

Diving Into The Twilight Zone VR for Marine Science

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(a) Viewing lobsters.

(b) Viewing stingrays.

(c) Viewing fish in a cave.

Figure 1: Underwater Marine VR: 360° videos of underwater marine science VR experiences.

ABSTRACT

Teaching students about underwater marine science is difficult due to the limitations required to access underwater environments. Marine science is typically not taught until tertiary education levels. We have developed a Virtual Reality experience for teaching marine science activities focusing on high school students. Our education programme and VR tool can help train the next generation of students into learning and being aware about marine science.

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1 INTRODUCTION

Despite Aotearoa, New Zealand having one of the largest marine areas in the world the majority of school children can't access

underwater environments directly, and marine science tends not to feature in the school curriculum until tertiary education.

Our approach takes students on a journey into the life of a marine scientist. Using cutting-edge technologies in 360-degree underwater videography, we provide an immersive Virtual Reality (VR) dive into a marine environment that is inaccessible to most people – *the twilight zone*. We provide a unique opportunity for students to drive our remotely operated vehicles (ROVs) in confined pool sessions enabling students to learn about how technology supports the exploration of underwater environments. School students can work directly with university students who share personal experiences around education and subject choices, enabling school students to see first-hand how they themselves might pursue this career.

Our project promotes the importance of collaboration between STEM subjects to answer big questions about the functioning of marine environments. Without deploying state of the art technologies we cannot hope to fully understand these ecosystems; and without a full understanding we cannot conserve them. Students who experience our project will gain an increased appreciation of the relevance of marine science to our economy and human wellbeing.

Through this journey of discovery, children will increase their interest in marine science and engineering, better understand pathways into higher education and strive for careers they may not have otherwise considered. We hope to inspire our audience to be good global citizens, and to share their knowledge with family and friends, and also their own experiences with us.

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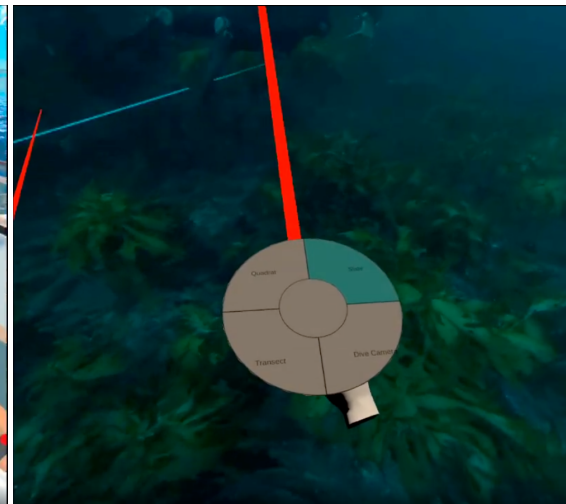
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(a) On the boat selecting equipment for a dive.



(b) User interface controls for switching between the different equipment.



(c) Using the quadrat to sample and estimate species.



(d) Setting up the transect to sample distribution and abundance of species.

Figure 2: MarineVR – underwater marine science experience demonstrating the scientific tools.

2 UNDERWATER MARINE VR

Underwater Marine VR (Figure 2) is the VR app experience we have developed to support high school students to learn about marine science in the twilight zone. The app is available on the Meta Oculus store including a video¹. The VR experience starts with the diver on a wharf with instructions on what to do during the experience along with tips on how to interact using the VR controllers. The app contains 360° videos of footage we have taken from protected marine reserves within New Zealand and integration with 3D assets to create a seamless VR experience.

Figure 2(a) shows a diver on a boat in the ocean. There are options to select one of the four available pieces of equipment before diving. These include: quadrat, transect, scribe, and camera. Once an item

has been selected the diver can then choose one of the seven dive experiences which shows different kinds of 360° experiences as displayed in Figure 1. Figure 2(b) shows the VR controls once a diver is under water where upon they can select one of the different pieces of equipment. Not all dives take all the equipment, hence for usability reasons we designed the app to be able to switch equipment easily. Figure 2(c) shows the diver setting up the quadrat (orange and red tubing) which is used to sample an estimate of the density of a species in an area. Figure 2(d) shows a diver using the transect which is used for sampling to study the distribution and abundance of different species along a line or pathway and data is collected at regular intervals. We are now evaluating our Underwater Marine VR experience with high school children on outreach excursions, field trips, and University open days.

¹Available at <https://www.oculus.com/experiences/quest/5275983562492506/>