Khaled bin Sultan Living Oceans Foundation

STANDARDS

- **CCSS**: RST.9-10.1, 3, 4, 5, 7, 8, 10; RST.11-12.1, 3, 4, 10; SL.9-10.1, 2, 3, 4, 6; SL.11-12.1, 2, 3, 4, 6; HSN.Q.A.1; HSS.IC.A.1
- **NGSS**: HS-LS1-2, HS-LS2-6
- **OLP**: 1.B, 5.B.1, 5.B.5

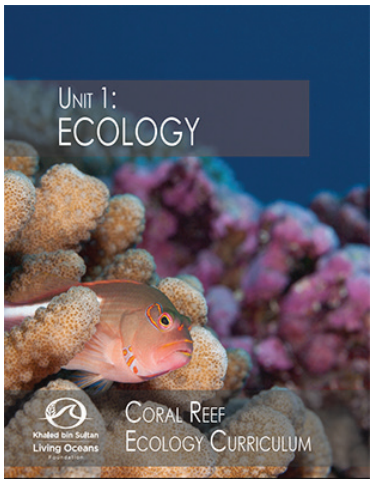
ONLINE CONTENTS

- Ecology Quiz
- *What Is Ecology?* Video
  Ecology explores living things, plus the way they interact with one another, and their physical surroundings. A coral reef is a very special type of home, it provides nourishment and shelter to an amazing range of living creatures. They interact with non-living things like rocks and sand, ocean currents, temperature, and much more. A vast web of living and non-living things makes up the ecology of coral reefs.

ECOLOGY

This lesson is a part of the *Ecology* unit, which explains what ecologists study and how it applies to coral reefs. Below is a summary of what is included in the entire unit.

UNIT CONTENTS



A. Background Information
   - Ecology
   - Biological Hierarchy of Life
   - Ecological Levels of Organization

B. Lessons

Watch it! What is Ecology?
- A worksheet to accompany the *What is Ecology?* video

Factors of the Reef
- A lesson to differentiate between inference and observation

Backyard Ecosystem
- An activity to perform a biological survey of an outdoor area

Read It! Lionfish: Scourge of the Caribbean
- A worksheet to accompany the *Lionfish: Scourge of the Caribbean* field blog

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LESSON 1 TEACHER'S NOTES

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LEARNING OBJECTIVES

- Differentiate between observation and inference.
- Classify ecological factors as biotic or abiotic
- Describe interactions between biotic and abiotic factors.

KEYWORDS

- Abiotic Factor
- Biotic Factor
- Ecology
- Inference
- Observation
- Organism

MATERIALS

- **Watch It! What is Ecology?** student worksheet
- **Lesson 1: Factors of the Reef** student worksheet
- **Appendix A: Coral Reef Pictures**

STANDARDS

- CCSS: RST.9-10.4, 5, 7; RST.11-12.4; SL.9-10.1, 3, 4, 6; SL.11-12.1, 3, 4, 6; HSN.Q.A.1; HSS.IC.A.1
- NGSS: HS-LS1-2
- OLP: 1.B, 5.B.1

PROCEDURE

1. Watch *What is Ecology?* YouTube video (https://youtu.be/TGR-QGdH3QU) and answer questions on Watch It! What is Ecology? student worksheet.
2. Teach *Unit 1: Ecology - Background Information*.
3. In order to reuse the activity, laminate the reef pictures found in **Appendix A: Coral Reef Pictures**.
4. Break students into groups. The activity will work best in groups of 3-4 students. This activity can also be conducted by individual students.
5. Hand out **Lesson 1: Factors of the Reef** student worksheet.
6. Go over *Additional Background Information* on the **Lesson 1: Factors of the Reef** student worksheet. Discuss the difference between observation/inference and biotic/abiotic. Ask students to write the definitions for each on their worksheet.
7. Either assign each group three pictures or set up stations around the room using all six pictures. Groups can rotate to each station.
8. Explain to students that they are going to make observations about a picture of a coral reef. They will identify a factor on the reef and record their observations about it. Remind students that they should use their prior knowledge.
9. Next, students will infer whether the factor is biotic or abiotic. Students can also use evidence related to their observations to explain how they came to their inference. They should identify at least one abiotic factor for each picture.
10. Once each group has finished, instruct them to present their findings for one or more of the pictures (This depends on group size). Each person in the group must present. If students are working individually, have each student present one factor to the class. Students should share what they observed and what inferences were made. Have the class decide whether they agree or disagree with whether the factor is biotic or abiotic. If anyone disagrees, be sure to ask that student why.
11. Have students answer the questions on their worksheet.

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LESSON 1 FACTORS OF THE REEF

ADDITIONAL BACKGROUND INFORMATION:

Do you know the difference between observation and inference?

Let's say that one day you're taking a walk along the beach. You look towards the sky to the west and you notice that some very dark clouds are forming, the wind suddenly picks up, and thunder starts to boom. What are your observations? What inferences can you make using this information?

Observation is a fact that is learned through the senses. There are five senses: sight, hearing, touch, taste, smell. When walking on the beach you *felt* and could probably *hear* that the wind had picked up. You were able to *hear* the thunder and *see* dark clouds. These are all observations.

Inference is based on observations and past experiences. While walking on the beach, you probably inferred that there is a storm on the way. You knew this based on your observations and past experiences of being in a storm.

What is the difference between an abiotic factor and a biotic factor?

Remember that abiotic means without life, so it is the non-living components of an ecosystem, like rocks, temperature, or the sun.

Biotic means living. Most scientists agree that all living organisms

- are made up of at least one cell,
- reproduce,
- have DNA to pass on to the next generation,
- and use energy to perform life functions and maintain their internal environments.

There are other characteristics, like movement, that indicate that an organism is living, but not all organisms have them. Other examples of these characteristics are:

- response to a stimulus,
- complexity,
- and growth/development.

INSTRUCTIONS:

1. Write the definitions for *abiotic*, *biotic*, *inference*, and *observation* in the space provided below.
2. In *Table 1*, write down the picture number that you were assigned by your teacher.
3. Observe the picture. Record all of your observations in *Table 1*. You should have at least 8 observations per picture.
4. Choose three factors from your observations. Make an inference about whether it is biotic or abiotic. Record this in the right-hand column of *Table 1*. Be sure to include an explanation for why you said this, based on your observations. (NOTE: You should describe at least one abiotic factor per picture.)
5. Repeat steps 2-4 with other reef pictures that are assigned by your teacher.
6. Present the information about one of the pictures to the class.
7. Answer the questions below.

INSTRUCTIONS: Fill out the table.

Term	Definition
Abiotic	
Biotic	
Inference	
Observation	

TABLE 1:

Photo #	Observations	Inferences
1		

Photo #	Observations	Inferences
2		
3		

Photo #	Observations	Inferences
4		
5		
6		

INSTRUCTIONS:

1. Did inferences change the way that you classified the factors? Explain your answer and provide an example.

2. Did you classify any of the factors incorrectly? Why did this happen?

3. Write a paragraph explaining three interactions among these factors. Use both observations and inferences to help you with your writing. Your interactions should include:
   - how two biotic factors affect each other
   - how two abiotic factors affect each other
   - how an abiotic factor affects one of the biotic factors

INSTRUCTIONS: Fill out the table.

Term	Definition
Abiotic	**The non-living component(s) of an organism's environment.**
Biotic	**The living or once living component of an organism's environment.**
Inference	**Drawing a conclusion based off of past experiences and observations.**
Observation	**A fact that is learned through one of the five senses: sight, sound, touch, taste, and hearing.**

TABLE 1: Answers may vary.

Photo #	Observations	Abiotic/Biotic Inferences
1	• There are a lot of fish. • Some of the fish are blue and some are yellow. • Light can be seen at the surface of the water. • The light looks white. • The water is blue. • The water is rippled at the surface. • The fish at the top of the photo has a rainbow on it. • Rainbows are created from a refraction of light in the water. • There are many types of coral. • Most of the coral is brown, but some is orange and some is red/pink.	Light is not made up of matter or cells, so it is abiotic. The water is moving around, so it is biotic. (NOTE: This is an inference that a student could potentially make. However, water is abiotic.) The rainbow is abiotic because it is made up of light, which is abiotic.

Photo #	Observations	Abiotic/Biotic Inferences
2	• The clam is really big and maroon. • It has a siphon in the center. • Its shell is covered with other organisms. • The human is holding a camera. • The camera is black and has flash bulbs. • The human has blue fins on. • There is a big hunk of yellow coral on the left. • There is green algae growing around the clam. • There is sand on the bottom of the water column. • The sand is white. • There are many things growing out of the sand. • The water is darker blue in the background and aqua close to the sand.	The clam is biotic because it uses its siphon to filter food. Living things need food. The camera is made of synthetic materials, such as plastic, so it is abiotic. The sand cannot move on its own and does not eat, so it is abiotic.
3	• The snake takes up most of the picture. • It is S-shaped and has a paddle shaped tail. • The snake is sort of orange colored, with its head darker than its body. • Its eye is open. • There are patterns in the sand. • Currents are the movement of water. • The sand is white. • There is purple coral under the snake. • There are patches of living coral and algae on the rock behind the snake. • There is a bowl-shaped coral on the back of the rock. • It looks like bubbles are coming out of it. • The back part of the picture is darker than the front.	Snakes on land move in an S-shape, so this snake is swimming through the water. Moving things are biotic. Currents are putting the patterns in the sand. They are not touchable, so they are abiotic. The photographer used a flash. Since darkness is not always there, it is abiotic.

Photo #	Observations	Abiotic/Biotic Inferences
4	• There are many types of corals. • Some look like fingers reaching up. • Others are round. • Most of the coral is tan colored. • There are many things growing on the corals, like the green and pink blobs between the fingers. • There are many types of fish in the background. • Some of them are multicolored. • The water is blue with lighter patches at the top. • There are little dots all over the water column, catching the light. • The sand on the bottom is white. • The coral to the left of the center is making a shadow on the sand. • Shadows form when light is blocked by an object.	Corals are abiotic because they cannot move and they look like rocks. (NOTE: This is an inference that a student could potentially make. However, coral is biotic.) The dots in the water column are plankton, which is a character on Sponge Bob, so it is biotic. Shadows are not always there, so they are abiotic.
5	• The water is a light blue. • There is a spot of white light at the top of the photo. • The corals are little branching mounds. • They are many different colors. • There are two yellow and black fish at the front of the photo. • More fish are in the background. • The fish are at different depths and different angles. • There is green algae that looks like lettuce growing between the corals in the front, right of the photo.	It is sunny and warm here. Temperature is not tangible, so it is abiotic. The fish are swimming around. Moving things are biotic. The green color of the algae means it does photosynthesis, so it is biotic.
6	• Bubbles are clumped up near the top of the photo. • There is a school of black-striped fish. • There is coral on the bottom half of the photo. • It is tan colored and bumpy. • There is a black and orange fish under the human. • The human is holding a camera. • She has a blue tank with a yellow and green label and a black bottom on her back. • Her legs are spread apart.	The bubbles are floating up from the person so probably contain carbon dioxide. They are abiotic. The tank is made of metal and filled with oxygen, so it is abiotic. The human is kicking to move through the water, so she is biotic.

INSTRUCTIONS: Answers may vary.

1. Did inferences change the way that you classified the factors? Explain your answer and provide an example.
   Inferences changed the way that I classified factors as biotic or abiotic. Without this previous knowledge, I might have classified the organisms differently. For example, I know that fish are vertebrates. Vertebrates are animals and therefore they are living or biotic.

2. Did you classify any of the factors incorrectly? Why did this happen?
   I classified water as biotic. I thought it could move on its own and things that move are living. I classified coral as abiotic. I thought it was a rock which is not living.

3. Write a paragraph explaining three interactions among these factors. Use both observations and inferences to help you with your writing. Your interactions should include:
   - how two biotic factors affect each other
   - how two abiotic factors affect each other
   - how an abiotic factor affects one of the biotic factors

   Biotic and abiotic factors can affect each other. For instance, a sponge (biotic) may try to grow on a coral (biotic), which could kill it. The water (abiotic) can move sand (abiotic) around so it is in different places and shapes. Finally, the sun (abiotic) helps the coral (biotic) get energy.

PHOTO 1

PHOTO 2

PHOTO 3

PHOTO 4

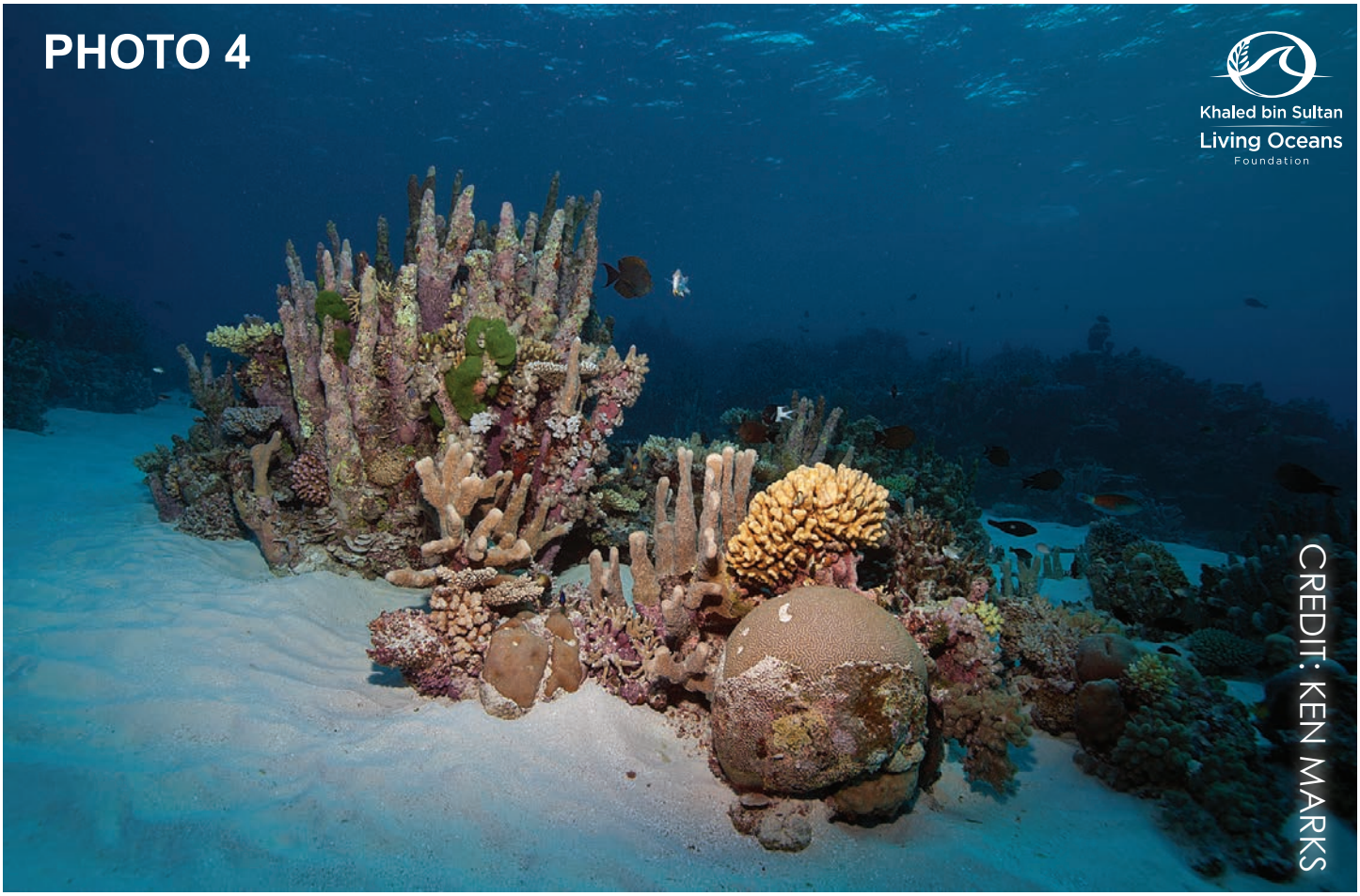

PHOTO 5

PHOTO 6