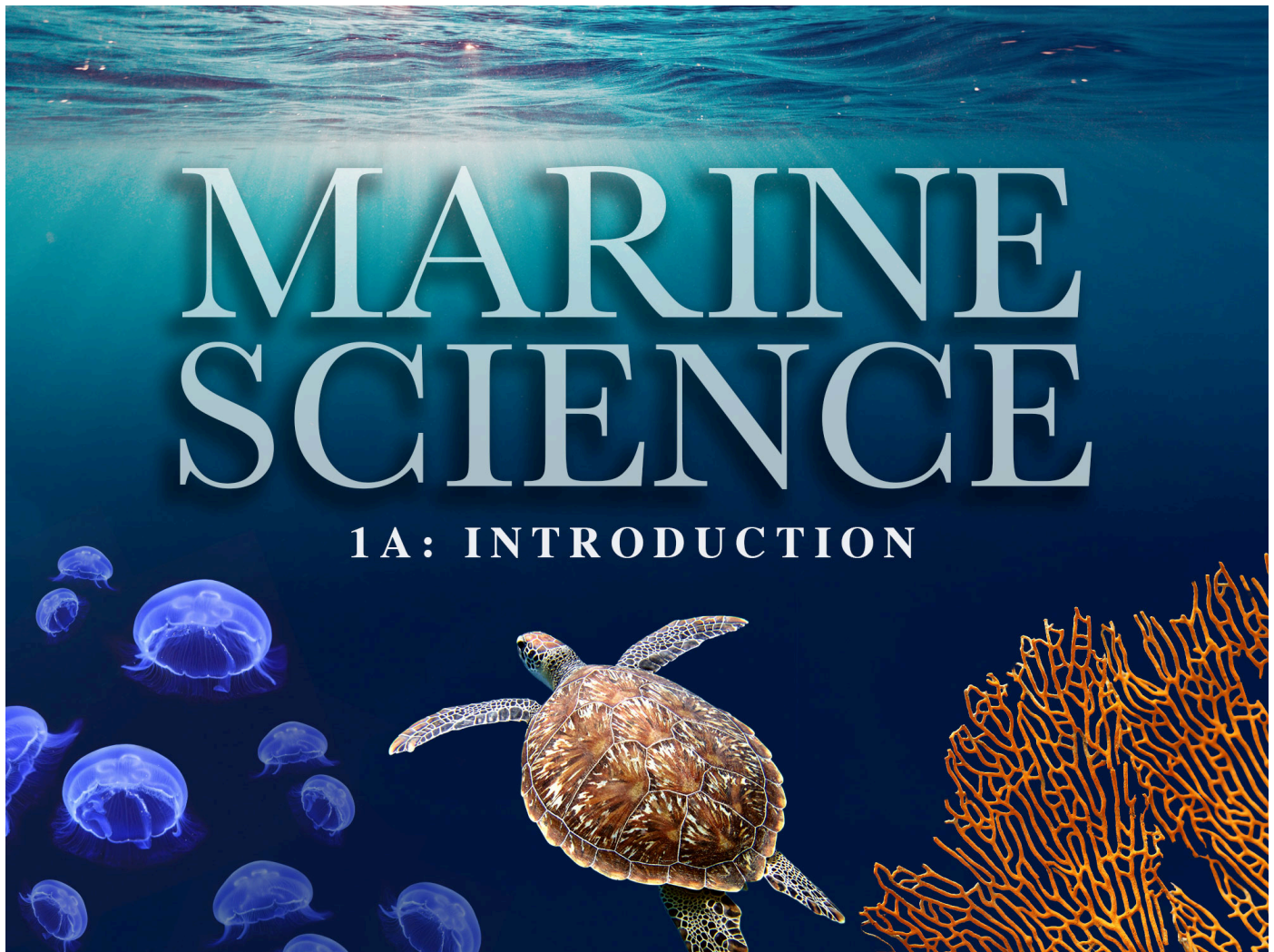


Course Syllabus

What you will learn in this course



Marine Science 1a: Introduction

From tiny puddles to vast oceans, water allows for processes that impact all things around us from wildlife and the air we breathe to our health and more! In this course, you will examine the essential nature of water and how its special properties support all life on Earth. Through the lens of the Scientific Method, you will engage with scientific inquiry to study aquatic ecosystems and how water, land, and weather all work together to create unique living environments. You will also learn about scientists who were critical to aquatic science and how to form valid and reliable conclusions from your study of water like they did. Let's dive in and see what makes water vital to life.

Unit 1: What Is Science?

Science is complex and dynamic while also being strict, methodical, and creative! We can describe and think of science in so many ways, but in order to go deeper into marine science, we'll need to nail down a working definition of science in general. How do we define this broad, all-encompassing term? We will arrive at a definition for science and work through what it means to be a scientist, how to test your ideas and observations scientifically, and how to present them to the world!

What will you learn in this unit?

After studying this unit, you will be able to:

1. Describe what constitutes science and how to test the reliability of a scientific claim
2. Discuss the steps of the scientific method
3. Envision a plan to test a hypothesis
4. Consider how a scientist's culture and background impact their findings
5. Explain how scientists from different times and places come to similar conclusions
6. Understand the parts of a scientific article

Unit 1 Assignments	
Assignment	Type
Lesson 01: The Basics of Science	Lesson
Lesson 02: A Walk Through the Scientific Method: Part 1	Lesson
Lesson 03: A Walk Through the Scientific Method: Part 2	Lesson
Lesson 04: Scientists Are People, Too	Lesson
Lesson 05: Reproducing Results	Lesson
Lesson 06: How to Read a Scientific Article	Lesson
Critical Thinking Questions	Submission
Activity 1: What Do I Want to Learn?	Submission
Activity 2: How Do You Read a Scientific Article?	Submission
Activity 3: What Does the Scientific Method Look Like?	Submission
Unit 1 Discussion 1	Discussion
Unit 1 Discussion 2	Discussion
Unit 1 Quiz	Multiple Choice

Unit 2: The Science of Water

Have you ever heard of the chemical compound dihydrogen monoxide? Every so often, a news outlet or a prank group will post an article or a survey listing the hazards of this chemical, like its ability to corrode and damage metals and the fact that it's a major component of acid rain. While this is all true, it's kind of a manipulation of the truth. Dihydrogen monoxide is simply the chemical name for water! Humidity does corrode metals, and water is obviously a major component of any kind of rain. Luckily for you, you're about to develop such a solid understanding of the science of water that you'll never fall for any kind of dihydrogen monoxide prank!

What will you learn in this unit?

After studying this unit, you will be able to:

1. Explain why the atomic structure of water gives it such unique properties
2. Identify the processes that allow water to move through various states
3. Define the principles of fluid dynamics, including hydrostatic pressure and buoyancy
4. Describe how density is affected by salinity, temperature, and pressure
5. Understand the basic functions of three biogeochemical cycles

Unit 2 Assignments	
Assignment	Type
Lesson 01: The Water Molecule	Lesson
Lesson 02: The States of Water	Lesson
Lesson 03: The Principles of Fluid Dynamics	Lesson
Lesson 04: Density	Lesson
Lesson 05: Biogeochemical Cycles	Lesson
Critical Thinking Questions	Submission
Activity 1: How Does the Nitrogen Cycle Work in the Ocean?	Submission
Activity 2: Will an Egg Sink or Float?	Submission
Unit 2 Discussion 1	Discussion
Unit 2 Discussion 2	Discussion
Unit 2 Quiz	Multiple Choice

Unit 3: An Earth of Land and Water

Earth is ever changing and ever moving. Whether it be the consistent shifting of continents, the violent shaking caused by an earthquake, or the fluctuating shapes of erratic coastlines, Earth never seems to rest. Understanding the mechanisms behind each of these processes will leave you with a greater appreciation for the monumental force that is Mother Nature. Grasping these concepts requires that we learn about the scientists, oceans, and landmasses of the past so that we can anticipate how these geological processes may affect our future.

What will you learn in this unit?

After studying this unit, you will be able to:

1. Describe how and why continents move over time
2. Understand the causes of various geological phenomena like earthquakes, volcanoes, and mountain ranges
3. Recognize and classify the different zones of the ocean based on their various characteristics
4. Illustrate how water in lakes, streams, rivers, and oceans shapes the topography of the land and the sea

Unit 3 Assignments	
Assignment	Type
Lesson 01: How the Ocean Has Changed	Lesson
Lesson 02: Oceanic Basins and Boundaries	Lesson
Lesson 03: The Zones of the Ocean	Lesson
Lesson 04: How Water Shapes Land and Sea	Lesson
Critical Thinking Questions	Submission
Activity 1: Could You Survive the Real Twilight Zone?	Submission
Activity 2: What Are Island Atolls?	Submission
Activity 3: What Does a Cross-Section of the Ocean Look Like?	Submission
Unit 3 Discussion 1	Discussion
Unit 3 Discussion 2	Discussion
Unit 3 Quiz	Multiple Choice

Unit 4: Weather Patterns on the Water

From 1962 to 1963, the Galveston Laboratory of the US Bureau of Commercial Fisheries (now known as the National Oceanic and Atmospheric Administration, or NOAA) released close to 8,000 glass bottles into the Gulf of Mexico. More than 57 years later, a couple walking the beach of Padre Island National Seashore in Corpus Christi, Texas, found one of those bottles. Inside the bottle, they discovered a postcard asking for the date and location the bottle was found. If the postcard was mailed back to NOAA, the couple would receive a \$0.50 reward! This experiment was meant to study ocean currents. Luckily, we now have much more sophisticated techniques and tools that help us to understand how the ocean moves. While we may all be familiar with terms like “current,” “wave,” “tide,” and “hurricane,” do we truly understand how these concepts describe hydrological movements within aquatic ecosystems? Don’t worry—it won’t take 57 years to find out!

What will you learn in this unit?

After studying this unit, you will be able to:

1. Identify and describe the measurable properties of a wave
2. Understand the importance of currents and how they affect various global systems
3. Describe how currents shape the biospheres around them
4. Recognize how weather and seasons impact aquatic ecosystems

Unit 4 Assignments	
Assignment	Type
Lesson 01: Waves	Lesson
Lesson 02: Currents	Lesson
Lesson 03: How Currents Cause Change	Lesson
Lesson 04: Weather and Aquatic Ecosystems	Lesson
Critical Thinking Questions	Submission
Activity 1: What Have I Learned So Far?	Submission
Activity 2: What Would We Find on the Galapagos Islands?	Submission
Unit 4 Discussion 1	Discussion
Unit 4 Discussion 2	Discussion
Unit 4 Quiz	Multiple Choice

Midterm Exam

1. Review information acquired and mastered from this course up to this point.
2. Take a course exam based on material from the **first half** of the course (**Note:** You will be able to open this exam only one time.)

Midterm Exam Assignments	
Assignment	Type
Midterm Exam	Multiple Choice
Midterm Discussion	Discussion

Unit 5: Life in the Water

The Great Divide—otherwise known as the Continental Divide of the Americas—determines how water flows as it makes its way from the northern tip of Alaska down through Canada, the United States, and then Mexico. If water falls to the west of the divide, it flows to the Pacific Ocean. If water falls to the east of the divide, it eventually makes its way to the Gulf of Mexico. The ability of water to flow all around the world is what helps

life flourish in even the most remote locations. Learning more about aquatic ecosystems and how all bodies of water are connected will help us to understand how vital it is that we advocate for adequate water quality around the globe.

What will you learn in this unit?

After studying this unit, you will be able to:

1. Recognize why water is an optimal ecosystem environment for the majority of Earth's organisms
2. Define a watershed and how the disrupted homeostasis of one body of water impacts another
3. Understand how to use various instruments and tools to measure water quality
4. Analyze and draw conclusions from a water sample

Unit 5 Assignments	
Assignment	Type
Lesson 01: Water as a Habitat	Lesson
Lesson 02: Wonderful Watersheds	Lesson
Lesson 03: Time to Test!	Lesson
Lesson 04: Analyzing a Water Sample	Lesson
Critical Thinking Questions	Submission
Activity 1: How Do We Test Water?	Submission
Activity 2: How Does Water Flow in a Watershed?	Submission
Unit 5 Discussion 1	Discussion
Unit 5 Discussion 2	Discussion
Unit 5 Quiz	Multiple Choice

Unit 6: Exploring Aquatic Ecosystems

Imagine you are a fish. What is the first thing you need for survival? Water! Okay, quick—find a body of water. Luckily for you, the vast majority of Earth's surface is covered by water. You could choose to live in the ocean, but where in the ocean would you live? Surface waters? Deep water? Maybe fresh water would be better for you! Even though we aren't fish and won't have to make these choices, learning about the many aquatic ecosystems and the factors that impact whether an organism can live somewhere or not can give you insight into how human activity affects aquatic systems.

What will you learn in this unit?

After studying this unit, you will be able to:

1. Explain the defining characteristics of various fresh water and brackish ecosystems
2. Define the various biotic and abiotic factors of multiple marine ecosystems
3. Describe the aquatic life zones that exist in different bodies of water
4. Categorize aquatic vertebrates and invertebrates and depict the biotic and abiotic factors that influence where they can live and why
5. Understand how human activity contributes to unbalanced ecosystems

Unit 6 Assignments	
Assignment	Type
Lesson 01: Fresh-Water and Brackish Ecosystems	Lesson
Lesson 02: Marine Ecosystems	Lesson
Lesson 03: Aquatic Life Zones	Lesson
Lesson 04: Aquatic Life	Lesson
Lesson 05: Unbalanced Ecosystems	Lesson
Critical Thinking Questions	Submission
Activity 1: What Unique Organisms Call Water Home?	Submission
Activity 2: What Are the Effects of Red Tides?	Submission
Activity 3: What Happens When Ocean Meets Land?	Submission
Unit 6 Discussion 1	Discussion
Unit 6 Discussion 2	Discussion
Unit 6 Quiz	Multiple Choice

Unit 7: How Ecosystems Work

The Great Barrier Reef is one of the seven wonders of the natural world. This sensational underwater environment is a large, sweeping ecosystem that is home to 3,000 coral reefs, each of which is considered its own unique ecosystem.^[1] Let's zoom in on one of these smaller ecosystems: A large barracuda lingers overhead as hundreds of tiny damselfish actively feed on algae growing on the reef, a lone tiger shark swerves through the dynamic coral, and many smaller prey fish lunge inside their hiding spots along the living reef. How do all these organisms live harmoniously within the same area? In this unit, we will define all the interspecies relationships mentioned above—and more!

What will you learn in this unit?

After studying this unit, you will be able to:

1. Understand how matter cycles within various aquatic systems
2. Describe how energy flows through the different organisms within an ecosystem using food chains, food webs, and energy pyramids
3. Recognize the different forms of relationships that exist between different individuals in an ecosystem
4. Predict how a population will grow over time using mathematical formulas

Unit 7 Assignments	
Assignment	Type
Lesson 01: The Flow of Matter and Energy	Lesson
Lesson 02: Energy Flow in an Ecosystem	Lesson
Lesson 03: Organism Relationships	Lesson
Lesson 04: Characteristics of a Population	Lesson
Critical Thinking Questions	Submission
Activity 1: How Does Carbon Move Through an Energy Pyramid?	Submission
Activity 2: How Do Symbiotic Relationships Help a Species Survive?	Submission
Unit 7 Discussion 1	Discussion
Unit 7 Discussion 2	Discussion
Unit 7 Quiz	Multiple Choice

Unit 8: The Evolution of Aquatic Life

We as humans tend to think of “life” in terms of terrestrial life-forms. However, much of life’s history has occurred under water. Approximately 2.3 billion years ago, a microbe known as cyanobacterium was the first known photosynthetic organism to produce gaseous oxygen—a game changer for life on Earth. However, it wasn’t until about 252 million years ago that shark and fish ancestors started to populate ocean environments. So, how do we go from cyanobacterium to the intense diversity we see today among plants and animals? The answer is simple: evolution. But just what exactly is this complex process? Let’s learn all about it!

What will you learn in this unit?

After studying this unit, you will be able to:

1. Define natural selection, and describe the conditions required for its success
2. Identify, compare, and classify aquatic organisms using a dichotomous key
3. Recognize and describe inherited adaptations in marine and fresh-water organisms
4. Explain how scientists have studied inherited adaptations throughout history

Unit 8 Assignments	
Assignment	Type
Lesson 01: Natural Selection	Lesson
Lesson 02: Identifying Aquatic Organisms	Lesson
Lesson 03: Adaptations of Marine and Fresh-Water Organisms	Lesson
Lesson 04: Studying the Adaptations of Marine Life	Lesson
Critical Thinking Questions	Submission
Activity 1: What Did I Get from This Course?	Submission
Activity 2: What Adaptations Help Sharks Survive?	Submission
Unit 8 Discussion 1	Discussion
Unit 8 Discussion 2	Discussion
Unit 8 Quiz	Multiple Choice

Final Exam

1. Review information acquired and mastered from this course up to this point.
2. Take a course exam based on material from **all units** in this course. (**Note:** You will be able to open this exam only one time.)

1. <https://education.nationalgeographic.org/resource/great-barrier-reef> ↔