

Muse®

Under the Sea

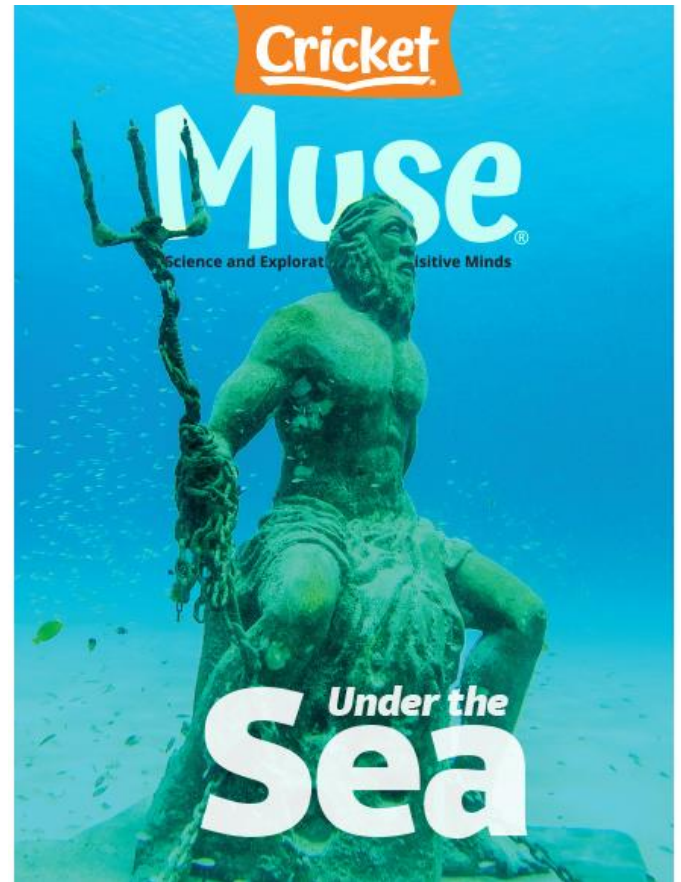
Marine exploration pioneer Jacques Cousteau once said, “The sea, once it casts its spell, holds one in its net of wonder forever.” This issue of MUSE echoes that sentiment as it introduces readers to long-lost shipwrecks, the birth of a coral reef, and the discovery of an underwater continent.

CONVERSATION QUESTION

What are scientists studying beneath the sea?

TEACHING OBJECTIVES

- Students will learn about the loss and rediscovery of the *Endurance*.
- Students will learn about the formation of artificial coral reefs.
- Students will learn about the discovery of the undersea continent Zealandia.
- Students will compare and contrast two different expeditions.
- Students will classify information.
- Students will construct explanations.
- Students will create meaningful mottos.
- Students will research the effects of artificial reefs on climate change.
- Students will use a mathematical formula to calculate area.



In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

SELECTIONS

- **By Endurance, We Conquer**
Expository Nonfiction, ~990L
- **The Second Life of a Shipwreck**
Expository Nonfiction, ~990L
- **A Land Underwater**
Expository Nonfiction, ~980L

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By Endurance, We Conquer

pp. 12–15, Expository Nonfiction

Students will read the full-circle account of the *Endurance*. Although the expedition ultimately failed to achieve its main objective, the ship and its crew are remembered as a remarkable example of determination and survival.



RESOURCES

- Compare and Contrast: Lost and Found

OBJECTIVES

- Students will learn about the loss and rediscovery of the *Endurance*.
- Students will compare and contrast two different expeditions.
- Students will create meaningful mottos.

KEY VOCABULARY

- **endurance** (p. 12) the ability to withstand hardship or adversity
- **coordinates** (p. 14) a set of numbers that is used to locate a point on a map or graph
- **degrade** (p. 15) to make the quality of something worse

ENGAGE

Conversation Question: What are scientists studying beneath the sea?

Tell students that the title of the article they will be reading is “By Endurance, We Conquer.” (Use the definition provided to discuss the meaning of the word *endurance*.) Point out that this phrase was also the personal motto of Ernest Shackleton, the captain of the ship *Endurance*. Have students use the title to help them predict the content of the article. Revisit predictions after the reading.

INTRODUCE VOCABULARY

Post and discuss the three vocabulary words and definitions. Have students Think-Pair-Share with a partner. Give them the following directives, one at a time:

1. Discuss the difference between physical and mental **endurance**. Talk about a situation in which you needed endurance.
2. Quickly sketch a 10×10 grid and number each axis 1–10. Have partners take turns giving each other **coordinates** to graph.
3. How could leaving your bike out in the rain **degrade** it?

READ & DISCUSS

Read the article aloud with the class. Have students reread the article in small groups to answer the questions below. Share responses.

1. Who captained the *Endurance* and how was the ship lost?
2. How did the captain and crew of the *Endurance* survive?
3. How did Autonomous Underwater Vehicles aid in the search for the *Endurance*?
4. List two things that explain how the *Endurance* was so well preserved.
5. How have Ernest Shackleton and his crew been honored and memorialized?

SKILL FOCUS: Compare and Contrast

INSTRUCT: Students will compare and contrast the expeditions of the *Endurance* and the *Endurance22*. Instruct pairs of students to revisit the text and underline information that will be helpful for this purpose. Introduce the *Compare and Contrast: Lost and Found* worksheet, and have partners record the data in the table.

ASSESS: Reconvene and review the worksheet.

EXTEND

Language Arts: Write Shackleton’s motto on the board: “By Endurance, We Conquer.” Inform students that a motto is a sentence or phrase that expresses a rule guiding the behavior of a person or group. A motto is meant to convey a positive attitude. Have students share mottos they know of, such as a school, team, or family motto. Then have them choose a group they belong to and create a fitting, positive motto for it. Encourage students to share their mottos and explain why it fits the group they wrote it for.

Lost and Found

Compare and Contrast Refer to the article and locate information to complete the chart below. Use details to explain each element of the expedition.

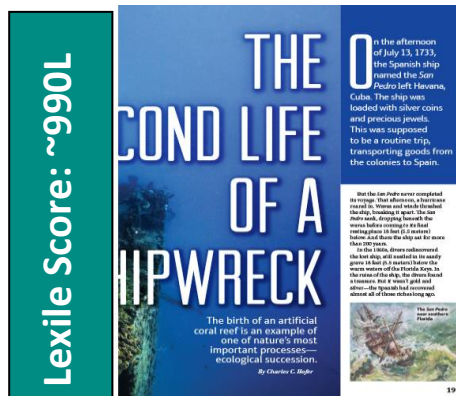
Expedition:	<i>Endurance</i>	<i>Endurance22</i>
mission		
tools/technology		
obstacles		
crew characteristics		
success or failure?		

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The Second Life of a Shipwreck

pp. 18–22, Expository Nonfiction

Readers will be submerged alongside the shipwreck *San Pedro* and will learn how it has become part of one of nature's most important processes. The wreck site boasts the birth of an artificial coral reef that has grown through gradual changes of species and communities over time.



RESOURCES

- Classifying Information: Reef Revival

OBJECTIVES

- Students will learn about the formation of artificial coral reefs.
- Students will classify information.
- Students will research the effects of artificial reefs on climate change.

KEY VOCABULARY

- spellbinding** (p. 20) holding your attention completely by being extremely interesting or entertaining
- shrubland** (p. 20) land on which shrubs and small trees are the main types of plants
- parrotfish** (p. 21) brightly colored marine fish with a parrot-like beak used for scraping food from coral or other hard surfaces

ENGAGE

Conversation Question: What are scientists studying beneath the sea?

Display the title of the article. Inform students that they will be learning about the *San Pedro*, a ship that sank off the coast of Florida in 1733. It was rediscovered by divers in the 1960s. Pose the following questions:

- How many years ago did the *San Pedro* sink? (**Answer:** 290 years)
- Supposing the ship was rediscovered in 1965, how many years did the ship remain lost in its sandy grave? (**Answer:** 232 years)
- How many years have passed since its rediscovery? (**Answer:** 58 years) Have students predict what the wreckage site looks like now.

INTRODUCE VOCABULARY

Post the three Key Terms. Review compound words (two smaller words combined to make a new, larger word). Use the word *shipwreck* as an example: *ship*—a large boat; *wreck*—a structure that has been damaged or destroyed. Ask how knowing the meaning of the parts can help them define the whole. Have students bisect and define the vocabulary words. Then post the meanings provided and compare definitions.

READ & DISCUSS

Pose the following questions to prompt meaningful discussion. Students should use complete sentences and details to answer each question.

- Explain ecological succession.
- What is the purpose of the Florida Keys National Marine Sanctuary?
- What is a pioneer species?
- How does the formation of a natural coral reef differ from that of an artificial reef?
- How do artificial reefs relieve human pressure on natural reefs?

SKILL FOCUS: Classify Information

INSTRUCT: Elicit from students that the main idea of the article is to provide readers with knowledge about the process of ecological succession and how it relates to the growth of artificial reefs. Present the *Classifying Information: Reef Revival* graphic organizer. Tell students they will use information from the article to determine if the statements listed describe an event in the primary or secondary succession.

ASSESS: After students complete the worksheet, have them create a mural of a coral reef. This can be an ongoing project as they study this issue of MUSE.

EXTEND

Environmental Science: Have students reread the final paragraph of the article, which begins with this sentence: “Artificial reefs are also at the frontlines in the battle against climate change.” Have students use print and online resources to learn **WHO** is working on artificial reef projects, **WHAT** is being done, **WHERE** efforts are being concentrated, **WHEN** artificial reef projects began, and **HOW** and **WHY** artificial reefs are a tool in addressing the serious risks to coastal communities posed by powerful storms and rising sea levels.

Reef Revival

Classifying Information Use information from the article to determine if the sentence pertains to something that happens during the **primary succession (P)** or during the **secondary succession (S)**. Write **P** or **S** in the box next to each sentence to indicate the stage of ecological succession.

	1. Once a larva finds a home, the soft-bodied coral metamorphoses into its next life stage called the polyp.
	2. Primary consumers soon arrive and will munch on the algae and help clean the coral.
	3. Filter feeders like clams and sea sponges move in, as do scavengers and decomposers.
	4. The process starts with the tiniest of organisms, known as the pioneer species.
	5. Communities of plants and animals move into the habitat created by the growing coral colony.
	6. Multiplying coral create the foundations for hard coral (reef-building coral) to grow.
	7. Eventually a few tiny coral polyps will build an entire coral colony.
	8. Algae and sea grasses will be the producers that form the base of the reef food chain.
	9. Together, the colonies of soft-bodied and hard-bodied polyps create the foundations for the coral reef ecosystem.
	10. With time, predators arrive at the reef

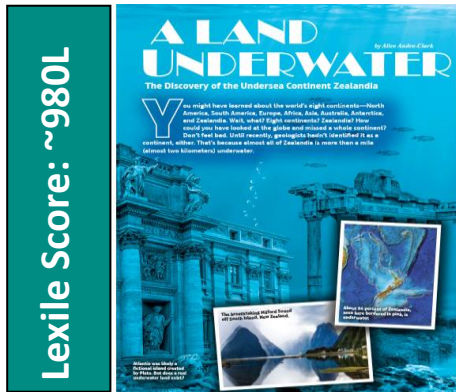
THINK TANK: When does a coral reef become a climax community? Discuss with a partner.

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A Land Underwater

pp. 36–37, Expository Nonfiction

Although about 94 percent of Zealandia is underwater, readers will discover how the landmass that once seemed like the remains of a mountain chain recently became classified as a continent.



RESOURCES

- Construct Explanations: A “Zeal” for Exploration

OBJECTIVES

- Students will learn about the discovery of the undersea continent Zealandia.
- Students will construct explanations.
- Students will use a mathematical formula to calculate area.

KEY VOCABULARY

- international** (p. 37) occurring between two or more nations

ENGAGE

Conversation Question: What are scientists studying beneath the sea?

Arrange the class into four groups and give each group a different land division to consider. Group 1: What defines something as a city/town? Group 2: What defines something as a state? Group 3: What defines something as a country? Group 4: What defines something as a continent? Give each group the opportunity to share their thoughts. Then have them ponder how a “new” town, state, country, or continent could be formed. Introduce the article “A Land Underwater.”

INTRODUCE VOCABULARY

Post and discuss the Key Word and its definition. Take the opportunity to do a primary word study using the word **international** as follows: *How many letters does the word have? How many letters are vowels? How many letters are consonants? How many syllables does the word have? Is it a thing (noun), action word (verb), or a describing word (adjective)? How can you use the word in a sentence? What words have a similar meaning to international (synonym)?*

READ & DISCUSS

Reinforce comprehension of the concepts presented in the article by using the following questions to direct discussion:

- How did New Zealand geologist Nick Mortimer become a continent seeker?
- What advancements in tools and technology between 1960 and 1990 gave scientists confidence that an undersea continent existed?
- Why is exploring an underwater continent particularly expensive and difficult?
- Why did exploring Zealandia become more appealing to New Zealand after a change in international law?
- What is still unknown about Zealandia?

SKILL FOCUS: Construct Explanations

INSTRUCT: Advise students to review the article and to study the four criteria that scientists use when trying to decide which landmasses can be considered continents. Distribute the *Construct Explanations: A “Zeal” for Exploration* graphic organizer. Tell students they will use information from the article to complete the chart.

ASSESS: Review the chart and then revisit the discussion from the Engage activity. What new information is revealed in the text?

EXTEND

Mathematics: Landmasses are calculated in square measurements because they have a length, a width, and a surface area. For example, Zealandia has an area of 1.9 square miles. Have students use the mathematical formula $A = L \times W$ to calculate the area of a playground with a length of 35 feet and a width of 27 feet.

(Answer: 945 square feet)

A “Zeal” for Exploration

Construct Explanations Use information from the text, particularly from page 37, to explain the four continent-defining criteria below. Include article details in your explanations.

Size	Separation
Rocks	Elevation

**What is a
continent?**