LESSON 5: A WHALE OF A MIGRATION

INTRODUCTION

Twice a year, humpback whales take an amazing 3000-mile journey. This seasonal migration takes them from cold waters where they spend summers feeding to warmer waters in the winter months to breed and raise young calves. How do the whales know where to go and how do they make sure they arrive?

LESSON SUMMARY

In this lesson, students learn how scientists identify and track humpback whales. They explore data and a map about the long migration whales make seasonally. They use this information with readings to explain how whales know where to go on their journeys.

OBJECTIVES

- Students will explore how scientists identify and track humpback whales.
- Students will learn about the ways whales keep track of where they are and where they are going during migration.

ESTIMATED TIME

45 minutes. If you would like to teach this lesson over 2 class periods, consider pausing the learning between steps 5 and 6.

STANDARDS ADRESSED

Science (NGSS): 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

OCEAN LITERACY PRINCIPLES

5 The ocean supports a great diversity of life and ecosystems.

Geography: Standard 8 The characteristics and spatial distribution of ecosystems and biomes on Earth's surface.

Mathematics (CCSS): 4.MD.A.2 Use the 4 operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

English Language Arts (CCSS): RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

SL.4.1.A Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

FOCUS QUESTION

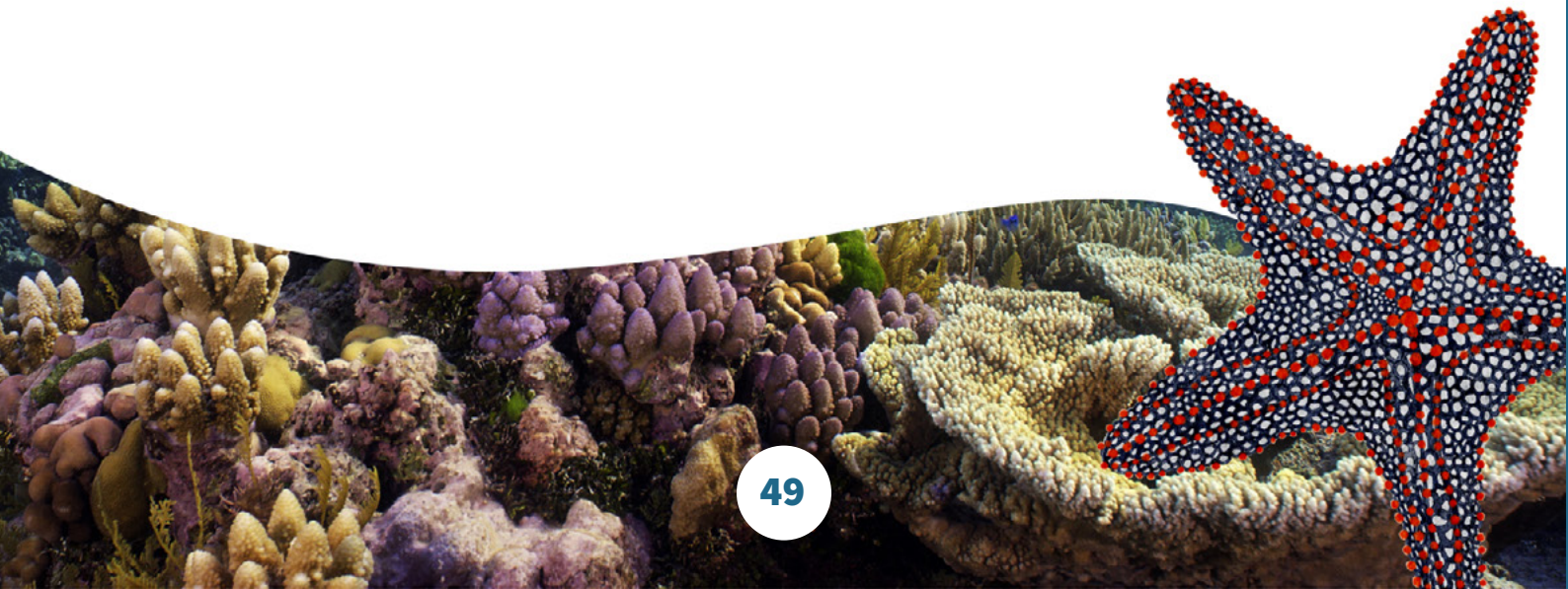
How do whales know where to go when they migrate?

MATERIALS

- Identifying Whales, display copy
- Whale Tracking Data, one per student
- How Do Whales Know Where to Go, one copy per group of 3 students, cut apart
- Compass or compass application on a smartphone

PREPARATION

- Make copies of all the handouts. For the handout How Do Whales Know Where to Go, cut the readings apart. Divide the readings so that each group of 3 students will get 1 copy of each of the 3 readings.



FACILITATION

Step 1. Display the pictures of the humpback whale and the mother whale and her calf. Allow students a little time to observe the whales. Share that they can grow to be more than 50 feet long, which is about the length of 3-4 cars placed bumper to bumper.

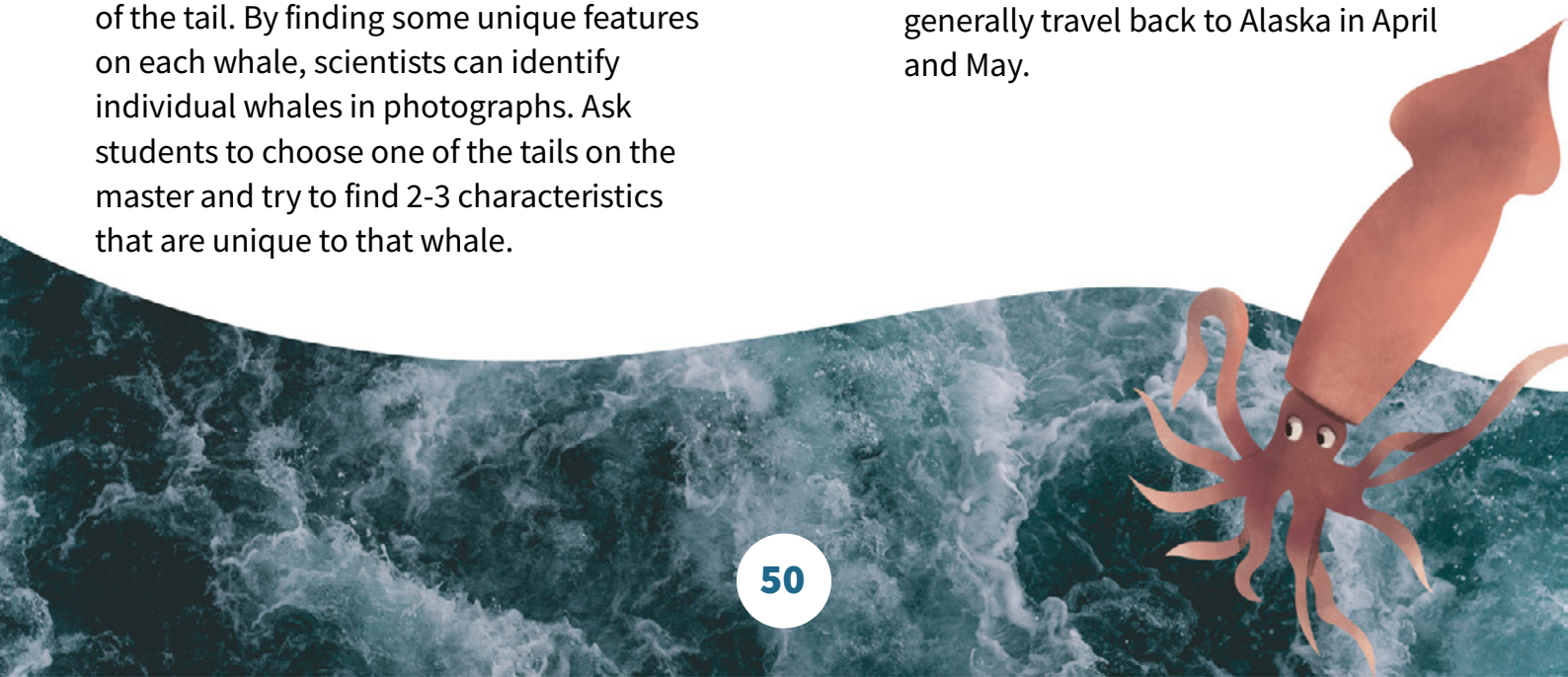
Step 2. Next, share the whale tails on the Identifying Whales master. Tell students that the pictures represent eight different humpback whales. Give them a minute to observe the pictures quietly. Ask students if they think they could tell the whales apart based on the pictures and describe which features contributed to whether they could identify individual whales or not. Students should say that the different whales have different patterns of white on their tails. They may also describe that the shape of some of the tails seems different.

Step 3. Tell students that scientists can tell whales apart using their flukes, or the two lobes that make up their tails. Many whales have a pattern of white on their flukes that is unique to each whale. Scientists also look at the shape of the flukes; the trailing edge of the flukes, which is the end further from the body; and the notch, or V-shape where the two flukes come together in the center of the tail. By finding some unique features on each whale, scientists can identify individual whales in photographs. Ask students to choose one of the tails on the master and try to find 2-3 characteristics that are unique to that whale.

Step 4. Share that being able to identify each whale allows scientists to track the whale's movements through the water. Distribute copies of the handout, Whale Tracking Data. Ask students to examine the data in the table and the map to learn more about the migration routes that whales take. Depending on your students, you may wish to have them read the introduction to the data as a class, then have them examine the data in the table, followed by the map.

Step 5. Lead a class discussion about the information on whale migration based on the whale tracking data. Ask students questions such as:

- Where did the whales begin and end their migration? These whales migrated from Alaska to Hawaii. Share with students that not all humpback whales follow this route but that they are an example to think about how whales migrate. Share that humpback whales generally spend the warm summer months feeding in cooler waters and in the winter they migrate to warmer waters to breed and raise young whale calves. For the whales observed in 2014 and 2015, the migration pattern is usually to travel south to Hawaii in November and December. These whales generally travel back to Alaska in April and May.



- How far did the whales travel overall? How far can they travel in a day? The whales traveled between 4,300 and 4,800 kilometers or between 2,600 and 3,000 miles. Three of the whales traveled around 130 to 140 kilometers or 80 to 90 miles a day. The other whale traveled around 90 kilometers or 60 miles a day. To reinforce math skills, you can have students do these calculations by determining the distance traveled per day for one or more of the whales.

- Did the whales seem to follow a particular route or did they seem to wander around? Students should see that whales did not necessarily take the exact same route, but that they did not swim off course, in circles, or back and forth. Their paths from Alaska to Hawaii were fairly straight routes. Guide students to an understanding that the whales must have a way to navigate and know where they are along the route.

Step 6. In groups of 3, have students discuss how humans might know what route to take to get from New York City to Los Angeles, a distance about the same length as the route the whales migrate. Students are likely to say that they would use a GPS application or a map. Discuss their ideas, probing them with questions such as, how many times do you think you would need to go back and forth before you did not need a map? Would your answer change if you knew you only went back and forth once a year compared to more or less often?

Step 7. Follow up on the previous step by having small groups discuss:

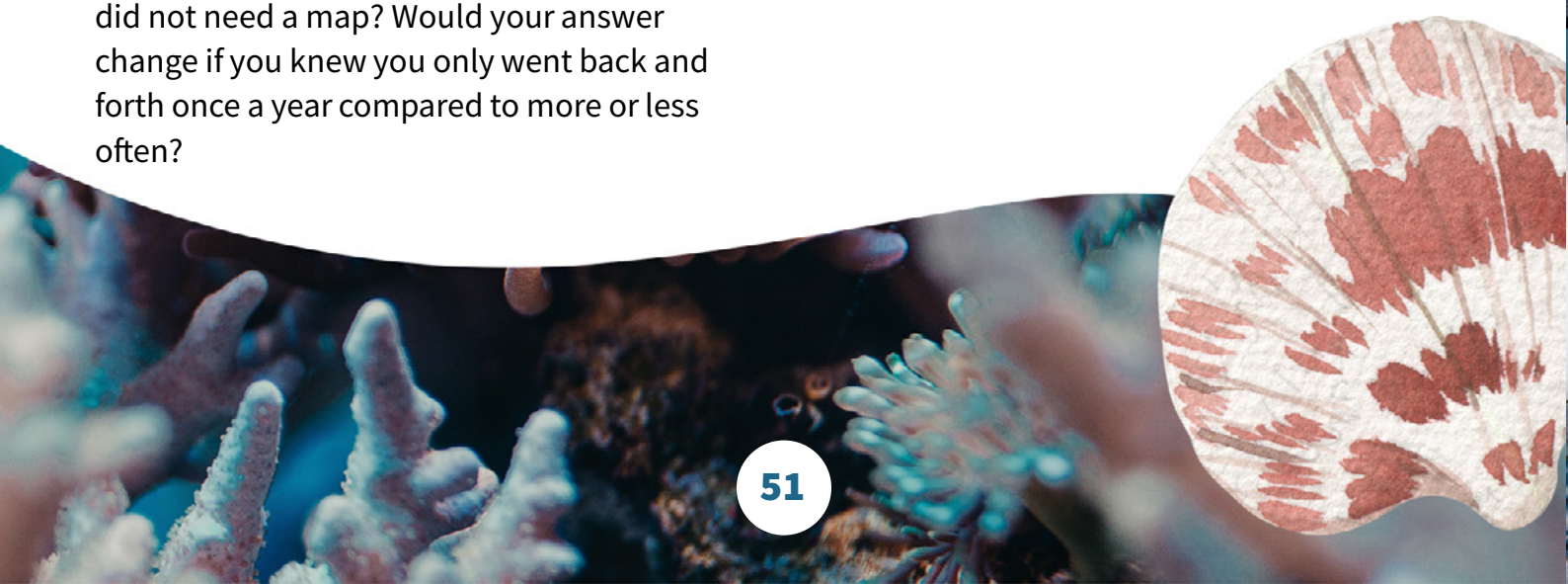
- whether whales can use the same methods humans do to know where they are going,

- how they think migrating back and forth only one time per year affects the whales' abilities to navigate, and

- how they think whales know where to go.

Step 8. Have students share their ideas to answer the question: how do humpback whales know where to go when they migrate? You may wish to give them some quiet time to individually write their ideas down before sharing with the class. Make a list of their ideas to display in the classroom.

Step 9. Tell students that they are going to have an opportunity to learn more about how whales know the route when they migrate. You will use a jigsaw strategy to support students in their learning. Give each group a set of readings from the handout How Do Whales Know Where to Go? Have each small group divide the readings so that each student reads one of the sections. This will be their home group for the jigsaw.



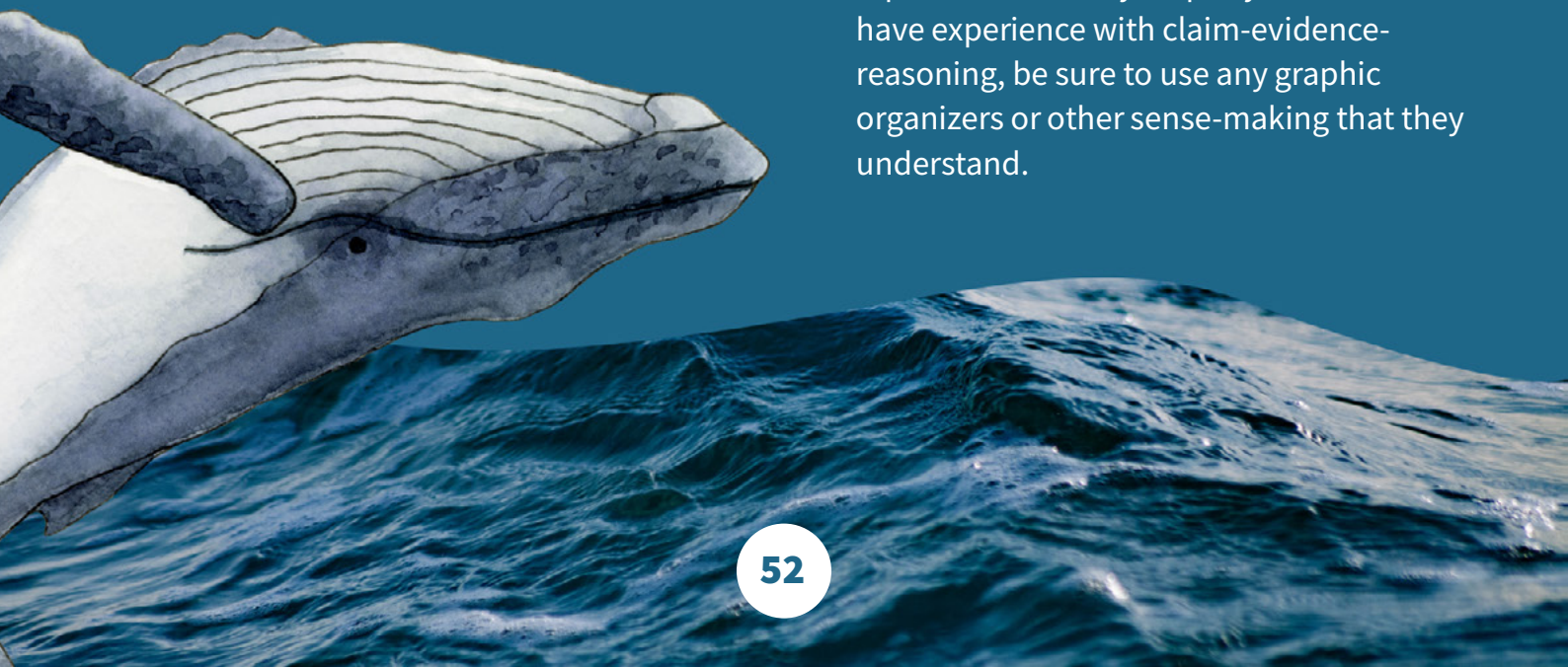
Step 10. Once students have had a chance to read, form small expert groups of students who read the same section. This should represent one student from each home group. Keep the groups to no more than 3 or 4 students to allow all students to participate and share. In a class of 30 students, this will mean that there are multiple expert groups for the same reading. Give the expert groups a few minutes to discuss what they read, focusing on making sure they know the important points to share with their home groups.

Step 11. Have students rejoin their home groups from step 9. Each home group will have at least one expert on each of the three readings. Allow time so that students can share about the sections they read. Remind them to share the important points they discussed in their expert groups. Tell students that they should listen carefully and be prepared to describe all the ways that whales might understand the migration routes.

Step 12. Briefly discuss each of the three sections of reading.

- When the class discusses the "communication" reading, consider sharing some recordings of humpback whales from Eavesdropping on Whales (https://sanctuaries.noaa.gov/news/feb21/eavesdropping-on-whales.html). Under the "Make Some Noise" subheading, there are three short recordings of humpback whales communicating.
- As the class discusses the "magnetic field" reading, show a compass or compass application on a smartphone so that students can see how it changes as a person faces different directions.
- During the discussion about whales using noises to sense structures on the ocean floor, be sure that students understand that we can never know exactly what a whale can or cannot see, but using technology scientists can guess what whale vision might be like.

Step 13. Write the question "how do whales know where to migrate?" on the board. Ask students to make a claim and offer evidence and reasoning to describe what they learned. Share that drawing a representation may help. If your students have experience with claim-evidence-reasoning, be sure to use any graphic organizers or other sense-making that they understand.



EXTENSION

- If students have questions about the Earth's magnetic field, the ESRI Story Map titled The Earth's Magnetic Field: The Force That's Always With You (https://noaa.maps.arcgis.com/apps/MapJournal/index.html?appid=3b9045c4d1aa408694d3759d1aa5ede4) offers an explanation of why it is important for many of the phenomena we see in our lives.
- Students may be interested in learning more about humpback whales using the Hawaiian Islands Humpback Whale National Marine Sanctuary's website (https://hawaiihumpbackwhale.noaa.gov/). This site includes videos, history, activities, conservation actions, and other information to allow students to learn more about many different connections with humpback whales.

Lesson 5 NOAA References

- National Marine Sanctuaries, Eavesdropping on Whales (https://sanctuaries.noaa.gov/news/feb21/eavesdropping-on-whales.html)
- NOAA National Centers for Environmental Information (NCEI), The Earth's Magnetic Field: The Force That's Always With You (https://noaa.maps.arcgis.com/apps/MapJournal/index.html?appid=3b9045c4d1aa408694d3759d1aa5ede4)
- Hawaiian Islands Humpback Whale National Marine Sanctuary (https://hawaiihumpbackwhale.noaa.gov/)

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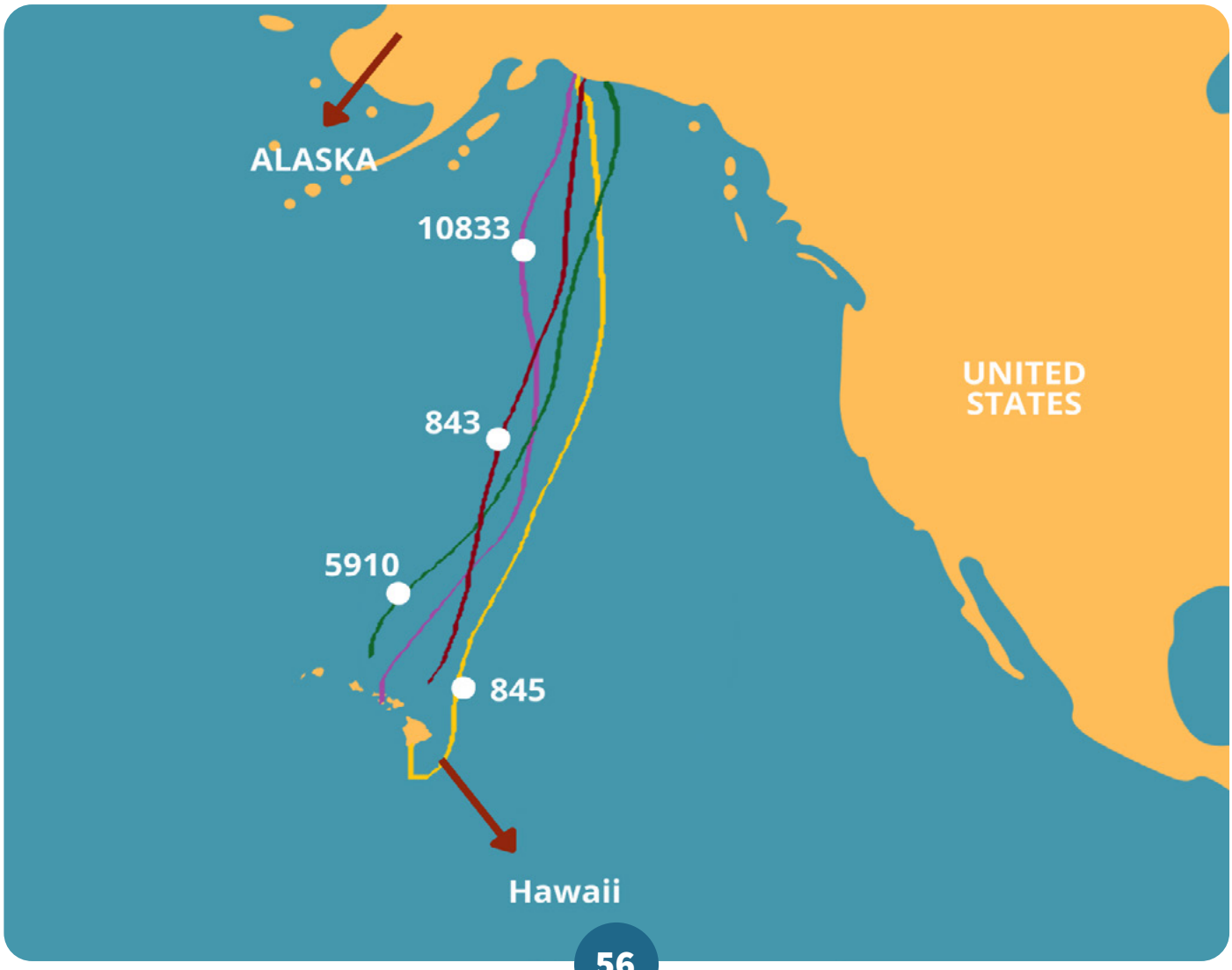
belong to NOAA

WHALE TRACKING DATA

Scientists have tracked many whales over the years. In 2014 and 2015, scientists observed 20 whales that were in the ocean near Alaska in November. The scientists tracked where the whales swam in the next 1-2 months. The table and map show data for 4 of the whales.

Whale Tag #	Date migration started	Date of last data collected	Total days tracked	Total distance migrated
843	November 25, 2014	December 18, 2014	31	4,372 km / 2,717 miles
845	December 2, 2014	January 8, 2015	37	4,744 km / 2,948 miles
5910	November 19, 2014	December 13, 2014	30	4,389 km / 2,727 miles
10833	November 28, 2015	January 13, 2016	46	4,303 km / 2,674 miles



Communication

Imagine walking with a group of people in the dark. The first person has a flashlight but the rest of you do not. The leader might call out when there is a curb or a rock so you are aware of it.

Scientists think that humpback whales make sounds to communicate as they migrate. One idea is that the leaders in the front of the group call out to other whales. This helps them find their way.

Scientists know that some of the sounds whales make can be heard for about 5 miles. Even if the whales are not traveling in a pod, these sounds might help them know the right way to go or if there are any dangers ahead.

Magnetic Fields

A compass is a simple tool that can help people find their way. Compasses have a needle that always points north. People can use a compass and a map to help them navigate where they want to go.

The needle in a compass points to the north because it is a small magnet. It points in the same direction because the Earth has a magnetic field that causes it to act as a magnet, too.

Humpback whales have magnetic material in their brains. This may help them sense the Earth's magnetic field and know where to migrate. Because the magnetic field has specific patterns around the planet, whales may be able to sense the different patterns and use that information to know their location.

Mapping the Seafloor

Just like on dry land, the floor of the ocean has mountains, valleys, and other forms. These landmarks may help whales know which way to go.

Compared to humans, whales have poor eyesight. They do not see color and their vision is probably between 10 and 100 times worse than what humans can see.

But, humpback whales have another way to "see" structures in the ocean. They can use clicks and other sounds to help them detect objects in the water. It is likely that they can listen to echoes from the sounds they make to determine where landforms are in the ocean. In this way, they may be able to navigate based on landmarks they pass on their migrations.