

# MarineXR

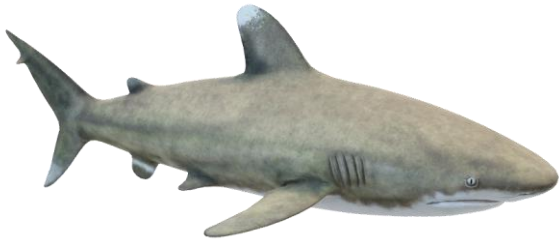
An augmented reality ocean experience



**Explore the wonders of our oceans...**



**No scuba gear required.**



Online web resources including lesson plans:

<http://marinexr.ca>

Mobile application available through:



Marine XR: Ocean education in AR



In collaboration with:

**E-X-A-R**  
STUDIOS

# Land Acknowledgement

We acknowledge that Western University and EXAR Studios is located on the traditional territories of the Anishinaabek (Anish-in-a-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ahpay-wuk) and Chonnonton (Chun-ongk-ton) Nations, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous Peoples (First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land, waterways and oceans and vital contributors of our society.

# Accessibility

## **Website accessibility**

MarineXR features a companion website (<http://marinexr.ca>) where further information is provided including detailed lesson plans and guidelines for instructors. The Web Content Accessibility Guidelines, WCAG 2.0, are a global standard in accessibility for website developers that was created by the World Wide Web Consortium (W3C). As per the Accessibility for Ontarians with Disabilities Act, 2005 (AODA), we have made significant efforts to ensure that the MarineXR website complies with WCAG 2.0.

## **Mobile augmented reality application**

Accessibility standards for extended reality (XR) content developers are still evolving (<https://www.w3.org/TR/2021/NOTE-xaur-20210825/>), but they can include adjustments such as providing captions for audio files. In addition, W3C recommends that wherever possible, immersive content be customizable for people with different cognitive and learning disabilities. Our MarineXR mobile application has closed captioning in any location where there is audio narration and allows instructors to fully customize in-app assessments and species information (including alternative languages) through a separate instructor portal. We focused on providing this level of customization because we are hopeful it will allow instructors to implement a more personalized level of augmented reality experience, particularly for those facing accessibility challenges.

Comments or suggestion regarding accessibility for our web or mobile development projects can be sent to the project leader, Dr Paul Mensink ([paul.mensink@uwo.ca](mailto:paul.mensink@uwo.ca)).

# Licenses

The MarineXR project has a range of educational components included. Below are the relevant license types for each resource.

<b>Component</b>	<b>License</b>
MarineXR (mobile application)	<a href="#"><u>CC BY-NC-ND</u></a>
Instructors guide	<a href="#"><u>CC BY-NC-ND</u></a>
Lesson plans	<a href="#"><u>CC BY-NC</u></a>

MarineXR is a joint collaboration between The Faculty of Science at Western University and Canadian creative company, EXAR Studios.



This project was supported by the Unity Charitable Fund, a Fund of the Tides Foundation, and made possible with funding by the Government of Ontario and through eCampusOntario's support of the Virtual Learning Strategy. To Learn more about the Virtual Learning Strategy visit:

<http://vls.ecampusontario.ca/>



*ecampus*  
Ontario

# Motivation for MarineXR

The development of science education within our post-secondary institutions, including broadly building scientific literacy and inquiry for the purposes of creating well-rounded citizens, is of critical importance for both scientists and non-scientists alike. A transition to hybrid campuses must continue to engage students in science, especially those from diverse disciplinary backgrounds that see themselves less as science 'people' and report a lack of intrinsic motivation and engagement with STEM subject matter.

MarineXR is an **augmented reality** (AR) learning module focusing on engaging *all* students in the nature of science conceptions, including the practice of science and scientists. In partnership with Canadian educational technology company, EXAR Studios, we created a fully immersive, multi-module ocean learning experience for integration into science curricula across Ontario. Our goals for this project were to i) promote the rapid expansion of AR experiences and digital fluency, ii) pilot cutting-edge AR technology that intuitively senses the surrounding environment, iii) develop bespoke and highly engaging learning modules including curriculum, pedagogy and assessment, and iv) implement an impact study of AR experience on students' motivation and engagement with educational content.

**The mission of MarineXR is to use augmented reality to engage students in science and promote scientific literacy, inquiry skills, and motivation.**



# What is MarineXR?

MarineXR is a freely available, fully immersive, **augmented reality** mobile application for both Apple and Android phones. MarineXR utilizes both 'tap-to-place' (user-defined) and real-time surface detection (via phone camera) to place 3D models in the user's environment. We have developed two different ocean educational experiences within the app that demonstrate two different technological approaches to using AR for education.

## MarineXR

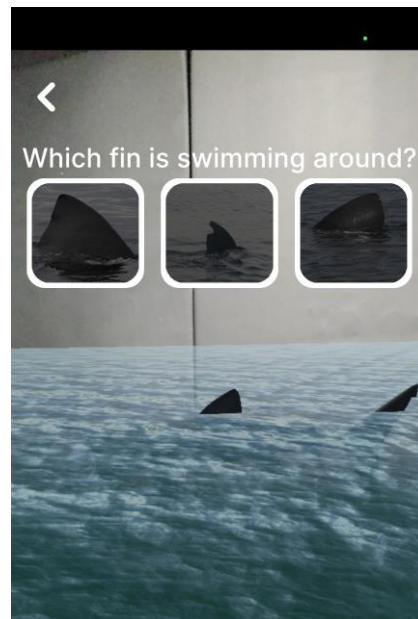
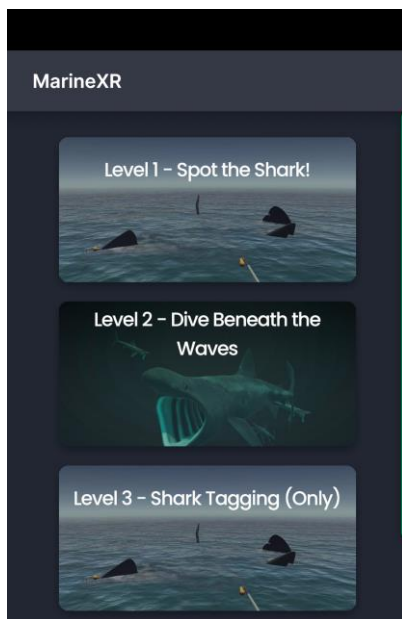


Basking shark conservation



Species learning modules

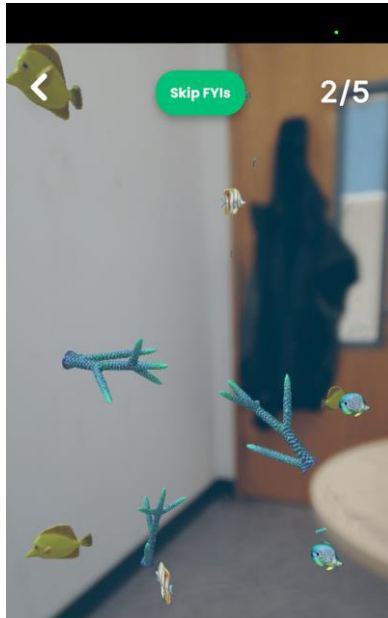
# Basking shark conservation



Using the principles of gamification, simulation, role-playing and immersion students explore scientific concepts and collect real-time data, using an enticing case study showcasing Canada's largest shark species, the basking shark. This experience takes students on an exploratory journey where they learn about basking shark biology and how scientists learn more about them.

This experience features a **guided narration** (with closed captions) to gently walk users through the experience.

# Species-specific modules



Our species learning modules use realistic and animated 3D representations of marine and freshwater species to teach students about their physiology, morphology and ecology.

Species are grouped into modules according to the learning objectives (e.g., coral reef biodiversity) and each species includes interactive information pop-ups. Students can test their learning with formative assessment questions including multiple choice and true/false (correct and incorrect answer feedback provided).

# Built-in modules

MarineXR includes over 100 marine species and we have designed 16 built-in modules that cover topics ranging from coral reef biodiversity to global fisheries. Below is the list of built-in modules instructors can choose from:

- Coral reef fish biodiversity
- Colourful and healthy reefs
- Coral bleaching
- Coral disease
- Temperate reefs
- Pelagic predators
- Anti-predator defenses
- Sharks!
- Pelagic foragers
- Molluscs echinoderms and cnidarians
- Fish speedsters!
- Commercial and recreational fisheries
- Endangered species
- Plastic oceans
- Morphological marvels
- Movement madness!

Instructors can create and customize their own modules through a web-based portal on <http://marinexr.ca>

# Credits and Acknowledgements

Project Team:

- Dr Paul Mensink
- Dr Lisa Briona
- Dr Isha Decoito

The following people assisted in creating modules and test banks:

- Andie Albert
- Scout Thompson
- Stefan Grahovac
- Pilar Caicedo Argüelles
- Pankaj Singla