Lesson 3.5
The Scientist Who Cracked the Dolphin Code
Now that students understand how sounds can be different from other sounds, they are introduced to their next Investigation Question: How can dolphins use different sounds to communicate with one another? Students listen to recorded dolphin whistles and discuss how the sounds are different from one another. In the book The Scientist Who Cracked the Dolphin Code, students read about a scientist who creates and studies visual representations of sound waves to understand dolphin communication. After reading, students examine three visual representations of dolphin whistles from the book. Students listen to the recorded dolphin whistles again and discuss how the visual representations in the book depict the dolphin sounds they heard. The purpose of this lesson is for students to begin to investigate how dolphins use different sounds to communicate.

Anchor Phenomenon: Dolphins in Blue Bay National Park communicate with one another underwater and calves only respond to their mother’s call.

Students learn:

- Scientists have used evidence to develop their ideas about dolphin communication.
- Dolphins can recognize one another by the changes in pitch in their whistles.
- Scientists use visual representations in their research and investigations.
- The methods scientists use are determined by the questions they are investigating.
- Science findings are based on recognizing patterns.
- Science assumes consistent patterns in natural systems.
- Science theories are based on a body of evidence and many tests.
- Science findings are limited to what can be answered with evidence.
Students read about a scientist who researches how dolphins recognize one another based on the pitch changes in their signature whistles.

Instructional Guide

1. Hold up a copy of *The Scientist Who Cracked the Dolphin Code* and introduce the book.

We’ve observed that there are some differences in the sounds that dolphins make. Next, you will read a book to learn more about how dolphins use different sounds to communicate.

2. Discuss the title of the book. Ask students what they think it means to “crack a code” and how this might relate to dolphin communication.

3. Distribute books. Distribute one copy of *The Scientist Who Cracked the Dolphin Code* to each pair of students.

You have been learning to visualize as you read science text to help you understand what you read. Today, you should use this strategy as you read *The Scientist Who Cracked the Dolphin Code*.

4. Read pages 3–4 as a class and model visualizing. Have volunteers read pages 3–4 aloud, as the class follows along.

We read on page 4 that animals communicate using sound in places where it’s hard to see. I can visualize what it might be like to be underwater in the ocean and hear the dolphin whistles that we listened to earlier.

5. Read pages 5–8 as a class and have students share what they visualized. Have volunteers read pages 5–8 aloud and ask students to visualize as they read. Then, have students share what they pictured in their minds. Accept all responses, prompting students to explain their ideas further, if needed.

6. Make sure students understand what signature whistles are. On page 7, point out the phrase *signature whistles*. Read aloud the second paragraph on page 7.

What does the text tell us about dolphin signature whistles?

[Each dolphin has a whistle that is different from every other dolphin’s whistle.]
7. Set a purpose for reading.

As you read the rest of this book, pay attention to the information that Sayigh gathered about signature whistles and how dolphins use them to communicate.

8. Prompt partners to read the rest of the book. Circulate among pairs as they read the rest of *The Scientist Who Cracked the Dolphin Code*. Remind students to visualize to help them understand the text as they read.

Teacher Support

**Background**

**About the Book: The Scientist Who Cracked the Dolphin Code**

*The Scientist Who Cracked the Dolphin Code* profiles a marine biologist named Laela Sayigh, with a focus on her study of bottlenose dolphin communication. The book follows her years of research and data analysis, culminating in her discovery of how dolphins recognize each other based on the pitch of their signature whistles. Colorful visual representations provide a clear depiction of how changes in pitch can be recognized and sorted by their differences. The final pages of the book discuss how Sayigh’s research has raised new questions for further study. *The Scientist Who Cracked the Dolphin Code* depicts a scientist engaging in investigations of sound waves and dolphin communication, offering students a practical model of the kind of investigations they are doing in the unit and of scientific practices in general.

**Background**

**Literacy Note: About Visualizing in This Lesson**

Students have been learning to use visualization to support their understanding during reading and in their investigations. In this lesson, you’ll engage students in discussions about visualizing before and after reading, but students will employ this strategy on their own. In this way, students gain valuable experience with using this sensemaking strategy to understand complex science text. There are many different ways in which students may choose to use the visualization strategy to engage with the book.

**Rationale**

**Pedagogical Goals: Understanding the Nature of Science**

One goal set forth by the Next Generation Science Standards (NGSS) is for students to understand the nature of science as a discipline and how scientific knowledge develops over time. The NGSS calls out eight understandings about the nature of science that are woven throughout the Amplify Science curriculum. This unit gives students an opportunity to experience five understandings about the nature of science: that Scientific Investigations Use a Variety of Methods; that Scientific Knowledge Is Based on Empirical Evidence; that Scientific Knowledge Assumes an Order and Consistency in Natural Systems; that Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena; and that Science Addresses Questions About the Natural and Material World. In this lesson, students read *The Scientist Who Cracked the Dolphin Code*, a book about marine biologist Laela Sayigh, who figured out how dolphins use signature whistles to communicate. Sayigh’s investigations were motivated by her questions about whether, and how, dolphins could recognize family members using distinct sounds. Students learn that Sayigh gathered evidence about dolphin communication by conducting tests to observe dolphins’ reactions to specific whistles. She also created visual representations of sound waves to analyze patterns in her data about how changes in pitch influence
dolphins’ ability to distinguish among different signature whistles. Since science assumes consistent patterns in nature, Sayigh was able to use the patterns she saw in her data to conclude that dolphins, in general, use signature whistles to communicate, not just those that she studied. Collectively, this text illustrates the ideas that:

• The methods scientists use are determined by the questions they are investigating.
• Science findings are based on recognizing patterns.
• Science assumes consistent patterns in natural systems.
• Science theories are based on a body of evidence and many tests.
• Science findings are limited to what can be answered with evidence.
Reflection

Students discuss how they used visualizing as a reading strategy. Then they write answers to the Investigation Question, based on what they read.

Instructional Guide

1. Discuss visualizing. Ask a few students to share where in the book they visualized to help them understand what they were reading. As they share, have students specify the place in the book (with the page number) where they used the strategy. Ask students who share to comment on how visualizing helped them understand the text.

2. Discuss signature whistles. Ask students to point out the evidence that Sayigh gathered and to explain how it helped her prove that dolphins recognize one another’s whistles.

   What did Sayigh learn about signature whistles?
   [Sayigh found that change in pitch is the most important thing that dolphins are listening for. Every bottlenose dolphin has its own signature whistle. Dolphins can recognize each other by their signature whistles.]

   How did Sayigh come to that conclusion?
   [She created and analyzed visual representations of the dolphin whistles.]

   How did the visual representations of the different dolphin whistles help her figure out what the dolphins were listening for?
   [The visual representations showed Sayigh that the signature whistles have patterns of pitch changes.]

   Sayigh recognized patterns in the visual representations of the dolphin whistles to better understand how dolphins communicate. Recognizing patterns in data helps scientists figure out all kinds of things about the natural world.

3. Introduce notebook page. Explain that students will write about what they now know about how dolphins communicate. Have students turn to page 64, How Dolphins Use Different Sounds to Communicate, in their notebooks.

   Write what you think about the Investigation Question: How can dolphins use different sounds to communicate with one another? We’ll continue to gather evidence to answer this question, but you should write what you think about it now, after reading The Scientist Who Cracked the Dolphin Code.
4. On-the-Fly Assessment: Students record their ideas about the Investigation Question. Allow time for students to complete page 64 in their notebooks. Encourage them to refer to the book as they write. As students work, circulate and observe what they are writing.

Embedded Formative Assessment

On-the-Fly Assessment 12: How Dolphins Use Different Sounds to Communicate

Look for: As students complete the notebook page, circulate and observe what they write about how dolphins use different sounds to communicate. Make note of how students are writing about signature whistles. Do they acknowledge that signature whistles have patterns of pitch changes? Do they acknowledge that dolphins respond to the specific patterns of pitch changes in their relatives’ whistles? Students do not need to have a complete understanding of these ideas at this point. They will continue to construct these ideas over the next two lessons, culminating in Lesson 3.7 when students construct a scientific explanation of how a mother dolphin and her calf communicate underwater.

Now what? If students do not yet understand that dolphin signature whistles have patterns of pitch changes that are unique to each individual dolphin, have them return to pages in the book that provide information about dolphin signature whistles. You may wish to discuss page 7 (as you did before students read the book) to make sure that students understand what signature whistles are. Refer back to the different dolphin whistles you played at the beginning of class. Then, have students reread page 10 and ask them to explain in their own words why the dolphins reacted more strongly to the whistles of their close relatives. Next, have students reread page 12. Ask them to describe what this page tells them about signature whistles. Finally, have students reread page 17. Ask them to explain what this text tells them about signature whistles.

Possible Responses

Investigation Notebook
How Dolphins Use Different Sounds to Communicate (page 64)

How can dolphins use different sounds to communicate with one another?
Dolphins use different sounds to communicate with one another. Every dolphin has a signature whistle that changes in pitch, like music does. Dolphins recognize the signature whistles of their family members because they can hear the changes in pitch.
How Dolphins Use Different Sounds to Communicate

Write your answer to the question below based on what you read in The Scientist Who Cracked the Dolphin Code.

How can dolphins use different sounds to communicate with one another?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Make a drawing if it helps you explain your thinking. Label your drawing.
Partner Reading

Students read about a scientist who researches how dolphins recognize one another based on the pitch changes in their signature whistles.

Instructional Guide

1. Hold up a copy of *The Scientist Who Cracked the Dolphin Code* and introduce the book.

   Hemos observado que hay algunas diferencias en los sonidos que hacen los delfines. A continuación, leerán un libro para aprender más acerca de cómo los delfines usan diferentes sonidos para comunicarse.

2. Discuss the title of the book. Ask students what they think it means to “crack a code” and how this might relate to dolphin communication.

3. Distribute books. Distribute one copy of *The Scientist Who Cracked the Dolphin Code* to each pair of students.

   Han estado aprendiendo a visualizar mientras leen textos científicos para ayudarles a entender lo que leen. Hoy deben usar esta estrategia mientras leen *La científica que descifró el código de los delfines*.

4. Read pages 3–4 as a class and model visualizing. Have volunteers read pages 3–4 aloud, as the class follows along.

   Leímos en la página 4 que los animales se comunican usando el sonido en lugares donde es difícil ver. Puedo visualizar cómo podría ser estar bajo el agua en el océano y oír los silbidos de delfines que escuchamos antes.

5. Read pages 5–8 as a class and have students share what they visualized. Have volunteers read pages 5–8 aloud and ask students to visualize as they read. Then, have students share what they pictured in their minds. Accept all responses, prompting students to explain their ideas further, if needed.

6. Make sure students understand what signature whistles are. On page 7, point out the phrase *signature whistles*. Read aloud the second paragraph on page 7.

   ¿Qué nos dice el texto sobre silbidos distintivos de delfines?
   [Cada delfín tiene un silbido que es diferente al silbido de cualquier otro delfín].
7. Set a purpose for reading.

Mientras leen el resto de este libro, pongan atención a la información que reunió Sayigh sobre silbidos distintivos y cómo los usan los delfines para comunicarse.

8. Prompt partners to read the rest of the book. Circulate among pairs as they read the rest of *The Scientist Who Cracked the Dolphin Code*. Remind students to visualize to help them understand the text as they read.

Teacher Support

Background

About the Book: *The Scientist Who Cracked the Dolphin Code*

*The Scientist Who Cracked the Dolphin Code* profiles a marine biologist named Laela Sayigh, with a focus on her study of bottlenose dolphin communication. The book follows her years of research and data analysis, culminating in her discovery of how dolphins recognize each other based on the pitch of their signature whistles. Colorful visual representations provide a clear depiction of how changes in pitch can be recognized and sorted by their differences. The final pages of the book discuss how Sayigh’s research has raised new questions for further study. *The Scientist Who Cracked the Dolphin Code* depicts a scientist engaging in investigations of sound waves and dolphin communication, offering students a practical model of the kind of investigations they are doing in the unit and of scientific practices in general.

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Students have been learning to use visualization to support their understanding during reading and in their investigations. In this lesson, you’ll engage students in discussions about visualizing before and after reading, but students will employ this strategy on their own. In this way, students gain valuable experience with using this sensemaking strategy to understand complex science text. There are many different ways in which students may choose to use the visualization strategy to engage with the book.

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Students discuss how they used visualizing as a reading strategy. Then they write answers to the Investigation Question, based on what they read.

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1. **Discuss visualizing.** Ask a few students to share where in the book they visualized to help them understand what they were reading. As they share, have students specify the place in the book (with the page number) where they used the strategy. Ask students who share to comment on how visualizing helped them understand the text.

2. **Discuss signature whistles.** Ask students to point out the evidence that Sayigh gathered and to explain how it helped her prove that dolphins recognize one another’s whistles.

   ¿Qué aprendió Sayigh acerca de silbidos distintivos? 
   [Sayigh descubrió que el cambio de tono es lo más importante que captan los delfines. Cada delfín mular tiene su propio silbido distintivo. Los delfines pueden reconocerse por sus silbidos distintivos].

   ¿Cómo llegó Sayigh a esa conclusión? 
   [Creó y analizó unas representaciones visuales de los silbidos de delfín].

   ¿Cómo la ayudaron las representaciones visuales de los diferentes silbidos a averiguar qué estaban atentos a escuchar los delfines? 
   [Las representaciones visuales le mostraban a Sayigh que los silbidos distintivos tienen patrones de cambios de tono].

   Sayigh reconoció patrones en las representaciones visuales de los silbidos de delfín para entender mejor cómo se comunican los delfines. Reconocer patrones en datos ayuda a los científicos a averiguar todo tipo de cosas sobre el mundo natural.

3. **Introduce notebook page.** Explain that students will write about what they now know about how dolphins communicate. Have students turn to page 64, How Dolphins Use Different Sounds to Communicate, in their notebooks.
4. On-the-Fly Assessment: Students record their ideas about the Investigation Question. Allow time for students to complete page 64 in their notebooks. Encourage them to refer to the book as they write. As students work, circulate and observe what they are writing.

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**Now what?** If students do not yet understand that dolphin signature whistles have patterns of pitch changes that are unique to each individual dolphin, have them return to pages in the book that provide information about dolphin signature whistles. You may wish to discuss page 7 (as you did before students read the book) to make sure that students understand what signature whistles are. Refer back to the different dolphin whistles you played at the beginning of class. Then, have students reread page 10 and ask them to explain in their own words why the dolphins reacted more strongly to the whistles of their close relatives. Next, have students reread page 12. Ask them to describe what this page tells them about signature whistles. Finally, have students reread page 17. Ask them to explain what this text tells them about signature whistles.

**Possible Responses**

Investigation Notebook
How Dolphins Use Different Sounds to Communicate (page 64)

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Dolphins use different sounds to communicate with one another. Every dolphin has a signature whistle that changes in pitch, like music does. Dolphins recognize the signature whistles of their family members because they can hear the changes in pitch.
Cómo los delfines usan diferentes sonidos para comunicarse

Escribe tu respuesta a la pregunta siguiente basándote en lo que leíste en La científica que descifró el código de los delfines.

¿Cómo pueden usar diferentes sonidos los delfines para comunicarse unos con otros?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Haz un dibujo si ayuda a explicar tu razonamiento. Identifica las partes de tu dibujo.