SMITHSONIAN MARINE

ECOSYSTEMS EXHIBIT

THE OCEAN EXPERIENCE

AT-HOME

AGES (14-16)

Smithsonian

Marine Station Fort Pierce

CONTENTS

MODULE I: OCEAN OPTIMISM

Our oceans are changing and while it can be easy to get lost in the constant influx of bad news highlighting the environmental issues of our planet, there is some research to be optimistic about! The anthropogenic (human-made) impacts on planet Earth are often negative and include changing climates, habitat fragmentation, the extinction of many species, and many others.

How can you find stories of Ocean Optimism? From marine scientists at the Smithsonian Marine Station, who are trying to understand and heal coral from stony coral tissue loss disease, to communicators and activists who are putting solutions to environmental issues in the forefront and on your screens. If you look for stories of environmental success, you will find them!

The Smithsonian's National Museum of Natural History conducts the Earth Optimism Summit every year and presents Earth Optimism as a way of shifting our perspective "…from problem to solution, from a sense of loss to one of hope, in the dialogue about conservation and sustainability." The Smithsonian's Ocean Portal presents a collection of successful stories in the marine sciences, giving us hope for the future of our natural resources. Check out the Portal and embark on a virtual quest for inspiration by exploring the map of ocean stories. **Look into the success stories in the Portal and find a role model or a cause that you are curious about or that inspires you to action.**

Your innate curiosity for the natural world can lead to a fundamental understanding of the environmental systems of Earth. How will you use your knowledge to make informed decisions about the issues impacting nature? Will you join us in slowing down the effects of climate degradation? We hope to have you as an ally and look forward to getting to know what keeps you optimistic about the future of our oceans.

Ocean Optimism Challenge:

1. Explore the Smithsonian Ocean Portal's map of success stories.
2. Watch some of the Teen Tuesday: Earth Optimism webcasts recordings to get familiarized with more stories of success. Dr. Melanie McField from the Smithsonian Marine Station spoke about her work with Healthy Reefs for Healthy People in the Mesoamerican Reef System.

3. Write about what makes YOU optimistic for the future of the oceans on your phone's notes app or a journal. Mention how you plan to contribute to the wellbeing of the planet currently and in the future. Are you planning to become a marine scientist? Let us know what topics you wish to study. Those dreams might just push you to becoming a member of the Smithsonian's optimism crew as a professional.
4. Post a picture of yourself or a beautiful oceanic scape using your journal entry as a caption and inspire others to follow! Tag us at @SmithsonianSMS on Instagram and Twitter. Use the hashtags #Earthoptimism and #Oceanoptimism on your post. Challenge your friends to become ocean optimists and join the movement by posting their own message.

Are you a creative at heart? Make an #EarthOptimism video project!
Teens such as yourself have created amazing videos already and we would love yours to be next. Just make sure to tag us or so we can share your perspective through our @SmithsonianSMS social media channels.

MODULE II: CITIZEN SCIENCE & SOCIAL DISTANCING

Incorporating education and field work with real-world implications has always been an essential part of our classic Ocean Field Experience camps. During in-person camp experiences our campers go out on the field and contribute to citizen science, learning methods of data collection to better understand the ecosystems around them. In this module we encourage you to experiment with some tools through which you can contribute to citizen science while adhering to social distancing:

ACTIVITY I: NASA'S NEMO-NET APP

(full version only available for iphone, Windows version available in Beta)

Credit: nemotnet.info

Help NASA Ames Research Center improve coral reef classification by painting images of coral! Download the Nemo-Net app to start contributing to science. Data generated through the game is submitted to NASA's NeMO-Net database.

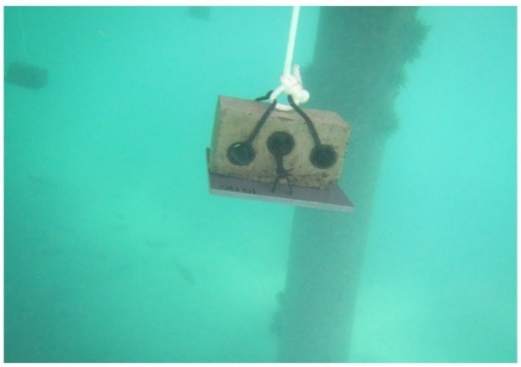
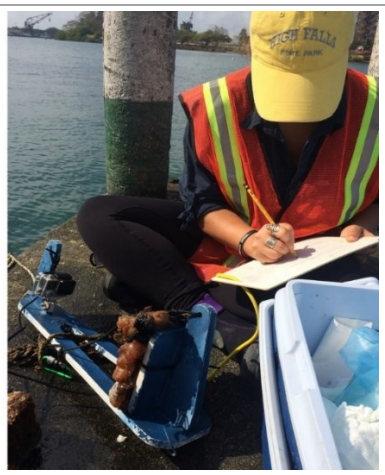
Real-life applications: NASA scientist Ved Chirayath invented two cameras including a technology named fluid lensing for imaging the Earth's underwater coastal regions from the sky (using planes, autonomous unmanned vehicles, or satellites). The technology removes the waves on the surface, providing images with a 10-meter resolution! Ved and his team at NASA Ames Research Center developed the NeMO-NET app and database as a way of training super computers to accurately process coral reef images for identification purposes. Their end goal? Using the technology to map coral reefs and assess their health around the world to better understand these important ecosystems.

ACTIVITY II: MANATEE CALL

Use your observation and listening skills to assist scientists from The Cetalingua Project by identifying manatee calls and vocalizations. Access the Manatee Call profile to look at a series of spectrograms (visual representations of sound waves) and listen to their matching audio to determine how many manatee calls can be heard and seen.

Real-life applications: The Cetalingua Project works to decode the relationship between the form and function of cetacean communications through the combination of citizen science and artificial intelligence. Manatee call seeks to understand the behaviors matched with manatee vocalizations.

ACTIVITY III: SERC'S INVADER ID

Credit: Invader ID (https://www.zooniverse.org/projects/serc/invader-id/about/research)

Help scientists from the Smithsonian Environmental Research Center's (SERC) Marine Invasions lab in their quest of understanding fouling communities, an aggregate of organisms that grow on top of underwater surfaces including docks, pilings, and the hulls of boats. Scientists working on this project suspend a series of plastic tiles from docks and piers for periods of three months. This allows sessile (non-moving) animals, bacteria, and algae to grow on the plates. The plates are then removed and photographed. As a volunteer of this project you will be looking at the photographs of plates and identifying the fouling organisms that have grown over the three-month period. The 2017 Plate Watch video newsletter gives a great overview of the Invader ID program.

Real-life applications: Fouling organisms often grow on the hulls of ships. As humans move their boats, they may be introducing fouling organisms to new regions. Sometimes these nonnative organisms don't survive in their new environments, while others can thrive and begin to reproduce. When these species begin outcompeting native species for resources, they can become invasive. Long-term tracking of fouling communities allows scientists at the Marine Invasions Lab to identify the introduction of new species at different locations. When new species are identified scientists can use Invader ID data to better understand their potential effects on the rest of ecosystem.

Credit: Francesco Ungaro

The Reef Environmental Foundation (REEF) is an international marine conservation organization that that trains SCUBA divers and snorkelers for active citizen science projects. They offer online educational resources about marine fish identification around the world including free "fishinars", online quizzes, and species galleries. Individuals can become members for free, take advantage of the educational resources, and voluntarily participate in different conservation projects. The REEF Volunteer Fish Survey Project allows citizen scientists to survey fish populations using a pre-designated method (for consistency). Volunteers then upload the results to REEF's data entry programs and eventually data are made available to the rest of the community. Explore their website to discover more marine conservation initiatives and to contribute to science while social distancing this summer!

Real-life applications: This organization is constantly sharing educational materials with the community of ocean enthusiasts. Their citizen science programs not only deal with topics such as species surveys but also contribute to the control of the invasive lionfish, and the conservation of Nassau Grouper. Find a series of publications and documentaries on their website to find how the data is used.

FIND MORE ONLINE CITIZEN SCIENCE PROJECTS:

www.zooiniverse.org & www.citizenscience.org

MODULE III: EXPLORING THE BIODIVERSITY AROUND YOU

LEARNING OBJECTIVES

After completing this activity, you will learn about different methods of observing and identifying living organisms. You will build a **biocube** to figure out what types of organisms can be found within one cubic foot. You will also learn to use a **dichotomous key**, a common tool in organism identification, and will start building your very own **herbarium**.

INTRODUCTION

For marine scientists, meticulous observation is necessary during data collection and analysis. For example, telling the difference between two species of fish while doing a transect or analyzing DNA sequences in the lab both require the use of careful and informed observation. No matter what type of science you find yourself in, meticulous data collection is always an important skill!

Learning to observe, identify, classify, and document the natural world are basic skills for a good marine biologist. The following three activities will focus on getting you out in nature to practice observation from different perspectives.

ACTIVITY I: A WORLD IN ONE CUBIC FOOT – LIFE IN A BIOCUBE

Activity from the Smithsonian National Museum of Natural History

INTRODUCTION

What life can be discovered in a cubic foot over one day? This is the question that photographer David Liittschwager and Smithsonian scientists wanted to answer when they were working on the book titled “A World in One Cubic Foot: Portraits of Biodiversity”. This is how the biocube was born. The authors discovered many organisms within 1 cubic foot of space in many different parts of the world.

The idea behind a biocube (any hollow cube made from 1-foot sides) is making biodiversity observation accessible and manageable to everyone. By learning about the natural areas around us at a small scale, we can eventually connect bits and pieces of ecosystems and see why they are important for the survival of many organisms. At the same time, the detailed collection of data makes our knowledge more specific, allowing us to appreciate the characteristics of each species and their role within the ecosystem. Almost anywhere you go on Earth, be it a creek, river, ocean, beach, or forest, you will most likely find a variety of fascinating critters. You just need to get yourself out there and observing!

Watch Biocubes: A World in Once Cubic Foot before starting.

Download the documents titled “*Biocube At Home – Activity at a Glance*” and “*Biocube At Home – Explorer Directions*” for instructions and procedures.

ACTIVITY II: ORGANISM IDENTIFICATION – USING A DICHOTOMOUS KEY

INTRODUCTION

Scientists who study organisms often spend a lot of time trying to identify them and grouping them based on shared characteristics. A dichotomous key is a tool used in science to classify organisms by following a list of paired, descriptive statements. The key begins with very general physical characteristics about a group of organisms and progressively gets more specific as we get closer to identifying a species by its scientific name. Watch this lesson by educator Erin Lomax to learn more about dichotomous keys.

Download the "SMEE Dichotomous Key Worksheet" and "SMEE Dichotomous Key Answer Sheet" to complete the activity.

ACTIVITY III: CREATE YOUR OWN PLANT PRESS

Activity from the National Museum of Natural History

INTRODUCTION

Plant pressing is a method used by scientists for preserving plants over long periods of time. They might want to keep the plants for cataloging them into museum or research collections or for later study. A collection of many classified, pressed plants is known as an herbarium. These can be valuable resources for museum scientists as they study the natural history of their region, including the introduction of new species or the disappearance of others over time.

Creating your own herbarium collection might be a good way to get acquainted with the coastal plants in your area. Smithsonian scientists will teach you the basics of plant pressing. This activity can also be a way of making beautiful pieces of art reminiscent of your favorite natural environments.

CAUTION

Some plants are protected, others are poisonous or produce allergic reactions. Conduct an internet search, or better yet, get a plant identification guide to learn more before collecting plants that are not familiar to you.

ADDITIONAL RESOURCES

Check out how scientists at the Smithsonian Tropical Research Institute prepare algae presses for preservation.

Science on the SPOT: Preserving the Forest of the Sea by KQED Science

University of Florida IFAS Extension (website): Florida native plant identification and video identification of other plants.

MODULE IV: SEA TURTLES

OVERVIEW

Learn about the sea turtles of the world and then explore the species found nesting on the Florida coast. Plan an early morning beach walk to identify the tracks of nesting sea turtles.

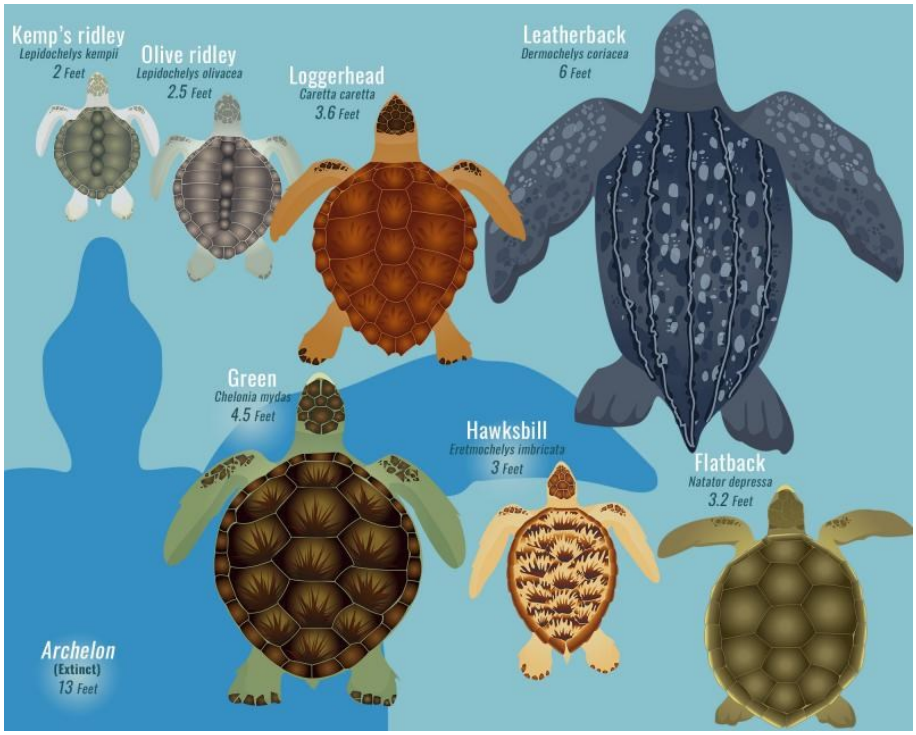
LEARNING OBJECTIVES

After completing this module, you will be able to identify the sea turtles found in the Atlantic Ocean, recognize their nests and identify the types of tracks produced by three species.

INTRODUCTION

Sea turtles are marine reptiles that have outlived the dinosaurs, having survived on Earth for approximately 110 million years. They swim all over the Earth's oceans, with the exception of the polar seas, and migrate for hundreds of miles between feeding and breeding areas (where they have babies). Sea turtles can hold their breath for several hours depending on the rate of activity! For example, they will catch a quick snooze under rocky ledges before coming up for air (they are air breathers after all). According to the Sea Turtle Conservancy, resting sea turtles can stay submerged for 4-7 hours.

Wondering what makes them different from terrestrial gopher tortoises or aquatic terrapin turtles found in Florida? Instead of legs, sea turtles have powerful flippers for swimming and live exclusively in ocean water. Females will come up to the beach to nest and green sea turtles will visit estuaries to feed on seagrasses, but they spend most of their lives out at sea.



Illustrated: The seven species of sea turtles currently alive. The blue outline is one of their ancient relatives: Archelon. Diagram belongs to Smithsonian Ocean.

There are seven species of sea turtles in the world. Look at the following diagram to learn how to identify the five species found in Florida waters. Look at the prefrontal scales, carapace (top of the shell), plastron (ventral area of the shell) and the amount of scutes (or plates) on the carapace:

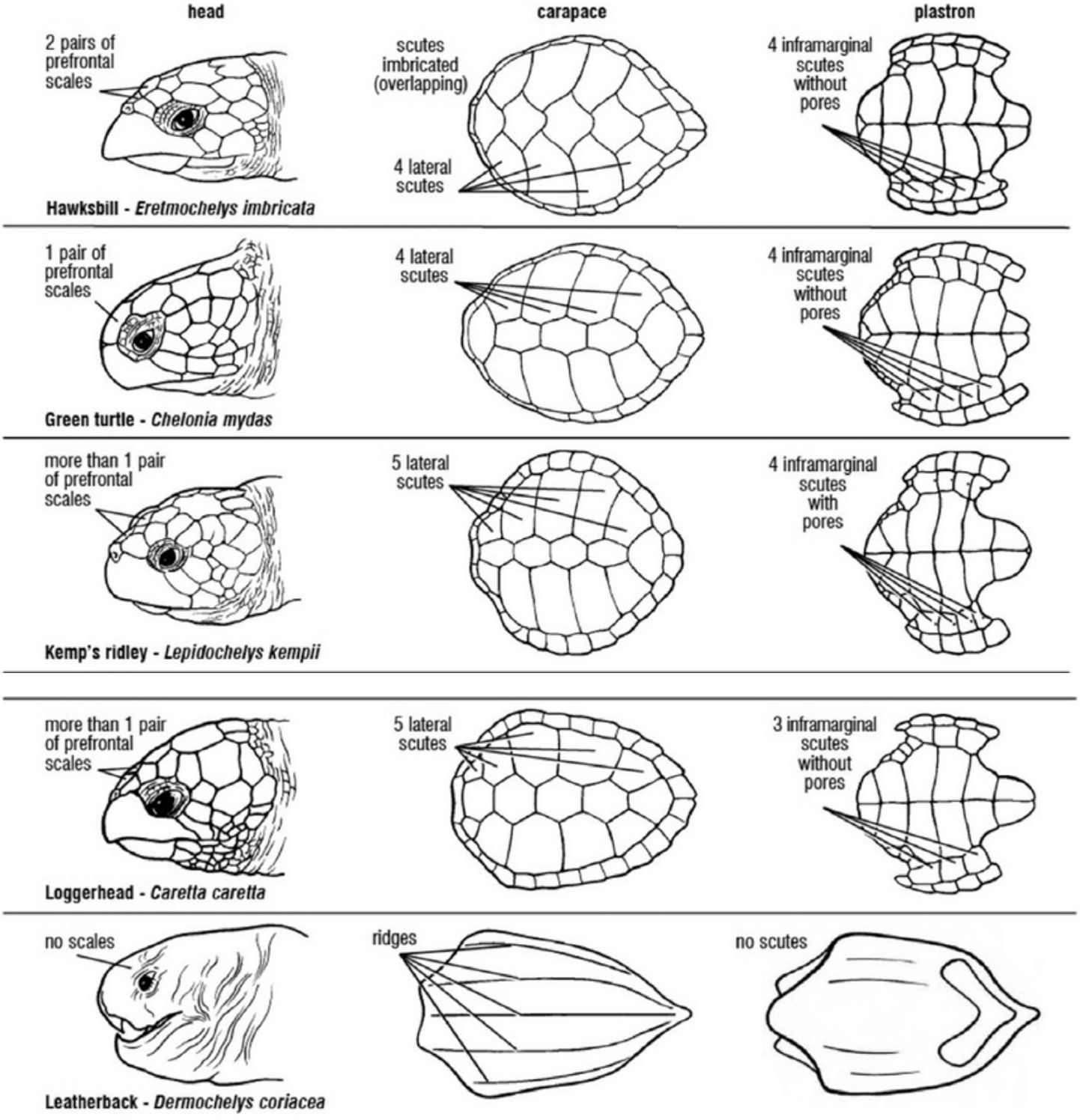
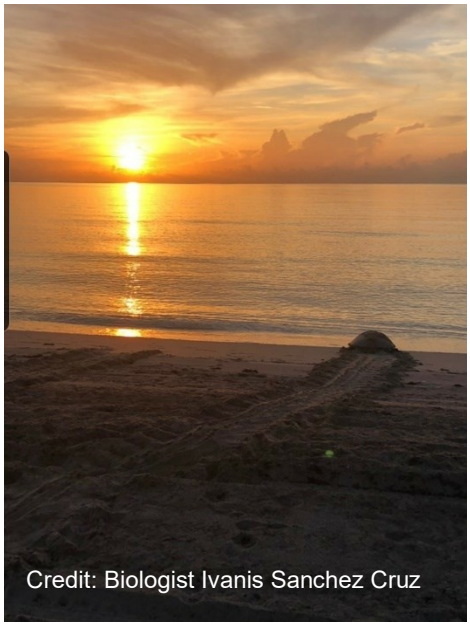


Diagram: [Shigenaka, Gary & Milton, Sarah & Lutz, Peter & Hoff, Rebecca & Yender, Ruth & Mearns, Alan. (2003). Oil and Sea Turtles: Biology, Planning, and Response.]

Female green, loggerhead, and leatherback sea turtles visit the sandy beaches located along Florida's coasts to lay their eggs at night between the months of March and October. They build nests, lay their eggs, and go back into the ocean, leaving the eggs to develop and hatch on their own. This makes it hard to keep track of the nesting females, which can swim up and down a stretch of beach multiple times in one night waiting for the perfect moment and place to crawl out of the water and lay their eggs.

How do sea turtle specialists keep track of the species of turtles nesting on and hatching from our beaches? One of the methods commonly used is simply observing!


Credit: Biologist Ivanis Sanchez Cruz

Each of the nesting species found in Florida leaves a different type of track behind, just like we leave footprints in the sand. The tracks left by a female can be correlated (matched) to the average size of the species, the shape of their bodies and the order in which they move their flippers as they climb up and down the sand. Just like turtle scientists and citizen scientists that help care for these endangered species every single day, you too can learn to identify the tracks left on the sand by nesting sea turtles! Ready to go out on a sea turtle track walk? Be mindful! Sea turtles are protected by the law, so remember to walk respectfully and at a safe distance from the nests.

MATERIALS

1. One good alarm clock! In order to have a successful mission, you and an adult will have to arrive at the beach before other beachgoers start walking over the tracks, consequently erasing them. Try to be at the beach between 6am-7am.
2. Print out this guide by the Florida Fish and Wildlife Conservation Commission (FWC) for your walk.
3. If you wish to have an extended version of the guide above, FWC website and learn the differences between the tracks made by a sea turtle that left the beach before nesting (a false crawl) and one that completed the process. (Optional)

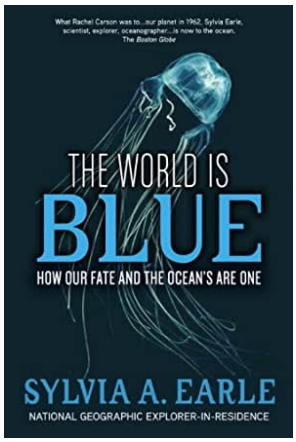
RECOMMENDATIONS

- To make sure you are not trampling any unmarked nests, please keep your walk as close to the water line as possible. The waterline can be easily identified by a long line of clumps of algae, seagrass, and shells that waves bring up to the shore
- If there happens to be a female nesting, please DO NOT approach. Keep a good distance from her, as your presence could be a stressor.

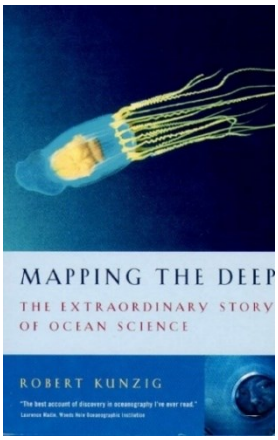
READ, WATCH, LISTEN!

Learn about our oceans by reading a book, watching a documentary, or listening to a podcast. Here is a list of options to aim for whenever you are missing the waves this summer. There are many more amazing audio-visual resources about the sea out there. Give them a try and keep on learning!

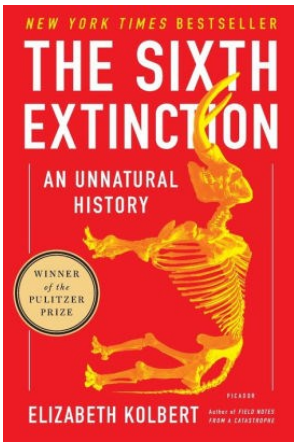
BOOKS



The World is Blue



Mapping the Deep

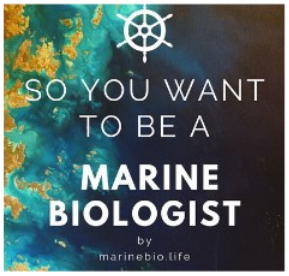


The Sixth Extinction

PODCASTS

Ocean Science Radio

Two Sea Fans



So You Want To be a Marine Biologist

ORCA Podcast

DOCUMENTARIES

A Plastic Ocean

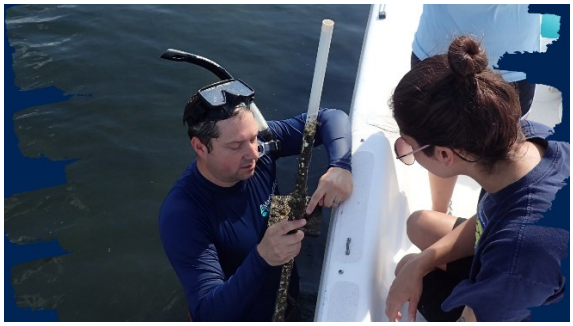
Chasing Coral

Mission Blue

(Full documentary)

CAREER DIVES: CONVERSATIONS IN MARINE SCIENCE SCHEDULE

Learn how Smithsonian marine science professionals earned their fins through this weekly summer series. Discussions will include how they found their paths into the marine sciences, interests, and research. Bring your questions for live Q&A sessions! Thursdays at 10 AM.



July 2
Dean Janiak, Biologist
Smithsonian Marine Station & Marine Geo Project
Registration: https://bit.ly/3cuMM7O

July 9
Kelly Pitts, Research technician
Coral Health and Marine Probiotics Lab,
Smithsonian Marine Ecosystems Exhibit
Registration: https://bit.ly/2U9418q

July 16
Michelle Donahue
Science writer and Communications specialist, Smithsonian Marine Station
Registration: https://bit.ly/2ACira8

July 23
Holly Sweat (Ph.D.),
Marine community ecologist
Smithsonian Marine Station
Registration: https://bit.ly/2U8eUas

July 30
Woody Lee,
Captain and Research technician
Smithsonian Marine Station
Registration: https://bit.ly/2ULwX6y