could bring them back? Stronger than ever? Coral reefs generate a large percent of the oxygen we currently breathe. Using stem cells to bring back coral species and gene modification technologies to allow the coral to become more resilient to the selection pressures it currently faces. The research will go towards manually evolving coral. Regenerating coral reefs will absorb the co2 in the ocean and reduce the carbon in our atmosphere allowing the oceans acidity levels to drop. Then using this technology to*

*de-extinct the coral species, we have already lost. This is not a short-term solution. This is a long-term process that once in place will be the solution to the climate crisis. I hope for this research to start in our great barrier reef and expand to all over Australia.*

## Benefit

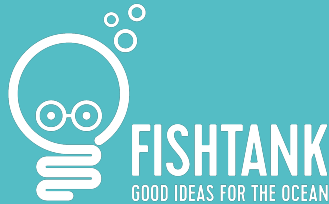
*There are lots of benefits of give back the reef these benefits include environmental, and economical. Let's think about what brings tourism to Australia our oceans, our beaches and our great barrier reef. Without our reefs we would lose millions of dollars in tourism and local businesses would suffer. Losing our reefs will also result in a loss of our marine biodiversity, and a rise in the oceans acidity levels. We would lose not only the millions of dollars we gain in tourism but our precious marine ecosystems not just in Australia but all around the world.*

## Marketing Strategies –Influencer/ social media marketing

*Using social media and make short videos about the project, the progress and the vision allow people to get involved and donate. Lots of other environmental projects do this and they gain a large following and lots of support.*

## –School Workshops

*Doing school tours and workshops for marine studies students show our progress and inspire young people.*



# The Buoy Line

**Hugo Haan**

**St Aloysius College, Milsons Point**

*Age: 16*

*Year: 10*

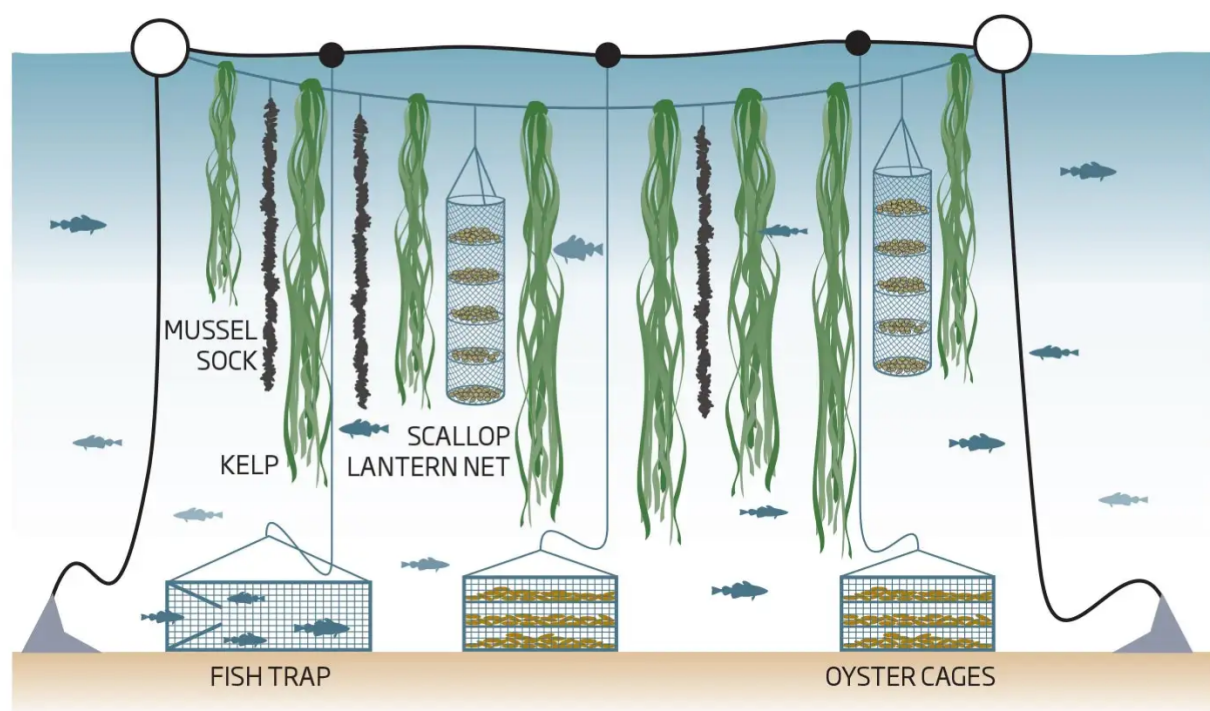
[View video here.](#)



## Fish Tank Vision Statement – Buoy Line

The oceans have faced many abuses from humanity, both deliberate, such as the dumping of sewerage and other waste as well as dredging and overfishing, and unintentional, such as the unforeseen impacts of plastic pollution and climate change. The UN states: “absorbs 30 percent of all carbon dioxide emissions and captures 90 percent of the excess heat generated by these emissions.” This leads to problems such as ocean acidification, which leads to coral bleaching among other destructive side effects. The oceans also face issues from land based agriculture, and from destructive aquaculture such as fish farming in which excess amounts of nutrients like nitrogen and phosphate end up in the ocean and lead to eutrophication, in which deadly algae blooms begin and exhaust swathes of sea of its oxygen. These are just some of the issues that the ocean faces, and it is evident how urgent this crisis has become.

3D ocean farming, coined and pioneered by Bren Smith, is an aquaculture technique that combines many innovative features that allow individuals to, in his words, “make a living on a living planet”. 3D ocean farming involves utilising the entire water column in addition to the surface area to maximise the productivity of the farm in the available area. 3D ocean farms can produce up to 10 to 30 tons of kelp and 250,000 shellfish per acre. In addition to this, the farms have very low capital requirements compared to land-based agriculture as they require no fertiliser, or feed, or anything to be added to the water, and the infrastructure consists only of buoys, ropes and anchors.



3D ocean farming combats six major issues facing the oceans. The kelp sequesters carbon at rates up to 10x higher than the same area of land based plants, combatting the cause of ocean acidification, as well as deacidifying the ocean water it itself is in. Additionally the diverse farm mimics an ecosystem, so that it can regenerate biodiversity in areas that needs it. One of the biggest benefits is the farms ability to filter and clean the water it is in. The seaweed in the farm absorbs the nitrogen from the water when it grows, and the shellfish species feed on all the nutrients in the water, which negates the effects of fish farming and decreases eutrophication. Finally the farm has two further benefits to the ocean in the alternatives it provides to harmful practices. Shellfish are extremely high in protein and provide alternatives to meat or fish in many cases while being much less taxing on the ocean and broader environment to produce. Finally, seaweed has so many uses, as a food which is higher in protein by weight than beef, and higher in



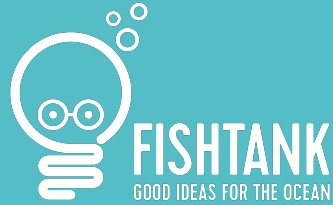
calcium by weight than milk, as animal feed, one Australian species, *Asparagopsis*, when fed in just small amounts to cattle, reduces methane emissions by up to 90%. Additionally seaweed can be manufactured into bioplastics which can replace traditional plastics, thereby reducing the amount of rubbish ending up in the ocean.

But 3D ocean farming is not my idea for Fish Tank, the problem that I specifically am trying to solve, is how, despite beginning to take off overseas, there is not a single 3D ocean farm running, under construction or even planned in Australia. I ran a survey using google forms, and received 5 responses from CEOs, leading scientists, and executives from ASSA (the Australian Sustainable Seaweed Alliance). What I gleaned from the results of that survey was the significance of the market gap in Australia, and the potential of my own idea. Firstly 3/5 of the experts believed that Australia had, if not the best, at least one of the best, potentials for the development of a commercial 3D ocean farming industry in the world. But I also discovered that 80% of the experts believed that starting a seaweed farm as an individual or small group in Australia is very difficult and poses unique challenges than elsewhere into the world. From here I discovered Jo Kelly's 2019 Seaweed Industry Blueprint which detailed many of the gaps and barriers to the development of the Australian Seaweed Farming Industry and through solving each of those problems I developed Buoy Line.

Buoy Line is a kind of one-stop-shop for prospective or operating Australian 3D ocean farmers. It provides a low-cost, low-risk and low-hassle way to establish a farm, and all the required resources to run one. It uses a kits-based system to do all this, in which a prospective farmer will choose a "Buoy Line Kit" which includes a modular farm design, in which the farmer decides upon a number of acres and the location, after which the best farm design is chosen. Because of this template-farm system, Buoy Line can get licensing for each farm beforehand, so that when a farmer wishes to build their own, there is a precedent which speeds up the process of obtaining licensing and a lease significantly. Buoy Line will campaign for large leases of ocean water which it can then subdivide for its customers. Once a kit has been chosen and a licensing and lease has been obtained the new farmer will then be connected with the nearest seaweed hatchery and connected with the best buyers for each of the products the farmer will be growing. The farmer will be informed of any grants they are eligible for, and have their capital costs subsidised as much as possible by BuoyLine to make the 3D ocean farming endeavour low risk. Buoy Line will work to collate all the latest research as well as Traditional Aboriginal Knowledge to form a best practice, which will be incorporated in the complete Australian 3D ocean Farming Handbook which will educate any new farmer on all there is to know from tying the knots on the ropes, to the best way to harvest the seaweed. Finally Buoy Line will create a network of mentors by paying experienced farmers a wage to mentor a new farmer, giving site-specific advice and sharing their own expertise. The final vision for Buoy Line will be one in which the support provided by Buoy Line is comprehensive enough that low socioeconomic individuals are able to make a living while saving the planet, by becoming a 3D ocean farmer with the help of Buoy Line.

The experts I surveyed had many positive things to say about Buoy Line, such as Dr Margie Rule: "This is a fantastic idea which has massive potential to help the seaweed farming industry." 60% of the experts believed that Buoy Line would be almost indispensable to 3D ocean farmers, while 100% of experts agreed that it would help in at least some way. Additionally Dr Adam Main, GM of CH4 South Australia, and Lindsay Hermes, who has significant experience working in government policy advocacy, believed that Buoy Line would be solidly viable financially and otherwise.

While Buoy Line's ability to help the oceans may be indirect it is strong. Because Buoy Line helps 3D ocean farmers who in turn, help the ocean.



# Nitronaut

**Leem Mirza, Waliba Azam,**

**Sarah Chau**

**Hurlstone Agricultural High School**

*Age: 16*

*Year: 10*

[View video here.](#)

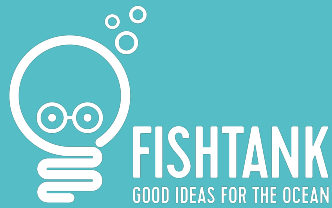


## **Vision Statement**

*Imagine vast expanses where life struggles to survive, where oxygen levels plummet, and aquatic ecosystems collapse. Welcome to the realm of Dead Zones, the haunting consequences of nutrient pollution and chemical run-off. This dire phenomenon arises from a process called eutrophication, a sinister combination of extreme high levels of nitrogen and phosphorus runoff, culminating in the rapid proliferation of algae blooms. As these blooms flourish, they cast a shadow over the underwater world, blocking sunlight from essential plants and consuming oxygen crucial for life. But the story takes a darker turn as these seemingly harmless algae morph into cyanobacteria, releasing chemicals and toxins that pose a threat not just to aquatic life but to our own well-being. World-wide, 415 dead zones have been identified, with it drastically increasing over the last 50 years. This statistic only ensures the fact that this number remaining stable can not be guaranteed. How did we get here, and more importantly, what can we do to steer away from this environmental abyss?*

*In the face of our escalating crisis, we proudly present our groundbreaking solution – the Nitronaut, an advanced aquatic machine designed to tackle the root cause of nutrient pollution and algae blooms. Nitronaut doesn't just identify the problem; it offers a multifaceted solution. When a potential dead zone is detected, our robot springs into action. For minor disruptions, such as 1 pH off the standard pH, it administers a targeted response by boiling water to restore the delicate balance of pH. In more severe cases, such as a difference of pH of 2 or more, Nitronaut utilises the power of anammox, efficiently converting excess nitrogen into filtered nitrogen and hydrogen. The nitrogen can then be used for other productive uses, offering an innovative approach to recycling and mitigating the impact on aquatic ecosystems. But that's not all – Nitronaut goes beyond crisis management. In cases of severe emergencies where a predator might mistake this machine to be prey, Nitronaut releases sound frequencies to deter these creatures away from the craft. If the predator still continues to charge at the craft, it has a flight response to automatically drive away at high speeds. The craft can also be controlled online from home for automatic or manual control in case of these dangers. It patrols for fish waste, promptly collecting them to prevent further nitrogen overload, and instead utilising it in areas where nitrogen is more necessary for human life. Equipped with GPS tracking and underwater vision, this marvel of engineering provides real-time data, allowing us to pinpoint areas prone to nutrient pollution.*

*This method has three main categories that provide an all-rounder solution to dead zones and the influx of nitrification – data identification, combat and utilisation. Data identification is our most important step, especially if we want to be able to help the vast majority of regions in the world. GPS tracking and detecting technology on this robot permits for the robot to detect which areas are prominently affected from the excess of ammonia, and immediately alerts all officials in charge of this project to use more widespread methods to treat that particular area. It can also provide an outline into what areas scientists and other individuals in the field of combating nitrification and dead zones should focus on more. Furthermore, Nitronaut is equipped with three combating technologies that can rid of the unreacted ammonia in that specific area of the ocean. By using the right method, the ocean can worry less about the ammonia in that area. However, after combatting ammonia, it is not thrown away. This ammonia is used in an area it specialises in most – agriculture. Fertilisers are always in need of nitrogen for a process known as nitrogen fixation. Nitronaut not only assists with the ocean, but also the agricultural industry, which is also just as essential as life under water. As you can see, all features of the Nitronaut is put to heavy use in life both on land and underwater. These three features lead it to become a unique machine that can potentially solve the issue of dead zones and nitrification in the future.*



# The Sound Sponge

**Yuyin Luo**

**Pymble Ladies College**

*Year: 10*

[View video here.](#)



# SAVE THE SEA SONGS

**Definition:** Unwanted/disturbing sound in the environment that negatively impacts living things. Any noise humans create on the coastline or in the marine environment contributes to sound pollution in the ocean.

Sound travels 25 times faster underwater compared to in the air.

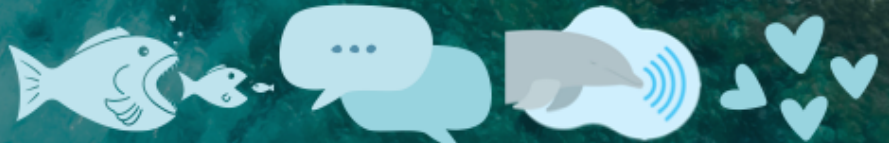
Underwater creatures have adapted to this and adopted sound as a large aspect of their lives. Noise pollution can prevent echolocation and drown out natural sounds such as sounds made by animals, rainfall and mating calls. As a result, sound pollution can negatively affect every aspect of their lives.

Did you know that noise pollution is a reason behind whale strandings?



Can cause:

- Strandings
- Increased stress
- Injuries to ears
- Decompression sickness from ascending too quickly in an attempt to escape the noise
- Alter behaviour of marine mammals e.g. move locations, stop eating & increase anti-predatory behaviours
- Interfere with communication e.g. decrease communication range & simplify vocal calls



This issue is not specific to any area. All the 7 seas of the world are affected by this. Sound travels very far underwater, meaning that even if a particular area seems undisturbed, it can still be a victim of sound pollution. Low-frequency sound waves spread even further since they lose less energy to the environment. Travelling at minimum velocity can allow sound waves to propagate over 25,000 kilometres far underwater. Even if some animals can't hear this, low-frequency sound waves often cause stress. Sources of low-frequency sound include: sonar, boats, construction and mining explosions.



## SOLUTION - THE SOUND SPONGE

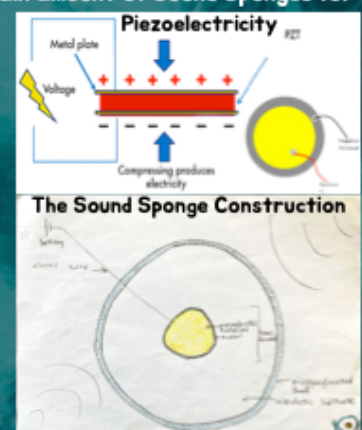
The sound sponge is a round device composed of a viscoelastic substrate (e.g. rubber and polyurethane), metal, piezoelectric material, electric wire and a microperforated shell. The combination of the viscoelastic substrate and microperforated shell materials allows the device to absorb low-frequency sound waves as well. The sound energy is transformed into electrical energy to take the unwanted sound energy permanently out of the water while making use of it as sustainable electricity. It requires no electricity to run, meaning it can last long and be eligible to be placed in many areas.

It is put in an area to prevent sound from travelling further and reduce noise levels. It is placed to prevent human-induced noises from travelling, not to absorb the sounds of marine mammals and natural sounds. Effective areas to put it include: along the coast of a city, under a boat, surrounding areas undergoing coastal construction and where there was sonar activity. This allows the natural sound activity to continue while preventing man-made noises from disturbing animals since the areas where it is placed are selective, and it does not have a large enough sound-absorbing radius to negatively impact sounds for marine creatures. Therefore, it will only reduce the negative effects of sound pollution on marine ecosystems, the negative effects of sound pollution on marine ecosystems.

We should present this invention to Governments of the world and the UN. They can purchase them to place in suitable areas and create laws on controlling noise pollution with the Sound Sponge. For example, making it compulsory to use a certain amount of Sound Sponges for every certain amount of decibels within a certain proximity to the ocean.

Materials:

- A porous microperforated shell helps absorb sound
- The viscoelastic substrate inside the shell absorbs sound
- A piezoelectric transducer is composed of a piezoelectric material surrounded by a metal plate. This is located inside the viscoelastic substrate and converts mechanical stress from sound waves into an electrical charge.
- An electrical current is made from the opposite charges. The current goes through an electrical wire.
- The electricity can be put into a battery which can be used to power boats, charge cars, etc.





# JUNIOR



# SeeWaste

**Enzo Haan**  
**St Aloysius College**

*Age: 14*  
*Year: 8*

[View video here.](#)

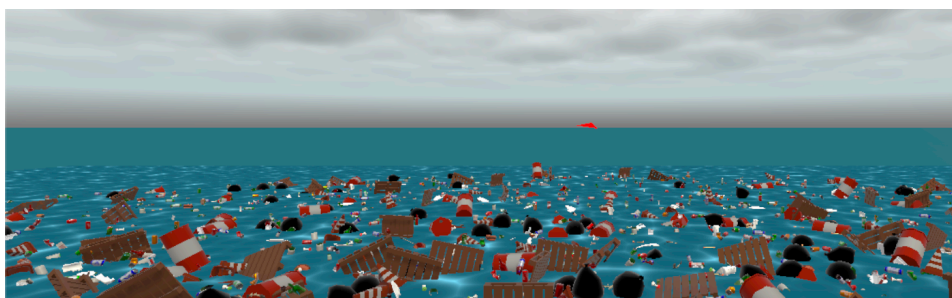
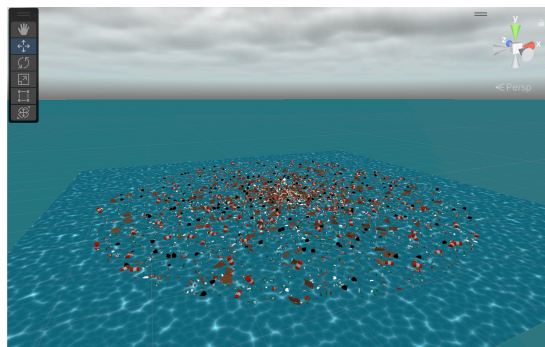


A harmless shopping bag, holding your lollies and snacks, soon to be demolished at your sleepover. As you arrive home you ditch the bag on the side of the road, not needing it anymore as you prepare for a sleepless night, full of fun. But whilst you step into the door, oblivious to the damage you have just caused, a gust of wind picks the bag up, carrying it to a storm drain where it is then swallowed by a torrent of rushing water. Now this so-called harmless shopping bag is making its way to the ocean, where it is likely to kill sea life and raise ocean temperatures.

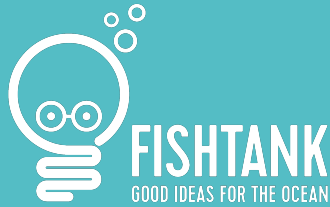
SeeWaste works to counter that. I believe that if our young population was further educated on the issues that face their generation in future, they would be more active in helping the solution. However, it is not enough just to teach them about plastic pollution, as this is nothing they haven't heard before. The real reason people ditch plastic by the side of the road is because although they are constantly told that what they are doing is bad, they cannot see it. They may hear about it on the news, but it does not affect them in their day-to-day life, so they don't make a change to stop waste ending up in the ocean.

SeeWaste will place booths across Australia, containing VR headsets. These VR headsets would (virtually) transport the player to the barren Great Pacific Garbage Patch, fully immersing them in the experience. It would begin with a voiceover guiding the user through images of the same spot in the ocean over time, as it gets progressively more and more polluted by plastic. The date will then progress into the future, showing what will happen if no change occurs. Then the voice will explain the rules and controls of a game, where you control a robot, to scoop up as much rubbish as you can within two minutes. The image will then cut to a live feed captured by a 360 degree lens located on the robot, and the player will begin the game. After the two minutes are up the robot will automatically make its way back to a deposit spot where it will leave the rubbish. This deposit area will be regularly emptied and recycled to make products such as Waterhaul's sunglasses.

The booth will be surrounded by big screens displaying information such as a live leaderboard, live feed of what the player is seeing, and a replay of the introductory "movie". SeeWaste will help change the mindsets of the young population, as it will expose them to a view of the plastic pollution that they have never experienced before. Just plainly showing them how it looks currently is not enough, you have to immerse them in the experience and show them the consequences of their actions if they don't stop them now. After the game has concluded the video will switch to a screen showing what the everyday person can do to reduce their waste, as well as a place to upload new solutions. The goal of SeeWaste is to expose a higher number of people to the issues that our earth faces today so they can work to save it while we still can. Currently, very few people are brainstorming and gathering information to develop a solution, so hopefully with the introduction of SeeWaste solutions will crop up everywhere. SeeWaste enables the greater population to have a say and help in the effort to save the oceans and thus empowering them to use less plastic.







# The Pen Crate

**Ilelsha Nair**

**PLC Sydney**

*Year: 9*

[View video here.](#)



*The urgency for action becomes clear as day when we take a step back to acknowledge the billions of plastic pens which contribute to the culmination of ocean pollution.*

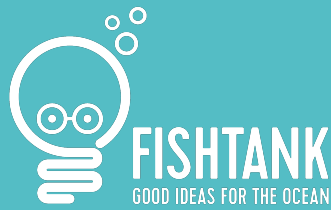
*In 2021, the International Union for Conservation of Nature claimed that 88% of the sea's surface is polluted by plastic waste. This piece of data provides us with an insight on ocean pollution and how we can achieve our sustainable goals. It emphasises the topics which need to be targeted by all strategies to achieve bluer oceans, preserve human health and safety, and protect marine life. There is no doubt that plastic is the greatest threat to our oceans. If we analysed this statistic, we begin to understand that a significant portion of this percentage can be traced back to landfills, which are often attributed to the poor disposal of man-made products. Items that are more difficult to gather and recycle such as technology and makeup containers are labelled as 'hard-to-recycle' and can frequently be found in landfills. If we brainstormed plastic items that fall under the criteria and have been prevalent in this century plastic pens would be near the top of the list.*

*It has been recognised that 8 to 14 million tonnes of plastic end up in our oceans each year. Annually, discarded plastic pens generate thousands of tonnes of plastic waste. However, it should be taken into account that the total number is far higher as the origins of the ballpoint pen date back to the late 1800s meaning these numbers have had many decades to accumulate. The issue is that despite 10 billion plastic pens being categorised as waste in previous years there is an absence of effective solutions to alleviate this problem. As a result, the majority of pens end up in landfills where they pose a risk of entering the ocean as pollutants.*

*'The Pen Crate' is a project that plans to send trademarked boxes to schools for people to use to dispose of their pens. At the end of each month, these boxes will be collected and sent to our organisation where the pens will be dismantled. Plastic pens are easy to disassemble, and their parts only consist of plastic and metal. In the modern world these two materials are exploited for everything from the packaging of snacks to architectural designs. It is for this reason that the dismantled pens will be broken down into a more basic form by organisations that recycle plastics and metals and then sent to manufacturers. As raw materials, they can be utilised by manufacturers to make ranging products such as water bottles, technology, and more. This will disrupt the linear lifespan of a plastic pen and transform it into a cycle.*

*The advantage of this project is that it is cost effective, requires minimal labour, and is not time consuming. All these characteristics are the outcome of its dependence on the community and will make this initiative manageable long term. The most common 'hard-to-recycle' items in schools are pens hence why we have chosen schools as the location of the boxes. Students are also likely to have more members in their households who may have gathered pens over the years. The main costs will be from transportation and any additional strategies to promote engagement in this project. We will only need to congregate once a month and can receive help from people whose desire to volunteer is stemmed from a passion to contribute to their community or students who need volunteering hours.*

*As previously mentioned, it has been acknowledged that over 10 billion pens are discarded each year worldwide. Implementing this strategy to alleviate this problem would lead to a considerable reduction in plastic waste. 'The Pen Crate' is a low maintenance but effective and organised plan to achieve our goals of reducing ocean pollution.*



# **SOLARIS: Modular solar panel design**

**Kelian Bourgeois**  
**Rose Bay Secondary College**

Age: 14  
Year: 9

[View video here.](#)



Vision statement:

*The World Wide Fund released an article explaining how the noise from cargo ships can interfere with echolocation; low frequency sounds travelling over vast distances that allow dolphins and whales to communicate. The article states that the underwater noise from cargo ships can interfere with these vocalizations, disrupting their communication and potentially affecting their ability to mate, find food, or navigate.*

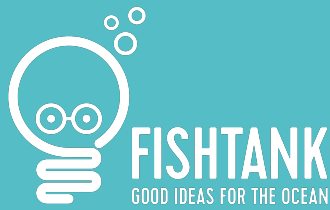
*In January of 2023 the International Maritime Organization (IMO) recognised that 'commercial shipping is one of the main contributors to underwater radiated noise (URN) which has adverse effects on critical life functions for a wide range of marine life.' Another study from ScienceDirect revealed that of general commercial shipping, containerships accounted for 75% of underwater shipping noise. This underwater noise also causes stress responses in marine animals, leading to altered behaviour patterns, such as changes in feeding, breeding, and migration.*

*It is without a doubt that we must address this issue, but because I believe that we will never completely stop the commercial shipping industry, it is important to strive to find alternative sustainable and marine-friendly solutions. Introducing electric engines, or hybrid engines in which the propeller shaft is powered by fuel-electric power will reduce reliance on the thermic engine, reducing the production of ocean noise. Now, the problem is, where to find the electricity required to drive these engines on such long shipping journeys. A stable and abundant source is solar energy, but how can we find space for all the panels?*

*My idea uses the space on top of each stack of containers, creating a vast blanket of solar panels that can be used to power the hybrid engine. This expanse of solar panels can all be linked to the hybrid engine, providing it with the power required to run. My innovation, SOLARIS (SOLAR In Ships), is a modular solar panel specifically designed to fit on top of shipping containers for the duration of the journey. Utilising the existing corner castings and twist locks that are on every shipping container, the reinforced solar panel will be able to easily attach to any container. These fittings will also allow for easy docking as the cranes used are already fitted to the corner castings. No change would be needed to be made to the other containers or the loading crane, which is the very reason that makes this design so unique. Its versatility and adaptability to each ship and each container is unmatched. It would be easy for solar panel companies to create these custom fittings, and they would then supply (by renting or selling) to shipping companies.*

*By providing an unlimited supply of energy to cargo ships equipped with fuel-electric hybrid engines, SOLARIS would highly reduce noise pollution, allowing dolphins, whales and other marine organisms to freely navigate the depths of the ocean in peace. As an additional benefit, the total fuel consumption would also be highly reduced, making it cost attractive for shipping companies, lowering carbon emissions and potentially slowing down the impact of climate change. Additionally, a hybrid engine will have less oil leaks, further protecting the ocean and its fragile citizens from minor oil spills from fuel powered engines across the world.*

*SOLARIS, powering the future of oceans.*



# Ocean Cleanup

**Olivia & Montana Weininger**  
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Age: 15  
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*The ocean is an infinite void. An endless supply of resource yet with the evolution of humanity, our destructive nature is evidently deteriorating this large portion of earth. With industrialisation and the need for the next best thing we often dismiss the substantial impact we have on our ecosystem at the pace we move in, especially our hydrosphere. The various categories of pollution, climate change, overfishing, ocean acidification, oil spills are to name a few of the potential risks that will ultimately kill what we simply take advantage of. Although these problems may never disappear, we can try and subside the damaged caused.*

*Algae blooms, a rapid increase in the algae population of fresh or marine water systems. An important part in the ecosystem but in excess stunts a challenge. A wide spreading problem that causes major complications underneath the surface of the water resulting in harm to the marine environment through excessive carbon dioxide from algae's oxygen properties. This is evidently prompting underwater suffocation to marine life as well as dispersing toxins that are affecting humans and animals. The production of Algae blooms can be dramatically increased resulting from excess nutrients from fertilizer, wastewater, and stormwater runoff as well as excess nitrogen and phosphorus. This one problem alone can diminish the capacity of fish and other aquatic organisms to locate food, leading to whole populations to leave an area or even die. Not only does it harm marine ecosystems, but water becomes unsafe to drink. Moreover, our livestock and food productions are being malnourished due to the stripped nutrients of such water from algae feeding.*

*Our filtering design will bio mimic the functions of an oyster. An animal that's sole purpose is to sift debris and other micro pollutants surrounding it, but oysters are designed for the depths of the ocean and algae blooms are predominately found on the surface. With this knowledge we have included the insertion of a flotation material (foam) that will ensure our design doesn't sink. Our design will ultimately improve this growing problem by effectively removing algae blooms from the water through a filtration system called reverse osmosis, which is used in aquariums, proving its success. With the flow of the current moving our product, algae will be sucked into the machine and through the filtration system trapping the algae blooms finally allowing the clean, filtered water to pass back into the ocean. Its aluminium alloy skeleton will ensure that it's safe for the environment. The material doesn't rust but oxidize, when it's in contact to water a layer of aluminium oxide film will quickly submerge the skeleton allowing an extra hard layer preventing any additional corrosion and protects underneath metal. This will evidently make our structure more stable allowing the product to be used longer without risk of breaking.*

*With the minimisation of algae blooms, the highlighting hallmarks this solution offers would include the enhancement of our water quality, benefiting aquatic wildlife, humans and animals that would suffer otherwise. It also provides the water with a sufficient supply of nutrients to nourish our produce.*

*There are many problems that layer the base of harm, in both ocean and land. We need to come together and find solutions to prevent the extinction of our ecosystems starting now.*



# **Mechanically-Driven Artificial Upwelling**

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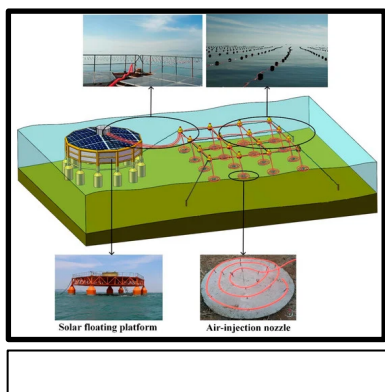


## **Mechanically-Driven Artificial Upwelling**

**Written by Abigail Mckenzie, Mya Wong, Tahlia Coulton, Abbie Clay, Amelia Wilson and Lillian King**

Upwelling is a process in which deep cold water rises towards the surface. Resting surface water is replaced by cold, nutrient-rich water that 'wells up' from below. Upwelling assists majorly in driving carbon dioxide gas to the surface to feed small organisms such as phytoplankton, algae, and other producers which all are a vital source of food for various marine organisms and the ecosystems they inhabit. In this report, mechanically driven artificial upwelling will be assessed as a viable option for many current problems including extreme weather during El Niño events, lack of biodiversity specifically in marine parks, and unsustainable food sources within fisheries.

Within Australian waters, there are three main issues that machine-driven artificial upwelling could assist and possibly solve. Firstly, during the 2023-2024 Australian summer, a large El Niño event will occur, causing extreme weather changes. When this drastic weather event occurs upwelling occurrences are decreased or put to a complete stop. Since upwelling provides a vital source of nutrients, such as carbon dioxide, phytoplankton production will slow. Phytoplankton is the foundation of all aquatic food webs and is a main food source to a variety of organisms from microorganisms to giant whales. When this primary producer is slowed, everything above is slowed as well, meaning development stops as well as new life. The second problem that has recently been gaining media attention is unsustainable aquaculture. Farmed fish require 1.15kg of food per 1 kg of body mass, making for a highly unbalanced ratio of food to fish. Phytoplankton feed zooplankton which can then be used as a food source. In some areas, this zooplankton production method is being exploited. Implementing artificial upwelling rapidly boosts phytoplankton production and therefore zooplankton production, which effectively stops major exploitation and assists in a sustainable aquaculture industry. The third area being explored is biodiversity lacking due to various reasons such as pollution and negative human destruction. To increase this lack of biodiversity we can use mechanically driven artificial upwelling to boost phytoplankton and zooplankton production. By increasing the lowest trophic levels, all levels above also increase, creating a more sustainable ecosystem for these organisms.



To prevent or assist in these, A proposed design is displayed in Figure 1. Figure 1 uses solar energy but the design is also able to utilise natural surface winds to power deeper upwelling. Figure 1 is a solar-powered floating barge, secured to the sea floor, that connects to a grid system of air tubes at depths where upwelling would naturally occur (variable by location). Solar power creates a steady flow of air that replicates the natural speed of upwelling at any given area. This design would be used in areas negatively affected by El Niño events. To utilise wind power, the previously stated air tube system below the surface remains constant. The source of energy will instead change to wind turbines or fans that will sit above the surface and catch surface winds. These surface winds will travel down to the below-surface air tubes

and will naturally create upwelling. This design would be a better option for open fish farms where higher winds occur. Both of these designs will be held up by buoys above the surface and the air expulsion tubes below the surface will be held down by light weights and adjustable length cords depending on the area the device is situated in.



*The proposed design is easy to install, it can be implemented in any area that requires focus or assistance. The main aim being targeted is phytoplankton production. Phytoplankton is the baseline of nearly every marine ecosystem and essentially puts said ecosystems into balance. Upwelling drives nutrients towards the surface, proving incredibly beneficial to phytoplankton production. A current issue that is more regularly being talked about is the incredibly unsustainable practices within the fishing aquaculture industry and an unbalanced amount of food to body mass. These upwelling devices can be implemented around fish farms to boost phytoplankton and zooplankton production. By boosting these, excess food is no longer needed to sustain these farmed fish and it is instead replaced with a new effective food source; the zooplankton. Extended research has been done on using zooplankton as a viable source of food for farmed fish and it has been proven to be just as effective as feeding fish wild harvested fish meal. Since the fish meal is created from trawler bycatch, replacing this will drastically reduce the demand for the marine life that makes up the fish meal, creating a more sustainable and cleaner fishing industry. Another benefit of these upwelling devices is taking the place of a lack of natural upwelling during El Niño events. Over this summer, the East coast of Australia will be experiencing an El Niño event, and upwelling near our coast will be either stopped completely or slowed. This will negatively affect our phytoplankton production and therefore affect every trophic level above it, causing some marine life to experience a rapid population decline or move to territory or areas where their bodies cannot sustain themselves. Upwelling devices can replicate the natural upwelling that stopped and effectively prevent any issues that occur due to El Niño events.*

*To conclude, mechanically driven artificial upwelling devices will be incredibly beneficial to currently occurring events that desperately need a solution, such as the unsustainable fishing industry and the El Niño event that Australia will be experiencing over the summer and possibly towards mid-2024. Upwelling is an incredibly important factor of all marine life and one of the many things that contribute to perfect balance within our oceans. Artificial upwelling is an idea currently being explored and is a viable solution for the future of our oceans and the preservation of our marine life.*