SCIENCE·3D

CALIFORNIA WHITE SHARK

In this packet, sample student answers are provided in red and notes to teachers are in blue.

In this **Science Mission**, students will explore how white shark populations might change and how humans can affect animal populations. They will develop hypotheses and use data to test them. Then, they will explore shark motion and distances traveled over time. Finally, they will explore how sharks respond to different factors in their environment by generating and testing hypotheses about what might influence numbers of baby white sharks in different habitats.

This activity offers numerous opportunities for students to do calculations and create graphs. For students that may struggle with this, consider providing the graphs or calculations and have them interpret patterns. For more advanced students, there are suggestions for writing assignments, more challenging math problems, and detailed interpretations of data.

Activity 1: White Sharks Through Time

The Shark Lab team collects data on the number of white sharks. They are trying to find out if white shark numbers are going up. If there are more babies each year, the population is probably growing. If the number of baby sharks is going down, the population may be in trouble.

Here are some things we know:

- White sharks used to be caught and killed.
- The water used to be polluted.
- White shark numbers used to be very low.
- White sharks are now protected in California.
- The water is now clean.

1. **Complete** the following paragraph by **circling** the correct words.

I think that the white shark population is **growing/staying the same/decreasing**. This is because their environment is now **better/worse** than it was before. If the population is **growing/staying the same/decreasing**, then the Shark Lab team should see **more/fewer/the same number of** baby white sharks each year.

Note: The answers in red are correct. However, if a student's responses are consistent across the sentences (e.g. "staying the same" and the "same number"), then that is an acceptable hypothesis that can be tested. Student responses to question 3 will depend on their hypotheses. It's acceptable for hypotheses to be incorrect as long as they are tested!

Let's test your hypothesis! Shark Lab flies a drone to count sharks. They fly it many times to get the correct number. Their data are in Table 1.

Table 1. White shark counts for five years

Year	Number of White sharks
2015	15
2016	17
2017	20
2018	22
2019	25

2. **Make** a bar graph of the data in Table 1. The first bar is done for you.

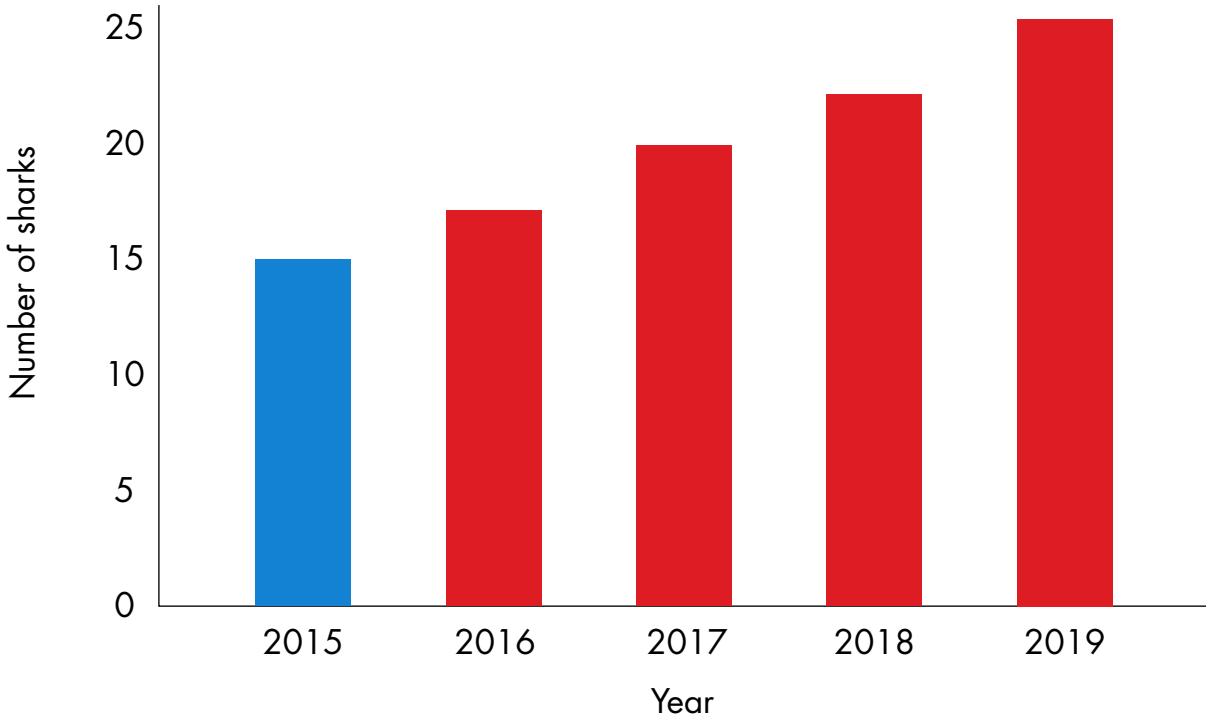

Figure 1. White shark counts for five years

3. **Describe** whether or not your hypothesis from question 1 might be correct. Use the evidence in Table 1 to support your answer.

Answers will vary. Students with the correct hypothesis will likely say: My hypothesis is supported because the number of baby white sharks is going up each year.

4. **Describe** why you think the white shark population is changing.

Answers will vary. Acceptable answers include: I think that the white shark population is increasing because they are protected, there is more food, or the oceans are less polluted.

Activity 2: Shark in Motion!

Motion is a change in the position of an object, like a swimming white shark! White sharks are always in motion! They never stop swimming. That means they can swim very far each day. But, how far can they swim in a single day? How far can they swim in a month? The Shark Lab wants to find out. Baby sharks might disappear from one place and show up later somewhere else. Could it be the same sharks? We can use how fast they can swim as a clue.

Some students may ask why white sharks never stop swimming. Discuss how many (but not all) sharks, need to swim to keep water constantly flowing over their gills.

The Shark Lab found that baby white sharks swim 2 kilometers per hour. Use this information to **complete** the questions and Table 2.

1. How far can a baby white shark swim in a day? Show your work.

   A baby white shark can swim 48 kilometers in a day.

   2 km per hour x 24 hours = 48 kilometers

2. Round this distance from your answer in question 1 to the nearest 10. **Write** your answer below.

   50 kilometers

3. Use the rounded answer in question 2 to **complete** Table 2.

Table 2. Distances baby white sharks can swim

Speed	Distance (km)
Distance in 1 day	50
Distance in 2 days	100
Distance in 3 days	150
Distance in 4 days	200
Distance in 5 days	250
Distance in 10 days	500
Distance in 30 days	1500

4. Draw a bar graph below to show how far a baby shark can swim. Use the data for 1 day to 5 days.

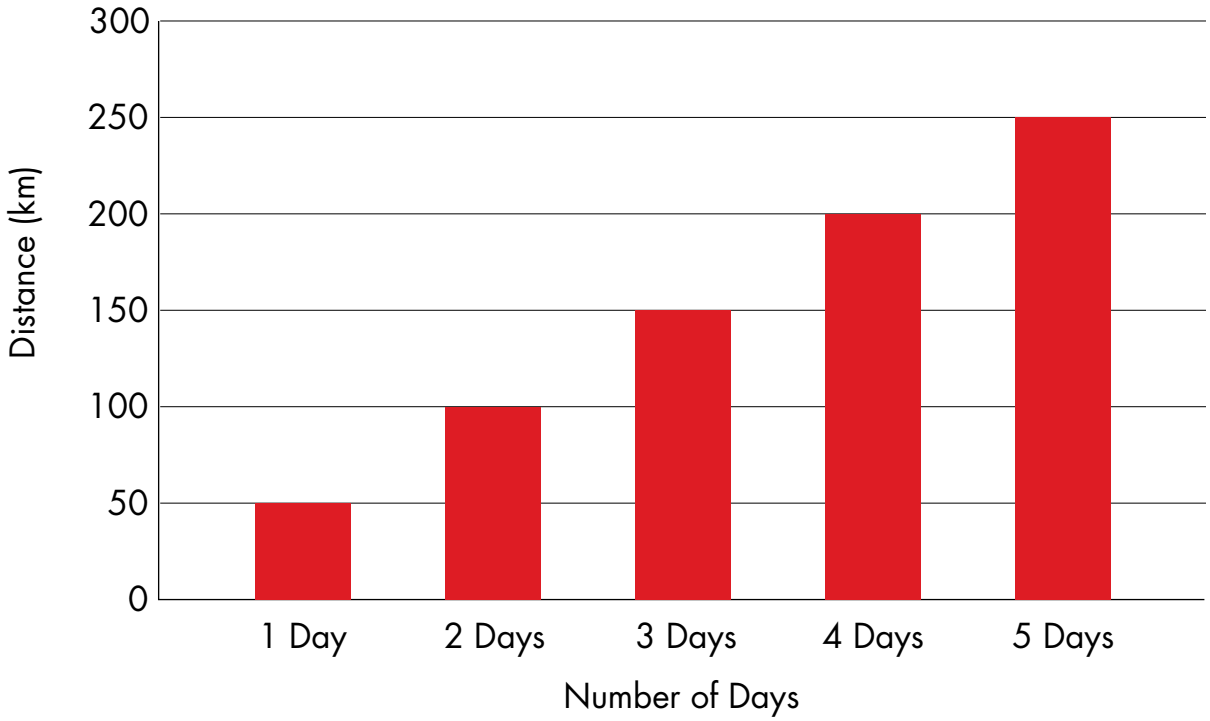

Figure 2. How far baby white sharks can swim

California is a big state. It is about 1,200 kilometers from north to south.

5. Calculate how many days it would take a shark to swim the length of California. Show your work.

1,200 km ÷ 50 km per day = 24 days

The Shark Lab team put tags on many young white sharks to track them. They also placed recorders at different locations along the California coast. When the tagged shark swims past a recorder, the shark's tag number and time is recorded. It looks something like this.

Location Map of Shark Lab Recorders

Table 3 on the next page shows the amount of time between two detections of a tagged shark by a recorder. It also shows the distance between the recorders that detected the sharks.

6. **Complete** Table 3 by calculating how far each shark moved per day. *Hint: divide the distance between detections by the days between detections.* If this math is too advanced for students, provide them with answers or go through how to solve this table as a class instead of asking students to complete the table independently.

Table 3. Distance and time between detections of five white sharks

Shark number	Days between detections	Distance between detections (km)	Distance moved per day
20191	1	0	0
20192	5	20	4
20193	10	100	10
20194	4	0	0
20195	2	30	15

Math Extension: Have students calculate the average distance that sharks moved per day. Have them add all the numbers in the last column and divide by 5.

Extend the Lesson: Have students create a bar graph showing how far each shark swam.

Use the graph you drew for question 4 and your calculations in Table 3 to answer the following questions.

7. **Explain** whether or not the five baby white sharks that were tagged behaved in the same way.

Not all white sharks did the same thing. Some didn't move. Some moved a long distance.

8. Do you think that sharks could have swam farther away if they wanted to? *Hint: Compare how far they can swim (Figure 2) to how far they did swim (Table 3).*

The sharks could have swam farther away than they did. But, they stayed in a smaller area.

Activity 3: White Sharks in a Changing Environment

Young white sharks respond to their environment. Both living and non-living factors affect how they behave.

1. **Complete** Table 4. Decide if each factor is living or non-living. Decide how it might affect white sharks.

Use terms like:
Helps them grow
Helps them catch food
Changes where they live
Might eat them
Might hurt them

Table 4. Factors that might affect young white sharks

Factor	Living or non-living?	How the factor might affect white sharks
Temperature of the water	Non-living	Changes where they live
Prey (fish and stingrays that sharks eat)	Living	Helps them grow or Changes where they live
Predators (killer whales, bigger sharks)	Living	Might eat them or Changes where they live
The amount of light underwater	Non-living	Helps them see prey or Helps them catch food
Pollution	Non-living	Might hurt them

Use Table 5 to answer the next question.

Table 5. Environmental conditions at different places the shark lab surveys white sharks

Location	Food level	Predators	Pollution
Bay 1	Low	None	Medium
Bay 2	High	None	Low
Bay 3	High	None	Low
Open coast 1	Low	None	Low
Open coast 2	Low	None	Low
Open coast 3	Medium	None	Low
Far offshore 1	Medium	High	Low
Far offshore 2	Medium	High	Low
Far offshore 3	High	High	Low

2. **Predict** what type of habitat will have the most young white sharks: **Bay**, **Open coast**, or **Far offshore**. **Describe** why you made this prediction. Extend this question by asking students to look at variation within the different types of habitats or have them rank the different types of habitats. Tell students that they are making a hypothesis: an idea that they can test!

I think that the bays will have the most white sharks. They have the most prey and no predators. Most bays don't have much pollution.

Figure 3 shows the number of white sharks seen on the Shark Lab's drones.

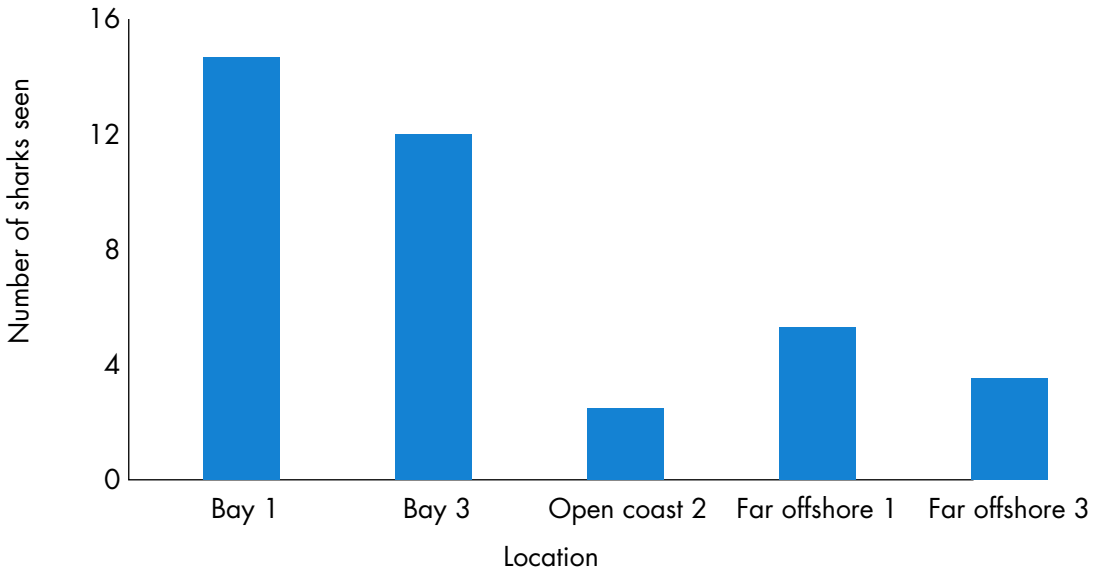

Figure 3. Number of white sharks observed in different locations

3. **Describe** if the information in Figure 3 supports your prediction from question 2.

This answer should be logical based on the answer in question 2. Students might say: Yes, it supports my hypothesis. Sharks were not found where there were a lot of predators (far offshore). They were most common where there was a lot of food and no predators.

Extend the Lesson: Have students write a paragraph about the factors that probably influenced sharks (e.g. predators, prey, pollution) or have them look deeper into the results. Have them try to explain the differences between the locations of similar habitats.