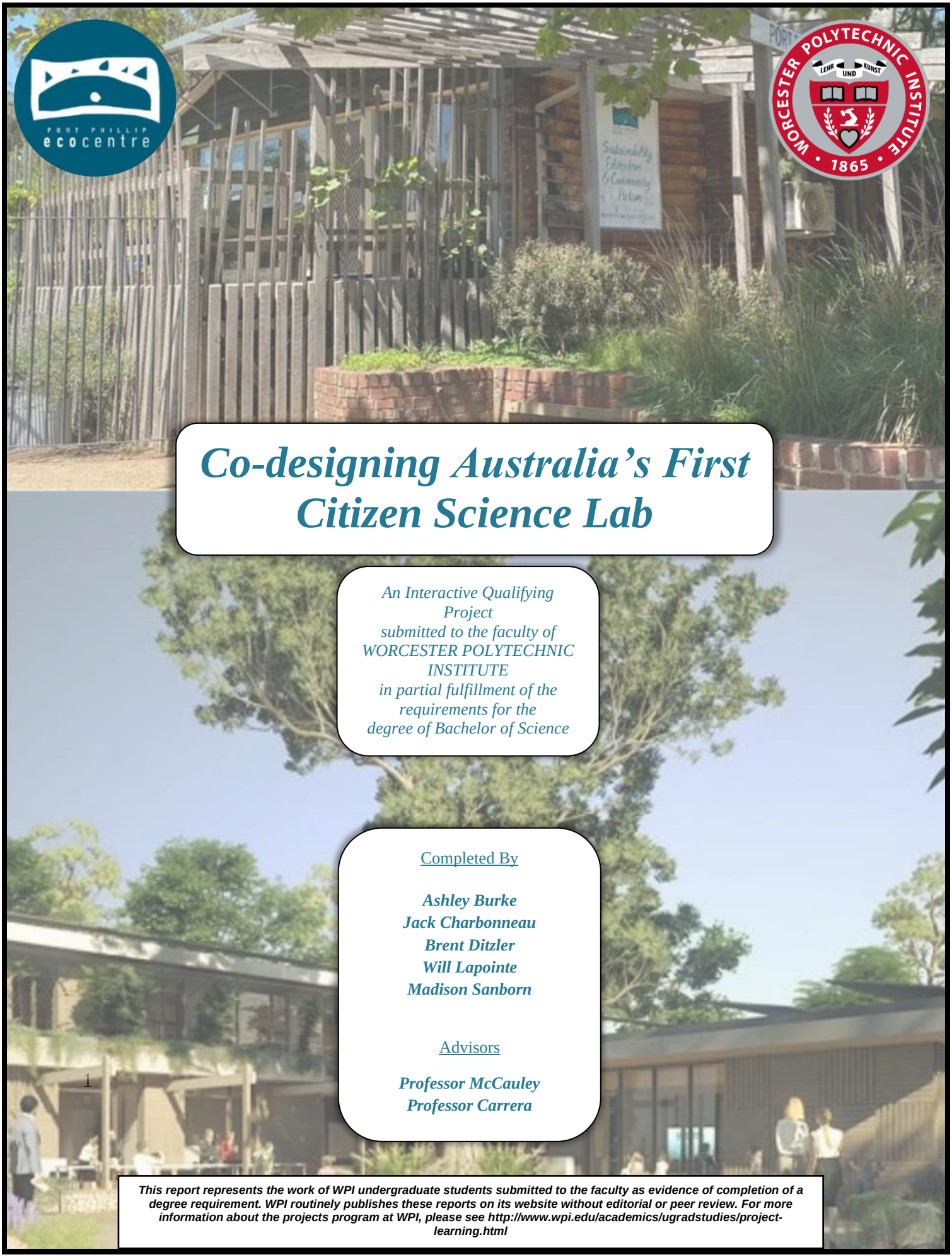

Co-designing Australia's First Citizen Science Lab

An Interactive Qualifying Project
submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the degree of Bachelor of Science

Completed By

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Abstract

The Port Phillip EcoCentre in St. Kilda, Victoria, Australia is a leading environmental conservation organization that focuses on using citizen science to study the environment in Port Phillip Bay. As the EcoCentre continues to expand both its projects and its volunteer base, the organization's opportunities are being constrained by their current facility. To allow for continued growth, the EcoCentre has developed plans for a new, state-of-the-art community center that will house Australia's first citizen science laboratory. Our team worked to co-design this new lab. We identified opportunities for the EcoCentre to expand their citizen science programs and collaborations within the new laboratory, recommended wish list equipment, and prepared promotional websites to help attract new investors and volunteers.

Acknowledgements

The 2022 Ecolab team acknowledges the Kulin Nations, including the Yalukut Weelam clan of the Bunurong/Boonwurrung language group, traditional owners of the land on which the Port Phillip EcoCentre is located. We pay respects to their Elders past and present and extend that respect to other Aboriginal and Elder members of their multicultural community. We would like to thank the following people for assisting us with our project, our work would not have been successful without their participation.

- **April Seymore, Michelle Fisher, Fam Charko**: For being our main liaisons at the EcoCentre and assisting us with every aspect of the project.
- **The rest of the EcoCentre staff**: For speaking with us about their projects at the EcoCentre and allowing us to participate in several citizen science volunteer projects.
- **The EcoCentre partner organizations**: For giving us their time for interviews to learn about their partnerships with the EcoCentre.
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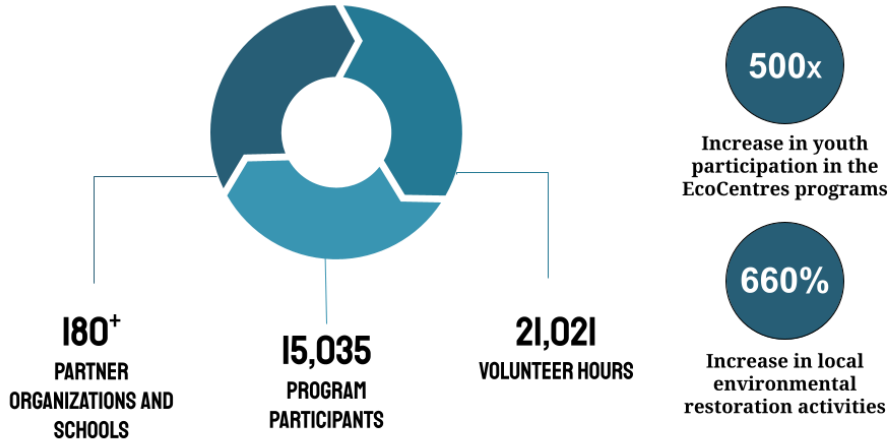
- **Dr. EcoDog Loki:** For being the best boy there is and always bringing a smile to our team

Executive Summary

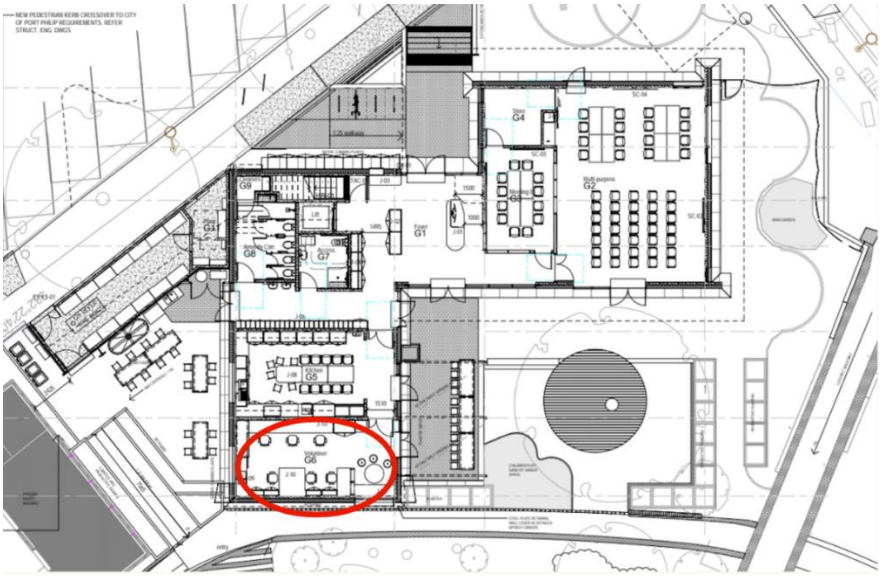
The Port Phillip EcoCentre in St. Kilda, Victoria, Australia, has been one of the leading environmental conservation organizations in the Melbourne region since it was founded in 1999. The EcoCentre utilizes community-based citizen science initiatives to track environmental changes in and around the bay, like performing litter audits, in an effort to start healing the bay of the damage caused by human activities. Citizen science allows the large-scale collection of data that would be impossible to gather without the help of community volunteers. It also provides local community members with opportunities to connect with their environment, and gain personal satisfaction by contributing to important scientific studies and discoveries.



As temperatures continue to rise and pollution increases, many waterways are experiencing human-induced environmental decline. In Melbourne, Australia, Port Phillip Bay is under threat by many different environmental issues, causing several organizations to begin to step up and start attacking these threats head on. The Bay has a very large catchment area with over 26,000km of drainage lines carrying water into the Bay, making it very vulnerable to litter pollution. Plastic pollution has also become an increasingly big concern for the area, as plastic remnants can wreak havoc on aquatic ecosystems, and damage marine life by inadvertent consumption.

The EcoCentre currently runs several different projects for individuals, small groups, as well as large corporate volunteer groups, each aiming to collect as much data as possible. Over the years, the EcoCentre has grown exponentially both in the number of active volunteers and in the size of its operations. The organization has operated out of the old baykeeper's cottage in St.

Kilda since it was founded, but the center has outgrown the building's capacity. With financial support from the City of Port Phillip, the EcoCentre is currently in the process of designing a new, state of the art, fit-for-purpose community center that will house the Port Phillip EcoCentre as well as Australia's first citizen science laboratory.



Our team was tasked with co-designing their new, purpose-built citizen science laboratory. To accomplish our goal, we identified three main objectives that we used to guide our progress.

Our first objective was to **identify citizen science opportunities within the Port Phillip EcoCentre's partner network and in the local citizen science network**. The team started by analyzing the Ecocentre's existing collaborations and selected five key organizations within the partner network to interview. We also interviewed members of three other global citizen science organizations to achieve a broader understanding of the subject. Finally, we employed participant observation by engaging in several of the EcoCentre's projects, increasing our understanding of how projects are created and run, as well as identifying areas for improvement. From this objective, we were able to generate fourteen different recommendations for the EcoCentre, ranging from potential project opportunities with partnering organizations, to suggestions for online webinars.

Our second objective was to **identify the equipment needed for current and future citizen science projects**. Our team started by sending a survey to six key EcoCentre staff, asking them questions regarding the materials and equipment used for ongoing projects. The survey also asked for any ideas for future projects along with any desired additional equipment for current

projects. This information was then compiled into a spreadsheet split into current, desired, and future equipment sections. This datasheet should continue to be used by the EcoCentre to track their equipment usage moving forward. We used the future and desired sections to create a recommendation data sheet with budget and best options with links for purchase, including ranges of estimated costs. Using this equipment wish list, we were able to supply the EcoCentre with estimates they can use to set their fundraising goals.

Finally, we **prepared promotional materials that can be used to help fundraise for the new laboratory**. We created a web page describing the Citizen Science Lab and the potential new lab equipment, that will be integrated into the official EcoCentre website. We also created another web page which describes our team's experience with citizen science, featuring photographs of each team member participating in citizen science, and a quote from each of us reflecting on our experiences. Finally, we produced a pitch deck with material and graphics to be used in presentations to potential philanthropic investors. The visuals we created serve as tools that can be used to convince and gain possible future funders, as well as for advertisement of the center and its new community building.

Based on our findings, our team was able to successfully identify several opportunities for citizen science research within the EcoCentre’s partner network, generate an expansive database for equipment, including several pieces of recommended equipment for the new laboratory, and design several visual, easy-to-comprehend promotional materials and websites for the advertisement of the new community centre and the Citizen Science Laboratory.

Authorship

Each member of our team contributed equally to the final product, including background research, writing, editing, interviewing, and the creation of the deliverables and promotional materials. The writing was broken into sections with everyone completing comparable amounts, and each section had primary editors as well as was edited by all members of the team before submission. The team completed most interviews and community events together. Finally, many of the deliverables were also completed together as a team, with Brent and Will spending additional time on the expense tracker and analysis, Ashley on the website, Jack on the pitch deck, and Maddie on the visual collateral.

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1.0 Introduction

The practice of citizen science can increase our scientific and environmental knowledge, produce large and diverse datasets, and influence policy and decision-making{Citation} (Angela Heathcote, 2018; Bill Dunford, n.d.). From discoveries as large as locating new exoplanets or rediscovering thought to be extinct species, to developing complete environmental catalogs, citizen science has played a silent role in countless studies world-wide. The Port Phillip EcoCentre in Melbourne, Australia is a non-profit, community-managed environment group that embodies the motivations of citizen science and is leading efforts to address environmental issues around Port Phillip Bay. Annually, about 20,000 environmental volunteer hours are hosted by the Port Phillip EcoCentre, over 1/3 of which follow a citizen science approach.

With a mission to "inspire, educate and demonstrate sustainable environmental practice and strengthen people's connection to the natural world", the EcoCentre has provided a base for over 3,000 volunteers, 120 organizations, 162 schools, and 15,035 participants over the past 21 years (Port Phillip EcoCentre, 2022). Throughout its existence, the EcoCentre has had a measurable impact on the region of Port Phillip Bay and has 'led the charge' in major areas of concern such as studying the sources of pollution of pollution throughout the bay in the *Clean Bay Blueprint* through their ongoing *Street2Bay* program, all while heavily including and relying on community partners and volunteers. Evidence of their community impact is shown in the reported 500-fold increase in youth participation, and a 660% increase in local environmental restoration activities over the last decade, both of which are projected to increase in the coming years (EcoCentre, 2022).

With this growth in popularity, the EcoCentre's needs have surpassed the capacity of its current building. As a result, the City of Port Phillip and the Victorian Government are co-funding a new built for purpose and sustainable building that will function as the first official citizen science lab in Australia. The design plans for the new building have already been established with the intention of maximizing the benefits they can bring to the community. Integrating modern designs and traditional elements of the old EcoCentre cottage, the new design also incorporates sustainable building practices, internal circulation, and more functional multi-use spaces that will allow for the continuous growth of the EcoCentre's programs and services. The EcoCentre has preliminary plans for the new building, which will include Australia's first built-for-purpose citizen science laboratory space. To build upon these plans, frameworks still need to be prepared for future and existing projects designed or re-oriented to fit within the context of their new space with new equipment. The laboratory will be a small room within the

center that will be retrofitted for environmental science experiments and will function as Australia's first built-for-purpose citizen science lab.

The goal of this project was to assist the EcoCentre in launching this new, purpose-built citizen science lab within the new building, with equipment plans, a functional cost analysis, and a framework for potential new project programs that can be run out of the laboratory. This was accomplished by first analyzing networks of the EcoCentre to identify areas of focus for new environmental projects that the EcoCentre is not currently active in and could benefit from expanding into. With these new opportunities in mind, we analyzed the overlap in equipment needs between the EcoCentre's current projects and potential new projects to best facilitate the flexible space and minimize startup and continuous expenses. Finally, we prepared documentation to be presented to new potential philanthropic contributors, that highlights the most captivating aspects of the new laboratory and projects.

2.0 Background

As the scale of scientific experiments continues to grow, researchers have needed to find ways to collect the vast amount of data that is required, leading to the development of citizen science. The word “citizen science” was first documented over three decades ago by the magazine *MIT Technology Review* according to the paper, *What Is Citizen Science? The Challenges of Definition*. The article ‘Lab for the Environment’ explained how the National Audubon Society, an American non-profit environmental organization with only 225 members, was able to collect enough data to produce monthly national maps of rain acidity levels (Haklay et al., 2021). While it can oftentimes take the government years to release data, the Audubon quickly produced scientific data, engaged local volunteers while teaching them about current environmental concerns, and addressed a politically and environmentally relevant issue.

Many individuals participate in citizen science without fully understanding how their involvement is active citizen science. Whether it's reporting or collecting trash on local beaches, counting the number of birds in community gardens, or playing a game in a museum, these actions can all be invaluable contributions to science. By utilizing simple everyday actions and training average citizens how to collect more complex data, scientists around the world can use less resources to get a greater quantity and variety of data for leading experiments.

Scientists design each program in a way that allows people of all ages and walks of life to collaborate and help gather data in engaging ways. While some citizen science initiatives can be relatively low maintenance to run and maintain, there are many challenges scientists must consider when designing a project. Citizen science practices vary from project to project, over time several methods of completing citizen science projects have proven to work above others. The United States Environmental Protection Agency (EPA) produced a Citizen Science handbook for their recommended practices to produce the best results. Most of these steps involve training volunteers in a group setting which allows for the easy collection of environmental data. Data Quality Indicators are also recommended to track the precision, accuracy, and bias of the data throughout the collection process performed by volunteers (*Handbook for Citizen Science: Quality Assurance and Documentation*, 2019). *Crowd the Tap* is an initiative funded by the United States EPA that has collected extensive data from around the United States tracking use of lead pipes for delivery of drinking water. This citizen science project involves the uploading of data involving local drinking water, as well as general questionnaires that are provided to the EPA and utility companies to identify priority service line replacements (Crowd the Tap, n.d.). Crowd the Tap uses easy submission methods, accessible questionnaires, and data that informs the public to further close the loop between environmental

science and community knowledge and education. Without the data of the initiative being made easily available, the volunteers will not know the effects of the data they have collected. Active participation and education are essential in effective citizen science projects, as well as protecting the privacy of the volunteers has proven to show throughout current practices.

2.1 Port Phillip Bay

Before becoming Australia's busiest container port, Port Phillip Bay was a large, grassy plain that served as a home to the indigenous Kulin nation for thousands of years. Eight to ten thousand years ago, the plain was inundated with water and became a large 1,930 square kilometer body of water with 333 kilometers of coastline. Despite the flooding of their home, the First Peoples Nation continued to live around the Bay (State of Victoria, 2017). Port Phillip Bay is home to a vast number of different organisms ranging from aquatic plants and seagrasses, shellfish, and corals, to hundreds of bird and fish species. With the Bay's extremely diverse ecosystems and many tourist attractions, Melbourne Water (a local government group focusing on the management and health of Australian water systems) describes Port Phillip Bay as "arguably the most important environmental, social and economic asset in the region; perhaps in all of Victoria" (*Port Phillip Bay | Port Phillip & Western Port Regional Catchment Strategy*, n.d.).

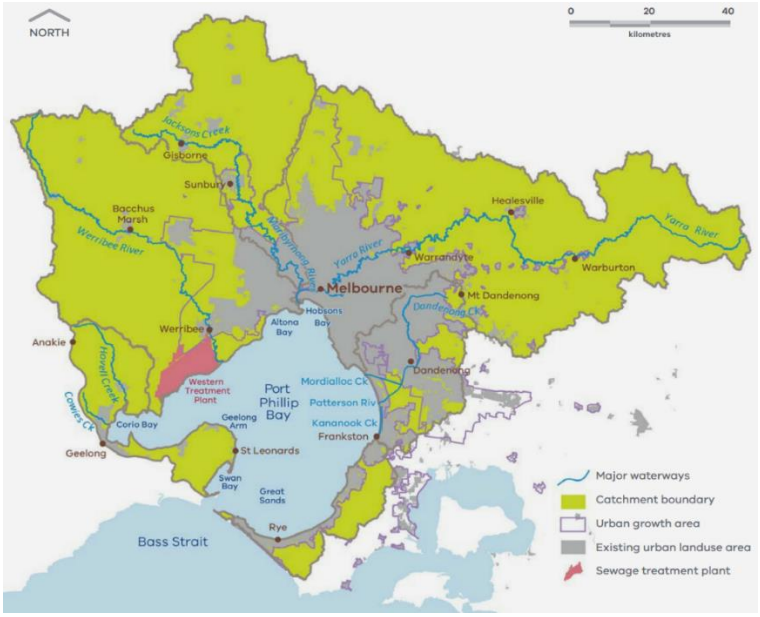


Figure 1: Port Phillip Bay and Catchment Area

2.1.1 Recreation and Economy

Port Phillip Bay attracts over 50 million visitors per year, which contributes more than $320 million per year to the economy through tourism and other associated business. Much of this is income from boat rentals, water sports, surfing, snorkeling, scuba tours, wildlife watching tours, and the hotel and food industries. The Bay's 135 coastal beaches are constantly packed with both tourists and locals relaxing and swimming, while others head to the surrounding cliffs' renowned diving spots. With such wide varieties of activities available in Port Phillip, tourism is one of the city's largest sources of income (State of Victoria, 2017).

Another integral piece of Port Phillip Bay's economy is the fishing industry. More than $420 million per year is brought in solely from recreational fishing, ranging from gear renting to deep sea fishing charter tours. Additionally, commercial fishing brings in over $3.5 million, mainly through the annual production of over 12,000 tons of finfish and 900 tons of blue mussels. Port Phillip Bay is also home to the largest functioning ports in the state of Victoria: the Port of Melbourne, which welcomes more than 3,000 ships per year, and the Port of Geelong, which handles most of the bulk commodities (State of Victoria, 2017). All these aspects of the Port Phillip economy rely heavily on the health and well-being of the bay, so continued environmental damage to the bay could be catastrophic to the city, as well as the state. To protect these economic assets, Port Phillip as well as the greater Melbourne area have placed heavy emphasis on the identification of environmental concerns that pose threats to the bay and are taking action to protect the area.

2.1.2 Environmental Issues in Port Phillip Bay

Port Phillip Bay is currently under threat from many different environmental problems, from climate change to advanced marine pest infestations. The bay's water system and its plant and animal inhabitants are all at risk, as well as those who live around the water's edges. There has already been significant damage inflicted to the water quality and the stability of the bay's ecosystems, and concerns will continue to grow if more effort is not made to reverse the issues.

2.1.2.1 Water Quality and Pollution

Over the next 35 years, the population of the Greater Melbourne area has been predicted to double, from 4.5 million to over 8 million people (State of Victoria, 2017). This large jump in population is likely to cause increased strain on the Port Phillip Bay ecosystems. The local community is already attempting to combat many of these negative effects by starting environmental surveys and putting in place protection and management plans.

One of the most telling analyses of a marine environment's health is its water quality. In 2018-19, The Environmental Protection Authority (EPA) of Victoria rated the Bay's water quality as "good", with their biggest concern being increasing nitrogen levels from the catchment area, which has led to efforts aimed at decreasing the introduction of street water pollutants, one of the area's biggest environmental goals (Melbourne Water, 2022). On top of the water that enters the bay through the feeding rivers, there are over 26,000 kilometers of drainage lines throughout the catchment area that lead into the bay. For this reason, as the population within the catchment area continues to increase, the water pollutants will as well. High chemical pollutant levels increase the risk of the bay developing algae blooms that are extremely toxic to the environment and outcompete the local aquatic plants for resources. Thus far the bay has deterred these growths through its natural defenses of biological nutrient fixation (converting toxins to usable forms) and large volumes of tidal exchanges with the ocean. Many water studies of the bay have identified the rising levels of nitrogen and altering the gutter systems and sewage treatment plants have been of primary emphasis (Melbourne Water, 2022).

On top of chemical pollutants, there are also many concerns surrounding the increasing levels of plastics found globally in our water systems. In Port Phillip Bay, over 2.5 billion pieces of litter are introduced to the water every year, from just two main feeding rivers (The Yarra and Maribyrnong Rivers); 85% of which was microplastics.

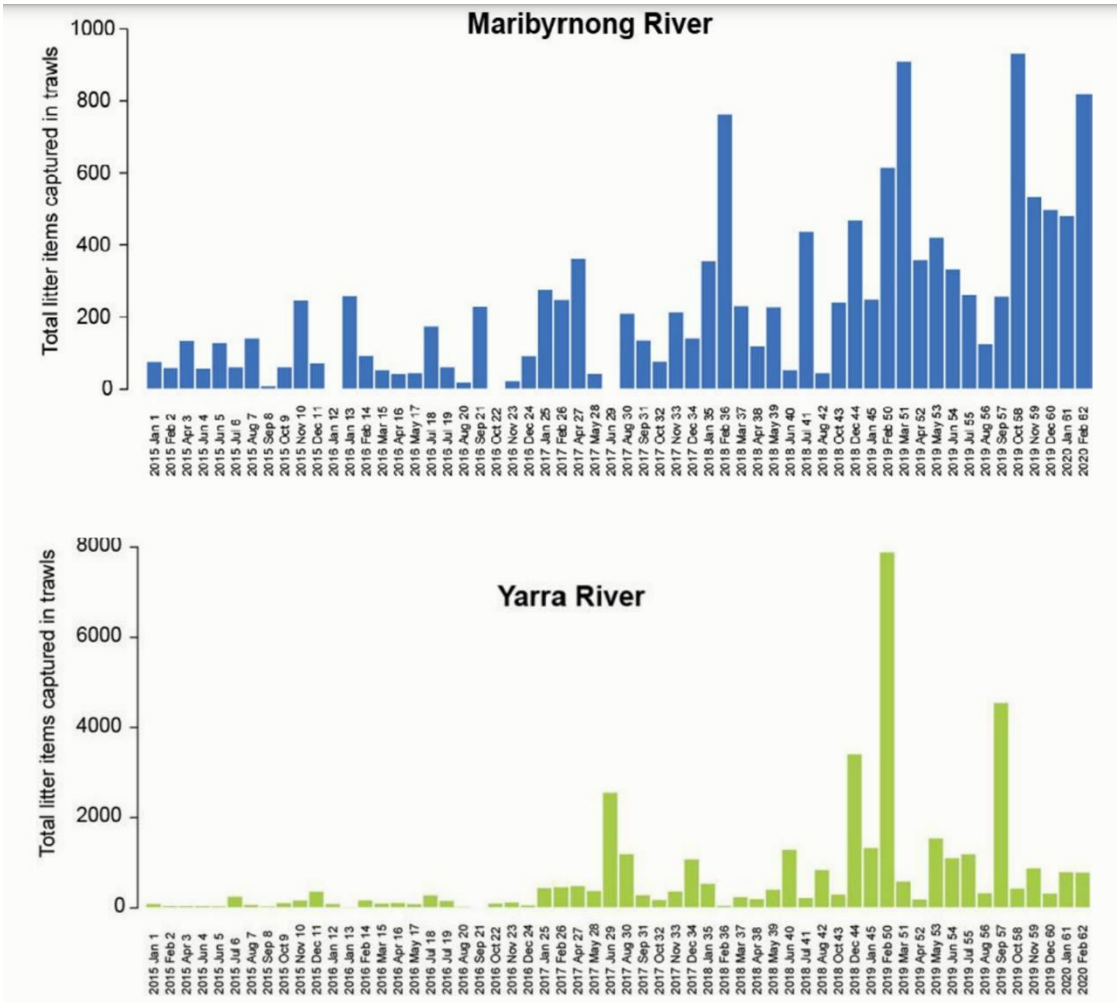


Figure 2: Number of Captured Litter Items in the Maribyrnong and Yarra Rivers between Jan 2015 and Feb 2020

Plastic pollution is found in all water systems in varying sizes, from full pieces of debris like bottles and takeaway containers, to micro- and nano-plastics that are much smaller and more challenging to study and remove. Plastics can be separated into two main types: primary (mainly 'nurdles') and secondary (plastic that has been processed and has subsequently fragmented into smaller pieces). Microplastics are defined as plastic particles that are less than half a centimeter in size. The smallest plastic particles are termed 'nanoplastics' and are invisible to the naked eye. *Nurdles*, pre-production plastic pellets that are used in manufacturing and enter the environment usually because of accidental spillage, whereas fragments are hard pieces of larger plastic items that have been broken down. Some of the most observed secondary plastics in Port Phillip Bay

are water bottle caps and plastic straws (Charko et al., 2020). These plastics put both marine plants and animals at risk as they can leach toxic chemicals and greenhouse gasses as they degrade. Microplastics also attract toxic pollutant buildup on their surfaces and can cause animals to slowly die by inadvertent ingestion. Additionally, there is also a growing concern about the effects nanoplastics have on human health, as they have been shown to be present in humans due to contaminated food and drinking water (Charko et al., 2020).

Figure 3: Nurdles in the Shore of Port Phillip Bay

2.1.2.2 Local Wildlife

Port Phillip Bay supports numerous different environments, both saltwater and freshwater, providing the perfect home for millions of organisms. The Bay houses six main species of marine mammals: two species of dolphins (common and bottlenose), two species of whales (Humpback and Southern Right), and Orcas. There is also a large population of Australian Fur Seals. In addition, the bay supports hundreds of seabirds, shorebirds, and penguins, as well as a wide variety of fish and invertebrates including sharks, rays, jellyfish, squid, and shellfish (State of Victoria, 2017). As chemical and plastic pollution levels continue to increase, these animals will be exposed to more dangerous environments and will be at much higher risk.

Over 35,000 hectares of marine environments have been protected within the Port Phillip Bay to conserve the area's diversity of aquatic plants, mangroves, reefs and their inhabitants. These areas include zones protecting the almost 150 species of local and migratory birds, and over 100 species of fish (Melbourne Water, 2022). There have also been numerous synthetic reefs installed in Port Phillip Bay to attempt to reverse the damage that has been done. In 2009, there were three boat-based reefs (The Rec, Tedesko, and Yakka reefs) added to serve as recreational fishing reefs, and to increase the wildlife populations. Built for the same purpose, the Moolpa, Merv's, and Wilson's reefs were constructed from basalt, and placed in the Corio region of the bay. Finally, a shellfish reef restoration project seeded 9ft Bank, Wilson Spit, Margaret's Reef, and Dromana Reef with millions of oysters and tons of mussels to rejuvenate their populations within the bay and attract more aquatic life (State of Victoria, 2021).

Although the number of different species present in Port Phillip Bay is something to be celebrated, not all organisms are supposed to be present. There is a large and quickly growing concern surrounding the rapidly increasing levels of infestation by foreign marine organisms. Over 100 non-native marine pest species have found their way into the bay, and the number is expected to continue to rise. The main source is suspected to be from contaminated boats or equipment used in a different body of water containing these species (Department of Jobs, 2021). One of the most concerning species is Japanese Seaweed, which grows in dense forests that can blackout the plants below them. The European Fan Worm is also extremely dangerous, as it out competes shellfish for their phytoplankton food source, and is nitrogen excreting, adding to the already building nitrogen levels (Melbourne Water, 2022). The invasive pests threaten the bay's ecosystems as they are often able to out compete the local flora and fauna, disturbing the typical food chain.

2.1.2.3 Climate Change

As the water temperatures rise due to climate change, aquatic plants and animals are at a high risk for population decreases as their habitats become compromised. This will cause the composition of the Bay's plants and wildlife to change drastically (Melbourne Water, 2022). Migrating species are also in danger as they are forced to change their typical migration patterns in response to the changes. The Bay also becomes more acidic as it absorbs increased levels of carbon dioxide from the atmosphere, posing a high risk for shellfish and mollusks (Melbourne Water, 2022).

Another main climate change concern is the rising global sea levels. Increases of between 0.18m to 0.59m are predicted to be seen by 2095 (Melbourne Water, 2022). This puts coastal regions in great danger for shoreline erosion and the submersion of transitional ecosystems. As

the coast erodes, the more than 1.3 million people that live along or near the Port Phillip Bay coast will be at risk. This will also cause trickle-down effects on the 4.5 million people living in the watershed around the Bay (State of Victoria, 2017). On top of the environmental importance of the bay, it also possesses great societal and economical value to the country, both of which will be in danger as climate change continues to worsen.

2.1.3 Current Protective Plans and Organizations

As the changing environment continues to pose great risks for Port Phillip and the surrounding Melbourne area, many organizations have stepped up and begun planning ways to protect their bay. The main group governing the bay is Environmental Protection Agency Victoria. This agency is tasked with enacting and enforcing the Environment Protection Act of 2017. The Marine and Coastal Act of 2018 was put into action along with the Central Regional Coastal Plan, which focuses on coastal development and erosion working with local governing agencies and the Department of Environment, Land, Water, and Planning (DELWP). Each of these legislations is enacted with the Climate Change Act and Victoria's Climate Change Adaptation Plan for 2017-2020. There are also several pieces of legislation enforced by Melbourne Water and the Corangamite Catchment Management Authority (CMA) that focuses on the management of the water systems under the Water Act of 1989 (State of Victoria, 2017).

To help enforce these policies and continue to study the environment, there are also many smaller-scale organizations that have been developed to study the Port Phillip Bay environment. Sustainability Victoria is an association of the government of Victoria that focuses on creating plans to reduce the amount of waste in the Port Phillip Bay area and create a net zero circular economy (Sustainability Australia, 2022). Finally, one of the biggest partners in the protection of Port Phillip Bay is the Port Phillip EcoCentre.

2.2 The Port Phillip EcoCentre

Port Phillip EcoCentre is a small, dynamic non-profit organization that connects and inspires people to care for land, water, wildlife, and community wellbeing. The idea of the EcoCentre was conceived in 1998 by the City of Port Phillip (CoPP) and became fully operational in 1999. Since its creation, the organization has been run out of the old park-keepers cabin within the St. Kilda Botanical Gardens.

Figure 4: Current Port Phillip EcoCentre

The center was designed as an overarching organization to provide structure and placement for the community to initiate and progress environmental projects relating to issues that were affecting their community and the broader bay area (Port Phillip EcoCentre, 2021). The EcoCentre works towards a healthy, thriving, and resilient planet where humans live in balance with the natural world. This is achieved by partnering with more than 250 schools and organizations. Operating off funding from government grants and philanthropic donations, the EcoCentre leads award-winning citizen science programs by deploying the community of Port Phillip and beyond. Through volunteer efforts and generous donations, the EcoCentre's leadership team has assembled a wide network of expertise and practical experience in community environmental on-ground action, original research, and education for all ages (EcoCentre, 2022).

2.2.1 EcoCentre Community Programs

The EcoCentre citizen science projects include environmental surveys to monitor pollutants, bio-indicators, flora and fauna species, microplastics, long term coastal conditions and more. Studies are conducted in both fixed terms and ongoing seasonal surveys to gather information year-round (EcoCentre, 2022).

As part of the Project Baykeeper initiative led by the Port Phillip EcoCentre and their very own "Baykeeper", Neil Blake (Medal of the Order), the group conducted the **Clean Bay Blueprint**, a three-year litter study conducted between July 2017 and June 2020. As stated by EcoCentre, it was a collaborative microplastics research project that enabled: rigorous and replicable methods to quantify plastic pollution through microplastics trawls and beach litter audits, community engagement in citizen science activities, and growth in partnerships with other organizations that target litter and Bay health (*Clean Bay Blueprint | Our Community Programs | EcoCentre*, n.d.).

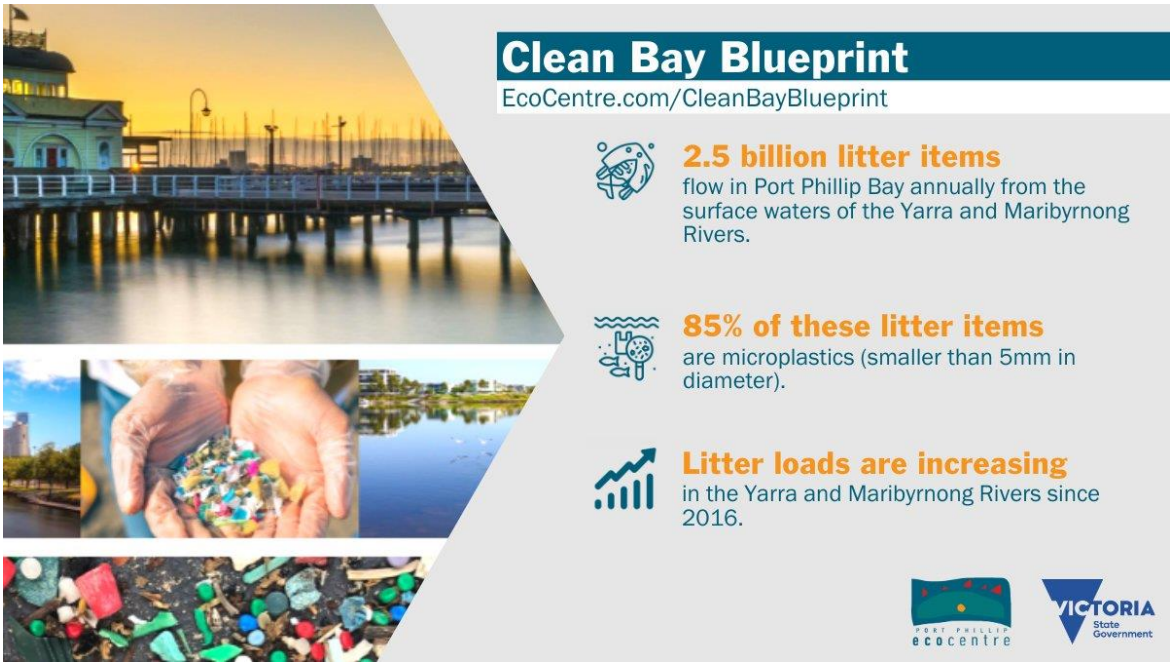


Figure 5: Clean Bay Blueprint Key Findings

The study concluded that 2.5 billion litter items flow into Port Phillip Bay annually from the surface waters or the Yarra and Maribyrnong Rivers, of which 85% of these litter items are microplastics smaller than 5mm in diameter. As a result, litter loads are increasing within these rivers causing further issues downstream into the Bay. It is findings such as these that show the importance of citizen science in highlighting major environmental concerns and areas where action needs to be taken by private or government powers (*Clean Bay Blueprint | Our Community Programs | EcoCentre*, n.d.).

Building off the success of the Clean Bay Blueprint study, the EcoCentre and the Port Phillip Baykeeper partnered with Scouts Victoria to conduct a far-reaching street litter and microplastics study on six different street use types across Greater Melbourne and their effects on adding pollutants into the Bay. This project, named Street2Bay, involved hundreds of Scouts from 26 Scout groups located throughout the bay's catchment areas. Groups were trained by the systematic audit method and given the necessary equipment and support to conduct audits in their catchment area every three months for two years. Audits were conducted on the six different street types: retail industrial, public building, sports fields, park, and residential, while focusing on three main areas, footpaths, gutters, and grass/mulch areas. Over 24 months, more than 500 volunteers and leaders of the scout's program were engaged in the program, resulting in an excess of 3,300 auditing hours. Within this time, the team collected approximately 54,000

pieces of litter, 74% of which were the targeted microplastics. The spread of their findings across the six main street types are shown in **Table 1:**

Table 1: Street2Bay Findings: Visual comparison of different street uses and municipalities

Legend (# per 100m2)	15-50	51-150	151-250	251-350	351-450	451 - 650	1000 +
Scout Group/s & Municipality	**Retail**	**Industrial**	**Public building**	**Sports field**	**Park**	**Resident**	
Brighton, Sandringham, Hampton - Bayside CC							
Belmont - Geelong CC							
Blackburn - Whitehorse CC							
Werribee - Wyndham CC		No audit					No audit
Footscray - Maribyrnong CC				No audit			No audit
Essendon - Moonee Valley CC							
Sunbury - Hume CC							
Eltham - Nillumbik CC							
North Balwyn - Boroondara CC							
Monbulk, Ferny Creek, Kallista - Yarra Ranges CC							
Wirringa - Monash CC				No audit			No audit
Everest Le Page - Kingston CC							
Sir Dallas Brookes - Frankston CC		No audit				No audit	No audit
Dromana / Red Hill - Mornington Pen CC							

Note 1: (Street2bay Litter Survey Project, 2021)

This ongoing project is funded by the Victorian Government Port Phillip Bay Fund and provides critical data relating to the Clean Bay Blueprint by helping to identify or rule out key sources of waterborne pollutants such as microplastics. Given the nature of this project and the vast area in need of analysis, a traditional science approach would be a limiting factor in the speed of data collection and overall end results. The citizen science method employed by the EcoCentre allows for large groups of people to work at these audit sites, increasing the volume and frequency of incoming data to be analyzed by specialists.

In addition to their wide range of projects, the EcoCentre also engages heavily in the community. The EcoCentre's education programs are tailored to four main groups: schools, teachers, youth groups, and young children in early educational settings. There are multiple opportunities for school trips to the EcoCentre, as well as summer and leadership programs for students of all ages. The EcoCentre also supplies opportunities for teachers to run educational

programs at their facility, and supplies resources for educators to use in their classrooms to assist with environmental teaching.

Collaborating with several environmentally driven organizations, the Port Phillip EcoCentre has worked extensively with Sustainability Victoria, Melbourne Water, and EPA Victoria with regards to microplastics in the Bay and overall water health in the Victoria territory. The EcoCentre has also worked alongside the Royal Melbourne Institute of Technology (RMIT) to further analyze certain aspects of microplastics and sunscreen's impact on the environment. The Port Phillip EcoCentre also receives advice and funding from the City of Port Phillip, the Australian Government, Bayside City Council, and the Victorian Government (Port Phillip EcoCentre, n.d.). Through continued partnerships and funding, the EcoCentre has grown in its outreach and size, which has created the need for more space and the opportunity to create a centralized hub in Australia.

2.2.2 The Future Citizen Science Hub

Since 1999, the EcoCentre has operated from a retrofitted cottage in the St. Kilda Botanic Gardens. Through their education and inspiration of the wider community, the group's collective impact has "transformed the way Melbourne understands wildlife, waterways and wellbeing in the age of climate change" (Port Phillip EcoCentre, 2021). As stated on the organization's website, the EcoCentre currently has over 3,000 volunteers, 120 community and business partners, connections, and programs at 162 schools, and 15,035 program participants. In the annual report for 2020 - 2021, the Port Phillip EcoCentre's President Pam O'Neal discussed the success they had in the past year alone amidst the challenges posed by the COVID-19 pandemic.

"The challenges of COVID-19 have meant that for a considerable part of the past year we were unable to work face to face. The situation demanded innovation, patience and creativity in the EcoCentre's planning and operations, yet we lost little in terms of engagement, action and collaboration: We had 16,515 program participants. Over 68,200 digital users accessed EcoCentre resources, blogs, and films. More than 14,000 volunteer hours were worked, which included the planting of over 6,100 coastal plants. We worked with 176 schools and early learning centers, with more than 11,100 students engaged between online and on-ground programs. Additionally, we worked with 115 partner groups, including Scouts, universities, Friends groups, health services and government agencies (*Port Phillip EcoCentre Annual Report 2020-21*, .)."

Even while facing the challenges of remote operations, the impact and outreach efforts of the EcoCentre in the broader Port Phillip Bay community remained impressive in scale and is evidence that their limiting factor is not rooted in their methods, but their means.

Having truly outgrown the capacity of the 1960s park-keeper's house, the group is redeveloping the site into a fit-for-purpose, "world leadership" Green Star-rated community environment hub, co-funded by the City of Port Phillip and the Victorian Government. For its contribution, the EcoCentre will be contributing $200,000 cash and in-tern, providing internal fit-out from basic furniture to specialist equipment. **Figure** 6 shows the preliminary floor layout of the EcoCentre's new hub and **Figure 7** shows an artist's rendition of the new space.

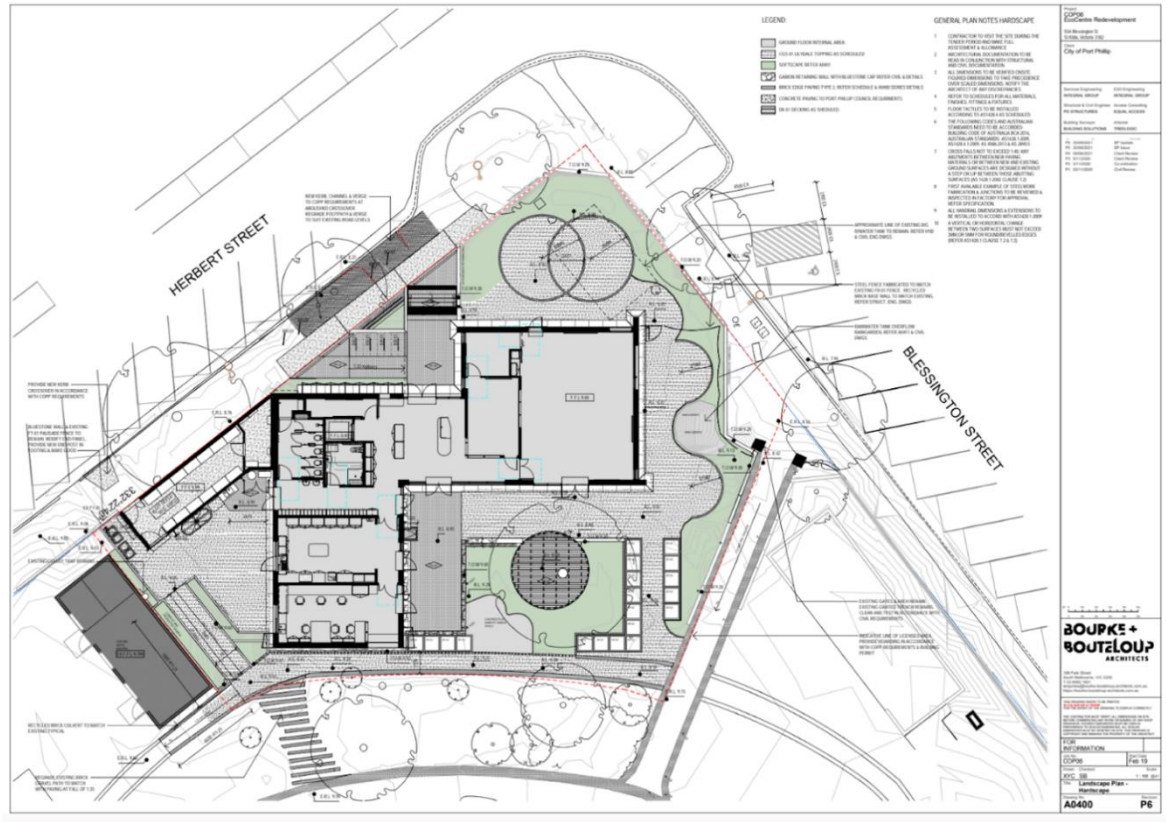


Figure 6: New EcoCentre Design Plans (Preliminary)

Within the preliminary design of the building, special considerations were taken to ensure the new space accelerates the team's vision while staying true to the leadership's team's beliefs. For example, the building will be two stories with solar panels on the roof. This design choice was made to maximize the area of sunlight that can reach the building, which is important as the EcoCentre is targeting Net Zero Energy, Zero Carbon, and holds a '6-Star Green Star'

certification. The design is focused on increasing individuals' interactions with their surroundings by keeping an open concept design and a large presence of natural light and greenery. The building's floor plan, including the lab space which is intended to be used as the center for the EcoCentre's existing and future citizen science experiments, also promotes community bonding and interaction with dedicated areas for meeting rooms, a kitchen, volunteer space, a community garden, and a multi-purpose area. These considerations elevate the EcoCentre's proposed new hub above an industrially focused laboratory space and into a role-model space for scientific practices, environmental sustainability, and community involvement (City of Port Phillip, n.d.).

Figure 7: New EcoCentre Render (Port Phillip EcoCentre, n.d.)

The opportunity to launch a new hub for citizen science, which will be the first citizen science lab in Australia, opens new doors and opportunities for community involvement and showcasing the impact of the EcoCentre's vision. This new building, rendered in Error! Reference source not found., will enable the community to work in a more streamlined manner

on ongoing and future projects, which can be designed around the available equipment to enhance their execution. It is important to note that the building, while designed and funded to be a community hub that supports the needs of the EcoCentre, is not the property of the organization. The Port Phillip EcoCentre will be leasing the space for the foreseeable future', but their contract does cause certain limitations for altering the space since a new tenant may eventually obtain the building. For example, the lab space needs to remain in its current design, therefore large changes such as the installation of a fume extracting system are not within the possibilities of the laboratory space, limiting the range of potential experiments or research. Additionally, while the EcoCentre may not be able to house large machinery or advanced equipment, their strong relations with community partners such as the Royal Melbourne Institute of Technology grants the potential for samples to be sent to more 'state-of-the-art' laboratories for testing beyond the EcoCentre's means.

Figure 8: New EcoCentre 3D Design

2.3 Citizen Science Labs and Organizations

Scientists analyze data from across the globe to gain insights into our Earth's endless unknowns. Many extensive projects require such large sets of data that the primary investigators are unable to collect all the needed information. This is where citizen science plays a substantial role in scientific advancements. Citizen science projects worldwide recruit volunteers in a vast number of locations to gather data for them on a certain subject, making large scale scientific projects possible. A prime example of global citizen science projects is "Globe at Night", which

is an experiment that measures the real-world effects of global light pollution. The data gathered from across the world helps scientists in many different fields, such as environmental scientists working on tracking the migration of bats to study nocturnal animal behavior. This is just one example of the many citizen science projects globally (Kayla Matthews, 2019). To expand our knowledge base, our team performed extensive background research on nine environmentally focused citizen science organizations, ranging from large international universities to small home-grown operations.

2.3.1 Australian Citizen Science Association

The Australian Citizen Science Association, also known as the ACSA, is a member-based organization whose goal is to advance citizen science in Australia through collaboration, advocacy, capacity building, and the wide-spread sharing of knowledge. The ACSA was formed in 2014 when a group of volunteers came together with hopes of increasing awareness about citizen science throughout Australia, as well as globally in the future. The ACSA is able to continue their effort with grants from the commonwealth government of Australia (*Who Is ACSA?*, n.d.).

2.3.2 Boston Museum of Science

The Boston Museum of Science is a science center located in Science Park, Boston Massachusetts, which is a piece of land that lies along the Charles River. The museum was founded in 1830 under a different name, the Boston Society of Natural History, and is currently home to over 700 active exhibits. Several of these exhibits can support their citizen science projects by increasing volunteer participation by allowing for the observation of simple tasks designed as games such as gait analysis studies. Along with these exhibits, the Museum houses the only domed IMAX screen in New England. The Museum's goal is, "to lead the nationwide effort to promote engineering education awareness, bringing science, technology, and mathematics alive through its exhibits, programs, and more" (Boston Museum of Science, n.d.).

Along with its main attraction as a museum, it is also part of the Expert and Citizen Assessment of Science and Technology or ECAST. ECAST is a network in which different Organizations, Institutions or Universities, and Science Museums can work together to use expert and citizen engagement to gather information on the implementation and use of science programs and methods nationwide. The Boston Museum of Science fits into this by holding projects and programs locally and internally to gain the knowledge needed to better the scientific process within a community (*Expert and Citizen Assessment of Science and Technology (ECAST) | Museum of Science, Boston*, n.d.).

2.3.3 Deakin University

Located in Victoria, Australia, Deakin University is one of the local public universities partnered with the Port Phillip EcoCentre. By offering innovative digital engagement and world-class programs, Deakin acts as "one of Australia's leading tertiary education providers" and provides individuals the opportunity to live and work in the evolving world (Deakin University, 2021).

Citizen science projects are one way in which Deakin can provide this opportunity for individuals to work and connect to the world. Victoria Coastal Monitoring Program (VCMP) is one effort that Deakin University helped initiate. This project taught volunteers how to measure and determine where coastal erosion is occurring along Victoria's coast with the use of high-tech drones (Deakin University, 2021.). Deakin University is also in the works of jump-starting their new Spider Crab Watch project. With the help of community members, the university hopes to gather enough data to understand the science behind the mass gatherings of the giant spider crabs throughout Port Phillip Bay (Deakin University, 2022).

With the development of these citizen science projects and the need for more volunteers, Deakin University has formed a supportive relationship with the Port Phillip EcoCentre. Over time, the two organizations have worked together in designing and hosting citizen science projects, as well as recruiting more scientists and sharing equipment between both organizations.

2.3.4 Hobson's Bay Wetland Centre

Hobson's Bay Wetland Centre is a community-based organization whose goal is to foster an environment where individuals are inspired to care for their natural world and improve their health and wellbeing by connecting with nature. Established in 2018, Hobson's Bay describes their initiatives as "driven by the knowledge that spending time in nature is vital for health and happiness and also promotes environmentally responsible behavior". For this reason, by 2025 they aim to build a purpose-built center that will provide a physical center to allow individuals to connect, run activities targeting health, wellbeing, and conservation, and enact research programs to care for nature with opportunities for learning in a natural environment (*Hobsons Bay Wetlands Centre — Our Centre,* 2022).

With similar goals in mind to those of Port Phillip EcoCentre, Hobsons Bay looks up to the EcoCentre as being a generation ahead of them. Due to the EcoCentre's additional 20 years of establishment over the Hobsons Bay Wetland Centre, the EcoCentre has been able to act as a positive role model and help foster inspiration for the Wetland Centre.

2.3.5 Leiden Citizen Science Lab

The Leiden Citizen Science Lab is located at Leiden University in the Netherlands and supports the growth and development of citizen science all throughout Europe. By creating a central platform for sharing and supporting the development of new knowledge, the university plans to further increase scientific activity in their community, as well as inspire citizen scientists throughout the European Union. The Science Lab sets up a select number of projects (or what they call SciShops) to focus on at a time to ensure the selected few are as informative and complete as possible. In 2018 they successfully completed projects in several different scientific sectors including air pollution, archeology, and languages & cultures. The current projects include two focusing on the effects of plastics in the environment, and another focusing on psychology. These projects are all run as community sourced programs and are completed primarily at Leiden University. A fourth project has also been proposed that will be globally accessible, allowing anyone with a smartphone to measure air and water quality with a downloadable app (*Citizen Science Lab - Leiden University*, 2019).

2.3.6 Tangaroa Blue Foundation

The Tangaroa Blue Foundation is a nation-wide, not-for-profit organization located within Australia. The Foundation's primary focus is on the removal of marine debris and analyzing the sources of the pollution to target problem areas (Tangaroa Blue, 2018a). Marine debris, specifically plastic pollution, is credited as one of the leading environmental issues worldwide. The organization garnered its name from one of its founders who was a native New Zealander who had a close connection through his family to a Maori Kaumatua (Elder). After consulting the Elder and his family, the group decided to choose the name Tangaroa, who is the Maori God of the Ocean. The god Tangaroa has a saying which translates to, "If you look after me, then I will look after you," which is in regard to the ocean. The philosophy of the Tangaroa Blue Foundation is centered around this idea, trying to promote the concept that we can't keep taking from the oceans and damaging them without giving back and attempting to right our wrongdoings (Tangaroa Blue, 2018).

The Foundation itself is focused on three major issues which they are trying to solve: marine debris and its many sources, a lack of framework in Australia to address marine debris concerns, and a lack of large-scale change at a higher governmental and political level. To address and tackle these issues Tangaroa Blue has four main solutions, with first working to remove what marine debris is already out there. This will begin the long process of removing toxins and chemical pollution from the ocean that affect both humans and local flora and fauna. Tangaroa Blue has removed marine debris from over 3,860 sites across Australia and continues

adding new sites every day. The next goal is to stop the flow of debris into the ocean. Through citizen science practices they are working to gather data on where the debris originates from and how to effectively plan to stop it. Third is to reduce the amount of waste we produce as a population, focusing on encouraging more sustainable practices at both local and national levels. The final and most complex focus of the organization is figuring out how to effectively achieve all this change. To do this, Tangaroa Blue uses different community groups, organizations, corporate groups, and many more to make people step up and volunteer to help better our oceans and fight back against the marine debris problem (Tangaroa Blue, 2018).

Tangaroa Blue cannot achieve their goal alone and has partnered with the Port Phillip EcoCentre. Through this partnership the EcoCentre can help Tangaroa Blue by providing volunteers, a volunteer workspace, and letters of support.

2.3.7 The Citizen Science Lab (Pittsburgh, US)

The Citizen Science Lab in Pittsburgh, Pennsylvania is a large-scale operation that has earned a high quality, global reputation. With two locations in Pittsburgh (in the South Hills and Hills districts), the Citizen Science Lab's goal is to bring hands-on STEM experiences to the community to teach them about different areas of science while simultaneously collecting data for each experiment (The Citizen Science Lab, n.d.).

The Pittsburgh lab is a nonprofit organization which has made tremendous progress in bridging the gap between high-end science and the public as they work to increase opportunities for scientific education in their community. Their "open to all" motto speaks to their goals of making scientific contributions accessible for all. The Science Lab offers many different programs and workshops which encapsulate a wide variety of scientific fields including anatomy, astronomy, biology, chemistry, engineering, physics, technology, and zoology.

2.3.8 Victoria National Parks Association

Victoria National Parks Association (VPNA) is a non-profit organization leading nature conservation efforts throughout Victoria. For over 70 years, VPNA has strived to foster a healthy and diverse natural environment within their state. This goal is being achieved by "facilitating strategic campaigns and education programs, developing policies, through hands-on conservation work, and by running bushwalking and outdoor activity programs which promote the care and enjoyment of Victoria's natural heritage" (Victorian National Parks Association, 2022)

With both teams located in Victoria, VNPA and Port Phillip EcoCentre exchange in a mutual relationship that increases both organizations' abilities to flourish. The relationship between these two organizations began just as a knowledge-based relationship, when the two

organizations shared an involvement in Radio Marinara (a community radio station), where they were able to openly share their various citizen science practices.

2.3.9 Melbourne Water

Melbourne Water is an Australian government organization which seeks to protect major water resources within the city of Melbourne. Melbourne Water's main goal is to enhance life and livability within Melbourne through the better treatment of its waterways. This goal is said to be achieved through three different areas which include strengthening the wellbeing of the community, co-creating the world's most desirable places to live, and enhancing the natural environment (Melbourne Water, 2021).

Melbourne water and the Port Phillip EcoCentre are both located within the city of Melbourne but are not currently partnered together for any projects. With around 1,000 connected members of the community and around 200 active volunteers, Melbourne Water has not needed to partner with other organizations in the past. Although they have this steady stream of volunteer work, Melbourne Water would like to consider partnering with the EcoCentre in the future on possible new project opportunities.

3.0 Methodology

The goal of this project was to co-design Australia's first purpose-built citizen science laboratory with the Port Phillip EcoCentre. Our objectives to complete this mission were:

1. To identify citizen science opportunities within the Port Phillip EcoCentre's partner network and the wider community
2. To survey projects and recommend laboratory equipment
3. To prepare promotional materials to fundraise for the new laboratory and projects

Figure 9: Port Phillip Bay, Victoria, Australia

The project will be conducted in the region directly surrounding Port Phillip Bay, including the City of Port Phillip and the greater Melbourne area. The EcoCentre is in the St. Kilda Botanical Gardens in Port Phillip and focuses on environmental concerns affecting the bay and nearby ecosystems. The EcoCentre also works with large partnership organizations that work with larger scopes including the state of Victoria as well as the entirety of Australia, but the organization focuses on projects that impact their local communities.

Our project took place over 14 total weeks, from January 11th to May 4th, with the first seven weeks being preparatory and the last seven weeks encompassing the execution of the project. We arrived in Melbourne on March 31st and worked at the EcoCentre until May 4th. By

the end of the 14-week period, we were able to provide valuable recommendations to the Port Phillip EcoCentre regarding project opportunities and equipment needs in the new lab space.

3.1 Identifying Citizen Science Project Opportunities

To identify citizen science opportunities that could be expanded into the new laboratory, we conducted a network analysis through three frames of reference: The global citizen science landscape, the EcoCentre's local partner network, and participating in local ongoing citizen science initiatives at the EcoCentre. Splitting our investigation up into these three levels provides a wealth of knowledge, both first-hand and second-hand that we were able to repurpose and turn into recommendations for the EcoCentre team.

3.1.1 Analyzing the Global Citizen Science Community

Our first method of identifying citizen science opportunities was to analyze global leaders of citizen science through interviews to gain information on how they choose and design their projects and experiments. We were successfully able to engage with three prestigious citizen science labs: Boston Museum of Science, Leiden University, and The Citizen Science Lab (Pittsburgh, USA). While the Boston Museum of Science mainly focuses its efforts on the museum and not citizen science, it is known for its involvement in citizen science. We interviewed the Manager of Science Communication at the museum to learn about the way their citizen science team operates. The Citizen Science Lab of Pittsburgh is a well-known citizen science laboratory in the US and runs a plethora of projects encompassing many different topics. We conducted an informal survey using a WPI Qualtrics survey with one of their citizen science directors. Since The Citizen Science Lab is a non-profit, like the Port Phillip EcoCentre, we also asked questions surrounding their funding of the lab and how they manage continuous expenses with contributions through grants and other sources. Lastly, we were fortunate to connect with the Citizen Science Director at Leiden Citizen Science Lab, located at Leiden University in the Netherlands. Following connecting via email we conducted a virtual semi-structured interview discussing how their lab runs and gained insight into how they create and maintain their projects that influence the greater European area.

3.1.2 Analyzing the Port Phillip EcoCentre's Local Partner Network

To gain more focused information on opportunities for the EcoCentre within South Australia, our team moved next to analyzing their local partner network. Building off the work done by a previous IQP team (EcoCentre IQP D18 Eco), our team gained access to a spreadsheet

of all EcoCentre's partners (2018) that included information about the type of organization, directionality of volunteers and data, and the strength of their partnership. The spreadsheet, shown in **Appendix L**, contained over 160 partnering schools, government agencies, and organizations. Since our team is focused on citizen science, we filtered this list to include only those organizations active in citizen science, leaving 26 groups.

From this condensed list of partners, we further shortened it to identify the best organizations for interview to find opportunities for partnership development and collaboration for the EcoCentre and its network partners, to find commonalities between partners that could lead to future projects, and to explore the needs of these organizations that the EcoCentre could alleviate. To accomplish this, we sorted each of these partners into one or two of five categories: microplastics/pollutants, water cleanup, conservation/preservation, wildlife, education, funder, and other. Each partner was given a "primary" and "secondary" category based on their leadership within their field, relationship with the EcoCentre, and area of focus. Once we identified five key 'primary' partners for a live interview, our team further designed organization specific interview questions for each case.

Table 2: Primary EcoCentre Partners Interviewed

EcoCentre Partner Interviewed	**Organization Focus**
Deakin University	Wildlife
Hobson's Bay Wetland Centre	Conservation/Preservation
Melbourne Water	Water Cleanup
Tangaroa Blue Foundation	Microplastics/Pollutants
Victoria National Parks Association	Wildlife

From the list of 26 key citizen science partners of the EcoCentre, a list of 'secondary' partners was selected for a supplemental survey. In addition to this list, the EcoCentre staff recommended additional organizations that would be valuable additions to our data. The survey, shown in **Appendix I**, was sent directly by EcoCentre Staff to multiple partners and in some cases was passed along by these organizations to additional citizen science members in the region, broadening the knowledge base of the results. The initial distribution list of the survey is shown below, however this does not represent the full list of recipients.

- Bellarine Catchment Network (BCN)
- Zoos Victoria
- City of Greater Geelong
- Department of Environment, Land, Water and Planning (DELWP)
    - Science impact & collaboration team (biodiversity division) x 2
    - Marine Policy & Programs (biodiversity division)
    - Senior project officer (biodiversity division)
    - Arthur Rylah Institute Director
- Marine Care Ricketts Point
- Parks Victoria
- Environmental Protection Agency of Victoria (EPA Victoria)
- Balcombe Estuary Reserve Group (BERG)
- Australian Citizen Science Association (ACSA)
- Coastcare Victoria
- Victorian Building Authority
- Yarra Riverkeeper
- Warribee Riverkeeper
- MESAC

3.1.3 Participating in Local Citizen Science Initiatives

Another key method we deployed is participant observation. This is the practice of participating in any of the citizen science projects conducted by both the EcoCentre and their partners and taking notes on how they are run from the participant perspective. From this we gained a hands-on, first-person perspective on the projects, specifically on how they are built, advertised, and run. By participating we were also able to identify areas of information loss or design flaws where the EcoCentre and its new lab could interject and close the loop.

3.2 Analyzing Equipment Needs

Our analysis of the EcoCentre's equipment needs developed throughout the course of the project. The primary approach of collecting this data was through an EcoCentre staff survey, however, while conducting interviews and participating in citizen science projects, additional information on the equipment needs and desires for the new lab space materialized. By collating all this information into an excel spreadsheet, we analyzed the data and produced a set of

equipment purchase and stocking recommendations along with a spreadsheet that included a best option and a budget option for each of the recommended equipment needs.

3.2.1 EcoCentre Staff Survey

Based on recommendation from April, 5 key EcoCentre staff members were sent the project equipment survey shown in **Appendix L**. The survey was designed to investigate what equipment they need to complete their current or desired future projects, the necessity and availability of each item, any potential roadblocks to its use at the EcoCentre. Nadav Zisin, Fam Charko, Neil Blake, Reiko Yamada, and Ben Francischelli, are the main outreach leaders and practicing citizen scientists at the EcoCentre who were polled with this survey.

The following main questions were asked for each project the interviewees entered:

1. What pieces of equipment would be useful for this project? Do you currently have this piece of equipment?
2. How necessary is this item?
3. How would/do you obtain this item? If the item is bought, who do you buy it from?
4. How many people are generally engaged? (Range? set #?)
5. What is the ratio of people to pieces of equipment needed to make this project effective?
6. Special Considerations (Power Supply, Sizing, Storage, Toxicity, Hazmat, etc.)

3.2.2 Analyzing Additional Equipment Needs

After several discussions with EcoCentre staff, we also added equipment to the collected data that would be useful in their active or future projects that were not directly mentioned in the project equipment survey. In addition, we took information from our participation and interviews with network partners to better inform the needs of the future EcoCentre laboratory. The survey answers were limited to equipment needed or desired for current or future planned projects and did not encompass equipment that would enable the EcoCentre staff to lead completely new initiatives out of the laboratory space.

3.3 Creating Promotional Materials for the Citizen Science Lab

Our team designed three unique deliverables for the EcoCentre to be used in their fundraising and awareness initiatives for the new hub and laboratory space. Specific guidance on

what deliverables would be best suited for this purpose were directed by the EcoCentre Executive Officer April Seymore.

The first deliverable is a ‘Pitch Deck’ which the EcoCentre can use during promotional presentations to philanthropic contributors covering background on the citizen science, the EcoCentre, and how the new Citizen Science lab will be transformative to their current capacity. This pitch deck was created in the form of a google slideshow which contains pictures and key information showing the most impressive aspects of citizen science and the new lab being built.

The other two deliverables created were mock web pages designed and displayed on our team website that will be added to the EcoCentre website aiding the promotion of the new lab and citizen science. The first page contains promotional material on the new laboratory space being built into the future EcoCentre citizen science hub. The page goes over what citizen science is, why it is important, and how the new EcoCentre lab will advance the EcoCentre’s ability to run these programs and generate positive change within the community. The second web page focuses on volunteer experience. Here our team shared our personal experiences as members of the EcoCentre team and working within citizen science along with a final full team consensus. Each member highlighted what they learned from volunteering and why they think volunteering in citizen science is important. The goal of these pieces of promotional collateral is to provide the EcoCentre with material to show off and generate new volunteers.

4.0 Findings

The findings of the project are focused into the three main categories outlined in the methodology. From the interviews and participatory observation, our team gathered a significant sum of information on the citizen science landscape the EcoCentre is a part of and the function of their organization within this network. The equipment analysis survey along with additional conversations provided valuable insight into what equipment will be needed for their new laboratory space. Lastly, we combined our wealth of knowledge and experience into a set of deliverables available for the EcoCentre to utilize for fundraising purposes.

4.1 Citizen Science Project Opportunities

The first set of results are focused on our findings from the citizen science interviews and participation our team engaged in while in Worcester and in Melbourne. We have results from our global citizen science interviews, EcoCentre partner interviews, both primary interviews secondary supplementary questionnaire, and from our participation

4.1.1 Global Citizen Science Interviews

4.1.1.1 Boston Museum of Science (Massachusetts, USA)

Our conversation with the Manager of Science Communication at the Boston Museum of Science gave our team general information on the operations of the Boston Museum of Science and their scale of operations along with vital insight into methods of attracting volunteers to projects. The interview questions used are shown in **Appendix C.** One tip we learned from their operations on both a local and national scale, is that the museum can connect to the local communities using “concern gathering sessions” to survey what issues are on people's minds. They also highlighted the importance of a partner network which they use to judge interest in certain areas and pick potential project collaborators. A method used by the Boston Museum of Science for engagement in citizen science is to use “Living Labs” where the visitors participate in short, fun games or exhibits which also provides data to the cognitive researchers who initiated the study. When discussing the problem of attracting citizen science volunteers, the interviewee emphasized ensuring that the general masses knew where the data that was being supplied was going and how it was going to be acted upon, essentially closing the loop on their contribution which is a point we heard to be vital in multiple of our other interviews. This also includes letting the participants see the data and know that they were able to contribute to change. This interview mainly helped inform the team the importance of being able to attract

volunteers and how to be successful in doing so along with providing a new perspective of citizen science engagement by making fun games that participants will be engaged in and forgetting to an extent they are also engaging in an important study.

4.1.1.2 The Citizen Science Lab at Leiden University (Leiden, Netherlands)

From our interview with the Coordinator of the Citizen Science Lab at Leiden University, we gained much needed insight into how the university runs their citizen science lab and programs, and further advice into the design and planning of our own projects here. The individual we interviewed explained how the focus for coming up with new projects is around public engagement. Our organization specific interview questions are shown in **Appendix B.** They explained how the first step in designing a new project is always to determine an area of focus to gain research in and find a way to make the project fun and engaging to the public. Finally, they touched on the most problematic parts of creating a new project. The two biggest challenges The Citizen Science Lab faces are making their projects feel formal enough to feel like “real” science, and the successful use of mobile applications. All this information will be used in the rest of our method in designing possibly new projects for the EcoCentre.

4.1.1.3 The Citizen Science Lab (Pennsylvania, USA)

Unfortunately, despite establishing contact with a staff member at The Citizen Science Lab and forwarding a questionnaire, shown in **Appendix I,** to be answered, our team did not receive any information. We attempted a follow up to see if there were technical difficulties with the digital survey but were not able to reconnect with our contact.

4.1.2 Port Phillip EcoCentre's Local Partner Network Interviews

Our team's analysis of the EcoCentre's citizen science partner network is visualized in **Figure 10** with distinction between the five 'primary' partners chosen for interview and other key 'secondary' partners considered for the supplementary questionnaire. The five 'primary' organizations chosen for interview and their organization's focuses are shown below in **Table 2.** After further discussion with the EcoCentre staff and communication on their part, we were additionally able to connect for an interview with a representative of Victoria National Parks Association, leading to six 'primary' partners engaged for the interview.

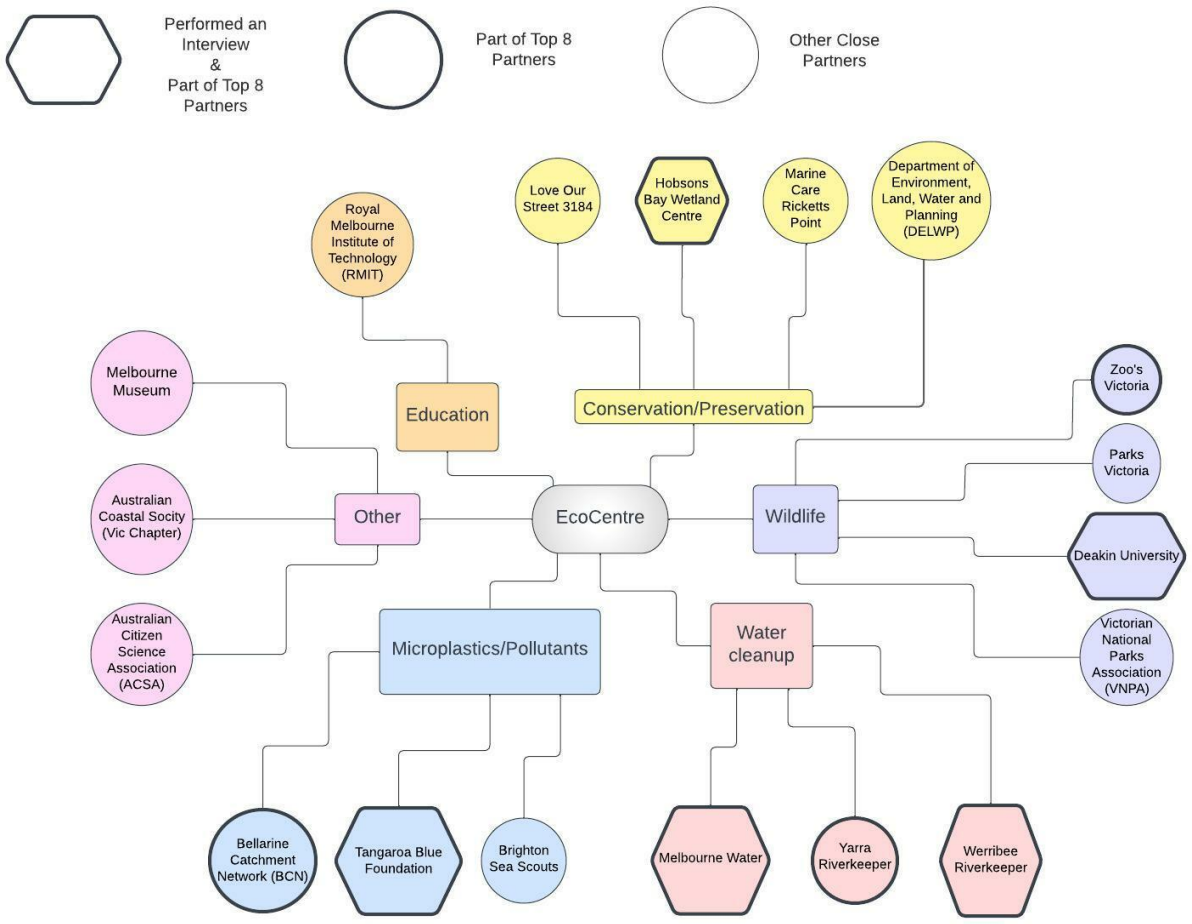


Figure 10: EcoCentre Key Citizen Science Partner Network Map

4.1.2.1 Interview with Deakin University

The interview with Deakin University was conducted by our team interviewing their Research Fellow for Spider Crab and Communications Manager based on the questions listed in **Appendix G.** From this interview, our team gathered insight into the design of a small citizen science research organization and a specific instance where the EcoCentre may not be able to assist purely through citizen science initiatives.

The main desire of this team at Deakin University is furthering their research into the spider crab population throughout the local ecosystems. Their project is ongoing and designed to be self-sustaining. Potential areas of growth they identified are having higher quality cameras and time lapse cameras that will allow for easier spotting of Spider Crabs as well as predators. The key issue with their project from a citizen science perspective is that not just any person is able to collect data on spider crab populations. Data is collected by certified divers and as such limits its quantity and frequency. The role of additional citizen scientists comes in the analysis of photos by multiple people where the data is averaged to get a more accurate count of the spider crab population.

Due to the regulations faced by Deakin University in their Spider Crab Watch initiative, the EcoCentre would need to take a different approach to citizen science partnership. The Interviewee discussed the potential for the EcoCentre to aid their work through information awareness of their program as that is the most important thing currently. Additionally, access to a physical space would help for holding group information events. By nature, citizen science participation in the Spider Crab Watch is less hands on than other initiatives. In addition to the EcoCentre providing aid to Deakin University from an informational perspective along with a space for workshops and meetings, a potential area that the new lab space can be used for would be in providing a space for citizen scientists to review live steam or recorded footage from spider crab divers for data collection.

4.1.2.2 Interview with Hobson's Bay Wetland Centre

The interview with Hobson's Bay Wetland Centre was conducted by Ashley, Brent, and Maddie interviewing their Citizen Science Team Leader based on the questions listed in **Appendix F.** From this interview, the team learned that Hobson's Bay Wetland Center is mainly interested in connecting people in nature, developing a purpose-built center for connecting people in nature, and caring for the wetland. Hobson's Bay Wetland Centre seems to be what the EcoCentre was a few years back, but in a different area, where citizen science isn't the same. Our team learned that they don't always have the resources to do in-house analysis, but they tend to latch on to other people's projects and help. Mainly, Hobson's Bay Wetland Centre goes through

the Australian Citizen Science Association for their projects and then promotes them through their center in Hobson's Bay.

Our team also learned that Hobson's Bay Wetland Centre is looking to the EcoCentre as a generation ahead and trying to emulate and improve what the EcoCentre has done in the past. While being a relatively small organization, the center is looking to branch out especially with respects to seagrass and other environmental aspects surrounding or in the wetlands. One aspect that was very helpful in our team's progress forward that our team was able to gather from speaking to the Citizen Science Team Leader was that some citizens participating in citizen science aren't confident in submitting data they collect in the field. This is mainly due to the fear of their data being wrong or fearing that they are going to mess up the database if they submit it. The interviewee suggested using workshops, virtually or in person, to get these people to step over the barrier of confidence of using apps and online resources to submit data to a database or project.

4.1.2.3 Interview with Tangaroa Blue Foundation

The interview with Tangaroa Blue Foundation was conducted by Jack and Will interviewing their Chief Executive Officer based on the questions listed in **Appendix E.** From the interview, we gathered that Tangaroa Blue is a nationally based organization that lacks a strong physical presence in St. Kilda which can be aided by the presence of a centralized citizen science hub like the EcoCentre's new lab.

One key issue pointed out by the interviewee is the frequent replication of projects in the same research areas or physical locations. Similarly, the selection of locations is often done arbitrarily, without knowledge of work that is already being done or quantifiable justifications. Tangaroa Blue does not have more areas of citizen science they would like to become involved in now, however, there is still ample opportunity for growth of their current initiatives with the EcoCentre. The interviewee also sees great value in the access to a physical hub and the development of their partnership with the EcoCentre, primarily focusing on the availability of a physical space for the purpose of information, awareness, and project executions. Another key issue established by the interviewee is that there is a lack of an established overarching body within the charitable organization sector causing issues in inter-organization awareness, overlap, and partnerships.

When asked more specifically about the use of the physical laboratory space, the interviewee offered insight into the desires of their organization for the space valuable to the EcoCentre when planning the space. A key point was the potential ability to store equipment as they do not have another established location in Melbourne. Access to microscopes would

increase their ability to analyze very small materials, enhancing their project experience. From a collaborative perspective, the interviewee would also be very open to other organizations using stored equipment at the EcoCentre for their own projects if sufficient protocols and insurances are in place for use.

4.1.2.4 Interview with Melbourne Water

The interview with Melbourne Water was conducted by Jack, Will, and Brent interviewing their WaterWatch coordinator based on the questions listed in **Appendix D.** In the interview, the team gathered that Melbourne Water, while having a large partner network, would be able to benefit from the new lab space with the desire to work on new projects. Melbourne Water can be a bigger voice and a facilitator for community groups that is different from most organizations since they are a government owned not-for-profit. While Melbourne Water can be a bigger voice, we gathered that they still have a desire to be a part of community projects including their own.

With the mention of the Port Phillip EcoCentre's new citizen science space, Melbourne Water had a desire to be involved in the space while building their relationship with the Port Phillip EcoCentre further. Such desire was mentioned to be in future projects with suggestions of fish tanks, or wildlife surveys in the bay. There was a good intention to build new projects and to further collaborate with the Port Phillip EcoCentre.

We also gathered that they are looking in the future to investigate vegetation, other survey techniques, and E-DNA as well as continuing opportunities that are surrounding waterways that will help management practices. In addition to the additional outreach areas they had briefly mentioned, the organization seems to be open to expansion into the areas that also affect waterways and their surroundings, sparking interest as to a potential project idea on our side.

4.1.2.5 Interview with Victoria National Parks Association

The interview with Victoria National Parks Association was conducted by Will Lapointe, Brent Ditzler, and Jack Charbonneau interviewing their resource coordinator based on the questions listed in **Appendix H.** From this interview our team was able to gather insight into a citizen science organization different from many of the others interviewed. Similar to Tangaroa Blue, the general consensus of the VNPA interviewee was that their organization is not looking to expand into new areas of citizen science, but to bolster their efforts in the topics they are currently engaged in. As mentioned by the interviewee, the presence of a purpose-built citizen

science laboratory, depending on its final design and potential for projects, could be very valuable in the future initiatives of VNPA.

The organization currently runs five to six projects with two active full-time personnel; however, they are content with the development in their procedures and no longer experience any large roadblocks that another organization could alleviate. Partnership with the EcoCentre would be focused on the potential for collaboration and projects developed out of the new, purpose-built space. The space does need to be built first and then they can go and envision what VNPA can do there. One idea that the interviewee mentioned is the potential for more in-depth sample analysis using microscopes along with the potential for a joint invertebrate bay health project.

4.1.2.6 Supplemental Survey

From our supplemental survey, our group received results from seven organizations: Australian Citizen Science Association, Bellarine Catchment, Marine Care Ricketts Point (MCRP), Zoos Victoria, Marine Education Science and Community (MESAC), and the Department of Environment, Land, Water and Planning (DELWP). A summary of the key results is shown below in **Table 3** and the full answers are shown in **Appendix I.**

Table 3: Key Findings from Supplemental Survey

Organization	**Themes**
Australian Citizen Science Association	Funding, Advocacy, Volunteer Attraction, Collaboration
Bellarine Catchment	New Citizen Science Methods, Physical Hub (research material), Collaboration
Marine Care Ricketts Point	Physical Hub (marine lab), Collaboration
Zoos Victoria	Volunteers, Experts, Invertebrate Research
Marine Education Science and Community	Self Sufficient (not looking for collaboration)

Department of Environment, Land, Water, and Planning	Collaboration, Training, Citizen Science Strategy

4.1.2.7 Summary of Citizen Science Opportunities

From our interviews and supplemental survey with the EcoCentre's partners, our team was able to gather valuable information on the Australian citizen science landscape. This helped us to identify both opportunities for the EcoCentre to expand into, and key focuses for the new purpose-built laboratory. The main conclusion drawn from our results is that many organizations within the EcoCentre's partner network have a desire to collaborate with the EcoCentre and make use of the purpose-built laboratory and citizen science hub. Utilization of the space is envisioned in many ways, such as collaborative storage of equipment, project awareness and advocacy, project execution, and volunteer networking among others. Additionally, many of these organizations view the Port Phillip EcoCentre as a lead advocate in citizen science development and envision their organizations expanding through these new features being created by the EcoCentre.

Another theme seen in the surveys and interviews is the desire for specific equipment that may not be present in the final laboratory such as wet tables, chemicals, and marine focused equipment. While this is not in the plan for the new laboratory space, the EcoCentre can recognize the needs for this specialized equipment and leverage their partner network to connect organizations with similar desires.

The interviews also provided information on new projects and initiatives the EcoCentre can engage in or advocate for. These research topics included, but are not limited to, more in-depth wildlife surveys of the Bay, vegetation research, Environmental-DNA studies, seagrass analysis of the wetlands, and invertebrate bay health studies. There was also a strong desire for a physical hub with storage and central space for collaboration, as well as a technologically advanced space for the live streaming of workshops and webinars.

The supplementary questionnaire was a valuable addition to the interview results and provided strong information on the desires of other organizations within the Port Phillip EcoCentre's network. These results generally mirrored those of the live interviews and importantly showed that there is broader interest by these partner organizations in the success of

the EcoCentre’s new laboratory and citizen science hub. Additionally, it brought to light that many organizations are actively willing to offer their support and connections for its success.

4.1.3 Lessons Learned from Local Citizen Science Initiatives

After interviewing these global citizen science labs, the team used participatory observation to learn more about how the Port Phillip EcoCentre runs its own programs as well as how it collaborates with other organizations to run programs. While in Melbourne, the team was able to participate in a storm drain cleanup in collaboration with the Tangaroa Blue Foundation, a mollusk survey with Neil Blake, a microplastic netting trawl test on the Yarra River, a beach fauna photography program, and a coastal erosion and dune profiling event.

4.1.3.1 Storm Drain Cleanup

The first event the team participated in was the storm drain cleanup in collaboration with the Tangaroa Blue Foundation. From this event the group got insight into how a well thought out, recurring, and purposeful project is run from beginning to end. When the project started it was evident that Tangaroa Blue had put much thought into how they wanted the event to go. We observed an initial check-in which then moved to a description of the event and a safety presentation. Every aspect was taken into account from pointing out all possible dangers, providing all necessary safety equipment, and visuals to help sort the debris into different categories. Additional attention to detail was seen in the data collection where you need to keep a record of all that you do through labels on every bag to then take photos of each bag and its contents with the label in view along with weighing and taking the volume of the bag before and after extracting the trash. While this exercise was quick, it truly helped the team in seeing how you need to take every single aspect of a project into account.

Figure 11: WPI EcoLab Team Participating in Tangaroa Blue's Strain the Drain Initiative

4.1.3.2 Mollusk Survey

The team was able to perform a routine mollusk survey at St. Kilda beach with Neil Blake. Each participant walked the shoreline from pier to pier collecting shells between the water line and the sand mark from the last high tide. The collected data is used to track the growth and recession of mollusk populations and size overtime. Participation in this event allowed first hand observation of the challenges of collected data in a citizen science setting as well as insight to potential improvements that could be made within these initiatives. For this project in particular, the main point of emphasis we discovered was in their data recording methods. The data sheet required extensive knowledge of the scientific names of the different shellfish, requiring a member of the staff to be present for data collection. The process was also found to be not as

efficient as it could be, because after each event the data must be transcribed into a separate database, adding an unnecessary middle step.

Figure 12: WPI EcoLab Team Participating in a Mollusk Survey with Port Phillip EcoCentre

4.1.3.3 Yarra River Plastics Trawl

The team was also able to attend the Yarra river plastics trawl on April 13th with Fam, Neil and the Yarra Riverkeeper. Beginning at the Yarra's Edge Marina, a small boat took us out into the Yarra and Maribyrnong River where we slowly pulled a net made of filter along the side of the boat. After the samples were collected, the end of the net containing any material that was in the water was detached and prepared to take back to the EcoCentre where it could be dried. Currently, the space is not adequate for the drying of large numbers of samples, and space for drying racks will be a point of emphasis in the new laboratory. In addition to the plastics trawl, we also used a water pump system designed by a previous WPI IQP team that vacuumed water at various depths through a filter. The water samples collected through this device also required significant drying time and space. These experiments taught us more about the specific equipment needs of the project and enabled more conversations about the desired use of the laboratory space.

4.1.3.4 Beach Fauna Photography Program

The Beach Fauna program hosted by the EcoCentre was a joint event with Gasworks Arts Park and the Photography Studies College. This program was to showcase the unique and critical flora and fauna that are in Port Phillip Bay. One key aspect of this project our team took away from our participation is the importance of knowing your audience and keeping them engaged in the desired activity. The photography students present were frankly not very interested in a lot of the more 'science focused' aspects of the event such as the litter audit with Alex or the mollusk survey with Neil. While these are important events, participants often become distracted and more interested in their opportunities to take photos of the surroundings. From this we can learn how to shape projects around the audience so that both parties' benefit from the experience. The goal of the EcoCentre is to raise awareness on their issues, so any extent in which their participants are engaged in the topics of concern is a valuable experience.

Figure 13: WPI EcoLab Team Observing the Flora and Fauna Photography Event

4.1.3.5 Coastal Erosion and Dune Profiling

The final event the team participated in was a Dune profiling activity with two members of the EcoCentre staff. This activity was a short two-hour excursion in which we measured the heights of the dunes from a control height. This project was another recurring project so it was very well put together and we were able to see how a routine project works. The EcoCentre staff

who ran the activity had data sheets, clipboards, and pens on the ready from the start of the activity and wasted no time starting when we arrived. They also gave very simple concise directions and every volunteer had a specific role in the activity which gave us our largest takeaway. The take away was that it doesn't matter how intricate or simple the project is, if you have a plan and concise rolls for each volunteer with straightforward directions, then a project will run as smoothly as possible.

Figure 14: WPI EcoLab Team Participating in a Dune Survey at St. Kilda Beach with Port Phillip EcoCentre

4.2 Equipment Requirements

The citizen science laboratory will only be a small space within the new EcoCentre building. This means that the staff must be conscientious about what projects are focused out of the lab and what equipment is stored there, as the space is restricted in size and needs to stay flexible. To recommend the equipment that would benefit the EcoCentre for future projects and still allow for storage space that could be provided to network partners, the team analyzed what equipment is currently used in existing projects that is not stationary or office supplies, as well as what staff would need for potential new projects or previous projects that could start back up after a hiatus due to COVID-19.

4.2.1 EcoCentre Staff Survey

To determine the staff's equipment needs and desires, our team developed an equipment spreadsheet, *Staff Equipment Survey Responses* **(Appendix L)**. The spreadsheet was designed with two sections, one for ongoing or existing projects and one for planned or desired future projects.

Based on which EcoCentre staff members are most involved with running community-based citizen science programs, our team distributed the spreadsheet to Neil Blake, Fam Charko, Nadav Zisin, Reiko Yamadar, and Ben Francischelli. The raw data results of this spreadsheet survey are displayed in **Appendix L.**

To visualize the overlap in equipment necessities across the EcoCentre staff, we created a word cloud diagram, as seen in **Figure 15.** This represents only overlaps in equipment from the survey above that the EcoCentre currently does not have access to. For the word cloud to be readable and concise, similar items were grouped into a common category. Items were then given a weight based on how many staff members listed the item in our excel questionnaire and whether the item was desirable or essential to the project. Items were ranked higher if there was more overlap in responses and was essential to running the project. This hierarchy can be seen by the increasing font size. A full breakdown of the specific items in each category along with their ranking is provided in **Appendix L.**

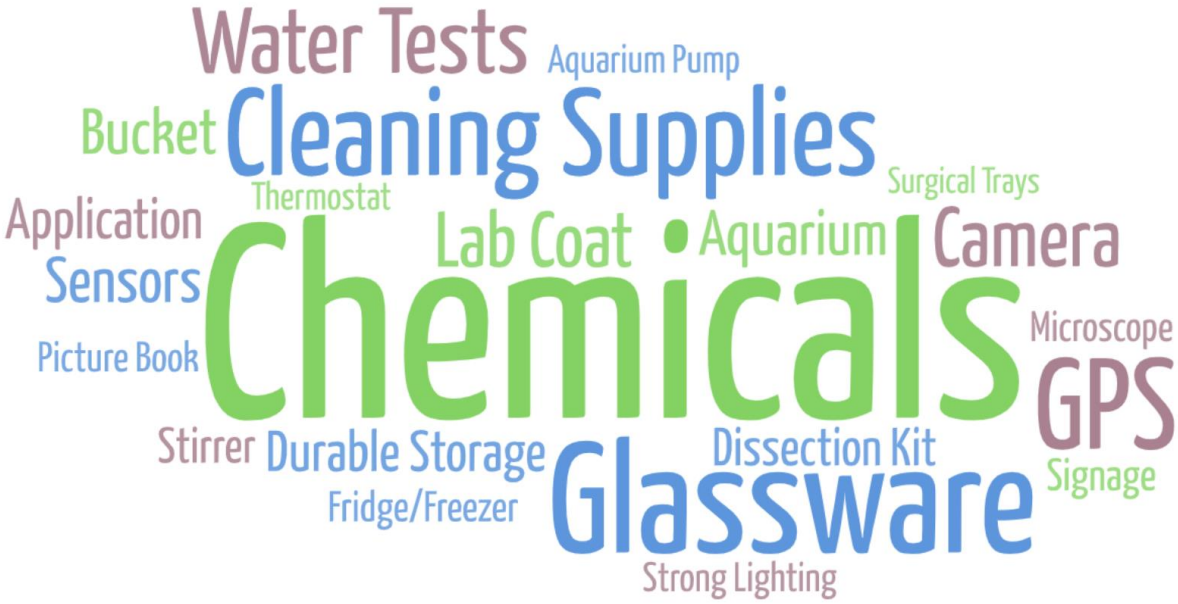


Figure 15: Word Cloud Portraying Overlap in the EcoCentre Staff's Equipment Necessities

4.2.2 Additional Equipment Requirements

After further discussions with the EcoCentre staff, we also included in the spreadsheet, *Staff Equipment Results*, the need for streaming equipment. This would include projector systems or a document camera that can easily handle the seamless delivery of virtual and hybrid workshops and webinars. This will allow the user to do complicated demonstrations without a crowded work area. We then took this information as well as the first equipment database and created an additional spreadsheet, *Equipment Wish List*, containing our equipment recommendations. This spreadsheet, in **Appendix L,** shows the best product or the wish list version if full funding was available and a budget option that is more suited towards the funding of a not-for-profit like the EcoCentre. These pieces of equipment were all from the staff survey or in discussion with the EcoCentre staff and have a label as such in the spreadsheet. The equipment is labeled with a link to a purchasing site as well as the producer and an estimated cost. The table below, **Table 4**, is the top ten equipment that will help progress and gather more precise data and accurate data quickly in the field. These all came from the discussions and surveys that we sent out which allowed us to discuss between ourselves and the EcoCentre staff which items would contribute the most to the progress of certain projects, but also be useful in multiple projects.

Table 4: Top 10 Wishlist Items

Top 10 Equipment	Estimated Cost
Drying Racks	$21.85 AUD
iPads for pictures or in field apps	$500 AUD
Identification Guides	(created by EcoCentre)
Streaming Camera	$120 AUD
Streaming Software	$23000 USD
Fridge/Freezer Combo	$4650 AUD
Glass Beakers	Varies with type
GPS	$160 AUD
Grab Bucket (plexiglass bottom)	$58 AUD
Microscope	$520 AUD

4.3 Citizen Science Lab Dissemination Materials

With the creation of the new laboratory, it will be important for the EcoCentre to create promotional material to be presented to potential philanthropic collaborators, as well as to be used as advertising material. The team focused on creating easy to understand visuals portraying information on the new facilities to get the community and funders excited about the possibilities the center presents. The team first created an infographic displaying the numerical information on the EcoCentre's volunteer hours, partnering organizations, and the future buildings statistics.

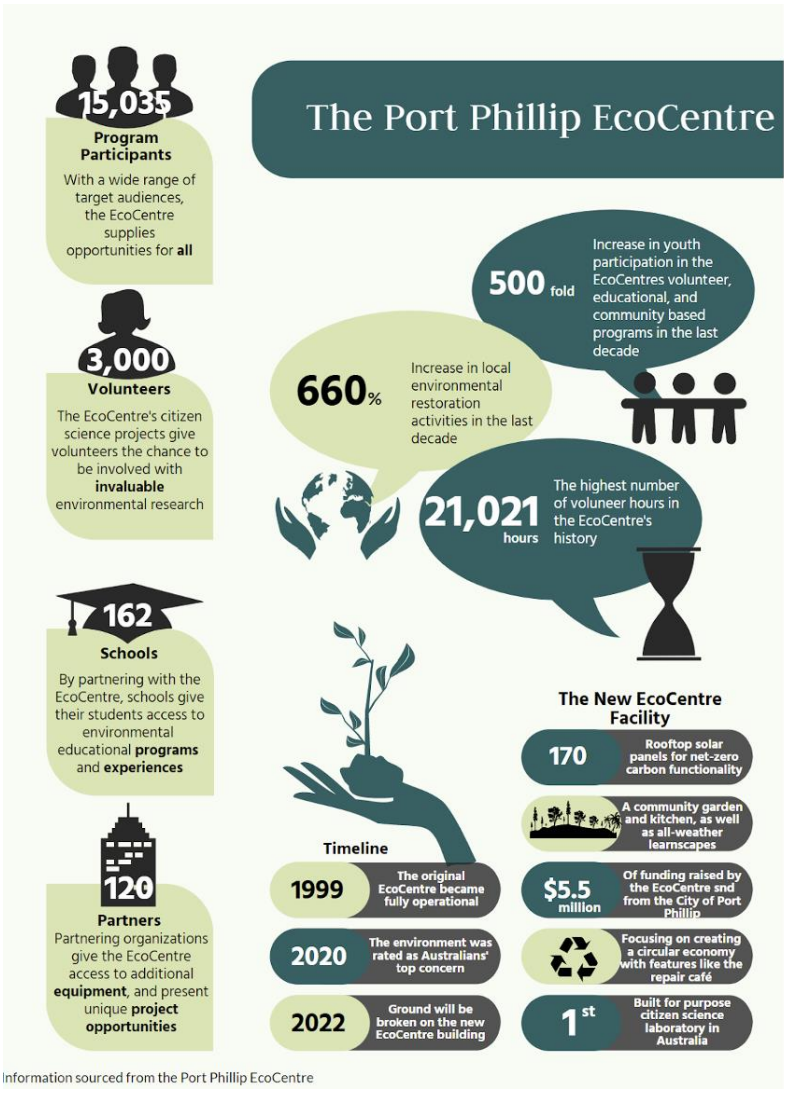


Figure 16: The Port Phillip EcoCentre Infographic Image created by EcoCentre IQP Team

Next the team created an interactive map of the Port Phillip Bay Region, showing the bay's points of interest. The map includes a rough outline of the bay's catchment area, showing the region of which, the rain and wastewater accumulate in the bay, taking with it the pollutants. Several of the EcoCentre's partners are marked on the map, as well as the locations of the shellfish restoration reefs and beach litter audit sites. This map serves as a spatial overview of the EcoCentre's involvements and bay points of interest, which can be used by the EcoCentre as a visual aid as they grow.

Note 2: Access Link: https://maphub.net/misanborn/port-phillip-bay

Figure 17: Port Phillip Bay Environmental Points of Interest Map

4.3.1 Promotional Slide Deck

Throughout multiple interviews and discussions with EcoCentre liaison April Seymour, she expressed a continuous need for promotional materials on the new laboratory that she can use to present to potential philanthropic funders in investment meetings. To aid her presentations, we created a pitch deck containing slides introducing the new center and explaining why it is something worth getting excited about. We hope the presentation can be used to inspire investors and help the EcoCentre acquire more funding. The promotional slide deck is available for access via the link in **Appendix K**.

4.3.2 New Laboratory Website Template

The main deliverable for objective three was a website framework advertising the new Port Phillip EcoCentre and Australia's first built-for purpose citizen science laboratory. Throughout our interviews and research, we found a large need for promotional material and interactive ways to spread the word about the new facilities, as they are relatively unknown. The official EcoCentre website only has a small section dedicated to the future hub. To supplement their site, we prepared a mock webpage, *Australia's First Citizen Science Lab*, on our Google site that can be easily transferred by the EcoCentre's web designer to the official website for publication. Once adopted into the public EcoCentre site, it will be a one stop page for anyone looking for information on the future hub. Access to the mock website is available through the link in **Appendix K.**

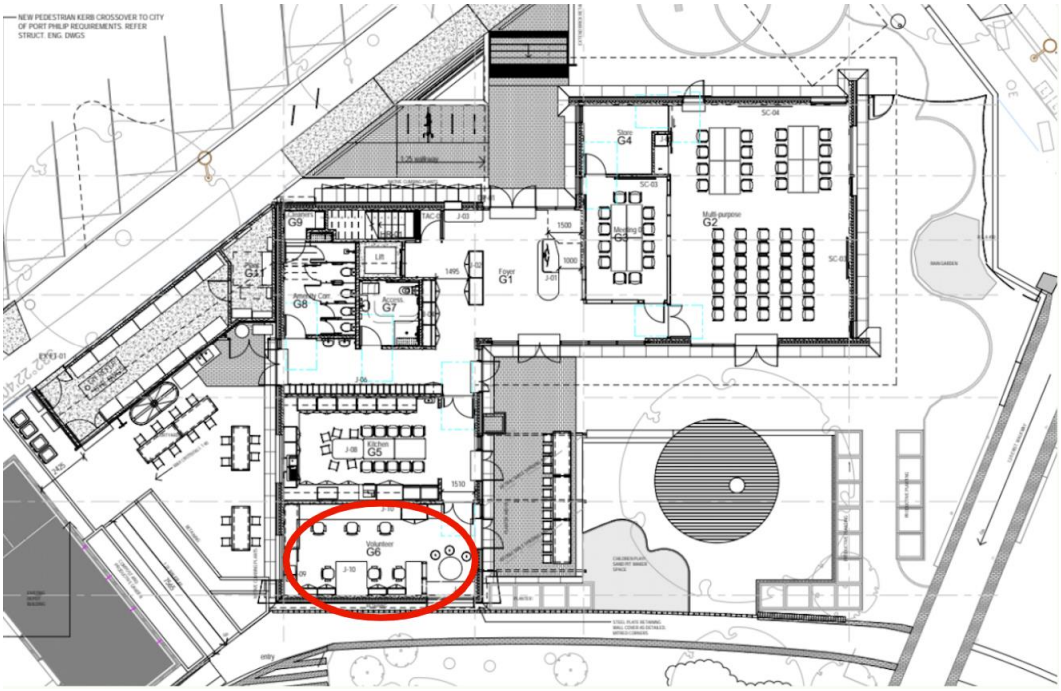
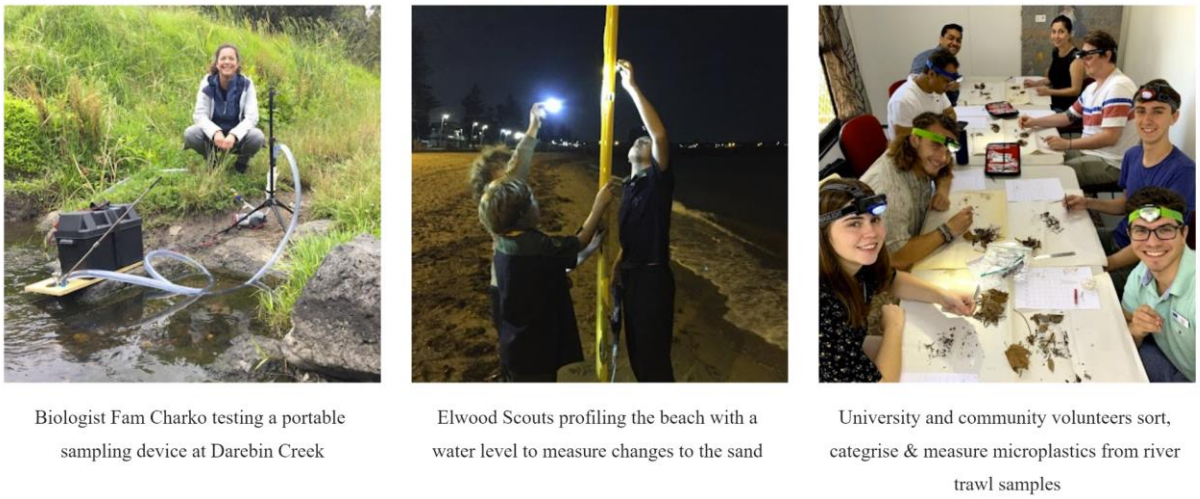


Figure 18: Australia's First Citizen Science Lab lab space location

The new web page begins by introducing the EcoCentre's plans to build a new community hub, containing Australia's first citizen science lab. This new lab space is highlighted within the blueprints of the building as seen in **Figure 18**.



Biologist Fam Charko testing a portable sampling device at Darebin Creek

Elwood Scouts profiling the beach with a water level to measure changes to the sand

University and community volunteers sort, categrise & measure microplastics from river trawl samples

Figure 19: Australia's First Citizen Science Lab Project Examples

After introducing the concept of the new building and lab space, the site features photographs of the EcoCentre staff and volunteers working on various projects. Our equipment analysis and recommendations were presented in this subsection through photos of equipment that could be in the new space. The site also explains key steps that people can take to get involved with the EcoCentre, and which staff members to contact about doing so. We hope that this webpage can be used as a starting point for anyone interested in learning more about the EcoCentre and its future hub and can also be used as an advertising tool to attract potential investors.

The last section in the mock web page, *Help Australia's First Citizen Science Lab*, emphasizes the EcoCentre's need for additional support by other organizations to help launch the new lab. The logos of all the organizations our team has been in contact with throughout the duration of the project are displayed at the bottom of this section (**Figure 20**). This is to allow other organizations to easily recognize that organizations they are already familiar with are helping the EcoCentre.

Figure 20: Australia's First Citizen Science Lab organization logos

4.3.3 Citizen Science Experience Website Page

To help enable the EcoCentre to recruit more volunteers, we created a mock web page, *Our Citizen Science Experience*, to individually highlight aspects we learned through our experience working on various citizen science projects. The EcoCentre can now quote our team and share our discoveries to help recruit new citizen scientists. An example layout of this mock webpage is available for access through the link in **Appendix K**.

"While I knew the EcoCentre contributed to the community around the Port Phillip Bay Area, I didn't realize how far the network reaches and how much this new hub and lab are needed because of the growth of the EcoCentre. Participating and being in several of the programs opened my eyes to how influential citizen science is. The physical space will provide so much for the programs the EcoCentre already runs and allow for even more community participation in future projects!" - Brent Ditzler

"Before being placed on the project with the Port Phillip EcoCentre, I had never taken part in citizen science projects as expansive as what the center has to offer. It was an amazing experience to learn about the importance of the community's involvement with the center, as in the shellfish survey that is used to track the organisms' population sizes. Working on this project made clear the need for a new physical hub to support the growth of the projects and staff, so the EcoCentre can continue to support the Port Phillip Bay. I am so glad I was able to play a role in the future of the new laboratory, and I am looking forward to hearing about and hopefully seeing the new facilities when they are up and running!" - Maddie Sanborn

"I really enjoyed working with the EcoCentre and participating in a range of citizen science projects that they have to offer. The projects were fun and engaging and I learned a lot about how a simple task such as collecting seashells can provide scientific data that can be used to help track the health of the Bay" - Ashley Burke

"I didn't know much about citizen science before working with the EcoCentre but the volunteer opportunities we did with them opened my eyes to what can be accomplished. My favorite volunteer project was the Erosion and Dune survey because it was a simple and well thought out activity in which I learned a lot about the environment and that measuring the dunes can give insight into their health and how to preserve them in the future!" - Will Lapointe

"I have been very impressed by the work done by the EcoCentre and their partners in the areas of citizen science working to improve their local ecosystems. The level of community engagement, research initiatives, focus on micro and macro issues, and partnership with other organizations is something I have never experienced in the charity sector before. This level of initiative lead by private or government affiliated groups is not common or at least not well known to the area I grew up in within the US and is something I see as only beneficial to the environment" - Jack Charbonneau

Along with the pictures and quotes from each team member (Shown above) we also wrote two paragraphs to go on the page. The first paragraph being an introduction to the slide and our initial thoughts on what we believed citizen science was. We then state that our ideas were completely changed, and we came out with a different outlook on citizen science after

volunteering. The second paragraph is a conclusion on our experiences with the EcoCentre. This paragraph serves as a way for us to recommend volunteering in citizen science to anyone who sees the webpage and can also be used by the EcoCentre to promote their projects with real experiences.

5.0 Recommendations

Based on the analysis of our research, interviews, and datasheets, we have formulated recommendations for taking advantage of the EcoCentre's citizen science network opportunities, and for what should be purchased and stored within the new laboratory.

5.1 Recommended Equipment

After sending out the equipment survey to members of the EcoCentre we created a spreadsheet which is shown in **Appendix L**. This spreadsheet holds all the information on equipment that the EcoCentre staff said they would like to have and our recommendations for said equipment. **Table 4** has multiple options for each piece of equipment, when multiple options are necessary, which are split into best or budget options. From this table, we then picked the top ten pieces of equipment that we recommend to the EcoCentre for their future laboratory. The rest of the recommended equipment can be seen in **Appendix L**.

5.1.1 Recommended Streaming Equipment

After several discussions and the constant theme of the possibility of the new EcoCentre lab being capable of hosting workshops, we decided it was most recommended that the new lab space include streaming equipment to adequately provide hybrid workshops in the space. The team researched the best and budget options for this equipment. In the end, we recommend that the new EcoCentre has good streaming software such as Echo360. Echo360 is a software that offers an easy to learn experience where the EcoCentre can live stream their content to anyone anywhere in the world within a secure platform. However, the tangible software that the EcoCentre can use without spending an excessive amount of money on just the software alone is OBS Studio. OBS Studio offers a more difficult to learn option which can live stream video to third party portals like Facebook or YouTube. This live stream may suffer in quality but is still a very viable option with the low-cost making up for any learning curve experienced.

On top of one of the two software's mentioned above, we recommend that along with the streaming software, the lab contains a streaming camera that is easy to use and allows for hands free streaming of a desktop surface with a clear picture. The camera for this lab should be able to capture HD video with little input lag. The camera must also allow a connection point to a computer or laptop and allow said video to be streamed and not just recorded. We recommend that the lab is equipped with a streaming camera that is close to the Lumens DC193 or close to its quality. Both items will allow for the influence of the EcoCentre to spread world-wide and for an initiative of worldwide citizen science to start from the EcoCentre.

5.1.2 Recommended Equipment for Ongoing Projects

Using our participant observation on top of the staff survey and discussions, our team took into careful consideration of what ongoing projects we felt needed the addition of new equipment to further help the workflow of these projects. Within this context, we recommend that EcoCentre investigates investing in several pieces of equipment that speed up data collection, provide more data variation, and allow for more precise locations for the data. This includes a GPS, a grab bucket, iPads for the field, and identification guides. These items should help gather more accurate data and allow Neil to survey sandbars on the beach that he wouldn't have been able to with his current equipment. The GPS will enable for precise locations of mollusks and seashells as well as dune profiling, further enhancing the precision of the data of these projects. The grab bucket with a plexiglass will be useful in allowing for gathering of samples from sandbars which are further out in the water allowing Neil to see underwater at these locations and also allow for more data variation that previously was limited to the beach. The iPads will allow for centralized pictures of the mollusks and seashells therefore speeding up the process of analyzing the data. With this, the compiling of data will be simplified, and Neil will only have pictures to analyze rather than description, speeding up the process. The identification guides will allow corporate groups to accurately describe and label mollusks and seashells, providing even more accurate data to the project further informing the study.

Along with the recommendation to investigate the purchase of equipment for this project, we recommend that the EcoCentre investigates the purchase of equipment surrounding the current Microplastics analysis project. This includes drying racks, strong lighting desk lamps, and a basic microscope with the expectation of continuing to collaborate and outsource for the use of the Fourier Transform Infrared (FTIR) Spectrometer and for the use of the GC-MS-AIQS. The drying racks and strong lighting desk lamps will allow for the quick drying of samples and give data analysis a quicker turnover to speed up the project. The basic microscope will allow for preliminary data analysis of these dried samples. It will also be useful in picking out certain types of microplastics that may be of interest before it goes to be analyzed in an FTIR spectrometer such as nurdles, raw plastic that is composed of oil and water that hasn't been processed yet.

5.1.3 Recommended Equipment for Future Projects

With respect to future projects, we recommend that the EcoCentre looks into the purchase of equipment for one future project with the possibility that the use of chemicals can be worked around. Should the EcoCentre see this project of wildlife dissections/necropsies influential to the health of the Bay, we recommend that the EcoCentre consults a professional on how chemical

storage can be achieved without tainting the sustainability efforts of the new building. We also recommend that the EcoCentre investigates securing pieces of equipment such as a fridge/freezer combination, glass beakers, a lab cleaning pump bottle, dissection kits, lab coats, medical trays, biohazard bags, and protective gloves. All these pieces of equipment help set up future projects as well if the chemicals can be worked around or stored safely. All this equipment will be crucial in allowing the workflow to be solely in-house and in the lab space.

5.1.4 Recommended Storing and Sharing of Equipment

Main Theme(s): Legal, Collaboration

After interviewing with multiple partners, it was clear that multiple organizations shared the desire to be able to store equipment at the new hub. Additionally, these organizations are willing to share their equipment that they are storing with other groups. Despite this desire, the groups were concerned about their equipment being damaged or lost. We recommend conducting further research to identify if there are any legal solutions such as equipment insurance for loaned equipment. This would allow the new lab space to act as a shared storage space for large and expensive equipment that may currently have nowhere to be stored. It could also be helpful to research if any local universities currently store equipment for external organizations, as they may have solutions to the concerns held by the EcoCentre's partners.

5.2 Recommended Project Opportunities

After the team finished all interviews and gathered the information from the supplemental surveys, we developed multiple recommended project opportunities to the EcoCentre. These project opportunities were thought up by cross referencing all the data from every interview and survey to find unsolved problems. Every recommended project opportunity is either one that we couldn't find being run locally or one that could be completely improved upon with the possibilities provided by the new EcoCentre hub.

5.2.1 Explore Seagrass Project Opportunity

Main Theme(s): Collaboration

Hobson's Bay Wetland Centre wants to create a database of seagrass diversity in the bay and possibly the health of said seagrass. A project could be started by the EcoCentre and Hobsons in which they collaborate to collect sea grass then analyze it at EcoCentre's new laboratory. We also recommend first discussing with experts to determine if the results from this study would be worth it before investing more resources towards it. By this collaboration, the

new laboratory will serve as a source of volunteer work and space to analyze seagrass. Our team did not identify an existing model to review for this opportunity.

5.2.2 Explore Spider Crab Project Opportunity

Main Theme(s): Project, Collaboration, Legal

Deakin University is looking for legal help on how to collect data on Spider Crabs. They struggle with contracting divers to help gather information since they are a university. We recommend connecting them with VNPA who does similar work to help them get more volunteers moving forward. The EcoCentre would play the role of a liaison between the two.

5.2.3 Explore Invertebrate Health Project Opportunity

Main Theme(s): Project, Collaboration

After interviewing with VNPA, we recommend that the EcoCentre reach out to them in the interest of developing research efforts on invertebrate health in Port Phillip Bay. The new laboratory space will serve to aid in data analysis through using a laboratory microscope and potentially dissection equipment. Additionally, we encouraged the EcoCentre to reach out to Zoos Victoria on the topic of Invertebrate health as this was a topic that also shared interest in pursuing.

5.2.4 Create Project Specific Identification Guides

Main Theme(s): Project, Information

From our participatory observation, we recommend the creation of project specific information guides, such as with the beach mollusk survey. The knowledge Neil has on the topic is vital to its success and needs to be realized in a physical or digital component. In this specific case a photo database with the different known mollusks would allow volunteers to participate in the study more easily and confidently. If field iPads are purchased for the new lab, an application could be built featuring this database for volunteers to use during the activity for reference. The new laboratory would serve as the physical or digital or physical storage of these project guides and be a good hub for the centralization of the information. We are not aware of existing models for these guides, but local partners may already implement a feature like this and would be working asking for additional information on.

5.2.5 Facilitate Community Project Input

Main Theme(s): Networking, Project

Create an anonymous project idea submission on the EcoCentre page for volunteers, local partners, or others to post suggestions of projects, areas of study, changes to projects, and better methods. This would allow the EcoCentre to get true, unbiased feedback from their participants and additionally will allow the average volunteer to have a greater feeling of contribution to the overall mission of the EcoCentre and the projects they participate in.

5.3 General Recommendations

In addition to the project and equipment-based recommendations developed above in 5.1 and 5.2, our team also brainstormed a list of general recommendations. These recommendations focus more on the overall function and day-to-day of the EcoCentre with the intent of improving quality of life and productivity. These recommendations range from themes of legal intricacies to shared databases between the EcoCentre and its partners.

5.3.1 Keep an Inventory of Equipment

Main Theme(s): Project, Databases

With many active and possible future projects, we found that the EcoCentre could greatly benefit from a database of equipment. We recommend creating and or expanding upon a spreadsheet which has all the equipment needed for different projects. We also recommend conversing with other partner organizations to see how they do this so that the model the EcoCentre expands upon has had research done on it. If the equipment database is made public, it could also lead to the creation of a loaning network for local organizations. Before purchasing new equipment, the database could be checked to see if any community groups already have it and would be willing to lend it out.

5.3.2 Host Information and Advocacy within the Hub

Main Theme(s): Social Media, Collaboration, Information, Advocacy

We recommend structuring a portion of the new citizen science hub around a shared information and advocacy center for partner organizations. This could be envisioned as allowing organizations to host information sessions at the EcoCentre by both a physical informational board and expansion of the EcoCentre’s social media presence. Outreach using these two mediums will allow different target audiences to be reached. The appointment of a specific networking and social media representative would be valuable to continue to spread knowledge

of the EcoCentre and its values. Many other environmental advocacy organizations have social media pages that can be used as an existing model.

5.3.3 Assist Volunteer's Confidence in Data

Main Theme(s): Information

With the focus of citizen science being data collection, we recommend that workshops be conducted with network partners and their volunteers to help get these participants in citizen science over the barrier of confidence when using apps and online resources to submit data. We also recommend that these workshops, which can be held virtually or in-person, go through the steps of submitting data and qualm any major areas of concern for those network partners or their volunteers. If the volunteers feel more confident, they are collecting and submitting the data correctly, they will be more likely to participate more often. We see the lab being the space in which these workshops can take place and be hosted in.

5.3.4 Source Skilled Volunteers and Workers

Main Theme(s): Collaboration, Networking

After interviews and supplementary questionnaires, we found that many of the smaller organizations partnered with the EcoCentre have trouble finding people or other groups with specialized skill sets to help with their projects. We recommend the EcoCentre to utilize their large network and abundant resources to aid these smaller organizations in getting connected with more specialized partners for their specific projects. The EcoCentre would once again work as a liaison. This could be accomplished by creating a publicly available listing of opportunities available listed by specialty focuses, that could be added to by local organizations.

5.3.6 Use Social Media

Main Theme(s): Social media, Advocacy, Information

To help the EcoCentre spread the word of citizen science, our team recommends expanding the EcoCentre's presence on social media. Some posts that the EcoCentre might want to consider are weekly local flora/fauna facts, a wildlife picture of the week, and information on different events and how individuals can make an impact. With social media being so popular with the younger generation, posts like these can help people learn and share info about the EcoCentre and the environment. Pictures posted of volunteers actively contributing will also help attract more volunteers. It would be best if a social media representative was available to keep

the account active and engaged with the community. There are many organizations that currently use social media to spread awareness and can be used as a reference for further ideas.

5.3.7 Utilize the Victorian Citizen Science Strategy

Main Theme(s): Legal, Project, Collaboration

Using the Victorian Citizen Science Strategy as a framework, we recommend that the EcoCentre adapts the use of the new citizen science laboratory needs and initiatives to how it sees fit in the citizen science landscape. We see the role of the lab being oriented with a larger goal in mind than just the EcoCentre itself and creating connections to more partners.

5.3.8 Follow up Engagement with Local Partners

Main Theme(s): Networking, Collaboration

There is a need from the network partners to have broader discussions on collaboration as many wanted to contribute. We encourage the EcoCentre to conduct a follow-up zoom meeting or conference with the organizations that were in previous contact. These discussions should include new initiatives, desires for the new laboratory, and collaboration to achieve shared goals. We recommend that these conversations take place to further understand what each organization has to offer and what they want out of the partnership. We envision the role of the lab to be an inspiration for these organizations to want to contribute and collaborate as well as to be part of establishing a central hub which was a shared goal between several organizations.

5.3.9 Facilitate Shared Research Network / Database

Main Theme(s): Information, Legal

Facilitate shared access to data and research databases for scholarly articles, peer reviewed publications, and other sources for volunteers and partner organizations while at the hub or within the lab. The legality of a shared login would need to be reviewed, but if possible, this could be implemented physically on to the desktop computers within the laboratory or larger hub, or as a network feature and therefore only accessible while on EcoCentre grounds. Local universities or libraries likely use a similar method for students or visitors to have access to their research databases and would be a good place to start for this development.

6.0 Conclusion

Our team was able to successfully complete all of our objectives and supply our sponsors with the requested deliverables at the end of the project term. We hope that with these results and recommendations, the EcoCentre can be better prepared for the launching of their new community hub and citizen science laboratory. The recommendations will supply the Centre with a starting point of which partners to speak with about potential collaboration within the new laboratory, and which projects to pursue. The equipment database can be continued to be used as a tracking device for the EcoCentre's current and planned projects' equipment, to ensure they always have enough supplies on hand and are aware of how to easily purchase more. With the equipment wish list, investors will be able to see exactly what their money is going towards, and the EcoCentre can set a fundraising goal. We also hope that the prepared promotional materials will be effectively used as advertising for the new laboratory to draw in more investors for the space and increase awareness of the opportunities the new center will supply. We look forward to seeing how our project will be able to assist the development of the new Port Phillip EcoCentre moving forward and hope to eventually see some of our contributions were helpful and reflected in the final facility.

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Appendices

Appendix A: The Citizen Science Lab Pittsburgh Survey Questions

Digital Survey Preview:
https://wpi.qualtrics.com/jfe/preview/SV_1H3WRj0dssWWKnc?Q_CHL=preview&Q_SurveyVersionID=current

1. What citizen science organizations or groups are you a part of?
2. What is your role at this or these organization(s)?
3. How long have you been working with this organization or organizations?
4. How large of a network of partners does your organization have? How does your organization fit into this network?
5. What is the scale of your citizen science operations? (Annual volunteers, project counts, etc)
6. Do outside sources such as local concerns or partners at the time greatly influence what projects you decide to greenlight?
7. How many projects do you run at a single time?
8. How many projects are in the lab space and how many are outside in the field?
9. Do you run any virtual projects? What additional supplies do you need to support virtual activities?
10. What is the most successful method for attracting citizen volunteers?
11. How do you present your project results to the public?
12. How do you typically come up with new projects?
13. What is the most challenging aspect of running a citizen science lab? Any insider tips or things to focus extra attention on?
14. What are the main sources of funding for your lab and programs?
15. Do you rent out your laboratory space or allow partners to use your lab?
16. How do you analyze and track expenses?
17. What continuous expenses do you find most costly in your laboratory?
18. What methods have you found the best for ordering equipment and other lab necessities? In bulk through one supplier? From multiple sources? Sponsorship?
19. Is there any additional information you think would be beneficial to know about your citizen science initiative or in planning new initiatives?

Appendix B: Leiden University Interview Questions

1. What is your role at Leiden University and how long have you been there?
2. How large of a network of partners does your organization have? How does your organization fit into this network?
3. What is the scale of your citizen science operations? (Annual volunteers, project counts, etc)
4. How many projects are currently being run in the lab space and how many are outside in the field?
5. Do you run any virtual projects and if so, what extra equipment do you use to run them?
6. How do you typically come up with new projects?
7. What is the most challenging aspect of running a citizen science lab?
8. Do you rent out your laboratory space or allow partners to use your lab?
9. What continuous expenses do you find most costly in your laboratory?
10. What methods have you found the best for ordering equipment and other lab necessities? In bulk through one supplier? From multiple sources? Sponsorship?
11. Do you have any insider tips or additional comments you think would be valuable to us regarding running a citizen science lab?
12. What is your most successful method for attracting citizen volunteers?

Appendix C: Boston Museum of Science Interview Questions

1. What is your role within the Boston Museum citizen science program?
2. How long have you been working with this organization or organization?
3. How large of a network of partners does your organization have? How does your organization fit into this network?
4. What is the scale of your citizen science operations? (Annual volunteers, project #, etc)
5. Do outside sources such as local concerns or partners at the time greatly influence what projects you decide to greenlight?
6. How many projects do you run at a single time? How many are in the museum and how many are outside in the field?
7. Do you run any virtual projects? What additional supplies do you need to support virtual activities?
8. What is the most successful method for attracting citizen volunteers?
9. How do you present your projects and results to the public?
10. How do you typically come up with new projects?
11. What is the most challenging aspect of running a citizen science association? Any insider tips or things to focus extra attention on?
12. What are the main sources of funding for your programs?
13. How do you analyze and track expenses?
14. What methods have you found the best for ordering equipment and other necessities? In bulk through one supplier? From multiple sources? Sponsorship?

Appendix D: Melbourne Water Interview Questions

1. What is your role at Melbourne Water and how long have you been there?
2. What are the top three issues your team is focused on? Have you thought about using citizen science to tackle these issues?
3. Describe your team's partnership with the EcoCentre (directionality of people, directionality of data, funding equipment; active projects; proposed projects).
4. How large of a network of partners and volunteers does Melbourne Water have? How does your organization and your team fit into this network?
5. The EcoCentre is looking to help close the loop in environmental programs in the community. Melbourne Water is heavily engaged in Bird Watch, Water Watch, _____. What can the EcoCentre do to aid your work? (Physical space, data analysis, volunteer engagement)
6. What methods do you use to fund these projects?
7. Are there areas of citizen science your team would like to be more active in?
8. Do you experience problems in the execution of your programs? If so, where are these restrictions focused? Personnel? Equipment? Funding? Time? If you had this resource, what would you do with it?
9. As you are aware, the EcoCentre is building a physical hub to serve as a collaborative citizen science space. Would your team take advantage of opportunities to store equipment and utilize the shared space for collaboration with other organizations?

Appendix E: Tangaroa Blue Foundation Interview Questions

1. What is your role at Tangaroa Blue and how long have you been there?
2. What are the top three issues your team is focused on? Have you thought about using citizen science to tackle these issues?
3. Describe your team's partnership with the EcoCentre
4. How large of a network of partners and volunteers does Tangaroa Blue have? How does your organization and your team fit into this network?
5. The EcoCentre is looking to help close the loop between environmental science programs and the community. What can the EcoCentre and their new lab do to aid your work? (Physical space, data analysis, volunteer engagement)
6. What methods does your team use to fund projects?
7. Are there areas of citizen science your team would like to be more active in?
8. Do you experience problems in the execution of your programs? If so, where are these restrictions focused?
9. As you are aware, the EcoCentre is building a physical hub to serve as a collaborative citizen science space. Would your team take advantage of opportunities to store equipment and utilize the shared space for collaboration with other organizations?

Appendix F: Hobsons Bay Wetland Centre Interview Questions

1. What is your role at Hobson's Bay Wetland Centre and how long have you been there?
2. What are the top three issues your team is focused on? Have you thought about using citizen science to tackle these issues?
3. Describe your team's partnership with the EcoCentre
4. How large of a network of partners and volunteers does Hobson's Bay Wetland Centre have? How does your organization and your team fit into this network?
5. The EcoCentre is looking to help close the loop in environmental programs in the community. Hobson's Bay is heavily engaged in Waterwatch, Carbon Sequestration, _____. What can the EcoCentre do to aid your work? (Physical space, data analysis, volunteer engagement)
6. What methods do you use to fund these projects?
7. Are there areas of citizen science your team would like to be more active in?
8. Do you experience problems in the execution of your programs? If so, where are these restrictions focused?

Appendix G: Deakin University Interview Questions

1. What is your role at Deakin University and how long have you been there?
2. Describe your team’s partnership with the EcoCentre.
3. What is the scale of your citizen science operations? (Num of annual volunteers, Num of projects annually & at one time, etc)
4. How is your team currently involved in citizen science? Are there areas of citizen science you would like to be more active in?
5. Do you have ideas for new projects that you'd like to work with the EcoCentre on?
6. Do you experience bottlenecks in your processes? If so, where are these roadblocks/chokepoints/restrictions focused? (Personnel? Equipment? Funding? Time?)
7. How does your university collaborate with other Universities and organizations in the area?

Appendix H: Victoria National Parks Association Interview Questions

1. What is your role in VNPA and how long have you been there?
2. What are the top three issues your team is focused on? Have you thought about using citizen science to tackle these issues?
3. Describe your team's partnership with the EcoCentre (directionality of people, directionality of data, funding equipment; active projects; proposed projects)
4. How large of a network of partners and volunteers does VNPA have? How does your organization and your team fit into this network?
5. The EcoCentre is looking to help close the loop in environmental programs in the community. What can the EcoCentre do to aid your work? (Physical space, data analysis, volunteer engagement)
6. What methods do you use to fund these projects?
7. Are there areas of citizen science your team would like to be more active in?
8. Do you experience problems in the execution of your programs? If so, where are these restrictions focused? Personnel? Equipment? Funding? Time? If you had this resource, what would you do with it?
9. As you are aware, the EcoCentre is building a physical hub to serve as a collaborative citizen science space. Would your team take advantage of opportunities to store equipment and utilize the shared space for collaboration with other organizations?

Appendix I: Port Phillip EcoCentre Supplemental Partner Survey Questions

Digital Survey Preview:
https://wpi.qualtrics.com/jfe/preview/SV_0ihto7wd6hAJnNQ?Q_CHL=preview&Q_SurveyVersionID=current

1. What is your background, and what is your current role at your organization?
2. The EcoCentre is looking to help close the loop in environmental programs in the community. What are the top three issues your team is currently focused on? In addition, what can the EcoCentre do to aid your work? (Ex. Physical space, data analysis, volunteer engagement)
3. Are there areas of citizen science your team would like to be more active in?
4. As you may be aware, the EcoCentre is building a physical hub including a space to serve as a collaborative citizen science lab. What equipment, services or activities could Australia's first Citizen Science Lab include to help your projects? How might your team take advantage of opportunities to store equipment and utilize the shared space for collaboration with other organizations?
5. What do you already have or utilise that the Citizen Science Lab does NOT need to replicate? (e.g., database, particular equipment, type of volunteer)
6. Any further comments or questions?

Survey Results:

M22-LAB: Supplementary Survey Response s- This spreadsheet is the raw data gathered by the supplementary questionnaire used in our recommendation analysis

https://docs.google.com/spreadsheets/d/1kRevLeuUb5TqKAmeS1l2AWINIKAx0oXh/edit?usp=sharing&ouid=107548905315904851722&rtpof=true&sd=true

Appendix J: Word Cloud Equipment Categories and Ranking

Score	Word Cloud Category	Equipment Item	Score Breakdown
5	Chemicals	Beaker cleaning chemicals (such as acetone)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Chemicals (Dissolve organic compound)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Preserving solution (alcohol/formaline/formaldehyde)	+ 1 pts: occurred once in the spreadsheet
4	Glassware	Glass Beakers	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Glass jars/storage containers x 2	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
4	Water Tests	Hydrometer (to measure salinity) x 2	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Water quality testing kit	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
4	Durable Storage	Tough plastic storage bags (ex: biohazard bags)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Glass jars/storage containers	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential

Score	Word Cloud Category	Equipment Item	Score Breakdown
4	Cleaning Supplies	Beaker cleaning chemicals (such as acetone)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
		Lab beaker cleaning pump bottle	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
3	Lab Coat	Lab Coat	+ 2 pts: occurred twice in the spreadsheet + 1 pts: was considered essential in only one of the entries
2	Application	Application	+ 2 pts: occurred twice in the spreadsheet
2	Camera	Camera (High Res)	+ 1 pts: occurred once in the spreadsheet
		Camera (With Pole)	+ 1 pts: occurred once in the spreadsheet
2	Fridge/Freezer	Fridge/Freezer Combo	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	GPS	GPS (A good one)	+ 1 pts: occurred once in the spreadsheet
		GPS	+ 1 pts: occurred once in the spreadsheet
2	Aquarium	Aquarium	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential

Score	Word Cloud Category	Equipment Item	Score Breakdown
2	Aquarium Pump	Aquarium Pump	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Strong Lighting	Strong desk lamp (good lighting)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Picture Book	Picture Book	+ 2 pts: occurred twice in the spreadsheet
2	Sensors	Arduino Sensors	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Surgical Trays	Medical/Surgical Trays	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Microscope	Microscope (infrared)	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Thermostat	Thermostat	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
2	Dissection Kit	Dissection Kit	+ 1 pts: occurred once in the spreadsheet + 1 pts: was considered essential
1	Bucket	Grab Bucket (hinged bucket and plexiglass bottom)	+ 1 pts: occurred once in the spreadsheet
1	Signage	Signage for monitoring sites	+ 1 pts: occurred once in the spreadsheet
1	Stirrer	Electronic Stirrers	+ 1 pts: occurred once in the spreadsheet

Appendix K: Port Phillip EcoCentre Promotional Material Digital Links

Deliverable 1: Pitch Deck:
https://docs.google.com/presentation/d/1CLdvVR7ZvC9dAizFPPeNlGWQ8nYvVKBlgPVBhvHNc3E/edit#slide=id.g125fdd3d0f5_1_0

Deliverable 2: Our Citizen Science Experience Mock Webpage:
https://sites.google.com/view/m22-lab/deliverables/our-citizen-science-experience?authuser=0

Deliverable 3: Australia's First Citizen Science Lab Mock Webpage:
https://sites.google.com/view/m22-lab/deliverables/australias-first-citizen-science-lab?authuser=0

Appendix L: Port Phillip EcoCentre Spreadsheet Digital Links

M22-LAB: Raw Partner Spreadsheet **-** This spreadsheet is the compilation of EcoCentre partners utilized in identifying key citizen science partners for interview

https://docs.google.com/spreadsheets/d/14IYttpNiFxwbUl1tSWK3YAtBsm14kkvP9rD4dNBAeoA/edit?usp=sharing

M22-LAB: Partner Analysis Spreadsheet- This spreadsheet is a further refining of the previous spreadsheet where our team build ranking functions to select the 5 key organizations for interview

https://docs.google.com/spreadsheets/d/1Cu90_PjXBQSkdPImIROa0HcG04a8RC08pmkVxOLWoKQ/edit?usp=sharing

M22-LAB: Staff Equipment Survey Responses **-** This spreadsheet is the project equipment survey sent out by the WPI team to the EcoCentre

https://docs.google.com/spreadsheets/d/1ry2e3soBrTZIHFxgGcKFAJGVOcP3k_WH4lmFPC-yb18/edit?usp=sharing

M22-LAB: Staff Equipment Results **-** This spreadsheet is a further refinement of the above spreadsheet, collating the results into a larger list rather than spread out by individual projects.

https://docs.google.com/spreadsheets/d/1mM_00YcJeFglT0sTpLcZPa9zcXyQQQPzeqNABfNqELk/edit?usp=sharing

M22-LAB: Partner and General Recommendations **-** This spreadsheet is a compilation of the partner and general recommendations further elaborated on in chapter 5 of this paper

https://docs.google.com/spreadsheets/d/1wM77m5mpyVypSyrFK8QvOooEsyDqHLAwSftAA0JIfkY/edit#gid=0

M22-LAB: Equipment Wish List - This spreadsheet is the compilation of equipment recommendations and their associated budget and best cost options including links and a recommendation rating.

https://docs.google.com/spreadsheets/d/1mp4KInzni9ggwElKkgq8onG9rYFNd7ZA7A2w6vrq_Hs/edit?usp=sharing