The Hydrous Presents:

IMMERSE PLUS

A Learning Activity to experience, explore and engage the Ocean

Immerse is a 9 minute virtual dive on the coral reefs of Palau with marine biologist Dr. Erika Woolsey as your guide. Swim with manta rays, sea turtles, and sharks while you explore beautiful and threatened coral ecosystems. Narrated by marine scientists and young ocean advocates, this experience seeks to inspire ocean connection and understanding.

This ***Immerse*** Learning Activity is designed to supplement the ***Immerse*** 360/VR experience.. We created it for educators, parents, and friends to share the ocean with others and think deeply about marine environments.

These materials are adapted from *Coral Reefs: A Hydrous Learning Expedition*, an educational prototype created in 2019 with funding from the National Geographic Society (award CP-132E-17). The Hydrous is currently developing a curriculum product building on these materials.

Learn more at: www.thehydro.us
Contact us at: info@thehydro.us

BEFORE YOUR VIRTUAL DIVE

REFLECT

Write down your answers to these questions and share your thoughts with others

1. When you hear the word ‘ocean,’ what do you think?

2. Have you ever visited the ocean? What have you done on your visits?

3. What do you think are the most interesting things about the ocean?

4. Have you ever been underwater in the ocean? Have you snorkeled? What about SCUBA diving? What did you think of these experiences?

5. Would you like to dive in the ocean? Why or why not?

6. List three questions that you have about the ocean. What do you wonder about?

7. What are your favorite ocean animals? What do you like about them?

YOUR VIRTUAL DIVE

Put on your VR headset* and begin ***Immerse***.

You don't need to do anything but **LOOK, LISTEN and ENJOY.**

Your dive guide, marine biologist Dr. Erika Woolsey, will take you underwater in the Republic of Palau, an island nation in the Pacific Ocean. You will explore coral reefs and learn about them from scientists and young ocean advocates.

Enjoy the dive. Don't forget to look around and explore by moving your head. You might even find animals like turtles, manta rays, and sharks!

DIVE IN.
LOOK UP. LOOK DOWN.
LOOK ALL AROUND.
LISTEN.

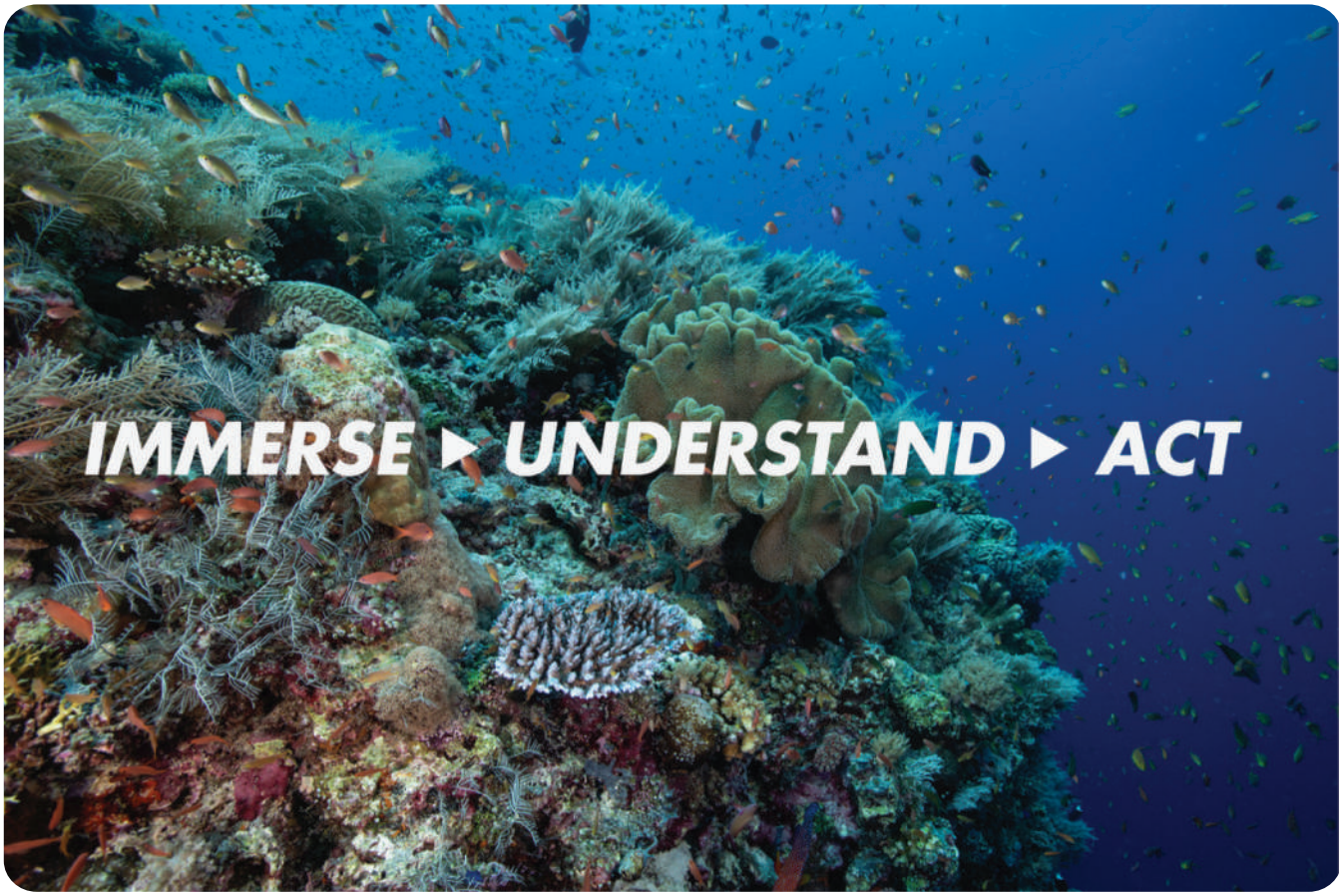
If you have the opportunity later, you can dive in again. Maybe you'll notice something new, or hear something you missed on your first dive. You can try with the sound turned up or down.

You can also read and review the narration with ***Immerse*** VR: The Narration.

*You can view the VR/360 film *Immerse* on a range of virtual reality headsets, including many Oculus, Vive, Samsung and Mobile Phone devices.

For a current list see https://thehydro.us/immerse

AFTER YOUR DIVE



Time now for you to participate!

EXPERIENCE
Reflect on your personal experience. What did you observe? How did you feel?

EXPLORE
Learn more about the science of coral reefs. What else do you want to know? How do you plan to learn more?

ENGAGE
Think about how coral reefs can be protected. What are other people doing? What can you do?

EXPERIENCE

Share Your Views

Write down your answers to these questions and share your thoughts with others

1. What caught your attention? What was the best part of this experience for you?

2. What surprised you?

3. What aroused your curiosity? What do you want to learn more about?

4. How has your opinion of the ocean changed with this virtual dive?

5. What did you learn that you didn't already know?

6. Does this virtual dive make you interested in taking a "real" dive?

7. Were you aware that there was a mass bleaching event on coral reefs around the world in 2016-2017? Now that you know about this, how does it make you feel?

9. Did this experience make you concerned about the ocean? How did this experience change your concerns?

10. Did you get any ideas about what you might do to help the ocean? What is an easy thing you can do to contribute to ocean health?

EXPLORE

Expanding your Understanding

Answer these questions the best you can. Write down your answers. Discuss them with others. Find out what you know and don't know, and what you are curious about.

You can find answers to these questions at the end of this **EXPLORE** section after you have answered them yourself. (These questions originally come from the **Explorer Cards** in ***CORAL REEFS: A Hydrous Learning Expedition***).

If you're interested in learning more, here are some great resources:

Coral Reefs 101 | National Geographic	https://bit.ly/3bKHchV
Coral: What is it?	https://bit.ly/3eTYYkM
How do corals build reefs?	https://bit.ly/3cVo6Ge
Coral Reef Animals:	https://s.si.edu/2Yby0zk
Coral Sea: GBR- Coral Spawning	https://bit.ly/3aKUp94

QUESTIONS

1. WHAT IS THE OCEAN FLOOR LIKE? Is it very deep? Is it flat in most places? Are there canyons?

2. WHAT ARE CORALS? Are they plants? Animals? Rocks?

"When you look at a coral reef, what you see is really cathedral-like. Coral reefs compete for space. They grow side by side, one on top of each other. That creates more space for other organisms to live in"

3. WHAT CONDITIONS DO CORALS NEED? Do tropical hard corals require sunlight? What else?

4. WHAT ARE THE PARTS OF A CORAL POLYP? Do you think polyps have brains? Legs? Stomachs? Make a drawing of a coral polyp, and one of a coral colony (a group of polyps).

5. WHAT'S THE RELATIONSHIP BETWEEN ZOOXANTHELLAE AND CORALS? Are the zooxanthellae (often called "zoox") that live inside corals important? What do they do for the corals?

6. WHAT HAPPENS WHEN CORALS BLEACH? Do bleached corals die? Why is it called "bleaching"?

... the global bleaching event from 2015 to 2017 was unprecedented in scale and severity.

7. TO BLEACH OR NOT TO BLEACH? When do corals bleach? Why do some corals bleach and others not?

8. WHAT IS BIODIVERSITY? How do coral reefs support biodiversity? Why is it important?

9. HOW DO CORALS REPRODUCE? Can corals reproduce from fragments? Do corals spawn frequently?

There's tremendous healing power that is built into genetics and into the evolution of coral reefs and if we give them half a chance they can recover.

10. WHY ARE CORAL REEFS IMPORTANT TO PEOPLE? Why are people concerned about threats to the reefs?

11. WHAT IS CLIMATE CHANGE? Why do you think the scientists in ***Immerse*** say that climate change is a major threat to coral reefs?

The sentences in ***bold italics*** are statements from the film.

ANSWERS

1. WHAT IS THE OCEAN FLOOR LIKE?

The ocean floor has canyons and mountains, just like we see on land. In fact, the longest mountain range in the world is mostly under the Atlantic Ocean, known as the Mid-Atlantic Ridge. Some of the mountain tops are tall enough to be above sea level, forming islands in the middle of the ocean- including the country of Iceland!

At its deepest point, the ocean is more than a mile deeper than the tallest point on land. Mt.Everest, the tallest mountain on Earth, is 8,848 m (29,029), while the Mariana Trench extends down to 10, 910 m (35,797) below the surface.

The only two people who have ever been to that depth are Jacques Piccard and Don Walsh, who took a submarine there in 1960. Since then several submersible robots have gone down to explore the trench and collect specimens of the deepest sea life.

Watch a cool animation showing just how deep the ocean gets: http://bit.ly/challenger_deep

2. WHAT ARE CORALS?

Corals, jellyfish, and anemones are all in the phylum Cnidaria. All members of this phylum have simple tissue organization with only two layers of cells. They have radial symmetry and no specialized circulatory system.

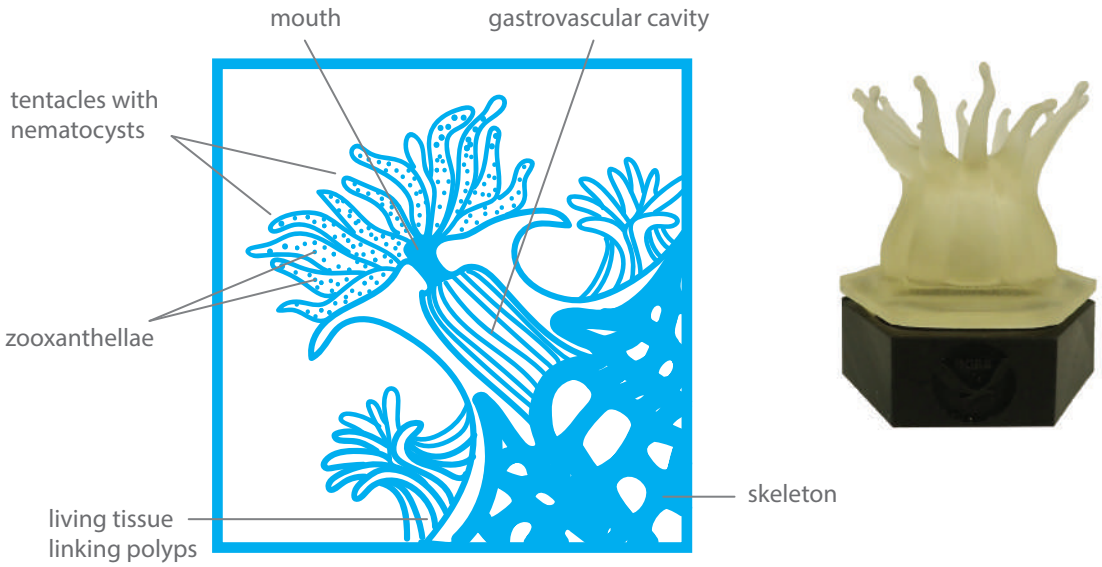
All are aquatic and rely on simple diffusion to take in and expel materials, except food that they catch in their tentacles using specialized stinging cells called nematocysts.

Most members of the phylum Cnidaria are solitary, except corals that live in colonies.

3. WHAT CONDITIONS DO CORALS NEED?

Corals require a hard substrate to settle on, sunlight, warm water (but not TOO warm), clear water (not too much sediment), and low nutrients, because high nutrients would cause macroalgae to flourish and block the sunlight.

4. WHAT ARE THE PARTS OF A CORAL POLYP?



Tentacles: Catch food from the surrounding water, with the help of nematocysts, and bring it to the mouth.

Nematocysts: Stinging structures contained in special cells called cnidocytes. Inject toxin into whatever they come into contain with- prey, or predators.

Mouth: Opening to the gastrovascular cavity.

Gastrovascular cavity: The internal space where digestion and gas exchange take place.

Skeleton: Hard corals secrete calcium carbonate which becomes a hard skeleton. This skeleton grows over time, giving shape to the coral colony. When a coral dies, the skeletal structure remains, and other organisms (including young corals) will settle on it.

Zooxanthellae (Zoh-zan-thel-lee): Small protists that live inside corals, in a symbiotic relationship. The coral provides a home and nutrients to the zooxanthellae, and the zooxanthellae transforms sunlight into energy using photosynthesis, making food for the coral. (Often called ZOOX).

Coral polyps combine to create coral colonies. Groups of colonies create reefs.

5. WHAT'S THE RELATIONSHIP BETWEEN ZOOXANTHELLAE AND CORALS?

In nature, corals provide a home and access to resources for zooxanthellae. Through a process called photosynthesis, the zooxanthellae process those resources to create energy for the coral to build its skeleton, reproduce, and grow as a colony through a process called photosynthesis.

Zooxanthellae, other algae, and plants have cells called chloroplasts that contain pigments that absorb certain colors of light and reflect the color of light that you see. This is what gives corals their color. The coral and the zooxanthellae both use the food made by photosynthesis as energy. In tropical reef building corals, Zooxanthellae provide up to 90% of their host's energy. The coral uses this energy boost to build its calcium carbonate skeleton, using minerals it gets from seawater.

For this partnership to be effective they need sunlight, clear water, and a particular salinity (salt content). Shallow water tropical corals are located in regions that typically satisfy these requirements.

While up to 90% of corals' energy comes from zooxanthellae, the other 10% comes from catching plankton as prey with their tentacles.

6. WHAT HAPPENS WHEN CORALS BLEACH?

On coral reefs higher than normal ocean temperatures are causing the corals to turn white and die. Sustained high temperatures stress out the coral animals enough to expel their symbionts which are a type of specialized algae that live in the coral tissues and provide food for their coral host. When these algae are gone you can see through the clear coral animals to their white calcium carbonate skeleton. Hence the term bleaching.

Over the years scientists have discovered the processes underlying coral bleaching through a set of laboratory experiments, where they have looked at the corals under microscopes and systematically varied the temperature of the water that corals are in.

These experiments have shown that at above normal temperatures, the photosynthesis process of the zooxanthellae generates a substance which is harmful to the coral's tissue. The coral animals respond by expelling the zooxanthellae to avoid further damage to their bodies.

When the zooxanthellae are gone the pure white of the coral skeletons shows through. Since coral tissue is transparent, when there is no color from the algae - the corals look bleached.

A bleached coral is NOT dead. In fact if conditions improve and the bleaching is not too severe, the zooxanthellae can repopulate over a period of weeks to months. However, many corals cannot survive for more than 10 days without zooxanthellae and will starve to death if conditions do not improve.

7. TO BLEACH OR NOT TO BLEACH?

Scientists are actively studying why some corals bleach and others do not. They have not yet found all the answers, but here are a few hypotheses:

1) Corals with a massive growth form may have higher thermal inertia, which would mean it takes more energy to change their temperature. If this is true, they would be less sensitive to the temperature of their environment. As water temperature increases, it may be that these corals (and their zooxanthellae) do not get stressed as easily.

2) Growing takes a lot of energy, so fast-growing coral forms need a lot of food from their zooxanthellae. As temperatures increase and zooxanthellae get stressed, these hungry, fast-growing corals could have a lower tolerance for unproductive zooxanthellae, and be quicker to kick them out.

3) Some corals may have a genetic advantage that prevents them from bleaching.

4) Some corals may have zooxanthellae that are more tolerant to temperature changes.

8. WHAT IS BIODIVERSITY?

Biodiversity is the collection of life in all its shapes and forms. We depend on biodiversity for clear water and air, for food and medicine, and for the overall resilience of our planet. Sadly biodiversity in our oceans is declining rapidly. We are losing species before we even discover them.

Coral reefs support a very wide range of different organisms. Fish, crabs, sharks, anemones and more. They provide environments where these different organisms can co-exist, creating a rich ecology that is generative. These reefs are often called “the rain forests of the ocean,” as they, like rain forests, are key to the survival of many species of life. The wide range of species are important for the health of the planet. Biodiversity is a measure of the health of an ecosystem.

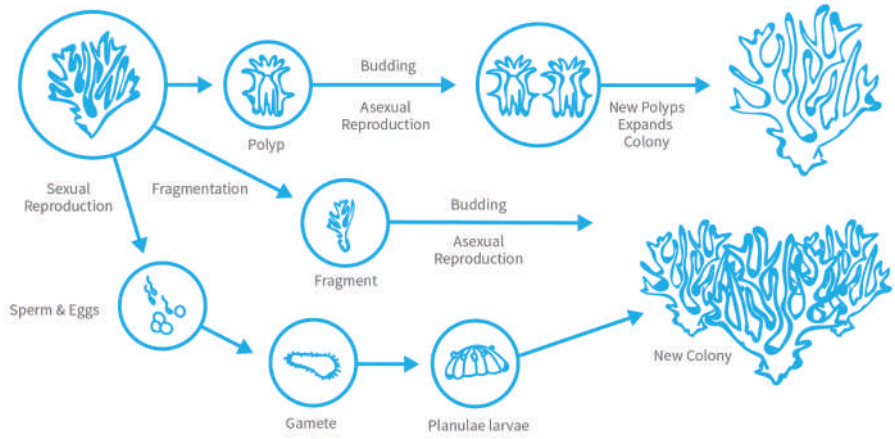
9. HOW DO CORALS REPRODUCE?

Corals reproduce in three quite different ways. Budding is effective for growing a colony of polyps. Fragmentation and spawning can begin new colonies.

Asexual Reproduction

Budding: Occurs when a polyp forms a bud – a new polyp – and it grows within an existing colony. All colony growth happens via budding and secretion of calcium carbonate.

Fragmentation: When a section of a coral colony breaks off, it can form a new colony through budding. Fragments are sometimes carried by currents, wave surge, or other animals to new locations before they grow into new colonies.



Sexual Reproduction

Corals can replenish themselves through mass spawning events each year when billions of gametes are released after sunset and around the full moon. The resulting larvae can drift with the water, to settle and grow new corals on degraded reefs.

Spawning: Corals reproduce sexually by brooding larvae, or by broadcast spawning. After internal fertilization, brooded larvae are released from the parent colony fully developed and ready to settle on the seafloor and grow into a new coral.

When corals broadcast spawn, they release eggs and sperm into the water simultaneously. This usually happens only once per year, around the full moon and after the sun sets. Egg and sperm meet in the water column and create a fertilized egg, also called a zygote. This zygote will drift with the water current over a few days- and sometimes hundreds of miles before it develops into a fully formed larva that is ready to settle, metamorphose, and grow into a new coral.

Corals release their eggs and sperm at very specific times of the year in different locations around the world. Factors that influence this timing include temperature, day length and lunar cycles.

The VR film *Immerse* includes an animation of coral spawning.

10. WHY ARE CORAL REEFS IMPORTANT TO PEOPLE?

Globally, over 500 million people rely on coral reefs as an important resource. In the United States the total economic value of coral reefs is estimated to be around $3.4 billion. They provide several important services and industries, including:

-Shoreline protection from storms
-Pharmaceuticals
-Ecotourism
-Fish and other food
-Aquarium trade

Not to mention they're nice to look at!

11. WHAT IS CLIMATE CHANGE?

In recent times, human industrial and agricultural activities have led to increasing amounts of carbon dioxide (CO2) and other gasses in the atmosphere. These gasses trap heat from sunlight that would normally escape the atmosphere, much like the glass walls of a greenhouse trap heat - this is called the "greenhouse effect." The entire atmosphere is getting warmer, and the ocean is too. The ocean is also absorbing excess CO2 from the atmosphere, causing ocean acidification.

But climate change is much more than increasing CO2 and temperatures. Water takes up more space as it warms, and sea levels are rising. At the same time, the warming of the Earth is causing ice in the poles to melt, adding more to rising sea levels. Human coastal settlements at low elevation are in danger of being flooded by seawater.

Temperature is also very closely linked to long-standing global patterns in wind and oceanic currents. As temperatures change, winds and currents also change, and local weather patterns are affected. So even though the overall trend is towards warming, ANY unusual or unseasonal weather events can be linked to climate change- this can even include very cold days!

ENGAGE

Protecting the Reefs

In addition to showing and describing the beauty and magic of the ocean, ***Immerse*** addressed the challenges of ocean conservation.

Scientists have been carefully observing coral reefs for decades. These ongoing monitoring programs have measured dramatic declines. Living coral cover has decreased by about 50 percent in the last fifty years.

1. Corals are negatively impacted by a wide range of factors including:

Overfishing	Plastics	Warming Oceans	Sedimentation
Ocean acidification	Agricultural Waste	Infectious Diseases	Habitat Destruction
Storms	Sea Level Rise	Predators (like Crown-of-Thorns Starfish)	

Which of these do you think has the greatest impact?

Do you know about any projects trying to solve these problems? Please explain.

Do you have any ideas about how to solve any of these problems? What are your ideas?

What other threats do you think coral reefs face?

The ocean is something that can protect itself. It just doesn't have the voice.

2. Many scientists, community members, and policy makers have noticed the threats to coral reefs and are taking a wide range of approaches to solve these issues. Below, you can see 12 categories of projects dedicated to coral reef health. Read each of these and follow some of the links that are provided.

Which approach do you think is most promising? Most interesting? Which would you like to be involved with? Discuss your selections with others.

The Most Promising: _____
The Most Interesting: _____
The Project you would most like to be involved in: _____

Approach 1.
Marine Protected Areas (MPAs): Countries around the globe are joining the efforts to protect marine ecosystems from destruction. MPAs protect geographic areas from human activities including development, fishing, resource extraction, and ship traffic. MPAs are established and managed by many different jurisdictions (national, state, local) and provide varied levels of protections.

INSIGHT: Limit human access to prevent damage to ocean ecosystems.

- Why it's important to protect a vast marine monument (bit.ly/natgeo_mpa) •
- Can Marine Protected Areas Save the Ocean? (bit.ly/mpa_save)
- MPAs in the United States (bit.ly/mpa_noaa)
- Does Size Matter for MPAs? (bit.ly/mpa_size)

Approach 2.
Putting a Price on Carbon: Climate change, driven in large part by carbon emissions, has devastating impacts not only on coral reefs but on human life. A recent report from a United Nations panel of scientists said putting a price on carbon dioxide (CO_2) emissions would be central for getting global warming under control. One way to accomplish this is to institute a carbon tax, which is a fee imposed on the burning of carbon-based fuels (coal, oil, gas). A carbon tax could provide a powerful financial incentive for technological innovation, and for businesses and individuals across the economy to switch to clean non-carbon energy sources.

INSIGHT: Reward sustainable actions in the marketplace.

- The social cost of carbon pollution (bit.ly/carbon_true)
- World Bank map of carbon pricing initiative around the world (bit.ly/carbon_pricing)

Approach 3.
Ocean Empathy: Education is key to promoting ocean awareness and encouraging individuals to appreciate, understand and then steward the ocean. Non-profits such as The Hydrous provide people with real and virtual ocean experiences to encourage scientific understanding and empathy.

INSIGHT: Develop an informed populace.

- The Hydrous - bringing the oceans to you (thehydro.us)
- Ocean Literacy - understanding our blue planet (bit.ly/ocean_literacy)

Approach 4.
Youth Participation and Activism: Young people in the United States and around the world have recognized that they have the most to lose when it comes to climate change, and the most to gain by solving it. They are educating themselves, their fellow students and their families - and finding ways to speak up for the ocean and their futures.

INSIGHT: Highlight a long term view.

- This is Zero Hour (bit.ly/youth_zerohour)
- Sunrise Movement (bit.ly/youth_sunrise)
- Youth Climate Strike (bit.ly/youth_strike)
- Heirs to Our Oceans (bit.ly/youth_heirs)

Approach 5.
Big Data: Illegal and unreported fishing currently accounts for ~30% of all catches. Using recent advances in satellite technology, cloud computing and machine learning, we can track fishing activity around the world in real-time, providing data to inform the enforcement of fishing regulations in areas with no national jurisdiction.

INSIGHT: Use big data to monitor fishing in remote areas.

- Global Fishing Watch (bit.ly/fish_global)
- Global Fishing Activity (real-time map) (bit.ly/fish_watchmap)
- Tracking fishing vessels reveals industry's toll on the oceans - Smithsonian (bit.ly/fish_track)

Approach 6.
Assisted Evolution: Scientists are searching for the magic recipe to breed a more resilient "super coral" with a better chance of surviving the hotter and more acidic oceans associated with global climate change. They do this by exposing coral polyps to conditions that mimic warmer and more acidic oceans - and breed- in the resulting resistant corals in the lab and on the ocean floor. They're also using deep freezing to allow long-term storage of many species of coral sperm and eggs - creating a sort of Noah's Ark of coral.

INSIGHT: Develop corals that can adapt to changing conditions in the oceans.

- Gates Coral Lab (bit.ly/gates_fb)
- How dangerous is messing with nature (bit.ly/gates_messing)
- What is Assisted Evolution (bit.ly/assist_aims)

Approach 7.
Improving Water Quality: Destruction of coastal wetlands, deforestation and land clearing for agriculture, industrial development, and dredging all lead to increased sedimentation in coastal waters. To stop sediment at its source and improve water quality, local landholders and communities must rebuild eroding land and restore vital coastal wetlands, which can be seen as the 'kidneys' of the ocean.

INSIGHT: Ecosystems and activities on land impact corals and need restoration and regulation.

- Greening Australia - Reef Aid Project (bit.ly/green_au)
- Cleaning up runoff - inspiring farmers to help (bit.ly/green_runoff)
- Clean water for reefs (bit.ly/green_reefs)

Approach 8.
Eliminating Ocean Trash: Local organizations have mobilized thousands of individuals to pick up trash from their local beaches. In addition to preventing this trash from entering the ocean, these activities have also built strong local communities devoted to ocean conservation, and informed many about the importance of waste management.

INSIGHT: Prevent trash from entering the ocean. Engage communities in caring about the ocean.

- Trash-free seas (bit.ly/trash_free)
- Be straw-free campaign (bit.ly/trash_straw)

Approach 9.
Coral Farming and Restoration: Researchers and communities are helping coral reproduce asexually by fragmenting corals, growing them in a safe place, and transplanting them to areas where reefs have been destroyed (coral 'farming'). They are helping out with sexual reproduction as well, to promote genetic diversity in coral populations and provide a potentially scalable approach to restoration.

INSIGHT: Grow new corals to replace devastated reefs.

- Spawning: An Intervention (bit.ly/secore_spawn)
- SECORE 'newsroom' (bit.ly/secore_news)
- PADI coral restoration program for divers (bit.ly/padi_reef)

Approach 10.
Carbon Sequestration: In order to limit atmospheric warming to levels below which irreversible changes become inevitable, some experts argue we'll need to actively remove (sequester) CO2 from the atmosphere. Sequestration techniques include reforestation, improving agricultural practice, bio-energy with carbon capture and storage (BECCS), and converting CO2 into building materials.

INSIGHT: Recapture carbon from fossil fuels before it enters the atmosphere.

- Changing carbon from waste to gold (bit.ly/seq_blue)
- USGS: What is carbon sequestration? (on.doi.gov/seq_faqs)
- Beneficial reuse of CO2 (bit.ly/seq_cement)

Approach 11.
Reducing Food Waste: Producing uneaten food squanders a whole host of resources - seeds, water, energy, land, fertilizer, hours of labor, money - and generates greenhouse gases at every stage. Organizations are working to reduce food waste in three ways: prevention (limiting the production of food that is not used), recycling (converting uneaten food into other products) and recovery (distributing unused foods to new destinations).

INSIGHT: Reduce food waste through prevention, recycling, and recovery.

- EPA Food Recovery Guide (bit.ly/food_epa)
- Best opportunities to reduce food waste (bit.ly/food_reduce)
- Food Runners - community food rescue (bit.ly/food_runners)

Approach 12.
Green Buildings: New building practices include a range of methods to minimize energy requirements, and even generate energy. Innovation in energy and construction technologies have made it possible for some projects to reach the ambitious goal of Net-Zero Energy (NZE) - where the amount of energy produced by a building is equal to or more than that required to operate it.

INSIGHT: Establish new standards to minimize a building's environmental impact.

- Sustainability: The Exploratorium as exhibit (bit.ly/buildings_exp)
- Advancing Net Zero - World Buildings Council (bit.ly/buildings_zero)
- Tackling Climate Change through Green Building Standards (LEED) (bit.ly/buildings_leed)

3. What do you think you can personally do about the problems in our ocean?

What I find most hopeful is our youth and their position towards climate change. Where many of our national leaders still still choose to continue to conveniently ignore the harsh realities of climate change young people seem to generally get the issue, accept it as a fact and want to tackle this global threat.

Everyone can protect the ocean everyday. Here are examples of things you can do:

1. Extend your understanding of the oceans.

2. Listen and read news stories with a critical mind.

3. Take a marine biology class, and consider a career in the marine area.

4. Participate in activities sponsored by ocean organizations (eg beach clean up, ocean events)

5. Donate to an ocean advocacy group.

6. Change your behaviors (Drive less, Use fewer plastics, Carefully choose the fish you are eating).

7. Talk to your friends and neighbors about the beauty, science, and magic of the ocean. Share what you have learned with them.

The Hydrous website provides a range of resources to consider to become more involved with ocean conservation (https://thehydro.us/goingblue). The priorities listed include 1) combating climate change 2) supporting sustainable fishing 3) keeping the ocean clean and 4) joining and supporting your local ocean community.

4. In ***Immerse*** Dr. Ruth Gates says:

It's not too big a problem and we can solve it. We've managed systems from the brink of extinction. We can do anything. We just have to allow ourselves to begin and get busy. You and I start today, that will make a difference. And if we talk to ten other people who will start today, that will make a difference. We can and we will start a movement.

This is Just a Beginning

Immerse gave you a view of the ocean that you may not have had before.

This Learning Activity has given you the opportunity to reflect on this experience and learn more about coral reef ecology and ocean solutions.

Experience: How do you think and feel about the ocean now?
Explore: How will you explore the ocean after this experience?
Engage: How might you become personally involved with the ocean?

Hoping that your ideas about the ocean have now expanded
and that you will enjoy learning even more about the marine world in the future.

Thank you for taking this Learning Journey.
We hope that you will continue exploring and making discoveries.

Thanks to Andrea Murchie, Allison Fritts Penniman, Anna Carolina Muller Queiroz and Surabhi Konkar for their contributions to this Learning Activity.