ECOLOGY ANIMATIONS FOR MELBOURNE'S MULTICULTURAL AUDIENCES

WRITTEN BY:

MIKE BEDARD
TANNER MCCARTHY
SUELA MILOSHI
ERIN PERRY

DATE:
18 MARCH 2021

ECOLOGY ANIMATIONS FOR MELBOURNE'S MULTICULTURAL AUDIENCES

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

WRITTEN BY:

MIKE BEDARD
TANNER MCCARTHY
SUELA MILOSHI
ERIN PERRY

DATE:
18 MARCH 2021

REPORT SUBMITTED TO:
SPONSOR ORGANIZATION:
THE PORT PHILLIP ECOCENTRE
PROJECT ADVISORS:
PROFESSORS ESTHER BOUCHER-YIP
AND STEPHEN MCCAULEY
WORCESTER POLYTECHNIC INSTITUTE

Acknowledgements

Our team would like to thank the Port Phillip EcoCentre for the opportunity to complete an exciting and important project despite pandemic restrictions. In particular, we appreciated the help from April Seymore, Reiko Yamada, Josh Solomonsz, Adrian Black, and Matt McArthur. While we were unfortunately unable to travel to Australia as planned, our team felt welcomed and enjoyed learning from these EcoCentre staff members.

Additionally, our project advisors were crucial to the success of this project. Professor Jason Davis led our project preparation class, and Professors Stephen McCauley and Esther Boucher-Yip led our project term. This project would not have been possible without their guidance.

And finally, our team would like to acknowledge the original custodians of the lands in Worcester, Massachusetts and Melbourne, Victoria. We pay our respects to elders past, present, and emerging of the Nipmuc and Boonwurrung.

Abstract

Our team communicated ecology concepts to Melbourne's diverse audiences by animating and translating videos to expand Port Phillip EcoCentre community outreach which has been impeded by language barriers and the pandemic. The four concepts we presented are not easily captured with cameras, so animation enabled in-depth explanation of ecological processes that would otherwise go unseen. These topics were: soft sediment systems; nest hollows; short-finned eels; native pollinators. We then translated these videos into six languages to include a multicultural audiences.

Executive Summary

Introduction

Port Phillip Bay in Melbourne, Australia is home to many unique ecosystems that support a wide range of local species. The Port Phillip EcoCentre is a nonprofit environmental organization that strives to protect the environment and educate the citizens of Melbourne about the wide array of ecosystems. The EcoCentre offers a variety of education programs, volunteer opportunities, and excursion tours. They are known for their amazing in-person and hands-on experiences. Due to the ongoing pandemic, the EcoCentre's mission to educate citizens of Port Phillip and Melbourne about local ecological concerns needed to be adapted. With the pandemic now restricting in-person opportunities, the EcoCentre provided many virtual alternatives. The EcoCentre began to offer virtual workshops, lessons and events, which helped them continue to operate effectively during the pandemic. Furthermore, the EcoCentre was already struggling to reach multi-lingual communities due to their limited staff diversity. Therefore, our project addresses pandemic and diversity challenges by delivering online videos offered in multiple languages.

Background

We researched the work of the Port Phillip EcoCentre to learn more about the unique ecology and language diversity of Melbourne, and animation best practices. We begin by discussing the EcoCentre and their mission to protect their environment, and educate the people of Melbourne about local ecosystems. Then we delve into Melbourne's ecosystems and the Port Phillip Bay. Melbourne's interconnected ecosystems are significant to the species and people that live alongside them. The EcoCentre notices the importance of preserving these ecosystems and strives to educate the city about these concerns. Our research then further examines specific ecosystems in Melbourne, such as the soft sediment systems in Port Phillip Bay, native pollinators, tree hollows, and short-finned eels. Our research also explains the use of animation as an education tool. We found that Melbourne's communities speak many languages other than English at home, so researching animation's applicability for reaching multilingual audiences was crucial.

Figure A: Soft Sediments

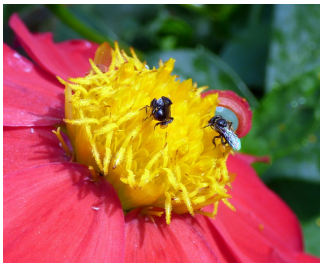

Figure B: Native Pollinators

Figure C: Nest Boxes

Figure D: Short-Finned Eels

Executive Summary

Methods

The goal of this project was to create educational animations so the Port Phillip EcoCentre can raise environmental awareness in Melbourne across its linguistically diverse communities. In order to meet this goal, our team completed three objectives:

1. Research subject matter for developing animations used in environmental education for multicultural audiences and the Port Phillip Bay area.

The methods of achieving our first objective of determining subject matter consisted of online database research on Melbourne's ecology and interviews with local experts on the subject. Some information was not able to be obtained through database research, so we conducted in-depth interviews with Matt McArthur (EcoCentre Marine Biologist) and Adrian Black (Mobile Zookeeper). They were able to provide us with detailed information on our animation topics that could not be found online. Matt McArthur was our primary source for the Soft Sediments Video, and Adrian Black assisted us with the Nest Hollows and Native Pollinators videos.

2. **Determine and execute our own creative process to animate videos that raise awareness for community conservation efforts.**

Our team began this project with no animation experience, and finished with the skills to deliver animated videos that taught audiences effectively. We accomplished our second objective by preparing carefully before the project term began in January. We met over winter break to conduct workshops as a team, completing training challenges and tutorials. We then defined our own creative process during the project term as shown in **Figure A**. We researched different strategies for maximizing learning through video, and how to hold an audience's attention. Once we felt strongly about our research, we created in depth storyboards to effectively plan out our videos. These storyboards would act as a visual guide throughout the production process of the video. Our storyboards were shared with our sponsors and advisors to receive feedback and once satisfied with them, our group used the tools provided by Adobe Animate to create our animations.

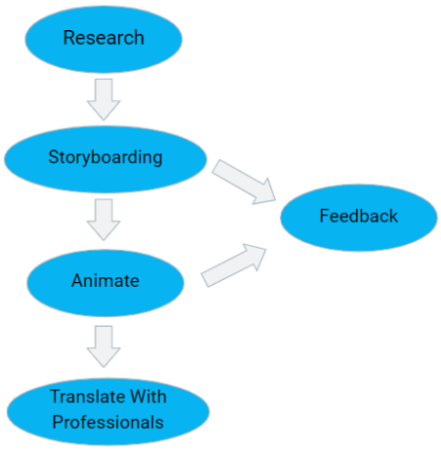

Figure E: Team Creative Process

Executive Summary

When creating our videos, we decided the most efficient system was a blend of individual and team work. With each member of the team choosing their own video to work on, we reduced potential scheduling and deadline conflicts. Daily meetings were held to discuss our progress and share issues. We met with our sponsors and advisors weekly to receive feedback on our in-progress animations.

3. Translate the audio and textual components of each video based on our research of communication across diverse communities to best reach our audiences.

Our third objective was to take into account the multicultural and multilingual aspect of our audience and translate our animations. We interviewed four of the EcoCentre's Multicultural Bay Ambassadors in order to understand how to make the animations appropriate and understandable for multicultural audiences. We asked questions about the appearance, content and wording of the animations to ensure that all of our ideas would translate well into other languages and cultures. After these discussions, our videos were ready for translation, so we solicited translation help from EcoCentre volunteers, the Multicultural Ambassadors, WPI international students, and professors. For anyone who was willing to speak in their native language we recorded a voiceover in that language, otherwise we believed that the translated subtitles and ESL-style audio would suffice to educate our viewers.

Findings

Through our preliminary meetings, we found that there are many concepts that need to be taken into consideration when making animations for an audience with diverse backgrounds and age groups. Our meetings with the EcoCentre staff and mobile zookeeper Adrian Black taught us how to develop our videos for the different age groups in our audience. We learned **strategies to make our visuals better** support our audio as well as how to **properly introduce complex vocabulary**.

Furthermore, our interviews with the EcoCentre's former Multicultural Bay Ambassadors opened our eyes to the **cultural sensitivities** that were necessary to create **videos that can be appreciated by multicultural audiences**. These included proper conversational etiquette between characters, dressing human characters in traditional clothing and using the proper honorifics to address any adult characters. They also described how to write our videos so that they can **translate seamlessly** into other languages, and personality traits that the characters should have so that children from those cultures can **best connect to and understand the characters**.

Executive Summary

Finalized Animations for Melbourne's Multicultural Audiences

Each video focused on a different topic important to the ecology of the Melbourne area. The **soft sediment systems** video conveyed the mechanics of the systems at the bottom of the Port Phillip Bay. The **nest hollows** video explained the issues hollow-dependent species are facing, and how people can help by building nest boxes and bat tubes. The **native pollinators** animation looked to demonstrate the importance of pollination and explain how different animals pollinate. The **short-finned eels** video aimed to educate viewers about the life cycle of eels by following the life of an animated eel character, Eli.

To determine the efficacy of our videos, we conducted pre and post-test surveys that each accumulated approximately 20 responses. The average scores achieved by viewers approximately doubled from the pre-test to the post-test. The scores suggest that each person gained significant knowledge from the pre-test to the post-test by analyzing the lowest scores of each test; the lowest scores of the post-test were much higher than those of the pre-test.

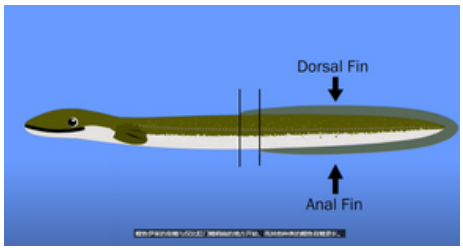

Figure F: Subitlted Short-finned Eels Video

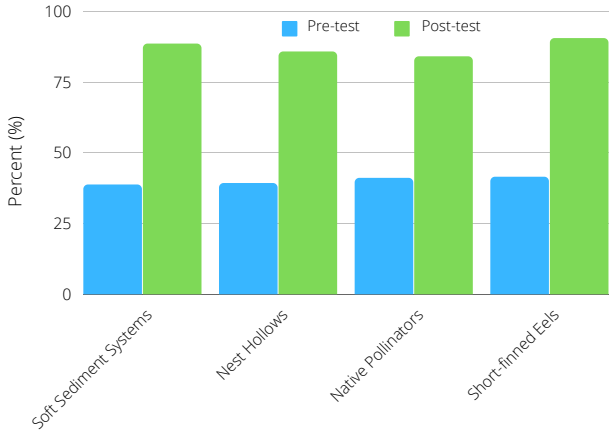

Figure G: Pre-test and Post-test Mean Scores

Conclusion

Melbourne and the Port Phillip Bay face many environmental issues that negatively affect their ecosystems, such as pollution and climate change, which destroy animal habitats. The videos we created demonstrate how the ecosystems surrounding Melbourne work and are affected by these environmental issues and are to be used as an educational resource by the EcoCentre. The EcoCentre visitors will understand how their home is being affected and will feel more connected to the nature around them. These videos have proven to have a high educational value, and therefore, we hope to have created resources for the Ecocentre and similar organizations to use animations to educate their visitors and empower them to take better care of the environment they live in.

Table of Contents

Table of Contents

List of Figures

1.0 Introduction

Melbourne and the Port Phillip Bay host uncommon ecosystems that support a diverse population of native Australians and immigrants alike. The Port Phillip EcoCentre is a nonprofit organization that works to protect its environment, educate local communities, and make change happen. The EcoCentre provides a variety of educational programs, volunteer opportunities, and excursion tours. One of their most important missions is to educate citizens of Port Phillip and Melbourne about local ecosystems and crucial ecological concerns (EcoCentre, 2020). The Port Phillip EcoCentre must work harder than ever to educate the people of Melbourne during pandemic restrictions.

Due to the COVID-19 outbreak, the best path for the EcoCentre to accomplish its outreach mission was not immediately clear (EcoCentre, 2020). The EcoCentre's trademark experience involves in-person, hands-on education sessions that take place outdoors (EcoCentre, 2020). The EcoCentre may have a virtual presence via social media, but their practices needed to change in order to continue operating effectively during the pandemic.

To assist the EcoCentre with their virtual mission, our group created four multilingual videos that address ecological concerns and educate viewers on the local ecology. In order to meet this goal, our team established three objectives: 1. Determine the best practices, creative processes, and subject matter for developing animations used in environmental education for multicultural audiences, 2. Create videos that raise awareness for community conservation efforts and include feedback we solicit from pertinent stakeholders, and 3. Translate the audio and textual components of each video based on our research of communication across diverse communities to best reach our audiences.

First, our team researched how the EcoCentre accomplished their mission before the pandemic, and the steps they have taken since the start of lockdown restrictions. With this foundational knowledge, we explored Melbourne's diversity and identified best practices for communicating with people speaking languages other than English at home. As about 60% of Melburnians speak only English at home (ABS, 2016), this aspect is integral to ensuring our project reaches as many people as possible and achieves the EcoCentre's outreach mission. We also researched the effectiveness of using animation in teaching, and found that it is an incredibly effective means to educate people of all ages.

With the best practices and audience in mind, we crafted each of our animations to have the highest educational value as possible for people of all different ages and cultures. Each video was translated into five different languages and was evaluated on its effectiveness at teaching. We generated surveys to quantify the educational value of the videos created. We provided our audiences with a pre-test and a post-test to determine the change in knowledge after viewing the video. Our videos proved to have a significant impact on the knowledge of our audience.

2.0 Background

This section presents our research into the Port Phillip EcoCentre, the unique ecology and language diversity of Melbourne, and animation best practices. We discuss the efforts Melbourne is putting forth to combat climate change at the local level, and how the Port Phillip EcoCentre is an integral part of this fosters coalitions of partners to protect the intricate web of biodiverse ecosystems in the area. We also explain the use of animation as an education tool and its applicability for reaching multilingual audiences.

Figure 1: Melbourne and the Port Phillip Bay

2.1 The Port Phillip EcoCentre

The Port Phillip EcoCentre is a nonprofit environmentalist organization that inspires meaningful change by educating their local community. Located outside Melbourne in the City of Port Phillip, the EcoCentre is run by paid staff and volunteers who work to preserve Port Phillip Bay and its surrounding ecosystems. Founded by Neil Blake, the team is currently led by Executive Officer April Seymore, and most other positions on the staff are focused on education (EcoCentre, 2020d).

The EcoCentre team provides a variety of immersive learning opportunities for people of all ages. The team offers hands-on and outdoor experiences targeting audiences who are not fully aware of their connections with the natural world (EcoCentre, 2020e). By varying the accessibility, depth, and time commitment of their experiences, the EcoCentre captures a wide audience. Some programs are straightforward and simple, featuring information sessions and quick activities for all ages (EcoCentre, 2020e). Other programs are more focused and detailed. For example, the EcoCentre ran a successful STEAM project for young students that included coding and circuit building (EcoCentre, 2020e). With over ten unique educational programs, the EcoCentre effectively raises awareness and precipitates change.

When explaining the need for redeveloping the EcoCentre building, the team stated, "In the last decade we have seen a 500-fold increase in young people engaging with our programs, a 660% increase in people taking action to restore their local environment, and our volunteer hours have increased to a record 20,000 per year in 2019" (EcoCentre, 2020b). As evidenced by these statistics, the EcoCentre is accomplishing its community engagement mission, which in turn has led to increased awareness of the EcoCentre's research.

Figure 2: Marine Biology Research

Not only does the EcoCentre educate the local community, they also conduct research to promote environmental health and wellbeing in the region. In one recent example, Fam Charko, the EcoCentre's marine biology expert, led a study examining the plastic pollution in Port Phillip Bay (EcoCentre, 2020c). She found that 374,647,680 pieces of plastic litter are reaching the Bay per year, and that this litter comes from Melbourne's suburbs (Preiss, 2019). These suburban polluters are therefore an important focus for the EcoCentre's educational campaigns. Furthemore, the EcoCentre's research is well-respected by the local residents and government alike, receiving $600,000 from the Victorian government in 2017 "to protect native biodiversity and improve water quality around Elster Creek and Werribee River" (Atkinson, 2017). The EcoCentre continues to conduct their own research, as well as support other local organizations. For example, in their Annual Report, they describe active partnerships with universities, cities, and activist groups to address issues including coastal erosion and litter (EcoCentre, 2020a). In general, the EcoCentre protects their community by conducting careful research on the local web of ecosystems.

2.2 Brief Overview of Melbourne's Urban Ecosystems and the Port Phillip Bay

Melbourne's diverse and interconnected ecosystems are significant to their endemic species and the humans that live alongside them. The City of Melbourne recognizes the importance of preserving this critical relationship, and released a "Nature in the City Strategy" in 2017. An ecosystem is "a community of living organisms interacting as a system with each other and also with the non-living components of the environment" (Melbourne, 2017). The Victorian state government also prioritizes preservation, and released a report titled Marine and Coastal Ecosystem Accounting: Port Phillip Bay. The government explains, "Port Phillip Bay has unique intrinsic values that are essential to the culture and wellbeing of people in Melbourne and Geelong. The ecosystems within the Bay provide benefits in the form of tourism, recreation, climate control, food, and other goods and services" (Eigenraam et al., 2016). These broad benefits highlight the power of the natural world in Melbourne.

The natural world includes the city itself, or the urban ecosystem, a multi-layered and dynamic relationship between skyscrapers, people, water, plants, and animals. The "Nature in the City Strategy" defines urban ecology as "the study and management" of these interactions, and proceeds to examine the different elements that interact. There are small parks, roof-top gardens, green facades, streetscapes, and potted plants that support plant life amidst The natural world includes the city itself, or the urban ecosystem, a multi-layered and dynamic relationship between skyscrapers, people, water, plants, and animals. The "Nature in the City Strategy" defines urban ecology as "the study and management" of these interactions, and proceeds to examine the different elements that interact. There are small parks, roof-top gardens, green facades, streetscapes, and potted plants that support plant life amidst downtown Melbourne, giving the city a "green" feeling. Also, "large landscaped parks just outside the central city such as Flagstaff Gardens, Treasury Gardens, Fitzroy Gardens, Fawkner Park, and the Royal Botanic Gardens" are well-loved by city residents. The City goes on to identify Melbourne's waterways as "the iconic Yarra River, the Maribyrnong River, and the Moonee Ponds Creek," which all play a key role in urban ecology. As for the animals calling Melbourne home, there are "239 species of birds, 12 species of reptiles, 18 species of mammals, seven species of frogs, over 1500 species of insects, and 31 species of fish recorded in the last 20 years in the municipality" (Melbourne, 2017). Melbourne, giving the city a "green" feeling. Also, "large landscaped parks just outside the central city such as Flagstaff Gardens, Treasury Gardens, Fitzroy Gardens, Fawkner Park, and the Royal Botanic Gardens" are well-loved by city residents. The City goes on to identify Melbourne's waterways as "the iconic Yarra River, the Maribyrnong River, and the Moonee Ponds Creek," which all play a key role in urban ecology. As for the animals calling Melbourne home, there are "239 species of birds, 12 species of reptiles, 18 species of mammals, seven species of frogs, over 1500 species of insects, and 31 species of fish recorded in the last 20 years in the municipality" (Melbourne, 2016).

Figure 3: Green Spaces in Melbourne

2.2 Brief Overview of Melbourne's Urban Ecosystems and the Port Phillip Bay

Much like the city it borders, the Port Phillip Bay hosts a strong and diverse ecosystem despite the large human population. In Marine and Coastal Ecosystem Accounting: Port Phillip Bay, Eigenraam, McCormick, and Contreras examine the Bay on behalf of the Victorian state government. They explain that "the Bay's 264 kilometres of coastline is almost continuously populated and includes Victoria's two largest cities – Melbourne and Geelong" (Eigenraam et. al, 2016). In addition to this human activity, the Bay contains a multitude of common and endemic species. For example, the Burrunan Dolphin (Tursiops australis) is found only in Port Phillip Bay and surrounding Australian waters due to the area's unique water composition and location relative to other dolphin populations (Marine Mammal Foundation, 2020). These rare animals are supported by the Bay's variety of ecosystem assets including saltmarsh, mangroves, seagrass, rocky reefs and soft sediments (Eigenraam et. al, 20).

Figure 4: Melbourne-Area Beach

2.3 Port Phillip Bay Ecology

To create effective animations, it is important to have a thorough knowledge of each of the video topics. The following section discusses the ecological concepts behind each of the videos we created.

2.3.1 Soft Sediment Systems

At first glance, 30 meters below the surface, the bottom of the Port Phillip Bay appears to be sandy mud. In reality, it is a complex system that supports diverse life. Thousands of living organisms can be found in just a square meter of the Bay. These organisms and their habitat are closely intertwined in what is called a "soft sediment system."

The Port Phillip Bay's soft sediment system consists of three layers. The topmost layer is cloudy mud, which is a product of the Yarra River. This cloudy mud is called "silt." Silt floats just above the second layer, which is mostly sand. These two layers are the most accessible for organisms because oxygen-carrying water diffuses easily between the particles of sediment. The sediment is also soft enough to facilitate organism movement between these two layers and the Bay water above. Below these two layers is black sand. Here, bacteria have used up all the oxygen, making it very difficult for life to take hold. The deoxygenated sand is hard-packed, further restricting potential life.

While these three layers may seem undesirable for life as we understand it, life finds a way. Certain plants and animals build networks for food, oxygen, and shelter. These unique organisms are called "ecosystem engineers," and not only do they survive, but they also create better habitat for organisms at the bottom of the Bay and above (McArthur). There are many organisms that work as ecosystem engineers, but for the purposes of this report, focus will be directed to five distinct plants and animals.

One prominent ecosystem engineer is the heart urchin. Their heart-shaped exoskeleton shells can be found washed up on the Bay's beaches, but they thrive at the bottom of the Bay. According to Port Phillip Bay marine biologist Matthew McArthur, they live in burrows, and "eat" the sediment between the bottom black sand layer and the more porous middle layer. When they consume and expel sediment as they crawl beneath the surface, they move so much sand that oxygen-rich water is drawn into the lower levels. This makes the middle layer more viable for life, and reduces the space taken up by the bottom layer.

While the bottom layer of sediment may be largely inhospitable, the lifestyle of the ghost shrimp can enable habitat expansion into this layer. These pale shrimps, also called "muddy shrimp," live in deep, complicated burrows that double as pathways for oxygen-rich water to reach areas of the black sand layer (McArthur). In this way, the ghost shrimp creates more living space for itself and other small organisms.

Figure 5: Heart Urchin

Figure 6: Ghost Shrimp

Plants can be excellent ecosystem engineers, too. Mangroves are particularly important to the shallower parts of the bay (McArthur). These short, tropical trees have tubular roots that spread far out, bringing oxygen below the surface. The roots often extend into the bottom black sand layer, expanding living spaces in a manner similar to that of the ghost shrimp.

Mangrove roots provide structural support for the soft sediment system, in addition to oxygen supply. Other plants that make the Bay floor more solid include sea grasses. Found in deeper parts of the pay, sea grasses can also provide shelter for smaller animals such as the Weedy Sea Dragon (McArthur).

Some ecosystem engineers have been more affected by climate change and humans than others. For centuries, oysters formed groups called “oyster beds” that acted as filters for cloudy silt. But European settlers harvested all the oysters and sold them for food. Despite recovery efforts by ecological organizations, the Port Phillip Bay remains much darker and cloudier without oyster bed filters (McArthur).

Figure 7: Mangroves

While some ecosystem engineers may go unnoticed by humans, the organisms these engineers support are recognizable. For example, stingrays camouflage themselves in the upper sediment layers. Dumpling squid hunt by burrowing into the uppermost sediment layers, leaving just their eyes visible to their predators. Dumpling squid are also able to coat their skin with the readily available silt and sand for further protection against predators (Taylor et al).

Figure 8: Squid on the Sea Floor

Further from the Bay floor, endangered species such as the Burrunan dolphin eat the fish, crabs, squid, and shrimp that are found in (or are supported by) the soft sediment system. The seagrasses that help hold the sediment system together also protect weaker swimmers like the Weedy Sea Dragons, potbellied seahorses, and pipefish. These animals may call the seagrass beds home, but swans call them food. Swans live in and alongside the Bay, diving down to eat the seagrasses that are a part of their diet (Taylor et al).

Figure 9: Fur Seal

Another recognizable bird in the Bay is the Little Penguin. Like the Burrunan dolphin, the Little Penguin eats smaller fish and squid that hide at the bottom of the Bay. Little Penguins raise their families on the shore, but spend most of their lives in the water (Taylor et al).

Animals like the Australian Fur Seal also spend time in the water and on land. They are usually between one and two meters long, but can weigh as much as 360kg. These intelligent hunters also eat fish and squid like the Little Penguin (Taylor et al).
No matter how far from the Bay floor organisms may live, they are all supported by the sediment system and ecosystem engineers at the bottom of the Bay.

2.3.2 Native Pollinators

A flower can possess male or female reproductive organs, or even both. The male organ is called the stamen, and the female organ is called the pistil. Pollination is the process of taking the pollen held in the stamen and transferring it to the pistil in order for the flower to reproduce (US Forest Service, n.d.). Once pollinated a flower will develop seeds or fruit, whose seeds can be planted for a new flower to grow, continuing its life cycle. A flower with only one type of reproductive organ is called a unisexual, or imperfect flower. Imperfect flowers rely on cross pollination in order to reproduce, meaning pollen must be transferred from the stamen of one male flower to the pistil of a separate female flower by either an animal or the wind (Support, 2019). Flowers with male and female reproductive organs are called bisexual, or perfect flowers. Many of these flowers can self pollinate, meaning a single flower can reproduce using its own pollen and ovaries (Support, 2019).

Bees are some of the world's most important pollinators. The Australian Stingless Bee is a vital cross pollinator, native to northern and eastern Australia. This small black bee is harmless to humans since it cannot sting, and it lives in a hive made of resin and wax. In their hive, there is a queen bee who lays eggs and watches over thousands of worker bees, whose job is to collect food for the colony (Zachos, 2021). These worker bees retrieve nectar and pollen from flowers during the pollination process. The pollen is held by the bee with its sticky hairs and when a bee moves to get food from another flower, some of that pollen falls off of the bee into the pistil of the new flower. That flower has now been pollinated and will begin to sprout seeds over time, while the bee brings its pollen and nectar back to its hive. While in the hive, the bee deposits its nectar, allowing it to dry out and become honey. The bees then mix some honey and pollen together to make a protein source to feed their larvae (Quiros, 2019).

Another bee that is a vital pollinator is the Blue Banded Bee, native to Victoria. These bees are larger than the stingless bees and are named for the bright blue striped fur on their lower abdomen (Aussie Bee, n.d.). They also have a stinger, but are not aggressive and will not sting people. Unlike the Australian Stingless Bee, the Blue Banded Bee pollinates through a method called buzz pollination. This form of pollination can only be performed on bisexual flowers, as the bee grabs the head of the flower then vibrates and shakes the flower, allowing pollen to drop into the pistil.

Figure 10: Australian Stingless Bee

Figure 11: Grey Headed Flying Fox

Though many people only consider bees and other insects when thinking about pollination, one of Australia's most important pollinators is the Grey Headed Flying Fox, native to the southeastern part of Australia. They are considered a keystone species, meaning their ecosystem would not be able to survive without them. This is due to their ability to pollinate flowers over long distances. Though they are a type of fruit bat, grey headed flying foxes feed on mostly pollen and nectar, and can travel up to 50 km in a day for food (Backyard Buddies n.d.). This allows pollen dispersal over a wide range of areas, emphasizing their importance. These bats live in large groups called camps, that can contain thirty thousand bats at one time. They are currently being protected and are classified as vulnerable due to habitat loss (NSW, 2020). Without pollinators, plants and animals wouldn't be able to survive and life on Earth would not be able to continue.

2.3.3 Tree Hollows, Nest Boxes, and Bat Tubes

Australia is home to over 350 species of land animals that depend on the hollows that form in gum trees either for shelter or breeding. Some of the many animals in Australia that rely on tree hollows include parrots, owls, possums, sugar gliders, microbats, and even many reptiles. Gum trees are the most common hollow producers in Melbourne. Specifically the River Red Gum Tree is the best known producer in the region. In Melbourne specifically some examples of Hala dependent species are docs, microbats, parrots, possums, and sugar gliders.

Trees are subject to many natural forces which caused the formation of tree hollows. These forces, such as storms, wind, and fire, break down the tree. Hollows usually form when a branch falls or is cut from a tree, which leaves a hole. Then wildlife can then use their beaks claws and teeth to enlarge the hole to be more suitable for protection and breeding. Now, many hollow dependent species are in decline because of the widespread destruction of hollow bearing trees. All around the World trees are being cut down for safety reasons, to make space, and for materialistic reasons. This is limiting spaces for wildlife to breed and protect. These species depend on hollows and with such insufficient space, these many hollow dependent species are at risk.Even if trees were to be replanted, it could take up to 100 years or more for hollows to form and to be suitable for use by wildlife. If hollow dependent species are to continue to survive urgent action is needed to protect these trees wherever possible. In addition, nest boxes are needed in areas where hollows have already been lost.

Figure 12: Tree Hollow

Figure 13: Gum Tree

Nest boxes will act as an artificial Hollow. Not only is this a great environment for animals but it also is a great unique opportunity for people to connect with nature. Nest boxes will act as an artificial hollow. Not only is this a great environment for animals but it also is a unique opportunity for people to connect with nature. Community involved nest box programs are a great tool for connecting people with nature because the benefits of the environment are easy to witness. They allow close observations of the behaviors of wildlife during the nesting period. It can be a very rewarding experience to have animals breed in an area that would have previously been uninhabitable. Since a great deal is yet to be learned about the behavior of hollow dependent species, nest boxes act as an important role in the future research of this topic.

This is becoming a widespread problem and immediate action needs to be taken. There are insufficient green spaces for wildlife to thrive, so it's imperative that we consider how schools, residential, and commercial spaces can support local wildlife. By planning in our gardens with a diverse range of plans and elements, we can foster greater biodiversity in our city. Creating habitats that is part of a variety of lifeforms involves providing a safe environment with shelter to hibernate sleep and rest, access to nesting materials, water and food. Creating a garden for one life is an easy action we can take to locally support the lives of many species struggling. Globally, we are seeing an increase and threatened endangered species due to many factors, with loss of habitat being one of the largest causes.

Figure 14: Nest Box

Figure 15: Sugar Glider

2.3.4 Short Finned Eels

Short-finned eels are born in the Coral Sea, which is located northeast of Australia (VEWH, n.d.). Ocean currents carry the eggs, and the larvae that hatch from them, south (Shiao et al., 2001). The eel larvae are tiny and transparent when they are born. They eat planktons and begin to grow into a leaf shape as they migrate south (Authority, Victorian Fisheries, 2015). Depending on the strength of the ocean currents each year, the larvae will reach areas all over Southern Australia (Native Fish Australia, n.d.). In some years, the currents are not as strong, so the majority of the larvae do not reach as far. This means that the population of eel larvae that reach Port Phillip Bay each year fluctuates greatly (Arundel and Barton, 2007).

By the time the larvae arrive in Port Phillip, they have begun metamorphosing into an eel shape. They still have not developed any pigment in this stage, so they are known as 'glass eels' . Once the larvae have metamorphosed into glass eels, they swim in closer to the shores (Authority, Victorian Fisheries, 2015). The eels live in freshwater, so they begin to look for signs of freshwater streams that lead into the ocean. Mckinnon and Gooley (1998) found that they detect the temperature and salinity of the water to navigate to nearby estuaries. Once they reach the estuaries, some eels will swim straight through them to the freshwater rivers, and others will linger in the brackish water before eventually making their way into the rivers (Authority, Victorian Fisheries, 2015).

Once they reach fresh water, the glass eels finally begin to develop pigment. They turn a dark olive green color on top and silver on their stomachs. As they are still not fully mature eels, they are now known as 'elvers'. Now that they have color and have grown, it is easy to see how these eels got their name. Their dorsal fin starts just before their anal fin, whereas in other species of eels, the dorsal fins are much longer.

Figure 16: Short-Finned Eel

The elvers prefer to live in still water, so they continue to swim upstream until they find a lake or swampy lagoon. If they run into an obstacle, like a waterfall or dam, the eels will crawl out of the river and slither around it (Australia, Atlas of Living, n.d). Once they find a suitable location, they will stay there until they have fully grown and matured (Authority, Victorian Fisheries, 2015). The short finned eels can grow up to over a meter, with the females growing larger than the males. It takes the males approximately 14 years to fully mature, while the females take 18 to 24 (Australia, Atlas of Living, n.d).

When the eels have matured, they begin preparing to migrate back to the ocean to have children. They engorge themselves to put on extra fat to use as fuel during their journey. They then swim back through the rivers and around the obstacles to reach the ocean. Then, they swim against the currents that dragged them south as larvae to reach the Coral Sea. They use all of the fat on their bodies to get there, and shortly after mating and laying eggs, they die and the cycle starts again with their eggs (Authority, Victorian Fisheries, 2015).

2.4 Language Diversity in Melbourne

Australia, and specifically the state of Victoria, is a diverse place with people from all around the world. In 2016, Victoria had a population of about six million people, of which almost 50% were either born overseas or had a parent that was born overseas. In Victoria, the most common countries of origin for first-generation immigrants are India, China, Vietnam, Italy, Greece, and Germany (Diverse Population, 2016).

The people of Victoria speak a variety of languages. As stated in the 2016 census, the top five languages spoken in Victoria in order are as follows: Mandarin, Italian, Greek, Vietnamese, and Arabic (Thangngo, 2017). According to the "Australian Bureau of Statistics of 2016", 40% of the citizens of Melbourne speak languages other than English at home. Specifically, the article "Languages Spoken at Home" posted by the city of Port Phillip, examines the number of citizens who speak languages other than English and the breakdown of what languages are the most popular. In the city of Port Phillip, 62% of the population speaks only English. The top languages spoken at home in Port Phillip are Greek, Mandarin, Italian, Russian and Spanish (Languages Spoken at Home).

Figure 17: Melbourne's Chinatown

2.4.1 The Need for Translation

For this project, our group will create at least four animated videos that highlight environmental concerns in Melbourne. Since Melbourne has a very large population of multilingual citizens, it is very important to translate the videos to the language suitable for audiences who speak other languages besides English. Not only will these videos target a larger population, they will be more effective when communicating to multilingual communities. The intended audience for these videos, as explained to us by our sponsors, is that the videos should be simple enough for kids to understand and interesting enough for adults. Research from Jessica Ball shows that children in elementary school learn best in their native language. It is thought that the same might apply with higher levels of study, as well. According to Ball, children whose primary language is not the language of instruction in school are more likely to drop out of school or fail their classes. Research has shown that a children's first language is the best language for literary and learning. Despite the growing evidence, many schools insist on only teaching in one language, which puts children who speak other languages at a disadvantage. UNESCO, also known as the United Nations Educational, Scientific and Cultural Organization, which is a specialized agency of the United Nations that promotes education, science and culture, has advocated primary education to teach in the native languages of students. Considering that there is data that shows that people learn better in their native languages, our group realizes the need to translate our videos in order to reach a larger audience.

2.4.2 Best Practices for Communicating With Non-native Speakers of English

When writing and speaking in a language suitable for audiences who speak English as a second language, such as many people living in Melbourne, there are some best practices on how to communicate properly. These best practices will not oversimplify our audio and textual components. Instead, we will engage native English speakers while respecting the comfort zone of someone who might speak another language at home. As suggested in the journal article, "How to Communicate with People Who Speak English as a Second Language (ESL)" , there are two different subtopics of how to approach communicating with a multilingual individual. When communicating verbally, there are some best practices to consider. Speaking at a slower speed and enunciating is very important. For people who speak multiple languages, it may be harder for them to understand when speaking fast. Therefore, by giving them time to absorb and think about the information given to them, it will help them comprehend what is trying to be said. Additionally, speaking over the phone or watching a video can be challenging for people who speak English as a second language. Especially when the individual cannot see the lips or gestures of the person trying to speak with them, speaking clearly and slowly is key to effectively communicating. Furthermore, speaking in an active voice and not using contraction or idioms is helpful for multilingual people because it simplifies the language. Active voice combats long sentences that can be hard to follow. Avoiding

2.4.2 Best Practices for Communicating With Non-native Speakers of English

contractions helps clear confusion of two words that are combined into one. Lastly, the use of idioms can be very bewildering to people whose second language is English. This is because idioms are figurative and have a non-literal meaning. These best practices help for writing and speaking in a language suitable for audiences whose second language is English (Sawin, 2000).

Another subtopic that is mentioned in the journal article, "How to Communicate with People Who Speak English as a Second Language (ESL)", is how to best practice writing in a language suitable for audiences who speak English as a second language. When writing, it is crucial to simplify sentences. To do so, shortening sentences, using straightforward vocabulary, and eliminating extra words will aid in communicating with individuals whose second language is English. Reducing the number of abbreviations, conjunctions, and acronyms will also aleve any confusion. Although it may be a time-saver to use these concepts in the writing, avoiding them will make it easier to communicate with multilingual individuals. In the end, when either writing or speaking to a person whose second language is English, it is about the audience. Consider what they know, need to know, and then plan how to best communicate the information (Sawin, 2000).

2.5 Effectiveness of Animation on Learning

Animations effectively teach their audience new material. Thomas and Israel (2014) studied the relationship between using animation in learning and student performance. They broke middle school students into two groups; one group was taught a science lesson conventionally and the other was shown animations to supplement the teaching. Each student took the same pretest before the instruction and the same post-test after. There was virtually no difference in the average pretest scores, but the children who watched animations had an average post test score over twice as high as the children who did not (Thomas and Israel, 2014). Using animations maximizes the audience's takeaway of the topic they are learning.

	Pretest	Posttest
Conventional	19.52	23.92
Multimedia	20.28	50.66

Figure 18: Pre and Post Test Results

Animations should maintain balance in the moving, audio and textual components to maximize their impact on the audience. McElhaney et al. (2015) studied existing science resources to determine what this balance must be. They used the Cognitive Load Theory as the basis of their evaluation; this theory describes the three types of cognitive loads: extraneous, intrinsic, and germane. McElhaney et al. (2015) determined that effective visual learning content minimizes extraneous and intrinsic cognitive loads and maximizes germane cognitive loads. This means that animations should not require the audience to have background knowledge of the topics and should avoid distracting moving parts. The visuals should reflect the audio to highlight the ideas.

Plass et al. (2009) enhanced this theory by investigating the effects of animations on the viewers. They proposed three additional principles: the multimedia principle, modality principle and conjoint retention hypothesis. The multimedia principle states that audio accompanied by pictures is easier to comprehend than text presented alone. Animations provide visualizations that reinforce information from the audio, which increases the audience's understanding. The modality principle states that it is difficult to comprehend text accompanied by pictures; the combination of visual, textual, and auditory elements increases the cognitive load, which decreases the audiences' ability to process the information. The final concept is the conjoint retention hypothesis, which states that visualizations are more effective when they are presented before the accompanying text. This way, the audience gets a general idea before they are asked to look at specific aspects. The cognitive load alone is not enough to evaluate animations, so the interactions between the text, image, and auditory elements should be considered.

3.0 Methodology

The goal of this project was to create educational animations so the Port Phillip EcoCentre can raise environmental awareness in Melbourne across its linguistically diverse communities. In order to meet this goal, our team completed three objectives:

1. **Research subject matter for developing animations used in environmental education for multicultural audiences and the Port Phillip Bay area.**
2. **Develop and execute our own creative process to animate videos that raise awareness for community conservation efforts.**
3. **Translate the audio and textual components of each video based on our research of communication across diverse communities to best reach our audiences.**

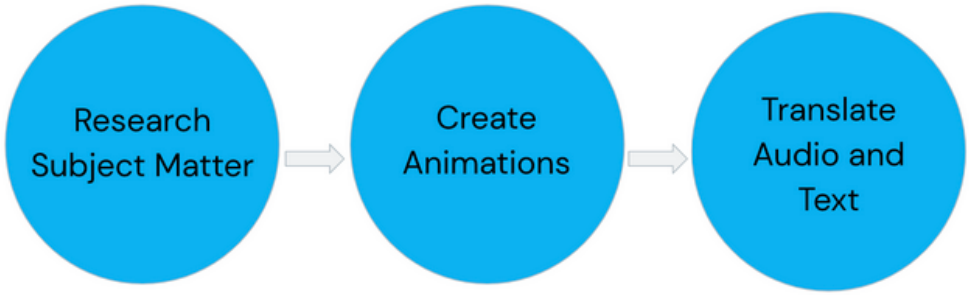

Figure 19: Visual of Objectives

3.1 Research subject matter for developing animations used in environmental education in Melbourne and the Port Phillip Bay area.

Our first objective was to research best practices and content for creating effective educational animations. Many scholarly databases were accessible for us to use through the WPI Library, such as ScienceDirect and Scopus, which contain a variety of helpful journals and articles. We also used Google Scholar to search through a larger variety of articles to find more generalized topics. **We conducted research on the ecology of Melbourne in order to give our videos the highest quality content and educational value.** We used the databases to research the specific topics that each animation will focus on so we can provide the best information possible to the audience. The Port Phillip EcoCentre's website and 2020 yearly report were also used to learn more about Melbourne's environment and conservation strategies.

Some information was not able to be obtained through database research, so we conducted interviews with **two ecology experts** in Melbourne. **Matt McArthur, a marine biologist** at the Port Phillip EcoCentre provided a great deal of information about the soft sediment systems in Port Phillip Bay. From this meeting, we learned that the soft sediment systems of the bay are important to highlight visually because there are many unique processes that occur that people cannot see. In just a single square meter of sand, there can be thousands of living organisms. While some of these organisms are small enough to escape the human eye, some of the larger organisms conduct processes below the surface that people still cannot see. For example, the Heart Urchin burrows in between a layer of habitable sediment, and a layer sediment that would normally be devoid of life. But as the Heart Urchin burrows, the movement from the burrowing allows fresh water carrying oxygen to diffuse into the previously inhospitable sediment. This process occurs out of human eyesight, so highlighting the contributions of the Heart Urchin and other organisms is crucial to understanding the Bay.

We also interviewed **Adrian Black, a mobile zoo owner and expert on Australian ecology**. He provided detailed information on Australia's native pollinators including the Australian Stingless Bee and the Grey Headed Flying Fox. He emphasized that these were each keystone species, and explained their specific actions that make them so vital to their respective ecosystems. Adrian also provided elaborate information about tree hollows and nest boxes. He discussed in detail the importance of nest boxes. This is because trees are being cut down, therefore a decrease in tree hollows for animals to live in. He communicated how to best portray the need for action and how to properly educate the audience using animated videos. He also helped describe the life cycle of a short finned eel.

After determining our subject and evaluating several animation programs, we decided to use **Adobe Animate** to create our animations. The software has many features that make creating images and movements very simple. There are also many tutorials to show inexperienced users how to use each of the features (Discover). Appendix A describes specific features that led us to choose Adobe Animate to create our animations.

3.2 Develop and execute our own creative process to animate videos that raise awareness for community conservation efforts.

Our team began this project with **no animation experience**, and finished with the **skills to deliver animated videos** that taught audiences effectively. We accomplished this by preparing carefully before the project term began in January, and by defining our own creative process during the project term. This section chronologically explains our work to accomplish our **feedback-driven video creation goal.**

3.2.1 Learning from Animated Examples

To begin planning our own videos, as a group, we created a database with a variety of videos to help us **learn more about animation best practices.** We also included multiple examples of YouTube channels with animation styles and information portrayals that we want our videos to resemble. These include TedX, CrashCourse, Neural Academy, and Kurzgesagt. The EcoCentre was particularly interested in our ability to replicate the style of TedX, so special attention was given to these videos.

3.2.2 Strategies for Maximizing Learning

Identifying how to make our videos effective teaching tools was a critical step. We found that **intentional segmentation** in instructional videos allows the audience to process the information easier. Breaking information into meaningful pieces reduces the cognitive load and helps the audience process the information (Biard et al., 2018). Their brains make connections between the important elements of each section and avoid drawing connections between unrelated sections. Including small pauses or a blackened screen between sections makes animations **easier to process**. For example, in between sections of our videos, we **included titles** of new species that are being introduced. We also took **longer pauses** in the audio between separate thoughts and scenes.

3.2.3 Strategies for Holding Audience Attention

Next, we researched **techniques to captivate** our audiences. We found that visuals should be manipulated to **emphasize important information** and hold the audience's attention. De Koning et al. (2009) researched the effects of three types of 'cueing' on the audience. These include "selection", which guides the audience's attention to a location, organization, which emphasizes the organization of the topics, and integration, which **shows the relationships between the elements of each topic.** These three types of cueing guide the audience's focus, making them feel more engaged. We implemented these strategies into each of our videos to guide the audience's eyes to the important messages we were trying to convey.

3.2.4 Storyboarding

According to a variety of sources, **storyboarding is a crucial first step** when creating animations. So, to effectively plan out our videos, our team created in depth storyboards before creating each video. A storyboard is a diagram or graphic representation of how the videos will be set up, **shot by shot**. The purpose of the storyboard is to act as a **visual guide** throughout the production process of the video. Having a strong understanding of what is going to happen in the video made the **creation of the videos easier.**

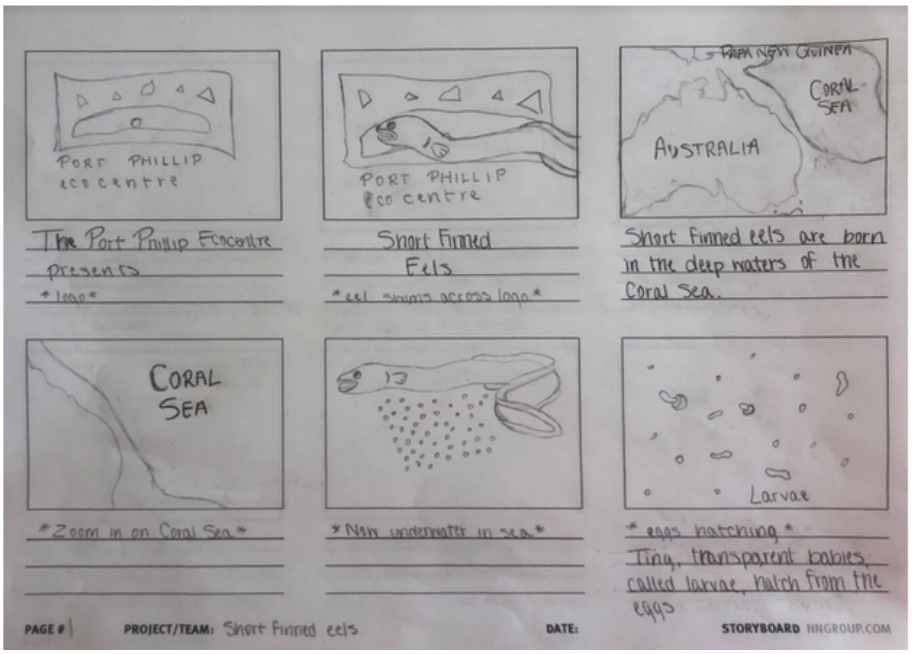

Figure 20: Example of Storyboard

3.2.5 Storyboard Feedback

We were also able to share our storyboards with our sponsors and received important feedback before we even began making the animations. This **eliminated any communication errors** and helped our team **maximize our time** to create the most effective videos possible.

With informal discussion, our goal was to **obtain and evaluate generalized feedback** from the advisors and EcoCentre staff, especially the Executive Director, April Seymore. At the end of the meetings, we took the information we gathered to **edit our storyboards**. The questions we will use for our meetings can be found in **Appendix C**. We then sent the improved versions of the storyboards to the EcoCentre for more in depth feedback from experts on our topics.

3.2.6 Learning to Animate

Once we were satisfied with our storyboards, our group used the tools provided by Adobe Animate to create our animations. These videos were produced in accordance with our **researched best practices and the animation techniques** our team has learned from Adobe Animate tutorials provided by Adobe. In addition, we found a helpful YouTube series named Intro to Adobe Animate 2020: Beginners Tutorial. We also drew inspiration from **12 Principles of Animation**, a tutorial created by an experienced animator named Alan Becker. By using this software and these techniques, we were able to produce **professional-looking animations in a relatively short time frame.**

3.2.7 Our Creative Process

When creating our videos, we decided the most efficient system was a **blend of individual and team work**. With each member of the team choosing their own video to work on, we **reduced potential scheduling and deadline conflicts.** We also **reduced potential software compatibility issues**, which was a concern because each team member, working remotely, had a different type of computer. We chose to share our files in **Google Drive**, making documents and revisions as **accessible as possible**.

We also **met daily** to discuss our progress and share issues. These **workshop-style** meetings allowed us to express our individual creativity while working towards the same goal. We each started with one storyboard, audio script, and background research. Once we received feedback from our advisors, sponsors, and Multicultural Bay Ambassador volunteers, we began animating our videos. The only deviation from this process was choosing to work together on the soft sediment systems video to reach a deadline for an EcoCentre presentation where a video example was desired.

By using this creative process, we stayed ahead of deadlines, delivered more creative work, and maintained a **healthy and collaborative team dynamic**.

3.2.8 Including Iterative Feedback

In order to create the most effective videos for the EcoCentre, **we surveyed both staff and audiences**. With a semi-structured and flexible approach, we were able to improve our work during the production process. In general, we strove to keep our interviews short and our questions concise. We wanted to **ensure accessibility,** especially during the stresses of the pandemic. Per the research of Maddox (2020), we attempted to conduct interviews over live video whenever possible. We were sure to schedule interviews at least a week in advance with respect to time zone differences. Our questions are found in **Appendix D**.

These questions were posed via virtual meetings with EcoCentre staff and other stakeholders, such as translators. We also added these questions to a Google Form and sent the form to our audiences. This form is found in **Appendix E**, and includes questions to gather feedback on the videos themselves, in addition to post-viewing checks for understanding. The results of pre- and post-testing are discussed in **5.2: Educational Value of Our Animations**.

The EcoCentre **promoted our work** during live virtual events as well as emails to volunteers and community members. By including the surveys in the video descriptions, we made it **easier for audience members to participate** in our data gathering. In addition to the Australians we surveyed, we worked with WPI students in our class to improve our videos. By showing our videos during weekly class meetings, we received prompt feedback about specific elements as shown in **Appendix F**. As seen in **Appendix F**, our data was collected in one Google Form per video. This allowed us to quickly identify patterns, repeated phrases, and comments that improved our work.

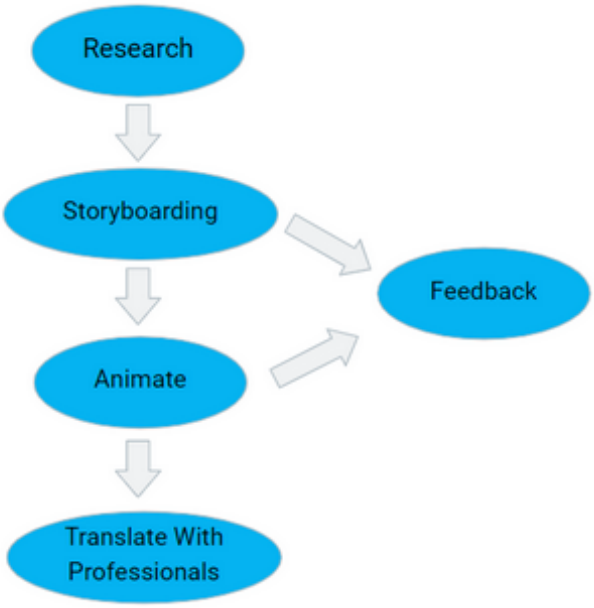

Figure 21: Our Creative Process Visualized

3.3 Translate the audio and textual components of each video based on our research of communication across diverse communities to best reach our audiences.

In order to take into account the multicultural and multilingual aspect of our audience, we have examined the most effective techniques of incorporating these aspects into animation. Multiple different cultures are reached by our videos, so the language needed to be simple and clear enough that when translated, the message was still understood. We interviewed four of the EcoCentre's previous **Multicultural Bay Ambassadors** (summer interns who are not native to Australia and use their knowledge of their native culture to assist the EcoCentre in developing and hosting events (Yamada, 2019) to **understand how to make the animations appropriate and understandable for multicultural audiences**. These interviews were semi-structured, as we wanted to allow for discussion and open-ended questions. We asked questions about the appearance, content and wording of the animations to ensure that all of our ideas would translate well into other languages and cultures. The interview questions can be found in **Appendix B**. At the conclusion of the interviews, we compared the answers to each question and made concrete lists of the strategies necessary for working with multicultural audiences.

Based on our interviews with the EcoCentre's Multicultural Bay Ambassadors during our research phase, **we will have written the narrative in a way that translates seamlessly into other languages**. We will be contacting the Multicultural Bay Ambassadors again to see if they would be willing to assist us in translating the videos to their native languages. We will work alongside them to understand their language and ensure that our narrative remains the same after the translation process.

Based on the responses we receive from the Multicultural Bay Ambassadors, we will need to contact others who are **experts in these languages**. We will set up meetings with our own contacts as well as international students and language professors at WPI to work together to translate the videos. WPI has a large population of international students who will be able to assist us in our translations. As of 2018, the student body consisted of 18.7 percent international students from at least 42 countries, and that number has continued to grow ("Worcester Polytechnic Institute International.", 2013). Therefore, there are many students we could approach to assist us with their knowledge.

We solicited translation help from EcoCentre volunteers when the Multicultural Ambassadors, WPI international students, and professors were unable to translate our videos. We let our translators decide if they created subtitles, audio or both based on their comfort level. The complete list of translators can be found in **Appendix F.**

3.4 Gantt Chart

Tasks	28 Jan - 3 Feb	4 - 10 Feb	11 - 17 Feb	18 - 24 Feb	25 Feb - 3 Mar	4 - 10 Mar	11 - 17 Mar
Research Video Topics							
Interview Multicultural Bay Ambassadors							
Storyboarding							
Interview Ecocentre Staff about Storyboard							
Video Creation							
Interview EcoCentre Staff about Animations							
Audience Survey							
Final Video Revisions							
Final Report Writing							
Presentation Creation							
				*Wrap up first video			

Figure 21: Gantt Chart

4.0 Findings

This section describes the takeaways that we had from our interviews throughout the project. This includes the meetings with the Multicultural Bay Ambassadors as well as EcoCentre volunteers and employees. We have excluded the names of the specific Bay Ambassadors for their privacy.

4.1 Considerations for Creating Animations

Animations are most effective for the community if they support existing programs or concepts that are difficult to explain within a program. The EcoCentre has created a series of videos on their YouTube channel that describe how to create a nest box and what they are. The animation about the importance of nest boxes shows the viewers why they are necessary to motivate them to create their own. Short Finned Eels can be found in the city of Melbourne, so if children see them swimming in the storm drains, they will know what they are and be able to **make a connection to the video**. It is not possible to see the processes that occur in the soft sediment systems of the bay, so an animation provides viewers with a better understanding of the processes and shows them how **important each aspect of their local ecosystem is**. Finally, the pollinators and their flowers are all over the city, so the animation can show children the effects of a lack of pollinators on the plants in the city, and why those species should be protected.

The target audience for an animation affects the information presented, vocabulary used and the visuals. Children will not understand high level scientific concepts and vocabulary, so **large concepts need to be broken down into a series of tiny concept explanations and the wording of each needs to be simple**. Furthermore, children will become distracted by unimportant visuals, but their understanding will be **enhanced by supportive visuals**. For example, zookeeper Adrian Black keeps a sugar glider in his front shirt pocket to simulate a nest hollow, and shows children the importance of those for the animal's comfort.

Cultural sensitivity is important to reach a multicultural audience. In order to allow children of different cultures to connect to the videos, they **must feel represented**. By ensuring the characters have personal qualities that are viewed positively in every culture, the children can better connect to them and understand the meaning behind each action the character takes. After our interviews of four previous Multicultural Bay Ambassadors from the EcoCentre, we determined that the **personal qualities were relatively the same across each culture**. The personal qualities that are necessary for characters to have are very similar. Our responses included:

- bubbly (mentioned multiple times)
- very friendly to other characters
- warm
- respectful to elders (mentioned multiple times)
- Close connection to community

All of these responses are very similar, and can easily be reflected in a character to allow children of all cultures to connect to the character. In addition, multiple Bay Ambassadors mentioned that if a human character was wearing a traditional dress from their culture, the children would be able to connect with that character better. When the children see someone that looks like them, as well as acts like them, they can **develop a better attachment to that specific character.**

Furthermore, it is important that none of the information presented is offensive to any cultures, as this would result in less viewers for the videos and less community engagement for the EcoCentre. Each of the Multicultural Bay Ambassadors identified aspects of Australian culture that may be different than their own and that are frowned upon. These included:

- Improper manners/etiquette
- Improper titles/honorifics used
- Public affection (mentioned multiple times)
- Opposite sex touching (hugging hello, etc.)
- Wearing loud or revealing clothes

Many of these did not apply to our animations since we mainly use animal characters, as opposed to people. Therefore, we concluded that **no aspects of our animations will offend viewers from other cultures.**

5.0 Finalized Animations for Melbourne's Multicultural Audiences

This section includes three key frames from each of the four videos we created, which are: Soft Sediment Systems, Nest Hollows, Nest Boxes and Bat Tubes, Ntive Pollinators in the City and Short-finned Eels. For the full videos, please visit the Ecology Animations Team YouTube and select the video in your preferred language.

5.1.1 Soft Sediment Systems

Lead Editor: Mike Bedard

The soft sediment systems video examined the ecosystem at the bottom of the Port Phillip Bay and the effects of this system on the greater web of plant, animal, and human life. The video starts by defining the soft sediment system, explaining the characteristics of the three main layers. Next, the ecosystem engineers are introduced and their interactions with the sediment and each other are shown. These interactions, and the sediment system itself, is very challenging to portray with traditional cameras and filming techniques. Thus, the animated nature of this video allowed for a more comprehensive examination.

After introducing the sediment system and ecosystem engineers, audiences are shown the different plants and animals benefit from the ecological processes occurring at the bottom of the bay. These organisms are more recognizable to the average viewer and include the endemic Burrunan Dolphin, the Little Penguin, and Weedy Sea Dragons. The video then ends with a reminder of the importance of the ecosystem engineers and the soft sediment system.

Figure 21: Mangroves, One of the Ecosystem Engineers, at Work.

Figure 22: Relationship Between Sponges, Sediment, and Animal Life

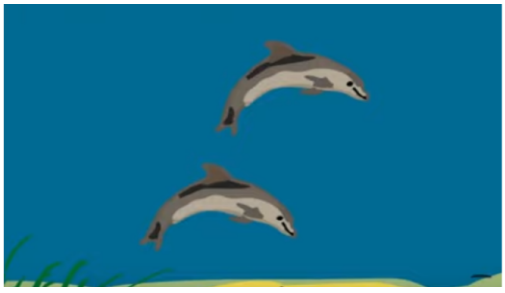

Figure 23: Introducing the Burrunan Dolphin, an Endemic Species

5.1.2 Nest Hollows, Nest Boxes and Bat Tubes

Lead Editor: Suela Miloshi

The Nest Hollows, Nest Boxes, Bat Tubes animation discussed the need for nest boxes and bat tubes. Nest hollows are very important for hollow dependent species. They provide a form of shelter and protection to these animals. In the extreme heat of summer, these species use nest hollows as cool refuge. The video explains the growing issue that trees in Victoria are being cut down for several reasons.

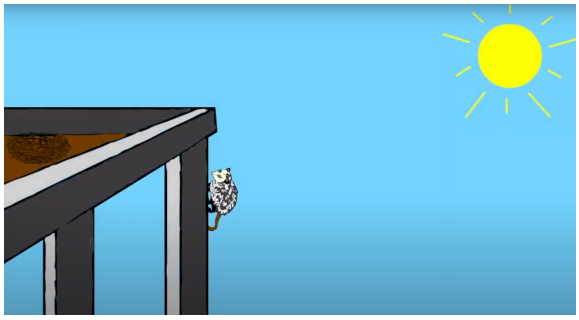

Figure 24: Hollow Dependent Possum in search for unique spaces to inhabit

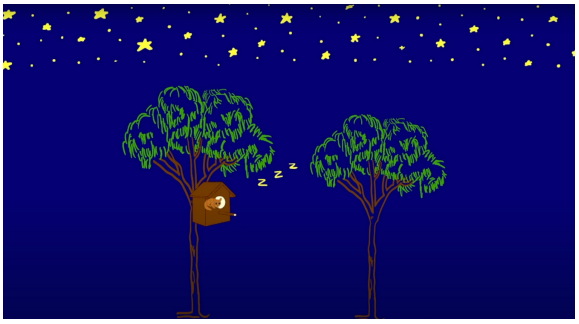

Figure 25: Nest Boxes provide a safe space for species to rest and sleep

This, however, leaves hollow dependent species in need for spaces to inhabit. Some examples of these hollow dependent species are ducks, parrots, possums, bats, and sugar gliders.

In order to save the lives of these hollow dependent species, change needs to happen now. Even if trees were to be replanted now, it would take over one hundred years for tree hollows to even begin to form. Now, these hollow dependent species have to find unique spaces to inhabit. For example, in the Melbourne area, possums are typically found creating homes on top of roofs. Therefore, nest boxes, and bat tubes are a great alternative to save these hollow dependent species from endangerment.

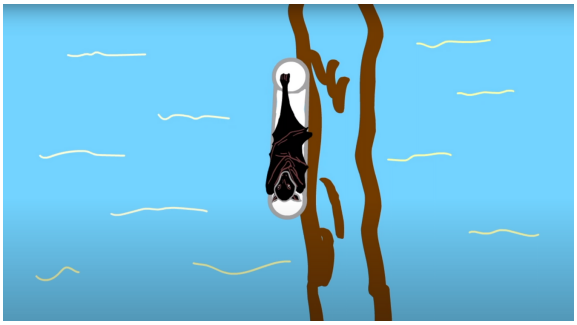

Figure 26: Bat rests in bat tube

5.1.3 Native Pollinators in the City

Lead Editor: Tanner McCarthy

The Native Pollinators animation looked to demonstrate the importance of pollination, and explain how different animals pollinate. This is not a process that is easily witnessed in person, so an animation was necessary to educate viewers. The animation begins with an introduction to pollination, describing the parts of a flower and how the pollination process allows them to reproduce.

Figure 27: Blue Banded Bee Performing Buzz Pollination

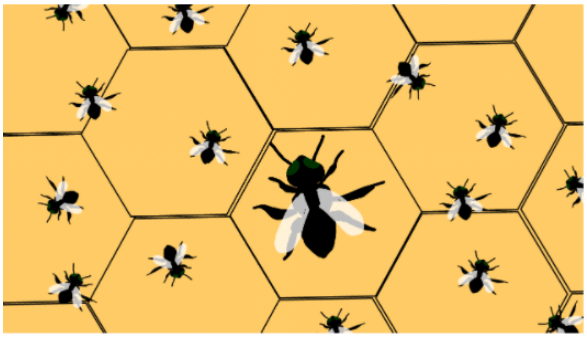

Figure 28: Australian Stingless Bees In Their Hive

From there, the animation transitions to highlighting three of Australia's most important native pollinators. This begins with the Blue Banded Bee, who pollinates in a unique way called buzz pollination. The animation then shifts to highlighting the Australian Stingless Bee and how it performs cross pollination.

Grey Headed Flying Foxes and how they cross pollinate is the next focus of the animation, due to many people lacking knowledge of pollinators outside of bees and other insects.

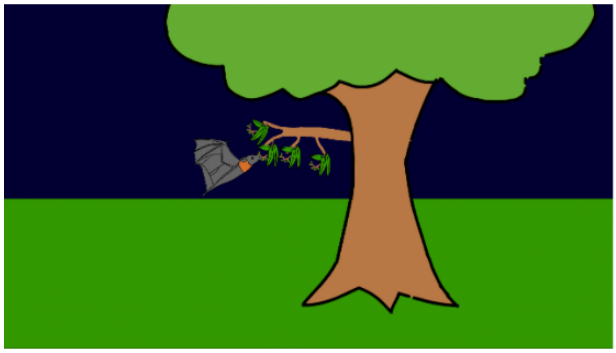

Figure 29: Grey Headed Flying Fox Eating Eucalyptus

5.1.4 Short-finned Eels

Lead Editor: Erin Perry

The short-finned eels video aimed to educate viewers on the lifecycle of eels. Since they travel thousands of kilometers, it is a difficult process to explain without visual guides. Furthermore, since the eels can find their way into the city storm drains and even streets, as well as the local lakes, dams, it is important for residents to understand how the eels got there.

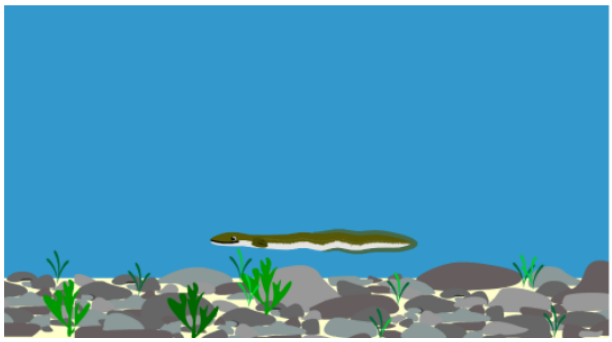

Figure 30: Eel Swimming in a Freshwater Stream

Figure 31: Geographical Context for the Eels' Journey

The animation begins when the eels are born as eggs, and follows the journey of the eels to Port Phillip Bay and then to their homes in the lakes and ponds in Victoria. Once they have fully grown, the animation follows the eels through their long migration back to their birthplace, where they have their own children and ultimately die.

The animation highlights facts about eels as they develop throughout the journey such as their size, historical importance, diet, and the scientific name of each growth stage.

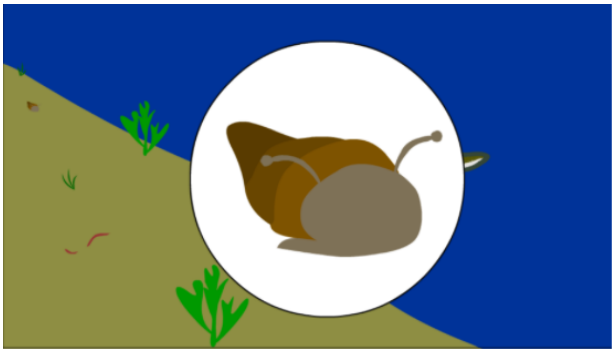

Figure 32: Introducing Diet of Eels

5.2 Educational Value of our Animations

To ensure the animations we created provide a high educational value for the EcoCentre to teach their visitors about each of the topics, we made pre-tests and post-tests for each video and surveyed our audiences. Figure X displays the results from each of the tests. Each of the mean post-test scores is drastically improved from the pre-test scores. Although the audience did score an average of approximately 40% on each pre-test, there was still improvement seen by each participant. For example, in the short-finned eels pre-test, the minimum score was 12.50%. However, the minimum score on the post-test was 68.75%, which is a 450% increase from the pre-test. Similarly, the nest hollows pre-test had a minimum score of 0%, and the post-test minimum was 57.14%. The other two videos also had similar results. This shows that everyone who watched the videos gained new knowledge on the topics.

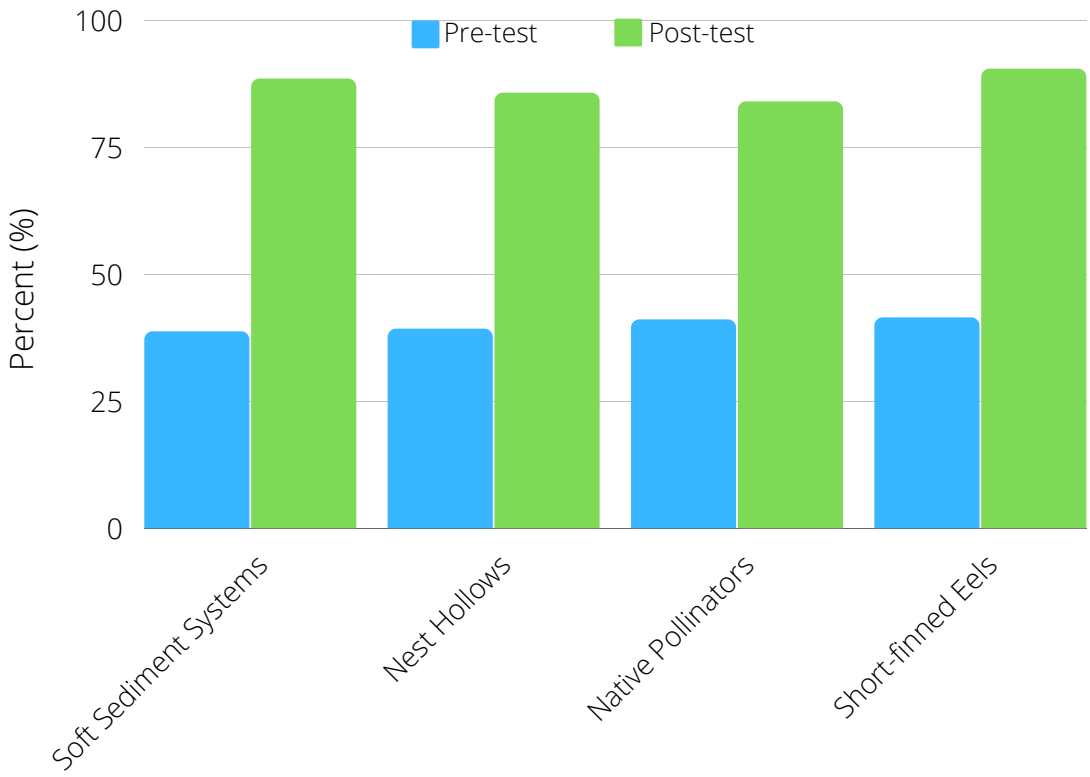

Figure 33: Pre-test and Post-test Mean Scores

6.0 Conclusion

Melbourne and the Port Phillip Bay face many environmental issues that negatively affect their ecosystems. Through research and video creation, we worked to help the EcoCentre achieve their mission of educating their community about these issues. Throughout the process of creating the videos, each of us gained new skills in not only research and interviewing, but also in storytelling, writing for a specific audience and creating animations. Without closely working together as a team we would not have been able to learn an entirely new software and accomplish this project. Our videos have already been used to teach audiences at the EcoCentre's virtual Culture and Nature Festival and will be shown on the large screens in Federation Square in Melbourne during the spring. The EcoCentre plans to put these videos on their website so that all of their volunteers and visitors have access to them, and also plan to create worksheets and activities based on the videos with graphics taken from each video. Through our project work, we hope to have created resources for the Ecocentre and similar organizations to use animations to educate their visitors and empower them to take better care of the environment they live in. We also hope that others will begin to implement our multicultural research practices before creating public educational resources in the future.

7.0 References

". 12 Best Animation Software for Beginners (Premium, Free, and Online)." GraphicMama Blog, 13 Mar. 2019, https://graphicmama.com/blog/best-animation-software-for-beginners/.

AlanBeckerTutorials. (2017, May 30). *12 Principles of Animation* (Official Full Series) [YouTube Video]. https://youtu.be/uDqjIdI4bF4

"Animation Software: Which One Should You Use? The Complete Guide." Bloop Animation, 10 Oct. 2013, https://www.bloopanimation.com/animation-software/.

Arundel, H., & Barton, J. (2007). A review of knowledge of selected estuaries in the Port Phillip Bay and western port bay regions [Melbourne Water]. http://dro.deakin.edu.au/view/DU:30020308

Atkinson, J. (2017, June 2). Port Phillip EcoCentre scores $600,000 grant for Water Workbees and Clean Bay Blueprint. *The Herald Sun*. https://www.heraldsun.com.au/leader/inner-south/port-phillip-ecocentre-scores-600000-grant-for-water-workbees-and-clean-bay-blueprint/news-story/c5013576a5864d76be1d57e1bada284b

Australia, A. of L. (n.d.). Species: Anguilla australis (Southern shortfin eel). Retrieved February 4, 2021, from https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:474949ae-5d6c-4d27-bc3b-dcd20db93e18

Authority, V. F. (2015, July 29). Short-finned eel. VFA. https://vfa.vic.gov.au/education/fish-species/short-finned-eel

Beebe, J. (2014). Rapid qualitative inquiry: A field guide to team-based assessment. Rowman & Littlefield.

Biard, Nicholas, et al. "Effects of Segmentation and Pacing on Procedural Learning by Video." Computers in Human Behavior, vol. 89, Dec. 2018, pp. 411–17. www.sciencedirect.com, doi:10.1016/j.chb.2017.12.002.

Biodiversity 2037. (n.d.). Victoria State Government. Retrieved November 14, 2020, from https://www.environment.vic.gov.au/biodiversity/biodiversity-plan

Bishko, L. (n.d.). Animation Studies – Vol.2, 2007.

Briggs, Carolyn. & O'Meara, John. & Victorian Aboriginal Corporation for Languages, issuing body. (2014). The journey cycles of the Boonwurrung : stories with Boonwurrung language. Melbourne, Victoria : Victorian Aboriginal Corporation for Languages

Brown, Andy, et al. "Dynamic Subtitles: The User Experience." Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video, Association for Computing Machinery, 2015, pp. 103–112. ACM Digital Library, doi:10.1145/2745197.2745204.

Climate change impacts on Melbourne. (n.d.). City of Melbourne. Retrieved November 14, 2020, from https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx#:%7E:text=Our%20climate%20in%20Victoria%20has,well%20as%20sea%20level%20rise

Common Blue-banded Bee (n.d.). The Australian Museum. https://australian.museum/learn/animals/insects/common-blue-banded-bee/.

Cox, E. (2020, May 14). *What is a coronavirus?* https://www.youtube.com/watch?v=D9tTi-CDjDU&list=WL&index=12&t=99s

Creating habitats for wildlife in our garden, schools, businesses and local areas...(n.d.). Green Song. https://dplandscapedesign.weebly.com/wildlife-gardens.html

Dahlman, L., & Lindsey, R. (2020, August 14). *Climate Change: Global Temperature.* NOAA. Retrieved November 14, 2020, from https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature#:%7E:text=According%20to%20the%20NOAA%202019,more%20than%20twice%20as%20great

de Koning, Björn B., et al. "Towards a Framework for Attention Cueing in Instructional Animations: Guidelines for Research and Design." Educational Psychology Review, vol. 21, no. 2, June 2009, pp. 113–40. Springer Link, doi:10.1007/s10648-009-9098-7.

Discover | Adobe Creative Cloud. https://creativecloud.adobe.com/discover/learn/animate/beginner/graphic-design/drawing/drawing-in-animate-cc. Accessed 16 Nov. 2020.

Disney, Oh My. "The 12 Principles of Animation as Illustrated through Disney." Oh My Disney, 20 July 2016, https://ohmy.disney.com/movies/2016/07/20/twelve-principles-animation-disney/.

Eigenraam, M., McCormick, F., & Contreras, Z. (2016). *Marine and Coastal Ecosystem Accounting: Port Phillip Bay* [Text]. The State of Victoria Department of Environment, Land, Water and Planning. https://www.environment.vic.gov.au/__data/assets/pdf_file/0025/49813/Marine-and-Coastal-Ecosystem-Accounting-Port-Phillip-Bay.pdf

Grey-headed Flying-fox (n.d.). Backyard Buddies. https://www.backyardbuddies.org.au/backyard-buddies/grey-headed-flying-fox#:~:text=People%20often%20complain%20about%20the,are%20an%20important%20keystone%20species.

HOW DOES COVID-19 AFFECT THE BODY? (2020, February 26). https://www.youtube.com/watch?v=Xj1nUFFVK1E&list=WL&index=5

Languages Spoken at Home. (n.d.). City of Port Phillip. https://profile.id.com.au/port-phillip/language

Maddox, A. (2020). *Doing Online Interviews.* https://docs.google.com/document/d/1clGjGABB2h2qbduTgfqribHmog9B6P0NvMgVuiHZCl8/edit?ts=5e88ae0a#

Marine Mammal Foundation. (2020). *Burrunan dolphin.* Marine Mammal Foundation. https://marinemammal.org.au/burrunan-dolphin/

McArthur, Matthew. *Port Phillip Bay Ecology*. 8 Feb. 2021.

McElhaney, Kevin W., et al. "Evidence for Effective Uses of Dynamic Visualisations in Science Curriculum Materials." *Studies in Science Education*, vol. 51, no. 1, Jan. 2015, pp. 49–85. *Taylor and Francis+NEJM*, doi:10.1080/03057267.2014.984506.

Mckinnon, L. J., & Gooley, G. J. (1998). Key environmental criteria associated with the invasion of Anguilla australis glass eels into estuaries of south-eastern Australia. Bulletin Français de La Pêche et de La Pisciculture, 349, 117–128. https://doi.org/10.1051/kmae:1998037

Meet the Creatures in Port Phillip Bay | The Nature Conservancy Australia. (n.d.). The Nature Conservancy Austraila. Retrieved November 8, 2020, from /explore/australian-animals/meet-the-creatures-in-port-phillip-bay

Meyer, J. (2016). *How to Storyboard an App or Website.* https://medium.com/@jjman505/how-to-storyboard-an-app-ede5ce249ea5

MORE INFORMATION ON BLUE BANDED BEES (Amegilla). (n.d.). Blue Banded Bee (Amegilla). https://www.aussiebee.com.au/blue-banded-bee-information.html
Native fish Australia. (n.d.). Retrieved February 4, 2021, from https://www.nativefish.asn.au/home/page/Short-Finned-Eel

Why are flying-foxes protected? (2020, December 23). NSW Environment, Energy and Science. https://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/flying-foxes/why-protected.

Plant Cells: Crash Course Biology #6. (2012, March 5). https://www.youtube.com/watch?v=9UvlqAVCoqY&list=WL&index=1

Plass, Jan L., et al. "Design Factors for Educationally Effective Animations and Simulations." *Journal of Computing in Higher Education*, vol. 21, no. 1, Apr. 2009, pp. 31–61. DOI.org (Crossref), doi:10.1007/s12528-009-9011-x.

Port Phillip, E. (n.d.). *Gio's Nestbox Forum.* https://www.dropbox.com/s/zul7047tuwzkwlb/Gio%20Nestbox%20Forum%20BookletSoftCopy.pdf?dl=0

Preiss, B. (2019, July 28). Rising tide of plastic choking Port Phillip Bay. *The Age.* https://www.theage.com.au/national/victoria/rising-tide-of-plastic-choking-port-phillip-bay-20190727-p52bcn.html

Quirós, G. (2019, May 7). *Honey Bees Make Honey ... and Bread?* KQED. https://www.kqed.org/science/1940898/honey-bees-make-honey-and-bread#:~:text=Older%20female%20adult%20bees%20collect,colony's%20main%20source%20of%20protein

Read our 2019/20 Annual Report. (2020, October 16). Port Phillip EcoCentre. Retrieved November 14, 2020, from https://ecocentre.com/blog/2020-10-16/annual-report

Shiao, J.-C., Tzeng, W.-N., Collins, A., & Jellyman, D. J. (2001). Dispersal pattern of glass eel stage of Anguilla australis revealed by otolith growth increments. MARINE ECOLOGY PROGRESS SERIES, 219, 241–250.

Support, E. W. (2019, December 24). *Reproductive Plant Parts.* OSU Extension Service. https://extension.oregonstate.edu/gardening/techniques/reproductive-plant-parts.

Taylor et al. "Port Phillip Bay Taxonomy Toolkit." *Port Phillip Marine Life*, https://portphillipmarinelife.net.au/search?searchType=Species. Accessed 10 Feb. 2021.

Thangngo. (2017, July 16). *Top Languages Spoken in Victoria*. IDENTITY Communications. https://identitycomms.com.au/2017/07/top-languages-spoken-victoria/

TipTut. (2020, February 3). *Intro to Adobe Animate* 2020 | Beginners Tutorial (Vols. 1-4) [YouTube Video]. https://youtu.be/7huMYp7WpsI

The City of Melbourne. (2017). *Nature in the City* (p. 60) [Text]. https://www.melbourne.vic.gov.au/SiteCollectionDocuments/nature-in-the-city-strategy.pdf

The Port Phillip EcoCentre. (2016). *EcoCentre Constitution* [Text]. https://ecocentre.com/sites/default/files/images/Documents/Constitution/EcoCentre%20Constitution%20%28Amended%20Oct%202016%29.pdf

The Port Phillip EcoCentre. (2018). E*coCentre Strategic Plan* 2018-2021 [Text]. https://ecocentre.com/sites/default/files/images/Documents/Strategic%20Plans/EcoCentre%20Strategic%20Plan%202018%202021.pdf

The Port Phillip EcoCentre. (2020a). *EcoCentre Annual Report* 2019-2020 (p. 62). https://ecocentre.com/sites/default/files/images/Documents/Annual-Reports/EcoCentre%20Annual%20Report%202020.pdf

The Port Phillip EcoCentre. (2020b). EcoCentre Redevelopment [Text]. https://ecocentre.com/redevelopment

The Port Phillip EcoCentre. (2020c). *Our Awards* [Text]. https://ecocentre.com/awards

The Port Phillip EcoCentre. (2020d). *Our Story* [Text]. https://ecocentre.com/ourstory

The Port Phillip EcoCentre. (2020e). *Programs* [Text]. https://ecocentre.com/programs

2016 Top 10 Languages Spoken in Melbourne. (2016). [Census Data]. Australian Bureau of Statistics.

The Side Effects of Vaccines - How High is the Risk? (2019, May 12). https://www.youtube.com/watch?v=zBkVCpbNnkU&list=WL&index=6

Thomas, Owolabi Olabode, and Oginni Omoniyi Israel. "Effectiveness of Animation and Multimedia Teaching on Students' Performance in Science Subjects." *Journal of Education, Society and Behavioural Science*, 2014, pp. 201–10. www.journaljesbs.com, doi:10.9734/BJESBS/2014/3340.

U.S. forest Service. (n.d.) https://www.fs.fed.us/wildflowers/pollinators/What_is_Pollination/.

Vallejo-Marín, M. (2019, January 23). *Buzz pollination: studying bee vibrations on flowers.* New Phytologist Foundation. https://nph.onlinelibrary.wiley.com/doi/full/10.1111/nph.15666.

Victoria's bushfire emergency: Biodiversity response and recovery. (n.d.). Victoria State Government. Retrieved November 14, 2020, from https://www.wildlife.vic.gov.au/home/biodiversity-bushfire-response-and-recovery

What climate can we expect in Port Phillip in the future? (n.d.). City of Port Phillip. Retrieved November 14, 2020, from https://www.portphillip.vic.gov.au/people-and-community/sustainability-action/climate-projections

Vewh—Creature feature: Short-finned eels. (n.d.). Retrieved February 4, 2021, from https://www.vewh.vic.gov.au/news-and-publications/stories/creature-feature-short-finned-eels

"Worcester Polytechnic Institute International." College Factual, 20 Feb. 2013, https://www.collegefactual.com/colleges/worcester-polytechnic-institute/student-life/international/.

Yamada, Reiko. Multicultural Bay Ambassadors. 3 Jan. 2019, https://ecocentre.com/bayambassadors.

Zachos, E. (2021, February 10). *These Australian Stingless Bees Have Spiral Hives-Here's Why. Animals.* https://www.nationalgeographic.com/animals/article/australian-stingless-spiral-bee-hive-construction-tetragonula-carbonaria-spd#:~:text=Colloquially%20called%20%22sugarbag%20bees%22%20in,species%20forms%20complex%2C%20spiral%20hives.&text=Tetragonula%20carbonaria%20is%20the%20only,queen%20overseeing%20thousands%20of%20workers.

Appendix A: Animation Software Considerations

Automatic lip syncing makes animated characters easy to manipulate. Adobe Animate has a built in tool that automatically lip syncs the mouths of characters to the words they are speaking (Discover). They provide options for the mouth shape of each character, and for each sound that the character could make when speaking the user simply selects a provided mouth shape. Whenever the character needs to make that sound, the mouth shape is automatically used. This makes the animation more realistic and makes it easier for the animator to create detailed animations.

Layer Parenting and Hinging allow animations to flow smoothly between frames. Layer Parenting allows relationships to be formed between elements of each layer (Discover). For example, the relationship between all of the body parts of a character can be set through layer parenting; the calf is a child of the leg, which is a child of the hip. Each of the child features moves when its parent feature moves. The parent feature moves along a preset hinge. The hinge is set by the animator and is the point that the selected object rotates around (Discover). For example, a leg would be rotated around the uppermost edge that connects to the hip. Using these tools together, the animation moves easily between poses.

All of these features together create a professional looking animation easily created by beginners. So long as each of the Adobe tools, as well as the strategies for animation, are implemented, the animation will be appealing for the viewers.

Appendix B: Interview Questions for Multicultural Bay Ambassadors

- What are common behaviors you may have noticed while in Australia that are frowned upon in your native country?
- What are the core values that the people of your native country possess that are different from those in Australia?
- Have you noticed any common English phrases that do not translate well to your native language?
- If we include human characters in some of our animations, what characteristics (physical and personality) would a child of your culture connect to?
- What aspects of an animation do you think are the most important to reach other cultures?

Appendix C: General Storyboard Discussion Questions

- What did you like/dislike about the storyboards? Why?
- Did you understand the content of the storyboards?
- Do you have any suggestions on the content of the storyboards? The animations? The text?
- How can we improve our storyboards?
- Did we convey the main ideas that you wanted us to include in the storyboards? If not, what are we missing?
- Overall, did the storyboard interest you? In other words, would you be excited to watch this video?

Appendix D: Interview Questions for EcoCentre Staff and Audiences

- In general, did you like or dislike the animated video?
- Why did you like or dislike the animated video?
- Did you understand the content of the video? What did you understand best?
- If you were already familiar with the content of the video, did you still find this animation beneficial?
- Were there any unnecessary elements (visuals, audio)?
- How would you improve this video?

Appendix E: Division of Labor

	Paper	Animations
Mike	1.0, 2.1-2.2 2.4.2	Soft Sediment Systems, Music
Tanner	2.3.2, 5.0, [cut two sections after ID2050]	Native Pollinators
Suela	1.0, 2.3.3, 2.5	Nest Hollows
Erin	2.3.4, 2.6-2.7, 5.0	Short-finned Eels
Everyone	3.0, 4.0, 6.0, Appendices	Prepping Soft Sediment Systems Video for EcoCentre Festival

Appendix F: Translation Credit

- Arabic
  - Mostafa Chehadeh
  - Karam Hallak
- Australian (audio)
  - Ben Francischelli
  - Didi Magtuto
- French
  - Mike Bedard
- Greek
  - The Miloshi Family
- Mandarin
  - Joseph Shih
  - Jinhua Xue
- Spanish
  - Matthew Casserly
  - Evan Costa
  - Nico Panzardi
- Vietnamese
  - Julie Pham